DOCKETED

Docket Number:	13-AFC-01
Project Title:	Alamitos Energy Center
TN #:	206428-2
Document Title:	Alamitos Suppl.AFC Appendices 1A to 5.1F
Description:	Alamitos Energy Center Supplemental AFC Appendices 1A to 5.1F
Filer:	Cathy Hickman
Organization:	AES Southland Development, LLC
Submitter Role:	Applicant
Submission Date:	10/26/2015 2:37:15 PM
Docketed Date:	10/26/2015

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Supplemental Application for Certification

Alamitos Energy Center

October 2015

Volume 2

Submitted by

AES
the power of being global

With Technical Assistance from

CH2MHILL®

Appendix 1A
Project Site Legal Description

EXHIBIT 'A'

IN THE COUNTY OF LOS ANGELES, STATE OF CALIFORNIA, BEING PARCEL 1 OF LOT LINE ADJUSTMENT RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958949, OFFICIAL RECORDS OF SAID COUNTY, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

THAT PORTION OF SECTION 2, TOWNSHIP 5 SOUTH, RANGE 12 WEST, IN THE RANCHO LOS ALAMITOS, AS SHOWN ON PARTITION MAP RECORDED IN BOOK 700, PAGE 141 OF DEEDS, IN THE OFFICE OF THE LOS ANGELES COUNTY RECORDER, DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTHWEST CORNER OF THE EAST ONE-HALF OF SAID SECTION 2;

THENCE SOUTH 00º 16' 10" WEST ALONG THE WESTERLY LINE OF SAID EAST ONE-HALF, A DISTANCE OF 2505.18 FEET, TO THE SOUTHEASTERLY LINE OF THE LOS CERRITOS CHANNEL AS SHOWN BY MAP ON FILE IN BOOK 79 OF RECORD OF SURVEYS, PAGE 91 THEREOF, ALSO BEING A POINT IN THE EASTERLY LINE OF THAT CERTAIN PARCEL OF LAND CONVEYED TO BIXBY RANCH, BY GRANT DEED RECORDED MAY 22, 1963 AS INSTRUMENT NO. 4371, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA;

THENCE NORTH 36º 20' 40" EAST ALONG SAID SOUTHEASTERLY LINE AND ALONG THE NORTHWESTERLY LINE OF SAID PARCEL CONVEYED TO BIXBY RANCH, A DISTANCE OF 74.85 FEET;

THENCE CONTINUING ALONG SAID SOUTHEASTERLY LINE AND SAID NORTHWESTERLY LINE ON A CURVE CONCAVE NORTHWESTERLY, HAVING A RADIUS OF 578.44 FEET, THROUGH, AN ANGLE OF 15º 05' 09", AN ARC LENGTH OF 152.30 FEET, TO THE NORTHWEST CORNER THEREOF, ALSO BEING AN ANGLE POINT ON THE WESTERLY LINE OF STUDEBAKER AS DESCRIBED IN GRANT OF EASEMENT MAY 19, 1965 AS INSTRUMENT NO. 3602, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA;

THENCE SOUTH 89º 43' 50" EAST ALONG THE NORTHERLY LINE OF SAID PARCEL CONVEYED TO BIXBY RANCH AND SAID WESTERLY LINE OF STUDEBAKER ROAD, A DISTANCE OF 29.45 FEET, TO THE NORTHEAST CORNER OF SAID PARCEL CONVEYED TO BIXBY RANCH;

THENCE SOUTH 00º 16' 10"W. ALONG THE EASTERLY LINE OF SAID PARCEL CONVEYED TO BIXBY RANCH AND ALONG SAID WESTERLY LINE OF STUDEBAKER ROAD, A DISTANCE OF 303.36 FEET;

THENCE SOUTHERLY ALONG SAID EASTERLY AND WESTERLY LINES AND ALONG THE WESTERLY LINE OF STUDEBAKER ROAD AS DESCRIBED IN GRANT OF EASEMENT RECORDED JULY 2, 1965 AS INSTRUMENT NO. 4310, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA, ON A CURVE CONCAVE

WESTERLY, HAVING A RADIUS OF 1950.00 FEET, THROUGH AN ANGLE OF 09º 51' 49" AN ARC LENGTH OF 335.70 FEET, TO THE SOUTHEAST CORNER OF SAID PARCEL CONVEYED TO BIXBY RANCH;

THENCE NORTH 48º 54' 15" WEST ALONG THE SOUTHERLY LINE OF SAID PARCEL CONVEYED TO BIXBY RANCH AND THE NORTHWESTERLY PROLONGATION THEREOF, A DISTANCE OF 386.41 FEET, TO A POINT IN THE SOUTHEASTERLY LINE OF THE LOS CERRITOS CHANNEL AS DESCRIBED IN DECREE OF CONDEMNATION (PARCEL 3) RECORDED NOVEMBER 8, 1955 IN BOOK 49471, PAGE 50 THEREOF, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA;

THENCE SOUTHWESTERLY ALONG SAID SOUTHEASTERLY LINE ON A CURVE CONCAVE NORTHWESTERLY, HAVING A RADIUS OF 1150.00 FEET, THROUGH AN ANGLE OF 10º 46' 45", AN ARC LENGTH OF 216.34 FEET, TO A LINE PARALLEL WITH AND 216.35 FEET SOUTHWESTERLY OF THE HEREIN BEFORE DESCRIBED COURSE OF NORTH 49º 00' 29" WEST, A DISTANCE OF 386.25 FEET (THE INITIAL RADIAL LINE BEARS. 40º 52' 03" EAST);

THENCE SOUTH 48º 54' 15" EAST ALONG SAID PARALLEL. LINE, A DISTANCE OF 448.33 FEET;

THENCE NORTH 41º 05' 45" EAST A DISTANCE OF 12.00 FEET, TO A LINE PARALLEL WITH AND 198.00 FEET SOUTHWESTERLY OF THE HEREIN BEFORE DESCRIBED COURSE OF NORTH 19 º 00' 29" WEST A DISTANCE OF 386.25 FEET;

THENCE SOUTH 48º 54' 15" EAST ALONG SAID PARALLEL LINE, A DISTANCE OF 206.12 FEET TO THE EASTERLY LINE OF STUDEBAKER ROAD AS DESCRIBED IN GRANT OF EASEMENT RECORDED JULY 2, 1965 AS INSTRUMENT NO. 4310, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA;

THENCE SOUTH 14º 28' 41" WEST ALONG SAID EASTERLY LINE, A DISTANCE OF 108.46 FEET;

THENCE SOUTH 67º 01' 13" EAST, A DISTANCE OF 158.38 FEET;

THENCE SOUTH 75º 13' 55" EAST, A DISTANCE OF 46.34 FEET;

THENCE SOUTH 81º 33' 03" EAST, A DISTANCE OF 55.65 FEET;

THENCE SOUTH 86º 01' 40" EAST A DISTANCE OF 45.08 FEET;

THENCE NORTH 87º 47' 05" EAST, A DISTANCE OF 58.45 FEET;

THENCE SOUTH 85º 19' 42" EAST, A DISTANCE OF 221.36 FEET;

THENCE SOUTH 89º 19' 34" EAST, A DISTANCE OF 165.45 FEET;

THENCE SOUTH 00 º 25' 37" WEST A DISTANCE OF 117.35 FEET;

THENCE SOUTH 00º 23' 44" EAST, A DISTANCE OF 152.50 FEET;

THENCE NORTH 89º 36' 16" EAST, A DISTANCE OF 50.78 FEET;

THENCE SOUTH 00º 01' 59" WEST, A DISTANCE OF 210.73 FEET;

THENCE SOUTH 89º 47' 00" EAST, A DISTANCE OF 734.42 FEET, TO THE WESTERLY LINE OF THE SAN GABRIEL RIVER AS DESCRIBED AS PARCEL 1 IN GRANT OF EASEMENT TO THE LOS ANGELES COUNTY FLOOD CONTROL DISTRICT, RECORDED MAY 13, 1925 IN BOOK 4865, PAGE 275 THEREOF, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA;

THENCE SOUTH 00º 15' 54" WEST ALONG SAID WESTERLY LINE, A DISTANCE OF 522.82 FEET;

THENCE SOUTHWESTERLY ALONG SAID WESTERLY LINE ON A CURVE CONCAVE NORTHWESTERLY, HAVING A RADIUS OF 2664.93 FEET, THROUGH AN ANGLE OF 18º 34' 59", AN ARC LENGTH OF 864.33 FEET, TO THE SOUTHERLY LINE OF SAID SECTION 2, ALSO BEING THE CENTERLINE OF WESTMINSTER AVENUE;

THENCE SOUTH 89º 43' 58" EAST ALONG SAID SOUTHERLY LINE AND SAID CENTERLINE, A DISTANCE OF 419.09 FEET, TO THE EASTERLY LINE OF SAID SAN GABRIEL RIVER;

THENCE NORTHEASTERLY ALONG SAID EASTERLY LINE ON A CURVE CONCAVE NORTHWESTERLY, HAVING A RADIUS OF 3065.09 FEET, THROUGH AN ANGLE OF 16º 05' 10", AN ARC LENGTH OF 860.54 FEET;

THENCE NORTH 00º 15' 54" EAST ALONG SAID EASTERLY LINE, A DISTANCE OF 4056.93 FEET, TO A LINE PARALLEL WITH AND 390.00 FEET SOUTHERLY OF THE NORTHERLY LINE OF SAID SECTION 2;

THENCE SOUTH 89º 43' 42" EAST ALONG SAID PARALLEL LINE, A DISTANCE OF 125.93 FEET, TO A POINT IN THE EASTERLY BOUNDARY LINE OF THE COUNTY OF LOS ANGELES AS SHOWN BY RECORD OF SURVEY ON FILE IN BOOK 84 OF RECORD OF SURVEYS, PAGE 00 THEREOF, RECORDS OF LOS ANGELES COUNTY, CALIFORNIA;

THENCE NORTH 27º 10' 42" WEST ALONG SAID EASTERLY BOUNDARY LINE, A DISTANCE OF 162.91 FEET, TO AN ANGLE POINT THEREIN;

THENCE NORTH 31º 24' 56” WEST ALONG SAID EASTERLY BOUNDARY LINE, A DISTANCE OF 288.43 FEET, TO A POINT IN SAID NORTHERLY
LINE OF SECTION 2, ALSO BEING THE CENTERLINE OF STATE HIGHWAY 22 (FORMERLY 7TH STREET);

THENCE NORTH 89º 43' 42" WEST ALONG SAID NORTHERLY LINE AND SAID CENTERLINE, A DISTANCE OF 299.52 FEET, TO A POINT IN SAID WESTERLY LINE OF THE SAN GABRIEL RIVER, ALSO BEING THE NORTHEAST CORNER OF THE PARCEL CONVEYED TO STATE OF CALIFORNIA BY GRANT DEED RECORDED

APRIL 4, 1962 AS INSTRUMENT NO. 1941, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA;

THENCE SOUTH 00º 15' 54" WEST ALONG SAID WESTERLY LINE AND THE EASTERLY LINE OF SAID PARCEL CONVEYED TO THE STATE OF CALIFORNIA, A DISTANCE OF 60.00 FEET, TO THE SOUTHEAST CORNER THEREOF;

THENCE CONTINUING SOUTH 00º 15' 54" WEST ALONG SAID WESTERLY LINE, A DISTANCE OF 978.08 FEET;

THENCE NORTH 89º 47' 03" WEST, A DISTANCE OF 212.39 FEET;

THENCE SOUTH 00º 09' 11" WEST, A DISTANCE OF 176.59 FEET;

THENCE NORTH 89º 43' 38" WEST, A DISTANCE OF 944.79 FEET;

THENCE SOUTH 21º 18' 51" EAST, A DISTANCE OF 171.42 FEET;

THENCE NORTH 89º 53' 42" WEST, A DISTANCE OF 299.63 FEET, TO THE EASTERLY LINE OF SAID STUDEBAKER ROAD AS DESCRIBED IN GRANT OF EASEMENT RECORDED JUNE 20, 1973 AS INSTRUMENT NO. 2689, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA;

THENCE NORTHERLY ALONG SAID EASTERLY LINE ON A CURVE CONCAVE EASTERLY, HAVING A RADIUS OF 153.00 FEET, THROUGH AN ANGLE OF 01º 39' 58", AN ARC LENGTH OF 4.45 FEET (THE INITIAL RADIAL LINE BEARS SOUTH 68º 23' 46" WEST);

THENCE NORTH 00º 16' 10" EAST ALONG SAID EASTERLY LINE AND ALONG THE EASTERLY LINE OF SAID STUDEBAKER ROAD AS DESCRIBED IN GRANT OF EASEMENT RECORDED MAY 19, 1965 AS INSTRUMENT NO. 3602, OF 94.21 FEET, TO THE MOST NORTHERLY CORNER OF SAID GRANT OF EASEMENT RECORDED MAY 19, 1965 AS INSTRUMENT NO. 3602;

THENCE SOUTH 10º 04' 56" WEST ALONG THE NORTHERLY LINE OF SAID GRANT OF EASEMENT RECORDED MAY 19, 1965 AS INSTRUMENT NO. 3602, A DISTANCE OF 58.67 FEET, TO AN ANGLE POINT THEREIN;

THENCE NORTH 89º 43' 44" WEST ALONG SAID NORTHERLY LINE AND THE WESTERLY PROLONGATION THEREOF, A DISTANCE OF 96.07 FEET, TO A LINE PARALLEL WITH AND DISTANT 149.00 FEET EASTERLY OF SAID WESTERLY LINE OF THE EAST ONE-HALF OF SECTION 2:

THENCE NORTH 00º 16' 10" EAST ALONG SAID PARALLEL LINE, A DISTANCE OF 1334.27 FEET, TO A POINT IN SAID NORTHERLY LINE OF SECTION 2, ALSO BEING THE CENTERLINE OF STATE HIGHWAY 22 (FORMERLY 7TH STREET);

THENCE NORTH 89º 43' 42" WEST ALONG SAID NORTHERLY LINE, A DISTANCE OF 149.00 FEET, TO **THE POINT OF BEGINNING**.

<u>EXCEPT THERE FROM</u> THAT PORTION OF THE EAST ONE-HALF OF SECTION 2, TOWNSHIP 5 SOUTH, RANGE 12 WEST, IN THE RANCHO LOS ALAMITOS, AS SHOWN ON PARTITION MAP RECORDED IN BOOK 700, PAGE 141 OF DEEDS, IN THE OFFICE OF THE LOS ANGELES COUNTY RECORDER, DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHWEST CORNER OF SAID EAST ONE-HALF;

THENCE SOUTH 89º 49' 51" EAST ALONG THE NORTHERLY LINE OF SAID SECTION 2, A DISTANCE OF 246.00 FEET, TO A LINE PARALLEL WITH AND DISTANT 246.00 FEET EASTERLY OF THE WESTERLY LINE OF SAID EAST ONE-HALF OF SECTION 2;

THENCE SOUTH 00º 10' 03" WEST ALONG SAID PARALLEL LINE, A DISTANCE OF 2614.95 FEET, BEING THE MOST NORTHERLY CORNER OF THAT PARCEL OF LAND CONVEYED TO BIXBY RANCH BY DEED RECORDED MAY 22, 1963 AS INSTRUMENT NO. 4371, OFFICIAL RECORDS OF LOS ANGELES COUNTY, ALSO BEING A POINT ON THE EASTERLY LINE OF STUDEBAKER ROAD AS DESCRIBED IN GRANT OF EASEMENT RECORDED MAY 19, 1965 AS INSTRUMENT NO. 3602, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA, BEING THE **TRUE POINT OF BEGINNING**;

THENCE SOUTHWESTERLY ALONG SAID EASTERLY LINE AND ALONG THE WESTERLY LINE OF SAID PARCEL CONVEYED TO BIXBY RANCH, ON A CURVE CONCAVE NORTHWESTERLY, HAVING A RADIUS OF 2050.00 FEET, THROUGH AN ANGLE OF 11º 31' 34", AN ARC LENGTH OF 412.40 FEET, TO THE SOUTHWEST CORNER OF SAID PARCEL CONVEYED TO
BIXBY RANCH;

THENCE SOUTH 48º 54' 15" EAST ALONG THE SOUTHERLY LINE OF SAID PARCEL CONVEYED TO BIXBY RANCH, A DISTANCE OF 54.63 FEET, TO A LINE PARALLEL WITH AND 246.00 FEET EASTERLY OF SAID WESTERLY LINE OF THE EAST ONE-HALF OF SECTION 2, ALSO BEING THE SOUTHEAST CORNER OF SAID PARCEL CONVEYED TO BIXBY RANCH;

THENCE SOUTH 00º 16' 10" WEST ALONG SAID PARALLEL LINE, A DISTANCE OF 12.30 FEET;

THENCE SOUTH 89º 39' 05" EAST, A DISTANCE OF 862.40 FEET;

THENCE NORTH 89º 50' 40" EAST, A DISTANCE OF 219.36 FEET;

THENCE NORTH 00º 17' 19" WEST, A DISTANCE OF 283.83 FEET;

THENCE NORTH 06º 11' 33" EAST A DISTANCE OF 57.86 FEET;

THENCE NORTH 89º 15' 38" WEST, A DISTANCE OF 160.46 FEET;

THENCE NORTH 00º 40' 11" EAST, A DISTANCE OF 182.33 FEET;

THENCE NORTH 44º 43' 38" EAST, A DISTANCE OF 37.01 FEET;

THENCE NORTH 00º 13' 05" WEST, A DISTANCE OF 200.42 FEET;

THENCE NORTH 89º 45' 07" WEST, A DISTANCE OF 300.22 FEET;

THENCE NORTH 00º 14' 53" EAST, A DISTANCE OF 20.92 FEET;

THENCE NORTH 89º 26' 01" WEST, A DISTANCE OF 640.78 FEET TO SAID LINE PARALLEL WITH AND 246.00 FEET EASTERLY OF THE WESTERLY LINE THE EAST ONE-HALF OF SECTION 2;

THENCE SOUTH 00º 16' 10" WEST ALONG SAID LINE, A DISTANCE OF 318.81 FEET TO **THE POINT OF BEGINNING**.

HEREINABOVE DESCRIBED PARCEL CONTAINING A GROSS AREA OF 5,507,944 SQ. FT. / 126.44 AC, MORE OR LESS;

SUBJECT TO CONDITIONS, COVENANTS, RESTRICTIONS, DEDICATIONS, DEEDS, AND RIGHTS OF WAY OF RECORD, IF ANY;

THE BASIS OF BEARINGS FOR THIS DESCRIPTION AND EXHIBIT IS THE CALIFORNIA COORDINATE SYSTEM OF 1983 (CCS83) ZONE V, WHICH IS BASED ON THE 2007.00 EPOCH OF THE NORTH AMERICAN DATUM OF 1983 (NAD83). ALL DISTANCES SHOWN HEREIN ARE GROUND DISTANCES. TO OBTAIN GRID DISTANCES, MULTIPLY THE GROUND DISTANCE BY THE PROJECT COMBINATION FACTOR OF 0.99987686.

ALL AS SHOWN ON EXHIBIT 'B', ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF;

THIS DESCRIPTION WAS PREPARED BY ME IN CONFORMANCE WITH THE CALIFORNIA PROFESSIONAL LAND SURVEYORS ACT ON MAY 8, 2012.

ANTHONY C. CUOMO, PLS 6042
EXP. 6/30/2013
DATED: 5/8/2012

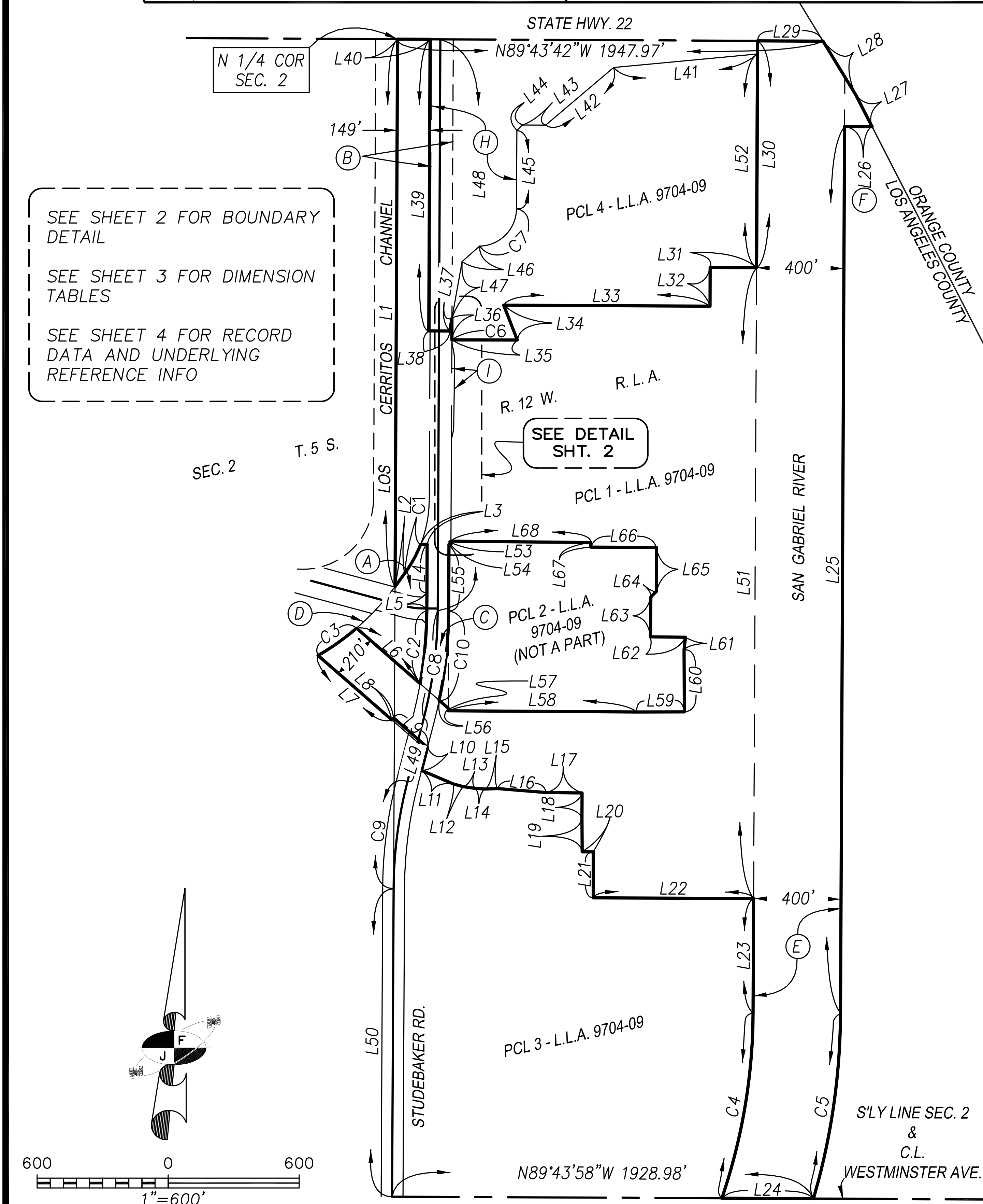
JOHNSON–FRANK & ASSOC., INC.

LAND SURVEYING – MAPPING
5150 E. HUNTER AVENUE
ANAHEIM, CALIFORNIA 92807–2049
(714) 777–8877 FAX (714) 777–1641

EXHIBIT 'B'

SKETCH TO ACCOMPANY LEGAL DESCRIPTION

DATE 2012–05–08 SHEET 1 OF 4



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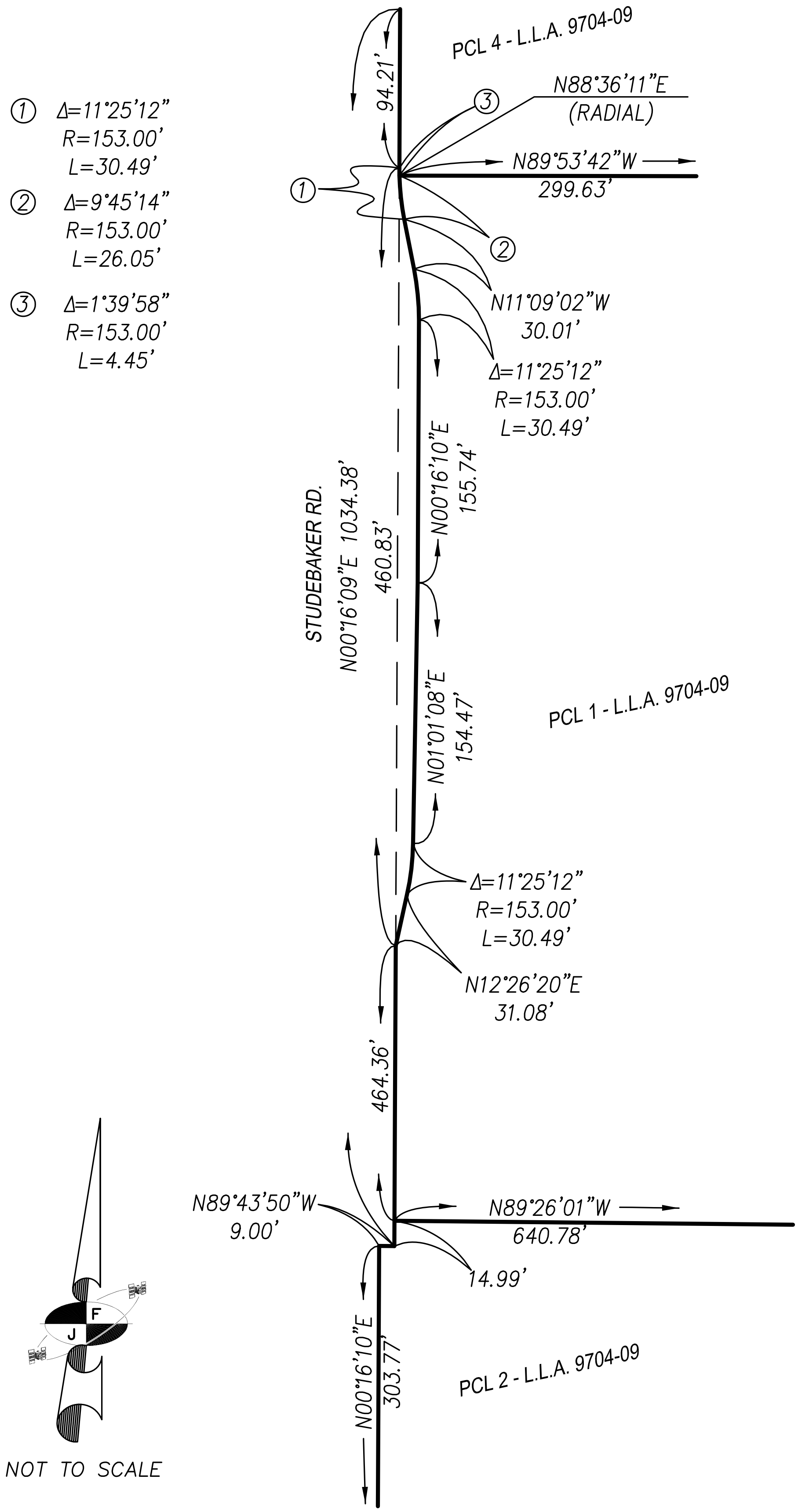
SKETCH TO ACCOMPANY LEGAL DESCRIPTION

DATE 2012-05-08 SHEET 2 OF 4



LINE TABLE			LINE TABLE		
LINE	LENGTH	BEARING	LINE	LENGTH	BEARING
L1	2505.18	N00°16'10"E	L36	94.21	N00°16'10"E
L2	74.85	N36°20'40"E	L37	58.67	N10°04'56"E
L3	29.45	N89°43'50"W	L38	96.07	N89°43'44"W
L4	221.02	N00°16'10"E	L39	1334.27	N00°16'10"E
L5	82.34	N00°16'10"E	L40	149.00	N89°43'42"W
L6	386.41	N48°54'15"W	L41	661.63	N84°36'28"E
L7	448.33	N48°54'15"W	L42	407.83	N49°44'46"E
L8	12.00	N41°05'45"E	L43	106.99	NS89°43'44"W
L9	206.12	N48°54'15"W	L44	35.35	N45°16'06"E
L10	108.46	N14°28'41"E	L45	357.97	N00°16'10"E
L11	158.38	N67°01'13"W	L46	106.99	N48°39'42"E
L12	46.34	N75°13'55"W	L47	264.05	N10°04'56"E
L13	55.65	N81°33'03"W	L48	2614.61	N00°16'10"E
L14	45.08	N86°01'40"W	L49	300.25	N14°28'41"E
L15	58.45	N87°47'05"E	L50	1408.87	N00°16'10"E
L16	221.36	N85°19'42"W	L51	2886.08	N00°15'54"E
L17	165.45	N89°19'34"W	L52	978.08	N00°15'54"E
L18	117.35	N00°25'37"E	L53	14.99	N00°16'10"E
L19	152.50	N00°23'44"W	L54	9.00	N89°43'50"W
L20	50.78	N89°36'16"E	L55	303.77	N00°16'10"E
L21	210.73	N00°01'59"E	L56	54.63	N48°54'15"W
L22	734.42	N89°47'00"W	L57	12.30	N00°16'10"E
L23	522.82	N00°15'54"E	L58	862.40	N89°39'05"W
L24	419.09	N89°43'58"W	L59	219.36	N89°50'40"E
L25	4056.93	N00°15'54"E	L60	283.83	N00°17'19"W
L26	125.93	N89°43'42"W	L61	57.86	N06°11'33"E
L27	162.91	N27°10'42"W	L62	160.46	N89°15'38"W
L28	288.43	N31°24'56"W	L63	182.33	N00°40'11"E
L29	299.52	N89°43'42"W	L64	37.01	N44°43'38"E
L30	1038.08	N00°15'54"W	L65	200.42	N00°13'05"W
L31	212.39	N89°47'03"W	L66	300.22	N89°45'07"W
L32	176.59	N00°09'11"E	L67	20.92	N00°14'53"E
L33	944.79	N89°43'38"W	L68	640.78	N89°26'01"W
L34	171.42	N21°18'51"W			
L35	299.63	N89°53'42"W			

CURVE TABLE				CURVE TABLE			
CURVE	LENGTH	RADIUS	DELTA	CURVE	LENGTH	RADIUS	DELTA
C1	152.30	578.44	15°05'09"	C6	4.45	153.00	1°39'58"
C2	335.70	1950.00	9°51'49"	C7	266.17	172.00	88°40'03"
C3	216.35	1150.00	10°46'45"	C8	495.97	2000.00	14°12'31"
C4	864.33	2664.93	18°34'59"	C9	495.97	2000.00	14°12'31"
C5	860.54	3065.09	16°05'10"	C10	412.40	2050.00	11°31'34"

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EXHIBIT 'B'
SKETCH TO ACCOMPANY LEGAL DESCRIPTION

DATE 2012–05–08 SHEET 3 OF 4

(A)

CONVEYED TO BIXBY RANCH, BY GRANT DEED RECORDED MAY 22, 1963 AS INSTRUMENT NO. 4371, OFFICIAL RECORDS OF LOS ANGELES COUNTY.

(B)

WESTERLY LINE OF STUDEBAKER AS DESCRIBED IN GRANT OF EASEMENT MAY 19, 1965 AS INSTRUMENT NO. 3602, OFFICIAL RECORDS OF LOS ANGELES COUNTY.

(C)

WESTERLY LINE OF STUDEBAKER ROAD AS DESCRIBED IN GRANT OF EASEMENT RECORDED JULY 2, 1965 AS INSTRUMENT NO. 4310, OFFICIAL RECORDS OF LOS ANGELES COUNTY

(D)

SOUTHEASTERLY LINE OF THE LOS CERRITOS CHANNEL AS DESCRIBED IN DECREE OF CONDEMNATION (PARCEL 3) RECORDED NOVEMBER 8, 1955 IN BOOK 49471, PAGE 50 THEREOF, OFFICIAL RECORDS OF LOS ANGELES COUNTY

(E)

WESTERLY LINE OF THE SAN GABRIEL RIVER AS DESCRIBED AS PARCEL 1 IN GRANT OF EASEMENT TO THE LOS ANGELES COUNTY FLOOD CONTROL DISTRICT, RECORDED MAY 13, 1925 IN BOOK 4865, PAGE 275 THEREOF, OFFICIAL RECORDS OF LOS ANGELES COUNTY

(F)

LINE PARALLEL WITH AND 390.00 FEET SOUTHERLY OF THE NORTHERLY LINE OF SAID SECTION 2

(G)

LINE PARALLEL WITH AND 390.00 FEET SOUTHERLY OF THE NORTHERLY LINE OF SAID SECTION 2

(H)

PARCEL CONVEYED TO STATE OF CALIFORNIA BY GRANT DEED RECORDED APRIL 4, 1962 AS INSTRUMENT NO. 1941, OFFICIAL RECORDS OF LOS ANGELES COUNTY

(I)

EASTERLY LINE OF SAID STUDEBAKER ROAD AS DESCRIBED IN GRANT OF EASEMENT RECORDED JUNE 20, 1973 AS INSTRUMENT NO. 2689, OFFICIAL RECORDS OF LOS ANGELES COUNTY

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EXHIBIT 'B'
SKETCH TO ACCOMPANY LEGAL DESCRIPTION
UNDERLYING RECORD REFERENCES

EXHIBIT "A"

LEGAL DESCRIPTION OF THE TOTAL PROPERTY

EXHIBIT "A"
"TOTAL PROPERTY"
LEGAL DESCRIPTION

ALL OF PARCEL 2 OF LOT LINE ADJUSTMENT LLA 9704-09, RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958950, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, STATE OF CALIFORNIA, ALSO DESCRIBED AS FOLLOWS:

THAT PORTION OF THE EAST ONE-HALF OF SECTION 2, TOWNSHIP 5 SOUTH, RANGE 12 WEST, IN THE RANCHO LOS ALAMITOS, AS SHOWN ON PARTITION MAP RECORDED IN BOOK 700, PAGE 141 OF DEEDS, IN THE OFFICE OF THE LOS ANGELES COUNTY RECORDER, DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHWEST CORNER OF SAID EAST ONE-HALF;

THENCE SOUTH 89° 49' 51" EAST ALONG THE NORTHERLY LINE OF SAID SECTION 2, A DISTANCE OF 246.00 FEET TO A LINE PARALLEL WITH AND DISTANT 246.00 FEET EASTERLY OF THE WESTERLY LINE OF SAID EAST ONE-HALF OF SECTION 2;

THENCE SOUTH 00° 10' 03" WEST ALONG SAID PARALLEL LINE, A DISTANCE OF 2614.95 FEET, BEING THE MOST NORTHERLY CORNER OF THE PARCEL OF LAND CONVEYED TO BIXBY RANCH BY DEED RECORDED MAY 22, 1963 AS INSTRUMENT NO. 4371, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA. ALSO BEING A POINT ON THE EASTERLY LINE OF STUDEBAKER ROAD AS DESCRIBED IN GRANT OF EASEMENT RECORDED MAY 19, 1965 AS INSTRUMENT NO. 3602, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA, BEING THE TRUE POINT OF BEGINNING.

THENCE SOUTHWESTERLY ALONG SAID EASTERLY LINE AND ALONG THE WESTERLY LINE OF SAID PARCEL CONVEYED TO BIXBY RANCH, ON A CURVE CONCAVE NORTHWESTERLY, HAVING A RADIUS OF 2050.00 FEET, THROUGH AN ANGLE OF 11° 30' 36", AN ARC LENGTH OF 411.82 FEET, TO THE SOUTHWEST CORNER OF SAID PARCEL CONVEYED TO BIXBY RANCH;

THENCE SOUTH 49° 00' 29" EAST ALONG THE SOUTHERLY LINE OF SAID PARCEL CONVEYED TO BIXBY RANCH, A DISTANCE OF 54.48 FEET, TO A LINE PARALLEL WITH AND 246.00 FEET EASTERLY OF SAID WESTERLY LINE OF THE EAST ONE-HALF OF SECTION 2, ALSO BEING THE SOUTHEAST CORNER OF SAID PARCEL CONVEYED TO BIXBY RANCH;

THENCE SOUTH 00° 10' 03" WEST ALONG SAID PARALLEL LINE, A DISTANCE OF 12.30 FEET;

THENCE SOUTH 89° 45' 12" EAST, A DISTANCE OF 862.40 FEET;

THENCE NORTH 89° 44' 33" EAST, A DISTANCE OF 219.36 FEET;

THENCE NORTH 00° 23' 26" WEST, A DISTANCE OF 283.83 FEET;

THENCE NORTH 06° 05' 26" EAST, A DISTANCE OF 57.86 FEET;

EXHIBIT "A"
"TOTAL PROPERTY"
LEGAL DESCRIPTION

THENCE NORTH 89° 21' 45" WEST, A DISTANCE OF 160.46 FEET;

THENCE NORTH 00° 34' 04" EAST, A DISTANCE OF 182.33 FEET;

THENCE NORTH 44° 37' 31" EAST, A DISTANCE OF 37.01 FEET;

THENCE NORTH 00° 19' 12" WEST, A DISTANCE OF 200.42 FEET;

THENCE NORTH 89° 51' 14" WEST, A DISTANCE OF 300.22 FEET;

THENCE NORTH 00° 08' 46" EAST, A DISTANCE OF 20.92 FEET;

THENCE NORTH 89° 32' 08" WEST, A DISTANCE OF 649.78 FEET TO SAID LINE PARALLEL WITH AND 246.00 FEET EASTERLY OF THE WESTERLY LINE THE EAST ONE-HALF OF SECTION 2;

THENCE SOUTH 00° 10' 03" WEST ALONG SAID LINE, A DISTANCE OF 319.50 FEET TO THE POINT OF BEGINNING.

EXCEPT THEREFROM ALL "SOUTHERN CALIFORNIA EDISON OPERATIONS IMPROVEMENTS" AS DEFINED AND SET FORTH IN THE GRANT DEED EXECUTED BY SOUTHERN CALIFORNIA EDISON COMPANY, A CALIFORNIA CORPORATION AS GRANTOR AND AES ALAMITOS DEVELOPMENT, INC., A DELAWARE CORPORATION AS GRANTEE, RECORDED MARCH 15, 2001 AS INSTRUMENT NO. 01-424640, OF OFFICIAL RECORDS.

EXCEPTING THEREFROM ALL OIL, GAS, PETROLEUM AND OTHER MINERAL OR HYDROCARBON SUBSTANCES IN AND UNDER SAID LAND, TOGETHER WITH THE RIGHT TO USE THAT PORTION ONLY OF SAID LAND WHICH UNDERLIES A PLANE PARALLEL TO SAID 500 FEET BELOW THE PRESENT SURFACE OF SAID LAND, FOR THE PURPOSE OF PROSPECTING FOR, DEVELOPING AND/OR EXTRACTING SAID OIL, GAS, PETROLEUM AND OTHER MINERAL OR HYDROCARBON SUBSTANCES FROM SAID LAND BY MEANS OF WELLS DRILLED INTO SAID SUB-SURFACE OF SAID LAND FROM DRILL SITES LOCATED ON OTHER LAND, IT BEING EXPRESSLY UNDERSTOOD AND AGREED THAT SAID SELLERS, THEIR HEIRS, SUCCESSORS AND ASSIGNS, SHALL HAVE NO RIGHT TO ENTER UPON THE SURFACE OF SAID LAND, OR TO USE SAID LAND OR ANY PORTION THEREOF, TO SAID DEPTH OF 500 FEET, FOR ANY PURPOSE WHATSOEVER, AS SET FORTH IN THE DEED FROM ERNEST A. BRYANT, JR., AND ALLEN L. CHICKERING, AS TRUSTEES UNDER THE LAST WILL AND TESTAMENT OF SUSANNA BIXBY BRYANT, ALSO KNOWN AS SUSANNA P. BRYANT, DECEASED, RECORDED JULY 27, 1953 IN BOOK 42302, PAGE 73, AS INSTRUMENT NO. 889, OF OFFICIAL RECORDS.

ALSO EXCEPTING THEREFROM ALL OIL, GAS, PETROLEUM AND OTHER MINERAL OR HYDROCARBON SUBSTANCES IN AND UNDER SAID LAND, WITHOUT, HOWEVER, THE RIGHT TO USE THE SURFACE THEREOF, AS EXCEPTED AND RESERVED IN THAT CERTAIN DEED TO EDISON SECURITIES COMPANY, A CORPORATION, DATED SEPTEMBER 02, 1953 AND RECORDED SEPTEMBER 15, 1953 IN BOOK 42694, PAGE 232, AS INSTRUMENT NO. 2298, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

EXHIBIT "A"
"TOTAL PROPERTY"
LEGAL DESCRIPTION

ALSO EXCEPTING THEREFROM ALL OIL, GAS, PETROLEUM AND OTHER MINERAL OR HYDROCARBON SUBSTANCES IN AND UNDER OR WHICH MAY BE PRODUCED FROM SAID LAND, TOGETHER WITH THE RIGHT TO USE THAT PORTION ONLY OF SAID LAND WHICH UNDERLIES A PLANE PARALLEL TO AND FIVE HUNDRED (500) FEET BELOW THE PRESENT SURFACE OF SAID LAND, FOR THE PURPOSE OF PROSPECTING FOR, DEVELOPING AND/OR EXTRACTING SAID OIL, PETROLEUM AND OTHER MINERAL OR HYDROCARBON SUBSTANCES FROM SAID LAND BY MEANS OF WELLS DRILLED INTO SAID SUBSURFACE OF SAID LAND FROM DRILL SITES LOCATED ON OTHER LAND, WITHOUT, HOWEVER, THE RIGHT TO ENTER UPON THE SURFACE OF SAID LAND, OR TO USE SAID LAND OR ANY PORTION THEREOF TO SAID DEPTH OF FIVE HUNDRED (500) FEET FOR ANY PURPOSE WHATSOEVER, AS PROVIDED IN DEED RECORDED MAY 22, 1963 AS INSTRUMENT NO. 4370, OFFICIAL RECORDS.

APN(S): 7237-019-005

CONTAINING 17.82 ACRES, MORE OR LESS

ALSO AS SHOWN ON EXHIBIT "A-1" ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF.

SUBJECT TO COVENANTS, CONDITIONS, RESTRICTIONS, RESERVATIONS, EASEMENTS AND RIGHTS-OF-WAY OF RECORD, IF ANY.

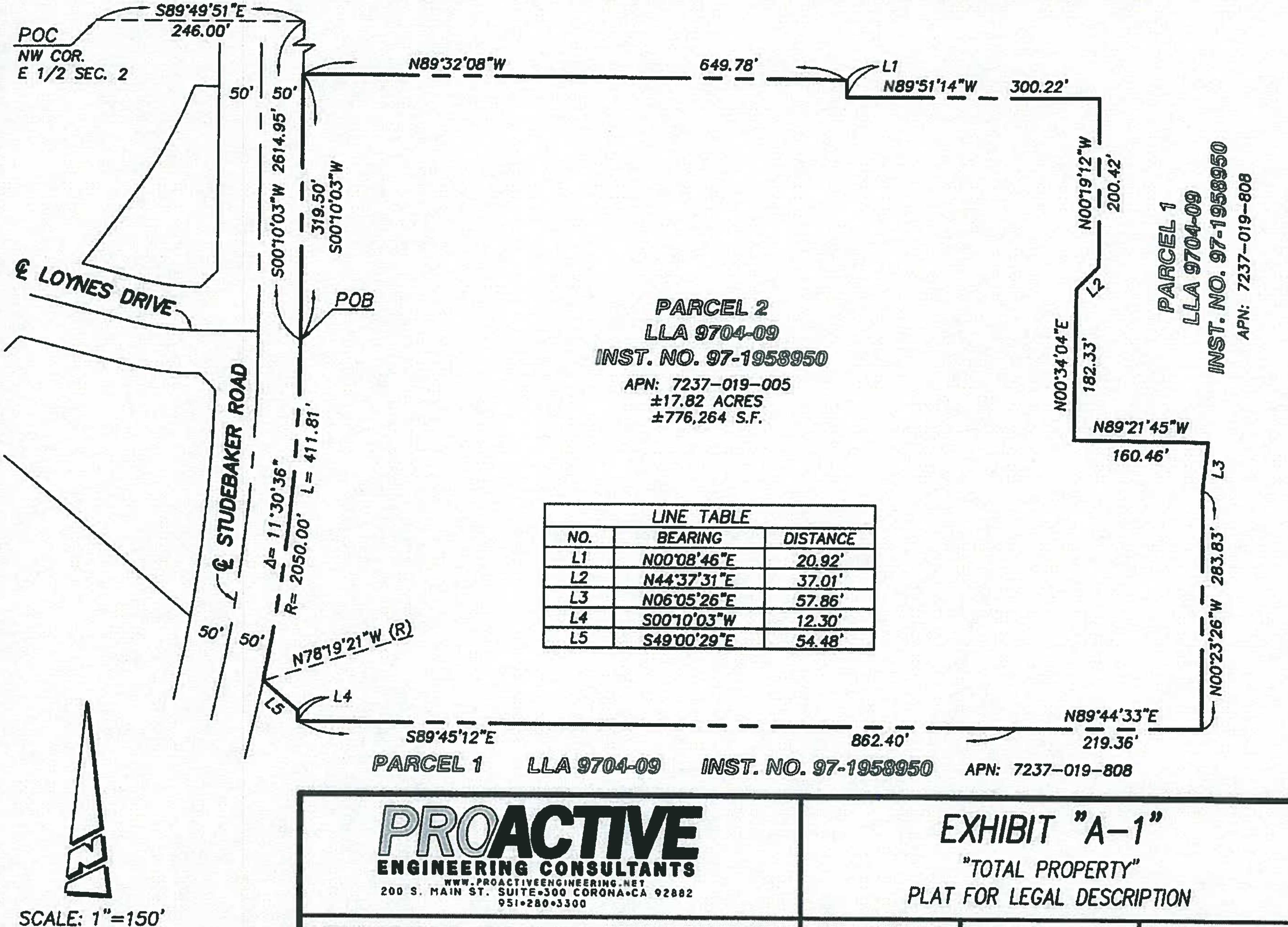
PREPARED BY: PROACTIVE ENGINEERING CONSULTANTS
UNDER THE DIRECTION OF:

LICENSED LAND SURVEYOR
CHARLES J. MOORE
L.S. 9106
STATE OF CALIFORNIA

CHARLES J. MOORE
REGISTRATION EXPIRES 9/30/16

DECEMBER 18, 2014
J.N. 06.198.000

PARCEL 2 OF LOT LINE ADJUSTMENT LLA 9704-09, RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958950, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, STATE OF CALIFORNIA.



LINE TABLE

NO.	BEARING	DISTANCE
L1	N00°08'46"E	20.92'
L2	N44°37'31"E	37.01'
L3	N06°05'26"E	57.86'
L4	S00°10'03"W	12.30'
L5	S49°00'29"E	54.48'

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951•280•3300

EXHIBIT "A-1"

"TOTAL PROPERTY"
PLAT FOR LEGAL DESCRIPTION

Z:\06.198.000 LONG BEACH\SURVEY\DRAWINGS\PSA_LEGAL_EX-A-1.DWG

DATE: 12/18/14 | J.N. 06.198.000 | SHEET 1 OF 1

EXHIBIT "B"

LEGAL DESCRIPTION OF THE PROPERTY

EXHIBIT "B"
PARCEL 'B'
LEGAL DESCRIPTION

THAT PORTION OF PARCEL 2 OF LOT LINE ADJUSTMENT LLA 9704-09, RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958950, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:

PARCEL 'B'

BEGINNING AT A POINT ON THE NORTHERLY LINE OF SAID PARCEL 2, SAID POINT BEING DISTANT EASTERLY 367.18 FEET, AS MEASURED ALONG SAID NORTHERLY LINE, FROM THE NORTHWEST CORNER THEREOF;

THENCE ALONG THE NORTHERLY, EASTERLY, AND SOUTHERLY LINES OF SAID PARCEL 2 THE FOLLOWING COURSES:

SOUTH 89°32'08" EAST, A DISTANCE OF 282.60 FEET;
SOUTH 00°08'46" WEST, A DISTANCE OF 20.92 FEET;
SOUTH 89°51'14" EAST, A DISTANCE OF 300.22 FEET;
SOUTH 00°19'12" EAST, A DISTANCE OF 200.42 FEET;
SOUTH 44°37'31" WEST, A DISTANCE OF 37.01 FEET;
SOUTH 00°34'04" WEST, A DISTANCE OF 182.33 FEET;
SOUTH 89°21'45" EAST, A DISTANCE OF 160.46 FEET;
SOUTH 06°05'26" WEST, A DISTANCE OF 57.86 FEET;
SOUTH 00°23'26" EAST, A DISTANCE OF 283.83 FEET;
SOUTH 89°44'33" WEST, A DISTANCE OF 219.36 FEET;

THENCE NORTH 89°45'12" WEST, A DISTANCE OF 495.03 FEET TO A POINT ON SAID SOUTHERLY LINE, SAID POINT BEING DISTANT EASTERLY 367.37 FEET, AS MEASURED ALONG SAID SOUTHERLY LINE, FROM THE WESTERLY TERMINUS OF THE COURSE SHOWN AS " NORTH 89°45'12" WEST, 862.40' ", ON SAID LOT LINE ADJUSTMENT 9704-09;

THENCE LEAVING SAID SOUTHERLY LINE NORTH 00°09'12" EAST, A DISTANCE OF 775.06 FEET TO THE **POINT OF BEGINNING.**

EXHIBIT "B"
PARCEL 'B'
LEGAL DESCRIPTION

CONTAINING 11.13 ACRES, MORE OR LESS

ALSO AS SHOWN ON EXHIBIT "B-1" ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF.

SUBJECT TO COVENANTS, CONDITIONS, RESTRICTIONS, RESERVATIONS, EASEMENTS AND RIGHTS-OF-WAY OF RECORD, IF ANY.

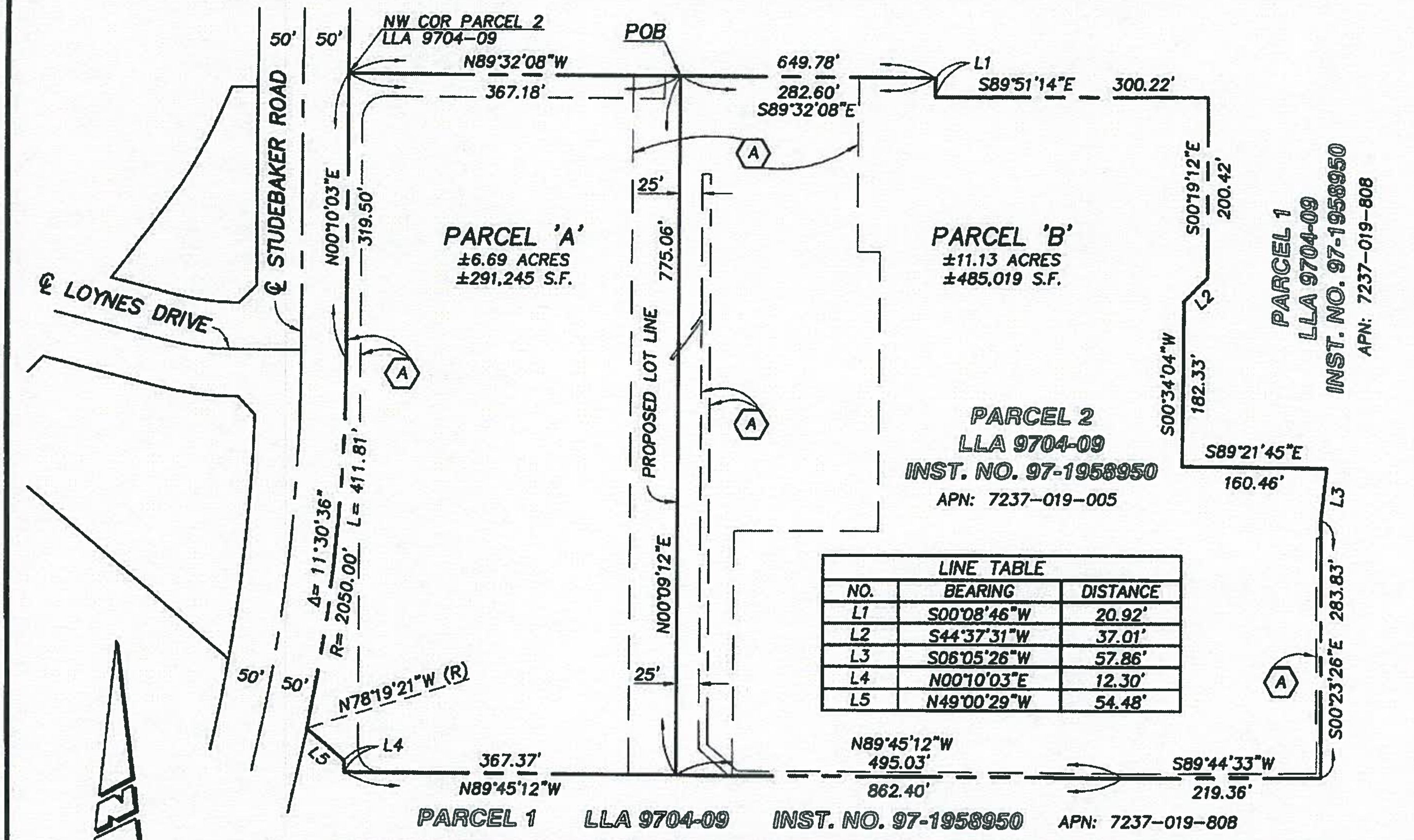
PREPARED BY: PROACTIVE ENGINEERING CONSULTANTS
UNDER THE DIRECTION OF:

LICENSED LAND SURVEYOR
CHARLES J. MOORE
L.S. 9106
STATE OF CALIFORNIA

CHARLES J. MOORE
REGISTRATION EXPIRES 9/30/16

DECEMBER 17, 2014
J.N. 06.198.000

A PORTION OF PARCEL 2 OF LOT LINE ADJUSTMENT LLA 9704-09, RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958950, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, STATE OF CALIFORNIA.



LINE TABLE

NO.	BEARING	DISTANCE
L1	S00°08'46"W	20.92'
L2	S44°37'31"W	37.01'
L3	S06°05'26"W	57.86'
L4	N00°10'03"E	12.30'
L5	N49°00'29"W	54.48'

SCALE: 1"=150'

(A) – SCE EASEMENT
REC. MARCH 15, 2001
INST. NO. 01-0424640 O.R.

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EXHIBIT "B-1"

PLAT FOR LEGAL DESCRIPTION

Z:\06.198.000 LONG BEACH\SURVEY\DRAWINGS\PSA_LEGAL_EX-B-1.DWG

DATE: 12/18/14	J.N. 06.198.000	SHEET 1 OF 1

EXHIBIT "C"

LEGAL DESCRIPTION OF THE RECONVEYANCE PROPERTY

EXHIBIT "C"
PARCEL 'A'
LEGAL DESCRIPTION

THAT PORTION OF PARCEL 2 OF LOT LINE ADJUSTMENT LLA 9704-09, RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958950, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:

PARCEL 'A'

BEGINNING AT A POINT ON THE NORTHERLY LINE OF SAID PARCEL 2, SAID POINT BEING DISTANT EASTERLY 367.18 FEET, AS MEASURED ALONG SAID NORTHERLY LINE, FROM THE NORTHWEST CORNER THEREOF;

THENCE LEAVING SAID NORTHERLY LINE, SOUTH 00°09'12" WEST A DISTANCE OF 775.06 FEET TO A POINT ON THE SOUTHERLY LINE OF SAID PARCEL 2, SAID POINT BEING DISTANT EASTERLY 367.37 FEET, AS MEASURED ALONG SAID SOUTHERLY LINE, FROM THE WESTERLY TERMINUS OF THE COURSE SHOWN AS " NORTH 89°45'12" WEST, 862.40' ", ON SAID LOT LINE ADJUSTMENT 9704-09;

THENCE ALONG SAID SOUTHERLY LINE, NORTH 89°45'12" WEST A DISTANCE OF 367.37 FEET;

THENCE CONTINUING ALONG SAID SOUTHERLY LINE NORTH 00°10'03" EAST, A DISTANCE OF 12.30 FEET;

THENCE NORTH 49°00'29" WEST A DISTANCE OF 54.48 FEET, TO A POINT ON THE EASTERLY RIGHT OF WAY OF STUDEBAKER ROAD, 100 FEET WIDE, SAID POINT ALSO BEING THE BEGINNING OF A NON-TANGANT CURVE, CONCAVE WESTERLY AND HAVING A RADIUS OF 2050.00 FEET, A RADIAL LINE TO SAID POINT BEARS SOUTH 78°19'21" EAST;

THENCE NORTHERLY ALONG SAID EASTERLY RIGHT OF WAY AND SAID CURVE THROUGH A CENTRAL ANGLE OF 11°30'36", AN ARC DISTANCE OF 411.81 FEET;

THENCE NORTH 00°10'03" EAST A DISTANCE OF 319.50 FEET TO THE NORTHWEST CORNER OF SAID PARCEL 2;

THENCE ALONG THE NORTHERLY LINE OF SAID PARCEL 2, SOUTH 89°32'08" EAST A DISTANCE OF 367.18 FEET TO THE **POINT OF BEGINNING.**

EXHIBIT "C"
PARCEL 'A'
LEGAL DESCRIPTION

CONTAINING 6.69 ACRES, MORE OR LESS.

ALSO AS SHOWN ON EXHIBIT "C-1" ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF.

SUBJECT TO COVENANTS, CONDITIONS, RESTRICTIONS, RESERVATIONS, EASEMENTS AND RIGHTS-OF-WAY OF RECORD, IF ANY.

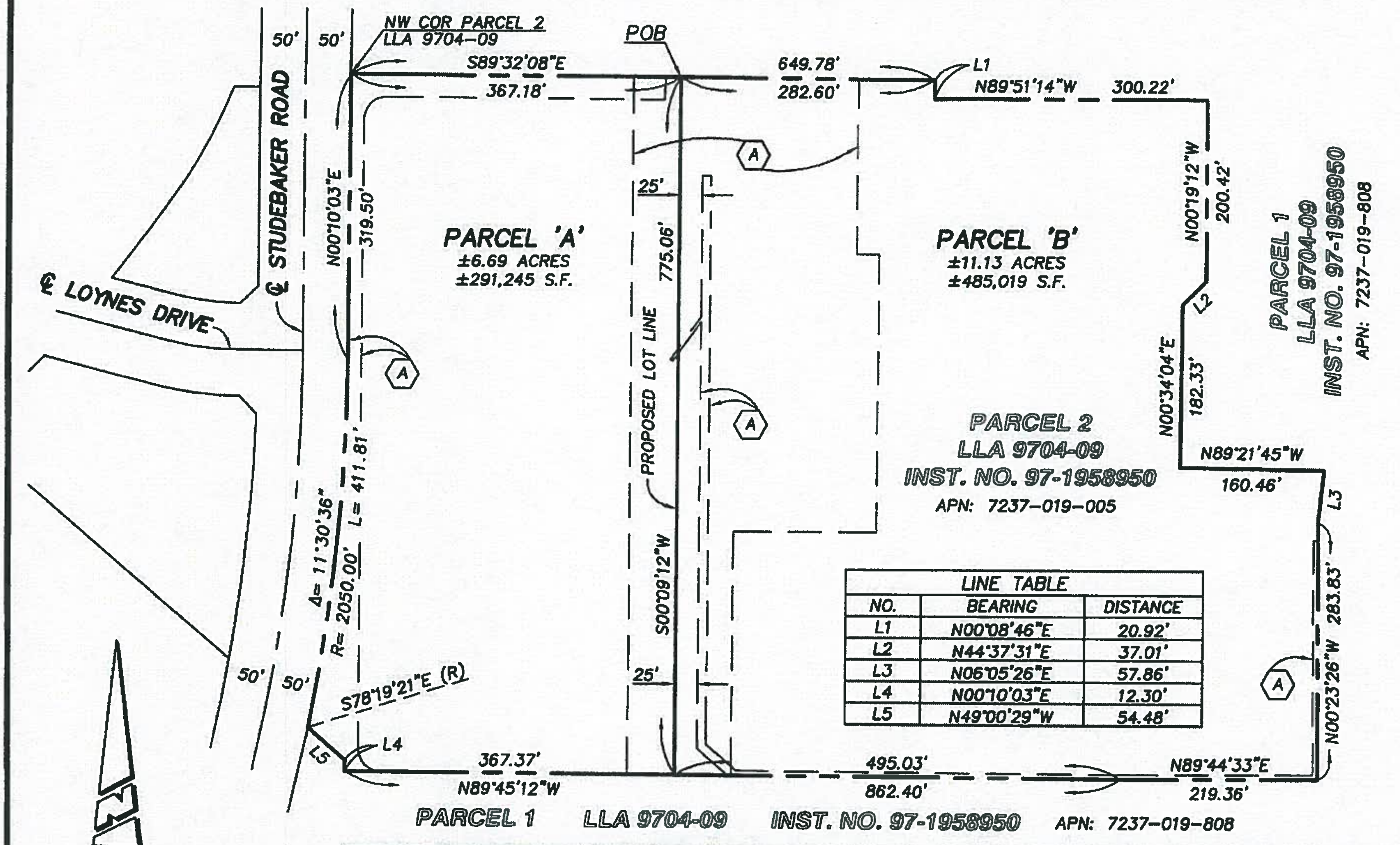
PREPARED BY: PROACTIVE ENGINEERING CONSULTANTS
UNDER THE DIRECTION OF:

LICENSED LAND SURVEYOR
CHARLES J. MOORE
L.S. 9106
STATE OF CALIFORNIA

CHARLES J. MOORE
REGISTRATION EXPIRES 9/30/16

DECEMBER 17, 2014
J.N. 06.198.000

A PORTION OF PARCEL 2 OF LOT LINE ADJUSTMENT LLA 9704-09, RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958950, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, STATE OF CALIFORNIA.



LINE TABLE		
NO.	BEARING	DISTANCE
L1	N00°08'46"E	20.92'
L2	N44°37'31"E	37.01'
L3	N06°05'26"E	57.86'
L4	N00°10'03"E	12.30'
L5	N49°00'29"W	54.48'

SCALE: 1"=150'

(A) — SCE EASEMENT
REC. MARCH 15, 2001
INST. NO. 01-0424640 O.R.

PROACTIVE ENGINEERING CONSULTANTS
WWW.PROACTIVEENGINEERING.NET
200 S. MAIN ST. SUITE•300 CORONA•CA 92882
951•280•3300

EXHIBIT "C-1"

PLAT FOR LEGAL DESCRIPTION

Z:\06.198.000 LONG BEACH\SURVEY\DRAWINGS\PSA_LEGAL_EX-C-1.DWG

DATE: 12/18/14 | J.N. 06.198.000 | SHEET 1 OF 1

EXHIBIT "D"

MEMORANDUM OF DUTY TO CONVEY

RECORDING REQUESTED BY AND
WHEN RECORDED RETURN TO:

Loynes Beach Partners, LLC
Attn: Randall W. Blanchard
26342 Oso Parkway, Suite 201
Mission Viejo, CA 92691

MEMORANDUM OF DUTY TO RECONVEY

This MEMORANDUM OF DUTY TO RECONVEY (the "Memorandum") is made as of this 31st day of December, 2014, by and between **LOYNES BEACH PARTNERS, LLC**, a California limited liability company ("Loynes"), and **AES ALAMITOS ENERGY, LLC**, a Delaware limited liability company ("AES") with reference to the facts set forth below:

RECITALS

A. Pursuant to that certain Agreement for Purchase and Sale of Real Property and Escrow Instructions, dated as of December 23, 2014 ("Agreement"), Loynes was the owner of that certain real property located in City of Long Beach, County of Los Angeles, State of California, as more particularly depicted on **Exhibit "A"** attached hereto and incorporated herein by this reference ("Total Property"). The Total Property is comprised of approximately 17.82 acres and known as APN 7237-019-005.

B. Loynes sold AES the Total Property.

C. Pursuant to Section 4.4 of the Agreement, AES has an obligation to reconvey to Loynes that portion of the Total Property described and depicted on **Exhibit "C"** attached hereto ("Reconveyance Property") upon the terms and conditions set forth in the Agreement.

AGREEMENT

NOW, THEREFORE, in furtherance of the foregoing, and for good and valuable consideration, receipt of which is hereby acknowledged, AES and Loynes agree as follows:

1 The parties hereto hereby incorporate into the terms of this Memorandum each and every one of the Recitals contained in Paragraphs A through C, inclusive, above, as though fully set forth herein.

2 Upon recordation of this Memorandum, the parties agree that AES purchased the Total Property, including the Reconveyance Property, subject to AES's obligation to reconvey the Reconveyance Property to Loynes upon the terms and conditions set forth in the Agreement.

3 Loynes and AES agree that this Memorandum shall be recorded immediately after the Grant Deed to the Total Property is recorded conveying the Total Property to AES. Due to AES's duty to reconvey the Reconveyance Property pursuant to Section 4.4 of the Agreement, AES agrees that it shall not encumber the Reconveyance Property with any deed(s) of trust or other matters recorded against the Reconveyance Property affecting title to the Reconveyance Property in any manner or way whatsoever, other than (i) liens for taxes not yet due and payable; and (ii) statutory liens and other liens imposed by law, in each case incurred in the ordinary course of business for amounts not yet overdue or for amounts being contested in good faith by appropriate proceedings.

[Signatures on following page]

IN WITNESS WHEREOF, the parties have executed this Memorandum as of the date and year first above written.

"AES"

AES ALAMITOS ENERGY, LLC, a
Delaware limited liability company

By: ______________________

Its: President

"Loynes"

LOYNES BEACH PARTNERS, LLC, a
California limited liability company

By: Seasmoke Partners-Studebaker, LLC, a California limited liability company, Its Manager

By: ______________________
Randall W. Blanchard,
Manager

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA)
COUNTY OF ORANGE)

On December 23, 2014, before me, Eddie Paul Frederick, a notary public, personally appeared Eric Pendergraft, who proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity, and that by his signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.
WITNESS my hand and official seal.

Signature ______________ (Seal)

EDDIE PAUL FREDERICK
Commission No. 1944407
NOTARY PUBLIC-CALIFORNIA
LOS ANGELES COUNTY
My Comm. Expires JULY 16, 2015

A notary public or other officer completing this certificate verifies only the identity of the individual who signed the document to which this certificate is attached, and not the truthfulness, accuracy, or validity of that document.

STATE OF CALIFORNIA)
COUNTY OF ORANGE)

On December 23, 2014, before me, Cynthia Pressel, a notary public, personally appeared RANDALL W. BLANCHARD, who proved to me on the basis of satisfactory evidence to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity, and that by his signature on the instrument the person, or the entity upon behalf of which the person acted, executed the instrument.

I certify under PENALTY OF PERJURY under the laws of the State of California that the foregoing paragraph is true and correct.
WITNESS my hand and official seal.

Signature *Cynthia Pressel* (Seal)

CYNTHIA PRESSEL
Commission # 2043369
Notary Public - California
Orange County
My Comm. Expires Sep 29, 2017

EXHIBIT "A"

LEGAL DESCRIPTION OF THE TOTAL PROPERTY

EXHIBIT "A"
"TOTAL PROPERTY"
LEGAL DESCRIPTION

ALL OF PARCEL 2 OF LOT LINE ADJUSTMENT LLA 9704-09, RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958950, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, STATE OF CALIFORNIA, ALSO DESCRIBED AS FOLLOWS:

THAT PORTION OF THE EAST ONE-HALF OF SECTION 2, TOWNSHIP 5 SOUTH, RANGE 12 WEST, IN THE RANCHO LOS ALAMITOS, AS SHOWN ON PARTITION MAP RECORDED IN BOOK 700, PAGE 141 OF DEEDS, IN THE OFFICE OF THE LOS ANGELES COUNTY RECORDER, DESCRIBED AS FOLLOWS:

COMMENCING AT THE NORTHWEST CORNER OF SAID EAST ONE-HALF;

THENCE SOUTH 89° 49' 51" EAST ALONG THE NORTHERLY LINE OF SAID SECTION 2, A DISTANCE OF 246.00 FEET TO A LINE PARALLEL WITH AND DISTANT 246.00 FEET EASTERLY OF THE WESTERLY LINE OF SAID EAST ONE-HALF OF SECTION 2;

THENCE SOUTH 00° 10' 03" WEST ALONG SAID PARALLEL LINE, A DISTANCE OF 2614.95 FEET, BEING THE MOST NORTHERLY CORNER OF THE PARCEL OF LAND CONVEYED TO BIXBY RANCH BY DEED RECORDED MAY 22, 1963 AS INSTRUMENT NO. 4371, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA. ALSO BEING A POINT ON THE EASTERLY LINE OF STUDEBAKER ROAD AS DESCRIBED IN GRANT OF EASEMENT RECORDED MAY 19, 1965 AS INSTRUMENT NO. 3602, OFFICIAL RECORDS OF LOS ANGELES COUNTY, CALIFORNIA, BEING THE TRUE POINT OF BEGINNING.

THENCE SOUTHWESTERLY ALONG SAID EASTERLY LINE AND ALONG THE WESTERLY LINE OF SAID PARCEL CONVEYED TO BIXBY RANCH, ON A CURVE CONCAVE NORTHWESTERLY, HAVING A RADIUS OF 2050.00 FEET, THROUGH AN ANGLE OF 11° 30' 36", AN ARC LENGTH OF 411.82 FEET, TO THE SOUTHWEST CORNER OF SAID PARCEL CONVEYED TO BIXBY RANCH;

THENCE SOUTH 49° 00' 29" EAST ALONG THE SOUTHERLY LINE OF SAID PARCEL CONVEYED TO BIXBY RANCH, A DISTANCE OF 54.48 FEET, TO A LINE PARALLEL WITH AND 246.00 FEET EASTERLY OF SAID WESTERLY LINE OF THE EAST ONE-HALF OF SECTION 2, ALSO BEING THE SOUTHEAST CORNER OF SAID PARCEL CONVEYED TO BIXBY RANCH;

THENCE SOUTH 00° 10' 03" WEST ALONG SAID PARALLEL LINE, A DISTANCE OF 12.30 FEET;

THENCE SOUTH 89° 45' 12" EAST, A DISTANCE OF 862.40 FEET;

THENCE NORTH 89° 44' 33" EAST, A DISTANCE OF 219.36 FEET;

THENCE NORTH 00° 23' 26" WEST, A DISTANCE OF 283.83 FEET;

THENCE NORTH 06° 05' 26" EAST, A DISTANCE OF 57.86 FEET;

EXHIBIT "A"
"TOTAL PROPERTY"
LEGAL DESCRIPTION

THENCE NORTH 89° 21' 45" WEST, A DISTANCE OF 160.46 FEET;

THENCE NORTH 00° 34' 04" EAST, A DISTANCE OF 182.33 FEET;

THENCE NORTH 44° 37' 31" EAST, A DISTANCE OF 37.01 FEET;

THENCE NORTH 00° 19' 12" WEST, A DISTANCE OF 200.42 FEET;

THENCE NORTH 89° 51' 14" WEST, A DISTANCE OF 300.22 FEET;

THENCE NORTH 00° 08' 46" EAST, A DISTANCE OF 20.92 FEET;

THENCE NORTH 89° 32' 08" WEST, A DISTANCE OF 649.78 FEET TO SAID LINE PARALLEL WITH AND 246.00 FEET EASTERLY OF THE WESTERLY LINE THE EAST ONE-HALF OF SECTION 2;

THENCE SOUTH 00° 10' 03" WEST ALONG SAID LINE, A DISTANCE OF 319.50 FEET TO THE POINT OF BEGINNING.

EXCEPT THEREFROM ALL "SOUTHERN CALIFORNIA EDISON OPERATIONS IMPROVEMENTS" AS DEFINED AND SET FORTH IN THE GRANT DEED EXECUTED BY SOUTHERN CALIFORNIA EDISON COMPANY, A CALIFORNIA CORPORATION AS GRANTOR AND AES ALAMITOS DEVELOPMENT, INC., A DELAWARE CORPORATION AS GRANTEE, RECORDED MARCH 15, 2001 AS INSTRUMENT NO. 01-424640, OF OFFICIAL RECORDS.

EXCEPTING THEREFROM ALL OIL, GAS, PETROLEUM AND OTHER MINERAL OR HYDROCARBON SUBSTANCES IN AND UNDER SAID LAND, TOGETHER WITH THE RIGHT TO USE THAT PORTION ONLY OF SAID LAND WHICH UNDERLIES A PLANE PARALLEL TO SAID 500 FEET BELOW THE PRESENT SURFACE OF SAID LAND, FOR THE PURPOSE OF PROSPECTING FOR, DEVELOPING AND/OR EXTRACTING SAID OIL, GAS, PETROLEUM AND OTHER MINERAL OR HYDROCARBON SUBSTANCES FROM SAID LAND BY MEANS OF WELLS DRILLED INTO SAID SUB-SURFACE OF SAID LAND FROM DRILL SITES LOCATED ON OTHER LAND, IT BEING EXPRESSLY UNDERSTOOD AND AGREED THAT SAID SELLERS, THEIR HEIRS, SUCCESSORS AND ASSIGNS, SHALL HAVE NO RIGHT TO ENTER UPON THE SURFACE OF SAID LAND, OR TO USE SAID LAND OR ANY PORTION THEREOF, TO SAID DEPTH OF 500 FEET, FOR ANY PURPOSE WHATSOEVER, AS SET FORTH IN THE DEED FROM ERNEST A. BRYANT, JR., AND ALLEN L. CHICKERING, AS TRUSTEES UNDER THE LAST WILL AND TESTAMENT OF SUSANNA BIXBY BRYANT, ALSO KNOWN AS SUSANNA P. BRYANT, DECEASED, RECORDED JULY 27, 1953 IN BOOK 42302, PAGE 73, AS INSTRUMENT NO. 889, OF OFFICIAL RECORDS.

ALSO EXCEPTING THEREFROM ALL OIL, GAS, PETROLEUM AND OTHER MINERAL OR HYDROCARBON SUBSTANCES IN AND UNDER SAID LAND, WITHOUT, HOWEVER, THE RIGHT TO USE THE SURFACE THEREOF, AS EXCEPTED AND RESERVED IN THAT CERTAIN DEED TO EDISON SECURITIES COMPANY, A CORPORATION, DATED SEPTEMBER 02, 1953 AND RECORDED SEPTEMBER 15, 1953 IN BOOK 42694, PAGE 232, AS INSTRUMENT NO. 2298, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF SAID COUNTY.

EXHIBIT "A"
"TOTAL PROPERTY"
LEGAL DESCRIPTION

ALSO EXCEPTING THEREFROM ALL OIL, GAS, PETROLEUM AND OTHER MINERAL OR HYDROCARBON SUBSTANCES IN AND UNDER OR WHICH MAY BE PRODUCED FROM SAID LAND, TOGETHER WITH THE RIGHT TO USE THAT PORTION ONLY OF SAID LAND WHICH UNDERLIES A PLANE PARALLEL TO AND FIVE HUNDRED (500) FEET BELOW THE PRESENT SURFACE OF SAID LAND, FOR THE PURPOSE OF PROSPECTING FOR, DEVELOPING AND/OR EXTRACTING SAID OIL, PETROLEUM AND OTHER MINERAL OR HYDROCARBON SUBSTANCES FROM SAID LAND BY MEANS OF WELLS DRILLED INTO SAID SUBSURFACE OF SAID LAND FROM DRILL SITES LOCATED ON OTHER LAND, WITHOUT, HOWEVER, THE RIGHT TO ENTER UPON THE SURFACE OF SAID LAND, OR TO USE SAID LAND OR ANY PORTION THEREOF TO SAID DEPTH OF FIVE HUNDRED (500) FEET FOR ANY PURPOSE WHATSOEVER, AS PROVIDED IN DEED RECORDED MAY 22, 1963 AS INSTRUMENT NO. 4370, OFFICIAL RECORDS.

APN(S): 7237-019-005

CONTAINING 17.82 ACRES, MORE OR LESS

ALSO AS SHOWN ON EXHIBIT "A-1" ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF.

SUBJECT TO COVENANTS, CONDITIONS, RESTRICTIONS, RESERVATIONS, EASEMENTS AND RIGHTS-OF-WAY OF RECORD, IF ANY.

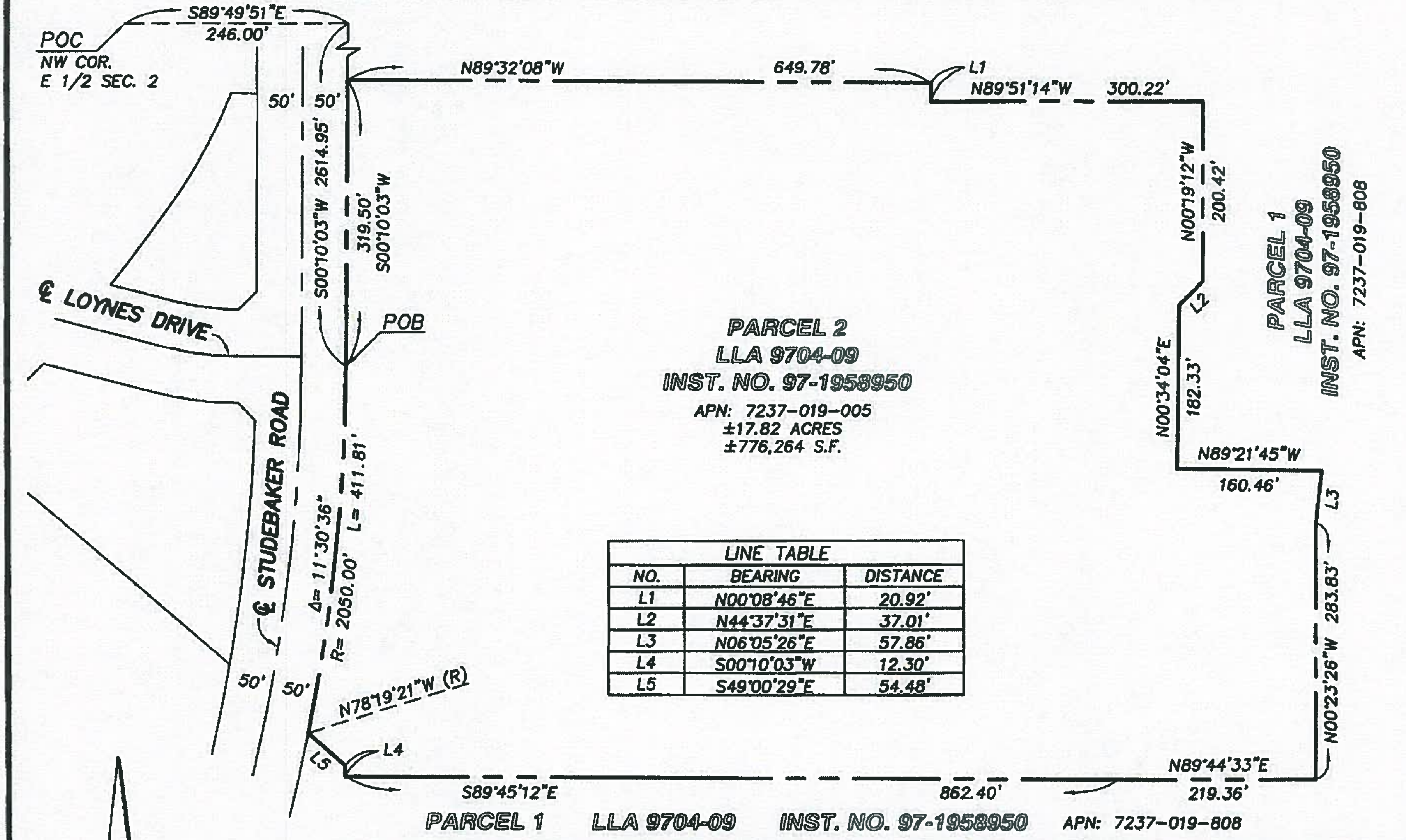
PREPARED BY: PROACTIVE ENGINEERING CONSULTANTS
UNDER THE DIRECTION OF:

LICENSED LAND SURVEYOR
CHARLES J. MOORE
L.S. 9106
STATE OF CALIFORNIA

CHARLES J. MOORE
REGISTRATION EXPIRES 9/30/16

DECEMBER 18, 2014
J.N. 06.198.000

PARCEL 2 OF LOT LINE ADJUSTMENT LLA 9704-09, RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958950, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, STATE OF CALIFORNIA.



LINE TABLE

NO.	BEARING	DISTANCE
L1	N00°08'46"E	20.92'
L2	N44°37'31"E	37.01'
L3	N06°05'26"E	57.86'
L4	S00°10'03"W	12.30'
L5	S49°00'29"E	54.48'

PROACTIVE ENGINEERING CONSULTANTS
WWW.PROACTIVEENGINEERING.NET
200 S. MAIN ST. SUITE-300 CORONA-CA 92882
951-280-3300

EXHIBIT "A-1"
"TOTAL PROPERTY"
PLAT FOR LEGAL DESCRIPTION

Z:\06.198.000 LONG BEACH\SURVEY\DRAWINGS\PSA_LEGAL_EX-A-1.DWG

DATE: 12/18/14 | J.N. 06.198.000 | SHEET 1 OF 1

EXHIBIT "B"

INTENTIONALLY OMITTED

EXHIBIT "C"

LEGAL DESCRIPTION OF THE RECONVEYANCE PROPERTY

EXHIBIT "C"
PARCEL 'A'
LEGAL DESCRIPTION

THAT PORTION OF PARCEL 2 OF LOT LINE ADJUSTMENT LLA 9704-09, RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958950, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:

PARCEL 'A'

BEGINNING AT A POINT ON THE NORTHERLY LINE OF SAID PARCEL 2, SAID POINT BEING DISTANT EASTERLY 367.18 FEET, AS MEASURED ALONG SAID NORTHERLY LINE, FROM THE NORTHWEST CORNER THEREOF;

THENCE LEAVING SAID NORTHERLY LINE, SOUTH 00°09'12" WEST A DISTANCE OF 775.06 FEET TO A POINT ON THE SOUTHERLY LINE OF SAID PARCEL 2, SAID POINT BEING DISTANT EASTERLY 367.37 FEET, AS MEASURED ALONG SAID SOUTHERLY LINE, FROM THE WESTERLY TERMINUS OF THE COURSE SHOWN AS " NORTH 89°45'12" WEST, 862.40' ", ON SAID LOT LINE ADJUSTMENT 9704-09;

THENCE ALONG SAID SOUTHERLY LINE, NORTH 89°45'12" WEST A DISTANCE OF 367.37 FEET;

THENCE CONTINUING ALONG SAID SOUTHERLY LINE NORTH 00°10'03" EAST, A DISTANCE OF 12.30 FEET;

THENCE NORTH 49°00'29" WEST A DISTANCE OF 54.48 FEET, TO A POINT ON THE EASTERLY RIGHT OF WAY OF STUDEBAKER ROAD, 100 FEET WIDE, SAID POINT ALSO BEING THE BEGINNING OF A NON-TANGANT CURVE, CONCAVE WESTERLY AND HAVING A RADIUS OF 2050.00 FEET, A RADIAL LINE TO SAID POINT BEARS SOUTH 78°19'21" EAST;

THENCE NORTHERLY ALONG SAID EASTERLY RIGHT OF WAY AND SAID CURVE THROUGH A CENTRAL ANGLE OF 11°30'36", AN ARC DISTANCE OF 411.81 FEET;

THENCE NORTH 00°10'03" EAST A DISTANCE OF 319.50 FEET TO THE NORTHWEST CORNER OF SAID PARCEL 2;

THENCE ALONG THE NORTHERLY LINE OF SAID PARCEL 2, SOUTH 89°32'08" EAST A DISTANCE OF 367.18 FEET TO THE **POINT OF BEGINNING.**

EXHIBIT "C"
PARCEL 'A'
LEGAL DESCRIPTION

CONTAINING 6.69 ACRES, MORE OR LESS.

ALSO AS SHOWN ON EXHIBIT "C-1" ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF.

SUBJECT TO COVENANTS, CONDITIONS, RESTRICTIONS, RESERVATIONS, EASEMENTS AND RIGHTS-OF-WAY OF RECORD, IF ANY.

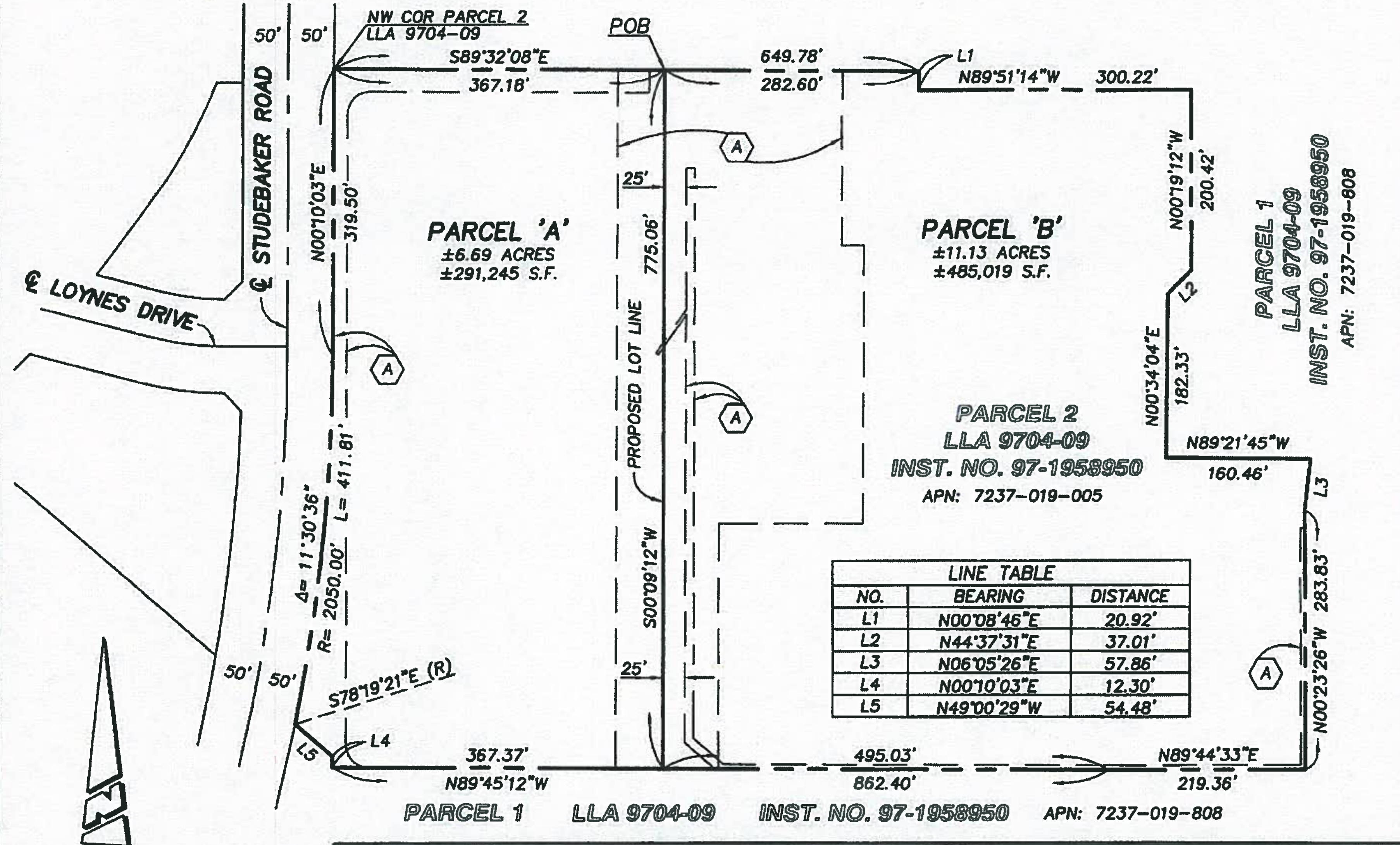
PREPARED BY: PROACTIVE ENGINEERING CONSULTANTS
UNDER THE DIRECTION OF:

LICENSED LAND SURVEYOR
CHARLES J. MOORE
L.S. 9106
STATE OF CALIFORNIA

CHARLES J. MOORE
REGISTRATION EXPIRES 9/30/16

DECEMBER 17, 2014
J.N. 06.198.000

A PORTION OF PARCEL 2 OF LOT LINE ADJUSTMENT LLA 9704-09, RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958950, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, STATE OF CALIFORNIA.



LINE TABLE		
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L4	N00°10'03"E	12.30'
L5	N49°00'29"W	54.48'

SCALE: 1"=150'

(A) – SCE EASEMENT
REC. MARCH 15, 2001
INST. NO. 01-0424640 O.R.

PROACTIVE
ENGINEERING CONSULTANTS
WWW.PROACTIVEENGINEERING.NET
200 S. MAIN ST. SUITE 300 CORONA CA 92882
951-280-3300

EXHIBIT "C-1"

PLAT FOR LEGAL DESCRIPTION

Z:\06.198.000 LONG BEACH\SURVEY\DRAWINGS\PSA_LEGAL_EX-C-1.DWG

DATE: 12/18/14 | J.N. 06.198.000 | SHEET 1 OF 1

EXHIBIT "E"

DRAINAGE EASEMENT

EXHIBIT "E"
DRAINAGE EASEMENT
LEGAL DESCRIPTION

A PORTION OF PARCEL 2 OF LOT LINE ADJUSTMENT LLA 9704-09, RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958950, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, STATE OF CALIFORNIA, DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE SOUTHERLY LINE OF SAID PARCEL 2, SAID POINT BEING DISTANT EASTERLY 367.37 FEET, AS MEASURED ALONG SAID SOUTHERLY LINE, FROM THE WESTERLY TERMINUS OF THE COURSE SHOWN AS " NORTH 89°45'12" WEST, 862.40' ", ON SAID LOT LINE ADJUSTMENT 9704-09;

THENCE LEAVING SAID SOUTHERLY LINE, NORTH 00°09'12" EAST A DISTANCE OF 60.00 FEET;

THENCE SOUTH 89°45'12" EAST A DISTANCE OF 30.00 FEET;

THENCE SOUTH 00°09'12" WEST A DISTANCE OF 60.00 FEET TO A POINT ON THE SOUTHERLY LINE OF SAID PARCEL 2;

THENCE NORTH 89°45'12" WEST A DISTANCE OF 30.00 FEET TO THE **POINT OF BEGINNING.**

CONTAINING 0.04 ACRES, OR 1,800 SQUARE FEET, MORE OR LESS.

ALSO AS SHOWN ON EXHIBIT "E-1" ATTACHED HERETO AND BY THIS REFERENCE MADE A PART HEREOF.

SUBJECT TO COVENANTS, CONDITIONS, RESTRICTIONS, RESERVATIONS, EASEMENTS AND RIGHTS-OF-WAY OF RECORD, IF ANY.

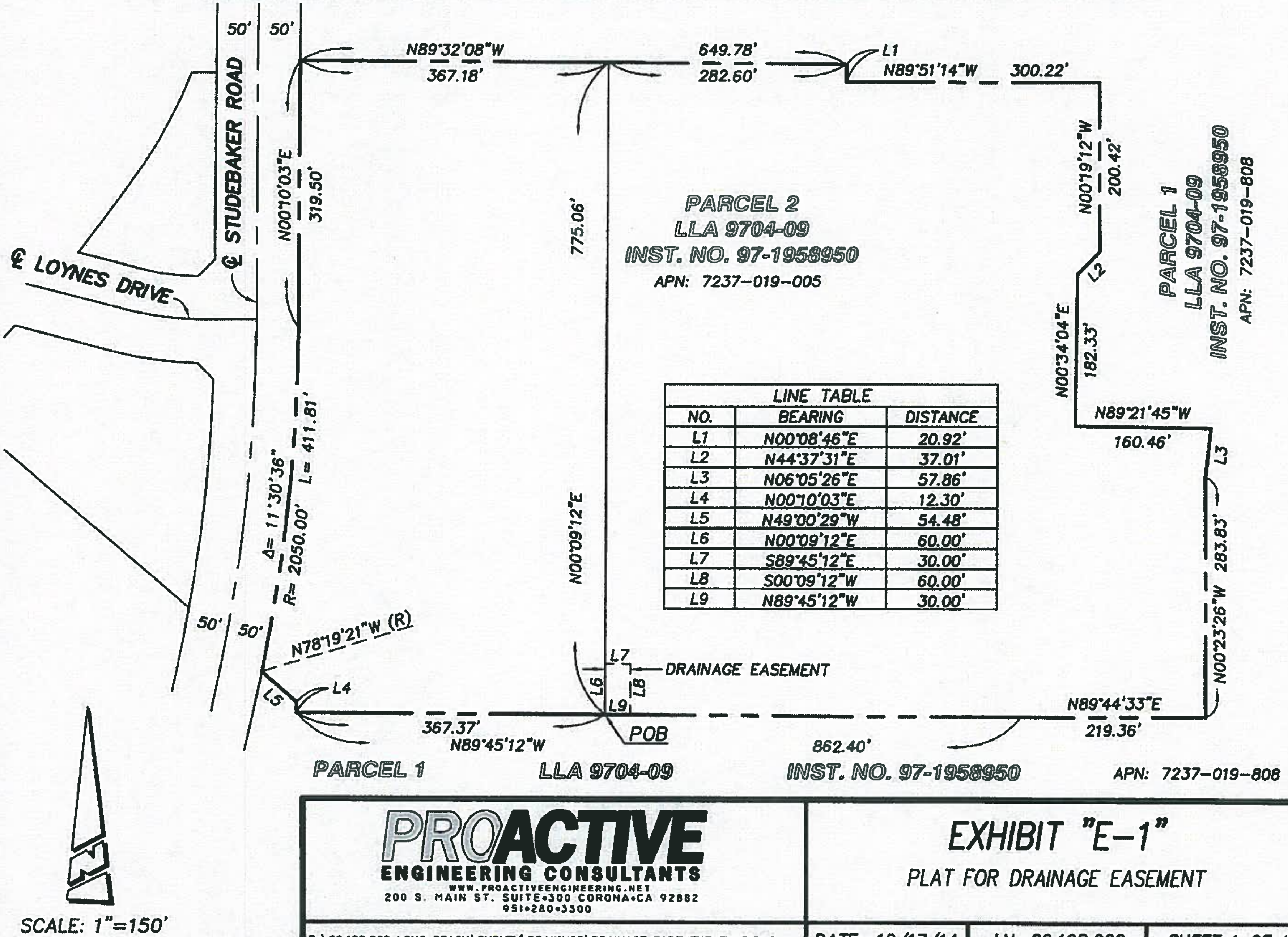
PREPARED BY: PROACTIVE ENGINEERING CONSULTANTS
UNDER THE DIRECTION OF:

LICENSED LAND SURVEYOR
CHARLES J. MOORE
L.S. 9106
STATE OF CALIFORNIA

CHARLES J. MOORE
REGISTRATION EXPIRES 9/30/16

DECEMBER 17, 2014
J.N. 06.198.000

PORTION OF PARCEL 2 OF LOT LINE ADJUSTMENT LLA 9704-09, RECORDED DECEMBER 12, 1997 AS INSTRUMENT NO. 97-1958950, OF OFFICIAL RECORDS, IN THE OFFICE OF THE COUNTY RECORDER OF LOS ANGELES COUNTY, STATE OF CALIFORNIA.



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L4	N00°10'03"E	12.30'
L5	N49°00'29"W	54.48'
L6	N00°09'12"E	60.00'
L7	S89°45'12"E	30.00'
L8	S00°09'12"W	60.00'
L9	N89°45'12"W	30.00'

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EXHIBIT "E-1"

PLAT FOR DRAINAGE EASEMENT

Z:\06.198.000 LONG BEACH\SURVEY\DRAWINGS\DRAINAGE EASEMENT_EX-B.DWG

DATE: 12/17/14 | J.N. 06.198.000 | SHEET 1 OF 1

Appendix 1B
Property Owners within 1,000 Feet of Project Site and Residents within 0.5 mile of Project Site

Provided on CD

Appendix 1C
Persons who Prepared the SAFC

APPENDIX 1C

Persons Who Prepared the SAFC

Section	Title	Preparer	Affiliation
	Project Development Manager	Jennifer Didlo	AES
	Environmental Project Manager	Stephen O'Kane	AES
	Project Engineer		AES
	Owner's Engineer	Nicholas Ryan/Dan Perlin	PEI/PEC
	Legal Counsel	Jeffery Harris, Samantha Pottenger	Ellison, Schneider & Harris
	AFC Project Manager	Jerry Salamy	CH2M HILL
	Deputy AFC Project Manager	Elyse Engel	CH2M HILL
1.0	Executive Summary	Jerry Salamy	
2.0	Project Description	Dan Perlin; Nicholas Ryan; Jerry Salamy	PEI/PEC/CH2M HILL
3.0	Electrical Transmission	Nicholas Ryan	PEC
4.0	Natural Gas Supply	Jerry Salamy	CH2M HILL
5.0	Environmental Information		
5.1	Air Quality	Jerry Salamy; Elyse Engel	CH2M HILL
5.2	Biological Resources	Rene Langis; Melissa Fowler	CH2M HILL
5.3	Cultural Resources	Clint Helton, R.P.A.; Natalie Lawson, R.P.A.	CH2M HILL
5.4	Geologic Hazards and Resources	Tom Lae, P.E.	CH2M HILL
5.5	Hazardous Materials Handling	Jerry Salamy; Cindy Salazar	CH2M HILL
5.6	Land Use	Aarty Joshi; Angela Wolfe	CH2M HILL
5.7	Noise	Mark Bastasch, P.E.	CH2M HILL
5.8	Paleontological Resources	W. Geoffrey Spaulding, Ph.D.; James Verhoff	CH2M HILL
5.9	Public Health	Jerry Salamy; Elyse Engel	CH2M HILL
5.10	Socioeconomics	Fatuma Yusuf, Ph.D.	CH2M HILL
5.11	Soils	Steve Long; Jennifer Krenz	CH2M HILL
5.12	Traffic and Transportation	Loren Bloomberg, P.E.; Lisa Valdez	CH2M HILL
5.13	Visual Resources	Tom Priestley, Ph.D.; Angela Wolfe	CH2M HILL
5.14	Waste Management	Jerry Salamy; Cindy Salazar	CH2M HILL
5.15	Water Resources	Matthew Franck	CH2M HILL
5.16	Worker Health and Safety	Jerry Salamy; Cindy Salazar	CH2M HILL
6.0	Alternatives	Jerry Salamy	CH2M HILL

Appendix 2A
Construction Equipment and Labor Requirements

Simple-Cycle Power Block	Months After Notice To Proceed																MAN MONTHS	DAYS / MO.	MAN DAYS	HRS / DAY	MAN HOURS
Construction Labor	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**					
Carpenters/Cement Finishers	2	8	14	22	26	22	26	30	38	30	16	8	8	4	2	0	256	23	5888	10	58880
Laborers	6	6	8	22	30	62	62	62	62	30	14	8	8	6	4	4	394	23	9062	10	90620
Teamsters	2	6	10	14	22	12	12	10	10	10	6	4	2	2	2	0	124	23	2852	10	28520
Electricians	2	6	8	10	14	16	30	56	68	74	76	86	34	20	10	10	520	23	11960	10	119600
Iron Workers	0	6	10	62	58	62	62	58	50	44	38	34	16	6	0	0	506	23	11638	10	116380
Millwrights	0	0	0	14	16	26	56	82	82	82	60	18	18	2	2	2	460	23	10580	10	105800
Boilermakers	0	0	0	0	0	28	28	28	28	28	28	22	22	22	0	0	234	23	5382	10	53820
Pipefitters	0	0	0	6	12	18	18	32	78	22	12	8	4	2	0	0	212	23	4876	10	48760
Insulation Workers	0	0	0	0	0	0	0	16	16	16	34	8	6	0	0	0	96	23	2208	10	22080
Operating Engineers	2	6	14	14	14	26	26	22	18	8	2	2	2	2	2	0	160	23	3680	10	36800
Sheetmetal Workers	0	0	0	0	0	6	12	14	18	14	14	14	4	2	0	0	98	24	2352	10	23520
Painters	0	0	0	0	0	8	18	18	18	8	8	4	4	4	0	0	90	25	2250	10	22500
TOTAL CRAFT LABOR	14	38	64	164	192	286	350	428	486	366	308	216	128	72	22	16	3150	23	72450	10	724500
TOTAL SUPERVISION	10	16	24	20	32	30	30	30	26	26	30	32	32	32	12	12	394	23	9062	10	90620
TOTAL MANPOWER	24	54	88	184	224	316	380	458	512	392	338	248	160	104	34	28	3544	23	81512	10	815120

Month 36 = May 2020
Month 51 = August 2021

Simple-Cycle Power Block	Months after Project Kickoff															
Construction Equipment	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**
Excavators		2	2	2	2	2	2									
Backhoe		2	2	2	2	2	2	2	2	2						
10 Wheel Dump Truck																
Dozer		4	4	4												
Front End Loader	2	2	4	4	4	4	2	2	2	2	2	2				
75 Ton Hydraulic Crane		2	2	2	2	2	2	2	2							
35 Ton Hydraulic Crane	2	2	2	2	2	2	2	2	2	2	2	2				
Pile Driver			4		4											
Fork Lift	4	4	4	4	4	4	4	4	4	4						
Grader		4	4	4												
Compactor		4	4	4	4	4	4									
Stake Truck	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Water Truck	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Pick-up Truck	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Air Compressor		4	4	4	4	4	4	4	4	4						
Light Towers				4	8	8	8	4								
Heavy Lift Lattice boom Main Crane																
Heavy Lift Lattice boom Tail Crain																
Heavy lift Gantry Crane			2	2	2	2	2									

Month 36 = May 2020
Month 51 = August 2021

Combined-Cycle Power Block: Construction Labor	2017							2018												2019												2020			MAN MONTHS	DAYS / MO.	MAN DAYS	HRS / DAY	TOTAL HOURS
CRAFT	JUN	JLY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR					
Month #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34					
FNTP - June 1, 2017	X																																						
MOBILIZE - November 29, 2017						X																																	
Piling Crew							8	8	8																										24	23	552	9	4,968
Carpenters							8	14	16	18	20	20	20	24	24	24	24	22	18	15	13	12													292	23	6,716	9	60,444
Laborers							8	12	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	16	5	5	414	23	9,522	9	85,698
Teamsters							2	4	4	4	5	5	6	7	7	7	7	7	7	7	7	7	7	7	7	7	7	5	5	5	3				146	23	3,358	9	30,222
Electricians							16	18	24	24	24	28	34	36	48	54	54	54	60	60	60	60	60	60	60	54	54	52	48	36	24	6	5	5	1,118	23	25,714	9	231,426
Ironworkers							8	10	10	12	12	12	12	12	12	14	14	14	14	14	14	14	10	8											216	23	4,968	9	44,712
Millwrights														4	6	8	12	12	12	12	12	12	12	12	12	12	12	10	8	6	4	4	3	3	188	23	4,324	9	38,916
Boilermakers														8	10	12	20	36	48	48	48	48	48	48	48	48	48	48	48	40	36				690	23	15,870	9	142,830
Plumbers																					2	2	2	2	2	2	2	2	2	2	2	2			24	23	552	9	4,968
Pipefitters							11	15	20	22	24	30	38	48	48	54	58	58	58	58	58	58	58	58	58	58	58	58	58	50	48	26	4	4	1,196	23	27,508	9	247,572
Insulation workers																							8	10	12	30	30	30	24	18	12				174	23	4,002	9	36,018
Operating Enginneers							6	8	10	10	12	12	12	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	14	3	3	2	330	23	7,590	9	68,310
Oilers / Mechanics							1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2								31	23	713	9	6,417
Cement Finishers							2	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4													60	23	1,380	9	12,420
Masons																																			0	23	0	9	0
Sheetrockers																									2	4	4	4	4	2	2				22	23	506	9	4,554
Roofers																					2	2	2	2	2	2									12	23	276	9	2,484
Sheetmetal Workers																																			0	23	0	9	0
Sprinkler Fitters																						4	4	4	4	4	4	4	4	4	3				39	23	897	9	8,073
Painters																							2	4	4	6	6	8	8	6	4				48	23	1,104	9	9,936
I & C - Control Room																		6	7	8	8	8	8	8	8	8	8	8	8	8	7	4	4	3	119	23	2,737	9	24,633
Guaranteed Substantial Complete-April 1, 2020																																			0				0
																																			0				0
TOTAL CRAFT LABOR																																			0	23	0	9	0
																																			0				0
TOTAL SUPERVISION (GENERAL FOREMEN)							3	4	4	4	4	5	5	6	7	7	7	7	7	7	7	7	9	9	9	9	9	9	9	9	9	4	2	2	180	23	4,140	9	37,260
TOTAL STAFFING	4	9	9	10	12	18	22	22	24	26	27	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	30	28	24	18	853	23	19,619	9	176,571
TOTAL MANPOWER	4	9	9	10	12	18	95	119	140	141	149	163	178	210	227	245	261	282	297	295	297	300	292	294	290	306	304	298	286	246	214	93	50	42	6,176	23	142,048	9	1,278,432

Combined-Cycle Power Block: Construction Equipment		START	2017							2018												2019												2020				
			J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M		
			Months																																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	TOTAL MONTHS	TOTAL HOURS
AWARD-FNTP		**1-Jun-17**	△																																			
MOBILIZE		**29-Nov-17**						△																														
SUBSTANTIAL COMPLETE		**1-Apr-20**																																				
ITEM	**EQUIPMENT DESCRIPTION**																																				**2010**	**391947**
1.00	Pile Drive Rigs								2	2	2																										6.00	1169.99
2.00	Rough Terrain Hydraulic Crane, 80 ton								1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	1	1	1		60.00	11699.91
3.00	Hydra Lift truck Crane, 22-23 Ton								1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2					40.00	7799.94
4.00	Cat Backhoe 416-420								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					24.00	4679.96
5.00	Cat Excavator 325										1	1	1	1	1	1	1	1																			8.00	1559.99
6.00	Cat IT 914G Loader								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					24.00	4679.96
7.00	Skidsteer Loader								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					24.00	4679.96
8.00	Rammer Compactor								2	3	4	4	4	4	4	4																					29.00	5654.96
9.00	Vibratory Plate Attachment (for RT Backhoe)								1	1	1	1	1	1	1	1																					8.00	1559.99
10.00	Roller Smooth Drum 3-5 ton Ride-on								1	1	1	1	1	1	1	1																					8.00	1559.99
11.00	Forklift 10,000 lb								1	1	1	1	1	1	1	1	1	1	1																		11.00	2144.98
12.00	Forklift 20,000 lb								1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2					46.00	8969.93
13.00	Reachlift 10,000 lb								1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1		48.00	9359.93
14.00	Articulating Boom Lift 125'													1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	1	1	1		33.00	6434.95
15.00	Articulating Boom Lift 135'															1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2				28.00	5459.96
16.00	Air Compressor 185 CFM								1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1		47.00	9164.93
17.00	Generator 5 kw								1	1	1	1	1																								5.00	974.99
18.00	Trash Pump 3" gas								2	2	2	2	2	2	2	1	1	1	1	1	2	2	2	2	2	2	1	1	1	1	1						36.00	7019.95
19.00	Hydrostatic Test Pump 4 GPM								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					24.00	4679.96
20.00	Concrete Vibrator								1	1	2	2	2	2	2	2																					14.00	2729.98
21.00	Concrete Power Trowel								1	1	1	1	2	2	2	2																					12.00	2339.98
22.00	Industrial Welding Generator 500 Amp								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					24.00	4679.96
23.00	Electric Welder 4 Pack 350 Amp								1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2					38.00	7409.94
24.00	Electric Welder 8 Pack 250 Amp										2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2					44.00	8579.93
25.00	Fusion Machine .50" - 4"								1	1	1	1	1	1	1	1																					8.00	1559.99
26.00	Fusion Machine 6" - 8"								1	1	1	1	1	1	1	1																					8.00	1559.99
27.00	Fusion Machine 10" - 18"								1	1	1	1	1	1	1	1																					8.00	1559.99
28.00	Fusion Machine 18" - 36"								1	1	1	1	1	1	1	1																					8.00	1559.99
29.00	Pickup Truck .75 Ton		7	7	7	7	7	10	12	12	12	12	14	15	15	16	16	16	16	19	19	19	19	19	19	19	19	19	19	19	19	12	12	12	8	8	481.00	93794.28
30.00	ATV's / Golf Carts								2	4	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	4	4	4		150.00	29249.78
31.00	Fuel Truck 1000 gallon								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					24.00	4679.96
32.00	Water Truck 2000 gallon								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					24.00	4679.96
33.00	Dump Truck 10 yard								1	1	1	1	1	1	1	1																					8.00	1559.99
34.00	Street Sweeper								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		27.00	5264.96
35.00	Semi-truck Tractor								1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2					45.00	8774.93
36.00	Lowbed Trailer								1	1	2	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4					88.00	17159.87
37.00	Crossing Plates or K-Rail								6	6	8	12	16	16	16	16																					96.00	18719.86
38.00	ARB radios								4	6	6	6	6	6	6	6	12	14	18	18	18	18	18	18	18	18	18	18	18	18	18	18	10	10	10	7	368.00	71759.45
39.00	Sand Blasting Pot 3-sack								1	1	1	1	1	1	1	1																					8.00	1559.99
40.00	Electric Threading Machine 2"								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					24.00	4679.96
41.00	Crawler Crane 225 Ton													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					19.00	3704.97
42.00	Crawler Crane Maxer 2000																1	1	1	1	1	1	1	1	1	1	1	1									12.00	2339.98

Appendix 2B
Construction Truck Requirements

Simple-Cycle Power Block	Months After Project Commencement																			
Months	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**	**Trucks per day per month**	**Days per Month**	**Total Trucks**	**%**
Standard Truck Deliveries																				
Fill Material	4	3	3														10	23	230	5%
Mechanical Equipment			2	2	6	6	6	6	6	2	2	2					40	23	920	19%
Electrical Equip. & Mtrls		2	2	4	4	6	6	6	4	2	2	2	2				42	23	966	20%
Piping, Supports, & Valves							3	3	3	3	2	2	2				18	23	414	9%
Concrete and Rebar		4	4	4	4	4	4	2									26	23	598	12%
Steel/Architectural		3	3	4	4	6	6	6	6								38	23	874	18%
Consumables & Supplies			1	1	1	2	2	2	2	2	1	1	1	0.5	0.5	0.5	18	23	402.5	8%
Contractor Mobilization	1	1	1														3	23	69	1%
Contractor Demobilization														0.4	0.4	0.4	1	23	27.6	1%
Construction Equipment	0.8	0.8	0.5	0.5	0.5	0.5						1	1	1	1	1	9	23	197.8	4%
Heavy Haul Truck Deliveries																				
GT'S				1		1											2	23	46	1%
Generators					1		1										2	23	46	1%
Main Transformers						0.2		0.2									0	23	9.2	0%
Total Truck Traffic at Site																				
Trucks/Day/Month	5.8	13.8	16.5	16.5	20.5	25.7	28.0	25.2	21.0	9.0	7.0	8.0	6.0	1.9	1.9	1.9				
Trucks /Month	133.4	317.4	379.5	379.5	471.5	591.1	644.0	579.6	483.0	207.0	161.0	184.0	138.0	43.7	43.7	43.7				
																	TOTAL TRUCK TRIPS AEC		4,800	

Month 36 = May 2020
Month 51 = August 2021

Combined-Cycle Power Block: Construction Trucks	**APPROXIMATE MONTHS OF CONSTRUCTION AND S&C**																									
	7	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**
Mobilize & demobilize	22	22	10	8	4																			22	24	20
Earthwork & pile	32	42	42	42	38	36	32																			
Concrete trucks			50	68	220	240	240	240	240	240	220	180	60													
Gases and weld supply trucks	2	4	4	4	4	4	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	2	2	2
Fuel trucks	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Equipment deliveries					4	8	14	16	18	22	24	30	30	36	36	36	36	36	20	12						
Heavy haul truckloads - HRSG modules									20	4																
Heavy haul truckloads - STG										2																
GE Heavy haul truckloads - CTG's						4																				
Heavy haul truckloads - GSU's								3																		
Pipe-valves-supports deliveries	10	10	16	16	16	16	18	18	20	20	20	20	22	22	24	24	24	24	24	20	20	8	6	4	2	1
Electrical bulk deliveries	6	6	8	8	8	8	8	8	8	8	8	10	10	10	10	10	10	10	10	6	4	4	4	4	2	1
Sanitary service trucks	10	12	14	16	18	20	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	18	16	12	11
Lumber deliveries	10	10	10	10	10	10	10	10	10	10	10	8	8													
Structural steel deliveries					6	8	12	12	10	6	6	6														
Reinforcing steel deliveries	4	10	12	12	12	12	12	12	10	8																
On-site pick-up trucks	12	12	12	12	14	15	15	16	16	16	16	19	19	19	19	19	19	19	19	19	19	19	19	12	12	12
Lay-down transport trucks	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	1	1	1	1	1

Month 7 = December 2017

Month 32 = January 2020

Appendix 2C
Engineering Design Criteria

APPENDIX 2C

Engineering Design Criteria

This appendix summarizes the codes, standards, criteria, and practices that generally will be used in the design and construction of the engineering systems for the Alamitos Energy Center (AEC).

2C.1 Civil Engineering Design Criteria

2C.1.1 Introduction

This section summarizes the codes, standards, criteria, and practices that generally will be used in the design and construction of civil engineering systems for the AEC. Consistent with the usual California Energy Commission (CEC) processes post-certification for all projects, additional project information will be developed during detailed design, engineering, material procurement specification and construction specifications.

2C.1.2 Codes and Standards

The design of civil engineering systems for the project will be in accordance with the applicable laws and regulations of the federal government, the State of California, applicable codes and ordinances, and industry standards. The current issue or edition of the documents at the time of filing this Application for Certification (AFC) will apply, unless otherwise noted. In cases where conflicts between the cited documents exist, requirements of the more conservative document will be used.

2C.1.2.1 Civil Engineering Codes and Standards

The following codes and standards have been identified as applicable, in whole or in part, to civil engineering design and construction of power plants.

- American Association of State Highway and Transportation Officials (AASHTO)—Standards and Specifications
- American Concrete Institute (ACI) – Standards and Recommended Practices
- American Institute of Steel Construction (AISC) – Standards and Specifications
- American National Standards Institute (ANSI) – Standards
- American Society of Testing and Materials (ASTM) – Standards, Specifications, and Recommended Practices
- American Water Works Association (AWWA) – Standards and Specifications
- American Welding Society – Codes and Standards
- Asphalt Institute – Asphalt Handbook
- State of California Department of Transportation (Caltrans) Standard Specification
- California Energy Commission (CEC) – Recommended Seismic Design Criteria for Non-Nuclear Generating Facilities in California, 1989
- Concrete Reinforcing Steel Institute (CRSI) – Standards
- Factory Mutual (FM) – Standards
- National Fire Protection Association (NFPA) – Standards
- California Building Code (CBC) 2013 (Effective January 1, 2014)

- Steel Structures Painting Council (SSPC) – Standards and Specifications
- American Society of Civil Engineers (ASCE) – Standards and Recommended Practices
- International Building Code (IBC) 2009 Effective July 1, 2012 with 2011 Los Angeles County Amendments
- United States Geological Survey

2C.1.2.2 Engineering Geology Codes, Standards, and Certifications

Engineering geology activities will conform to the applicable federal, state and local laws, regulations, ordinances, and industry codes and standards.

Federal. None are applicable.

State. The Warren-Alquist Act, Public Resources Code (PRC), Section 25000 et seq. and the CEC Code of Regulations (CCR), Siting Regulations, Title 20 CCR, Chapter 2, require that an AFC address the geologic and seismic aspects of the site.

The California Environmental Quality Act (CEQA), PRC 21000 et seq. and the CEQA Guidelines require that potential significant effects, including geologic hazards, be identified and a determination made as to whether they can be substantially reduced.

Local. California State Planning Law, Government Code Section 65302, requires each city and county to adopt a general plan, consisting of nine mandatory elements, to guide its physical development. Section 65302(g) requires that a safety element be included in the general plan addressing seismic issues, among other issues.

The site development activities will require certification by a Professional Geotechnical Engineer and a Professional Engineering Geologist during and following construction, in accordance with the CBC, Chapter 70. The Professional Geotechnical Engineer and the Professional Engineering Geologist will certify the placement of earthen fills and the adequacy of the site for structural improvements, as follows:

- Both the Professional Geotechnical Engineer and the Professional Engineering Geologist will address CBC Chapter 70, Sections 7006 (Grading Plans), 7011 (Cuts), 7012 (Terraces), 7013 (Erosion Control), and 7015 (Final Report).
- The Professional Geotechnical Engineer will also address CBC Chapter 70, Sections 7011 (Cuts) and 7012 (Terraces).

Additionally, the Professional Engineering Geologist will present findings and conclusions pursuant to PRC, Section 25523 (a) and (c); and 20 CCR, Section 1752 (b) and (c).

2C.2 Structural Engineering Design Criteria

2C.2.1 Introduction

This section summarizes the codes, standards, criteria, and practices that will be generally used in the design and construction of structural engineering systems for the AEC. Consistent with the usual CEC processes post-certification for all projects, additional project information will be developed during detail design, engineering, material procurement specification and construction specifications.

2C.2.2 Codes and Standards

The design of structural engineering systems for the project will be in accordance with the laws and regulations of the federal government, the State of California, applicable codes and ordinances, and the industry standards. The current issue or edition of the documents at the time of filing of this AFC will apply, unless otherwise noted. In cases where conflicts between the cited documents exist, requirements of the more conservative document will be used.

The following codes and standards have been identified as applicable, in whole or in part, to structural engineering design and construction of power plants.

- California Building Code, 2013 Edition (IBC, 2009) with 2011 Los Angeles County Amendments
- American Institute of Steel Construction (AISC)
  - Manual of Steel Construction—13th Edition 325-05
    - Specification for Structural Steel Buildings, March 9, 2005
    - Specification for Structural Joints Using ASTM A325 or A490 Bolts, June 30, 2004
    - Code of Standard Practice for Steel Buildings and Bridges, March 18, 2005
  - Seismic Design Manual 327-05
- American Concrete Institute (ACI)
  - ACI 318-08, Building Code Requirements for Structural Concrete
  - ACI 301-05, Specifications for Structural Concrete for Buildings
  - ACI 530-08, Building Code Requirements for Masonry Structures
- American Society of Civil Engineers (ASCE)
  - ASCE 7-05, Minimum Design Loads for Buildings and Other Structures
- American Society of Mechanical Engineers (ASME)
  - STS-1-2000, Steel Stacks
- American Welding Society (AWS)
  - D1.1—Structural Welding Code—Steel
  - D1.3—Structural Welding Code—Sheet Steel
- Code of Federal Regulations, Title 29—Labor, Chapter XVII, Occupational Safety and Health Administration (OSHA)
  - Part 1910—Occupational Safety and Health Standards
  - Part 1926—Construction Safety and Health Regulations
- National Association of Architectural Metal Manufacturers (NAAMM)—Metal Bar Grating Manual
- Hoist Manufacturers Institute (HMI), Standard Specifications for Electric Wire Rope Hoists (HMI 100)
- IEEE 980 – Guide for Containment and Control of Oil Spills in Substations
- National Electric Safety Code (NESC), C2-2007
- National Fire Protection Association (NFPA Standards)
  - NFPA 850 Fire Protection for Electric Generating Plants
- OSHA Williams-Steiger Occupational Safety and Health Act of 1970
- Steel Deck Institute (SDI)—Design Manual for Floor Decks and Roof Decks

2C.2.2.1 CEC Special Requirements

Prior to the start of any increment of construction, the proposed seismic-force procedures for project structures and the applicable designs, plans and drawings for project structures will be submitted to the CEC's Compliance Project Manager or the Chief Building Official as the CEC's delegatee, for review.

Proposed seismic-force procedures, designs, plans, and drawings shall be those for:

- Major project structures
- Major foundations, equipment supports, and anchorage
- Large, field-fabricated tanks
- Switchyard structures

2C.2.3 Structural Design Criteria

2C.2.3.1 Datum

Site topographic elevations will be based on an elevation survey conducted using known elevation benchmarks.

2C.2.3.2 Frost Penetration

The site is located in an area free of frost penetration. Bottom elevation of all foundations for structures and equipment, however, will be maintained at a minimum of 12 inches below the finished grade.

2C.2.3.3 Temperatures

The historic maximum and minimum temperatures are as follows:

Maximum	111°F
Minimum	25°F

2C.2.3.4 Design Loads

General. Design loads for structures and foundations will comply with all applicable building code requirements.

Dead Loads. Dead loads will consist of the weights of structure and all equipment of a permanent or semi-permanent nature including tanks, bins, wall panels, partitions, roofing, drains, piping, cable trays, bus ducts, and the contents of tanks and bins measured at full operating capacity. The contents of the tanks and bins, however, will not be considered as effective in resisting structure uplift due to wind forces; but will be considered as effective for seismic forces.

Live Loads. Live load will consist of uniform floor live loads and equipment live loads. Uniform live loads are assumed equivalent unit loads that are considered sufficient to provide for movable and transitory loads, such as the weights of people, portable equipment and tools, small equipment or parts, which may be moved over or placed on the floors during maintenance operations, and planking. The uniform live loads will not be applied to floor areas that will be permanently occupied by equipment.

Lateral earth pressures, hydrostatic pressures, and wheel loads from trucks will be considered as live loads.

Uniform live loads will be in accordance with ASCE Standard 7, but will not be less than the following:

• Roofs	20 pounds per square foot (psf)
• Floors and Platforms (steel grating and checkered plates)	100 psf

In addition, a uniform load of 50 psf will be used to account for piping and cable trays, except that where the piping and cable loads exceed 50 psf, the actual loads will be used.

Furthermore, a concentrated load of 5 kips will be applied concurrently to the supporting beams of the floors to maximize stresses in the members, but the reactions from the concentrated loads will not be carried to the columns.

• Floors (elevated concrete floors)	100 psf

In addition, elevated concrete slabs will be designed to support an alternate concentrated load of 2 kips in lieu of the uniform loads, whichever governs. The concentrated load will be treated as a uniform distributed load acting over an area of 2.5 square feet, and will be located in a manner to produce the maximum stress conditions in the slabs.

• Operating Floors	As applicable
• Control Room Floor	150 psf
• Electrical Rooms	250 psf
• Stairs, Landings, and Walkways	100 psf

In addition, a concentrated load of 2 kips will be applied concurrently to the supporting beams for the walkways to maximize the stresses in the members, but the reactions from the concentrated loads will not be carried to the columns.

• Pipe Racks	50 psf

Where the piping and cable tray loads exceed the design uniform load, the actual loads will be used. In addition, a concentrated load of 8 kips will be applied concurrently to the supporting beams for the walkways to maximize the stresses in the members, but the reactions from the concentrated loads will not be carried to the columns.

- Hand Railings

Hand railings will be designed for a 200-pound concentrated load applied at any point and in any direction.

• Slabs on Grade	250 psf
• Truck Loading Surcharge Adjacent to Structures	250 psf
• Truck Support Structures	AASHTO-HS-20-44
• Special Loading Conditions	Actual loadings

Lay down loads from equipment components during maintenance and floor areas where trucks, forklifts or other transports have access will be considered in the design of live loads.

Live loads may be reduced in accordance with the provisions of CBC Section 1607.

Posting of the floor load capacity signs for all roofs, elevated floors, platforms and walkways will be in compliance with the OSHA Occupational Safety and Health Standard, Walking and Working Surfaces, Subpart D. Floor load capacity for slabs on grade will not be posted.

Earth Pressures. Earth pressures will be in accordance with the recommendations contained in the project specific geotechnical report.

Groundwater Pressures. Hydrostatic pressures due to groundwater or temporary water loads will be considered in detailed design.

Wind Loads. The wind forces will be calculated in accordance with CBC with a basic wind speed of 85 miles per hour (mph) and an exposure category of ‘C.’

Seismic Loads. Structures will be designed and constructed to resist the effects of earthquake loads as determined in CBC, Section 1613. The Seismic Design Category is D. The occupancy category of the structure is III (per CBC Table 1604.5) and corresponding importance factor (I) is 1.25. Other seismic parameters will be obtained from the geotechnical report.

Snow Loads. Snow loads will not be considered.

Turbine Generator Loads. The combustion turbine generator loads for pedestal and foundation design will be furnished by the equipment manufacturers, and will be applied in accordance with the equipment manufacturers’ specifications, criteria, and recommendations.

Special Considerations for Steel Stacks. Steel stacks will be designed to withstand the normal and abnormal operating conditions in combination with wind loads and seismic loads, and will include the along-wind and across-wind effects on the stacks. The design will meet the requirements of ASME/ANSI STS-1-2000, "Steel Stacks," using allowable stress design method, except that increased allowable stress for wind loads as permitted by AISC will not be used.

Special Considerations for Structures and Loads during Construction. For temporary structures, or permanent structures left temporarily incomplete to facilitate equipment installations, or temporary loads imposed on permanent structures during construction, the allowable stresses may be increased by 33 percent.

Structural backfill may be placed against walls, retaining walls, and similar structures when the concrete strength attains 80 percent of the design compressive strength (f'_c), as determined by sample cylinder tests. Restrictions on structural backfill, if any, will be shown on the engineering design drawings.

Design restrictions imposed on construction shoring removal that are different from normal practices recommended by the ACI codes will be shown on engineering design drawings.

Metal decking used as forms for elevated concrete slabs will be evaluated to adequately support the weight of concrete plus a uniform construction load of 50 psf, without increase in allowable stresses.

2C.2.4 Design Basis

2C.2.4.1 General

Reinforced concrete structures will be designed by the strength design method, in accordance with the CBC and the ACI 318, "Building Code Requirements for Structural Concrete."

Steel structures will be designed by the working stress method, in accordance with the CBC and the AISC Specification for Structural Steel Buildings.

Foundation design will be in accordance with the "Final Subsurface Investigation and Foundation Report" for the facility.

2C.2.4.2 Factors of Safety

The factor of safety for all structures, tanks, and equipment supports will be as follows:

Against Overturning	1.50
Against Sliding	1.50 for Wind Loads 1.10 for Seismic Loads
Against Uplift Due to Wind	1.50
Against Buoyancy	1.25

2C.2.4.3 Allowable Stresses

Calculated stresses from the governing loading combinations for structures and equipment supports will not exceed the allowable limits permitted by the applicable codes, standards, and specifications.

2C.2.4.4 Load Factors and Load Combinations

For reinforced concrete structures and equipment supports, using the strength method, the strength design equations will be determined based on CBC, Sections 1605.2.1, 1605.4, 1912, and ACI-318-08 Section 9.2. The Allowable Stress Design load combinations of CBC 2007 Section 1605.3 will be used to assess soil bearing pressure and stability of structures per CBC Sections 1805 and 1613, respectively.

Steel-framed structures will be designed in accordance with CBC, Chapter 22 and the ANSI/AISC 360-05 Specification for Structural Steel Buildings, March 9, 2005. Connections will conform to Research Council on Structural Connections of the Engineering Foundation Specification for Structural Joints.

2C.2.5 Construction Materials

2C.2.5.1 Concrete and Grout

The design compressive strength (f'_c) of concrete and grout, as measured at 28 days, will be as follows:

Underground electrical duct bank encasement and lean concrete backfill (Class D)	2,000 psi
Structural concrete (Classes CSA & CLA)	3,000 psi
Structural concrete (Class BSA & BLA)	4,000 psi
Structural grout	5,000 psi

The classes of concrete and grout to be used will be shown on engineering design drawings or indicated in design specifications.

2C.2.5.2 Reinforcing Steel

Reinforcing steel bars for concrete will be deformed bars of billet steel, conforming to ASTM A615, Grade 60 or A706, Grade 60.

Welded wire fabric for concrete will conform to ASTM A185.

2C.2.5.3 Structural and Miscellaneous Steel

Structural and miscellaneous steel will generally conform to ASTM A36, ASTM A572, or ASTM A992 except in special situations where higher strength steel is required.

High-strength structural bolts, including nuts and washers, will conform to ASTM A325 or ASTM A490.

Bolts other than high-strength structural bolts will conform to ASTM A307, Grade A.

Foundation anchor bolts to be F1554-Grade 36 unless noted otherwise.

2C.2.5.4 Concrete Masonry

Concrete masonry units will be hollow, normal weight, non-load-bearing Type I, conforming to ASTM C90, lightweight.

Mortar will conform to ASTM C270, Type S.

Grout will conform to ASTM C476.

2C.2.5.5 Other Materials

Other materials for construction, such as anchor bolts, shear connectors, concrete expansion anchors, embedded metal, etc., will conform to industry standards and will be identified on engineering design drawings or specifications.

2C.3 Mechanical Engineering Design Criteria

2C.3.1 Introduction

This section summarizes the codes, standards, criteria, and practices that will be generally used in the design and construction of mechanical engineering systems for the AEC. Consistent with the usual CEC processes post-certification for all projects, additional project information will be developed during detailed design, engineering, material procurement specification, and construction specifications.

2C.3.2 Codes and Standards

The design of the mechanical systems and components will be in accordance with the laws and regulations of the federal government, State of California applicable codes and ordinances, and industry standards. The current issue or revision of the documents at the time of the filing of this AFC will apply, unless otherwise noted. If there are conflicts between the cited documents, the more conservative requirements shall apply.

The following codes and standards are applicable to the mechanical aspects of the power facility.

- California Building Standards Code, 2013 (Effective January 2014) with 2011 Los Angeles County Amendments
- American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code
- ASME/ANSI B31.1 Power Piping Code
- ASME Performance Test Codes
- ASME Standard TDP-1
- American National Standards Institute (ANSI) B16.5, B16.34, and B133.8
- American Boiler Manufacturers Association (ABMA)
- American Gear Manufacturers Association (AGMA)
- Air Moving and Conditioning Association (AMCA)
- American Society for Testing and Materials (ASTM)
- American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE)
- American Welding Society (AWS)
- Cooling Tower Institute (CTI)
- Heat Exchange Institute (HEI)
- Manufacturing Standardization Society (MSS) of the Valve and Fitting Industry
- National Fire Protection Association (NFPA)
- Hydraulic Institute Standards (HIS)
- Tubular Exchanger Manufacturer's Association (TEMA)

2C.3.3 Mechanical Engineering General Design Criteria

2C.3.3.1 General

The systems, equipment, materials, and their installation will be designed in accordance with the applicable codes; industry standards; and local, state, and federal regulations, as well as the design criteria; manufacturing processes and procedures; and material selection, testing, welding, and finishing procedures specified in this section.

Detailed equipment design will be performed by the equipment vendors in accordance with the performance and general design requirements to be specified later by the project architect/engineering firm. Equipment vendors will be responsible for using construction materials suited for the intended use.

2C.3.3.2 Materials—General

Asbestos will not be used in the materials and equipment supplied. Where feasible, materials will be selected to withstand the design operating conditions, including expected ambient conditions, for the design life of the plant. It is anticipated that some materials will require replacement during the life of the plant due to corrosion, erosion, etc.

Pumps. Pumps will be sized in accordance with industry standards. Where feasible, pumps will be selected for maximum efficiency at the normal operating point. Pumps will be designed to be free from excessive vibration throughout the operating range.

Tanks. Large outdoor storage tanks will not be insulated except where required to maintain appropriate process temperatures or for personnel protection.

Overflow connections and lines will be provided. Maintenance drain connections will be provided for complete tank drainage.

Manholes, where provided, will be at least 24 inches in diameter and hinged to facilitate removal. Storage tanks will have ladders and cleanout doors as required to facilitate access/maintenance. Provisions will be included for proper tank ventilation during internal maintenance.

Heat Exchangers. The heat exchangers will be provided as components of mechanical equipment packages and may be air-cooled or water-cooled shell-and-tube or plate type. Heat exchangers will be designed in accordance with TEMA or manufacturer's standards. Fouling factors will be specified in accordance with TEMA.

Pressure Vessels. Pressure vessels will be designed, constructed, and installed in accordance with the ASME Boiler and Pressure Vessel Code

Piping and Piping Supports. Stainless steel pipe may be Schedule 10S where design pressure permits. Underground piping may be high-density polyethylene (HDPE) or polyvinyl chloride (PVC) where permitted by code, operating conditions, and fluid properties. In general, water system piping will be HDPE or PVC where embedded or underground and carbon steel where aboveground. Appropriately lined and coated carbon steel pipe may alternately be used for buried water piping.

Threaded joints will not normally be used in piping used for lubricating oil, and natural gas service. Natural gas piping components will not use synthetic lubricants. Victaulic, or equal, couplings may be used for low energy aboveground piping, where feasible.

Piping systems will have high point vents and low point drains. Drains with restricting orifices or automated valves will be installed in low points of lines where condensate can collect during normal operation.

Hose and process tubing connections to portable components and systems will be compatible with the respective equipment suppliers' standard connections for each service.

Stainless steel piping will be used for portions of the lubricating oil system downstream of the filters. Carbon steel piping may be used elsewhere.

Valves

General Requirements. Valves will be arranged for convenient operation from floor level where possible and, if required, will have extension spindles, chain operators, or gearing. Hand-actuated valves will be operable by one person. Gear operators will be provided to make sure that the force required at the hand wheel of the operator does not exceed 20 lbs.

Valves will be arranged to close when the hand wheel is rotated in a clockwise direction when looking at the hand wheel from the operating position. The direction of rotation to close the valve will be clearly marked on the face of each hand wheel.

Valve materials will be suitable for operation at the maximum working pressure and temperature of the piping to which they are connected. Steel valves will have cast or forged steel spindles. Seats and faces will be of low friction, wear resistant materials. Valves in throttling service will be selected with design characteristics and of materials that will resist erosion of the valve seats when the valves are operated partly closed.

Drain and Vent Valves and Traps. Drains and vents in 600 pound class or higher piping and 900°F or higher service will be double-valved.

Trap bodies and covers will be cast or forged steel and will be suitable for operating at the maximum working pressure and temperature of the piping to which they are connected. Traps will be piped to drain collection tank or sumps and returned to the cycle if convenient.

Low-pressure Water Valves. Low-pressure water valves will be gate or butterfly type of cast iron construction. Ductile iron valves will have ductile iron bodies, covers, gates (discs), and bridges; the spindles, seats, and faces will be bronze. Fire protection valves will be Underwriters Laboratories-approved butterfly valves meeting NFPA requirements.

Instrument Air Valves. Instrument air valves will be the ball type of stainless construction, with valve face and seat of approved wear-resistant alloy.

Nonreturn Valves. Nonreturn valves for steam service will be in accordance with ANSI standards and properly drained. Nonreturn valves in vertical positions will have bypass and drain valves. Bodies will have removable access covers to enable the internal parts to be examined or renewed without removing the valve from the pipeline.

Motor Actuated Valves. Electric motor actuators will be designed specifically for the operating speeds, differential and static pressures, process line flow rates, operating environment, and frequency of operations for the application. Electric actuators will have self-locking features. A hand wheel and declutching mechanism will be provided to allow hand wheel engagement at any time except when the motor is energized. Actuators will automatically revert to motor operation, disengaging the hand wheel, upon energizing the motor. The motor actuator will be placed in a position relative to the valve that prevents leakage of liquid, steam, or corrosive gas from valve joints onto the motor or control equipment.

Safety and Relief Valves. Safety valves and/or relief valves will be provided as required by code for pressure vessels, heaters, and boilers. Safety and relief valves will be installed vertically. Piping systems that can be over-pressurized by a higher-pressure source will also be protected by pressure-relief valves. Equipment or parts of equipment that can be over pressurized by thermal expansion of the contained liquid will have thermal-relief valves.

Instrument Root Valves. Instrument root valves will be specified for operation at the working pressure and temperature of the piping to which they are connected. Test points and sample lines in systems that are 600 pound class or higher service will be double valved.

Heating, Ventilating, and Air Conditioning (HVAC). HVAC system design will be based on site ambient conditions specified in the, Project Description.

Except for the HVAC systems serving the control room, maintenance shop, lab areas, and administration areas, the systems will not be designed to provide comfort levels for extended human occupancy.

Air conditioning will include both heating and cooling of the inlet filtered air. Air velocities in ducts and from louvers and grills will be low enough not to cause unacceptable noise levels in areas where personnel are normally located.

Fans and motors will be mounted on anti-vibration bases to isolate the units from the building structure. Exposed fan outlets and inlets will be fitted with guards. Wire guards will be specified for belt driven fans and arranged to enclose the pulleys and belts.

Air filters will be housed in a manner that facilitates removal. The filter frames will be specified to pass the air being handled through the filter without leakage.

Ductwork, filter frames, and fan casings will be constructed of mild steel sheets stiffened with mild steel flanges and galvanized. Ductwork will be the sectional bolted type and will be adequately supported. Duct joints will be leak tight.

Grills and louvers will be of adjustable metal construction.

Thermal Insulation and Cladding. Parts of the facility requiring insulation to reduce heat loss or afford personnel safety will be thermally insulated. Minimum insulation thickness for hot surfaces near personnel will be designed to limit the outside lagging surface temperature to a maximum of 140°F.

The thermal insulation will have as its main constituent calcium silicate, foam glass, fiber glass, or mineral wool, and will consist of pre-formed slabs or blankets, where feasible. Asbestos-containing materials are prohibited. An aluminum jacket or suitable coating will be provided on the outside surface of the insulation. Insulation system materials, including jacketing, will have a flame spread rating of 25 or less when tested in accordance with ASTM E 84.

Insulation at valves, pipe joints, steam traps, or other points to which access may be required for maintenance will be specified to be removable with a minimum of disturbance to the pipe insulation. At each flanged joint, the molded material will terminate on the pipe at a distance from the flange equal to the overall length of the flange bolts to permit their removal without damaging the molded insulation. Outdoor aboveground insulated piping will be clad with textured aluminum of not less than 30 mil thickness and frame reinforced. At the joints, the sheets will be sufficiently overlapped and caulked to prevent moisture from penetrating the insulation. Steam trap stations will be “boxed” for ease of trap maintenance.

Design temperature limits for thermal insulation will be based on system operating temperature during normal operation.

Outdoor and underground insulation will be moisture resistant.

Testing. Hydrostatic testing, including pressure testing at 1.5 times the design pressure, or as required by the applicable code, will be specified and performed for pressure boundary components where an in-service test is not feasible or permitted by code.

Welding. Welders and welding procedures will be certified in accordance with the requirements of the applicable codes and standards before performing any welding. Records of welder qualifications and weld procedures will be maintained.

Painting. Except as otherwise specified, equipment will receive the respective manufacturer’s standard shop finish. Finish colors will be selected from among the paint manufacturer’s standard colors.

Finish painting of un-insulated piping will be limited to that required by OSHA for safety or for protection from the elements.

Piping to be insulated will not be finish painted.

Lubrication. The types of lubrication specified for facility equipment will be suited to the operating conditions and will comply with the recommendations of the equipment manufacturers.

The initial startup charge of flushing oil will be the equipment manufacturer’s standard lubricant for the intended service. Subsequently, such flushing oil will be sampled and analyzed to determine whether it can also be used for normal operation or must be replaced in accordance with the equipment supplier’s recommendations.

Rotating equipment will be lubricated as designed by the individual equipment manufacturers. Where automatic lubricators are fitted to equipment, provision for emergency hand lubrication will also be specified. Where applicable, equipment will be designed to be manually lubricated while in operation without the removal of protective guards. Lubrication filling and drain points will be readily accessible.

2C.4 Electrical Engineering Design Criteria

2C.4.1 Introduction

This section summarizes the codes, standards, criteria, and practices that will be generally used in the design and construction of electrical engineering systems for the AEC. Consistent with the usual CEC processes post-certification for all projects, additional project information will be developed during detailed design, engineering, material procurement specification, and construction specifications.

2C.4.2 Codes and Standards

The design of the electrical systems and components will be in accordance with the laws and regulations of the federal government, the State of California, applicable codes and ordinances, and industry standards. The current issue or revision of the documents at the time of filing this AFC will apply, unless otherwise noted. If there are conflicts between the cited documents, the more conservative requirement will apply.

The following codes and standards are applicable to the electrical aspects of the power facility:

- American National Standards Institute (ANSI)
- American Society for Testing and Materials (ASTM)
- Anti-Friction Bearing Manufacturers Association (AFBMA)
- California Building Standards Code
- California Electrical Code
- Insulated Cable Engineers Association (ICEA)
- Institute of Electrical and Electronics Engineers (IEEE)
- Illuminating Engineering Society (IES)
- National Association of Corrosion Engineers (NACE)
- National Electrical Code (NEC)
- National Electrical Manufacturers Association (NEMA)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA)
- Underwriters Laboratories, Inc. (UL)

2C.4.3 Switchyard and Transformers

2C.4.3.1 Switchyard

Each power block at the AEC site will consist of three independent combustion turbine generators and one steam turbine generator. All sixteen generators from all four blocks will tie into an existing 230 kV switchyard.

The switchyard will consist of circuit breakers and lines to the grid. Each line will be equipped with the appropriate instrument transformers for protection and metering. Surge arresters will be provided for the outgoing lines in the area of the takeoff towers.

The switchyard will be located near the main step-up transformers and will require an overhead span for the connection.

The breakers will be of the dead tank design with current transformers on each bushing. Disconnect switches will be located on each side of the breakers to isolate the breaker, and one switch will be located at each line termination or transformer connection for isolation of the lines or transformer for maintenance.

Tubular bus used in the switchyard will be aluminum alloy. Cable connections between the tube bus and equipment will be ACSR, AAAC, or AAC cable. Tube and cables will meet all electrical and mechanical design requirements. Instrument transformers (current and capacitive voltage transformers) will be included for protection and synchronization where required.

A grounding grid will be provided to control step and touch potentials in accordance with IEEE Standard 80, Safety in Substation Grounding. Metallic equipment, structures, and fencing will be connected to the grounding grid of buried conductors and ground rods, as required for personnel safety. The substation ground grid will be tied to the plant ground grid.

Lightning protection will be provided by shield wires or lightning masts. The lightning protection system will be designed in accordance with IEEE 998 guidelines.

All faults will be detected, isolated, and cleared in a safe and coordinated manner as soon as practical to ensure the safety of equipment, personnel, and the public. Protective relaying will meet IEEE requirements and will be coordinated with the utility.

Revenue metering will be provided on the 230kV bus to record net power to or from the switchyard. Meters and a metering panel will be provided.

2C.4.3.2 Generator Circuit Breakers

Each generator will have a dedicated generator circuit breaker (GCB). The GCBs will be capable of handling the generator nameplate output. They will also be rated for the available through fault currents associated with the circuit.

The GCBs will serve two purposes. They will allow each generator to be isolated from the grid and they will be used to synchronize the generators with the grid.

During plant startup the GCBs will be open. When the generator is at full speed and synchronized with the grid, the GCBs will be closed to allow power flow from the generators to the grid.

2C.4.3.3 Transformers

The generators will be connected to the 230 kV switchyards through main step-up transformers. The step-up transformers will be designed in accordance with ANSI standards C57.12.00, C57.12.90, and C57.91. Each main step-up transformer will have metal oxide surge arrestors connected to the high-voltage terminals and will have manual de-energized (“no-load”) tap changers located in high-voltage windings.

Two of the four generators on each power block will be provided with 13.8-kV to 4.16-kV auxiliary power transformer. The auxiliary transformers will be used to feed all of the electrical loads associated with the plant.

During plant startup, power will be backed through the generator step-up transformers to the auxiliary transformers. Once each generator has been started and synchronized with the utility bus, the generator circuit breakers will be closed. When this occurs, the generators will begin feeding power to the auxiliary transformers (only applies to the units connected to auxiliary transformers) and exporting power to the grid.

2C.5 Control Engineering Design Criteria

2C.5.1 Introduction

This section summarizes the codes, standards, criteria, and practices that will be generally used in the design and installation of instrumentation and controls for the AEC. Consistent with the usual CEC processes post-certification for all projects, additional project information will be developed during detailed design, engineering, material procurement specification and construction specifications.

2C.5.2 Codes and Standards

The design specification of all work will be in accordance with the laws and regulations of the federal government, the State of California, and applicable codes and ordinances. A summary of general codes and industry standards applicable to design and control aspects of the power facility follows.

- American National Standards Institute (ANSI)
- American Society of Mechanical Engineers (ASME)
- The Institute of Electrical and Electronics Engineers (IEEE)
- International Society of Automation (ISA)
- National Electrical Manufacturers Association (NEMA)
- National Electrical Safety Code (NESC)
- National Fire Protection Association (NFPA)
- American Society for Testing and Materials (ASTM)

2C.5.3 Control Systems Design Criteria

2C.5.3.1 General Requirements

Electronic signal levels, where used, will be 4 to 20 milliamps (mA) for analog transmitter outputs, controller outputs, electric-to-pneumatic converter inputs, and valve positioner inputs.

The switched sensor full-scale signal level will be between 0 and 125 volt (V).

2C.5.3.2 Pressure Instruments

In general, pressure instruments will have linear scales with units of measurement in pounds per square inch, gauge (psig).

Pressure gauges will have either a blowout disk or a blowout back and an acrylic or shatterproof glass face.

Pressure gauges on process piping will be resistant to plant atmospheres.

Pressure test points will have isolation valves and caps or plugs. Pressure devices on pulsating services will have pulsation dampers.

2C.5.3.3 Temperature Instruments

In general, temperature instruments will have scales with temperature units in degrees Fahrenheit (°F). Exceptions to this are electrical machinery resistance temperature detectors (RTDs) and transformer winding temperatures, which are in degrees Celsius (°C).

Bimetal-actuated dial thermometers will have 4.5- or 5-inch-diameter (minimum) dials and white faces with black scale markings and will consist of every angle-type. Dial thermometers will be resistant to plant atmospheres.

Temperature elements and dial thermometers will be protected by thermowells except when measuring gas or air temperatures at atmospheric pressure. Temperature test points will have thermowells and caps or plugs.

RTDs will be 100-ohm platinum, 3-wire type. The element will be spring-loaded, mounted in a thermowell, and connected to a cast iron head assembly.

Thermocouples will be Type J or K dual-element, grounded, spring-loaded, for general service. Materials of construction will be dictated by service temperatures. Thermocouple heads will be the cast type with an internal grounding screw.

2C.5.3.4 Level Instruments

Reflex-glass or magnetic level gauges will be used. Level gauges for high-pressure service will have suitable personnel protection.

Gauge glasses used in conjunction with level instruments will cover a range that includes the highest and lowest trip/alarm set points.

2C.5.3.5 Flow Instruments

Flow transmitters will typically be the differential pressure-type with the range similar to that of the primary element. In general, linear scales will be used for flow indication and recording.

Magnetic flow transmitters may be used for liquid flow measurement below 200°F.

2C.5.3.6 Control Valves

Control valves in throttling service will generally be the globe-body cage type with body materials, pressure rating, and valve trims suitable for the service involved. Other style valve bodies (e.g., butterfly, eccentric disk) may also be used when suitable for the intended service.

Valves will be designed to fail in a safe position.

Control valve body size will not be more than two sizes smaller than line size, unless the smaller size is specifically reviewed for stresses in the piping.

Control valves in 600-Class service and below will be flanged where economical. Where flanged valves are used, minimum flange rating will be ANSI 300 Class.

Critical service valves will be defined as ANSI 900 Class and higher in valves of sizes larger than 2 inches.

Severe service valves will be defined as valves requiring anti-cavitation trim, low noise trim, or flashing service, with differential pressures greater than 100 pounds per square inch (psi).

In general, control valves will be specified for a noise level no greater than 90 decibel A-rated (dBA) when measured 3 feet downstream and 3 feet away from the pipe surface.

Valve actuators will use positioners and the highest pressure, smallest size actuator, and will be the pneumatic-spring diaphragm or piston type. Actuators will be sized to shut off against at least 110 percent of the maximum shutoff pressure and designed to function with instrument air pressure ranging from 80 to 125 psig.

Hand wheels will be furnished only on those valves that can be manually set and controlled during system operation (to maintain plant operation) and do not have manual bypasses.

Control valve accessories, excluding controllers, will be mounted on the valve actuator unless severe vibration is expected.

Solenoid valves supplied with the control valves will have Class H coils. The coil enclosure will normally be a minimum of NEMA 4 but will be suitable for the area of installation. Terminations will typically be by pigtail wires.

Valve position feedback (with input to the DCS for display) will be provided for all control valves.

2C.5.3.7 Instrument Tubing and Installation

Tubing used to connect instruments to the process line will be stainless steel for primary instruments and sampling systems.

Instrument tubing fittings will be the compression type. One manufacturer will be selected for use and will be standardized as much as practical throughout the plant.

Differential pressure (flow) instruments will be fitted with three-valve manifolds; two-valve manifolds will be specified for other instruments as appropriate.

Instrument installation will be designed to correctly sense the process variable. Taps on process lines will be located so that sensing lines do not trap air in liquid service or liquid in gas service. Taps on process lines will be fitted with a shutoff (root or gauge valve) close to the process line. Root and gauge valves will be main-line class valves.

Instrument tubing will be supported in both horizontal and vertical runs as necessary. Expansion loops will be provided in tubing runs subject to high temperatures. The instrument tubing support design will allow for movement of the main process line.

2C.5.3.8 Pressure and Temperature Switches

Field-mounted pressure and temperature switches will have either NEMA Type 4 housings or housings suitable for the environment.

In general, switches will be applied such that the actuation point is within the center one-third of the instrument range.

2C.5.3.9 Field-mounted Instruments

Field-mounted instruments will be of a design suitable for the area in which they are located. They will be mounted in areas accessible for maintenance and relatively free of vibration and will not block walkways or prevent maintenance of other equipment.

Field-mounted instruments will be grouped on racks. Supports for individual instruments will be prefabricated, off-the-shelf, 2-inch pipe stand. Instrument racks and individual supports will be mounted to concrete floors, to platforms, or on support steel in locations not subject to excessive vibration.

Individual field instrument sensing lines will be sloped or pitched in such a manner and be of such length, routing, and configuration that signal response is not adversely affected.

Liquid level controllers will generally be the non-indicating, displacement-type with external cages.

2C.5.3.10 Instrument Air System

Branch headers will have a shutoff valve at the takeoff from the main header. The branch headers will be sized for the air usage of the instruments served, but will be no smaller than 3/8 inch. Each instrument air user will have a shutoff valve, filter, outlet gauge, and regulator at the instrument.

2C.6 Chemical Engineering Design Criteria

2C.6.1 Introduction

This section summarizes the general chemical engineering design criteria for the AEC project. These criteria form the basis of the design for the chemical components and systems of the project. Consistent with the usual CEC processes post-certification for all projects, additional specific design information is developed during detailed design to support equipment and erection specifications. This appendix summarizes the codes, standards, and general criteria that will be used during detailed design.

2C.6.2 Design Codes and Standards

The design and specification of all work will be in accordance with the laws and regulations of the federal government, the State of California, and applicable codes and ordinances. Industry codes and standards relevant to chemical engineering design to be used in design and construction are summarized below.

- ANSI B31.1 Power Piping Code
- ASME Performance Test Code 31, Ion Exchange Equipment
- American Society for Testing and Materials (ASTM)
- California Building Code (CBC)
- Occupational Safety and Health Administration (OSHA)
- Steel Structures Painting Council Standards (SSPC)
- Underwriters Laboratories
- American Waterworks Association (AWWA)

Other recognized standards will be used as required to serve as design, fabrication, and construction guidelines when not in conflict with the above-listed standards.

The codes and industry standards used for design, fabrication, and construction will be the codes and industry standards, including all addenda, in effect as stated in equipment and construction purchase or contract documents.

2C.6.3 General Criteria

2C.6.3.1 Design Water Quality

Service Water. Service water (such as fire water, eye wash station water, etc.) will be provided by the Long Beach Water Department to the AEC.

Reverse Osmosis Membrane System. Raw water will be filtered and purified via a reverse osmosis (RO) system to remove suspended solids and the majority of the dissolved solids. The RO permeate will be forwarded to an RO storage tank that will supply the evaporative cooler makeup demand and the demineralized water system. The RO reject stream will be discharged to the existing circulating water outfall.

Demineralized Water System. Demineralized water will be produced by a Mixed Bed DI system. The high-quality demineralized water will be used for the on-line water wash, and steam cycle make up. The demineralized water will be the highest practical quality. Minimum quality requirements shall be in compliance with EPRI recommendations as stated in EPRI document 1010438 “Cycle Chemistry Guidelines for CC/HRSGs”.

Construction Water. Water for use during construction will be supplied from the existing city water feed.

Fire Protection Water. The source of water for fire protection will be from the existing Redondo Beach Generating Station fire water tank. The tank will have a minimum capacity of 2 hours of firewater reserved in the tank.

2C.6.3.2 Chemical Conditioning

Reverse Osmosis Membrane System Chemical Conditioning. Chemical feed systems will supply the following water-conditioning chemicals to the RO system to minimize corrosion and control, the formation of mineral scale, and biofouling:

- Dechlorination: Sodium bisulfite to remove chlorine residual
- Mineral scale dispersant: Polyacrylate based solution
- Corrosion inhibitor: Phosphate based
- pH control: Sulfuric acid for alkalinity consumption and scaling tendencies
- Clean-in-place (CIP): Chemical cleaning solution contains sodium hydroxide, sodium hypochlorite, and citric acid

Mixed Bed Demineralizer System Chemical Conditioning

- Because the bottles will be regenerated offsite, no chemicals will be stored or handled onsite to service these units.

Process Water Chemical Conditioning. The plant process water will be chlorinated using sodium hypochlorite (bleach).

2C.6.3.3 Chemical Storage

Storage Capacity. Dechlorination feed equipment will consist of a returnable tote with two full capacity sodium bisulfite metering pumps.

The scale inhibitor feed equipment will consist of a returnable tote with two full-capacity scale inhibitor metering pumps.

Corrosion control feed equipment will consist of a returnable tote with two full-capacity corrosion control metering pumps.

The sulfuric acid feed equipment will consist of a storage tank. The tank will be accompanied by two, full-capacity sulfuric acid metering pumps.

The chemical cleaning solution tanks will consist of a drum and solution mixing tank for each of the three CIP chemicals. The cleaning solution is prepared by mixing sodium hydroxide (caustic), sodium hypochlorite (bleach), and citric acid.

The sodium hypochlorite feed equipment will consist of a bulk storage tank and two full-capacity hypochlorite metering pumps.

Facilities for feeding a non-oxidizing biocide will include returnable totes and two full-capacity chemical metering pumps.

Containment. Chemical storage tanks containing corrosive fluids will be surrounded by berms. Berms and drain piping design will allow a full tank capacity spill without overflowing the curbing. For multiple tanks located within the same curbed area, the largest single tank will be used to size the curbing and drain piping. For outdoor chemical containment areas, additional containment volume will be included for stormwater.

Closed Drains. Waste piping for volatile liquids and wastes with offensive odors will use closed drains to control noxious fumes and vapors.

Coatings. Tanks, piping, and curbing for chemical storage applications will be provided with a protective coating system. The specific requirements for selection of an appropriate coating will be identified prior to equipment and construction contract procurements.

2C.6.3.4 Wastewater Treatment

The primary wastewater collection system will collect process wastewater from all of the plant equipment, including the evaporative coolers and water treatment equipment.

Wastewater from the water treatment system will consist of the reject stream from the RO units that will initially reduce the concentration of dissolved solids in the plant makeup water before it is treated in the EDI system.

General plant drains will collect area wash down, sample drains, and drainage from facility equipment areas. Water from these areas will be collected in a system of floor drains, hub drains, sumps, and piping and routed to the wastewater collection system. Drains that potentially could contain oil or grease will first be routed through an oil/water separator.

Wastewater from combustion turbine water washes will be collected in a water wash drains tank. The wastewater will be discharged to the existing oil/water separator and then sent to the wastewater tank to await truck collection and disposal.

2C.7 Geologic and Foundation Design Criteria

2C.7.1 Introduction

This section provides a summary description of the site conditions and preliminary foundation-related subsurface conditions. The project has been evaluated with respect to its potential impacts on the geologic environment and the potential impacts that geologic and seismic hazards may have on the proposed site. The principle seismic hazards evaluated at the site are surface ground rupture, ground shaking, seismically induced liquefaction, and various manifestations of liquefaction-related hazards, i.e. dynamic settlement and lateral spreading. Soil-related hazards addressed include soil liquefaction, hydrocompaction (or collapsible soils), and expansive soils. Preliminary foundation and earthwork considerations are based on Ninyo & Moore’s preliminary geotechnical evaluation completed for the AEC site. For complete geotechnical information please see the attached Preliminary Geotechnical Evaluation report by Ninyo & Moore, dated October 19, 2011, project no. 208356001.

2C.7.2 Scope of Work

Information contained in this appendix reflects the codes, standards, criteria, and practices that will be used in the design and construction of site and foundation engineering systems for the facility. Consistent with the usual CEC processes post-certification for all projects, additional project information will be developed during detailed design, engineering, material procurement specification, and construction specifications. This information will be included in a final geotechnical engineering study to be completed prior to detailed design.

2C.7.3 Site Conditions

The proposed AEC site covers approximately 63 acres and is located in Los Angeles County, California, within the city limits of Long Beach, California. Elevation of the site is approximately 13 feet above mean sea level.

2C.7.4 Assessment of Seismic-Related Hazards

2C.7.4.1 Stratigraphy

Four (4) soil borings and four (4) cone penetrometer tests were performed by Ninyo & Moore at the project site to verify the soil consistency and characteristics.

2C.7.4.2 Regional Seismicity

The site is located in a seismically active area, as is the majority of southern California, and the potential for strong ground motion in the project area is considered significant during the design life of the proposed structures. Figure 5 shows the approximate site location relative to the principal faults in the region. Based on Ninyo & Moore's background review and site reconnaissance, the project site is not transected by known active or potentially active faults. The site is located within a State of California Seismic Hazard Zone as an area considered susceptible to liquefaction (CDMG, 1998), as shown on Figure 6 of the preliminary geotechnical report. The site is not located within a State of California Earthquake Fault Zone (EFZ).

2C.7.4.3 Surface Fault Rupture

Surface fault rupture is the offset or rupturing of the ground surface by relative displacement across a fault during an earthquake. Based on Ninyo & Moore's review of referenced geologic and fault hazard data, the site is not transected by known active or potentially active faults. The southwest corner of the power plant property is located approximately 200 feet from the State of California EFZ for the active Newport-Inglewood Fault Zone (NIFZ). The mapped projection of the fault zone near the site is approximately ½ mile from the proposed re-powering project area. Therefore, the potential for surface rupture is relatively low.

2C.7.4.4 Liquefaction, Dynamic Settling and Lateral Spreading

Liquefaction is the phenomenon in which loosely deposited granular soils located below the water table undergo rapid loss of shear strength due to excess pore pressure generation when subjected to strong earthquake-induced ground shaking. Ground shaking of sufficient duration results in the loss of grain-to-grain contact due to the rapid rise of in pore water pressure; causing the soil to behave as a fluid for a short period of time. Liquefaction is known generally to occur in saturated or near-saturated cohesionless soils at depths shallower than 50 feet below the ground surface. Factors known to influence liquefaction potential include composition and thickness of soil layers, grain size, relative density, groundwater level, degree of saturation, and both intensity and duration of ground shaking.

The project site is mapped in a State of California Seismic Hazard Zone as potentially liquefiable. The preliminary liquefaction analysis indicated that scattered saturated sandy alluvial layers between approximately 7 and 56 feet are potentially liquefiable during the design earthquake event. A groundwater depth of 2 feet was used in the analysis. The results of the liquefaction analysis are presented in Appendix C of the Ninyo & Moore Preliminary Geotechnical Report.

To evaluate the potential impact from liquefaction, an analysis was performed to estimate the magnitude of dynamic settlement due to liquefaction. The analysis indicated that liquefaction-induced settlement at the project site would be generally less than 1 inch (Appendix C of the Ninyo & Moore Preliminary Geotechnical Report).

Lateral spreading of the ground surface during an earthquake usually takes place along weak shear zones that have formed within a liquefiable soil layer. Based on the Ninyo & Moore analysis of the sampler blow counts and generally discontinuous nature of the underlying soil layers encountered in the exploration, the project site is not considered susceptible to significant seismically induced lateral spread.

2C.7.4.5 Ground Shaking

Earthquake events from one of the regional active or potentially active faults near the project could result in strong ground shaking which could affect the project site. The level of ground shaking at a given location depends on many factors, including the size and type of earthquake, distance from the earthquake, and subsurface geologic conditions. The type of construction also affects how particular structures and improvements perform during ground shaking.

The potential levels of ground shaking could impact the proposed re-powering project without appropriate design mitigation, and therefore, guidelines of the governing jurisdictions and the CBC should be followed in the detail design phase of the project.

2C.7.5 Assessment of Soil-related Hazards

2C.7.5.1 Expansive Soils

Expansive soils include clay minerals that are characterized by their ability to undergo significant volume change (shrink or swell) due to variations in moisture content. Sandy soils are generally not expansive. Changes in soil moisture content can result from rainfall, irrigation, pipeline leakage, surface drainage, perched groundwater, drought, or other factors.

Volumetric change of expansive soil may cause excessive cracking and heaving of structures with shallow foundations, concrete slabs-on-grade, or pavements supported on these materials. Constructing project improvements on soils known to be potentially expansive could have a significant impact to the project. Based on the Ninyo & Moore subsurface exploration, the near-surface soils at the project site are predominantly composed of sandy silt and fine-grained sand with silt and clay. These soils are typically low to moderately expansive. The site-specific potential for expansive soils at the location of the proposed improvements should be evaluated during the detailed design stage of the project in order to provide recommendations to mitigate the potential impacts of expansive soils.

2C.7.5.2 Compressible/Collapsible Soils

Compressible soils are generally composed of soils that undergo consolidation when exposed to new loading, such as fill or foundation loads. Soil collapse is a phenomenon where the soils undergo a significant decrease in volume upon increase in moisture content, with or without an increase in external loads. Buildings, structures and other improvements may be subject to excessive settlement-related distress when compressible soils or collapsible soils are present.

Based on the Ninyo & Moore subsurface exploration and background review, the project site is underlain by existing fill soils and interbedded alluvial sediments. Older, undocumented fill soils are considered potentially compressible. In addition, some very soft to soft clayey silt and silty clay alluvial layers were encountered, which are considered potentially compressible. Due to the high groundwater levels encountered at the site and the reported historically high groundwater, the site soils are not susceptible to hydro-collapse. Due to the presence of potentially compressible soils at the site, the potential impacts of settlement are significant without appropriate mitigation during detailed project design and construction.

2C.7.5.3 Subsidence

Subsidence is characterized as a sinking of the ground surface relative to surrounding areas, and can generally occur where deep soil deposits are present. Subsidence in areas of deep soil deposits is typically associated with regional groundwater withdrawal or other fluid withdrawal from the ground such as oil and natural gas. Subsidence can result in the development of ground cracks and damage to foundations, buildings and other improvements. Historic oil and gas withdrawal has resulted in significant ground subsidence in some areas of Long Beach. The City of Long Beach Seismic Safety Element includes information and maps regarding regional subsidence associated with oil and gas withdrawal including the locations and magnitude of known subsidence. The project site is not located in an area of mapped subsidence. Therefore, the potential for subsidence is relatively low.

2C.7.5.4 Groundwater

During the subsurface exploration groundwater was encountered at depths ranging from 8 to 14 feet below the ground surface. Based on Ninyo & Moore’s background review, historic high groundwater levels near the site have been measured at approximately 10 feet below the ground surface. Groundwater levels will vary and may be influenced by tidal fluctuations, precipitation, irrigation, groundwater pumping, projected sea level rise and other factors.

2C.7.5.5 Corrosive Soils

The project site is located in a geologic environment that could potentially contain soils that are corrosive to concrete and metals. Corrosive soil conditions may exacerbate the corrosion hazard to buried conduits, foundations, and other buried concrete or metal improvements. Corrosive soil could cause premature deterioration of these underground structures or foundations. Constructing project improvements on corrosive soils could have a significant impact to the project. Recommendations should be provided by a corrosion engineer during the detailed design phase of the project to mitigate the potential impacts of corrosive soils.

2C.7.6 Preliminary Foundation Considerations

2C.7.6.1 General Foundation Design Criteria

For satisfactory performance, the foundation of any structure must satisfy two independent design criteria. First, it must have an acceptable factor of safety against bearing failure in the foundation soils under maximum design load. Second, settlements during the life of the structure must not be of a magnitude that will cause structural damage, endanger piping connections, or impair the operational efficiency of the facility. Selection of the foundation type to satisfy these criteria depends on the nature and magnitude of dead and live loads, the base area of the structure and the settlement tolerances. Where more than one foundation type satisfies these criteria, then cost, scheduling, material availability, and local practice will probably influence or determine the final selection of the type of foundation.

Based on results of the preliminary geotechnical evaluation, the project site is suitable for the proposed improvements from a geotechnical perspective. The potential geologic and seismic hazards described above may be mitigated by employing sound engineering practice in the design and construction of the new power generating facilities and associated improvements. This practice includes the implementation of appropriate geotechnical recommendations during design and construction of the improvements at the site. Typical methods to mitigate potential significant hazards that may be encountered during construction are summarized in the following sections with further information and details provided in the Preliminary Geotechnical Report by Ninyo & Moore.

2C.7.6.2 Shallow Foundations

Preliminary geotechnical evaluation indicates the proposed structures can be supported on mat foundations when combined with in-situ ground improvements. Relatively light minor structures, new pavements and hardscape areas may be supported on suitable compacted fill, placed in accordance with detailed geotechnical recommendations.

Ground improvement techniques such as vibro-replacement stone columns, rammed aggregate piers or compaction grouting would mitigate the compressible soils and liquefaction hazard, and the new structures could then be supported on shallow mat foundation systems within the ground improvement zones. Further geotechnical investigation will be required to determine allowable bearing pressures if ground improvement techniques prove to be a cost effective solution for the project.

2C.7.6.3 Deep Foundations

The site is susceptible to compressible soils and the potential for dynamic settlement related to liquefaction. Therefore, the preliminary geotechnical evaluation recommends supporting the major re-powering improvement structures on deep pile foundations.

Driven pre-cast concrete pile foundations can be considered for preliminary design of the proposed re-powering improvements. A typical 14 inch diameter pre-cast pile driven to approximately 50 feet deep can be considered based on preliminary geotechnical investigation. An axial capacity of 90 kips can be used.

2C.7.7 Preliminary Earthwork Considerations

2C.7.7.1 Site Preparation and Grading

The subgrade preparation would include the complete removal of all vegetation and any topsoil. Any vegetation consists of weeds and grasses with a maximum root depth of less than a foot. Topsoil can be stockpiled and may be reused in remote areas of the site.

As shown on the Proposed Drainage Plan, any site fill work should be performed as detailed below. All soil surfaces to receive fill should be proof-rolled with a heavy vibratory roller or a fully loaded dump truck to detect soft areas.

2C.7.7.2 Temporary Excavations

All excavations should be sloped in accordance with Occupational Safety and Health Act (OSHA) requirements. Based on preliminary evaluation, subsurface excavation are anticipated to be composed of predominantly sandy silt and fine-grained sand with silt and clay. These sandy soils generally have relatively little cohesion and have a high potential for caving. Therefore, temporary slopes above the water table should be stable at an inclination of 1 ½:1 (horizontal to vertical) for excavations deeper than 4 feet but not more than 10 feet below existing grade. Some surficial sloughing may occur, and temporary slopes will be evaluated in the field by a geotechnical engineer. Sheet piling could also be used to support any excavation. The need for internal supports in the excavation will be determined based on the final depth of the excavation. Any excavation below the water table would be dewatered prior to the start of excavation.

2C.7.7.3 Permanent Slopes

Cut and fill slopes shall be 2h:1v (horizontal to vertical) maximum.

2C.7.7.4 Backfill Requirements

Based on the preliminary geotechnical evaluation, it is anticipated that the materials encountered in near-surface excavations would be appropriate material for re-use as structural fill. Recommended backfill materials shall be in conformance with the “Green book” (Standard Specifications for Public Works Construction) specifications for structural backfill and approved by Geotechnical Engineer. All fill material will be free of organic matter, debris, or clay balls, with a maximum size not exceeding 3 inches.

Fill compaction requirements shall be verified with the final geotechnical investigation prior to detailed design. For preliminary design and estimating purposes the following guidelines shall be followed: Structural fill will be compacted to at least 95 percent of the maximum dry density as determined by ASTM D 1557 when used for raising the grade throughout the site, below footings or mats, or for rough grading. Fill placed behind retaining structures may be compacted to 90 percent of the maximum dry density as determined by ASTM D 1557. Initially, structural fill will be placed in lifts not exceeding 8 inches loose thickness. Thicker lifts may be used pursuant to approval based on results of field compaction performance. The moisture content of all compacted fill will fall within 3 percentage points of the optimum moisture content measured by ASTM D 1557, except the top 12 inches of subgrade will be compacted to 95 percent of ASTM D 1557 maximum density.

Pipe bedding can be compacted in 12-inch lifts to 90 percent of the maximum dry density as determined by ASTM D 1557. Common fill to be placed in remote and/or unsurfaced areas may be compacted in 12-inch lifts to 85 percent of the maximum dry density as determined by ASTM D 1557.

2C.7.8 Inspection and Monitoring

A California-registered Geotechnical Engineer or Engineering Geologist will monitor geotechnical aspects of foundation construction and/or installation, excavation and fill placement. At a minimum the Geotechnical Engineer/Engineering Geologist will monitor the following activities:

- Excavation operations will be monitored to confirm extent of excavation and removal of unsuitable material.
- Surfaces to receive fill will be inspected prior to fill placement to verify that no pockets of loose/soft or otherwise unsuitable material were left in place, free of standing water and that the subgrade is suitable for structural fill placement.
- Fill placement operations will be monitored by an independent testing agency. Field compaction control testing will be performed regularly and in accordance with the applicable specification to be issued by the Geotechnical Engineer.
- The Geotechnical Engineer will witness pile installation if required.
- Settlement monitoring of significant foundations and equipment is recommended on at least a quarterly basis during construction and the first year of operation, and then semi-annually for the next 2 years.

2C.7.9 Site Design Criteria

2C.7.9.1 General

The project will be located in Long Beach, CA. The approximate 63-acre site contains existing power generation structures.

2C.7.9.2 Datum

Currently, the site grade ranges from approximately 7 to 14 feet above mean sea level, as evidenced by a recent topographical survey, based on the North American Vertical Datum of 1988 (NAVD ’88).

2C.7.10 Foundation Design Criteria

2C.7.10.1 General

Reinforced concrete structures (spread footings, mats, and deep foundations) will be designed consistent with Section 1.1 and 1.2, Civil and Structural Engineering Design Criteria.

Foundation design will be in accordance with this appendix and the detailed design geotechnical investigation for the site.

2C.7.10.2 Groundwater Pressures

Hydrostatic pressures due to groundwater or temporary water loads will be considered in detailed design.

2C.7.10.3 Factors of Safety

The factor of safety for structures, tanks and equipment supports with respect to overturning, sliding, and uplift due to wind and buoyancy will be as defined in Section 1.2, Structural Engineering Design Criteria.

2C.7.10.4 Load Factors and Load Combinations

For reinforced concrete structures and equipment supports, using the strength method, the load factors and load combinations will be in accordance with Section 1.2, Structural Engineering Design Criteria.

2C.7.11 References

California Building Code. 2013.

Preliminary Geotechnical Evaluation Report by Ninyo & Moore, dated October 19, 2011, project no. 208356001.

Appendix 2D
Will Serve Letters

Long Beach Water Department
The Standard in Water Conservation & Environmental Stewardship

KEVIN L. WATTIER, General Manager

September 4, 2013

Mr. Stephen O'Kane
AES Southland
690 N. Studebaker Rd.
Long Beach, CA 90803

Dear Mr. O'Kane:

Subject: **"Will Serve" Letter for the Proposed AES Facility Development at 690 North Studebaker Road**

The Long Beach Water Department is transmitting this "Will Serve" letter in response to your request for the proposed AES Facility located at 690 N. Studebaker Road in the City of Long Beach.

According to our current records, there is a potable water service connection to the existing AES Facility to a 12-inch asbestos cement (AC) potable water line on Studebaker Road. There is also an existing 8-inch vitrified clay pipe (VCP) sewer line on Vista Street.

All of these public facilities are available to serve the proposed site. Potable water and sewer services will be made available for the proposed development in accordance with our Rules and Regulations for Potable Water, Reclaimed Water, and Sewer Service.

If you have any questions, please call Ms. Jinny Huang at (562) 570-2346 or Mr. Dennis Santos at (562) 570-2381.

Sincerely,

Robert J. Verceles, P.E.
Division Engineer

cc: Jinny Huang, Senior Civil Engineer
Dennis Santos, Civil Engineering Associate

RJV:JH:rc
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Southern California Gas Company
A Sempra Energy utility℠

Douglas D. Spahr, P.E.
Sr. Account Manager

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semprautilites.com

Confidential

December 2, 2013

Mr. John Kistle
Project Manager
AES Alamitos, LLC
690 N. Studebaker Road
Long Beach, CA 90803

Subject: SoCalGas Transportation Service Request Response for Alamitos Development

Dear Mr. Kistle:

Thank you for your request concerning gas transportation service to the existing Alamitos Generating Station location based on the AES development plan.

Summary

Subject to the execution of appropriate contracts and the applicable rules and regulations, including California Public Utilities Commission (CPUC) approved rules and tariffs, and the AES development plan outlined below including the fast start and ramp proflies[1], SoCalGas can provide natural gas transportation service to the proposed site using the existing SoCalGas transmission lines located on the Alamitos property.

- The fast start and fast ramp profiles are as described in the AES development plan.
- The AES development plans will allow SoCalGas to use its existing eastern Transmission line L-1021 to serve power blocks B1, B2 and B3.
- The AES plan can accommodate SoCalGas serving power block B4 from its existing western Transmission line L-1022.

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[1] The fast start profile calls for two of three turbines per power block starting at time zero, ramping to full output 11 minutes later at which time the third turbine of the power block starts and ramps to full power between minutes 11 and 22 of the starting cycle. SoCalGas evaluated and confirmed that all four power blocks could be served under this operating scenario at the same time in the projected year 2025.

SoCalGas evaluated and confirmed that all twelve turbines could be served during a fast ramp profile of 70% power to 100% power within one minute. Likewise, SoCalGas evaluated and confirmed the ability to serve during a fast ramp down profile of 100% power to 70% power within one minute.

SoCalGas Service Assessment Based on
AES Alamitos Development Schedule

	2017	2018	2019	2020	2021	2022	2025
Quarter & New Block Added		Q2 / B1	Q1 / B2			Q2 / B3	Q4 / B4
Quarter & Units Retired		Q2 / 5 & 6			Q4 / 3 & 4		Q3 / 1 & 2
L-1021[2] Service, (MMcf/hr)[3]	10.7	3.8	7.6	7.6	7.6	11.4	11.4
L-1022[4] Service (MMcf/hr)	9.7	9.7	9.7	9.7	3	3	3.8
Total MMcf/hr	20.4	13.5	17.3	17.3	11.4	14.4	15.2
Nominal MWs	1,997	1,550	2,080	2,080	1,412	1,942	2,122

The estimated service lateral pipeline and on-site compressor costs shown in the summary table below are based on historic SoCalGas costs, the current SoCalGas minimum operating pressure of 160 psig of the two existing transmission pipelines (MinOP), the AES stated turbine inlet pressure of 550 psig and include direct costs, indirect costs and the Income Tax Component of Contributions and Advances (ITCCA)[5] at 22%, which is scheduled to increase to 35% effective January 1, 2014[6].

Service Laterals

SoCalGas has determined that the existing transmission service lines are sufficient to meet the Alamitos service request outlined above.

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[2] Line 1021 is the 30 inch diameter transmission pipeline located on the eastern side of the Alamitos property.
[3] MMcf/hr = million standard cubic feet per hour.
[4] Line 1022 is the 20 inch diameter transmission pipeline located on the western edge of the Alamitos property.
[5] http://www.socalgas.com/regulatory/tariffs/tm2/pdf/PS-IV.pdf
[6] http://www.socalgas.com/regulatory/tariffs/tm2/pdf/4446.pdf

Peak Load per pipeline (MMcf/d)	Estimated Service Lateral Diameter[7] (Inches)	Estimated Service Lateral (Miles)	Estimated Service Lateral Cost (Millions)	Estimated Onsite Compression Required (HP)	Estimated Compression Cost[8] (Millions)
91	Existing L-1022, 20	Existing	N/A	8,000	$36.7
273	Existing L-1021, 30	Existing	N/A	24,000	$110

On-Site Compression

The estimated on-site booster compression cost is based on the AES specified inlet pressure requirement and the SoCalGas interconnecting pipeline's current Minimum Operating Pressure (MinOP) of 160 psig for both of the existing L-1021 and L-1022 transmission lines.

Each new power block requires approximately 8,000 hp of gas compression split between the two SoCalGas transmission lines as shown in the table above. With all four power blocks constructed, SoCalGas estimates Alamitos will need a total of 32,000 hp of on-site booster compression.

The L-1021(eastern) served power blocks will need: 8,000 hp of compression in the second quarter of 2018 for B1, 8,000 hp of compression in the first quarter of 2019 for B2 and 8,000 hp of compression for in the second quarter of 2022 for B3.

The L-1022 (western) served power block B4 will need an additional 8,000 hp of compression to be installed in the fourth quarter of 2025.

Service Pressure

Based on current operating characteristics of the SoCalgas system, it is estimated that the service pressure to the Alamitos meter set assemblies will vary between the minimum operating pressure of 160 psig and the Maximum Allowable Operating Pressure of 190 psig.

Service pressure is provided on an as available basis, with no pressure level guarantees or warranties of any kind.

Additional Assumptions and Conditions

The availability of natural gas service, as set forth in this letter, is based on current conditions of supply, demand, pressures and regulatory policies, is subject to change, and is not a guarantee of future operations.

[7] It is estimated that the existing pipeline diameters will incur a pressure drop of 5 psig resulting from the quick-start and fast ramp profiles.

[8] Compression costs are based on gas fired primer movers and estimated per horsepower installed, including units, valves and basic controls, but not advance controls for multiple modes of operation. The costs listed include direct costs, indirect costs and the ITCCA tax.

This service offering has a sunset date of the earlier of six (6) months from the date of this letter or a change in the assumptions.

As described above and further below, this preliminary cost estimate does not include, among other things, the cost of a tap and an appropriate meter set. The costs of modifying or building new meter sets for large electricity generating facilities can be significant. Recently completed meter sets for similar large electricity generation facilities have cost in the range of $2 million for each meter set, which includes direct costs, indirect costs and ITCCA taxes.

This preliminary cost estimate is for the construction cost of the facilities and is provided at your request. SoCalGas/SDG&E have not performed a detailed specific site or route evaluation for your project in the development of this estimate. Additionally, costs associated with permitting, paving, right-of-way, environmental, gas quality, measurement, regulatory, and land acquisition/development issues; and any unusual construction costs or facility requirements (e.g. freeway, river, or channel crossings) are explicitly excluded from this preliminary cost estimate. These costs are the developer's responsibility and can be significant.

SoCalGas/SDG&E's construction costs also continue to rise with increasing costs of labor and materials. Since this preliminary cost estimate is developed using average historical project cost data, it is highly likely that the actual construction costs for your particular project could vary significantly from this preliminary estimate based on the actual design, permitting and construction variables associated with this specific project. SoCalGas/SDG&E urge you to retain the services of a third-party engineering construction firm, or enter into a design and engineering contract with SoCalGas/SDG&E to develop a more accurate construction cost estimate for your specific project. SoCalGas/SDG&E do not recommend any use of this preliminary cost estimate. Any use by you is at your own risk and should factor in the above risks and limitations.

Assuming normal planning and construction schedules for the interconnection facilities needed to establish service, SoCalGas would require approximately eighteen (18) to twenty-four (24) months from the completion of contracts and the receipt of the requested deposit in order to complete the planning, design and construction of the service facilities needed for your project.

For an additional fee, SoCalGas can prepare a more detailed engineering construction estimate that will include costs that have been omitted from this preliminary estimate.

Thank you for your consideration.

Sincerely,

Appendix 3A
CAISO Interconnection Study

the power of being global

AES NORTH AMERICA DEVELOPMENT, LLC

March 09, 2012

Dear Ms. Debi Le Vine,

Please find enclosed the required information for the interconnection process associated with redevelopment at the AES Alamitos facility. To the extent that the CAISO or Participating TO find that the total capability or electrical characteristics of the Generating Unit have substantially changed then it is AES' intention to proceed to Cluster 5 and potentially the independent study path.

Specifically the information provided includes the Affidavit stating AES believes the redevelopment does not represent a substantial change and the technical data supplied in Appendix A and its Attachment 1 describing the redevelopment.

Should you require additional information, please do not hesitate to contact me. We appreciate your consideration to this request and further your cooperation to do so in a very timely fashion.

Kind Regards,

Jennifer Didlo

Vice President

AES North America Development, LLC

AFFIDAVIT

This affidavit is being submitted in satisfaction of the requirements in Section 25.1.2 of the CAISO Tariff of the California Independent System Operator Corporation ("CAISO").

1. I, Jennifer Didlo, the undersigned, as a representative of AES North America Development, LLC located at 4300 Wilson Blvd, Arlington, VA, 22203, am authorized to execute this affidavit on behalf of AES North America Development, LLC.

2. AES North America Development, LLC is an affiliate of AES Alamitos, LLC, the legal owner of the AES Alamitos generating facility located at 690 N. Studebaker Road, Long Beach, CA 90803 and connected to the CAISO Controlled Grid.

3. AES North America Development, LLC further represents that it is proceeding with repowering activities at the AES Alamitos generating facility.

4. AES North America Development, LLC further represents that the total generating capacity of any Generating Unit(s) at the AES Alamitos generating facility will not be increased and the electrical characteristics of any Generating Unit(s) will remain substantially unchanged as part of the contemplated repowering activities.

I, Jennifer Didlo, declare under penalty of perjury that the foregoing statements are true to the best of my knowledge.

Signed: ______________________

Print Name: Jennifer Didlo

Title: Vice President

Date: March 9, 2012

AES North America Development, LLC

4300 Wilson Blvd

Arlington, VA 22203

Appendix 1 Interconnection Request
INTERCONNECTION REQUEST

Provide **three copies** of this completed form pursuant to Section 7 of this GIP Appendix 1 below.

1. The undersigned Interconnection Customer submits this request to interconnect its Generating Facility with the CAISO Controlled Grid pursuant to the CAISO Tariff (check one):
   - ☐ Fast Track Process.
   - ☐ Independent Study Process.
   - ☒ Queue Cluster Process.
   - ☐ One-Time Deliverability Assessment pursuant to GIP Section 8.1.
   - ☐ Annual Deliverability Assessment pursuant to GIP Section 8.

2. This Interconnection Request is for (check one):
   - ☐ A proposed new Generating Facility.
   - ☒ An increase in the generating capacity or a Material Modification to an existing Generating Facility.

3. Requested Deliverability Status is for (check one):
   - ☒ Full Capacity (For Independent Study Process and Queue Cluster Process only)
     (Note – Deliverability analysis for Independent Study Process is conducted with the next annual Cluster Study – See GIP Section 4.6)
   - ☐ Energy Only

4. The Interconnection Customer provides the following information:

   a. Address or location, including the county, of the proposed new Generating Facility site or, in the case of an existing Generating Facility, the name and specific location, including the county, of the existing Generating Facility;

   Project Name: **Alamitos Energy Center**

   Project Location:

   Street Address: **690 N Studebaker Rd**

   City, State: **Long Beach, California**

   County: **Los Angeles**

   Zip Code: **90803**

   GPS Coordinates (decimal format):

   Latitude: **33.76926944** Longitude: **-118.1003139**

   b. Maximum net megawatt electrical output (as defined by section 2.c of Attachment A to this appendix) of the proposed new Generating Facility or the amount of net megawatt increase in the generating capacity of an existing Generating Facility;

   Maximum net megawatt electrical output (MW): **1902.867 MW at 85 °F** ***OR***
   Net Megawatt increase (MW):

c. Type of project (i.e., gas turbine, hydro, wind, etc.) and general description of the equipment configuration (if more than one type is chosen include net MW for each);

☐ Cogeneration	(MW)
☐ Reciprocating Engine	(MW)
☐ Biomass	(MW)
☐ Steam Turbine	(MW)
☐ Gas Turbine	(MW)
☐ Wind	(MW)
☐ Hydro	(MW)
☐ Photovoltaic	(MW)
☒ Combined Cycle	**1902.867** (MW)
☐ Other (please describe):	(MW)

General description of the equipment configuration (e.g. number, size, type, etc):
The project is comprised of four CCGT blocks (Block 1, Block 2, Block 3 and Block 4) having a maximun net output of 1902.867 MW @ 85F. Each block is comprised of 3 gas turbines rated at 115.962 MW, 122.065 MVA each and 1 steam turbine rated at 145.148 MW, 152.787 MVA.

d. Proposed In-Service Date (first date transmission is needed to the facility), Trial Operation date and Commercial Operation Date by day, month, and year and term of service (**dates must be sequential**):

Proposed In-Service Date:	**Block 1: 01/01/2017, Block 2: 01/01/2017, Block 3: 01/01/2020, Block 4: 01/01/2023**
Proposed Trial Operation Date:	**Block 1: 06/01/2018, Block 2: 06/01/2018, Block 3: 06/01/2021, Block 4: 06/01/2024**
Proposed Commercial Operation Date:	**Block 1: 01/01/2019, Block 2: 01/01/2019, Block 3: 11/01/2022, Block 4: 11/01/2025**
Proposed Term of Service (years):	**30 years (All blocks)**

e. Name, address, telephone number, and e-mail address of the Interconnection Customer's contact person (primary person who will be contacted);

Name:	**John Kistle**
Title:	**Vice President**
Company Name:	**AES North America Development, LLC**
Street Address:	**690 N. Studebaker Road**
City, State:	**Long Beach, California**
Zip Code:	**90803**
Phone Number:	**(562) 493-7894**
Fax Number:	**(562) 493-7320**
Email Address:	**John.Kistle@AES.com**
DUNS Number:	

f. Approximate location of the proposed Point of Interconnection (i.e., specify transmission facility interconnection point name, voltage level, and the location of interconnection);

230 kV Alamitos Switching Station.

g. Interconnection Customer data (set forth in Attachment A)

The Interconnection Customer shall provide to the CAISO the technical data called for in GIP Appendix 1, Attachment A. Three (3) copies are required.

5. Applicable deposit amount as specified in the GIP made payable to California ISO. Send check to CAISO (see section 7 for details) along with the:
   a. Appendix 1 to GIP (Interconnection Request) for processing.
   b. Attachment A to Appendix 1 (Interconnection Request Generating Facility Data).

6. Evidence of Site Exclusivity as specified in the GIP and name(s), address(es) and contact information of site owner(s) (check one): **Current Title Report is available upon request.**

   Site is an existing generating facility, wholly owned by AES.
   Plant Manager: Weikko Wirta
   690 N. Studebaker Rd.
   Long Beach, CA 90803
   562-493-7831

   ☒ Is attached to this Interconnection Request
   ☐ Deposit in lieu of Site Exclusivity attached, Site Exclusivity will be provided at a later date in accordance with this GIP

7. This Interconnection Request shall be submitted to the CAISO representative indicated below:

   New Resource Interconnection
   California ISO
   P.O. Box 639014
   Folsom, CA 95763-9014

   Overnight address: California ISO, Attn: Grid Assets, 250 Outcropping Way, Folsom, CA 95630

8. Representative of the Interconnection Customer to contact:

Name:	**Hala Ballouz, PE**
Title:	**President**
Company Name:	**Electric Power Engineers, Inc. (EPE)**
Street Address:	**9433 Bee Caves Road, Building 3, Suite 210**
City, State:	**Austin, Texas**
Zip Code:	**78733**
Phone Number:	**(512) 382-6700**
Fax Number:	**(866) 379-3635**
Email Address:	**hballouz@epeconsulting.com**

9. This Interconnection Request is submitted by: **AES North America Development, LLC**

   Legal name of the Interconnection Customer: **AES North America Development, LLC**

   By (signature): ______________________

   Name (type or print): **John Kistle**

   Title: **Vice President**

   Date: **9 March, 2012**

Attachment A Generating Facility Data
To GIP Appendix 1
Interconnection Request

GENERATING FACILITY DATA

Provide three copies of this completed form pursuant to Section 7 of GIP Appendix 1.

All drawings provided herein as PDFs are also available electronically upon request.

1. **Provide two original prints and one reproducible copy (no larger than 36" x 24") of the following:**

   A. Site drawing to scale, showing generator location and Point of Interconnection with the CAISO Controlled Grid.

   B. Single-line diagram showing applicable equipment such as generating units, step-up transformers, auxiliary transformers, switches/disconnects of the proposed interconnection, including the required protection devices and circuit breakers. For wind and photovoltaic generator plants, the one line diagram should include the distribution lines connecting the various groups of generating units, the generator capacitor banks, the step up transformers, the distribution lines, and the substation transformers and capacitor banks at the Point of Interconnection with the CAISO Controlled Grid.

2. Generating Facility Information

A. Total Generating Facility rated output (MW): **Gross: 1972.135 MW at 85 °F and 95% PF**
B. Generating Facility auxiliary Load (MW): **69.268 MW at 85 °F**
C. Project net capacity (A-B)(MW): **1902.867 MW at 85 °F and 95% PF**
D. Standby Load when Generating Facility is off-line (MW): **1.1**
E. Number of Generating Units: **4 blocks (each composed of 3 gas turbines and 1 steam turbine)**
(Please repeat the following items for each generator)
F. Individual generator rated output (MW for each unit):
Gas: 115.962 MW at 38.8°C rated coolant inlet temperature.
Steam: 145.148 MW at 38.8°C rated coolant inlet temperature.
G. Manufacturer: **BRUSH (for all generators)**
H. Year Manufactured: _____
I. Nominal Terminal Voltage (kV): **13.8 (for all generators)**
J. Rated Power Factor (%):**0.95 (for all generators)**
K. Type (Induction, Synchronous, D.C. with Inverter): **Synchronous (for all generators)**
L. Phase (three phase or single phase): **Three Phase (for all generators)**
M. Connection (Delta, Grounded WYE, Ungrounded WYE, impedance grounded):
Impedance grounded
N. Generator Voltage Regulation Range (+/- %):
Gas: +/- 10%,
Steam: Selectable from +/- 10% to +/- 25%.
O. Generator Power Factor Regulation Range:
Gas: -0.7 to +0.7,
Steam: -0.95 to +0.85
P. For combined cycle plants, specify the plant net output capacity (MW) for an outage of the steam turbine or an outage of a single combustion turbine **1439.019 MW at 85 °F and 95% PF for an outage of a single combustion turbine from each block**

3. **Synchronous Generator – General Information:**
(Please repeat the following for each generator model)

A. Rated Generator speed (rpm): **3600 (for all generators)**

B. Rated MVA:
Gas: 122.065 MVA each,
Steam: 152.787 MVA each

C. Rated Generator Power Factor: **0.95 (for all generators)**

D. Generator Efficiency at Rated Load (%):
Gas: 98.62% each
Steam: 98.67% each

E. Moment of Inertia (including prime mover):
42,707 kgm2 for each Gas Turbine + Generator.
6102 kgm2 for each Steam Turbine + Generator.

F. Inertia Time Constant (on machine base) H:
1.28 kW sec/kVA for each gas turbine generator,
1.09 kW sec/kVA for each steam turbine generator sec or MJ/MVA

G. SCR (Short-Circuit Ratio - the ratio of the field current required for rated open-circuit voltage to the field current required for rated short-circuit current): **Gas: 0.53 each, Steam: 0.49 each**

H. Please attach generator reactive capability curves.

I. Rated Hydrogen Cooling Pressure in psig (Steam Units only): _____

J. Please attach a plot of generator terminal voltage versus field current that shows the air gap line, the open-circuit saturation curve, and the saturation curve at full load and rated power factor.

4. **Excitation System Information**
(Please repeat the following for each generator model)

A. Indicate the Manufacturer **Gas: ABB inc., Steam: Brush** and Type **Gas: UNITROL 6000, Steam: Brushless** of excitation system used for the generator. For exciter type, please choose from 1 to 9 below or describe the specific excitation system.

☐ (1) Rotating DC commutator exciter with continuously acting regulator. The regulator power source is independent of the generator terminal voltage and current.

☐ (2) Rotating DC commentator exciter with continuously acting regulator. The regulator power source is bus fed from the generator terminal voltage.

☐ (3) Rotating DC commutator exciter with non-continuously acting regulator (i.e., regulator adjustments are made in discrete increments).

☐ (4) Rotating AC Alternator Exciter with non-controlled (diode) rectifiers. The regulator power source is independent of the generator terminal voltage and current (not bus-fed).

☐ (5) Rotating AC Alternator Exciter with controlled (thyristor) rectifiers. The regulator power source is fed from the exciter output voltage.

☐ (6) Rotating AC Alternator Exciter with controlled (thyristor) rectifiers.

☐ (7) Static Exciter with controlled (thyristor) rectifiers. The regulator power source is bus-fed from the generator terminal voltage.

☐ (8) Static Exciter with controlled (thyristor) rectifiers. The regulator power source is bus-fed from a combination of generator terminal voltage and current (compound-source controlled rectifiers system.

☒ (9) Other (specify):
Steam: as in #1 above.
Gas: Static Exciter with controlled (thyristors) rectifiers. The main power source for the Exciter is fed from an AC auxilliary source through a step down transformer

B. Attach a copy of the block diagram of the excitation system from its instruction manual. The diagram should show the input, output, and all feedback loops of the excitation system.

C. Excitation system response ratio (ASA):
Gas: 180% Ceiling Voltage; Steam: 2.4

D. Full load rated exciter output voltage: **Gas: 145 VDC (Based on Generator Field Data provided); Steam: 174 VDC**

E. Maximum exciter output voltage (ceiling voltage): **Gas: 263 VDC (Based on 180% Ceiling voltage requirement); Steam: 365 VDC**

F. Other comments regarding the excitation system?

5. Power System Stabilizer Information

(Please repeat the following for each generator model. All new generators are required to install PSS unless an exemption has been obtained from WECC. Such an exemption can be obtained for units that do not have suitable excitation systems.)

A. Manufacturer: **Gas: ABB; Steam: Brush**

B. Is the PSS digital or analog? **Gas: Digital; Steam: Digital**

C. Note the input signal source for the PSS:
☐ Bus frequency ☐ Shaft speed ☐ Bus Voltage
☒ Other (specify source):
Gas: Three phase generator CT's (Current Measurement);
Steam: Active Electrical Power Frequency & Generator Internal Voltage. Both inputs derived from sensing transformer signals.

D. Please attach a copy of a block diagram of the PSS from the PSS Instruction Manual and the correspondence between dial settings and the time constants or PSS gain.

E: Other comments regarding the PSS?

6. Turbine-Governor Information

(Please repeat the following for each generator model)

Please complete Part A for steam, gas or combined-cycle turbines, Part B for hydro turbines, and Part C for both.

A. Steam, gas or combined-cycle turbines:

(1) List type of unit (Steam, Gas, or Combined-cycle): **4 x Combined-cycle blocks (3 x Gas and 1 x Steam per block)**

(2) If steam or combined-cycle, does the turbine system have a reheat process (i.e., both high and low pressure turbines)? **Non- Reheat**

(3) If steam with reheat process, or if combined-cycle, indicate in the space provided, the percent of full load power produced by each turbine:
Low pressure turbine or gas turbine: _____%
High pressure turbine or steam turbine: _____%

B. Hydro turbines:

(1) Turbine efficiency at rated load: _____%

(2) Length of penstock: _____ft

(3) Average cross-sectional area of the penstock: _____ft2

(4) Typical maximum head (vertical distance from the bottom of the penstock, at the gate, to the water level): _____ft

(5) Is the water supply run-of-the-river or reservoir: _____

(6) Water flow rate at the typical maximum head: _____ft3/sec
(7) Average energy rate: _____kW-hrs/acre-ft
(8) Estimated yearly energy production: _____kW-hrs

C. Complete this section for each machine, independent of the turbine type.

(1) Turbine manufacturer: **MHI for both Gas and Steam**
(2) Maximum turbine power output: _____MW
(3) Minimum turbine power output (while on line): _____MW
(4) Governor information:
(a) Droop setting (speed regulation): **Gas: 4%, Steam: >4%**
(b) Is the governor mechanical-hydraulic or electro-hydraulic (Electro-hydraulic governors have an electronic speed sensor and transducer.)? **Electro-Hydraulic for both Gas and Steam**
(c) Other comments regarding the turbine governor system? _____

7. Induction Generator Data:

A. Rated Generator Power Factor at rated load: _____
B. Moment of Inertia (including prime mover): _____
C. Do you wish reclose blocking? ☐Yes ☐No
Note: Sufficient capacitance may be on the line now, or in the future, and the generator may self-excite unexpectedly.

8. Generator Short Circuit Data

For each generator model, provide the following reactances expressed in p.u. on the generator base:

- X"1 – positive sequence subtransient reactance: **Gas: 0.121, Steam: 0.14** p.u**
- X2 – negative sequence reactance: **Gas: 0.15, Steam: 0.182** p.u**
- X0 – zero sequence reactance: **Gas: 0.082, Steam: 0.091** p.u**

Generator Grounding (select 1 for each model):

A. ☐ Solidly grounded
B. ☒ Grounded through an impedance
Impedance value in p.u on generator base
R: **614.66 on 100 MVA base (for all generators)** p.u.
X: **249.95 on 100 MVA base (for all generators)** p.u.
C. ☐ Ungrounded

9. Step-Up Transformer Data

For each step-up transformer, fill out the data form provided in Table 1.

10. Interconnection Facilities Line Data

There is no need to provide data for new lines that are to be planned by the Participating TO. However, for transmission lines that are to be planned by the generation developer, please provide the following information:

Nominal Voltage: **230**kV
Line Length: **Block 1: Two 3-phase lines, 0.26 miles each**
Block 2: Two 3-phase lines, 0.05 miles each
Block 3: Two 3-phase lines, 0.46 miles each

Line termination Points: _____
Conductor Type: **ACSR** Size: **1033.5 kcmil**
If bundled. Number per phase: _____, Bundle spacing: _____in.
Phase Configuration. Vertical: **X**, Horizontal: _____
Phase Spacing: A-B: **15**ft., B-C: **15**ft., C-A: **30**ft.
Distance of lowest conductor to Ground at full load and 40ºC: **44.8** ft
Ground Wire Type: **AW** Size: **313.7** Distance to Ground: **49** ft
Attach Tower Configuration Diagram
Summer line ratings in amperes (normal and emergency) **Normal: 1001.5 Amps (x 2; two 3-phase lines); Emergency: 1057.5 Amps (x 2; two 3-phase lines)**
Positive Sequence Resistance (R): **Block 1: 0.000045; Block 2: 0.000009, Block 3: 0.00079, Block 4: 0.000034** p.u.** (for entire line length)
Positive Sequence Reactance: (X): **Block 1: 0.000364; Block 2: 0.000070, Block 3: 0.000645, Block 4: 0.000280** p.u**(for entire line length)
Zero Sequence Resistance (R0): **Block 1: 0.000186; Block 2: 0.000036, Block 3: 0.000328, Block 4: 0.000143** p.u.** (for entire line length)
Zero Sequence Reactance: (X0): **Block 1: 0.001258; Block 2: 0.000242, Block 3: 0.002225, Block 4: 0.000968** p.u** (for entire line length)
Line Charging (B/2): **Block 1: 0.00039331; Block 2: 0.000075636, Block 3: 0.00069585, Block 4: 0.00030254** p.u**
** On 100-MVA and nominal line voltage (kV) Base

10a. For Wind/photovoltaic plants, provide collector System Equivalence Impedance Data Provide values for each equivalence collector circuit at all voltage levels.

Nominal Voltage: _____
Summer line ratings in amperes (normal and emergency) _____
Positive Sequence Resistance (R1): _____ p.u. ** (for entire line length of each collector circuit)
Positive Sequence Reactance: (X1): _____ p.u** (for entire line length of each collector circuit)
Zero Sequence Resistance (R0): _____ p.u. ** (for entire line length of each collector circuit)
Zero Sequence Reactance: (X0): _____ p.u** (for entire line length of each collector circuit)
Line Charging (B/2): _____ p.u** (for entire line length of each collector circuit)
** On 100-MVA and nominal line voltage (kV) Base

11. Wind Generators

Number of generators to be interconnected pursuant to this Interconnection Request: _____

Average Site Elevation: _____ ☐Single Phase ☐Three Phase

Inverter manufacturer, model name, number, and version:

_____

List of adjustable set points for the protective equipment or software:

_____
Field Volts: _____
Field Amperes: _____
Motoring Power (MW): _______
Neutral Grounding Resistor (If Applicable): _____
I22t or K (Heating Time Constant): _____
Rotor Resistance: _____
Stator Resistance: _____
Stator Reactance: _____
Rotor Reactance: _____

Magnetizing Reactance: _____
Short Circuit Reactance: _____
Exciting Current: _____
Temperature Rise: _____
Frame Size: _____
Design Letter: _____
Reactive Power Required In Vars (No Load): _____
Reactive Power Required In Vars (Full Load): _____
Total Rotating Inertia, H: _____ Per Unit on 100 MVA Base

Note: A completed General Electric Company Power Systems Load Flow (PSLF) data sheet must be supplied with the Interconnection Request. If other data sheets are more appropriate to the proposed device then they shall be provided and discussed at Scoping Meeting.

12. Load Flow and Dynamic Models:

Provide load flow model for the generating plant and its interconnection facilities in GE PSLF *.epc format, including new buses, generators, transformers, interconnection facilities. An equivalent model is required for the plant with generation collector systems. This data should reflect the technical data provided in this Attachment A.

For each generator, governor, exciter and power system stabilizer, select the appropriate dynamic model from the General Electric PSLF Program Manual and provide the required input data. The manual is available on the GE website at www.gepower.com. Select the following links within the website: 1) Our Businesses, 2) GE Power Systems, 3) Energy Consulting, 4) GE PSLF Software, 5) GE PSLF User's Manual. **Include any user written *.p EPCL files to simulate inverter based plants' dynamic responses (typically needed for inverter based PV/wind plants). Provide a completed *.dyd file that contains the information specified in this section.**

There are links within the GE PSLF User's Manual to detailed descriptions of specific models, a definition of each parameter, a list of the output channels, explanatory notes, and a control system block diagram. The block diagrams are also available on the CAISO Website.

If you require assistance in developing the models, we suggest you contact General Electric. Accurate models are important to obtain accurate study results. Costs associated with any changes in facility requirements that are due to differences between model data provided by the generation developer and the actual generator test data, may be the responsibility of the generation developer.

TABLE 1

TRANSFORMER DATA
(Provide for each level of transformation)

UNIT **Gas Generators (12 Identical Generators, 3 per Block)**

NUMBER OF TRANSFORMERS **1 per Gas Generator** PHASE **Three**

RATING	H Winding	X Winding	Y Winding
Rated MVA	**75/99/123**	**75/99/123**	_____
Connection (Delta, Wye, Gnd.)	**Wye Grounded**	**Delta**	_____
Cooling Type (OA,OA/FA, etc) :	**ONAN/ONAF/ONAF**	**ONAN/ONAF/ONAF**	_____
Temperature Rise Rating	**65 °C**	**65 °C**	_____
Rated Voltage	**230**	**13.8**	_____
BIL	**900**	**95**	_____
Available Taps (% of rating)	**+/- 10%**	**N/A**	_____
Load Tap Changer? (Y or N)	**Y**	**N**	_____
Tap Settings		**N/A**	_____
IMPEDANCE	**H-X**	**H-Y**	**X-Y**
Percent	**10%**	_____	_____
MVA Base	**73**	_____	_____
Tested Taps	_____	_____	_____
WINDING RESISTANCE	**H**	**X**	**Y**
Ohms	_____	_____	_____

CURRENT TRANSFORMER RATIOS

H_____ X_____ Y_____ N_____

Percent exciting current at 100% Voltage _____ 110% Voltage _____

Supply copy of nameplate and manufacture's test report when available

TABLE 1

TRANSFORMER DATA
(Provide for each level of transformation)

UNIT **Steam Generators (4 Identical Generators, 1 per Block)**

NUMBER OF TRANSFORMERS **1 per Steam Generator** PHASE **Three**

RATING	H Winding	X Winding	Y Winding
Rated MVA	**93/123/153**	**93/123/153**	_____
Connection (Delta, Wye, Gnd.)	**Wye Grounded**	**Delta**	_____
Cooling Type (OA,OA/FA, etc) :	**ONAN/ONAF/ONAF**	**ONAN/ONAF/ONAF**	_____
Temperature Rise Rating	**65 °C**	**65 °C**	_____
Rated Voltage	**230**	**13.8**	_____
BIL	**900**	**95**	_____
Available Taps (% of rating)	**+/- 10%**	**N/A**	_____
Load Tap Changer? (Y or N)	**Y**	**N**	_____
Tap Settings		**N/A**	_____
IMPEDANCE	**H-X**	**H-Y**	**X-Y**
Percent	**10%**	_____	_____
MVA Base	**93**	_____	_____
Tested Taps	_____	_____	_____
WINDING RESISTANCE	**H**	**X**	**Y**
Ohms	_____	_____	_____

CURRENT TRANSFORMER RATIOS

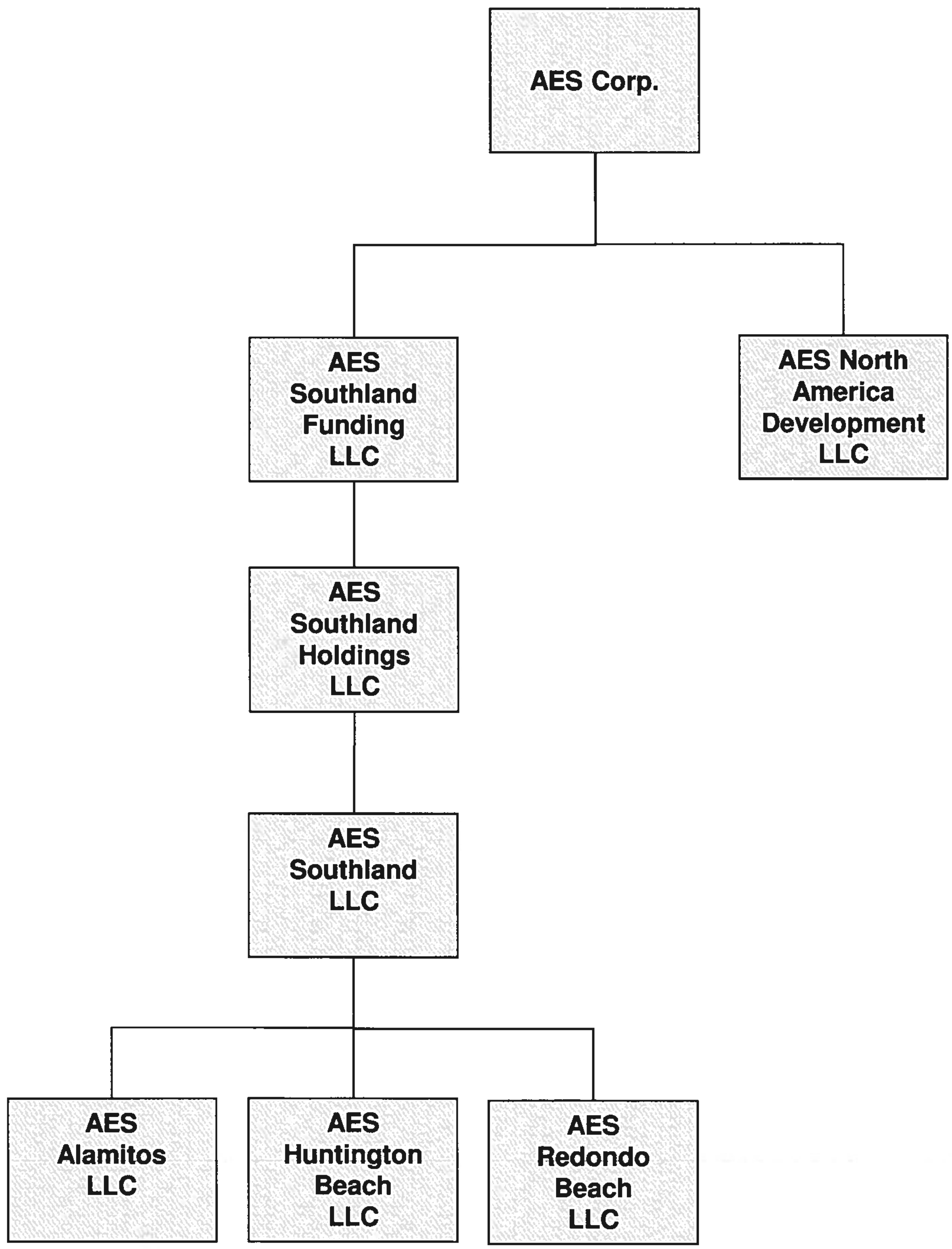
H_____ X_____ Y_____ N_____

Percent exciting current at 100% Voltage _____ 110% Voltage _____

Supply copy of nameplate and manufacture's test report when available

AES Legal Structure

March 9, 2012



BRUSH

ELECTRICAL DATA SHEET

Falcon Works, Nottingham Road, Loughborough, Leics. LE11 1EX, England
Telephone: +44 (0) 1509 611511 Fax: +44 (0) 1509 610440 E-mail: salesuk@brush.eu

1. RATING DETAILS

1.1	Frame size	YDAX 8-400ER
1.2	Terminal voltage	13.80 kV
1.3	Frequency	60 Hz
1.4	Speed	3600 rev/min
1.5	Power factor	0.850
1.6	Applicable national standard	IEEE C50.13
1.7	Rated air inlet temperature	15.0 °C
1.8	Rated output	120.700MW, 142.000 MVA

2. PERFORMANCE CURVES

2.1	Output vs air inlet temperature	H.E.P. 31216
2.2	Generator capability diagram	H.E.P. 31217
2.3	Efficiency vs output	H.E.P. 31218
2.4	Open and short circuit curves	H.E.P. 31219
2.5	Permitted duration of negative sequence current	H.E.P. 1216

3. REACTANCES

3.1	Direct axis synchronous reactance, Xd(i)	251 %
3.2	Direct axis saturated transient reactance, X'd(v)	20.1 % ± 15 %
3.3	Direct axis saturated sub transient reactance, X"d(v)	14.4 % ± 15 %
3.4	Unsaturated negative sequence reactance, X2(i)	17.7 %
3.5	Unsaturated zero sequence reactance, X0(i)	9.7 %
3.6	Quadrature axis synchronous reactance Xq(i)	229 %
3.7	Quadrature axis saturated transient reactance X'q(v)	24 %
3.8	Quadrature axis saturated sub transient reactance X"q(v)	17 %
3.9	Short circuit ratio	0.45

Notes:

Date: 24-Aug-2011

1. The electrical details provided are calculated values. Unless otherwise stated, all values are subject to tolerances as given in the relevant national standards.

I.D.: OPP01562C1

BRUSH

ELECTRICAL DATA SHEET - CONTINUATION

YDAX 8-400ER, 120.700 MW, 0.850 pf, 13.80 kV, 60 Hz

4. RESISTANCES AT 20°C

4.1	Rotor resistance	0.070 ohms
4.2	Stator resistance per phase	0.0012 ohms

5. TIME CONSTANTS AT 20°C

5.1	Transient O.C. time constant, T'_{do}	13.1 seconds
5.2	Transient S.C. time constant, T'_{d}	0.84 seconds
5.3	Sub transient O.C. time constant T''_{do}	0.05 seconds
5.4	Sub transient S.C. time constant, T''_{d}	0.04 seconds

6. INERTIA

6.1	Moment of inertia, WR^2 (See note 2)	2157 $Kg.m^2$
6.2	Inertia constant, H	1.08 kW.secs/kVA

7. CAPACITANCE

7.1	Capacitance per phase of stator winding to earth	0.40 microfarad

8. EXCITATION

8.1	Excitation current at no load, rated voltage	540 amps
8.2	Excitation voltage at no load, rated voltage	38 volts
8.3	Excitation current at rated load and P.F.	1664 amps
8.4	Excitation voltage at rated load and P.F.	145 volts
8.5	Inherent voltage regulation, F.L. to N.L.	35 %

Notes:

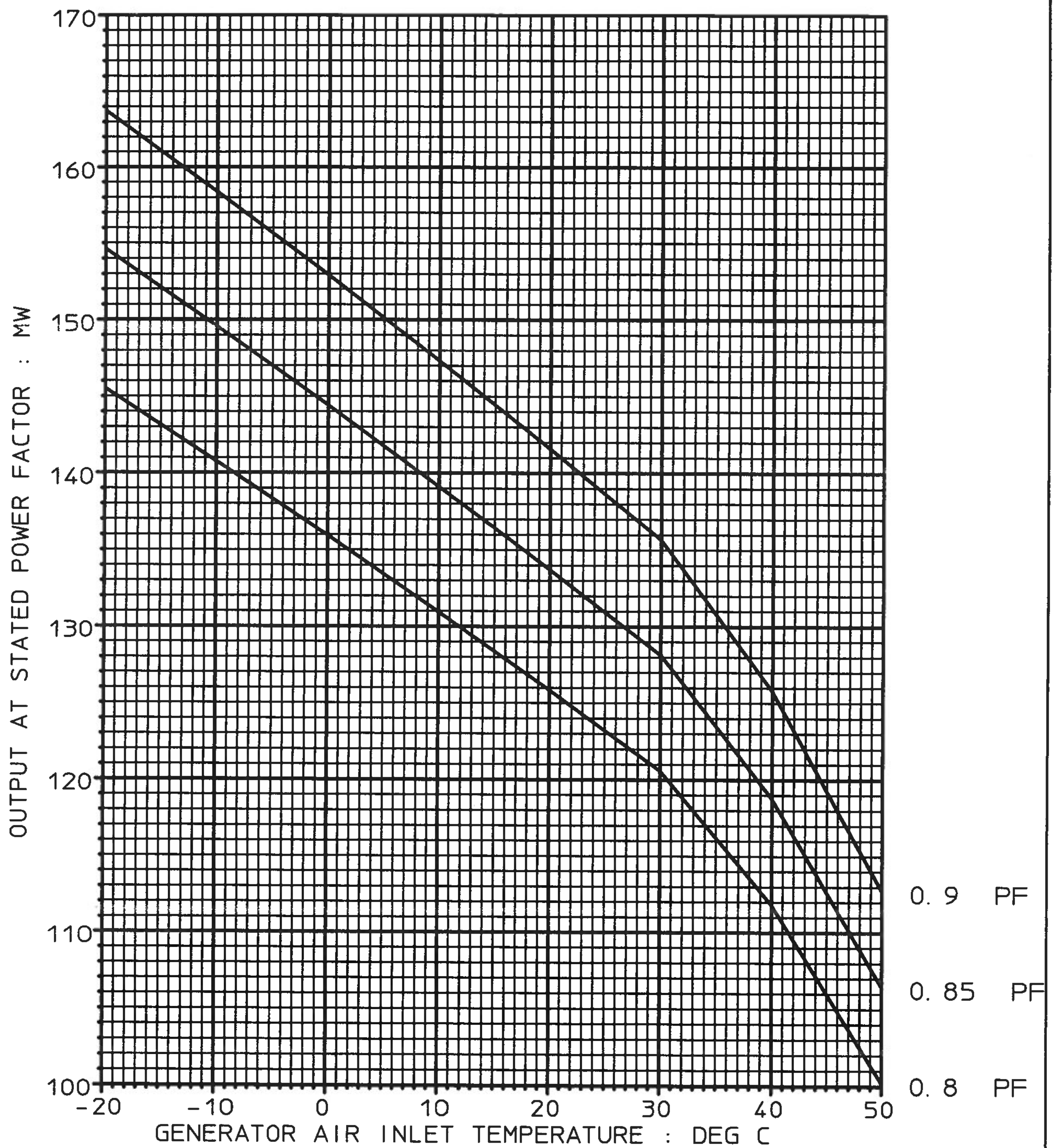
1. The electrical details provided are calculated values. Unless otherwise stated, all values are subject to tolerances as given in the relevant national standards.

2. The rotor inertia value may vary slightly with generator / turbine interface. In the event of conflict, the figure quoted on the rotor geometry drawing takes precedence.

Date: 24-Aug-2011

I.D.: OPP01562C1

VARIATION OF GENERATOR OUTPUT WITH AIR INLET TEMP



YDAX 8-400ER
13.80KV, 3 Ph, 60Hz.

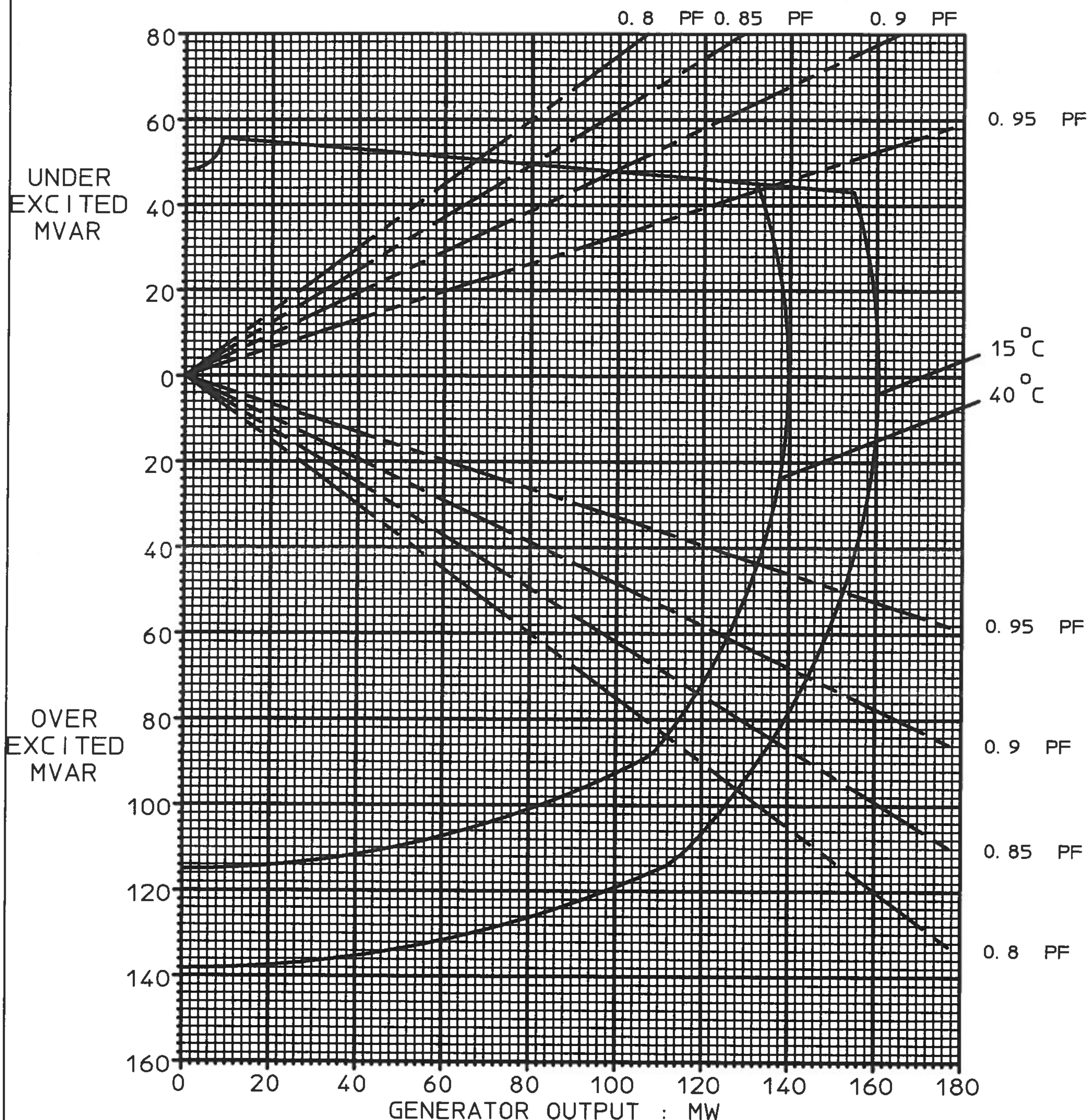
Up to 1000 meters ASL

IN ACCORDANCE WITH
IEEE C50.13
Class B temperatures.
Total temperatures Stator 123 Deg C
Rotor 125 Deg C

Issue No. 1 : 24-Aug-2011

BRUSH ELECTRICAL MACHINES LTD. H. E. P 31217

GENERATOR CAPABILITY DIAGRAM



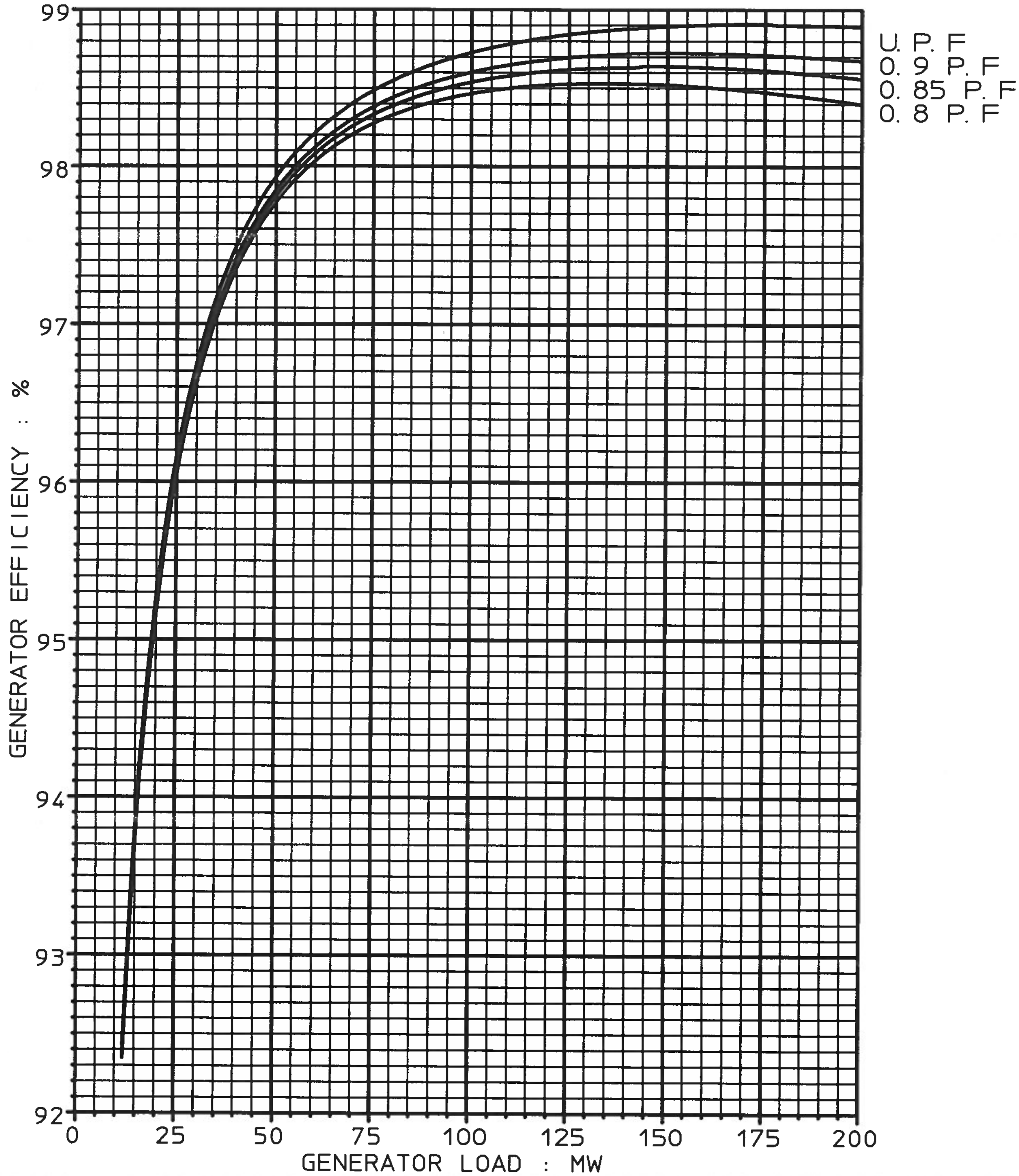
YDAX 8-400ER
13. 80KV, 3 Ph, 60Hz.

Up to 1000 meters ASL

IN ACCORDANCE WITH
IEEE C50. 13
Class B temperatures.
Total temperatures Stator 123 Deg C
Rotor 125 Deg C

Issue No. 1 : 24-Aug-2011

VARIATION OF GENERATOR EFFICIENCY WITH LOAD



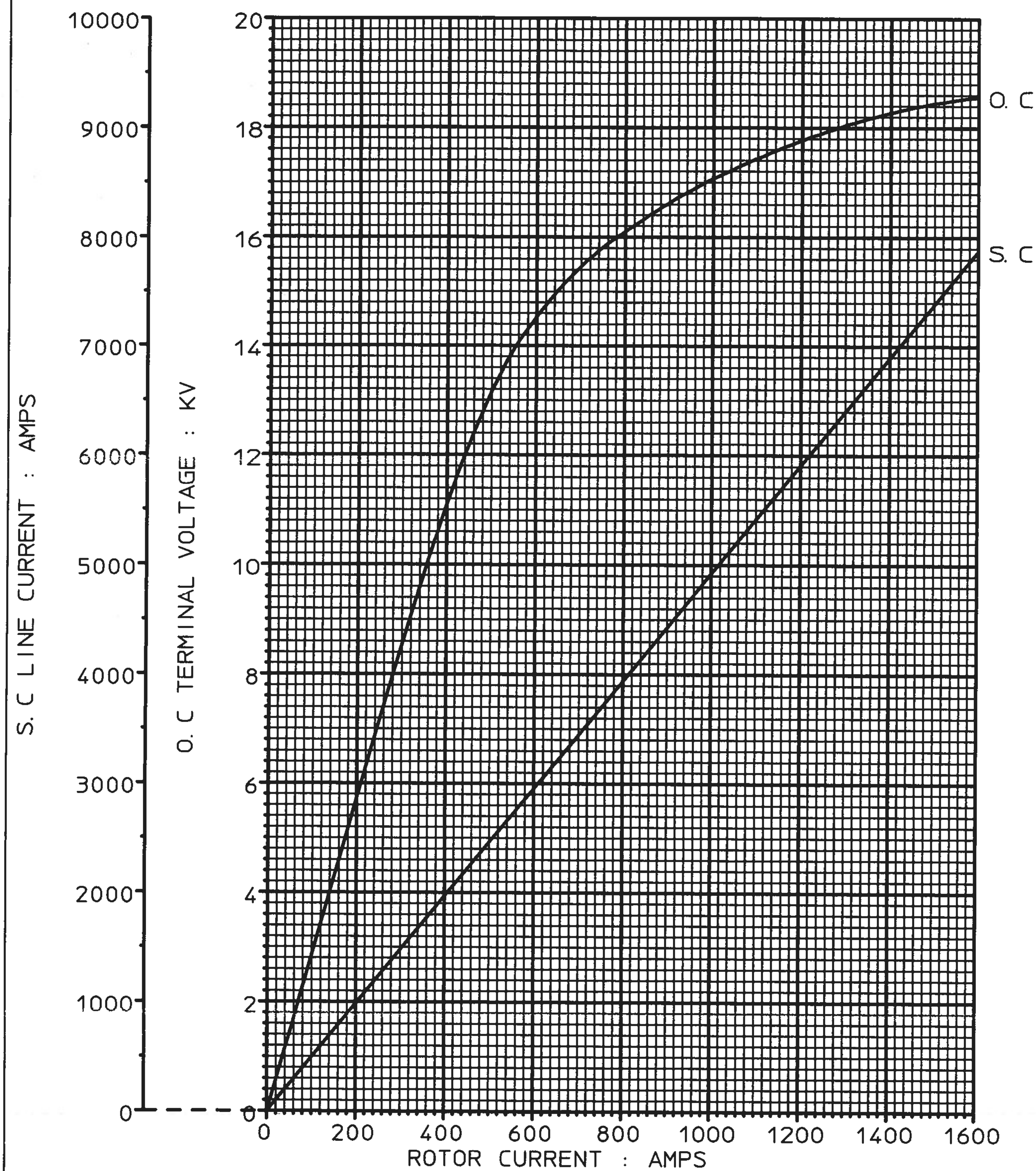
YDAX 8-400ER
13. 8 KV, 3 Ph, 60 Hz.

Efficiencies shown are guaranteed subject to the tolerance specified in IEC 60034-1.

Issue No. 1:24-Aug-2011

BRUSH ELECTRICAL MACHINES LTD. H.E.P 31219

OPEN CIRCUIT AND SHORT CIRCUIT CHARACTERISTIC

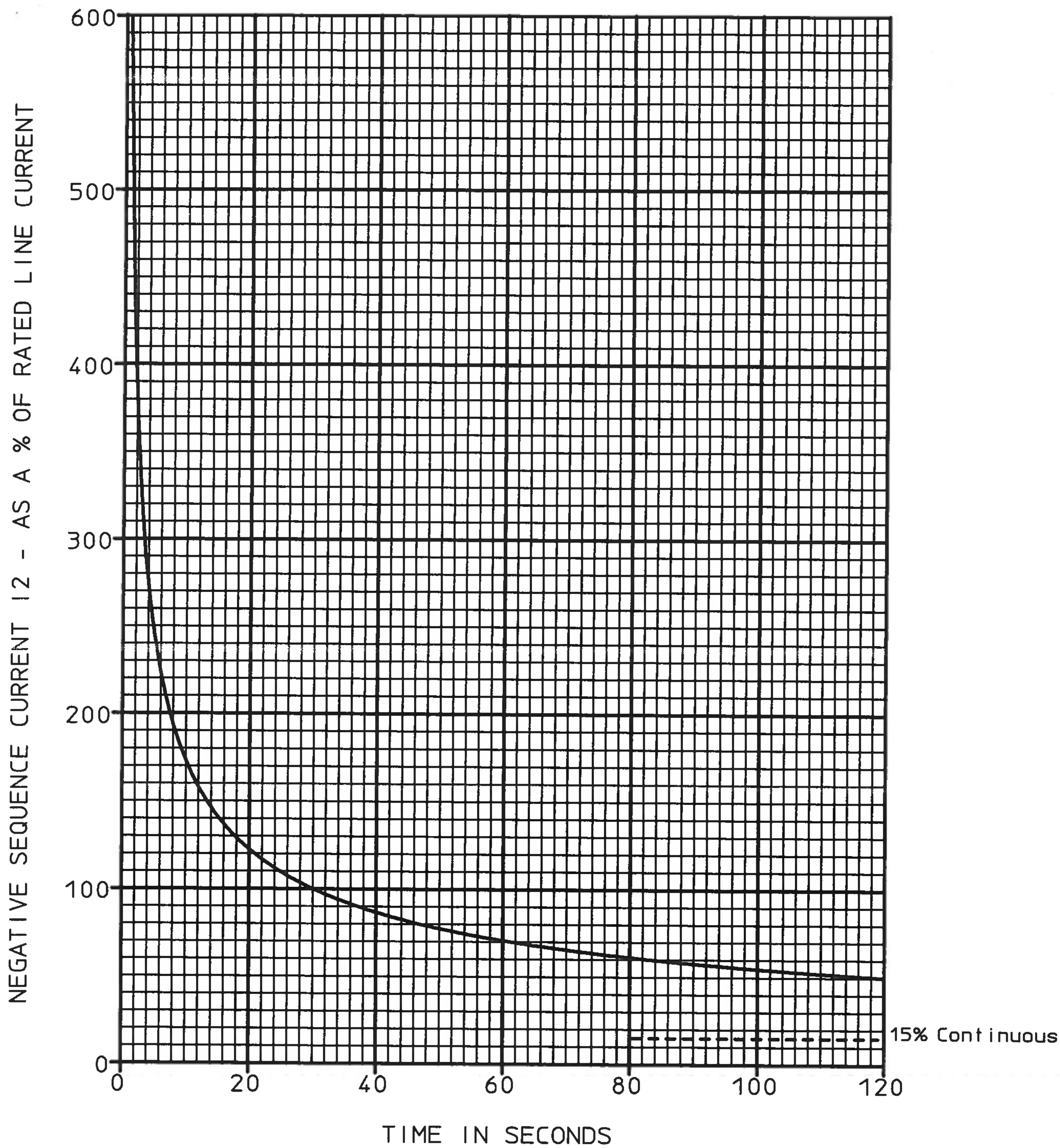


YDAX 8-400ER
3Ph, 60Hz, 3600 RPM.

Issue No. 1 : 24-Aug-2011

PERMISSIBLE DURATION OF NEGATIVE SEQUENCE CURRENT

$I_2^2 t = 30$



NOTE: For continuous operation rated current must not be exceeded in any one phase.

ELECTRICAL DATA SHEET

Falcon Works, Nottingham Road, Loughborough, Leics. LE11 1EX, England
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1. RATING DETAILS

1.1	Frame size	BDAX 82-445ERH
1.2	Terminal voltage	13.80 kV
1.3	Frequency	60 Hz
1.4	Speed	3600 rev/min
1.5	Power factor	0.950
1.6	Applicable national standard	IEEE C50.13
1.7	Rated coolant inlet temperature	38.8 °C
1.8	Rated output	145.148MW, 152.787 MVA

2. PERFORMANCE CURVES

2.1	Output vs coolant inlet temperature	H.E.P. 31605
2.2	Generator capability diagram	H.E.P. 31606
2.3	Efficiency vs output	H.E.P. 31607
2.4	Open and short circuit curves	H.E.P. 31608
2.5	Permitted duration of negative sequence current	H.E.P. 1216

3. REACTANCES

3.1	Direct axis synchronous reactance, Xd(i)	227 %
3.2	Direct axis saturated transient reactance, X'd(v)	19.3 % ± 15 %
3.3	Direct axis saturated sub transient reactance, X"d(v)	14.0 % ± 15 %
3.4	Unsaturated negative sequence reactance, X2(i)	18.2 %
3.5	Unsaturated zero sequence reactance, X0(i)	9.1 %
3.6	Quadrature axis synchronous reactance Xq(i)	207 %
3.7	Quadrature axis saturated transient reactance X'q(v)	23 %
3.8	Quadrature axis saturated sub transient reactance X"q(v)	17 %
3.9	Short circuit ratio	0.49

Notes:

Date: 05-Mar-2012

I.D.: OPP01562G2

1. The electrical details provided are calculated values. Unless otherwise stated, all values are subject to tolerances as given in the relevant national standards.

BRUSH

ELECTRICAL DATA SHEET - CONTINUATION

BDAX 82-445ERH, 145.148 MW, 0.950 pf, 13.80 kV, 60 Hz

4. RESISTANCES AT 20°C

4.1	Rotor resistance	0.077 ohms
4.2	Stator resistance per phase	0.0009 ohms

5. TIME CONSTANTS AT 20°C

5.1	Transient O.C. time constant, T'_{do}	12.4 seconds
5.2	Transient S.C. time constant, T'_{d}	0.85 seconds
5.3	Sub transient O.C. time constant T''_{do}	0.05 seconds
5.4	Sub transient S.C. time constant, T''_{d}	0.04 seconds

6. INERTIA

6.1	Moment of inertia, WR^2 (See note 2)	2352 $Kg.m^2$
6.2	Inertia constant, H	1.09 kW.secs/kVA

7. CAPACITANCE

7.1	Capacitance per phase of stator winding to earth	0.45 microfarad

8. EXCITATION

8.1	Excitation current at no load, rated voltage	579 amps
8.2	Excitation voltage at no load, rated voltage	44 volts
8.3	Excitation current at rated load and P.F.	1521 amps
8.4	Excitation voltage at rated load and P.F.	155 volts
8.5	Inherent voltage regulation, F.L. to N.L.	33 %

Notes:

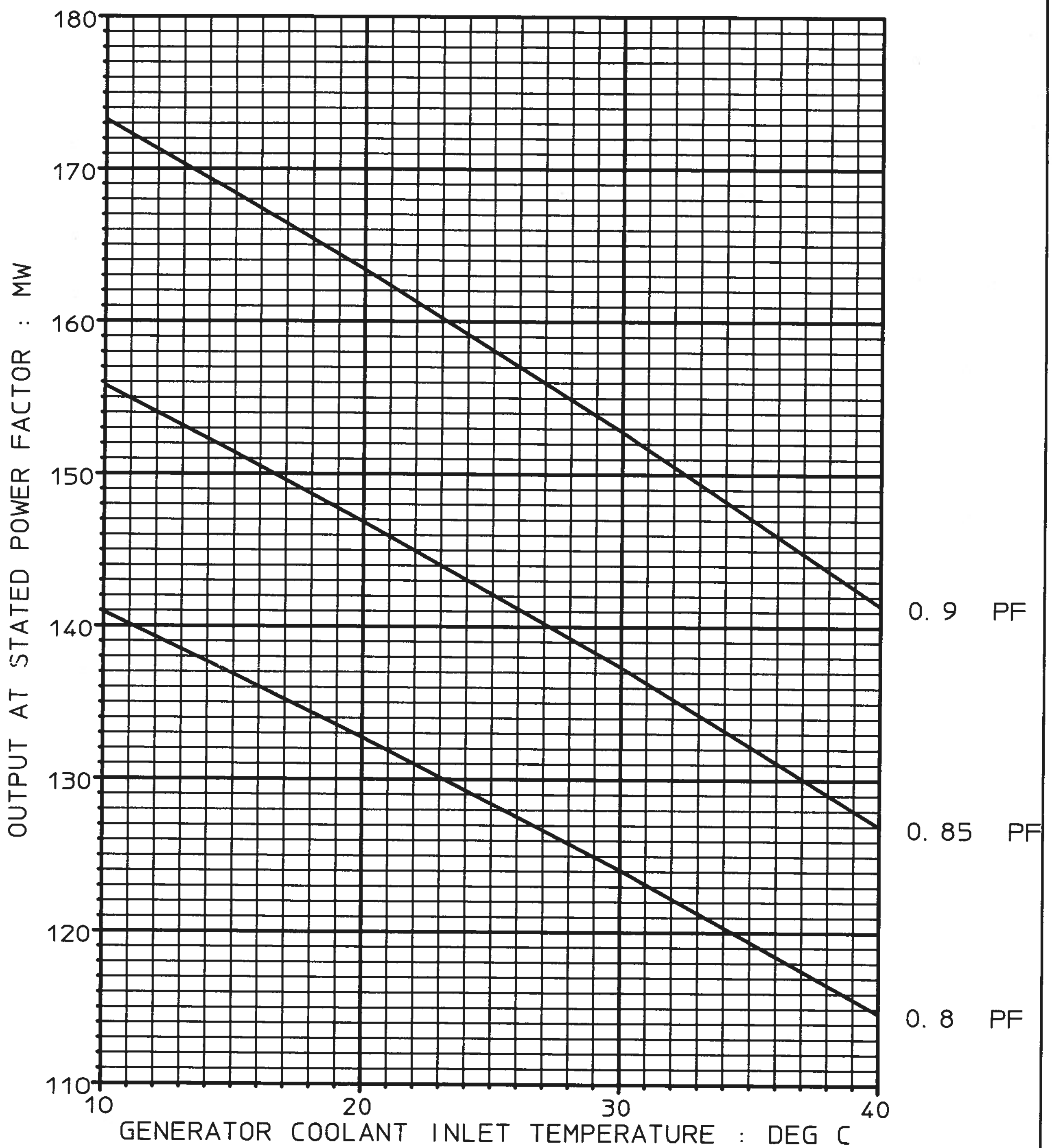
1. The electrical details provided are calculated values. Unless otherwise stated, all values are subject to tolerances as given in the relevant national standards.

2. The rotor inertia value may vary slightly with generator / turbine interface. In the event of conflict, the figure quoted on the rotor geometry drawing takes precedence.

Date: 05-Mar-2012

I.D.: OPP01562G2

VARIATION OF GENERATOR OUTPUT WITH COOLANT TEMP



BDAX 82-445ERH
13. 80KV, 3 Ph, 60Hz.

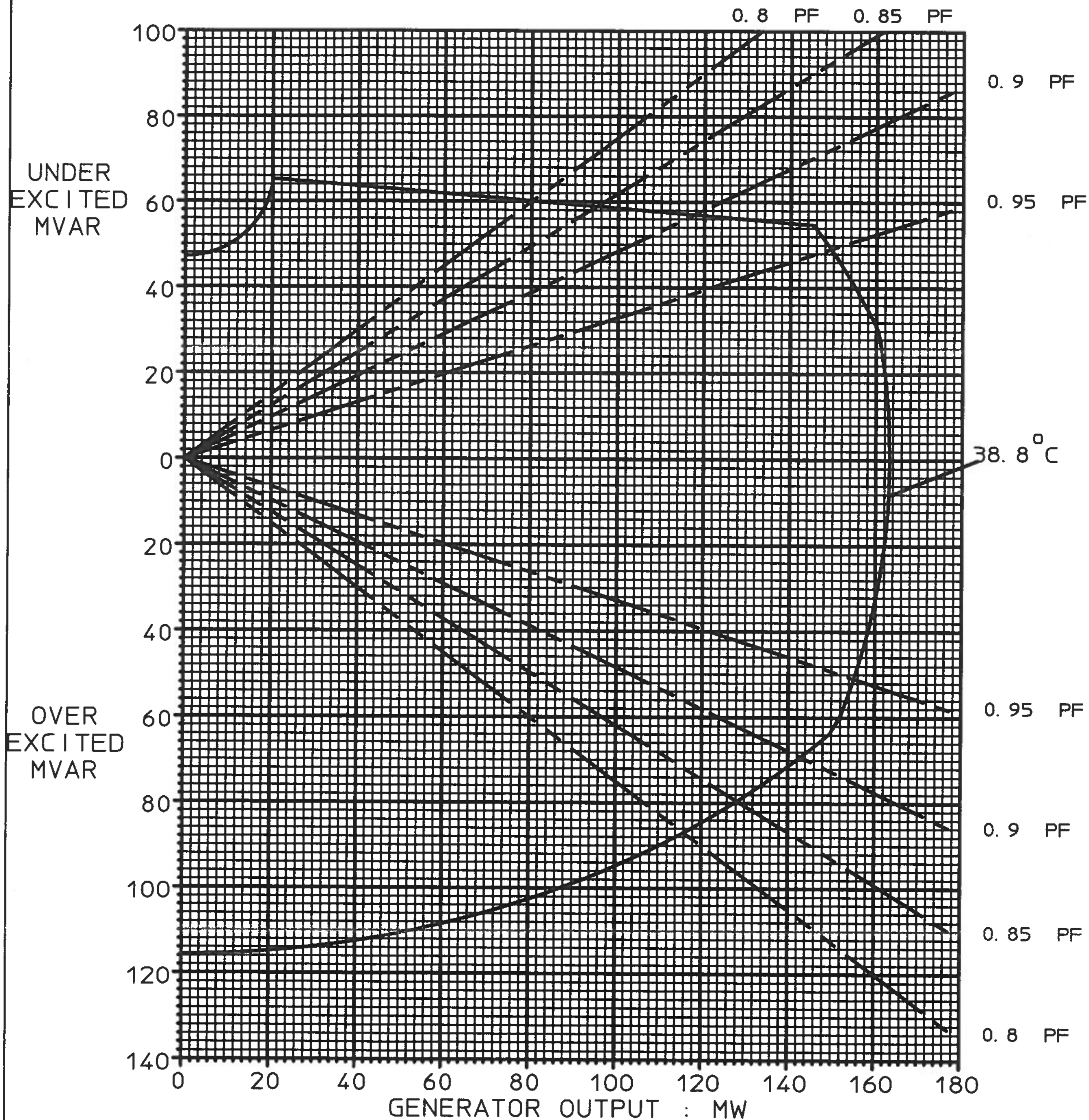
Up to 1000 meters ASL

Coolant: Fresh Water

IN ACCORDANCE WITH
IEEE C50. 13
Class B temperatures.
Total temperatures Stator 123 Deg C
Rotor 125 Deg C

BRUSH ELECTRICAL MACHINES LTD. H. E. P 31606

GENERATOR CAPABILITY DIAGRAM



BDAX 82-445ERH
13.80KV, 3 Ph, 60Hz.

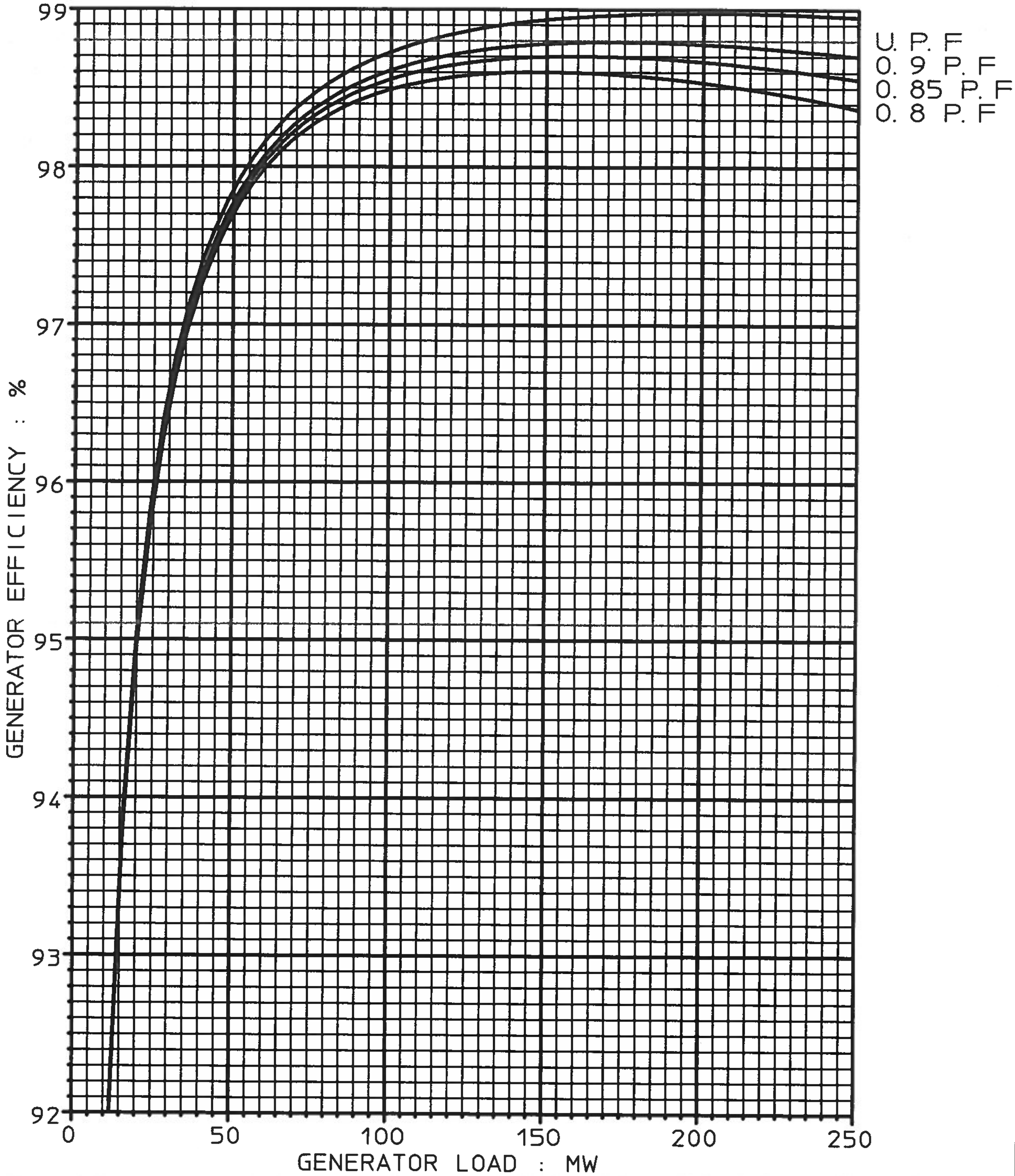
Up to 1000 meters ASL

Coolant:

IN ACCORDANCE WITH
IEEE C50.13
Class B temperatures.
Total temperatures Stator 123 Deg C
Rotor 125 Deg C
Fresh Water

Issue No. 1 : 16-Nov-2011

VARIATION OF GENERATOR EFFICIENCY WITH LOAD



BDAX 82-445ERH
13. 8 KV, 3 Ph, 60 Hz.

Efficiencies shown are guaranteed subject to the tolerance specified in IEC 60034-1.

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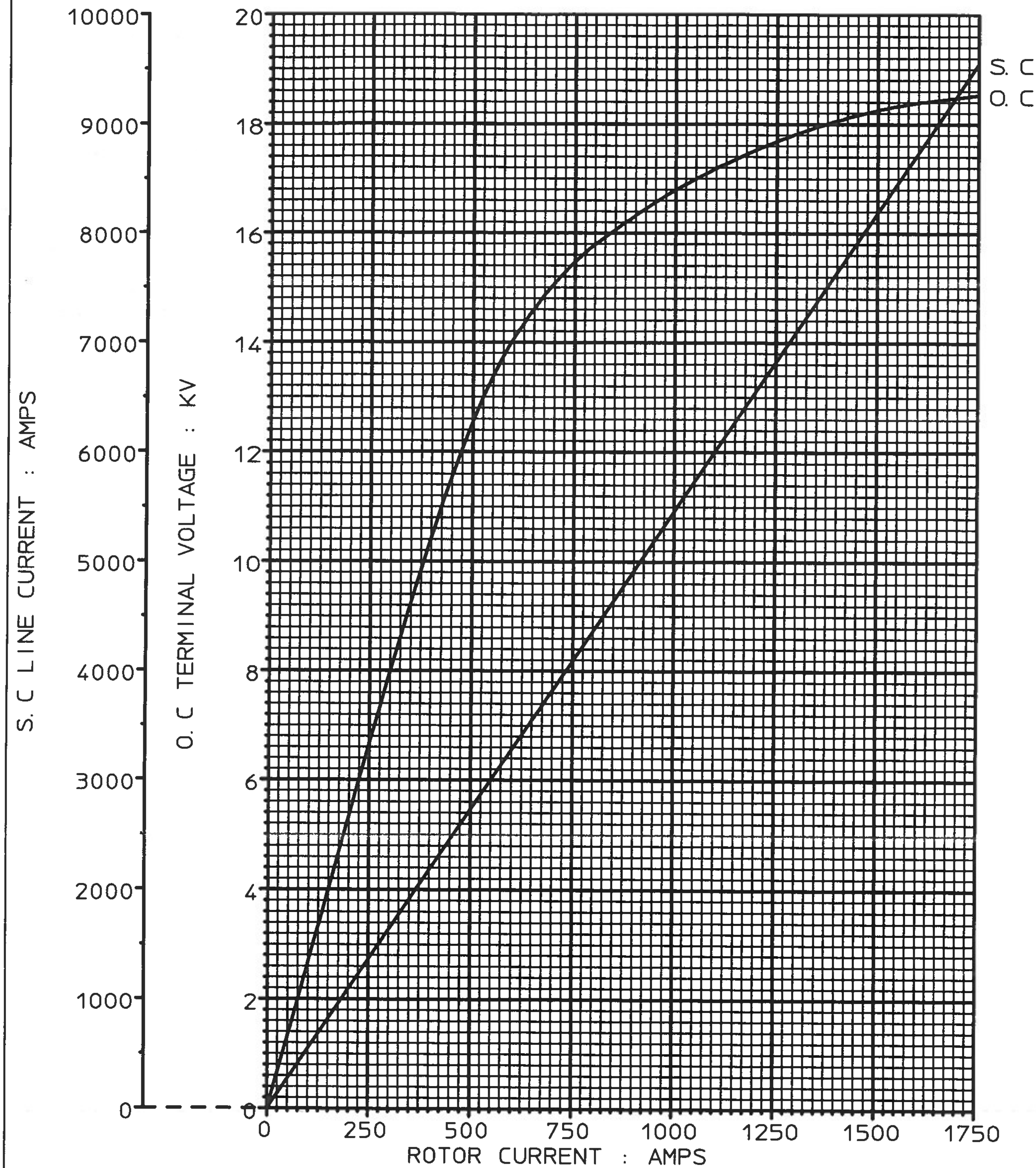
OPEN CIRCUIT AND SHORT CIRCUIT CHARACTERISTIC

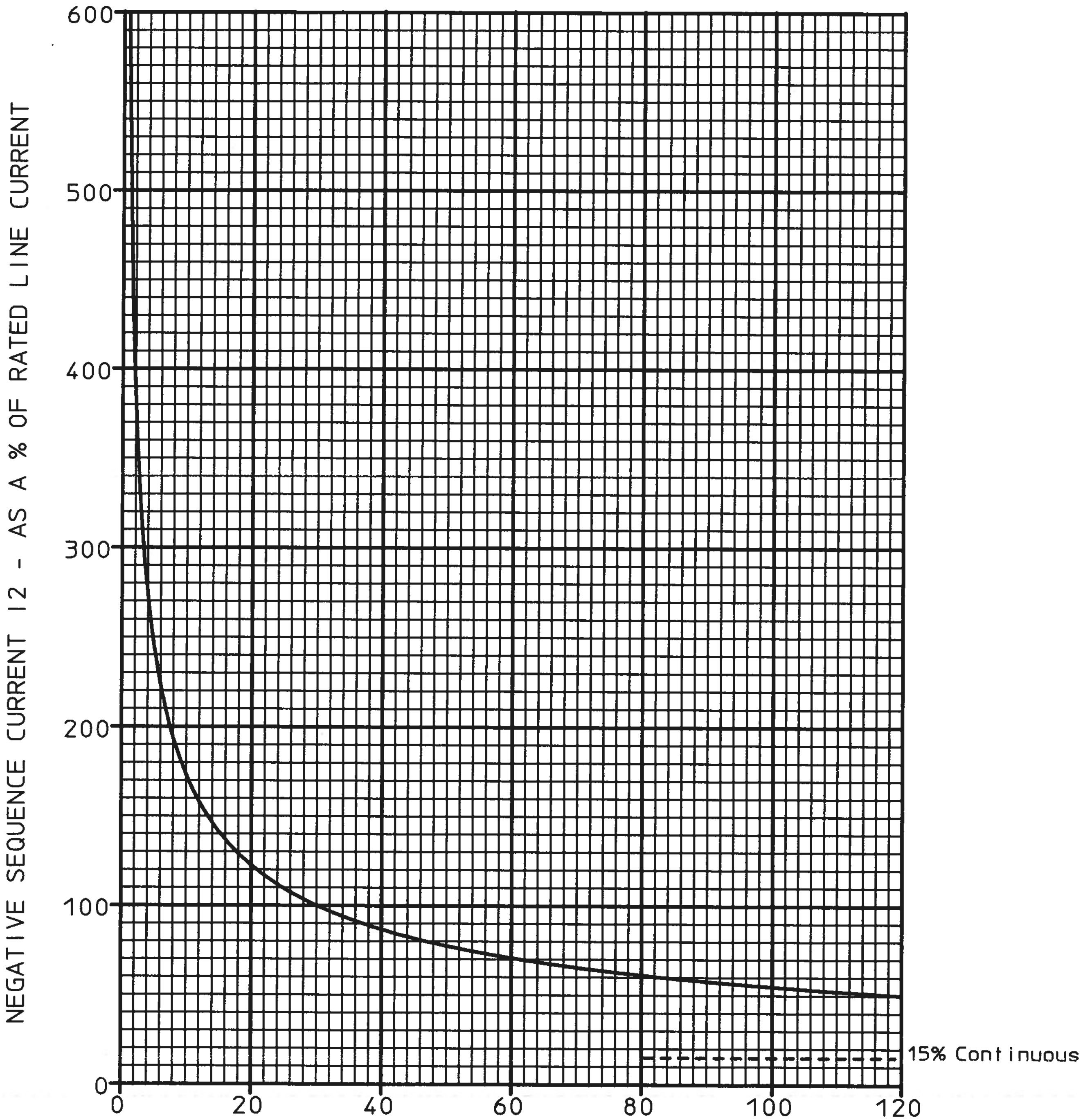


BDAX 82-445ERH
3Ph, 60Hz, 3600 RPM.

Issue No. 1 : 16-Nov-2011

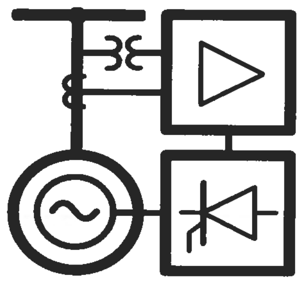
PERMISSIBLE DURATION OF NEGATIVE SEQUENCE CURRENT

$$I_2^2 t = 30$$



NOTE: For continuous operation rated current must not be exceeded in any one phase.

Unitrol® 6000



Static Excitation System
Model Conversion to IEEE Type ST1A

Type des.	Unitrol 6000		Part no.				
Prep.	A.Tristan	2010-11-15	Doc.kind	Technical description			No. of p.
Appr.	P.Smulders	2010-11-22	Title	Static Excitation System Model Conversion to IEEE Type ST1A			4
Resp.dept.	DMPE						
ABB	ABB Inc.		Doc. no.	-	Lang. en	Rev. ind. -	Page 1

FILE: Unitrol 6000 Static Excitation Model Conversion to IEEE Type ST1A.doc; TEMPLATE: Techn_Doc_Stand_P.dot R0; SKELETON: ; SAVEDATE: 11/22/2010 10:15:00 AM

1. UNITROL 6000 AVR PARAMETERS AND IEEE MODEL

The Unitrol 6000 Model for Static Excitation Systems is directly represented by the ST5B model as defined in IEEE Standard 421.5-2005. The introduction of this model into the IEEE standard is relatively recent and as a consequence, power system simulator software for modeling and analisys of excitation systems performace may not have the ST5B model included. Since the ST5B is a variation of the ST1A model (figure 1) the later can be used as an alternate model to represent the Unitrol 6000 static excitation system.

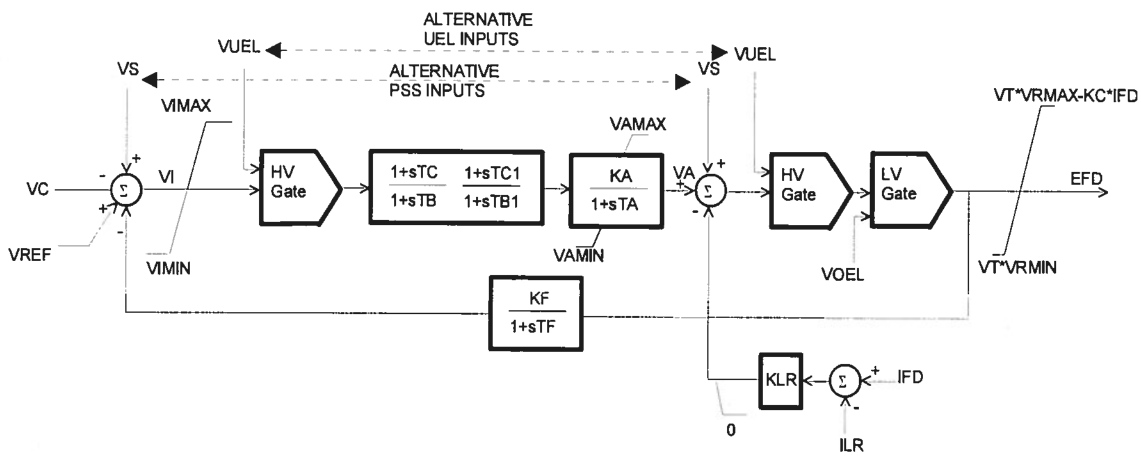


Figure 1 IEEE Model Type ST1A for Static Excitation

The following illustrates the conversion from Unitrol 6000 parameters to ST1A format

V_{RMax} = V_{Amax} = Upper Ceiling Factor Limit = $1.35 * U_{ac} * \cos(\alpha_{min}) / (I_{fAGL} * U_{fn} / I_{fn})$ [pu]

V_{RMin} = V_{Amin} = Lower Ceiling Factor Limit = $1.35 * U_{ac} * \cos(\alpha_{max}) / (I_{fAGL} * U_{fn} / I_{fn})$ [pu]

V_{IMax} $\cong V_{RMax} / V_p$ [pu]

V_{IMin} $\cong V_{RMin} / V_p$ [pu]

T_C = T_a [s]

T_B = $T_a(V_o/V_p)$ [s]

T_{B1} = $T_b(V_p/V_\infty)$ [s]

T_{C1} = T_b [s]

K_A = V_o [pu]

T_A = T_s = 0.003s

K_F = 0.0 (not applicable to Unitrol)

T_F = 0.001 (not applicable to Unitrol, but some programs do not accept 0.0)

I_{LR} = $1.6 * (I_{fn} / I_{fAGL})$ [pu]

KLR $\cong$ Vp (oel) [pu] (proportional gain of the Over-Excitation Limiter)

K_C can be set to 0 since the excitation transformer calculation already considers the voltage drop caused by commutation overlap

V_T variable representing the generator terminal voltage (excitation is fed from generator terminals).

Abbreviations:

α_{min} : Minimum thyristor firing angle (typically 10deg)

α_{max} : Maximum thyristor firing angle (typically 150deg)

I_{fAGL} : Field current on air gap line to give rated terminal voltage (@ no-load)

I_{fn} : Nominal (rated) excitation current

U_{ac} : Excitation transformer rated secondary voltage

U_{fn} : Nominal (rated) excitation voltage

V_o : PID AVR low frequency gain

V_p : PID AVR proportional gain

V_∞ : PID AVR high frequency gain

T_a : PID AVR time constant

T_b : PID AVR time constant

$V_{p\ (oel)}$: PID Maximum Field Current Limiter proportional gain

T_s : Converter time delay (power stage)

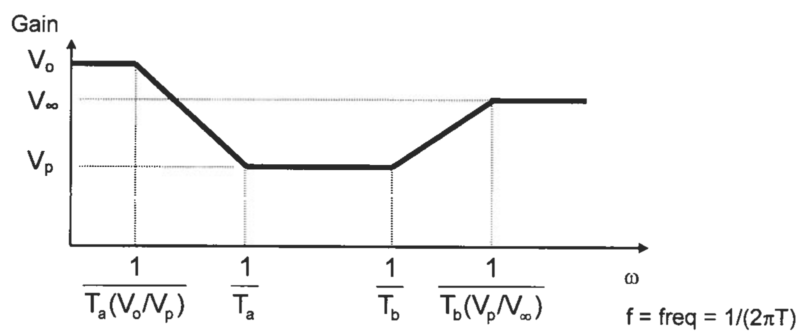


Figure 2 Unitrol 6000 PID-Filter characteristic

Unitrol 6000 parameter ranges		
Name	**Description**	**Value range**
UpperCeilingFactorLimit	Calculated automatically by software	-100..100
LowerCeilingFactorLimit	Calculated automatically by software	-100..100
vo	PID AVR low frequency gain	0.01..10000
vp	PID AVR proportional gain	0.01..10000
voo	PID AVR high frequency gain	0.01..10000
ta	PID AVR time constant	0..100 s
tb	PID AVR time constant	0..10 s
vp (oel)	PID Maximum Field Current Limiter proportional gain	0.01..10000

3 Power system stabilizer

3.1 Computer representation of IEEE PSS 2B

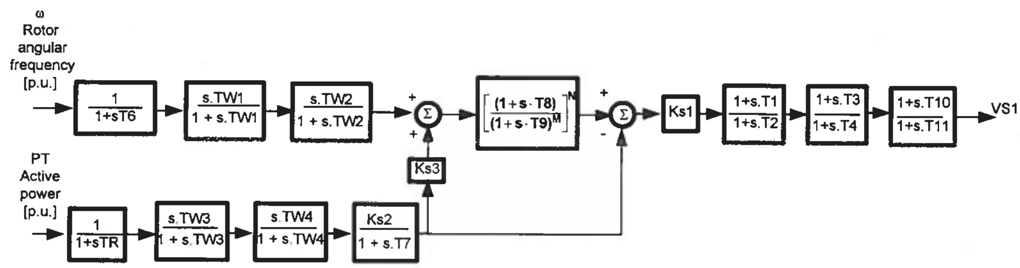


Figure 3-1: Computer representation of PSS2B according to IEEE 421.5 2005

<u>Short model description of PSS2B (ref. to Figure 3-1)</u>

The model consists of the following sub models:

- Calculation of driving power
- Filtering of torsional oscillations and noise components
- Calculation of acceleration power
- Phase and gain conditioning for stabilizing signal

The required signals for the generations of stabilizing signals are the active power PT and the rotor angular frequency deviation.
Both signals are submitted to two wash-out stages which are provided for the elimination of steady state signal component.
An approach for the integral of electric power is obtained by applying the output of the second washout filter of power channel to a first order transfer function. The value T7 shall correspond washout time constants TW1, TW2, TW3 that are selected to allow the operation of the PSS in the frequency range of interest (e.g. >0.1 Hz). The constant Ks2 shall be equal to T7/(2H) in order to obtain a proper signal relationship for the calculation of the acceleration power.
Ks3 is provided for the fine scaling between signals coming from power and frequency channels. Normally Ks3 is equal to 1.
The integral of driving power is obtained from the summation of conditioned frequency signal and the calculated integral of electric power variation.
A selective low pass filter so called "ramp tracking filter" is provided for the suppression of high frequency components (e.g. shaft torsional oscillations).
The integral of acceleration power is calculated from the difference between integral of driving power and integral of electric power.
The conditioning network consisting of the gain Ks1 and three lead-lag stages are provided in order to achieve the required phase and gain compensation for the stabilizing signal. Finally the maximum and minimum amplitudes of stabilizing signal can be limited as well by individual and adjustable maximum and minimum adjustable limitation parameters (ref. PSS control logic).

3.2 Parameter list of PSS2B

Parameter	Description	Unit	Standard settings	Proposed setting
TW1,TW2	Wash out time constants	s	2.0	
TW3,TW4	Wash out time constants	s	2.0	
Ks1	PSS gain factor	p.u.	5.0	
Ks2	Compensation factor for calculation of integral of electric power	p.u.	0.2	
Ks3	Signal matching factor	p.u.	1.0	
T1,T3,T10	Lead time constants of conditioning network	s	0.20 0.36 0.01	
T2,T4,T11	Lag time constants of conditioning network	s	0.04 0.12 0.01	
TR	Active power transducer time constant	s	0.02	0.02
T6	Rotor angular frequency deviation transducer time constant	s	0.02	0.02
T7	Time constant for integral of electric power calculation	s	2.0	
T8	Ramp tracking filter time constant	s	0.0	
T9	Ramp tracking filter time constant	s	1.0	
M	Ramp tracking filter degree	-	5	
N	Ramp tracking filter degree	-	1	

3.3 Correspondence between model parameters and equipmet settings

Parameter	Equipment settings correspondece for PSS2B
TR and T6	No correspondence, constant values
TW1	Reg_PSS_IEEE_2B.TW1
TW2	Reg_PSS_IEEE_2B.TW2
TW3	Reg_PSS_IEEE_2B.TW3
TW4	Reg_PSS_IEEE_2B.TW4
Ks1	Reg_PSS_IEEE_2B.Ks1
Ks2	Reg_PSS_IEEE_2B.Ks2
Ks3	Reg_PSS_IEEE_2B.Ks3
T1	Reg_PSS_IEEE_2B.T1
T2	Reg_PSS_IEEE_2B.T2
T3	Reg_PSS_IEEE_2B.T3
T4	Reg_PSS_IEEE_2B.T4
T7	Reg_PSS_IEEE_2B.T7
T8	Reg_PSS_IEEE_2B.T8
T9	Reg_PSS_IEEE_2B.T9
T10	Reg_PSS_IEEE_2B.T10
T11	Reg_PSS_IEEE_2B.T11
M	Reg_PSS_IEEE_2B.m
N	Reg_PSS_IEEE_2B.n

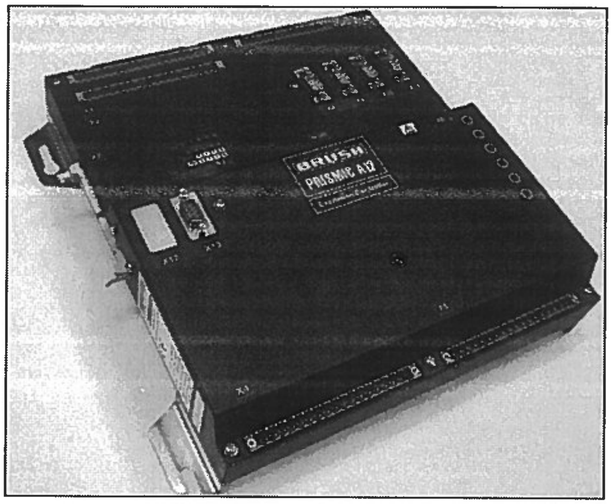
PRISMIC® A12

Excitation System

PRODUCT SPECIFICATION

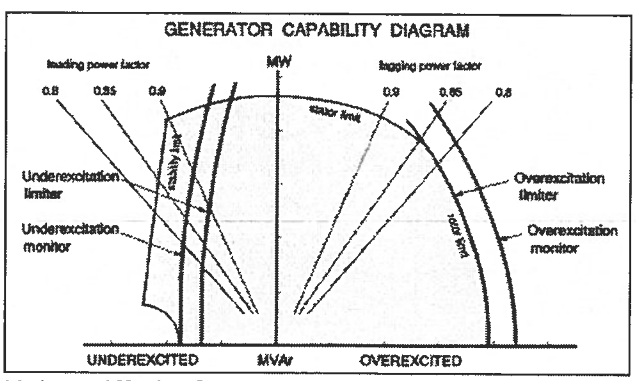
Introduction

The PRISMIC® A12 excitation system has been designed to control the excitation of a brushless generator. It incorporates the latest digital micro controller technology to make it the most comprehensive and compact controller available.



The PRISMIC® A12 is based upon proven technology and combines the experience and hardware of the BRUSH PRISMIC® A50 excitation controller. It includes, additional features such as intergrated speed detection, power system stabiliser and sychronisation.

The PRISMIC® A12 is produced on a plate mounted system either as a single channel or twin channel arrangement. As a twin system each controller acts as a hot standby for the other and is independently controlled with auto tracking, and smooth transfer. An optional colour display screen is also available.



Limiter and Monitor Settings

Features

- Complete excitation system mounted on a plate
- Available either as a single unit or as a high integrity twin configuration
- Integrated Power System Stabiliser (optional)
- Integrated auto synchroniser (optional)
- Integrated speed detection eliminating need for seperate speed switch
- Rotor earth fault detector input included eliminating the need for separate unit
- Negative forcing of exciter field voltage
- Modes of operation include generator terminal voltage control, power factor control, VAr control and offload VArs
- Digital Outputs
- Analogue Input Signal for special application
- Auxiliary power supply input allows easy setting of unit without PMG supply present
- Manual Reference
- Soft start for controlled application of excitation
- Diode Failure Detection and Indication
- HMI (Human Machine Interface) software for advanced maintenance diagnostics and downloading of data
- Oscilloscope style trending and analogue data logging (5ms resolution) via HMI
- Event Logging
- Externally mounted display interface computer (Optional)
- Automatic and manual excitation limiters

The following limiters are included:

- Under Excitation Limiter
- Over Excitation Limiter
- Over Flux (V/Hz) Limiter
- Stator Current Limiter
- Fast Acting Field Current Limiter
- Terminal Voltage Limiter

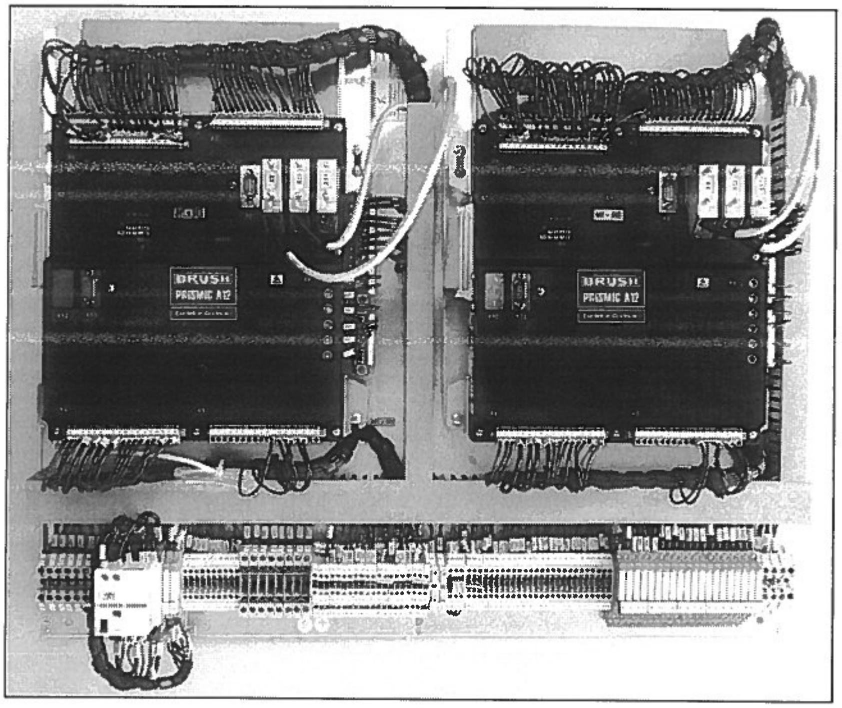
Automatic transfer of control to hot standby channel initiated by:

- Over Voltage Monitor Triggered
- Under Voltage Monitor Triggered
- Over Excitation Monitor Triggered
- Under Excitation Monitor Triggered
- Over Flux Monitor Triggered
- Voltage Sensing Error

The PRISMIC® A12 includes the following communication port

- 1 x RS232 service port
- 1 x CANbus port for communication with hot standby unit in twin configurations
- 1 x CANbus port available for connection of display interface computer
- 1 x RS485 / RS232 Modbus RTU port for SCADA/ DCS communications
- 1 x PROFIBUS port (optional)

BRUSH



Ratings

Max continuous output current:	20A
Max 10 second output current:	30A
Excitation supply voltage:	Single phase 85 to 264V
Excitation supply frequency:	48Hz to 480Hz
Nominal sensing voltage:	100V to 120V
Auxiliary power supply:	24V d.c.
Voltage sensing phases:	Either 3 phase or 1 phase
Nominal generator frequency:	50Hz or 60Hz
Current transformer input nominal:	Either 5A or 1A
Current transformer input burden:	Less than 0.5VA
Maximum field voltage for forcing:	75% of available PMG voltage*
Minimum field voltage:	-75% of available PMG voltage*
Voltage adjustment range	Selectable from +/-10% to +/-25%
Accuracy of control:	+/-0.25%
Operating temperature range:	-20DegC to +50 DegC
Storage temperature range:	-20DegC to +80 DegC
Dimensions	570x699x185mm (HxWxD)
Weight:	31kg

Standards Applicable

The excitation controller is designed according to IEC61010. The controller functions according to the AC8B model defined in the IEEE Std 421.5 2005 for Excitation Systems Modelling.

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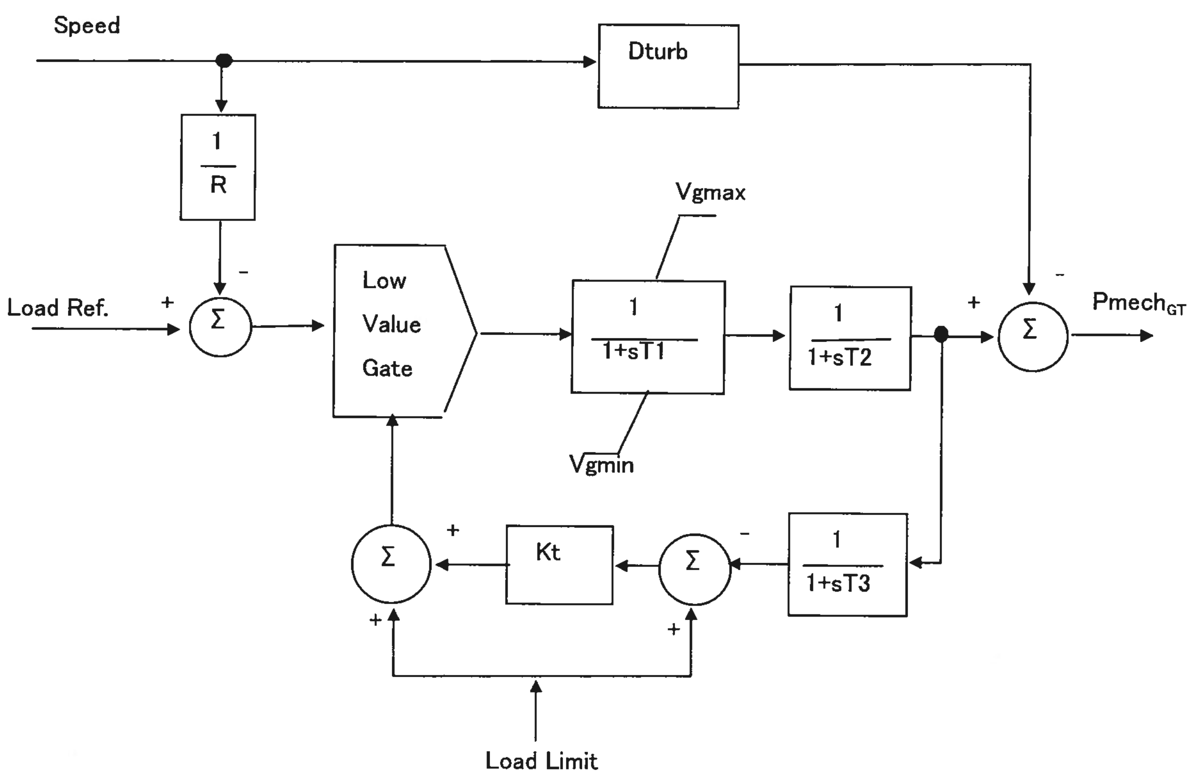
Gas Turbine Governor Model

1.	Speed Droop	R=	0.04	
2.	Controller Lag Time Constant	T1=	0.1	second
3.	Turbine Power Time Constant	T2=	1.0	second
4.	Turbine Exhaust Temperature Time Constant	T3=	5.0	second
5.	Temperature Limitter Gain	Kt=	3 (1 + 1/24s)	
6.	Maximum Valve Position	Vgmax=	1.0	
7.	Minimum Valve Position	Vgmin=	0.05	
8.	Turbine Damping Coefficient	Dturb=	0.10	

Block Diagram

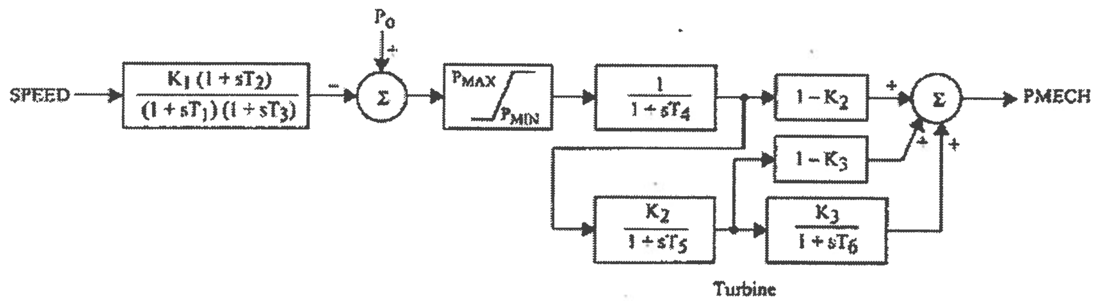


(based on GAST)

Drawing No. F30-791

Turbine Dynamic Model Block Diagram

IEESGO : IEEE standard turbine-governor model



0.004	T_1, Controller Lag (Seconds)
0.02	T_2, Controller Lead (Seconds)
0.35	T_3, Governor Lag (>0) (Seconds)
0.06	T_4, Delay Due To Steam Inlet Volumes Associated With Steam Chest And Inlet Piping (Seconds)
0	T_5, Reheater Delay Including Hot And Cold Leads (Seconds)
0	T_6, Delay Due To IP-LP Turbine, Cross-Over Pipes, And LP End Hoods (Seconds)
20	K_1, 1/Per Unit Regulation
0	K_2, Fraction
0	K_3, Fraction
Max output [MW]	P_{MAX}, Upper Power Limit
0	P_{MIN}, Lower Power Limit

Only for Reference

AES
the power of being global
1450 Lake Robbins Drive, Suite 600,The Woodlands,TX 77380

Bank of America, National Association
901 Main St, Lower Level
MCKINNEY TX US 75069

001107

Date
March 26, 2012
VOID AFTER 180 DAYS

Amount
********500,000.00

*** Five hundred thousand dollars and zero cents ***

Authorized Signature

Pay to the Order of:
California ISO
Attn: Grid Assets
250 Outcropping Way
Folsom CA US 95630

Authorized Signature

⑈001107⑈ ⑆111000012⑆ 4427110595⑈

AES North America Dev.LLC

Remittance Advice Voucher

Vendor ID	Vendor Name	Check Date	Check No
50000858	California ISO	March 26,2012	001107

Invoice No	Invoice Date	PO#	Text	Gross Amount	Withholding Tax	Cash Discount	Net Amount
CR031912A	03/19/2012			250000.00	0.00	0.00	250,000.00
CR031912B	03/19/2012			250000.00	0.00	0.00	250,000.00
TOTAL:				500,000.00	0.00	0.00	500,000.00

May 24, 2012

Jennifer Didlo
Vice President
AES North America Development, LLC
4300 Wilson Boulevard
Arlington, Virginia 22203

RE: AES Alamitos and Redondo Beach

Dear Ms.Didlo:

The California Independent System Operator Corporation ("ISO") and Southern California Edison Company ("SCE") have completed their assessment of AES North America Development, LLC request dated March 9, 2012 to review the AES Alamitos Energy Center ("Alamitos") and Redondo Beach Generating Facility ("Redondo") repowering to determine if the total capability and electrical characteristics are substantially unchanged in accordance with Section 25.1 of the ISO tariff. As discussed further below, due to the short-circuit duty impact of the Alamitos repowering and the change to total capability of Redondo repowering, neither repowering meets the criteria to forgo the interconnection queue process.

The ISO and SCE performed a number of studies to evaluate if the total capability and electrical characteristics are substantially unchanged including:

- Dynamic stability assessments under both no-disturbance and critical contingency conditions;
- Post transient governor power flow studies under critical contingencies; and
- Short circuit duty studies

Because Redondo Beach's proposed total capacity is less than one half of its existing plant capacity, the analyses for determination of equivalent electrical characteristics and total capability were performed mutually exclusive (i.e., plant-by-plant basis) of the proposed repowering of Alamitos, which has total capability that is not "substantially unchanged" from its existing capacity (per Section 25.1.2). Otherwise, if both of these proposals were studied on an aggregated basis, they would not satisfy the "total capability" requirements. The evaluation was performed using the WECC-approved 2012 heavy summer power flow case (12hs4a.sav) and its corresponding dynamic data. To further evaluate the performance of the proposed Alamitos repowering project with respect to the status of Redondo Beach power plant, the ISO also performed additional sensitivity assessments for the two scenarios where (a) Redondo Units 5, 6, and 7 were retired and Unit 8 was replaced with the new proposed project, and (b) Redondo 5, 6, and 7 were kept in service and Unit 8 was replaced with the new proposed project.

Alamitos Repowering

Total Capability
Total capability of the Alamitos repowered project is "substantially unchanged", with the new capacity representing 98% of the existing plant's capacity.

Dynamic Stability Assessment
Two dynamic stability studies were performed, the first is a no-disturbance and the second is a major disturbance evaluation (i.e., G-2 Palo Verde where two units at Palo Verde trip off-line). The no-disturbance test is to evaluate whether the dynamic models of the new units provide a straight line response (i.e., good data) under no disturbance conditions. The second test was performed with the worst contingency in the WECC system (i.e., G-2 Palo Verde) to see if the new units have the same or better dynamic stability response as the existing facilities. Alamitos met WECC reliability criteria for both of these evaluations.

Post-transient Governor Power Flow Study
The post-transient governor power flow study was performed with the same contingency as above (G-2 Palo Verde) to test whether a solution was obtained and whether the post-transient voltage results are the same as in the existing system. A solution was obtained for the Alamitos case, under the contingency, and the results were similar to the existing system study case. The proposed Alamitos project met the above requirements.

Short-Circuit Duty Test
Based on the short circuit duty assessment, AES' proposed plan for Alamitos could cause negative short-circuit duty impacts at five substations (Center, Barre, Lewis, Villa Park and Ellis). The short-circuit duty decreases on one side of the Alamitos Bus (the 230 kV bus is operated in split arrangement) which also decreases duty at Lighthipe, Hinson, Redondo Beach, and Long Beach Substations, which is a good outcome. However, short-circuit duty increases on the other side of the Alamitos Bus (+2090 amps) which also increases short-circuit duty at Center (+460 amps), Barre (+190 amps), Lewis (+120 amps), Villa Park (+70 amps), Ellis (+60 amps). This increase in short-circuit duty could result in creating a need for new breaker upgrades that have not yet been defined at these substations. The specific results are as follows:

		3PH (kA)		
Bus	kV	Existing	Repower	Delta (kA)
Alamitos A	230	35.63	33.24	-2.39
Lighthipe	230	44.59	44.11	-0.48
Hinson	230	42.20	42.05	-0.15
Mesa	230	54.69	54.7	0.01
Redondo	230	45.95	45.87	-0.08
Alamitos B	230	31.60	33.69	2.09
Barre	230	59.35	59.54	0.19
Longbeach	230	28.34	28.25	-0.09
Ellis	230	44.10	44.16	0.06
Lewis	230	58.17	58.29	0.12
Villa park	230	50.10	50.17	0.07
Center	230	42.50	42.96	0.46

With this impact to the other buses, the electrical characteristics of the Alamitos repowering are not substantially unchanged from the existing facilities. Thus Section 25.1.2.1 of the ISO tariff cannot be cited as a path to forgo the interconnection queue process. Alamitos has already applied to cluster 5 and will need to continue through the interconnection queue process.

If AES decides to revise the technical specifications used for each generator at Alamitos to mitigate the short circuit duty, then the ISO and SCE are willing to evaluate the new proposal.

Redondo Beach Repowering

Total Capability

The new total plant capacity is 37% of its existing total plant's capacity, and that is a significant change from the existing capability. Since the total capability of the repowered project does not meet the criteria of "substantially unchanged" as required in Section 25.1.2, no further reliability assessments were performed.

With this change in total capability the Redondo repowering is substantially changed from the existing facilities. Thus Section 25.1.2.1 of the ISO tariff cannot be cited as a path to forgo the interconnection queue process. AES has already applied to cluster 5 for the Redondo repowering project and will need to continue through the interconnection queue process.

The ISO and SCE look forward to working with AES to repower these units. Please feel free to contact Judy Brown at 916-608-7062 or jbrown@caiso.com with any questions.

Kindest regards,

Deborah A. Le Vine
Director of Interconnection Implementation

Cc: Jill Horswell (SCE)
David Berndt (SCE)
Jorge Chacon (SCE)

June 6, 2012

John Kistle
Vice President
AES North America Development, LLC
690 N. Studebaker Road
Long Beach, California 90803

Dear Mr. Kistle:

This letter is to confirm the CAISO has received your application and fee for the Cluster 5 interconnection studies for the new generators to be constructed and installed as part of the Alamitos Energy Center project. Your application has been accepted and I confirm receipt of the application fee. The CAISO will evaluate the information provided to determine the system impact issues that might arise as a result of this project. The CAISO will contact AES with further information requests as required and to establish a schedule for the completion of the study.

Sincerely,

Judy Brown

Judy Brown
Lead Interconnection Specialist

California ISO
Shaping a Renewed Future

California Independent System Operator Corporation

August 1, 2012

Jennifer Didlo
Vice President
AES Alamitos, LLC
690 N. Studebaker Road
Long Beach, California 90803

RE: AES Alamitos

Dear Ms. Didlo:

As discussed in the May 24, 2012 letter from the California Independent System Operator Corporation ("ISO") and Southern California Edison Company ("SCE") completed their assessment of AES North America Development, LLC request dated March 9, 2012 to review the AES Alamitos Energy Center ("Alamitos") and Redondo Beach Generating Facility ("Redondo") repowering to determine if the total capability and electrical characteristics are substantially unchanged in accordance with Section 25.1 of the ISO tariff. In that initial review, due to the short-circuit duty impact of the Alamitos repowering project; the repowering did not meet the criteria to forgo the interconnection queue process.

Since that point in time, Alamitos has worked with SCE and subsequently the ISO to change the generation step up transformer impedance to resolve the concern on the short circuit duty studies. Based on the revised generation step up transformer and generation data (which was sent to SCE on June 13, 2012 and to the ISO on July 3, 2012), as well as the new interconnection configuration for Alamitos West and Alamitos East 230 kV buses, the ISO agrees that Alamitos can forgo the interconnection queue process as the total capability and electrical characteristics are substantially unchanged from the existing facility. The following table lists the changes in short circuit duties at various locations in the Los Angeles basin near the Alamitos switchyard based on the updated short circuit duty assessment completed by SCE. The updated short circuit duty lowered the three-phase short circuit duties at various locations noted below. Based on the updated study results as presented to the ISO on July 2, 2012, the previously identified short circuit duty concerns are mitigated with the changes in the generator step up transformers submitted by the Interconnection Customer.

		3PH (kA)		
Bus	kV	Existing	Repower	Delta (kA)
Alamitos A	230	35.63	34.50	-1.13
Lighthipe	230	44.59	44.30	-0.29
Hinson	230	42.20	42.06	-0.14
Mesa	230	54.69	54.53	-0.16
Redondo	230	45.95	45.87	-0.08
Alamitos B	230	31.60	30.63	-0.97
Barre	230	59.35	58.85	-0.50
Longbeach	230	28.34	28.27	-0.07
Ellis	230	44.10	43.99	-0.11
Lewis	230	58.17	57.87	-0.30
Villa park	230	50.10	49.93	-0.17
Center	230	42.50	42.19	-0.31

Total Capability
Total capability of the Alamitos repowered project is "substantially unchanged". The previous analysis resulted in 1,893.6 MW output representing 98% of the existing plant's capacity and the new analysis resulted in 1,893 MW output.

Dynamic Stability Assessment
Two dynamic stability studies were performed, the first is a no-disturbance and the second is a major disturbance evaluation (i.e., G-2 Palo Verde where two units at Palo Verde trip off-line). Alamitos still meets the WECC reliability criteria for both of these evaluations.

Post-transient Governor Power Flow Study
The post-transient governor power flow study was performed with the same contingency as above (G-2 Palo Verde) to test whether a solution was obtained and whether the post-transient voltage results are the same as in the existing system. The proposed Alamitos project still meets the above requirements.

Short-Circuit Duty Test
Based on the short circuit duty assessment, AES' revised proposal for the generation step-up transformer and splitting of the Alamitos bus into an East bus and West bus, resolved the negative short-circuit duty impacts that could have been caused at five substations (Center, Barre, Lewis, Villa Park and Ellis). With this new configuration, the electrical characteristics of the Alamitos repowering are substantially unchanged from the existing facilities.

Therefore, Section 25.1.2.1 of the ISO tariff can be cited as a path to forgo the interconnection queue process. Alamitos has already applied to cluster 5 and will need to withdraw from that interconnection queue process as soon as possible. With respect to the deposit Alamitos made in the cluster 5 process, Alamitos will receive a refund of the $250,000 study deposit less costs incurred to date for application review and the scoping meeting. The ISO notified SCE to stop charging to Alamitos on July 27, 2012 and we anticipate an invoice from them shortly so that we can close out this project and send you a refund.

The ISO and SCE look forward to working with AES to repower these units. Please feel free to contact Judy Brown at 916-608-7062 or jbrown@caiso.com with any additional questions.

Kindest regards,

Deborah A. Le Vine
Director of Infrastructure Contracts & Management

Cc: Julie Gill (AES)
Jill Horswell (SCE)
David Berndt (SCE)
Jorge Chacon (SCE)

Madams, Sarah/SAC

From: Hala Ballouz [HBallouz@epeconsulting.com]
Sent: Tuesday, July 03, 2012 10:14 AM
To: Brown, Judy
Cc: Zhang, Yi; Le, David; John Kistle; Jennifer Didlo; Carlos Matar; Hugo Mena; Billy Yancey
Subject: RE: Alamitos Additional Data Request
Attachments: Alamitos V17_2012-7-3.epc; Alamitos Project_One Line Diagram_2012-07-03.pdf

Judy,

Please find attached the EPC file for power flow case that reflects the latest changes to the Alamitos project interconnection design that SCE evaluated for SCD. Note that for technical reasons while converting from our software to .epc, we could not include zero sequence data; therefore, and in the interest of time, we are listing below all the zero sequence data that your Team need to supplement in the model. Please refer to the attached One-line diagram for the table header labeling.

Please let me know if your engineers will enter the zero sequence data, else we will revert to working on addressing the conversion issues in the next day or two.

GSUs

	Generators Connected to Alamitos A		Generators Connected to Alamito	
	T4 and T8	T1, T2, T3, T5, T6 and T7	T12 and T16	T9, T10, T11, T13, T
GSU MVA Ratings	94/124/154 ONAN/ONAF/ONAF	75/99/123 ONAN/ONAF/ONAF	94/124/154 ONAN/ONAF/ONAF	75/99/12 ONAN/ONAF/(
MVA Base for Z%	94	75	94	75
Z %	6.25	6.25	16	16
X/R	34.1	34.1	34.1	34.1
R (pu) on 100 MVA base (Z+)	0.0019	0.0024	0.0049	0.0062
X (pu) on 100 MVA base (Z+)	0.0664	0.0832	0.1701	0.2132
R_0 (pu) on 100 MVA base (Z_0)	0.0017	0.0021	0.0044	0.0056
X_0 (pu) on 100 MVA base (Z_0)	0.0598	0.0749	0.1531	0.1919

Tie Lines:

	Block 1 to Switchyard	Block 2 to Switchyard	Block 3 to Switchyard	Block 4 to Switchyard
R (pu) on 100 MVA base (Z+)	0.000057	0.000051	0.000092	0.000018
X (pu) on 100 MVA base (Z+)	0.000461	0.000414	0.000751	0.000149
B (pu) on 100 MVA base (B+)	0.00050933	0.00045777	0.00082988	0.00016457
R_0 (pu) on 100 MVA base (Z_0)	0.000308	0.000277	0.000501	0.000099
X_0 (pu) on 100 MVA base (Z_0)	0.001264	0.001136	0.002060	0.000408

Generators:

	Gas	Steam
MVA base	122.065	153.229
X''1 – Positive sequence subtransient reactance	0.123	0.14
X''2 – Negative sequence	0.153	0.183

subtransient reactance		
X''0 – Zero sequence subtransient reactance	0.084	0.091

Generator Grounding (for all generators):

R : 614.66 on 100 MVA base
X : 249.95 on 100 MVA base

Best,
Hala N. Ballouz, P.E. , President

Electric Power Engineers, Inc.
Office: (512) 382 6700 ext 301

From: Brown, Judy [mailto:jbrown@caiso.com]
Sent: Monday, July 02, 2012 3:00 PM
To: Hala Ballouz
Cc: Zhang, Yi; Le, David
Subject: Alamitos Additional Data Request

Hala:
Would you please send us the updated epc files for power flow case modeling that reflect these changes for the generator step up (GSU) transformers? Thank you!

Judy Brown
Lead Interconnection Specialist
California ISO
(916) 608-7062

NOTE: Failure to include the correct Project Name, Cluster Number, and Queue Number in the SUBJECT LINE will significantly delay the processing of and response to your communications.

Appendix 3B
FAA Notice of Criteria

7FA.05, Unit 1

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2014.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	33 Deg 46 M 3.404 S N
Longitude:	118 Deg 6 M 3.157 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	15 (nearest foot)
Structure Height (AGL):	140 (nearest foot)
Traverseway:	No Traverseway (Additional height is added to certain structures under 77.9(c))
Is structure on airport:	(●) No ( ) Yes

Results

You exceed the following Notice Criteria:

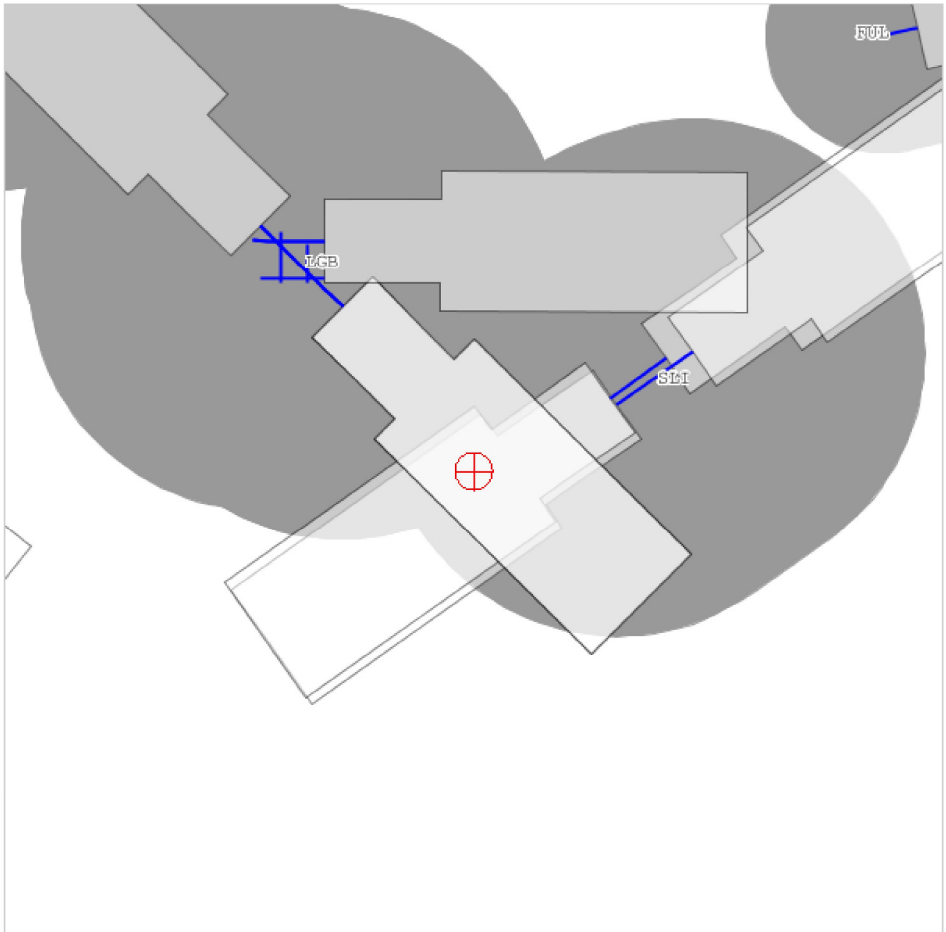
Your proposed structure exceeds an instrument approach area by 38 feet and aeronautical study is needed to determine if it will exceed a standard of subpart C of 14CFR Part 77. The FAA, in accordance with 77.9, requests that you file.

Your proposed structure is in proximity to a navigation facility and may impact the assurance of navigation signal reception. The FAA, in accordance with 77.9, requests that you file.

77.9(b) by 4 ft. The nearest airport is SLI, and the nearest runway is 04L/22R.

The FAA requests that you file

7FA.05, Unit 1



7FA.05, Unit 2

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2014.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	33 Deg 46 M 1.972 S N
Longitude:	118 Deg 6 M 3.149 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	15 (nearest foot)
Structure Height (AGL):	140 (nearest foot)
Traverseway:	No Traverseway (Additional height is added to certain structures under 77.9(c))
Is structure on airport:	(●) No ( ) Yes

Results

You exceed the following Notice Criteria:

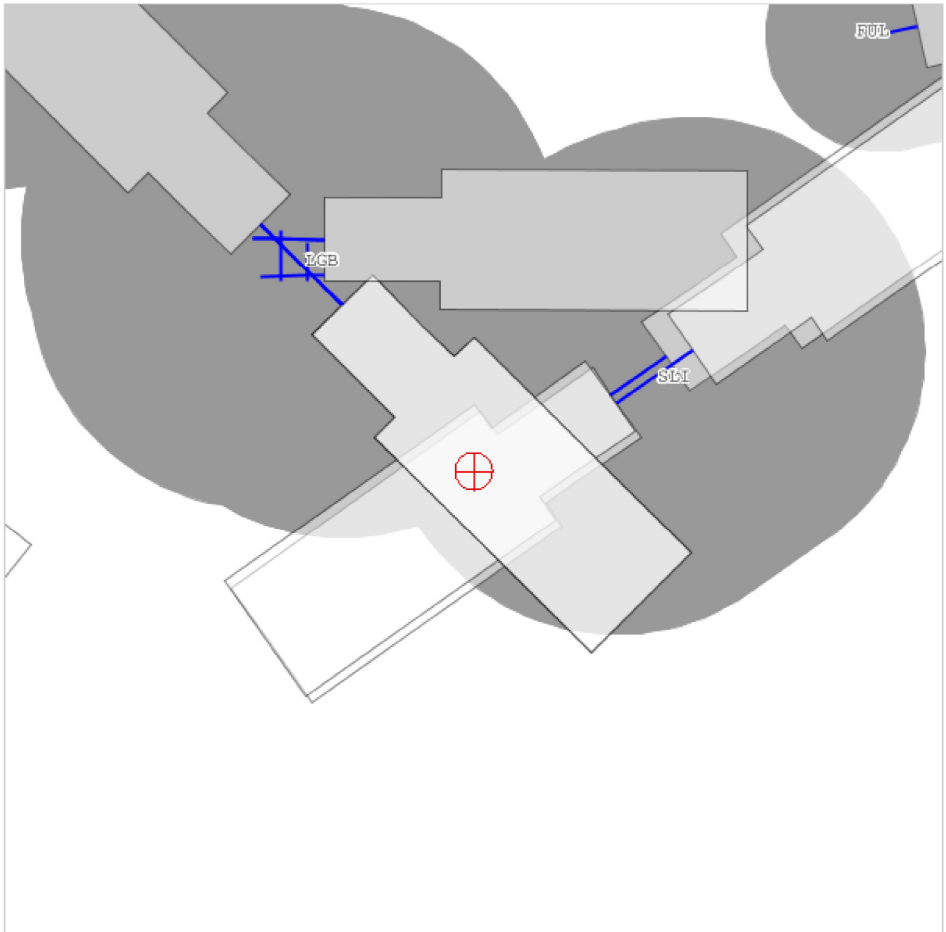
Your proposed structure exceeds an instrument approach area by 38 feet and aeronautical study is needed to determine if it will exceed a standard of subpart C of 14CFR Part 77. The FAA, in accordance with 77.9, requests that you file.

Your proposed structure is in proximity to a navigation facility and may impact the assurance of navigation signal reception. The FAA, in accordance with 77.9, requests that you file.

77.9(b) by 3 ft. The nearest airport is SLI, and the nearest runway is 04L/22R.

The FAA requests that you file

7FA.05, Unit 2



LMS-100, Unit 1

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2014.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	33 Deg 46 M 10.12 S N
Longitude:	118 Deg 5 M 55.69 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	15 (nearest foot)
Structure Height (AGL):	80 (nearest foot)
Traverseway:	No Traverseway (Additional height is added to certain structures under 77.9(c))
Is structure on airport:	(•) No ( ) Yes

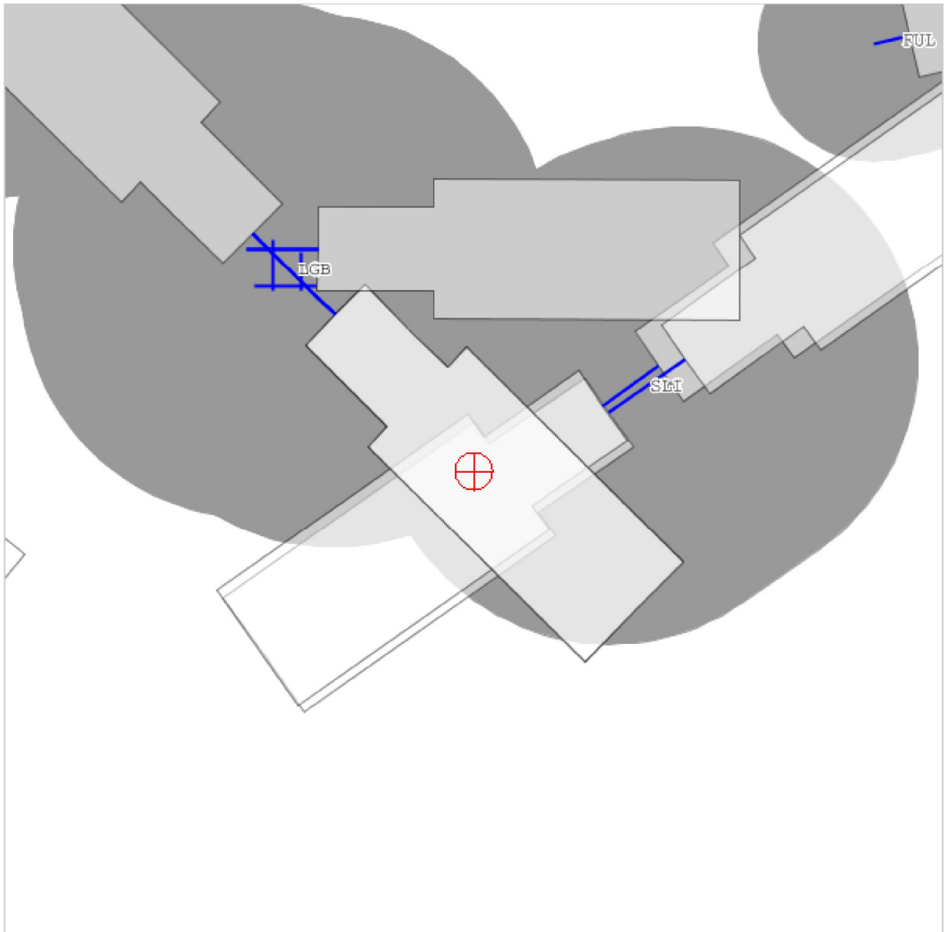
Results

You exceed the following Notice Criteria:

Your proposed structure is in proximity to a navigation facility and may impact the assurance of navigation signal reception. The FAA, in accordance with 77.9, requests that you file.

The FAA requests that you file

LMS-100, Unit 1



LMS-100, Unit 2

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2014.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	33 Deg 46 M 9.628 S N
Longitude:	118 Deg 5 M 55.69 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	15 (nearest foot)
Structure Height (AGL):	80 (nearest foot)
Traverseway:	No Traverseway (Additional height is added to certain structures under 77.9(c))
Is structure on airport:	(●) No ( ) Yes

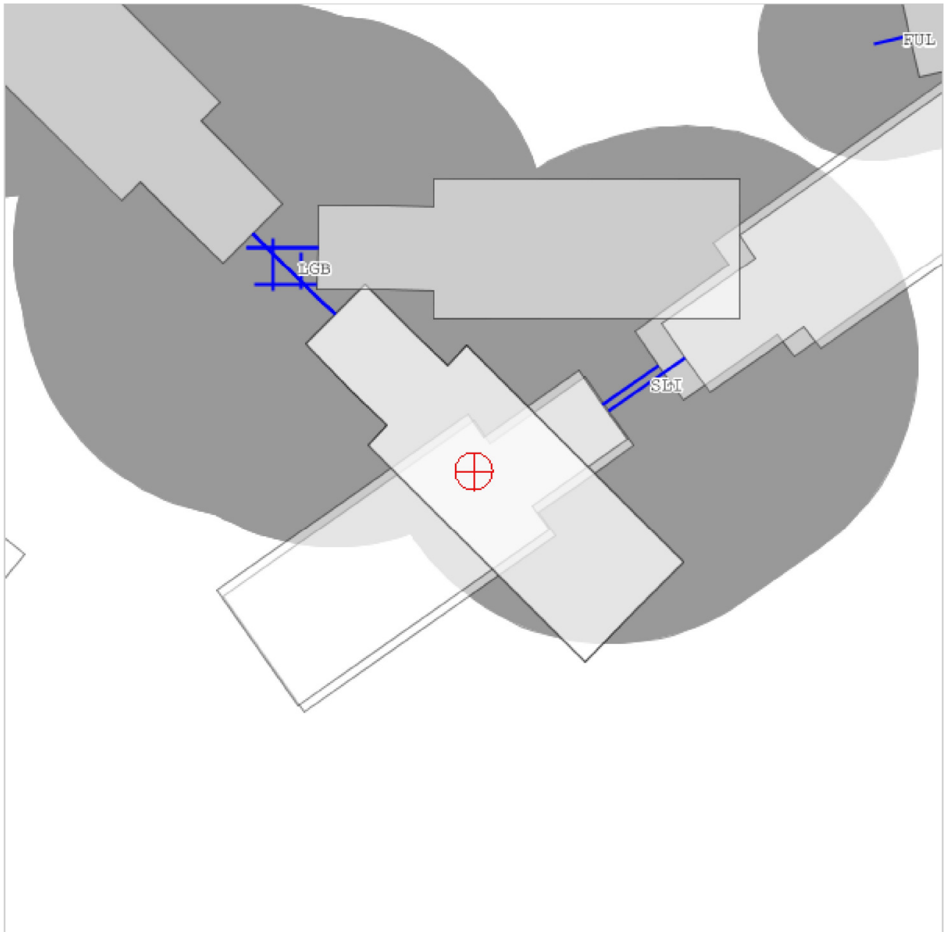
Results

You exceed the following Notice Criteria:

Your proposed structure is in proximity to a navigation facility and may impact the assurance of navigation signal reception. The FAA, in accordance with 77.9, requests that you file.

The FAA requests that you file

LMS-100, Unit 2



LMS-100, Unit 3

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2014.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	33 Deg 46 M 6.001 S N
Longitude:	118 Deg 5 M 55.68 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	15 (nearest foot)
Structure Height (AGL):	80 (nearest foot)
Traverseway:	No Traverseway (Additional height is added to certain structures under 77.9(c))
Is structure on airport:	(•) No ( ) Yes

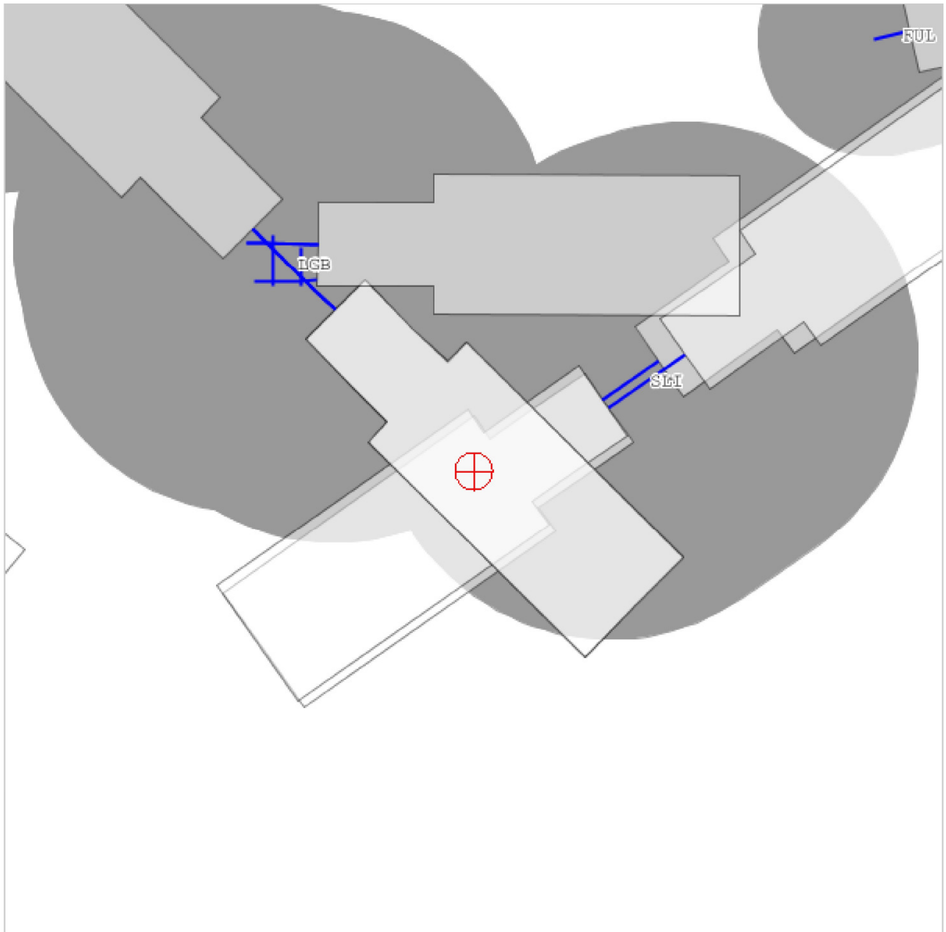
Results

You exceed the following Notice Criteria:

Your proposed structure is in proximity to a navigation facility and may impact the assurance of navigation signal reception. The FAA, in accordance with 77.9, requests that you file.

The FAA requests that you file

LMS-100, Unit 3



LMS-100, Unit 4

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2014.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	33 Deg 46 M 5.498 S N
Longitude:	118 Deg 5 M 55.67 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	15 (nearest foot)
Structure Height (AGL):	80 (nearest foot)
Traverseway:	No Traverseway (Additional height is added to certain structures under 77.9(c))
Is structure on airport:	(●) No ( ) Yes

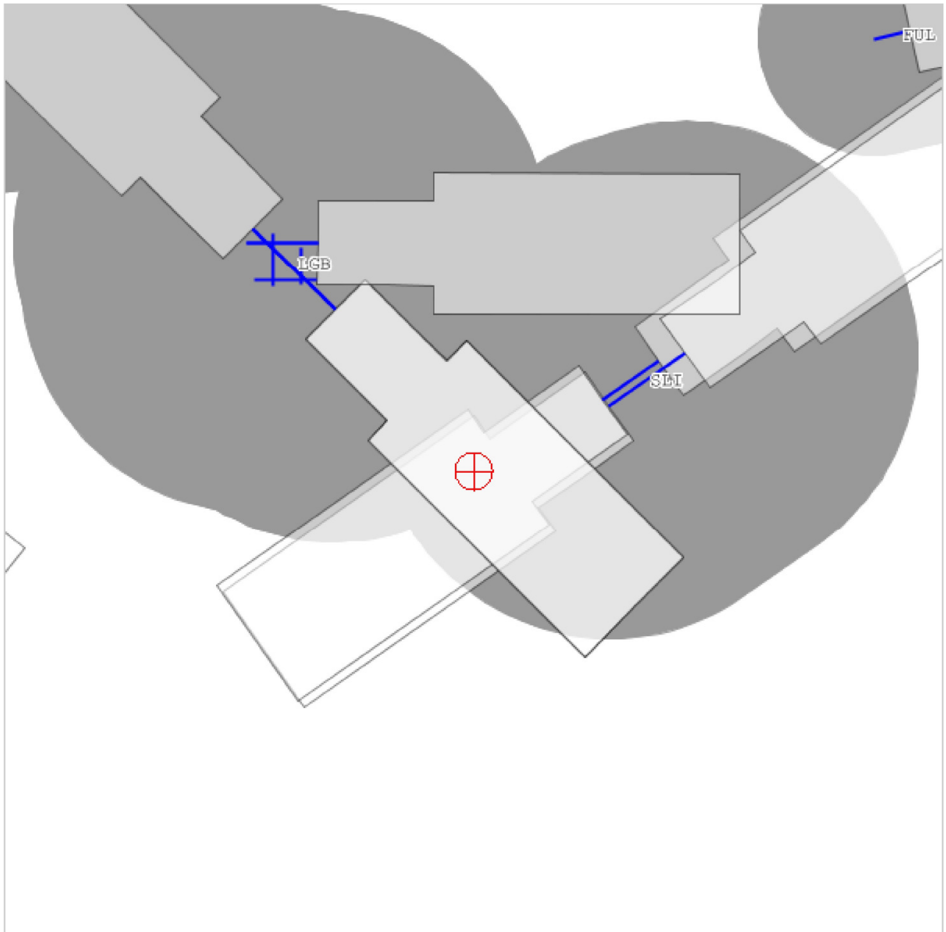
Results

You exceed the following Notice Criteria:

Your proposed structure is in proximity to a navigation facility and may impact the assurance of navigation signal reception. The FAA, in accordance with 77.9, requests that you file.

The FAA requests that you file

LMS-100, Unit 4



Auxiliary Boiler

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2014.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	33 Deg 45 M 59.99 S N
Longitude:	118 Deg 6 M 2.024 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	15 (nearest foot)
Structure Height (AGL):	80 (nearest foot)
Traverseway:	No Traverseway (Additional height is added to certain structures under 77.9(c))
Is structure on airport:	(•) No ( ) Yes

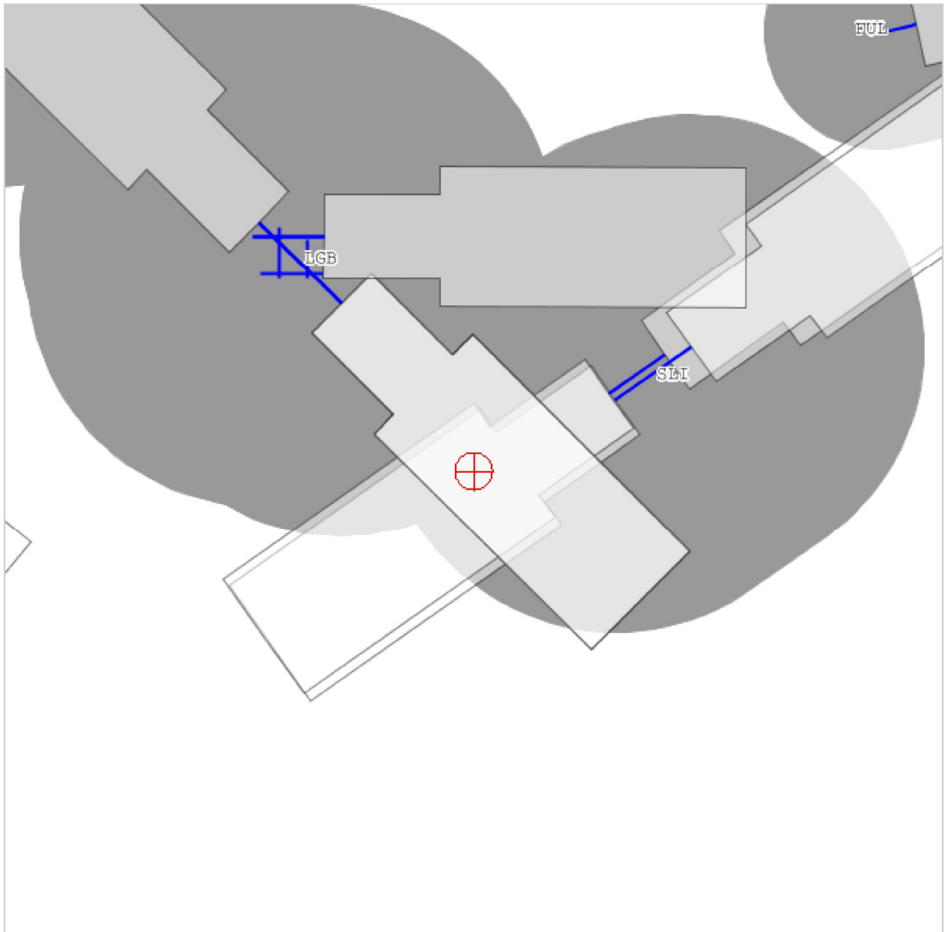
Results

You exceed the following Notice Criteria:

Your proposed structure is in proximity to a navigation facility and may impact the assurance of navigation signal reception. The FAA, in accordance with 77.9, requests that you file.

The FAA requests that you file

Auxiliary Boiler



ACC, NE Corner

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2014.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	33 Deg 45 M 58.74 S N
Longitude:	118 Deg 5 M 58.51 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	15 (nearest foot)
Structure Height (AGL):	104 (nearest foot)
Traverseway:	No Traverseway (Additional height is added to certain structures under 77.9(c))
Is structure on airport:	(•) No ( ) Yes

Results

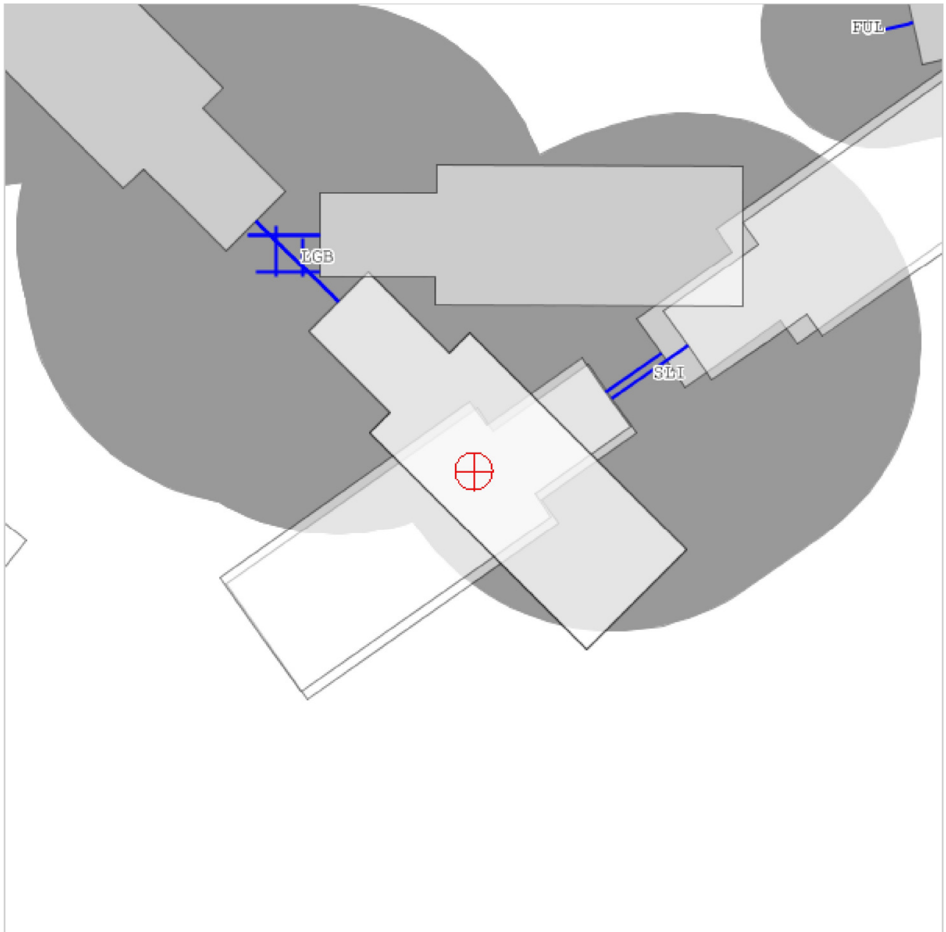
You exceed the following Notice Criteria:

Your proposed structure exceeds an instrument approach area by 2 feet and aeronautical study is needed to determine if it will exceed a standard of subpart C of 14CFR Part 77. The FAA, in accordance with 77.9, requests that you file.

Your proposed structure is in proximity to a navigation facility and may impact the assurance of navigation signal reception. The FAA, in accordance with 77.9, requests that you file.

The FAA requests that you file

ACC, NE Corner



ACC, SE Corner

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2014.2.0

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You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	33 Deg 45 M 56.73 S N
Longitude:	118 Deg 5 M 58.53 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	15 (nearest foot)
Structure Height (AGL):	104 (nearest foot)
Traverseway:	No Traverseway (Additional height is added to certain structures under 77.9(c))
Is structure on airport:	◉ No ○ Yes

Results

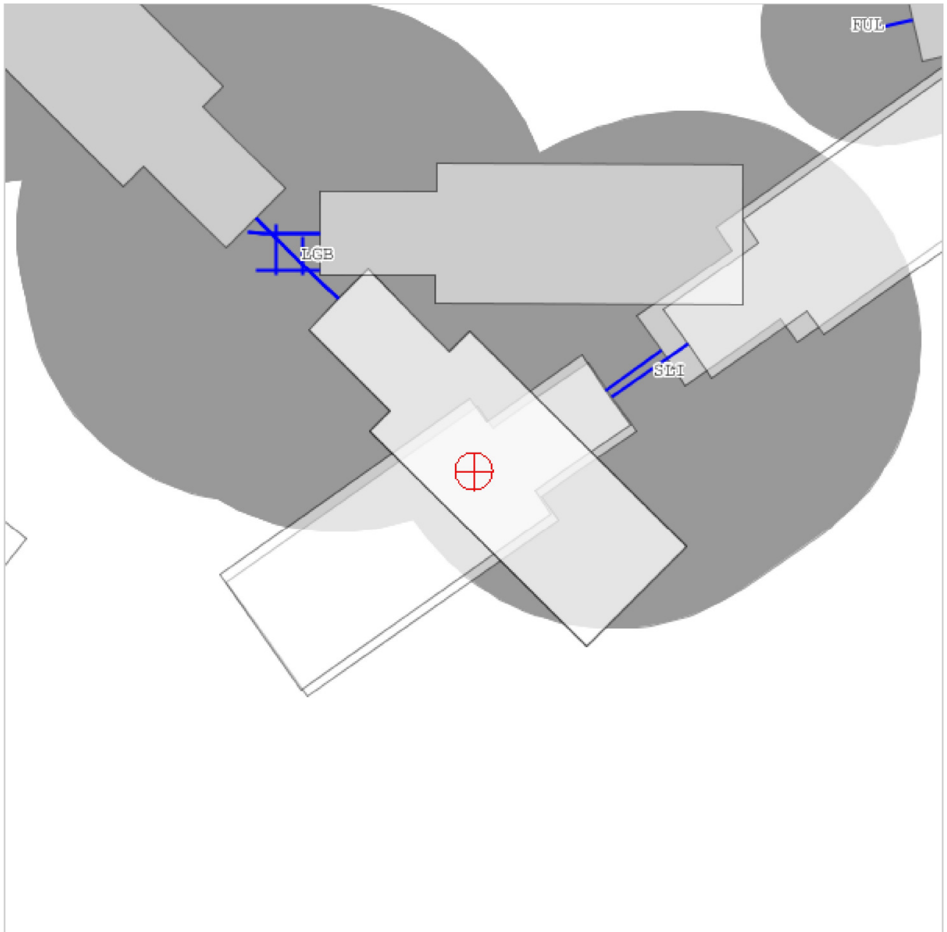
You exceed the following Notice Criteria:

Your proposed structure exceeds an instrument approach area by 2 feet and aeronautical study is needed to determine if it will exceed a standard of subpart C of 14CFR Part 77. The FAA, in accordance with 77.9, requests that you file.

Your proposed structure is in proximity to a navigation facility and may impact the assurance of navigation signal reception. The FAA, in accordance with 77.9, requests that you file.

The FAA requests that you file

ACC, SE Corner



ACC, SW Corner

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2014.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
- your proposed structure will be in proximity to a navigation facility and may impact the assurance of navigation signal reception
- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	33 Deg 45 M 56.74 S N
Longitude:	118 Deg 6 M 2.019 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	15 (nearest foot)
Structure Height (AGL):	104 (nearest foot)
Traverseway:	No Traverseway (Additional height is added to certain structures under 77.9(c))
Is structure on airport:	(•) No ( ) Yes

Results

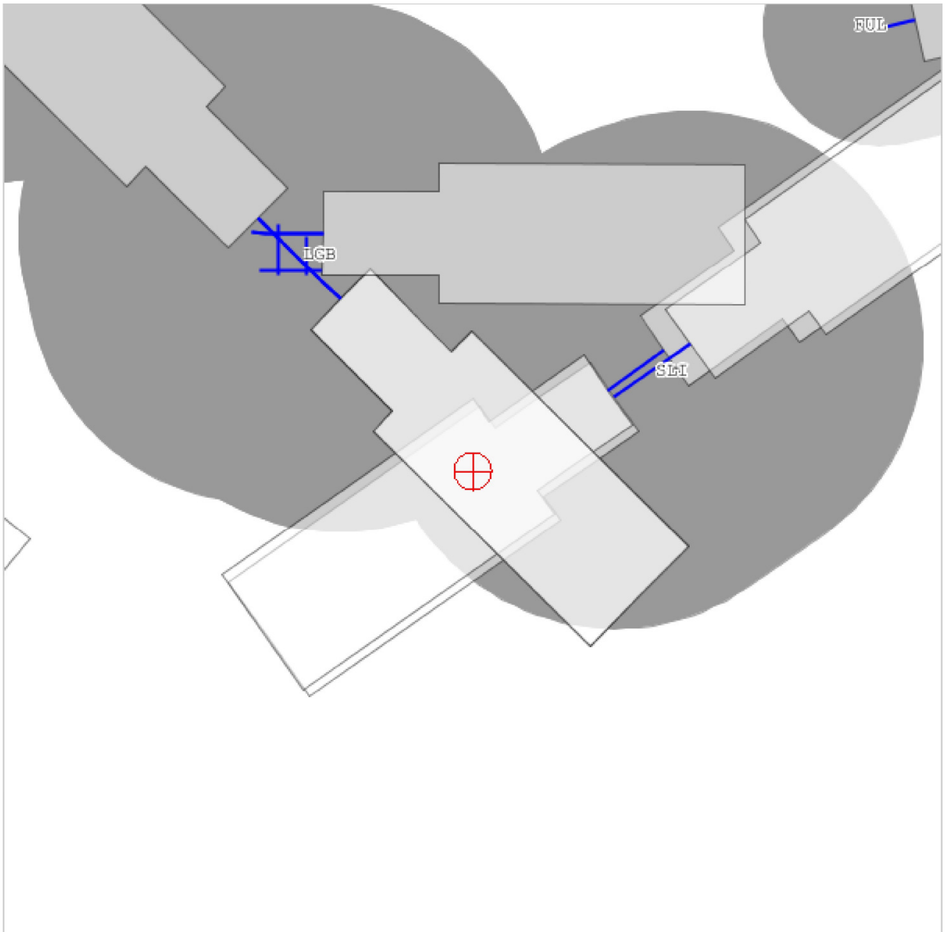
You exceed the following Notice Criteria:

Your proposed structure exceeds an instrument approach area by 2 feet and aeronautical study is needed to determine if it will exceed a standard of subpart C of 14CFR Part 77. The FAA, in accordance with 77.9, requests that you file.

Your proposed structure is in proximity to a navigation facility and may impact the assurance of navigation signal reception. The FAA, in accordance with 77.9, requests that you file.

The FAA requests that you file

ACC, SW Corner



ACC, NW Corner

Federal Aviation Administration

« OE/AAA

Notice Criteria Tool

Notice Criteria Tool - Desk Reference Guide V_2014.2.0

The requirements for filing with the Federal Aviation Administration for proposed structures vary based on a number of factors: height, proximity to an airport, location, and frequencies emitted from the structure, etc. For more details, please reference CFR Title 14 Part 77.9.

You must file with the FAA at least 45 days prior to construction if:

- your structure will exceed 200ft above ground level
- your structure will be in proximity to an airport and will exceed the slope ratio
- your structure involves construction of a traverseway (i.e. highway, railroad, waterway etc...) and once adjusted upward with the appropriate vertical distance would exceed a standard of 77.9(a) or (b)
- your structure will emit frequencies, and does not meet the conditions of the FAA Co-location Policy
- your structure will be in an instrument approach area and might exceed part 77 Subpart C
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- your structure will be on an airport or heliport
- filing has been requested by the FAA

If you require additional information regarding the filing requirements for your structure, please identify and contact the appropriate FAA representative using the Air Traffic Areas of Responsibility map for Off Airport construction, or contact the FAA Airports Region / District Office for On Airport construction.

The tool below will assist in applying Part 77 Notice Criteria.

Latitude:	33 Deg 45 M 58.78 S N
Longitude:	118 Deg 6 M 2.01 S W
Horizontal Datum:	NAD83
Site Elevation (SE):	15 (nearest foot)
Structure Height (AGL):	104 (nearest foot)
Traverseway:	No Traverseway (Additional height is added to certain structures under 77.9(c))
Is structure on airport:	(●) No ( ) Yes

Results

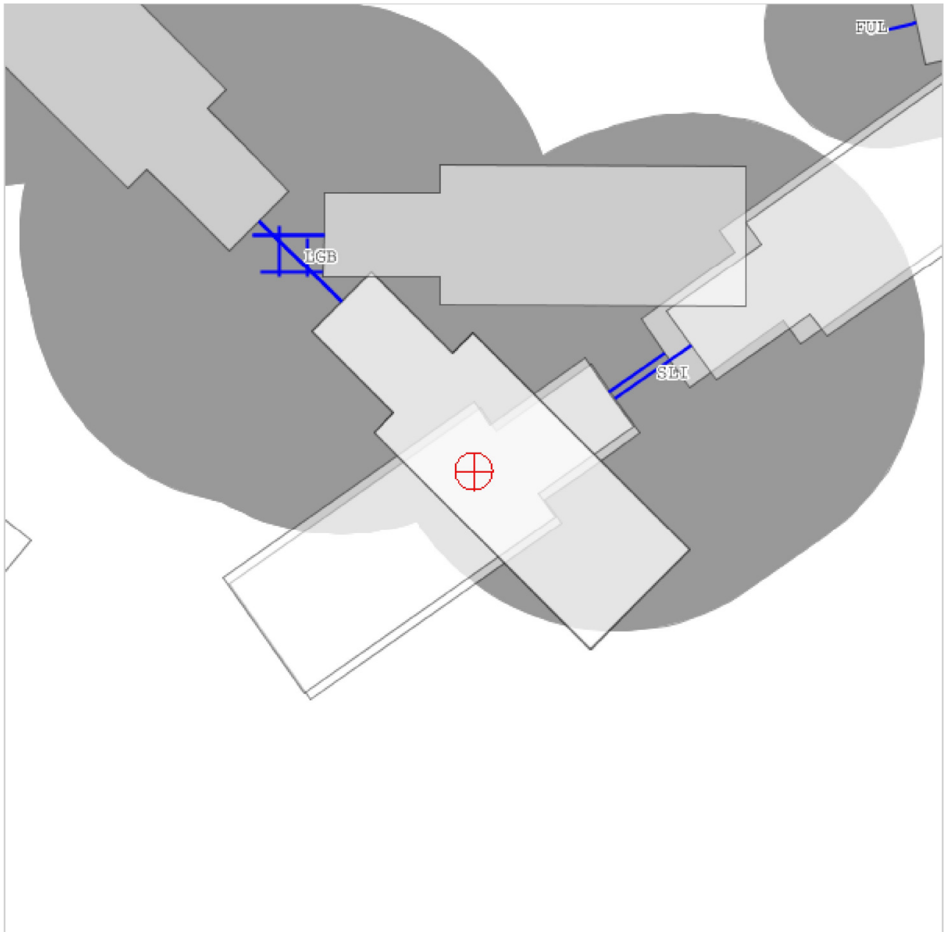
You exceed the following Notice Criteria:

Your proposed structure exceeds an instrument approach area by 2 feet and aeronautical study is needed to determine if it will exceed a standard of subpart C of 14CFR Part 77. The FAA, in accordance with 77.9, requests that you file.

Your proposed structure is in proximity to a navigation facility and may impact the assurance of navigation signal reception. The FAA, in accordance with 77.9, requests that you file.

The FAA requests that you file

ACC, NW Corner



Appendix 5.1A
Construction Emission Estimates

APPENDIX 5.1A

Construction Emission Estimates

(Criteria and Greenhouse Gas)

Tables 5.1A.1 through 5.1A.9 summarize the emissions from construction of the Combined-Cycle Power Block.

Tables 5.1A.10 through 5.1A.18 summarize the emissions from construction of the Simple-Cycle Power Block.

Tables 5.1A.19 through 5.1A.21 summarize construction emissions from all stages of the Project.

Table 5.1A.1 Onsite Construction Equipment Exhaust Emissions

Construction Equipment CO Emissions from Combined-Cycle Block Construction

Onsite Equipment	CO Emissions (lb/month)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	0.00	0.00	0.00	0.00
Excavator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	98.77	98.77	98.77	98.77	98.77	98.77	98.77	98.77	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	0.00	0.00	0.00	0.00	0.00	0.00	95.04	95.04	142.57	142.57	142.57	190.09	190.09	190.09	285.13	285.13	285.13	285.13	285.13	332.66	332.66	332.66	332.66	332.66	332.66	332.66	285.13	285.13	285.13	285.13	47.52	47.52	47.52	0.00
Tractor/Loader/Backhoe	0.00	0.00	0.00	0.00	0.00	0.00	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	37.42	0.00	0.00	0.00	0.00
Rubber Tired Loader	0.00	0.00	0.00	0.00	0.00	0.00	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	44.17	0.00	0.00	0.00	0.00
Air Compressor	0.00	0.00	0.00	0.00	0.00	0.00	56.19	56.19	56.19	56.19	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	112.39	56.19	56.19	56.19	0.00
Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	50.09	50.09	75.14	75.14	75.14	75.14	75.14	75.14	75.14	75.14	75.14	50.09	50.09	50.09	50.09	50.09	50.09	50.09	50.09	50.09	50.09	50.09	50.09	50.09	0.00	0.00	0.00	0.00
Roller	0.00	0.00	0.00	0.00	0.00	0.00	34.65	34.65	34.65	34.65	34.65	34.65	34.65	34.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	23.82	23.82	23.82	47.63	47.63	71.45	71.45	95.26	95.26	95.26	95.26	95.26	95.26	119.08	119.08	142.90	142.90	142.90	142.90	142.90	142.90	142.90	142.90	142.90	95.26	47.63	47.63	0.00
Bore/Drill Rig	0.00	0.00	0.00	0.00	0.00	0.00	195.33	195.33	195.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	84.78	0.00	0.00	0.00	0.00
Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	186.59	186.59	186.59	186.59	186.59	93.29	93.29	93.29	93.29	93.29	93.29	93.29	93.29	93.29	93.29	93.29	93.29	93.29	93.29	93.29	93.29	93.29	93.29	93.29	0.00	0.00	0.00	0.00
Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	15.02	20.02	25.03	25.03	30.04	30.04	30.04	30.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	6.49	6.49	6.49	6.49	6.49	6.49	6.49	6.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sweeper/Scrubber	0.00	0.00	0.00	0.00	0.00	0.00	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	44.19	0.00
Pumps	0.00	0.00	0.00	0.00	0.00	0.00	279.88	279.88	279.88	279.88	279.88	279.88	279.88	186.59	186.59	186.59	186.59	186.59	279.88	279.88	279.88	279.88	279.88	279.88	186.59	186.59	186.59	186.59	186.59	93.29	0.00	0.00	0.00	0.00
Skid Steer Loader	0.00	0.00	0.00	0.00	0.00	0.00	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	24.82	0.00	0.00	0.00	0.00
Welders	0.00	0.00	0.00	0.00	0.00	0.00	34.43	34.43	103.28	103.28	103.28	103.28	103.28	103.28	103.28	103.28	137.71	137.71	137.71	137.71	137.71	137.71	137.71	137.71	137.71	137.71	137.71	137.71	137.71	137.71	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00	235.76	314.34	392.93	392.93	392.93	392.93	392.93	392.93	235.76	235.76	235.76	235.76	235.76	235.76	235.76	235.76	235.76	235.76	235.76	235.76	235.76	235.76	235.76	235.76	157.17	157.17	157.17	0.00
Onsite Total (lb/month)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1,533.44**	**1,617.03**	**1,940.82**	**1,769.31**	**1,830.51**	**1,808.55**	**1,808.55**	**1,739.07**	**1,605.77**	**1,605.77**	**1,541.42**	**1,516.38**	**1,609.67**	**1,681.01**	**1,681.01**	**1,704.83**	**1,704.83**	**1,704.83**	**1,611.53**	**1,611.53**	**1,564.01**	**1,564.01**	**1,564.01**	**1,470.72**	**400.34**	**352.71**	**352.71**	**0.00**
Onsite Total (lb/day) [a]	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**66.67**	**70.31**	**84.38**	**76.93**	**79.59**	**78.63**	**78.63**	**75.61**	**69.82**	**69.82**	**67.02**	**65.93**	**69.99**	**73.09**	**73.09**	**74.12**	**74.12**	**74.12**	**70.07**	**70.07**	**68.00**	**68.00**	**68.00**	**63.94**	**17.41**	**15.34**	**15.34**	**0.00**
Onsite Total (tpy)	**10.23**																																	

Construction Equipment VOC Emissions from Combined-Cycle Block Construction

Onsite Equipment	VOC Emissions (lb/month)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	0.00	0.00	0.00	0.00
Excavator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.60	1.60	1.60	1.60	1.60	1.60	1.60	1.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	0.00	0.00	0.00	0.00	0.00	0.00	2.59	2.59	3.89	3.89	3.89	5.18	5.18	5.18	7.78	7.78	7.78	7.78	7.78	9.07	9.07	9.07	9.07	9.07	9.07	9.07	7.78	7.78	7.78	7.78	1.30	1.30	1.30	0.00
Tractor/Loader/Backhoe	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.00	0.00	0.00	0.00
Rubber Tired Loader	0.00	0.00	0.00	0.00	0.00	0.00	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	0.00	0.00	0.00	0.00
Air Compressor	0.00	0.00	0.00	0.00	0.00	0.00	0.91	0.91	0.91	0.91	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82	0.91	0.91	0.91	0.00
Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.81	0.81	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	1.22	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.00	0.00	0.00	0.00
Roller	0.00	0.00	0.00	0.00	0.00	0.00	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.77	0.77	0.77	1.54	1.54	2.32	2.32	3.09	3.09	3.09	3.09	3.09	3.09	3.86	3.86	4.63	4.63	4.63	4.63	4.63	4.63	4.63	4.63	4.63	3.09	1.54	1.54	0.00
Bore/Drill Rig	0.00	0.00	0.00	0.00	0.00	0.00	5.33	5.33	5.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	0.00	0.00	0.00	0.00
Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	3.03	3.03	3.03	3.03	3.03	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	0.00	0.00	0.00	0.00
Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.44	0.59	0.73	0.73	0.88	0.88	0.88	0.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sweeper/Scrubber	0.00	0.00	0.00	0.00	0.00	0.00	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	1.43	0.00
Pumps	0.00	0.00	0.00	0.00	0.00	0.00	4.54	4.54	4.54	4.54	4.54	4.54	4.54	3.03	3.03	3.03	3.03	3.03	4.54	4.54	4.54	4.54	4.54	4.54	3.03	3.03	3.03	3.03	3.03	1.51	0.00	0.00	0.00	0.00
Skid Steer Loader	0.00	0.00	0.00	0.00	0.00	0.00	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.00	0.00	0.00	0.00
Welders	0.00	0.00	0.00	0.00	0.00	0.00	1.01	1.01	3.02	3.02	3.02	3.02	3.02	3.02	3.02	3.02	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	4.03	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00	3.82	5.10	6.37	6.37	6.37	6.37	6.37	6.37	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	3.82	2.55	2.55	2.55	0.00
Onsite Total (lb/month)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**32.68**	**34.10**	**40.84**	**36.28**	**37.34**	**37.89**	**37.89**	**37.15**	**35.57**	**35.57**	**34.97**	**34.57**	**36.08**	**38.15**	**38.15**	**38.92**	**38.92**	**38.92**	**37.41**	**37.41**	**36.11**	**36.11**	**36.11**	**34.60**	**9.28**	**7.73**	**7.73**	**0.00**
Onsite Total (lb/day) [a]	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.42**	**1.48**	**1.78**	**1.58**	**1.62**	**1.65**	**1.65**	**1.62**	**1.55**	**1.55**	**1.52**	**1.50**	**1.57**	**1.66**	**1.66**	**1.69**	**1.69**	**1.69**	**1.63**	**1.63**	**1.57**	**1.57**	**1.57**	**1.50**	**0.40**	**0.34**	**0.34**	**0.00**
Onsite Total (tpy)	**0.22**																																	

Construction Equipment NO_X Emissions from Combined-Cycle Block Construction

Onsite Equipment	NO_X Emissions (lb/month)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	0.00	0.00	0.00	0.00
Excavator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.94	6.94	6.94	6.94	6.94	6.94	6.94	6.94	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	0.00	0.00	0.00	0.00	0.00	0.00	11.23	11.23	16.85	16.85	16.85	22.47	22.47	22.47	33.70	33.70	33.70	33.70	33.70	39.31	39.31	39.31	39.31	39.31	39.31	39.31	33.70	33.70	33.70	33.70	5.62	5.62	5.62	0.00
Tractor/Loader/Backhoe	0.00	0.00	0.00	0.00	0.00	0.00	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	2.63	0.00	0.00	0.00	0.00
Rubber Tired Loader	0.00	0.00	0.00	0.00	0.00	0.00	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	0.00	0.00	0.00	0.00
Air Compressor	0.00	0.00	0.00	0.00	0.00	0.00	3.95	3.95	3.95	3.95	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	7.90	3.95	3.95	3.95	0.00
Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	3.52	3.52	5.28	5.28	5.28	5.28	5.28	5.28	5.28	5.28	5.28	3.52	3.52	3.52	3.52	3.52	3.52	3.52	3.52	3.52	3.52	3.52	3.52	3.52	0.00	0.00	0.00	0.00
Roller	0.00	0.00	0.00	0.00	0.00	0.00	2.43	2.43	2.43	2.43	2.43	2.43	2.43	2.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	17.64	17.64	17.64	35.27	35.27	52.91	52.91	70.55	70.55	70.55	70.55	70.55	70.55	88.18	88.18	105.82	105.82	105.82	105.82	105.82	105.82	105.82	105.82	105.82	70.55	35.27	35.27	0.00
Bore/Drill Rig	0.00	0.00	0.00	0.00	0.00	0.00	23.08	23.08	23.08	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	10.02	0.00	0.00	0.00	0.00
Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	13.11	13.11	13.11	13.11	13.11	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	6.56	0.00	0.00	0.00	0.00
Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	10.07	13.43	16.79	16.79	20.15	20.15	20.15	20.15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	4.35	4.35	4.35	4.35	4.35	4.35	4.35	4.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sweeper/Scrubber	0.00	0.00	0.00	0.00	0.00	0.00	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	32.72	0.00
Pumps	0.00	0.00	0.00	0.00	0.00	0.00	19.67	19.67	19.67	19.67	19.67	19.67	19.67	13.11	13.11	13.11	13.11	13.11	19.67	19.67	19.67	19.67	19.67	19.67	13.11	13.11	13.11	13.11	13.11	6.56	0.00	0.00	0.00	0.00
Skid Steer Loader	0.00	0.00	0.00	0.00	0.00	0.00	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	18.38	0.00	0.00	0.00	0.00
Welders	0.00	0.00	0.00	0.00	0.00	0.00	23.09	23.09	69.27	69.27	69.27	69.27	69.27	69.27	69.27	69.27	92.37	92.37	92.37	92.37	92.37	92.37	92.37	92.37	92.37	92.37	92.37	92.37	92.37	92.37	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00	16.57	22.09	27.61	27.61	27.61	27.61	27.61	27.61	16.57	16.57	16.57	16.57	16.57	16.57	16.57	16.57	16.57	16.57	16.57	16.57	16.57	16.57	16.57	16.57	11.04	11.04	11.04	0.00
Onsite Total (lb/month)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**227.71**	**236.59**	**305.97**	**300.52**	**307.82**	**324.52**	**324.52**	**335.60**	**308.86**	**308.86**	**325.01**	**323.25**	**329.81**	**353.06**	**353.06**	**370.70**	**370.70**	**370.70**	**364.14**	**364.14**	**358.52**	**358.52**	**358.52**	**351.97**	**123.88**	**88.60**	**88.60**	**0.00**
Onsite Total (lb/day) [a]	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**9.90**	**10.29**	**13.30**	**13.07**	**13.38**	**14.11**	**14.11**	**14.59**	**13.43**	**13.43**	**14.13**	**14.05**	**14.34**	**15.35**	**15.35**	**16.12**	**16.12**	**16.12**	**15.83**	**15.83**	**15.59**	**15.59**	**15.59**	**15.30**	**5.39**	**3.85**	**3.85**	**0.00**
Onsite Total (tpy)	**2.15**																																	

Table 5.1A.1 Onsite Construction Equipment Exhaust Emissions

Construction Equipment SO_X Emissions from Combined-Cycle Block Construction

Onsite Equipment	SO_X Emissions (lb/month)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.00	0.00	0.00	0.00
Excavator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.21	0.32	0.32	0.32	0.42	0.42	0.42	0.64	0.64	0.64	0.64	0.64	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.64	0.64	0.64	0.64	0.11	0.11	0.11	0.00
Tractor/Loader/Backhoe	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00
Rubber Tired Loader	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.00	0.00	0.00	0.00
Air Compressor	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.09	0.09	0.09	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.09	0.09	0.09	0.00
Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.00	0.00	0.00	0.00
Roller	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.06	0.06	0.09	0.09	0.13	0.13	0.13	0.13	0.13	0.13	0.16	0.16	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.13	0.06	0.06	0.00
Bore/Drill Rig	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.43	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.00	0.00	0.00	0.00
Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.30	0.30	0.30	0.30	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.00	0.00	0.00	0.00
Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sweeper/Scrubber	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.06	0.00
Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.30	0.30	0.30	0.30	0.30	0.45	0.45	0.45	0.45	0.45	0.45	0.30	0.30	0.30	0.30	0.30	0.15	0.00	0.00	0.00	0.00
Skid Steer Loader	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.00	0.00	0.00	0.00
Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.06	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.41	0.51	0.51	0.51	0.51	0.51	0.51	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.20	0.20	0.20	0.00
Onsite Total (lb/month)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.65**	**2.76**	**3.26**	**2.87**	**2.97**	**2.95**	**2.95**	**2.83**	**2.72**	**2.72**	**2.65**	**2.62**	**2.77**	**2.91**	**2.91**	**2.94**	**2.94**	**2.94**	**2.79**	**2.79**	**2.68**	**2.68**	**2.68**	**2.53**	**0.59**	**0.52**	**0.52**	**0.00**
Onsite Total (lb/day) [a]	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.12**	**0.12**	**0.14**	**0.12**	**0.13**	**0.13**	**0.13**	**0.12**	**0.12**	**0.12**	**0.12**	**0.11**	**0.12**	**0.13**	**0.13**	**0.13**	**0.13**	**0.13**	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**	**0.11**	**0.03**	**0.02**	**0.02**	**0.00**
Onsite Total (tpy)	**0.02**																																	

Construction Equipment PM_{10} Emissions from Combined-Cycle Block Construction

Onsite Equipment	PM_{10} Emissions (lb/month)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.00	0.00	0.00	0.00
Excavator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.35	0.52	0.52	0.52	0.69	0.69	0.69	1.04	1.04	1.04	1.04	1.04	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.04	1.04	1.04	1.04	0.17	0.17	0.17	0.00
Tractor/Loader/Backhoe	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.00	0.00	0.00	0.00
Rubber Tired Loader	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.00	0.00	0.00	0.00
Air Compressor	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.12	0.12	0.12	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.12	0.12	0.12	0.00
Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.11	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.00	0.00	0.00	0.00
Roller	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.10	0.10	0.15	0.15	0.21	0.21	0.21	0.21	0.21	0.21	0.26	0.26	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.21	0.10	0.10	0.00
Bore/Drill Rig	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.71	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.00	0.00	0.00	0.00
Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.00	0.00	0.00	0.00
Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sweeper/Scrubber	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.00
Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.40	0.40	0.40	0.40	0.40	0.61	0.61	0.61	0.61	0.61	0.61	0.40	0.40	0.40	0.40	0.40	0.20	0.00	0.00	0.00	0.00
Skid Steer Loader	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00
Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.68	0.85	0.85	0.85	0.85	0.85	0.85	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.34	0.34	0.34	0.00
Onsite Total (lb/month)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.05**	**4.23**	**4.98**	**4.32**	**4.45**	**4.48**	**4.48**	**4.33**	**4.19**	**4.19**	**4.04**	**3.99**	**4.19**	**4.41**	**4.41**	**4.46**	**4.46**	**4.46**	**4.26**	**4.26**	**4.09**	**4.09**	**4.09**	**3.89**	**0.94**	**0.83**	**0.83**	**0.00**
Onsite Total (lb/day) [a]	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.18**	**0.18**	**0.22**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.18**	**0.18**	**0.18**	**0.17**	**0.18**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.18**	**0.18**	**0.18**	**0.17**	**0.04**	**0.04**	**0.04**	**0.00**
Onsite Total (tpy)	**0.03**																																	

Table 5.1A.1 Onsite Construction Equipment Exhaust Emissions

Construction Equipment $PM_{2.5}$ Emissions from Combined-Cycle Block Construction

Onsite Equipment	$PM_{2.5}$ Emissions (lb/month)																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Excavator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.00
Cranes	0.00	0.00	0.00	0.00	0.00	0.00	0.35	0.35	0.52	0.52	0.52	0.69	0.69	0.69	1.04	1.04	1.04
Tractor/Loader/Backhoe	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
Rubber Tired Loader	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Air Compressor	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.12	0.12	0.12	0.24	0.24	0.24	0.24	0.24	0.24	0.24
Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.11	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Roller	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.00	0.00	0.00
Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.10	0.10	0.15	0.15	0.21	0.21	0.21	0.21
Bore/Drill Rig	0.00	0.00	0.00	0.00	0.00	0.00	0.71	0.71	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.40	0.40	0.40	0.40	0.20	0.20	0.20	0.20	0.20	0.20
Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.04	0.05	0.05	0.06	0.06	0.06	0.06	0.00	0.00	0.00
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
Sweeper/Scrubber	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Pumps	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.61	0.61	0.61	0.61	0.61	0.61	0.40	0.40	0.40	0.40
Skid Steer Loader	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Welders	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.27
Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.68	0.85	0.85	0.85	0.85	0.85	0.85	0.51	0.51	0.51
Onsite Total (lb/month)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.05**	**4.23**	**4.98**	**4.32**	**4.45**	**4.48**	**4.48**	**4.33**	**4.19**	**4.19**	**4.04**
Onsite Total (lb/day) [a]	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.18**	**0.18**	**0.22**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.18**	**0.18**	**0.18**
Onsite Total (tpy)	**0.03**																

Onsite Equipment	$PM_{2.5}$ Emissions (lb/month)																
	18	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**
Water Truck	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.00	0.00	0.00	0.00
Excavator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	1.04	1.04	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.04	1.04	1.04	1.04	0.17	0.17	0.17	0.00
Tractor/Loader/Backhoe	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.00	0.00	0.00	0.00
Rubber Tired Loader	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.00	0.00	0.00	0.00
Air Compressor	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.12	0.12	0.12	0.00
Forklifts	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.00	0.00	0.00	0.00
Roller	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aerial Lifts	0.21	0.21	0.26	0.26	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.21	0.10	0.10	0.00
Bore/Drill Rig	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Truck	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.00	0.00	0.00	0.00
Generator Sets	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.00	0.00	0.00	0.00
Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sweeper/Scrubber	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.00
Pumps	0.40	0.61	0.61	0.61	0.61	0.61	0.61	0.40	0.40	0.40	0.40	0.40	0.20	0.00	0.00	0.00	0.00
Skid Steer Loader	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.00	0.00	0.00	0.00
Welders	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.51	0.34	0.34	0.34	0.00
Onsite Total (lb/month)	**3.99**	**4.19**	**4.41**	**4.41**	**4.46**	**4.46**	**4.46**	**4.26**	**4.26**	**4.09**	**4.09**	**4.09**	**3.89**	**0.94**	**0.83**	**0.83**	**0.00**
Onsite Total (lb/day) [a]	**0.17**	**0.18**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.19**	**0.18**	**0.18**	**0.18**	**0.17**	**0.04**	**0.04**	**0.04**	**0.00**

Construction Equipment CO_2 Emissions from Combined-Cycle Block Construction

Onsite Equipment	CO_2 Emissions (metric tons/month)																
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**
Water Truck	0.00	0.00	0.00	0.00	0.00	0.00	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81
Excavator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.84	5.84	5.84	5.84	5.84	5.84	5.84	5.84	0.00
Cranes	0.00	0.00	0.00	0.00	0.00	0.00	10.02	10.02	15.04	15.04	15.04	20.05	20.05	20.05	30.07	30.07	30.07
Tractor/Loader/Backhoe	0.00	0.00	0.00	0.00	0.00	0.00	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08
Rubber Tired Loader	0.00	0.00	0.00	0.00	0.00	0.00	5.02	5.02	5.02	5.02	5.02	5.02	5.02	5.02	5.02	5.02	5.02
Air Compressor	0.00	0.00	0.00	0.00	0.00	0.00	3.33	3.33	3.33	3.33	6.66	6.66	6.66	6.66	6.66	6.66	6.66
Forklifts	0.00	0.00	0.00	0.00	0.00	0.00	3.05	3.05	4.58	4.58	4.58	4.58	4.58	4.58	4.58	4.58	4.58
Roller	0.00	0.00	0.00	0.00	0.00	0.00	2.42	2.42	2.42	2.42	2.42	2.42	2.42	2.42	0.00	0.00	0.00
Aerial Lifts	0.00	0.00	0.00	0.00	0.00	0.00	1.83	1.83	1.83	3.65	3.65	5.48	5.48	7.30	7.30	7.30	7.30
Bore/Drill Rig	0.00	0.00	0.00	0.00	0.00	0.00	21.66	21.66	21.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Truck	0.00	0.00	0.00	0.00	0.00	0.00	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81
Generator Sets	0.00	0.00	0.00	0.00	0.00	0.00	6.66	6.66	6.66	6.66	6.66	3.33	3.33	3.33	3.33	3.33	3.33
Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	4.57	6.09	7.62	7.62	9.14	9.14	9.14	9.14	0.00	0.00	0.00
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	1.74	1.74	1.74	1.74	1.74	1.74	1.74	1.74	0.00	0.00	0.00
Sweeper/Scrubber	0.00	0.00	0.00	0.00	0.00	0.00	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49
Pumps	0.00	0.00	0.00	0.00	0.00	0.00	9.99	9.99	9.99	9.99	9.99	9.99	9.99	6.66	6.66	6.66	6.66
Skid Steer Loader	0.00	0.00	0.00	0.00	0.00	0.00	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76
Welders	0.00	0.00	0.00	0.00	0.00	0.00	1.74	1.74	5.22	5.22	5.22	5.22	5.22	5.22	5.22	5.22	6.97
Other General Industrial Equipment	0.00	0.00	0.00	0.00	0.00	0.00	12.87	17.16	21.45	21.45	21.45	21.45	21.45	21.45	12.87	12.87	12.87
Onsite Total (metric tons/month)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**109.87**	**115.68**	**137.36**	**117.52**	**122.38**	**125.88**	**125.88**	**124.38**	**112.52**	**112.52**	**108.42**
Onsite Total (metric tons/day) [a]	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.78**	**5.03**	**5.97**	**5.11**	**5.32**	**5.47**	**5.47**	**5.41**	**4.89**	**4.89**	**4.71**
Onsite Total (metric tons/year)	**1,421.07**																

Onsite Equipment	CO_2 Emissions (metric tons/month)																
	18	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**
Water Truck	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	0.00	0.00	0.00	0.00
Excavator	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	30.07	30.07	35.08	35.08	35.08	35.08	35.08	35.08	35.08	30.07	30.07	30.07	30.07	5.01	5.01	5.01	0.00
Tractor/Loader/Backhoe	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	0.00	0.00	0.00	0.00
Rubber Tired Loader	5.02	5.02	5.02	5.02	5.02	5.02	5.02	5.02	5.02	5.02	5.02	5.02	5.02	0.00	0.00	0.00	0.00
Air Compressor	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	6.66	3.33	3.33	3.33	0.00
Forklifts	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	0.00	0.00	0.00	0.00
Roller	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aerial Lifts	7.30	7.30	9.13	9.13	10.95	10.95	10.95	10.95	10.95	10.95	10.95	10.95	10.95	7.30	3.65	3.65	0.00
Bore/Drill Rig	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fuel Truck	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	8.81	0.00	0.00	0.00	0.00
Generator Sets	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33	3.33	0.00	0.00	0.00	0.00
Plate Compactors	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Pressure Washer	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sweeper/Scrubber	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	3.49	0.00
Pumps	6.66	9.99	9.99	9.99	9.99	9.99	9.99	6.66	6.66	6.66	6.66	6.66	3.33	0.00	0.00	0.00	0.00
Skid Steer Loader	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	1.76	0.00	0.00	0.00	0.00
Welders	6.97	6.97	6.97	6.97	6.97	6.97	6.97	6.97	6.97	6.97	6.97	6.97	6.97	0.00	0.00	0.00	0.00
Other General Industrial Equipment	12.87	12.87	12.87	12.87	12.87	12.87	12.87	12.87	12.87	12.87	12.87	12.87	12.87	8.58	8.58	8.58	0.00
Onsite Total (metric tons/month)	**106.90**	**110.23**	**117.07**	**117.07**	**118.89**	**118.89**	**118.89**	**115.56**	**115.56**	**110.55**	**110.55**	**110.55**	**107.22**	**27.72**	**24.07**	**24.07**	**0.00**
Onsite Total (metric tons/day) [a]	**4.65**	**4.79**	**5.09**	**5.09**	**5.17**	**5.17**	**5.17**	**5.02**	**5.02**	**4.81**	**4.81**	**4.81**	**4.66**	**1.21**	**1.05**	**1.05**	**0.00**

Table 5.1A.1 Onsite Construction Equipment Exhaust Emissions

Construction Equipment N_2O Emissions from Combined-Cycle Block Construction

Onsite Equipment	N_2O Emissions (metric tons/month)																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Water Truck	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Excavator	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
Cranes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0003	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005	0.0008	0.0008	0.0008
Tractor/Loader/Backhoe	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Rubber Tired Loader	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Air Compressor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Forklifts	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Roller	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000
Aerial Lifts	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002
Bore/Drill Rig	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0005	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fuel Truck	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Generator Sets	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Plate Compactors	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000
Pressure Washer	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sweeper/Scrubber	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Pumps	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002
Skid Steer Loader	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Welders	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002
Other General Industrial Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0004	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0003	0.0003	0.0003
Onsite Total (metric tons/month)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0028**	**0.0029**	**0.0034**	**0.0029**	**0.0031**	**0.0032**	**0.0032**	**0.0031**	**0.0028**	**0.0028**	**0.0027**
Onsite Total (metric tons/day) [a]	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**
Onsite Total (metric tons/year)	**0.04**																

Onsite Equipment	N_2O Emissions (metric tons/month)																
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Water Truck	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000
Excavator	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cranes	0.0008	0.0008	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0009	0.0008	0.0008	0.0008	0.0008	0.0001	0.0001	0.0001	0.0000
Tractor/Loader/Backhoe	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
Rubber Tired Loader	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
Air Compressor	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0001	0.0001	0.0000
Forklifts	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
Roller	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Aerial Lifts	0.0002	0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0001	0.0001	0.0000
Bore/Drill Rig	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fuel Truck	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000
Generator Sets	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
Plate Compactors	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pressure Washer	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sweeper/Scrubber	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000
Pumps	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0001	0.0000	0.0000	0.0000	0.0000
Skid Steer Loader	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Welders	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000
Other General Industrial Equipment	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0002	0.0002	0.0002	0.0000
Onsite Total (metric tons/month)	**0.0027**	**0.0028**	**0.0029**	**0.0029**	**0.0030**	**0.0030**	**0.0030**	**0.0029**	**0.0029**	**0.0028**	**0.0028**	**0.0028**	**0.0027**	**0.0007**	**0.0006**	**0.0006**	**0.0000**
Onsite Total (metric tons/day) [a]	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Construction Equipment CH_4 Emissions from Combined-Cycle Block Construction

Onsite Equipment	CH_4 Emissions (metric tons/month)																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Water Truck	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Excavator	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0000
Cranes	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0006	0.0008	0.0008	0.0008	0.0011	0.0011	0.0011	0.0017	0.0017	0.0017
Tractor/Loader/Backhoe	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Rubber Tired Loader	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Air Compressor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0002	0.0002	0.0002	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
Forklifts	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Roller	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000
Aerial Lifts	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0002	0.0002	0.0003	0.0003	0.0004	0.0004	0.0004	0.0004
Bore/Drill Rig	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0012	0.0012	0.0012	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fuel Truck	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005
Generator Sets	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0004	0.0004	0.0004	0.0004	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Plate Compactors	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0003	0.0004	0.0004	0.0005	0.0005	0.0005	0.0005	0.0000	0.0000	0.0000
Pressure Washer	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000
Sweeper/Scrubber	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002
Pumps	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0004	0.0004	0.0004	0.0004
Skid Steer Loader	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Welders	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0004
Other General Industrial Equipment	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0007	0.0010	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0007	0.0007	0.0007
Onsite Total (metric tons/month)	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0062**	**0.0065**	**0.0078**	**0.0066**	**0.0069**	**0.0071**	**0.0071**	**0.0070**	**0.0064**	**0.0064**	**0.0061**
Onsite Total (metric tons/day) [a]	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0000**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**
Onsite Total (metric tons/year)	**0.08**																

Onsite Equipment	CH_4 Emissions (metric tons/month)																
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Water Truck	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0000	0.0000	0.0000	0.0000
Excavator	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cranes	0.0017	0.0017	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0020	0.0017	0.0017	0.0017	0.0017	0.0003	0.0003	0.0003	0.0000
Tractor/Loader/Backhoe	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
Rubber Tired Loader	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0000	0.0000	0.0000	0.0000
Air Compressor	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0002	0.0002	0.0002	0.0000
Forklifts	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000
Roller	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Aerial Lifts	0.0004	0.0004	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0004	0.0002	0.0002	0.0000
Bore/Drill Rig	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Fuel Truck	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0000	0.0000	0.0000	0.0000
Generator Sets	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000
Plate Compactors	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Pressure Washer	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Sweeper/Scrubber	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000
Pumps	0.0004	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0004	0.0004	0.0004	0.0004	0.0004	0.0002	0.0000	0.0000	0.0000	0.0000
Skid Steer Loader	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
Welders	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0000	0.0000	0.0000	0.0000
Other General Industrial Equipment	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0005	0.0005	0.0005	0.0000
Onsite Total (metric tons/month)	**0.0060**	**0.0062**	**0.0066**	**0.0066**	**0.0067**	**0.0067**	**0.0067**	**0.0065**	**0.0065**	**0.0062**	**0.0062**	**0.0062**	**0.0061**	**0.0016**	**0.0014**	**0.0014**	**0.0000**
Onsite Total (metric tons/day) [a]	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0003**	**0.0001**	**0.0001**	**0.0001**	**0.0000**

Notes:
[a] Per 'CEC_Matrix_To_AES__070115.xlsx', the days per month are as follov 23

Table 5.1A.2 Onsite Motor Vehicle Exhaust Emissions

Onsite Construction Vehicle CO Emissions from Combined-Cycle Block Constructior

Vehicle Type	CO Emissions (lb/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Onsite Semi-truck Tractor	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.00	0.00	0.00	0.00
Onsite Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/day)	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.04**	**0.04**	**0.04**	**0.06**	**0.06**	**0.06**	**0.06**	**0.06**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.01**	**0.01**	**0.01**	**0.01**
Vehicle Type	CO Emissions (lb/month)[a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Onsite Semi-truck Tractor	0.00	0.00	0.00	0.00	0.00	0.00	0.45	0.45	0.45	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.00	0.00	0.00	0.00
Onsite Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**0.88**	**0.88**	**0.88**	**1.33**	**1.33**	**1.33**	**1.33**	**1.33**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**1.10**	**0.20**	**0.20**	**0.20**	**0.20**
Onsite Total (tpy)	**0.01**																																	

Onsite Construction Vehicle VOC Emissions from Combined-Cycle Block Constructior

Vehicle Type	VOC Emissions (lb/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Onsite Semi-truck Tractor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0062	0.0062	0.0062	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0125	0.0000	0.0000	0.0000	0.0000
Onsite Dump Truck	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0031	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Onsite Total (lb/day)	**0.0006**	**0.0006**	**0.0006**	**0.0006**	**0.0006**	**0.0006**	**0.0100**	**0.0100**	**0.0100**	**0.0162**	**0.0162**	**0.0162**	**0.0162**	**0.0162**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0131**	**0.0006**	**0.0006**	**0.0006**	**0.0006**
Vehicle Type	VOC Emissions (lb/month)[a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
Onsite Semi-truck Tractor	0.000	0.000	0.000	0.000	0.000	0.000	0.144	0.144	0.144	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.287	0.000	0.000	0.000	0.000
Onsite Dump Truck	0.000	0.000	0.000	0.000	0.000	0.000	0.072	0.072	0.072	0.072	0.072	0.072	0.072	0.072	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Onsite Total (lb/month)	**0.014**	**0.014**	**0.014**	**0.014**	**0.014**	**0.014**	**0.229**	**0.229**	**0.229**	**0.373**	**0.373**	**0.373**	**0.373**	**0.373**	**0.301**	**0.301**	**0.301**	**0.301**	**0.301**	**0.301**	**0.301**	**0.301**	**0.301**	**0.301**	**0.301**	**0.301**	**0.301**	**0.301**	**0.301**	**0.301**	**0.014**	**0.014**	**0.014**	**0.014**
Onsite Total (tpy)	**0.002**																																	

Onsite Construction Vehicle SO_X Emissions from Combined-Cycle Block Construction

Vehicle Type	SO_X Emissions (lb/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003	0.00003
Onsite Semi-truck Tractor	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00014	0.00014	0.00014	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00028	0.00000	0.00000	0.00000	0.00000
Onsite Dump Truck	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00007	0.00007	0.00007	0.00007	0.00007	0.00007	0.00007	0.00007	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Onsite Total (lb/day)	**0.00003**	**0.00003**	**0.00003**	**0.00003**	**0.00003**	**0.00003**	**0.00024**	**0.00024**	**0.00024**	**0.00038**	**0.00038**	**0.00038**	**0.00038**	**0.00038**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00031**	**0.00003**	**0.00003**	**0.00003**	**0.00003**
Vehicle Type	SO_X Emissions (lb/month)[a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Onsite Semi-truck Tractor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0032	0.0032	0.0032	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0065	0.0000	0.0000	0.0000	0.0000
Onsite Dump Truck	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0016	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Onsite Total (lb/month)	**0.0006**	**0.0006**	**0.0006**	**0.0006**	**0.0006**	**0.0006**	**0.0055**	**0.0055**	**0.0055**	**0.0087**	**0.0087**	**0.0087**	**0.0087**	**0.0087**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0071**	**0.0006**	**0.0006**	**0.0006**	**0.0006**
Onsite Total (tpy)	**0.00005**																																	

Onsite Construction Vehicle NO_X Emissions from Combined-Cycle Block Construction

Vehicle Type	NO_X Emissions (lb/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Onsite Semi-truck Tractor	0.000	0.000	0.000	0.000	0.000	0.000	0.087	0.086	0.086	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.172	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.000	0.000	0.000	0.000
Onsite Dump Truck	0.000	0.000	0.000	0.000	0.000	0.000	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.043	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Onsite Total (lb/day)	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.001**	**0.131**	**0.130**	**0.130**	**0.216**	**0.216**	**0.216**	**0.216**	**0.216**	**0.173**	**0.173**	**0.173**	**0.173**	**0.173**	**0.175**	**0.175**	**0.175**	**0.175**	**0.175**	**0.175**	**0.175**	**0.175**	**0.175**	**0.175**	**0.175**	**0.001**	**0.001**	**0.001**	**0.001**
Vehicle Type	NO_X Emissions (lb/month)[a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Onsite Semi-truck Tractor	0.00	0.00	0.00	0.00	0.00	0.00	2.00	1.98	1.98	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	3.96	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	0.00	0.00	0.00	0.00
Onsite Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**3.02**	**2.99**	**2.99**	**4.97**	**4.97**	**4.97**	**4.97**	**4.97**	**3.98**	**3.98**	**3.98**	**3.98**	**3.98**	**4.02**	**4.02**	**4.02**	**4.02**	**4.02**	**4.02**	**4.02**	**4.02**	**4.02**	**4.02**	**4.02**	**0.01**	**0.01**	**0.01**	**0.01**
Onsite Total (tpy)	**0.03**																																	

Onsite Construction Vehicle PM_{10} Emissions from Combined-Cycle Block Construction

Vehicle Type	PM_{10} Emissions (lb/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Onsite Semi-truck Tractor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0009	0.0007	0.0007	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0014	0.0000	0.0000	0.0000	0.0000
Onsite Dump Truck	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Onsite Total (lb/day)	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0015**	**0.0012**	**0.0012**	**0.0019**	**0.0019**	**0.0019**	**0.0019**	**0.0019**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0001**	**0.0001**	**0.0001**	**0.0001**
Vehicle Type	PM_{10} Emissions (lb/month)[a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Onsite Semi-truck Tractor	0.000	0.000	0.000	0.000	0.000	0.000	0.020	0.016	0.016	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.032	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.031	0.000	0.000	0.000	0.000
Onsite Dump Truck	0.000	0.000	0.000	0.000	0.000	0.000	0.010	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Onsite Total (lb/month)	**0.003**	**0.003**	**0.003**	**0.003**	**0.003**	**0.003**	**0.033**	**0.027**	**0.027**	**0.044**	**0.044**	**0.044**	**0.044**	**0.044**	**0.035**	**0.035**	**0.035**	**0.035**	**0.035**	**0.034**	**0.034**	**0.034**	**0.034**	**0.034**	**0.034**	**0.034**	**0.034**	**0.034**	**0.034**	**0.034**	**0.003**	**0.003**	**0.003**	**0.003**
Onsite Total (tpy)	**0.0002**																																	

Onsite Construction Vehicle $PM_{2.5}$ Emissions from Combined-Cycle Block Construction

Vehicle Type	$PM_{2.5}$ Emissions (lb/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Onsite Semi-truck Tractor	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0006	0.0004	0.0004	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0000	0.0000	0.0000	0.0000
Onsite Dump Truck	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0003	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Onsite Total (lb/day)	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0009**	**0.0007**	**0.0007**	**0.0011**	**0.0011**	**0.0011**	**0.0011**	**0.0011**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0009**	**0.0001**	**0.0001**	**0.0001**	**0.0001**
Vehicle Type	$PM_{2.5}$ Emissions (lb/month)[a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
Onsite Semi-truck Tractor	0.000	0.000	0.000	0.000	0.000	0.000	0.013	0.010	0.010	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.019	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.018	0.000	0.000	0.000	0.000
Onsite Dump Truck	0.000	0.000	0.000	0.000	0.000	0.000	0.007	0.005	0.005	0.005	0.005	0.005	0.005	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Onsite Total (lb/month)	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.022**	**0.016**	**0.016**	**0.026**	**0.026**	**0.026**	**0.026**	**0.026**	**0.021**	**0.021**	**0.021**	**0.021**	**0.021**	**0.020**	**0.020**	**0.020**	**0.020**	**0.020**	**0.020**	**0.020**	**0.020**	**0.020**	**0.020**	**0.020**	**0.002**	**0.002**	**0.002**	**0.002**
Onsite Total (tpy)	**0.0001**																																	

Table 5.1A.2 Onsite Motor Vehicle Exhaust Emissions

Onsite Construction Vehicle CO_2 Emissions from Combined-Cycle Block Construction

Vehicle Type	CO_2 Emissions (metric tons/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Onsite Semi-truck Tractor	0.000	0.000	0.000	0.000	0.000	0.000	0.004	0.004	0.004	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.000	0.000	0.000	0.000
Onsite Dump Truck	0.000	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Onsite Total (metric tons/day)	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**0.006**	**0.006**	**0.006**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.000**	**0.000**	**0.000**	**0.000**
Vehicle Type	**CO_2 Emissions (metric tons/month)[a]**																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Onsite Semi-truck Tractor	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08	0.08	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.17	0.00	0.00	0.00	0.00
Onsite Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (metric tons/month)	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.14**	**0.14**	**0.14**	**0.22**	**0.22**	**0.22**	**0.22**	**0.22**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.01**	**0.01**	**0.01**	**0.01**
Onsite Total (metric tons/year)	**2.35**																																	

Onsite Construction Vehicle N_2O Emissions from Combined-Cycle Block Construction

Vehicle Type	N_2O Emissions (metric tons/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007	0.000000007
Onsite Semi-truck Tractor	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000010	0.000000010	0.000000010	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000019	0.000000000	0.000000000	0.000000000	0.000000000
Onsite Dump Truck	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000
Onsite Total (metric tons/day)	**0.000000007**	**0.000000007**	**0.000000007**	**0.000000007**	**0.000000007**	**0.000000007**	**0.000000021**	**0.000000021**	**0.000000021**	**0.000000031**	**0.000000031**	**0.000000031**	**0.000000031**	**0.000000031**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000026**	**0.000000007**	**0.000000007**	**0.000000007**	**0.000000007**
Vehicle Type	**N_2O Emissions (metric tons/month)[a]**																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015	0.00000015
Onsite Semi-truck Tractor	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000022	0.00000022	0.00000022	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000044	0.00000000	0.00000000	0.00000000	0.00000000
Onsite Dump Truck	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000011	0.00000011	0.00000011	0.00000011	0.00000011	0.00000011	0.00000011	0.00000011	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000
Onsite Total (metric tons/month)	**0.0000002**	**0.0000002**	**0.0000002**	**0.0000002**	**0.0000002**	**0.0000002**	**0.0000005**	**0.0000005**	**0.0000005**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000006**	**0.0000002**	**0.0000002**	**0.0000002**	**0.0000002**
Onsite Total (metric tons/year)	**0.00001**																																	

Onsite Construction Vehicle CH_4 Emissions from Combined-Cycle Block Construction

Vehicle Type	CH_4 Emissions (metric tons/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016	0.000000016
Onsite Semi-truck Tractor	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000010	0.000000010	0.000000010	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000020	0.000000000	0.000000000	0.000000000	0.000000000
Onsite Dump Truck	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000005	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000	0.000000000
Onsite Total (metric tons/day)	**0.000000016**	**0.000000016**	**0.000000016**	**0.000000016**	**0.000000016**	**0.000000016**	**0.000000032**	**0.000000032**	**0.000000032**	**0.000000042**	**0.000000042**	**0.000000042**	**0.000000042**	**0.000000042**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000037**	**0.000000016**	**0.000000016**	**0.000000016**	**0.000000016**
Vehicle Type	**CH_4 Emissions (metric tons/month)[a]**																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004
Onsite Semi-truck Tractor	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000002	0.0000002	0.0000002	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000000	0.0000000	0.0000000	0.0000000
Onsite Dump Truck	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000001	0.0000001	0.0000001	0.0000001	0.0000001	0.0000001	0.0000001	0.0000001	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000
Onsite Total (metric tons/month)	**0.0000004**	**0.0000004**	**0.0000004**	**0.0000004**	**0.0000004**	**0.0000004**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000010**	**0.0000010**	**0.0000010**	**0.0000010**	**0.0000010**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000008**	**0.0000004**	**0.0000004**	**0.0000004**	**0.0000004**
Onsite Total (metric tons/year)	**0.00001**																																	

Notes:
[a] The days per month are per 'CEC_Matrix_To_AES__070115.xlsx', as presented on the 'Fugitive Dust' tab.

Table 5.1A.3 Onsite Construction Fugitive Dust Emissions

Grading, Bulldozing, and Truck Dumping/Loading Activity Levels for Combined-Cycle Block Construction

Source	Monthly Activity Levels																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Disturbance (acres) [a]	0.00	0.00	0.00	0.00	0.00	0.00	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	0.00	0.00	0.00	0.00
Bulldozer Operation (hours) [b]	0.00	0.00	0.00	0.00	0.00	0.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	230.00	0.00	0.00	0.00	0.00
Soil Imported/Exported (cubic yards) [c]	0.00	0.00	0.00	0.00	0.00	0.00	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	518.08	0.00	0.00	0.00	0.00

Notes:
[a] Estimated a total of 30.6 acres is disturbed during Combined-Cycle Block Construction, as provided in 'Alamitos-Soil Management- Kiewit Compiled-18mar2015.xls'; assumed this disturbance was equally distributed amongst the months in which tractors/loaders/backhoes are utilized, since graders are not specifically identified in the equipment list.
[b] Bulldozer Operation calculated based on the number of rubber tired loaders, since bulldozers are not specifically identified in the equipment list, and the hours of operation per month, as consistent with other construction phases:
Hours per Day: 10
Days per Month: 23
[c] Estimated a total of 12,434 cubic yards of fill is exported and/or imported for the Combined-Cycle Block area, as provided in 'Alamitos-Soil Management- Kiewit Compiled-18mar2015.xls'; assumed the exports/imports and associated loading/dumping activity are equally distributed amongst the months in which rubber tired loaders are utilized.

Onsite Construction Vehicle Fugitive PM_{10} Emissions from Combined-Cycle Block Construction

Vehicle Type	Fugitive PM_{10} Emissions (lb/day) [a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
Onsite Semi-truck Tractor	0.00	0.00	0.00	0.00	0.00	0.00	0.69	0.69	0.69	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	0.00	0.00	0.00	0.00
Onsite Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/day)	**0.34**	**0.34**	**0.34**	**0.34**	**0.34**	**0.34**	**1.38**	**1.38**	**1.38**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**	**1.72**	**0.34**	**0.34**	**0.34**	**0.34**
Vehicle Type	**Fugitive PM_{10} Emissions (lb/month) [a]**																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93
Onsite Semi-truck Tractor	0.00	0.00	0.00	0.00	0.00	0.00	15.86	15.86	15.86	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	0.00	0.00	0.00	0.00
Onsite Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	7.93	7.93	7.93	7.93	7.93	7.93	7.93	7.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**7.93**	**7.93**	**7.93**	**7.93**	**7.93**	**7.93**	**31.71**	**31.71**	**31.71**	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**	**39.64**	**39.64**	**39.64**	**39.64**	**39.64**	**39.64**	**39.64**	**39.64**	**39.64**	**39.64**	**39.64**	**39.64**	**39.64**	**39.64**	**39.64**	**39.64**	**7.93**	**7.93**	**7.93**	**7.93**
Onsite Total (tpy)	**0.26**																																	

Notes:
[a] Emissions based on highest (controlled) unpaved road emission factor for PM_{0}.

Onsite Construction Vehicle Fugitive $PM_{2.5}$ Emissions from Combined-Cycle Block Construction

Vehicle Type	Fugitive $PM_{2.5}$ Emissions (lb/day) [a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Onsite Semi-truck Tractor	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.07	0.07	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.00	0.00	0.00	0.00
Onsite Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/day)	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.14**	**0.14**	**0.14**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.17**	**0.03**	**0.03**	**0.03**	**0.03**
Vehicle Type	**Fugitive $PM_{2.5}$ Emissions (lb/month) [a]**																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Onsite Semi-truck Tractor	0.00	0.00	0.00	0.00	0.00	0.00	1.59	1.59	1.59	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	0.00	0.00	0.00	0.00
Onsite Dump Truck	0.00	0.00	0.00	0.00	0.00	0.00	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**0.79**	**3.17**	**3.17**	**3.17**	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**	**3.96**	**3.96**	**3.96**	**3.96**	**3.96**	**3.96**	**3.96**	**3.96**	**3.96**	**3.96**	**3.96**	**3.96**	**3.96**	**3.96**	**3.96**	**3.96**	**0.79**	**0.79**	**0.79**	**0.79**
Onsite Total (tpy)	**0.03**																																	

Notes:
[a] Emissions based on the highest (controlled) unpaved road emission factor for $PM_{2.5}$.

Onsite Grading, Bulldozing, and Truck Dumping/Loading Fugitive PM_{10} Emissions from Combined-Cycle Block Construction

Construction Activity	Fugitive PM_{10} Emissions (lb/day) [a, b]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Grading [c]	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Bulldozing	0.00	0.00	0.00	0.00	0.00	0.00	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	0.00	0.00	0.00	0.00
Truck Dumping/Loading [d, e]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/day)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**1.21**	**0.00**	**0.00**	**0.00**	**0.00**
Construction Activity	**Fugitive PM_{10} Emissions (lb/month) [a, b]**																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Grading	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.00	0.00	0.00	0.00
Bulldozing	0.00	0.00	0.00	0.00	0.00	0.00	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	27.70	0.00	0.00	0.00	0.00
Truck Dumping/Loading	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**27.94**	**0.00**	**0.00**	**0.00**	**0.00**
Onsite Total (tpy)	**0.17**																																	

Notes:
[a] Work days per month are as follows, per 'CEC_Matrix_To_AES__070115.xlsx': 23
[b] Emissions based on the highest (controlled) emission factor for PM_{0}.
[c] Per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013), the following blade width was assumed for grading equip 12 ft
[d] Assume that soil is dumped from or loaded to the truck the same month it is imported or exported, respectively.
[e] Per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013), the following conversion factor was used: 1.26 tons/cubic yard

Onsite Grading, Bulldozing, and Truck Dumping/Loading Fugitive $PM_{2.5}$ Emissions from Combined-Cycle Block Construction

Construction Activity	Fugitive $PM_{2.5}$ Emissions (lb/day) [a, b]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Grading [c]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bulldozing	0.00	0.00	0.00	0.00	0.00	0.00	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.66	0.00	0.00	0.00	0.00
Truck Dumping/Loading [d, e]	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/day)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.66**	**0.00**	**0.00**	**0.00**	**0.00**
Construction Activity	**Fugitive $PM_{2.5}$ Emissions (lb/month) [a, b]**																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Grading	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00
Bulldozing	0.00	0.00	0.00	0.00	0.00	0.00	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	15.23	0.00	0.00	0.00	0.00
Truck Dumping/Loading	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**15.25**	**0.00**	**0.00**	**0.00**	**0.00**
Onsite Total (tpy)	**0.09**																																	

Notes:
[a] Work days per month are as follows, per 'CEC_Matrix_To_AES__070115.xlsx': 23
[a] Emissions based on the highest (controlled) emission factor for $PM_{2.5}$.
[c] Per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013), the following blade width was assumed for grading equip 12 ft
[d] Assume that soil is dumped from or loaded to the truck the same month it is imported or exported, respectively.
[e] Per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013), the following conversion factor was used: 1.26 tons/cubic yard

Onsite Construction Vehicle Activity for Combined-Cycle Block Construction

Vehicle Type	Miles/Day [a]	Working Days per Month [b]
Onsite Pick-up Truck	1	23
Onsite Semi-truck Tractor	2	23
Onsite Dump Truck	1	23

Notes:
[a] Estimated based on the dimensions of the project site and anticipated activity.
[b] Per 'CEC_Matrix_To_AES__070115.xlsx'.

Table 5.1A.3 Onsite Construction Fugitive Dust Emissions

Fugitive Dust Emission Factors for Unpaved Roads

Vehicles on Unpaved Surfaces at Industrial Sites

Parameter	PM_{10}	$PM_{2.5}$
Mean Vehicle Weight [a]	16.5	16.5
Silt Content [b]	8.5	8.5
k [c]	1.5	0.15
a [c]	0.9	0.9
b [c]	0.45	0.45
P [d]	33	33
Emission Factor (Uncontrolled, lb/mile) [e]	2.15	0.22
Reduction from Applying Soil Stabilizers [f]	84%	84%
Emission Factor (Controlled, lb/mile)	0.34	0.03

Notes:

[a] Mean vehicle weight assumes that medium/heavy duty trucks weigh 16.5 tons.

[b] Silt content taken from Table 13.2.2-1 of Section 13.2.2 of *AP-42* (EPA, 2006) for a Construction Site, Scraper Route; this value is consistent with the CalEEMod default for the South Coast Air Basin.

[c] k, a, and b taken from Table 13.2.2-2 of Section 13.2.2 of *AP-42* (EPA, 2006) for industrial roads.

[d] P taken as the CalEEMod default for the Long Beach climate region of the South Coast Air Basin.

[e] Emission factor calculated using Equations 1a and 2 from Section 13.2.2 of *AP-42* (EPA, 2006):

Emission Factor (lb/mile) = $\{k \text{ (lb/mile)} \times [\text{Silt Content (\%)} / 12]^{a} \times [\text{Mean Vehicle Weight (tons)} / 3]^{b}\} \times [(365 - P) / 365]$

[f] Control efficiency taken from Table XI-D of the *SCAQMD CEQA Handbook* for Travel Over Unpaved Roads (SCAQMD, 2007).

Fugitive Dust Emission Factors for Truck Dumping/Loading

Truck Dumping on a Pile or Loading to a Truck from a Pile

Parameter	PM_{10}	$PM_{2.5}$
k [a]	0.35	0.053
U [b]	4.9	4.9
M [a]	12.0	12.0
Emission Factor (lb/ton) [c]	0.0001	0.00001
Reduction from Watering to Maintain 12% Moisture [d]	69%	69%
Emission Factor (Controlled, lb/ton)	0.00003	0.000004

Notes:

[a] k and M taken from Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

[b] U taken as the CalEEMod default for the Long Beach climate region of the South Coast Air Basin. Value converted from units of m/s to mph.

[c] Emission factor calculated using the following equation from Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013):

Emission Factor (lb/ton) = $k \times 0.0032 \times [U \text{ (mph)} / 5]^{1.3} / [M \text{ (\%)} / 2]^{1.4}$

[d] Control efficiency taken from Table XI-A of the *SCAQMD CEQA Handbook* for Scraper Loading and Unloading (SCAQMD, 2007).

Fugitive Dust Emission Factors for Grading

Grading Equipment Passes

Parameter	PM_{10}	$PM_{2.5}$
S [a]	7.1	7.1
F [a]	0.6	0.031
Emission Factor (lb/VMT) [b]	1.543	0.167
Reduction from Applying Soil Stabilizers [c]	84%	84%
Emission Factor (Controlled, lb/VMT)	0.247	0.027

Notes:

[a] S and F taken from Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

[b] Emission factor calculated using the following equation from Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013):

PM_{10} Emission Factor (lb/VMT) = $0.051 \times [S \text{ (mph)}]^{2.0} \times F_{PM10}$

$PM_{2.5}$ Emission Factor (lb/VMT) = $0.04 \times [S \text{ (mph)}]^{2.5} \times F_{PM2.5}$

[c] Control efficiency taken from Table XI-A of the *SCAQMD CEQA Handbook* for Post-demolition Stabilization (SCAQMD, 2007).

Fugitive Dust Emission Factors for Bulldozing

Bulldozing Equipment Passes

Parameter	PM_{10}	$PM_{2.5}$
C [a]	1.0	5.7
M [a]	7.9	7.9
s [a]	6.9	6.9
F [a]	0.75	0.105
Emission Factor (lb/hr) [b]	0.753	0.414
Reduction from Applying Soil Stabilizers [c]	84%	84%
Emission Factor (Controlled, lb/hr)	0.120	0.066

Notes:

[a] C, M, s, and F taken from Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013). These values are consistent with the CalEEMod defaults for the South Coast Air Basin.

[b] Emission factor calculated using the following equation from Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013):

PM_{10} Emission Factor (lb/hr) = $\{[C \times s \text{ (\%)}^{1.5}] / [M \text{ (\%)}^{1.4}]\} \times F_{PM10}$

$PM_{2.5}$ Emission Factor (lb/hr) = $\{[C \times s \text{ (\%)}^{1.2}] / [M \text{ (\%)}^{1.3}]\} \times F_{PM2.5}$

[c] Control efficiency taken from Table XI-A of the *SCAQMD CEQA Handbook* for Post-demolition Stabilization (SCAQMD, 2007).

Table 5.1A.4 Offsite Motor Vehicle Exhaust and Fugitive Dust Emissions

Offsite Vehicle Usage During Combined-Cycle Block Construction

Vehicle Type	Number per Day																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks[a]	0.00	0.00	0.00	0.00	0.00	0.00	13.00	17.00	19.00	21.00	23.00	25.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	31.00	27.00	19.00	15.00	14.00	0.00	0.00
Material Hauling Trucks[b]	0.00	0.00	0.00	0.00	0.00	0.00	97.00	113.00	162.00	178.00	334.00	359.00	363.00	337.00	354.00	338.00	306.00	276.00	152.00	90.00	92.00	92.00	92.00	92.00	76.00	60.00	46.00	32.00	30.00	43.00	41.00	35.00	0.00	0.00
Construction Worker Commute[c]	4.00	9.00	9.00	10.00	12.00	18.00	95.00	119.00	140.00	141.00	149.00	163.00	178.00	210.00	227.00	245.00	261.00	282.00	297.00	295.00	297.00	300.00	292.00	294.00	290.00	306.00	304.00	298.00	286.00	246.00	214.00	93.00	50.00	42.00

Notes:
[a] Offsite Delivery Trucks include trucks transporting "Gases and weld supply trucks", "Fuel trucks", and "Sanitary service trucks", as provided in 'CEC_Matrix_To_AES__070115.xlsx'. It was assumed that these trucks travel directly to AEC.
[b] Material Hauling Trucks include trucks transporting "Mobilize & demobilize", "Earthwork & pile", "Concrete trucks", "Equipment deliveries", "Heavy haul truckloads - HRSG modules", "Heavy haul truckloads - STG", "GE Heavy haul truckloads - CTG's", "Heavy haul truckloads - GSU's", "Pipe-valves-supports Deliveries", "Electrical bulk deliveries", "Lumber deliveries", "Structural steel deliveries", "Reinforcing steel deliveries", "On-site pick-up trucks", and "Lay-down transport trucks", as provided in 'CEC_Matrix_To_AES__070115.xlsx'.
[c] Assumed 1 commute per 1 worker; number of workers taken from 'CEC_Matrix_To_AES__070115.xlsx'.

Offsite Vehicle CO Emissions from Combined-Cycle Block Construction

Vehicle Type	CO Emissions (lb/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.000	0.000	0.000	0.000	0.000	0.000	0.238	0.311	0.347	0.384	0.420	0.457	0.567	0.567	0.567	0.567	0.567	0.567	0.567	0.567	0.567	0.567	0.567	0.567	0.567	0.567	0.567	0.567	0.494	0.347	0.274	0.256	0.000	0.000
Material Hauling Trucks	0.000	0.000	0.000	0.000	0.000	0.000	4.939	5.754	8.249	9.064	17.008	18.281	18.485	17.161	18.026	17.212	15.582	14.054	7.740	4.583	4.685	4.685	4.685	4.685	3.870	3.055	2.342	1.630	1.528	2.190	2.088	1.782	0.000	0.000
Construction Worker Commute	0.353	0.794	0.794	0.882	1.058	1.587	8.376	10.492	12.344	12.432	13.137	14.371	15.694	18.515	20.014	21.601	23.012	24.864	26.186	26.010	26.186	26.451	25.745	25.922	25.569	26.980	26.803	26.274	25.216	21.689	18.868	8.200	4.408	3.703
Offsite Total (lb/day)	**0.353**	**0.794**	**0.794**	**0.882**	**1.058**	**1.587**	**13.553**	**16.557**	**20.940**	**21.880**	**30.566**	**33.109**	**34.745**	**36.243**	**38.607**	**39.380**	**39.161**	**39.485**	**34.493**	**31.159**	**31.438**	**31.702**	**30.997**	**31.173**	**30.006**	**30.602**	**29.712**	**28.470**	**27.237**	**24.226**	**21.230**	**10.238**	**4.408**	**3.703**
Vehicle Type	CO Emissions (lb/month)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.000	0.000	0.000	0.000	0.000	0.000	5.466	7.147	7.988	8.829	9.670	10.511	13.034	13.034	13.034	13.034	13.034	13.034	13.034	13.034	13.034	13.034	13.034	13.034	13.034	13.034	13.034	13.034	11.352	7.988	6.307	5.886	0.000	0.000
Material Hauling Trucks	0.000	0.000	0.000	0.000	0.000	0.000	113.607	132.346	189.735	208.475	391.183	420.463	425.148	394.696	414.607	395.868	358.389	323.253	178.023	105.409	107.751	107.751	107.751	107.751	89.012	70.272	53.875	37.479	35.136	50.362	48.019	40.992	0.000	0.000
Construction Worker Commute	8.112	18.251	18.251	20.279	24.335	36.502	192.648	241.318	283.903	285.931	302.154	330.544	360.962	425.854	460.328	496.830	529.276	571.862	602.280	598.224	602.280	608.364	592.140	596.196	588.085	620.531	616.475	604.308	579.973	498.858	433.966	188.593	101.394	85.171
Offsite Total (lb/month)	**8.11**	**18.25**	**18.25**	**20.28**	**24.33**	**36.50**	**311.72**	**380.81**	**481.63**	**503.23**	**703.01**	**761.52**	**799.14**	**833.58**	**887.97**	**905.73**	**900.70**	**908.15**	**793.34**	**716.67**	**723.06**	**729.15**	**712.93**	**716.98**	**690.13**	**703.84**	**683.38**	**654.82**	**626.46**	**557.21**	**488.29**	**235.47**	**101.39**	**85.17**
Offsite Total (tpy)	**4.84**																																	

Offsite Vehicle VOC Emissions from Combined-Cycle Block Construction

Vehicle Type	VOC Emissions (lb/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.000	0.000	0.000	0.000	0.000	0.000	0.060	0.079	0.088	0.097	0.107	0.116	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.144	0.125	0.088	0.070	0.065	0.000	0.000
Material Hauling Trucks	0.000	0.000	0.000	0.000	0.000	0.000	1.336	1.556	2.231	2.451	4.600	4.944	4.999	4.641	4.875	4.655	4.214	3.801	2.093	1.239	1.267	1.267	1.267	1.267	1.047	0.826	0.634	0.441	0.413	0.592	0.565	0.482	0.000	0.000
Construction Worker Commute	0.008	0.018	0.018	0.020	0.024	0.036	0.190	0.238	0.280	0.282	0.298	0.326	0.356	0.421	0.455	0.491	0.523	0.565	0.595	0.591	0.595	0.601	0.585	0.589	0.581	0.613	0.609	0.597	0.573	0.493	0.429	0.186	0.100	0.084
Offsite Total (lb/day)	**0.008**	**0.018**	**0.018**	**0.020**	**0.024**	**0.036**	**1.586**	**1.873**	**2.599**	**2.831**	**5.005**	**5.386**	**5.499**	**5.205**	**5.473**	**5.289**	**4.881**	**4.509**	**2.832**	**1.974**	**2.005**	**2.011**	**1.995**	**1.999**	**1.771**	**1.583**	**1.386**	**1.181**	**1.111**	**1.173**	**1.063**	**0.733**	**0.100**	**0.084**
Vehicle Type	VOC Emissions (lb/month)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.000	0.000	0.000	0.000	0.000	0.000	1.386	1.813	2.026	2.239	2.452	2.666	3.305	3.305	3.305	3.305	3.305	3.305	3.305	3.305	3.305	3.305	3.305	3.305	3.305	3.305	3.305	3.305	2.879	2.026	1.599	1.493	0.000	0.000
Material Hauling Trucks	0.000	0.000	0.000	0.000	0.000	0.000	30.725	35.793	51.314	56.382	105.795	113.713	114.980	106.745	112.130	107.062	96.926	87.423	48.146	28.508	29.141	29.141	29.141	29.141	24.073	19.005	14.571	10.136	9.503	13.620	12.987	11.086	0.000	0.000
Construction Worker Commute	0.184	0.415	0.415	0.461	0.553	0.829	4.376	5.481	6.448	6.494	6.863	7.508	8.198	9.672	10.455	11.284	12.021	12.989	13.679	13.587	13.679	13.818	13.449	13.541	13.357	14.094	14.002	13.725	13.173	11.330	9.857	4.283	2.303	1.934
Offsite Total (lb/month)	**0.18**	**0.41**	**0.41**	**0.46**	**0.55**	**0.83**	**36.49**	**43.09**	**59.79**	**65.12**	**115.11**	**123.89**	**126.48**	**119.72**	**125.89**	**121.65**	**112.25**	**103.72**	**65.13**	**45.40**	**46.13**	**46.26**	**45.90**	**45.99**	**40.74**	**36.40**	**31.88**	**27.17**	**25.55**	**26.98**	**24.44**	**16.86**	**2.30**	**1.93**
Offsite Total (tpy)	**0.59**																																	

Offsite Vehicle SO_X Emissions from Combined-Cycle Block Construction

Vehicle Type	SO_X Emissions (lb/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0063	0.0083	0.0092	0.0102	0.0112	0.0122	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0151	0.0131	0.0092	0.0073	0.0068	0.0000	0.0000
Material Hauling Trucks	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.1153	0.1343	0.1925	0.2115	0.3969	0.4266	0.4314	0.4005	0.4207	0.4016	0.3636	0.3280	0.1806	0.1069	0.1093	0.1093	0.1093	0.1093	0.0903	0.0713	0.0547	0.0380	0.0356	0.0511	0.0487	0.0416	0.0000	0.0000
Construction Worker Commute	0.0008	0.0017	0.0017	0.0019	0.0023	0.0035	0.0182	0.0228	0.0268	0.0270	0.0286	0.0312	0.0341	0.0403	0.0435	0.0470	0.0500	0.0541	0.0569	0.0566	0.0569	0.0575	0.0560	0.0564	0.0556	0.0587	0.0583	0.0571	0.0548	0.0472	0.0410	0.0178	0.0096	0.0081
Offsite Total (lb/day)	**0.0008**	**0.0017**	**0.0017**	**0.0019**	**0.0023**	**0.0035**	**0.1398**	**0.1654**	**0.2286**	**0.2488**	**0.4366**	**0.4700**	**0.4805**	**0.4558**	**0.4792**	**0.4637**	**0.4287**	**0.3971**	**0.2526**	**0.1786**	**0.1813**	**0.1819**	**0.1804**	**0.1808**	**0.1610**	**0.1450**	**0.1280**	**0.1102**	**0.1036**	**0.1075**	**0.0970**	**0.0662**	**0.0096**	**0.0081**
Vehicle Type	SO_X Emissions (lb/month)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.000	0.000	0.000	0.000	0.000	0.000	0.145	0.190	0.212	0.235	0.257	0.280	0.347	0.347	0.347	0.347	0.347	0.347	0.347	0.347	0.347	0.347	0.347	0.347	0.347	0.347	0.347	0.347	0.302	0.212	0.168	0.157	0.000	0.000
Material Hauling Trucks	0.000	0.000	0.000	0.000	0.000	0.000	2.651	3.088	4.428	4.865	9.129	9.812	9.921	9.210	9.675	9.238	8.363	7.543	4.154	2.460	2.514	2.514	2.514	2.514	2.077	1.640	1.257	0.875	0.820	1.175	1.121	0.957	0.000	0.000
Construction Worker Commute	0.018	0.040	0.040	0.044	0.053	0.079	0.419	0.525	0.617	0.622	0.657	0.719	0.785	0.926	1.001	1.080	1.151	1.243	1.310	1.301	1.310	1.323	1.288	1.296	1.279	1.349	1.340	1.314	1.261	1.085	0.944	0.410	0.220	0.185
Offsite Total (lb/month)	**0.018**	**0.040**	**0.040**	**0.044**	**0.053**	**0.079**	**3.215**	**3.803**	**5.257**	**5.721**	**10.043**	**10.810**	**11.053**	**10.483**	**11.023**	**10.665**	**9.861**	**9.133**	**5.811**	**4.107**	**4.171**	**4.184**	**4.149**	**4.157**	**3.703**	**3.336**	**2.944**	**2.535**	**2.383**	**2.472**	**2.232**	**1.523**	**0.220**	**0.185**
Offsite Total (tpy)	**0.052**																																	

Table 5.1A.4 Offsite Motor Vehicle Exhaust and Fugitive Dust Emissions

Offsite Vehicle NO_X Emissions from Combined-Cycle Block Construction

Vehicle Type	NO_X Emissions (lb/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.00	0.00	0.00	0.00	0.00	0.00	2.04	2.40	2.68	2.96	3.25	3.53	4.37	4.37	4.37	4.37	4.37	4.37	4.37	4.09	4.09	4.09	4.09	4.09	4.09	4.09	4.09	4.09	3.56	2.51	1.98	1.69	0.00	0.00
Material Hauling Trucks	0.00	0.00	0.00	0.00	0.00	0.00	36.48	37.88	54.31	59.68	111.98	120.36	121.70	112.98	118.68	113.32	102.59	92.53	50.96	27.24	27.84	27.84	27.84	27.84	23.00	18.16	13.92	9.68	9.08	13.01	12.41	8.88	0.00	0.00
Construction Worker Commute	0.03	0.07	0.07	0.08	0.10	0.15	0.77	0.84	0.99	0.99	1.05	1.15	1.25	1.48	1.60	1.72	1.84	1.98	2.09	1.83	1.85	1.86	1.82	1.83	1.80	1.90	1.89	1.85	1.78	1.53	1.33	0.52	0.28	0.23
Offsite Total (lb/day)	**0.03**	**0.07**	**0.07**	**0.08**	**0.10**	**0.15**	**39.29**	**41.12**	**57.98**	**63.63**	**116.27**	**125.03**	**127.32**	**118.83**	**124.65**	**119.41**	**108.80**	**98.89**	**57.42**	**33.16**	**33.77**	**33.79**	**33.74**	**33.76**	**28.89**	**24.15**	**19.90**	**15.62**	**14.42**	**17.05**	**15.72**	**11.08**	**0.28**	**0.23**
Vehicle Type	NO_X Emissions (lb/month)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.00	0.00	0.00	0.00	0.00	0.00	46.85	55.17	61.67	68.16	74.65	81.14	100.61	100.61	100.61	100.61	100.61	100.61	100.61	94.01	94.01	94.01	94.01	94.01	94.01	94.01	94.01	94.01	81.88	57.62	45.49	38.83	0.00	0.00
Material Hauling Trucks	0.00	0.00	0.00	0.00	0.00	0.00	839.11	871.33	1,249.16	1,372.54	2,575.43	2,768.21	2,799.05	2,598.57	2,729.65	2,606.28	2,359.53	2,128.20	1,172.05	626.41	640.33	640.33	640.33	640.33	528.97	417.61	320.17	222.72	208.80	299.29	285.37	204.22	0.00	0.00
Construction Worker Commute	0.75	1.68	1.68	1.87	2.24	3.36	17.73	19.26	22.66	22.82	24.11	26.38	28.81	33.99	36.74	39.65	42.24	45.64	48.07	42.18	42.47	42.89	41.75	42.04	41.46	43.75	43.47	42.61	40.89	35.17	30.60	11.90	6.40	5.37
Offsite Total (lb/month)	**0.75**	**1.68**	**1.68**	**1.87**	**2.24**	**3.36**	**903.70**	**945.76**	**1,333.49**	**1,463.51**	**2,674.20**	**2,875.73**	**2,928.47**	**2,733.17**	**2,867.00**	**2,746.54**	**2,502.38**	**2,274.46**	**1,320.73**	**762.61**	**776.81**	**777.24**	**776.10**	**776.38**	**664.45**	**555.37**	**457.65**	**359.35**	**331.58**	**392.08**	**361.45**	**254.95**	**6.40**	**5.37**
Offsite Total (tpy)	**13.33**																																	

Offsite Vehicle PM_{10} Emissions from Combined-Cycle Block Construction

Vehicle Type	PM_{10} Emissions (lb/day)[a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.000	0.000	0.000	0.000	0.000	0.000	0.171	0.219	0.244	0.270	0.296	0.322	0.399	0.399	0.399	0.399	0.399	0.399	0.399	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.397	0.346	0.243	0.192	0.178	0.000	0.000
Material Hauling Trucks	0.000	0.000	0.000	0.000	0.000	0.000	4.146	4.706	6.746	7.412	13.909	14.950	15.116	14.034	14.742	14.075	12.743	11.493	6.330	3.688	3.770	3.770	3.770	3.770	3.114	2.459	1.885	1.311	1.229	1.762	1.680	1.393	0.000	0.000
Construction Worker Commute	0.090	0.203	0.203	0.225	0.270	0.405	2.138	2.677	3.150	3.172	3.352	3.667	4.005	4.724	5.107	5.512	5.872	6.344	6.682	6.636	6.681	6.748	6.568	6.613	6.523	6.883	6.838	6.703	6.433	5.534	4.814	2.092	1.125	0.945
Offsite Total (lb/day)	**0.090**	**0.203**	**0.203**	**0.225**	**0.270**	**0.405**	**6.455**	**7.602**	**10.140**	**10.855**	**17.557**	**18.939**	**19.520**	**19.157**	**20.247**	**19.986**	**19.014**	**18.237**	**13.410**	**10.721**	**10.848**	**10.915**	**10.735**	**10.780**	**10.035**	**9.739**	**9.120**	**8.412**	**8.009**	**7.539**	**6.686**	**3.663**	**1.125**	**0.945**
Vehicle Type	PM_{10} Emissions (lb/month)[a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.000	0.000	0.000	0.000	0.000	0.000	3.942	5.031	5.623	6.215	6.807	7.399	9.174	9.174	9.174	9.174	9.174	9.174	9.174	9.135	9.135	9.135	9.135	9.135	9.135	9.135	9.135	9.135	7.956	5.599	4.420	4.092	0.000	0.000
Material Hauling Trucks	0.000	0.000	0.000	0.000	0.000	0.000	95.351	108.230	155.162	170.487	319.902	343.847	347.678	322.775	339.058	323.733	293.084	264.350	145.584	84.822	86.707	86.707	86.707	86.707	71.627	56.548	43.353	30.159	28.274	40.526	38.641	32.046	0.000	0.000
Construction Worker Commute	2.070	4.658	4.658	5.176	6.211	9.316	49.169	61.576	72.442	72.960	77.099	84.343	92.105	108.663	117.460	126.774	135.053	145.919	153.681	152.626	153.661	155.213	151.074	152.109	150.039	158.317	157.283	154.178	147.970	127.275	110.719	48.109	25.865	21.727
Offsite Total (lb/month)	**2.07**	**4.66**	**4.66**	**5.18**	**6.21**	**9.32**	**148.46**	**174.84**	**233.23**	**249.66**	**403.81**	**435.59**	**448.96**	**440.61**	**465.69**	**459.68**	**437.31**	**419.44**	**308.44**	**246.58**	**249.50**	**251.05**	**246.92**	**247.95**	**230.80**	**224.00**	**209.77**	**193.47**	**184.20**	**173.40**	**153.78**	**84.25**	**25.87**	**21.73**
Offsite Total (tpy)	**2.28**																																	

Notes:

[a] PM_{10} Emissions include emissions from exhaust and paved roads.

Offsite Vehicle $PM_{2.5}$ Emissions from Combined-Cycle Block Construction

Vehicle Type	$PM_{2.5}$ Emissions (lb/day)[a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.000	0.000	0.000	0.000	0.000	0.000	0.057	0.069	0.078	0.086	0.094	0.102	0.127	0.127	0.127	0.127	0.127	0.127	0.127	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.109	0.077	0.060	0.055	0.000	0.000
Material Hauling Trucks	0.000	0.000	0.000	0.000	0.000	0.000	1.571	1.711	2.454	2.696	5.059	5.437	5.498	5.104	5.362	5.119	4.635	4.180	2.302	1.306	1.335	1.335	1.335	1.335	1.103	0.871	0.667	0.464	0.435	0.624	0.595	0.469	0.000	0.000
Construction Worker Commute	0.025	0.055	0.055	0.061	0.074	0.110	0.583	0.730	0.858	0.865	0.914	0.999	1.091	1.288	1.392	1.502	1.600	1.729	1.821	1.808	1.820	1.839	1.790	1.802	1.777	1.875	1.863	1.826	1.753	1.508	1.311	0.570	0.306	0.257
Offsite Total (lb/day)	**0.025**	**0.055**	**0.055**	**0.061**	**0.074**	**0.110**	**2.211**	**2.511**	**3.390**	**3.646**	**6.066**	**6.539**	**6.716**	**6.518**	**6.880**	**6.748**	**6.362**	**6.036**	**4.250**	**3.239**	**3.280**	**3.298**	**3.249**	**3.261**	**3.005**	**2.871**	**2.655**	**2.415**	**2.297**	**2.208**	**1.967**	**1.093**	**0.306**	**0.257**
Vehicle Type	$PM_{2.5}$ Emissions (lb/month)[a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.000	0.000	0.000	0.000	0.000	0.000	1.312	1.597	1.785	1.972	2.160	2.348	2.912	2.912	2.912	2.912	2.912	2.912	2.912	2.874	2.874	2.874	2.874	2.874	2.874	2.874	2.874	2.874	2.503	1.761	1.391	1.266	0.000	0.000
Material Hauling Trucks	0.000	0.000	0.000	0.000	0.000	0.000	36.131	39.364	56.434	62.008	116.351	125.060	126.454	117.396	123.318	117.745	106.597	96.146	52.950	30.032	30.700	30.700	30.700	30.700	25.361	20.022	15.350	10.678	10.011	14.349	13.681	10.780	0.000	0.000
Construction Worker Commute	0.565	1.270	1.270	1.411	1.694	2.540	13.407	16.781	19.743	19.884	21.012	22.986	25.101	29.614	32.011	34.549	36.806	39.767	41.882	41.582	41.863	42.286	41.159	41.441	40.877	43.132	42.850	42.004	40.313	34.675	30.164	13.103	7.044	5.917
Offsite Total (lb/month)	**0.56**	**1.27**	**1.27**	**1.41**	**1.69**	**2.54**	**50.85**	**57.74**	**77.96**	**83.86**	**139.52**	**150.39**	**154.47**	**149.92**	**158.24**	**155.21**	**146.31**	**138.83**	**97.74**	**74.49**	**75.44**	**75.86**	**74.73**	**75.01**	**69.11**	**66.03**	**61.07**	**55.56**	**52.83**	**50.78**	**45.24**	**25.15**	**7.04**	**5.92**
Offsite Total (tpy)	**0.76**																																	

Notes:

[a] $PM_{2.5}$ Emissions include emissions from exhaust and paved roads.

Offsite Vehicle CO_2 Emissions from Combined-Cycle Block Construction

Vehicle Type	CO_2 Emissions (metric tons/day)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.000	0.000	0.000	0.000	0.000	0.000	0.329	0.430	0.480	0.531	0.581	0.632	0.784	0.784	0.784	0.784	0.784	0.784	0.784	0.784	0.784	0.784	0.784	0.784	0.784	0.784	0.784	0.784	0.682	0.480	0.379	0.354	0.000	0.000
Material Hauling Trucks	0.000	0.000	0.000	0.000	0.000	0.000	5.579	6.499	9.318	10.238	19.210	20.648	20.878	19.383	20.361	19.440	17.600	15.874	8.742	5.176	5.291	5.291	5.291	5.291	4.371	3.451	2.646	1.841	1.725	2.473	2.358	2.013	0.000	0.000
Construction Worker Commute	0.045	0.102	0.102	0.113	0.136	0.204	1.076	1.348	1.585	1.597	1.687	1.846	2.016	2.378	2.571	2.775	2.956	3.194	3.364	3.341	3.364	3.397	3.307	3.330	3.284	3.465	3.443	3.375	3.239	2.786	2.424	1.053	0.566	0.476
Offsite Total (metric tons/day)	**0.045**	**0.102**	**0.102**	**0.113**	**0.136**	**0.204**	**6.984**	**8.277**	**11.383**	**12.365**	**21.479**	**23.126**	**23.678**	**22.545**	**23.715**	**22.999**	**21.339**	**19.852**	**12.889**	**9.301**	**9.439**	**9.472**	**9.382**	**9.405**	**8.439**	**7.700**	**6.872**	**5.999**	**5.647**	**5.739**	**5.161**	**3.420**	**0.566**	**0.476**
Vehicle Type	CO_2 Emissions (metric tons/month)																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.000	0.000	0.000	0.000	0.000	0.000	7.557	9.883	11.045	12.208	13.371	14.533	18.021	18.021	18.021	18.021	18.021	18.021	18.021	18.021	18.021	18.021	18.021	18.021	18.021	18.021	18.021	18.021	15.696	11.045	8.720	8.139	0.000	0.000
Material Hauling Trucks	0.000	0.000	0.000	0.000	0.000	0.000	128.318	149.484	214.305	235.471	441.839	474.910	480.202	445.807	468.296	447.130	404.798	365.112	201.076	119.058	121.704	121.704	121.704	121.704	100.538	79.372	60.852	42.332	39.686	56.883	54.238	46.300	0.000	0.000
Construction Worker Commute	1.042	2.344	2.344	2.605	3.126	4.689	24.745	30.996	36.466	36.727	38.811	42.457	46.364	54.700	59.128	63.816	67.984	73.454	77.361	76.840	77.361	78.142	76.058	76.579	75.537	79.705	79.184	77.621	74.496	64.077	55.741	24.224	13.024	10.940
Offsite Total (metric tons/month)	**1.04**	**2.34**	**2.34**	**2.60**	**3.13**	**4.69**	**160.62**	**190.36**	**261.82**	**284.41**	**494.02**	**531.90**	**544.59**	**518.53**	**545.44**	**528.97**	**490.80**	**456.59**	**296.46**	**213.92**	**217.09**	**217.87**	**215.78**	**216.30**	**194.10**	**177.10**	**158.06**	**137.97**	**129.88**	**132.01**	**118.70**	**78.66**	**13.02**	**10.94**
Offsite Total (metric tons/year)	**5,167.44**																																	

Table 5.1A.4 Offsite Motor Vehicle Exhaust and Fugitive Dust Emissions

Offsite Vehicle N_2O Emissions from Combined-Cycle Block Construction

Vehicle Type	N_2O Emissions (metric tons/day)																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Offsite Delivery Trucks	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000086	0.00000113	0.00000126	0.00000139	0.00000152	0.00000166	0.00000205	0.00000205	0.00000205	0.00000205	0.00000205
Material Hauling Trucks	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00000000	0.00001862	0.00002170	0.00003110	0.00003418	0.00006413	0.00006893	0.00006970	0.00006470	0.00006797	0.00006490	0.00005875
Construction Worker Commute	0.00000042	0.00000095	0.00000095	0.00000106	0.00000127	0.00000191	0.00001005	0.00001259	0.00001482	0.00001492	0.00001577	0.00001725	0.00001884	0.00002223	0.00002403	0.00002593	0.00002762
Offsite Total (metric tons/day)	**0.0000004**	**0.0000010**	**0.0000010**	**0.0000011**	**0.0000013**	**0.0000019**	**0.0000295**	**0.0000354**	**0.0000472**	**0.0000505**	**0.0000814**	**0.0000878**	**0.0000906**	**0.0000890**	**0.0000940**	**0.0000929**	**0.0000884**

Vehicle Type	N_2O Emissions (metric tons/day)																
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.00000205	0.00000205	0.00000205	0.00000205	0.00000205	0.00000205	0.00000205	0.00000205	0.00000205	0.00000205	0.00000205	0.00000179	0.00000126	0.00000099	0.00000093	0.00000000	0.00000000
Material Hauling Trucks	0.00005299	0.00002918	0.00001728	0.00001766	0.00001766	0.00001766	0.00001766	0.00001459	0.00001152	0.00000883	0.00000614	0.00000576	0.00000826	0.00000787	0.00000672	0.00000000	0.00000000
Construction Worker Commute	0.00002985	0.00003143	0.00003122	0.00003143	0.00003175	0.00003091	0.00003112	0.00003069	0.00003239	0.00003218	0.00003154	0.00003027	0.00002604	0.00002265	0.00000984	0.00000529	0.00000445
Offsite Total (metric tons/day)	**0.0000849**	**0.0000627**	**0.0000506**	**0.0000512**	**0.0000515**	**0.0000506**	**0.0000508**	**0.0000473**	**0.0000460**	**0.0000431**	**0.0000397**	**0.0000378**	**0.0000356**	**0.0000315**	**0.0000175**	**0.0000053**	**0.0000044**

Vehicle Type	N_2O Emissions (metric tons/month)																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Offsite Delivery Trucks	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000198	0.0000259	0.0000289	0.0000320	0.0000350	0.0000381	0.0000472	0.0000472	0.0000472	0.0000472	0.0000472
Material Hauling Trucks	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0004284	0.0004990	0.0007154	0.0007860	0.0014749	0.0015853	0.0016030	0.0014882	0.0015633	0.0014926	0.0013513
Construction Worker Commute	0.0000097	0.0000219	0.0000219	0.0000243	0.0000292	0.0000438	0.0002313	0.0002897	0.0003408	0.0003432	0.0003627	0.0003968	0.0004333	0.0005112	0.0005526	0.0005964	0.0006354
Offsite Total (metric tons/month)	**0.000010**	**0.000022**	**0.000022**	**0.000024**	**0.000029**	**0.000044**	**0.000679**	**0.000815**	**0.001085**	**0.001161**	**0.001873**	**0.002020**	**0.002084**	**0.002047**	**0.002163**	**0.002136**	**0.002034**
Offsite Total (metric tons/year)	**0.021**																

Vehicle Type	N_2O Emissions (metric tons/month)																
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.0000472	0.0000472	0.0000472	0.0000472	0.0000472	0.0000472	0.0000472	0.0000472	0.0000472	0.0000472	0.0000472	0.0000411	0.0000289	0.0000229	0.0000213	0.0000000	0.0000000
Material Hauling Trucks	0.0012188	0.0006712	0.0003974	0.0004063	0.0004063	0.0004063	0.0004063	0.0003356	0.0002650	0.0002031	0.0001413	0.0001325	0.0001899	0.0001811	0.0001546	0.0000000	0.0000000
Construction Worker Commute	0.0006865	0.0007230	0.0007181	0.0007230	0.0007303	0.0007108	0.0007157	0.0007060	0.0007449	0.0007400	0.0007254	0.0006962	0.0005988	0.0005209	0.0002264	0.0001217	0.0001022
Offsite Total (metric tons/month)	**0.001953**	**0.001441**	**0.001163**	**0.001176**	**0.001184**	**0.001164**	**0.001169**	**0.001089**	**0.001057**	**0.000990**	**0.000914**	**0.000870**	**0.000818**	**0.000725**	**0.000402**	**0.000122**	**0.000102**

Offsite Vehicle CH_4 Emissions from Combined-Cycle Block Construction

Vehicle Type	CH_4 Emissions (metric tons/day)																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Offsite Delivery Trucks	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000009	0.0000012	0.0000013	0.0000015	0.0000016	0.0000018	0.0000022	0.0000022	0.0000022	0.0000022	0.0000022
Material Hauling Trucks	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000000	0.0000198	0.0000231	0.0000330	0.0000363	0.0000681	0.0000732	0.0000741	0.0000687	0.0000722	0.0000690	0.0000624
Construction Worker Commute	0.0000020	0.0000046	0.0000046	0.0000051	0.0000061	0.0000092	0.0000483	0.0000605	0.0000712	0.0000717	0.0000758	0.0000829	0.0000905	0.0001068	0.0001155	0.0001246	0.0001327
Offsite Total (metric tons/day)	**0.0000020**	**0.0000046**	**0.0000046**	**0.0000051**	**0.0000061**	**0.0000092**	**0.0000690**	**0.0000848**	**0.0001056**	**0.0001095**	**0.0001455**	**0.0001579**	**0.0001668**	**0.0001777**	**0.0001899**	**0.0001957**	**0.0001974**

Vehicle Type	CH_4 Emissions (metric tons/day)																
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.0000022	0.0000022	0.0000022	0.0000022	0.0000022	0.0000022	0.0000022	0.0000022	0.0000022	0.0000022	0.0000022	0.0000019	0.0000013	0.0000011	0.0000010	0.0000000	0.0000000
Material Hauling Trucks	0.0000563	0.0000310	0.0000184	0.0000188	0.0000188	0.0000188	0.0000188	0.0000155	0.0000122	0.0000094	0.0000065	0.0000061	0.0000088	0.0000084	0.0000071	0.0000000	0.0000000
Construction Worker Commute	0.0001434	0.0001511	0.0001500	0.0001511	0.0001526	0.0001485	0.0001495	0.0001475	0.0001556	0.0001546	0.0001516	0.0001455	0.0001251	0.0001088	0.0000473	0.0000254	0.0000214
Offsite Total (metric tons/day)	**0.0002019**	**0.0001842**	**0.0001706**	**0.0001720**	**0.0001735**	**0.0001695**	**0.0001705**	**0.0001652**	**0.0001701**	**0.0001662**	**0.0001603**	**0.0001535**	**0.0001352**	**0.0001183**	**0.0000554**	**0.0000254**	**0.0000214**

Vehicle Type	CH_4 Emissions (metric tons/month)																
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Offsite Delivery Trucks	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000021	0.000028	0.000031	0.000034	0.000037	0.000040	0.000050	0.000050	0.000050	0.000050	0.000050
Material Hauling Trucks	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000455	0.000530	0.000760	0.000835	0.001567	0.001684	0.001703	0.001581	0.001661	0.001586	0.001436
Construction Worker Commute	0.000047	0.000105	0.000105	0.000117	0.000140	0.000211	0.001111	0.001392	0.001638	0.001649	0.001743	0.001907	0.002082	0.002457	0.002656	0.002866	0.003053
Offsite Total (metric tons/month)	**0.00005**	**0.00011**	**0.00011**	**0.00012**	**0.00014**	**0.00021**	**0.00159**	**0.00195**	**0.00243**	**0.00252**	**0.00335**	**0.00363**	**0.00384**	**0.00409**	**0.00437**	**0.00450**	**0.00454**
Offsite Total (metric tons/year)	**0.050**																

Vehicle Type	CH_4 Emissions (metric tons/month)																
	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Offsite Delivery Trucks	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000044	0.000031	0.000024	0.000023	0.000000	0.000000
Material Hauling Trucks	0.001295	0.000713	0.000422	0.000432	0.000432	0.000432	0.000432	0.000357	0.000282	0.000216	0.000150	0.000141	0.000202	0.000192	0.000164	0.000000	0.000000
Construction Worker Commute	0.003299	0.003474	0.003451	0.003474	0.003509	0.003416	0.003439	0.003392	0.003580	0.003556	0.003486	0.003346	0.002878	0.002503	0.001088	0.000585	0.000491
Offsite Total (metric tons/month)	**0.00464**	**0.00424**	**0.00392**	**0.00396**	**0.00399**	**0.00390**	**0.00392**	**0.00380**	**0.00391**	**0.00382**	**0.00369**	**0.00353**	**0.00311**	**0.00272**	**0.00127**	**0.00058**	**0.00049**

Offsite Construction Vehicle Activity for Combined-Cycle Block Construction

Vehicle Type	Roundtrip Miles/Day	Working Days per Month[a]
Offsite Delivery Trucks[b]	13.8	23
Material Hauling Trucks[c]	40.0	23
Construction Worker Commute[b]	29.4	23

Notes:
[a] Per 'CEC_Matrix_To_AES__070115.xlsx'.
[b] Roundtrip miles/day for Offsite Delivery Trucks and Construction Worker Commute taken as the Urban, South Coast Air Basin C-NW and H-W values, respectively, from Table 4.2 of Appendix D of the *CalEEMod User's Guide* (ENVIRON, 2013).
[c] Roundtrip miles/day for Material Hauling Trucks taken as the default from Section 4.5 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

Table 5.1A.5 Equations Used to Calculate Criteria Pollutant and GHG Emissions

Equations Used to Calculate Emissions from Combined-Cycle Block Construction

Emission Source	Pollutant(s)	Equation	Variables
Construction Equipment Exhaust	CO, VOC, NO_X, SO_X, PM_{10}, and $PM_{2.5}$	E_m = EF x N x Hp x L x H / 453.6	E_m = Emissions (lb/month)
			EF = Emission factor (g/bhp-hr)
			N = Number of pieces of equipment
			Hp = Average horsepower
			L = Average load factor
			H = Hours per month
			453.6 = Conversion from g to lb
		$E_d = E_m$ / D	E_d = Emissions (lb/day)
			E_m = Emissions (lb/month)
			D = Number of construction days per month
		$E_t = \Sigma E_m$ / 2,000	E_t = Emissions (tpy)
			E_m = Emissions (lb/month)
			2,000 = Conversion from lb to tons
	CO_2	E_m = N x FC x EF x H x 0.001	E_m = Emissions (metric tons/month)
			N = Number of pieces of equipment
			FC = Fuel consumption (gallons/hour)
			EF = Emission factor (kg/gallon)
			H = Hours per month
			0.001 = Conversion from kg to metric tons
		$E_d = E_m$ / D	E_d = Emissions (metric tons/day)
			E_m = Emissions (metric tons/month)
			D = Number of construction days per month
		$E_t = \Sigma E_m$	E_t = Emissions (metric tons/year)
			E_m = Emissions (metric tons/month)
	CH_4 and N_2O	E_m = N x FC x EF x H / 1,000 x 0.001	E_m = Emissions (metric tons/month)
			N = Number of pieces of equipment
			FC = Fuel consumption (gallons/hour)
			EF = Emission factor (g/gallon)
			H = Hours per month
			1,000 = Conversion from g to kg
			0.001 = Conversion from kg to metric tons
		$E_d = E_m$ / D	E_d = Emissions (metric tons/day)
			E_m = Emissions (metric tons/month)
			D = Number of construction days per month
		$E_t = \Sigma E_m$	E_t = Emissions (metric tons/year)
			E_m = Emissions (metric tons/month)
Onsite and Offsite Vehicle Exhaust and Paved and Unpaved Road Fugitive PM_{10} and $PM_{2.5}$	CO, VOC, NO_X, SO_X, PM_{10}, and $PM_{2.5}$	E_d = N x VMT x EF / 453.6	E_d = Emissions (lb/day)
			N = Number of vehicles
			VMT = Vehicle miles traveled per day (miles/day)
			EF = EMFAC2014 emission factor (g/mile). Paved and unpaved road fugitive PM_{10} and $PM_{2.5}$ emission factors calculated per Sections 13.2.1 and 13.2.2 of *AP-42* , respectively (EPA, 2011; EPA, 2006)
			453.6 = Conversion from g to lb
		$E_m = E_d$ x D	E_m = Emissions (lb/month)
			E_d = Emissions (lb/day)
			D = Number of construction days per month
		$E_t = \Sigma E_m$ / 2,000	E_t = Emissions (tpy)
			E_m = Emissions (lb/month)
			2,000 = Conversion from lb to tons

Table 5.1A.5 Equations Used to Calculate Criteria Pollutant and GHG Emissions

Equations Used to Calculate Emissions from Combined-Cycle Block Construction

Emission Source	Pollutant(s)	Equation	Variables
Onsite and Offsite Vehicle Exhaust	CO_2	E_d = N x VMT / FE x EF x 0.001	E_d = Emissions (metric tons/day) N = Number of vehicles VMT = Vehicle miles traveled per day (miles/day) FE = Fuel economy (mpg) EF = Emission factor (kg/gallon) 0.001 = Conversion from kg to metric tons
		$E_m = E_d$ x D	E_m = Emissions (metric tons/month) E_d = Emissions (metric tons/day) D = Number of construction days per month
		$E_t = \Sigma E_m$	E_t = Emissions (metric tons/year) E_m = Emissions (metric tons/month)
	CH_4 and N_2O	E_d = N x VMT x EF / 1,000 x 0.001	E_d = Emissions (metric tons/day) N = Number of vehicles VMT = Vehicle miles traveled per day (miles/day) EF = Emission factor (g/mile) 1,000 = Conversion from g to kg 0.001 = Conversion from kg to metric tons
		$E_m = E_d$ x D	E_m = Emissions (metric tons/month) E_d = Emissions (metric tons/day) D = Number of construction days per month
		$E_t = \Sigma E_m$	E_t = Emissions (metric tons/year) E_m = Emissions (metric tons/month)
Onsite Fugitive PM_{10} and $PM_{2.5}$ from Truck Dumping/Loading	PM_{10} and $PM_{2.5}$	E_d = T x 1.2641662 x EF / D	E_d = Emissions (lb/day) T = Tons of material dumped 1.2641662 = Conversion from cubic yards to tons EF = Fugitive PM_{10} and $PM_{2.5}$ emission factors (lb/ton), calculated per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013). D = Number of construction days per month
		$E_m = E_d$ x D	E_m = Emissions (lb/month) E_d = Emissions (lb/day) D = Number of construction days per month
		$E_t = \Sigma E_m$ / 2,000	E_t = Emissions (tpy) E_m = Emissions (lb/month) 2,000 = Conversion from lb to tons
Onsite and Offsite Fugitive PM_{10} and $PM_{2.5}$ from Grading	PM_{10} and $PM_{2.5}$	E_d = EF x A / W x 43,560 / 5,280 / D	E_d = Emissions (lb/day) EF = Fugitive PM_{10} and $PM_{2.5}$ emission factors (lb/mile), calculated per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013). A = Site disturbed (acres/month) W = Grading equipment blade width (ft) 43,560 = Conversion factor from square feet to acres 5,280 = Conversion factor from feet to miles D = Number of construction days per month
		$E_m = E_d$ x D	E_m = Emissions (lb/month) E_d = Emissions (lb/day) D = Number of construction days per month
		$E_t = \Sigma E_m$ / 2,000	E_t = Emissions (tpy) E_m = Emissions (lb/month) 2,000 = Conversion from lb to tons
Onsite Fugitive PM_{10} and $PM_{2.5}$ from Bulldozing	PM_{10} and $PM_{2.5}$	E_d = EF x H / D	E_d = Emissions (lb/day) EF = Fugitive PM_{10} and $PM_{2.5}$ emission factors (lb/mile), calculated per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013). H = Hours per month for all bulldozers D = Number of construction days per month
		$E_m = E_d$ x D	E_m = Emissions (lb/month) E_d = Emissions (lb/day) D = Number of construction days per month
		$E_t = \Sigma E_m$ / 2,000	E_t = Emissions (tpy) E_m = Emissions (lb/month) 2,000 = Conversion from lb to tons

Table 5.1A.6 Number of Onsite Construction Equipment and Motor Vehicles

Number of Onsite Equipment for Combined-Cycle Block Construction

Onsite Equipment	Number per Month[a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Water Truck	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Excavator	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cranes[b]	0	0	0	0	0	0	2	2	3	3	3	4	4	4	6	6	6	6	6	7	7	7	7	7	7	7	6	6	6	6	1	1	1	0
Tractor/Loader/Backhoe[c]	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Rubber Tired Loader[d]	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Air Compressor	0	0	0	0	0	0	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	0
Forklifts[e]	0	0	0	0	0	0	2	2	3	3	3	3	3	3	3	3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0
Roller	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aerial Lifts[f]	0	0	0	0	0	0	1	1	1	2	2	3	3	4	4	4	4	4	4	5	5	6	6	6	6	6	6	6	6	6	4	2	2	0
Bore/Drill Rig	0	0	0	0	0	0	2	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fuel Truck	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Generator Sets[g]	0	0	0	0	0	0	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Plate Compactors[h]	0	0	0	0	0	0	3	4	5	5	6	6	6	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pressure Washer[i]	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sweeper/Scrubber	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0
Pumps[j]	0	0	0	0	0	0	3	3	3	3	3	3	3	2	2	2	2	2	3	3	3	3	3	3	2	2	2	2	2	1	0	0	0	0
Skid Steer Loader	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0
Welders[k]	0	0	0	0	0	0	1	1	3	3	3	3	3	3	3	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4	0	0	0	0
Other General Industrial Equipment[l]	0	0	0	0	0	0	6	8	10	10	10	10	10	10	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	4	4	4	0

Notes:

[a] Equipment counts taken from 'CEC_Matrix_To_AES__070115.xlsx

[b] Numbers presented for Cranes include the equipment counts for the Rough Terrain Hydraulic Crane 80 Ton, Hydra Lift Truck Crane 22-23 Ton, Crawler Crane 225 Ton, and Crawler Crane Maxer 2(

[c] Numbers presented for Tractor/Loader/Backhoe include the equipment counts for the Cat Backhoe 416-42

[d] Numbers presented for Rubber Tired Loader include the equipment counts for the Cat IT 914G Loade

[e] Numbers presented for Forklifts include the equipment counts for the Forklift 10,000 lb and Forklift 20,000 l

[f] Numbers presented for Aerial Lifts include the equipment counts for the Articulating Boom Lift 125', Articulating Boom Lift 135', and Reachlift 10,000

[g] Numbers presented for Generator Sets include the equipment counts for the Generator 5 kW and Industrial Welding Generator 500 Ar

[h] Numbers presented for Plate Compactors include the equipment counts for the Rammer Compactor and Concrete Power Trowe

[i] Numbers presented for Pressure Washer include the equipment counts for the Sand Blasting Pot 3-sac

[j] Numbers presented for Pumps include the equipment counts for the Hydrostatic Test Pump 4 GPM and Trash Pump 3" Ga

[k] Numbers preseted for Welders include the equipment counts for the Electric Welder 4 Pack 350 Amp and Electric Welder 8 Pack 250 Am

[l] Numbers presented for Other General Industrial Equipment include the equipment counts for Fusion Machine .50"-4", Fusion Machine 10"-18", Fusion Machine 18"-36", Fusion Machine 6"-8", and ATVs/Golfcarts. ARB radios, Concrete Vibrator, Crossing Plates or K-Rail, Electric Threading Machine 2", Lowbed Trailer, and Vibratory Plate Attachment (for RT Backhoe) were not included in the number of equipment as they were either electrically powered or not

Number of Onsite Motor Vehicles for Combined-Cycle Block Construction

Vehicle Type	Number per Month[a]																																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Onsite Pick-up Truck[b]	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Onsite Semi-truck Tractor	0	0	0	0	0	0	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	0	0	0	0
Onsite Dump Truck	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes:

[a] Vehicle counts taken from 'CEC_Matrix_To_AES__070115.xlsx

[b] Assumed only one pick-up truck would be used onsite during the course of construction activitie

Table 5.1A.7 Construction Equipment Exhaust Criteria Pollutant Emission Factors

Construction Equipment Emission Factors for Combined-Cycle Block Construction

Equipment [a]	Percent Usage [b]	Hours per Month [c]	Horsepower [d]	Load Factor [d]	Emission Factors (g/bhp-hr) [e]						Fuel Consumption (gallons/hour) [g]
					CO	VOC	NO_X	SO_X [f]	PM_{10}	$PM_{2.5}$	
Water Truck [h]	50%	115	400	0.38	2.200	0.060	0.260	0.005	0.008	0.008	7.51
Excavator	85%	196	163	0.38	3.700	0.060	0.260	0.005	0.008	0.008	2.93
Cranes	65%	150	226	0.29	2.200	0.060	0.260	0.005	0.008	0.008	3.28
Tractor/Loader/Backhoe	55%	127	98	0.37	3.700	0.060	0.260	0.005	0.008	0.008	1.61
Rubber Tired Loader	55%	127	200	0.36	2.200	0.060	0.260	0.005	0.008	0.008	3.89
Air Compressor	80%	184	78	0.48	3.700	0.060	0.260	0.006	0.008	0.008	1.77
Forklifts	75%	173	89	0.20	3.700	0.060	0.260	0.005	0.008	0.008	0.87
Roller	60%	138	81	0.38	3.700	0.060	0.260	0.005	0.008	0.008	1.72
Aerial Lifts	65%	150	63	0.31	3.700	0.120	2.740	0.005	0.008	0.008	1.20
Bore/Drill Rig	85%	196	206	0.50	2.200	0.060	0.260	0.005	0.008	0.008	5.43
Fuel Truck [h]	50%	115	400	0.38	2.200	0.060	0.260	0.005	0.008	0.008	7.51
Generator Sets	80%	184	84	0.74	3.700	0.060	0.260	0.006	0.008	0.008	1.77
Plate Compactors	70%	161	8	0.43	4.100	0.120	2.750	0.008	0.008	0.008	0.93
Pressure Washer	80%	184	13	0.30	4.100	0.120	2.750	0.008	0.008	0.008	0.93
Sweeper/Scrubber	80%	184	64	0.46	3.700	0.120	2.740	0.005	0.008	0.008	1.86
Pumps	80%	184	84	0.74	3.700	0.060	0.260	0.006	0.008	0.008	1.77
Skid Steer Loader	55%	127	65	0.37	3.700	0.120	2.740	0.005	0.008	0.008	1.36
Welders	80%	184	46	0.45	4.100	0.120	2.750	0.007	0.008	0.008	0.93
Other General Industrial Equipment	70%	161	88	0.34	3.700	0.060	0.260	0.005	0.008	0.008	1.31

Notes:

[a] Assumed all equipment is fired with diesel fuel, per Section 4.2 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

[b] Percent Usage assumed typical of power plant construction.

[c] Hours per month calculated based on the following schedule, as consistent with other construction phases:

Work hours per day:	10
Work days per month:	23

[d] Construction equipment horsepower and load factor taken from Table 3.3 of Appendix D of the *CalEEMod User's Guide* (ENVIRON, 2013).

[e] Unless otherwise noted, construction equipment emission factors taken from Table 3.5 of Appendix D of the *CalEEMod User's Guide* (ENVIRON, 2013), assuming Tier 4 Final engine controls.

[f] SO_X construction equipment emission factors taken from Table 3.4 of Appendix D of the *CalEEMod User's Guide* (ENVIRON, 2013) for the year 2017.

[g] Fuel consumption based on consumption in the OFFROAD2011 model for the South Coast Air Basin in the year 2017; value estimated by dividing the reported consumption (lb/year) by the reported activity (hours/year) and by the density of diesel fuel (assumed to be 7 lb/gallon). Since the OFFROAD2011 output did not include data for an Air Compressor, Generator Sets, Plate Compactors, Pressure Washer, Pumps, and Welders, their fuel consumption was assumed to be best represented by that for Other Construction Equipment.

[h] Horsepower, load factor, and emission factors for Off-Highway Trucks were assumed representative of Water and Fuel Trucks.

Table 5.1A.8 Onsite and Offsite Motor Vehicle Criteria Pollutant Emission Factors

Vehicle Emission Factors for Combined-Cycle Block Construction

Vehicle Type	Vehicle Class [a]	Exhaust Emission Factors (g/mile) [b]															Paved Road Emission Factors (g/mile) [c]		Fuel Economy (mpg) [d]
		CO	VOC	SO_X	NO_X 2017	NO_X 2018	NO_X 2019	NO_X 2020	PM_{10} 2017	PM_{10} 2018	PM_{10} 2019	PM_{10} 2020	$PM_{2.5}$ 2017	$PM_{2.5}$ 2018	$PM_{2.5}$ 2019	$PM_{2.5}$ 2020	PM_{10}	$PM_{2.5}$	
Onsite Pick-up Truck	Light-duty Truck	4.036	0.274	0.012	0.341	0.300	0.266	0.238	0.062	0.061	0.061	0.060	0.034	0.033	0.033	0.032	N/A	N/A	20.252
Onsite Semi-truck Tractor	Heavy-duty Diesel	4.433	1.415	0.032	19.715	19.527	19.730	19.741	0.199	0.159	0.154	0.141	0.132	0.094	0.089	0.077	N/A	N/A	5.573
Onsite Dump Truck	Heavy-duty Diesel	4.433	1.415	0.032	19.715	19.527	19.730	19.741	0.199	0.159	0.154	0.141	0.132	0.094	0.089	0.077	N/A	N/A	5.573
Offsite Delivery Trucks	Heavy-duty Diesel	0.601	0.152	0.016	5.151	4.638	4.334	3.963	0.133	0.122	0.121	0.117	0.069	0.059	0.057	0.054	0.300	0.075	5.573
Material Hauling Trucks	Heavy/Medium-duty Diesel	0.577	0.156	0.013	4.265	3.802	3.432	2.877	0.184	0.172	0.164	0.151	0.109	0.097	0.089	0.077	0.300	0.075	7.098
Construction Worker Commute	Light-duty Auto/Truck	1.360	0.031	0.003	0.125	0.109	0.096	0.086	0.047	0.047	0.047	0.047	0.020	0.019	0.019	0.019	0.300	0.075	22.787

Notes:

[a] The vehicle classes are represented as follows:

Light-duty Truck: Assumed to be 50% LDT1 Gas and 50% LDT2 Gas values.

Heavy-duty Diesel: Assumed to be 100% HHDT DSL values, per Section 4.5 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

Heavy/Medium-duty Diesel: 50% HHDT DSL and 50% MHDT DSL values, per Section 4.5 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

Light-duty Auto/Truck: 50% LDA Gas, 25% LDT1 Gas, and 25% LDT2 Gas values, per Section 4.5 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

[b] Exhaust emission factors from EMFAC2014 for the South Coast Air Basin (Los Angeles County), calendar year 2017 for CO, VOC, and SO_X. Calendar years 2017, 2018, 2019, and 2020 were used for NO_X, PM_{10}, and $PM_{2.5}$. A speed of 5 mph was assumed for onsite vehicles; a speed of 40 mph was assumed for offsite vehicles and worker commutes, which is consistent with the CalEEMod defaults. An average temperature of 68°F and humidity of 55% were used per Table B-1 of *CT-EMFAC: A Computer Model to Estimate Transportation Project Emissions* (UC Davis, 2007).

[c] Paved road emission factors calculated using CalEEMod methodology, as described below.

[d] Fuel economy from the EMFAC2014 Web Database (http://www.arb.ca.gov/emfac/2014/) for the South Coast Air Basin, calendar year 2017.

Derivation of Paved Road Emission Factors

Vehicles on Paved Roads

Parameter	PM_{10}	$PM_{2.5}$
Average Weight [a]	2.4	2.4
k [b]	1.0	0.25
sL [a]	0.1	0.1
Emission Factor (g/mile) [c]	0.300	0.075

Notes:

[a] Average Weight and sL taken as the CalEEMod defaults for the Long Beach climate region of the South Coast Air Basin.

[b] k taken from Table 13.2.1-1 of Section 13.2.1 of *AP-42* (EPA, 2011).

[c] Emission factor calculated using Equation 1 from Section 13.2.1 of *AP-42* (EPA, 2011):

Emission Factor (g/mile) = k (g/mile) x $[sL\ (g/m^2)]^{0.91}$ x $[Average\ Weight\ (tons)]^{1.02}$

Table 5.1A.9 Onsite and Offsite Greenhouse Gas Emission Factors

Greenhouse Gas Emission Factors for Combined-Cycle Block Construction

Fuel / Category Type	Emission Factor	Emission Factor Units	Emission Factor Source
CO_2 Emission Factors			
Gasoline	8.778	kg CO_2/gallon	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Table 13.1. April.
Diesel	10.206	kg CO_2/gallon	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Table 13.1. April.
N_2O Emission Factors			
Gasoline Passenger Car Model Year 2012 [a]	0.0036	g N_2O/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Table 13.5. April.
Gasoline Light-duty Truck Model Year 2012 [a]	0.0066	g N_2O/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Table 13.5. April.
Diesel Heavy-duty Truck Model Year 1960 - 2012 [a]	0.0048	g N_2O/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Table 13.5. April.
Diesel Off-road Vehicle	0.256	g N_2O/gallon	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Table 13.7. April.
CH_4 Emission Factors			
Gasoline Passenger Car Model Year 2012 [a]	0.0173	g CH_4/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Table 13.5. April.
Gasoline Light-duty Truck Model Year 2012 [a]	0.0163	g CH_4/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Table 13.5. April.
Diesel Heavy-duty Truck Model Year 1960 - 2012 [a]	0.0051	g CH_4/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Table 13.5. April.
Diesel Off-road Vehicle	0.576	g CH_4/gallon	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors*. Table 13.7. April.

Notes:

[a] Model Year 2012 was the most recent year of emission factors available. As a result, it was assumed representative of vehicles used for this project.

Table 5.1A.10 Onsite Construction Equipment Exhaust Emissions

Construction Equipment CO Emissions from Simple-Cycle Block Construction

Onsite Equipment	CO Emissions (lb/month)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Water Truck	169.56	169.56	169.56	169.56	169.56	169.56	169.56	169.56	169.56	169.56	169.56	169.56	169.56	169.56	169.56	169.56
Excavator	0.00	197.55	197.55	197.55	197.55	197.55	197.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grader	0.00	256.12	256.12	256.12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	95.04	190.09	285.13	285.13	285.13	285.13	285.13	190.09	190.09	95.04	95.04	95.04	0.00	0.00	0.00	0.00
Tractor/Loader/Backhoe	0.00	74.83	74.83	74.83	74.83	74.83	74.83	74.83	74.83	74.83	0.00	0.00	0.00	0.00	0.00	0.00
Rubber Tired Loader	88.35	88.35	176.70	176.70	176.70	176.70	88.35	88.35	88.35	88.35	88.35	88.35	0.00	0.00	0.00	0.00
Crawler Tractor	0.00	319.27	319.27	319.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Compressor	0.00	224.77	224.77	224.77	224.77	224.77	224.77	224.77	224.77	224.77	0.00	0.00	0.00	0.00	0.00	0.00
Forklift	100.18	100.18	100.18	100.18	100.18	100.18	100.18	100.18	100.18	100.18	0.00	0.00	0.00	0.00	0.00	0.00
Roller	0.00	138.59	138.59	138.59	138.59	138.59	138.59	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.00	0.00	157.17	157.17	471.52	314.34	314.34	157.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**453.14**	**1,759.32**	**2,099.89**	**2,099.89**	**1,838.84**	**1,681.66**	**1,593.31**	**1,004.96**	**847.78**	**752.74**	**352.95**	**352.95**	**169.56**	**169.56**	**169.56**	**169.56**
Onsite Total (lb/day) [a]	**19.70**	**76.49**	**91.30**	**91.30**	**79.95**	**73.12**	**69.27**	**43.69**	**36.86**	**32.73**	**15.35**	**15.35**	**7.37**	**7.37**	**7.37**	**7.37**
Offsite Total (tpy)	**7.42**															

Construction Equipment VOC Emissions from Simple-Cycle Block Construction

Onsite Equipment	VOC Emissions (lb/month)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Water Truck	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62	4.62
Excavator	0.00	3.20	3.20	3.20	3.20	3.20	3.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grader	0.00	6.99	6.99	6.99	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	2.59	5.18	7.78	7.78	7.78	7.78	7.78	5.18	5.18	2.59	2.59	2.59	0.00	0.00	0.00	0.00
Tractor/Loader/Backhoe	0.00	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	0.00	0.00	0.00	0.00	0.00	0.00
Rubber Tired Loader	2.41	2.41	4.82	4.82	4.82	4.82	2.41	2.41	2.41	2.41	2.41	2.41	0.00	0.00	0.00	0.00
Crawler Tractor	0.00	8.71	8.71	8.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Compressor	0.00	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	3.64	0.00	0.00	0.00	0.00	0.00	0.00
Forklift	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	1.62	0.00	0.00	0.00	0.00	0.00	0.00
Roller	0.00	2.25	2.25	2.25	2.25	2.25	2.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.00	0.00	2.55	2.55	7.65	5.10	5.10	2.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**11.25**	**39.84**	**47.40**	**47.40**	**36.80**	**34.25**	**31.84**	**21.25**	**18.70**	**16.11**	**9.63**	**9.63**	**4.62**	**4.62**	**4.62**	**4.62**
Onsite Total (lb/day) [a]	**0.49**	**1.73**	**2.06**	**2.06**	**1.60**	**1.49**	**1.38**	**0.92**	**0.81**	**0.70**	**0.42**	**0.42**	**0.20**	**0.20**	**0.20**	**0.20**
Offsite Total (tpy)	**0.16**															

Construction Equipment NO_X Emissions from Simple-Cycle Block Construction

Onsite Equipment	NO_X Emissions (lb/month)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Water Truck	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04	20.04
Excavator	0.00	13.88	13.88	13.88	13.88	13.88	13.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grader	0.00	30.27	30.27	30.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	11.23	22.47	33.70	33.70	33.70	33.70	33.70	22.47	22.47	11.23	11.23	11.23	0.00	0.00	0.00	0.00
Tractor/Loader/Backhoe	0.00	5.26	5.26	5.26	5.26	5.26	5.26	5.26	5.26	5.26	0.00	0.00	0.00	0.00	0.00	0.00
Rubber Tired Loader	10.44	10.44	20.88	20.88	20.88	20.88	10.44	10.44	10.44	10.44	10.44	10.44	0.00	0.00	0.00	0.00
Crawler Tractor	0.00	37.73	37.73	37.73	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Compressor	0.00	15.79	15.79	15.79	15.79	15.79	15.79	15.79	15.79	15.79	0.00	0.00	0.00	0.00	0.00	0.00
Forklift	7.04	7.04	7.04	7.04	7.04	7.04	7.04	7.04	7.04	7.04	0.00	0.00	0.00	0.00	0.00	0.00
Roller	0.00	9.74	9.74	9.74	9.74	9.74	9.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.00	0.00	11.04	11.04	33.13	22.09	22.09	11.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**48.75**	**172.66**	**205.38**	**205.38**	**159.47**	**148.42**	**137.98**	**92.08**	**81.04**	**69.81**	**41.71**	**41.71**	**20.04**	**20.04**	**20.04**	**20.04**
Onsite Total (lb/day) [a]	**2.12**	**7.51**	**8.93**	**8.93**	**6.93**	**6.45**	**6.00**	**4.00**	**3.52**	**3.04**	**1.81**	**1.81**	**0.87**	**0.87**	**0.87**	**0.87**
Offsite Total (tpy)	**0.70**															

Table 5.1A.10 Onsite Construction Equipment Exhaust Emissions

Construction Equipment SO_X Emissions from Simple-Cycle Block Construction

Onsite Equipment	SO_X Emissions (lb/month)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Water Truck	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
Excavator	0.00	0.26	0.26	0.26	0.26	0.26	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grader	0.00	0.57	0.57	0.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	0.21	0.42	0.64	0.64	0.64	0.64	0.64	0.42	0.42	0.21	0.21	0.21	0.00	0.00	0.00	0.00
Tractor/Loader/Backhoe	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.00	0.00	0.00	0.00	0.00	0.00
Rubber Tired Loader	0.19	0.19	0.39	0.39	0.39	0.39	0.19	0.19	0.19	0.19	0.19	0.19	0.00	0.00	0.00	0.00
Crawler Tractor	0.00	0.71	0.71	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Compressor	0.00	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.00	0.00	0.00	0.00	0.00	0.00
Forklift	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.00	0.00	0.00	0.00	0.00	0.00
Roller	0.00	0.18	0.18	0.18	0.18	0.18	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.00	0.00	0.20	0.20	0.61	0.41	0.41	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**0.91**	**3.32**	**3.93**	**3.93**	**3.05**	**2.85**	**2.65**	**1.79**	**1.59**	**1.38**	**0.78**	**0.78**	**0.38**	**0.38**	**0.38**	**0.38**
Onsite Total (lb/day) [a]	**0.04**	**0.14**	**0.17**	**0.17**	**0.13**	**0.12**	**0.12**	**0.08**	**0.07**	**0.06**	**0.03**	**0.03**	**0.02**	**0.02**	**0.02**	**0.02**
Offsite Total (tpy)	**0.01**															

Construction Equipment PM_{10} Emissions from Simple-Cycle Block Construction

Onsite Equipment	PM_{10} Emissions (lb/month)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Water Truck	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Excavator	0.00	0.43	0.43	0.43	0.43	0.43	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grader	0.00	0.93	0.93	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	0.35	0.69	1.04	1.04	1.04	1.04	1.04	0.69	0.69	0.35	0.35	0.35	0.00	0.00	0.00	0.00
Tractor/Loader/Backhoe	0.00	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00
Rubber Tired Loader	0.32	0.32	0.64	0.64	0.64	0.64	0.32	0.32	0.32	0.32	0.32	0.32	0.00	0.00	0.00	0.00
Crawler Tractor	0.00	1.16	1.16	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Compressor	0.00	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.00	0.00	0.00	0.00	0.00	0.00
Forklift	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00
Roller	0.00	0.30	0.30	0.30	0.30	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.00	0.00	0.34	0.34	1.02	0.68	0.68	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**1.50**	**5.31**	**6.32**	**6.32**	**4.91**	**4.57**	**4.25**	**2.83**	**2.49**	**2.15**	**1.28**	**1.28**	**0.62**	**0.62**	**0.62**	**0.62**
Onsite Total (lb/day) [a]	**0.07**	**0.23**	**0.27**	**0.27**	**0.21**	**0.20**	**0.18**	**0.12**	**0.11**	**0.09**	**0.06**	**0.06**	**0.03**	**0.03**	**0.03**	**0.03**
Offsite Total (tpy)	**0.02**															

Construction Equipment $PM_{2.5}$ Emissions from Simple-Cycle Block Construction

Onsite Equipment	$PM_{2.5}$ Emissions (lb/month)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Water Truck	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Excavator	0.00	0.43	0.43	0.43	0.43	0.43	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grader	0.00	0.93	0.93	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	0.35	0.69	1.04	1.04	1.04	1.04	1.04	0.69	0.69	0.35	0.35	0.35	0.00	0.00	0.00	0.00
Tractor/Loader/Backhoe	0.00	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.00	0.00	0.00	0.00	0.00	0.00
Rubber Tired Loader	0.32	0.32	0.64	0.64	0.64	0.64	0.32	0.32	0.32	0.32	0.32	0.32	0.00	0.00	0.00	0.00
Crawler Tractor	0.00	1.16	1.16	1.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Compressor	0.00	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.49	0.00	0.00	0.00	0.00	0.00	0.00
Forklift	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.22	0.00	0.00	0.00	0.00	0.00	0.00
Roller	0.00	0.30	0.30	0.30	0.30	0.30	0.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.00	0.00	0.34	0.34	1.02	0.68	0.68	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**1.50**	**5.31**	**6.32**	**6.32**	**4.91**	**4.57**	**4.25**	**2.83**	**2.49**	**2.15**	**1.28**	**1.28**	**0.62**	**0.62**	**0.62**	**0.62**
Onsite Total (lb/day) [a]	**0.07**	**0.23**	**0.27**	**0.27**	**0.21**	**0.20**	**0.18**	**0.12**	**0.11**	**0.09**	**0.06**	**0.06**	**0.03**	**0.03**	**0.03**	**0.03**
Offsite Total (tpy)	**0.02**															

Table 5.1A.10 Onsite Construction Equipment Exhaust Emissions

Construction Equipment CO_2 Emissions from Simple-Cycle Block Construction

Onsite Equipment	CO_2 Emissions (metric tons/month)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Water Truck	17.60	17.60	17.60	17.60	17.60	17.60	17.60	17.60	17.60	17.60	17.60	17.60	17.60	17.60	17.60	17.60
Excavator	0.00	11.67	11.67	11.67	11.67	11.67	11.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grader	0.00	24.14	24.14	24.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Cranes	10.02	20.05	30.07	30.07	30.07	30.07	30.07	20.05	20.05	10.02	10.02	10.02	0.00	0.00	0.00	0.00
Tractor/Loader/Backhoe	0.00	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	4.15	0.00	0.00	0.00	0.00	0.00	0.00
Rubber Tired Loader	10.03	10.03	20.06	20.06	20.06	20.06	10.03	10.03	10.03	10.03	10.03	10.03	0.00	0.00	0.00	0.00
Crawler Tractor	0.00	34.30	34.30	34.30	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Air Compressor	0.00	13.35	13.35	13.35	13.35	13.35	13.35	13.35	13.35	13.35	0.00	0.00	0.00	0.00	0.00	0.00
Forklift	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	0.00	0.00	0.00	0.00	0.00	0.00
Roller	0.00	9.66	9.66	9.66	9.66	9.66	9.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other General Industrial Equipment	0.00	0.00	8.58	8.58	25.74	17.16	17.16	8.58	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Onsite Total (metric tons/month)	**43.75**	**151.05**	**179.68**	**179.68**	**138.41**	**129.83**	**119.80**	**79.86**	**71.28**	**61.25**	**37.65**	**37.65**	**17.60**	**17.60**	**17.60**	**17.60**
Onsite Total (metric tons/day) [a]	**1.90**	**6.57**	**7.81**	**7.81**	**6.02**	**5.64**	**5.21**	**3.47**	**3.10**	**2.66**	**1.64**	**1.64**	**0.77**	**0.77**	**0.77**	**0.77**
Onsite Total (metric tons/year)	**1,229.88**															

Construction Equipment N_2O Emissions from Simple-Cycle Block Construction

Onsite Equipment	N_2O Emissions (metric tons/month)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Water Truck	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004
Excavator	0.0000	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Grader	0.0000	0.0006	0.0006	0.0006	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cranes	0.0003	0.0005	0.0008	0.0008	0.0008	0.0008	0.0008	0.0005	0.0005	0.0003	0.0003	0.0003	0.0000	0.0000	0.0000	0.0000
Tractor/Loader/Backhoe	0.0000	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Rubber Tired Loader	0.0003	0.0003	0.0005	0.0005	0.0005	0.0005	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0000	0.0000	0.0000	0.0000
Crawler Tractor	0.0000	0.0009	0.0009	0.0009	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Air Compressor	0.0000	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Forklift	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Roller	0.0000	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Other General Industrial Equipment	0.0000	0.0000	0.0002	0.0002	0.0006	0.0004	0.0004	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Onsite Total (metric tons/month)	**0.00110**	**0.00379**	**0.00451**	**0.00451**	**0.00347**	**0.00326**	**0.00300**	**0.00200**	**0.00179**	**0.00154**	**0.00094**	**0.00094**	**0.00044**	**0.00044**	**0.00044**	**0.00044**
Onsite Total (metric tons/day) [a]	**0.00005**	**0.00016**	**0.00020**	**0.00020**	**0.00015**	**0.00014**	**0.00013**	**0.00009**	**0.00008**	**0.00007**	**0.00004**	**0.00004**	**0.00002**	**0.00002**	**0.00002**	**0.00002**
Onsite Total (metric tons/year)	**0.031**															

Construction Equipment CH_4 Emissions from Simple-Cycle Block Construction

Onsite Equipment	CH_4 Emissions (metric tons/month)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Water Truck	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010	0.0010
Excavator	0.0000	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Grader	0.0000	0.0014	0.0014	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Cranes	0.0006	0.0011	0.0017	0.0017	0.0017	0.0017	0.0017	0.0011	0.0011	0.0006	0.0006	0.0006	0.0000	0.0000	0.0000	0.0000
Tractor/Loader/Backhoe	0.0000	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Rubber Tired Loader	0.0006	0.0006	0.0011	0.0011	0.0011	0.0011	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0000	0.0000	0.0000	0.0000
Crawler Tractor	0.0000	0.0019	0.0019	0.0019	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Air Compressor	0.0000	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Forklift	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Roller	0.0000	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Other General Industrial Equipment	0.0000	0.0000	0.0005	0.0005	0.0015	0.0010	0.0010	0.0005	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Onsite Total (metric tons/month)	**0.0025**	**0.0085**	**0.0101**	**0.0101**	**0.0078**	**0.0073**	**0.0068**	**0.0045**	**0.0040**	**0.0035**	**0.0021**	**0.0021**	**0.0010**	**0.0010**	**0.0010**	**0.0010**
Onsite Total (metric tons/day) [a]	**0.0001**	**0.0004**	**0.0004**	**0.0004**	**0.0003**	**0.0003**	**0.0003**	**0.0002**	**0.0002**	**0.0002**	**0.0001**	**0.0001**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Onsite Total (metric tons/year)	**0.069**															

Notes:

[a] Per 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx', the days per month are as follc 23

Table 5.1A.11 Onsite Motor Vehicle Exhaust Emissions

Onsite Construction Vehicle CO Emissions from simple-Cycle Block Construction

Vehicle Type	CO Emissions (lb/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Onsite Stake Truck	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Onsite Total (lb/day)	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**	**0.05**
Vehicle Type	**CO Emissions (lb/month) [a]**															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
Onsite Stake Truck	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Onsite Total (lb/month)	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**	**1.12**
Onsite Total (tpy)	**0.01**															

Onsite Construction Vehicle VOC Emissions from Simple-Cycle Block Construction

Vehicle Type	VOC Emissions (lb/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Onsite Stake Truck	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.009
Onsite Total (lb/day)	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**	**0.010**
Vehicle Type	**VOC Emissions (lb/month) [a]**															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Onsite Stake Truck	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Onsite Total (lb/month)	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**	**0.23**
Onsite Total (tpy)	**0.001**															

Onsite Construction Vehicle SO_X Emissions from Simple-Cycle Block Construction

Vehicle Type	SO_X Emissions (lb/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005
Onsite Stake Truck	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027	0.00027
Onsite Total (lb/day)	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**	**0.00032**
Vehicle Type	**SO_X Emissions (lb/month) [a]**															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011	0.0011
Onsite Stake Truck	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062	0.0062
Onsite Total (lb/month)	**0.0073**	**0.0073**	**0.0073**	**0.0073**	**0.0073**	**0.0073**	**0.0073**	**0.0073**	**0.0073**	**0.0073**	**0.0073**	**0.0073**	**0.0073**	**0.0073**	**0.0073**	**0.0073**
Onsite Total (tpy)	**0.00004**															

Onsite Construction Vehicle NO_X Emissions from Simple-Cycle Block Construction

Vehicle Type	NO_X Emissions (lb/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Onsite Stake Truck	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.174	0.173	0.173	0.173	0.173	0.173	0.173	0.173	0.173
Onsite Total (lb/day)	**0.175**	**0.175**	**0.175**	**0.175**	**0.175**	**0.175**	**0.175**	**0.175**	**0.174**	**0.174**	**0.174**	**0.174**	**0.174**	**0.174**	**0.174**	**0.174**
Vehicle Type	**NO_X Emissions (lb/month) [a]**															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Onsite Stake Truck	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98
Onsite Total (lb/month)	**4.03**	**4.03**	**4.03**	**4.03**	**4.03**	**4.03**	**4.03**	**4.03**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**	**4.00**
Onsite Total (tpy)	**0.02**															

Table 5.1A.11 Onsite Motor Vehicle Exhaust Emissions

Onsite Construction Vehicle PM_{10} Emissions from Simple-Cycle Block Construction

Vehicle Type	PM_{10} Emissions (lb/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Onsite Stake Truck	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012	0.0012
Onsite Total (lb/day)	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**	**0.0015**
Vehicle Type	PM_{10} Emissions (lb/month) [a]															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Onsite Stake Truck	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
Onsite Total (lb/month)	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**
Onsite Total (tpy)	**0.0002**															

Onsite Construction Vehicle $PM_{2.5}$ Emissions from Simple-Cycle Block Construction

Vehicle Type	$PM_{2.5}$ Emissions (lb/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
Onsite Stake Truck	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006	0.0006
Onsite Total (lb/day)	**0.0008**	**0.0008**	**0.0008**	**0.0008**	**0.0008**	**0.0008**	**0.0008**	**0.0008**	**0.0008**	**0.0008**	**0.0008**	**0.0008**	**0.0008**	**0.0008**	**0.0008**	**0.0008**
Vehicle Type	$PM_{2.5}$ Emissions (lb/month) [a]															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
Onsite Stake Truck	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.016	0.014	0.014	0.014	0.014	0.014	0.014	0.014	0.014
Onsite Total (lb/month)	**0.019**	**0.019**	**0.019**	**0.019**	**0.019**	**0.019**	**0.019**	**0.019**	**0.018**	**0.018**	**0.018**	**0.018**	**0.018**	**0.018**	**0.018**	**0.018**
Onsite Total (tpy)	**0.0001**															

Onsite Construction Vehicle CO_2 Emissions from Simple-Cycle Block Construction

Vehicle Type	CO_2 Emissions (metric tons/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Onsite Stake Truck	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007
Onsite Total (metric tons/day)	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**	**0.008**
Vehicle Type	CO_2 Emissions (metric tons/month) [a]															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Onsite Stake Truck	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Onsite Total (metric tons/month)	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**
Onsite Total (metric tons/year)	**2.17**															

Onsite Construction Vehicle N_2O Emissions from Simple-Cycle Block Construction

Vehicle Type	N_2O Emissions (metric tons/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001	0.00000001
Onsite Stake Truck	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002
Onsite Total (metric tons/day)	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**	**0.00000003**
Vehicle Type	N_2O Emissions (metric tons/month) [a]															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.0000003	0.0000003	0.0000003	0.0000003	0.0000003	0.0000003	0.0000003	0.0000003	0.0000003	0.0000003	0.0000003	0.0000003	0.0000003	0.0000003	0.0000003	0.0000003
Onsite Stake Truck	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004	0.0000004
Onsite Total (metric tons/month)	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**	**0.0000007**
Onsite Total (metric tons/year)	**0.000009**															

Table 5.1A.11 Onsite Motor Vehicle Exhaust Emissions

Onsite Construction Vehicle CH_4 Emissions from Simple-Cycle Block Construction

Vehicle Type	CH_4 Emissions (metric tons/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.00000003	0.00000003	0.00000003	0.00000003	0.00000003	0.00000003	0.00000003	0.00000003	0.00000003	0.00000003	0.00000003	0.00000003	0.00000003	0.00000003	0.00000003	0.00000003
Onsite Stake Truck	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002	0.00000002
Onsite Total (metric tons/day)	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**	**0.00000005**
Vehicle Type	**CH_4 Emissions (metric tons/month) [a]**															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.0000007	0.0000007	0.0000007	0.0000007	0.0000007	0.0000007	0.0000007	0.0000007	0.0000007	0.0000007	0.0000007	0.0000007	0.0000007	0.0000007	0.0000007	0.0000007
Onsite Stake Truck	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005	0.0000005
Onsite Total (metric tons/month)	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**	**0.0000012**
Onsite Total (metric tons/year)	**0.000015**															

Notes:

[a] The days per month are per 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx', as presented on the 'Fugitive Dust' tab.

Table 5.1A.12 Onsite Construction Fugitive Dust Emissions

Grading, Bulldozing, and Truck Dumping/Loading Activity Levels for Simple-Cycle Block Construction

Source	Monthly Activity Levels															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Disturbance (acres)[a]	0.00	2.81	2.81	2.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bulldozer Operation (hours)[b]	0.00	920.00	920.00	920.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Soil Imported/Exported (cubic yards)[c]	301.08	301.08	301.08	301.08	301.08	301.08	301.08	301.08	301.08	301.08	301.08	301.08	0.00	0.00	0.00	0.00

Notes:

[a] Estimated a total of 8.42 acres is disturbed during Simple-Cycle Block Construction, as provided in 'LMS 100 Alamitos Soil Management 05.07.15.xlsx'; assumed this disturbance was equally distributed amongst the months in which graders are utilized.

[b] Bulldozer Operation calculated based on the number of equipment and the hours of operation per month, per 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx':

Hours per Day: 10

Days per Month: 23

[c] Estimated a total of 3,613 cubic yards of material is exported and/or imported for the Simple-Cycle Block area, as provided in 'LMS 100 Alamitos Soil Management 05.07.15.xlsx'; assumed the exports/imports and associated loading/dumping activity are equally distributed amongst the months in which front end loaders are utilizec

Onsite Construction Vehicle Fugitive PM_{10} Emissions from Simple-Cycle Block Construction

Vehicle Type	Fugitive PM_{10} Emissions (lb/day)[a]															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69	0.69
Onsite Stake Truck	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38	1.38
Onsite Total (lb/day)	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**
Vehicle Type	**Fugitive PM_{10} Emissions (lb/month)[a]**															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	15.86	15.86	15.86	15.86	15.86	15.86	15.86	15.86	15.86	15.86	15.86	15.86	15.86	15.86	15.86	15.86
Onsite Stake Truck	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71	31.71
Onsite Total (lb/month)	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**	**47.57**
Onsite Total (tpy)	**0.29**															

Notes:

[a] Emissions based on highest (controlled) unpaved road emission factor for PM_{10}.

Onsite Construction Vehicle Fugitive $PM_{2.5}$ Emissions from Simple-Cycle Block Construction

Vehicle Type	Fugitive $PM_{2.5}$ Emissions (lb/day)[a]															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Onsite Stake Truck	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Onsite Total (lb/day)	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**	**0.21**
Vehicle Type	**Fugitive $PM_{2.5}$ Emissions (lb/month)[a]**															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59
Onsite Stake Truck	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17	3.17
Onsite Total (lb/month)	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**	**4.76**
Offsite Total (tpy)	**0.03**															

Notes:

[a] Emissions based on the highest (controlled) unpaved road emission factor for $PM_{2.5}$.

Onsite Grading, Bulldozing, and Truck Dumping/Loading Fugitive PM_{10} Emissions from Simple-Cycle Block Construction

Construction Activity	Fugitive PM_{10} Emissions (lb/day)[a, b]															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Grading[c]	0.0000	0.0207	0.0207	0.0207	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bulldozing	0.0000	4.8177	4.8177	4.8177	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Truck Dumping/Loading[d, e]	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0005	0.0000	0.0000	0.0000	0.0000
Onsite Total (lb/day)	**0.0005**	**4.8388**	**4.8388**	**4.8388**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0005**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Construction Activity	**Fugitive PM_{10} Emissions (lb/month)[a, b]**															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Grading	0.00	0.48	0.48	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bulldozing	0.00	110.81	110.81	110.81	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Truck Dumping/Loading	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00
Onsite Total (lb/month)	**0.01**	**111.29**	**111.29**	**111.29**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.00**	**0.00**	**0.00**	**0.00**
Onsite Total (tpy)	**0.17**															

Notes:

[a] Work days per month are as follows, per 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx': 23

[b] Emissions based on the highest (controlled) emission factor for PM_{10}.

[c] Per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013), the following blade width was assumed for grading equipment: 12 ft

[d] Assume that soil is dumped from or loaded to the truck the same month it is imported or exported, respectively.

[e] Per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013), the following conversion factor was used: 1.26 tons/cubic yard

Table 5.1A.12 Onsite Construction Fugitive Dust Emissions

Onsite Grading, Bulldozing, and Truck Dumping/Loading Fugitive $PM_{2.5}$ Emissions from Simple-Cycle Block Construction

Construction Activity	Fugitive $PM_{2.5}$ Emissions (lb/day) [a, b]															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Grading [c]	0.0000	0.0022	0.0022	0.0022	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Bulldozing	0.0000	2.6482	2.6482	2.6482	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Truck Dumping/Loading [d, e]	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000
Onsite Total (lb/day)	**0.0001**	**2.6505**	**2.6505**	**2.6505**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0001**	**0.0000**	**0.0000**	**0.0000**	**0.0000**
Construction Activity	**Fugitive $PM_{2.5}$ Emissions (lb/month) [a, b]**															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Grading	0.000	0.051	0.051	0.051	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Bulldozing	0.000	60.908	60.908	60.908	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Truck Dumping/Loading	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.000	0.000	0.000	0.000
Onsite Total (lb/month)	**0.002**	**60.961**	**60.961**	**60.961**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.002**	**0.000**	**0.000**	**0.000**	**0.000**
Onsite Total (tpy)	**0.09**															

Notes:
[a] Work days per month are as follows, per 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx': 23
[b] Emissions based on the highest (controlled) emission factor for $PM_{2.5}$.
[c] Per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013), the following blade width was assumed for grading equipment: 12 ft
[d] Assume that soil is dumped from or loaded to the truck the same month it is imported or exported, respectively.
[e] Per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013), the following conversion factor was used: 1.26 tons/cubic yard

Onsite Construction Vehicle Activity for Simple-Cycle Block Construction

Vehicle Type	Miles/Day [a]	Working Days per Month [b]
Onsite Pick-up Truck	1	23
Onsite Stake Truck	2	23

Notes:
[a] Estimated based on the dimensions of the project site and anticipated activity.
[b] Per 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx'.

Fugitive Dust Emission Factors for Unpaved Roads

Vehicles on Unpaved Surfaces at Industrial Sites

Parameter	PM_{10}	$PM_{2.5}$
Mean Vehicle Weight [a]	16.5	16.5
Silt Content [b]	8.5	8.5
k [c]	1.5	0.15
a [c]	0.9	0.9
b [c]	0.45	0.45
P [d]	33	33
Emission Factor (Uncontrolled, lb/mile) [e]	2.15	0.22
Reduction from Applying Soil Stabilizers [f]	84%	84%
Emission Factor (Controlled, lb/mile)	0.34	0.03

Notes:
[a] Mean vehicle weight assumes that medium/heavy duty trucks weigh 16.5 tons.
[b] Silt content taken from Table 13.2.2-1 of Section 13.2.2 of *AP-42* (EPA, 2006) for a Construction Site, Scraper Route; this value is consistent with the CalEEMod default for the South Coast Air Basin.
[c] k, a, and b taken from Table 13.2.2-2 of Section 13.2.2 of *AP-42* (EPA, 2006) for industrial roads.
[d] P taken as the CalEEMod default for the Long Beach climate region of the South Coast Air Basin.
[e] Emission factor calculated using Equations 1a and 2 from Section 13.2.2 of *AP-42* (EPA, 2006):
Emission Factor (lb/mile) = {k (lb/mile) x [Silt Content (%) / 12]^a x [Mean Vehicle Weight (tons) / 3]^b} x [(365 - P) / 365]
[f] Control efficiency taken from Table XI-D of the *SCAQMD CEQA Handbook* for Travel Over Unpaved Roads (SCAQMD, 2007).

Fugitive Dust Emission Factors for Truck Dumping/Loading

Truck Dumping on a Pile or Loading to a Truck from a Pile

Parameter	PM_{10}	$PM_{2.5}$
k [a]	0.35	0.053
U [b]	4.9	4.9
M [a]	12.0	12.0
Emission Factor (lb/ton) [c]	0.0001	0.00001
Reduction from Watering to Maintain 12% Moisture [d]	69%	69%
Emission Factor (Controlled, lb/ton)	0.00003	0.000004

Notes:
[a] k and M taken from Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).
[b] U taken as the CalEEMod default for the Long Beach climate region of the South Coast Air Basin. Value converted from units of m/s to mph.
[c] Emission factor calculated using the following equation from Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013):
Emission Factor (lb/ton) = k x 0.0032 x [U (mph) / 5]$^{1.3}$ / [M (%) / 2]$^{1.4}$
[d] Control efficiency taken from Table XI-A of the *SCAQMD CEQA Handbook* for Scraper Loading and Unloading (SCAQMD, 2007).

Table 5.1A.12 Onsite Construction Fugitive Dust Emissions

Fugitive Dust Emission Factors for Grading

Grading Equipment Passes

Parameter	PM_{10}	$PM_{2.5}$
S [a]	7.1	7.1
F [a]	0.6	0.031
Emission Factor (lb/VMT) [b]	1.543	0.167
Reduction from Applying Soil Stabilizers [c]	84%	84%
Emission Factor (Controlled, lb/VMT)	0.247	0.027

Notes:

[a] S and F taken from Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

[b] Emission factor calculated using the following equation from Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013):

PM_{10} Emission Factor (lb/VMT) = $0.051 \times [S\ (mph)]^{2.0} \times F_{PM10}$

$PM_{2.5}$ Emission Factor (lb/VMT) = $0.04 \times [S\ (mph)]^{2.5} \times F_{PM2.5}$

[c] Control efficiency taken from Table XI-A of the *SCAQMD CEQA Handbook* for Post-demolition Stabilization (SCAQMD, 2007).

Fugitive Dust Emission Factors for Bulldozing

Bulldozing Equipment Passes

Parameter	PM_{10}	$PM_{2.5}$
C [a]	1.0	5.7
M [a]	7.9	7.9
s [a]	6.9	6.9
F [a]	0.75	0.105
Emission Factor (lb/hr) [b]	0.753	0.414
Reduction from Applying Soil Stabilizers [c]	84%	84%
Emission Factor (Controlled, lb/hr)	0.120	0.066

Notes:

[a] C, M, s, and F taken from Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013). These values are consistent with the CalEEMod defaults for the South Coast Air Basin.

[b] Emission factor calculated using the following equation from Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013):

PM_{10} Emission Factor (lb/hr) = $\{[C \times s\ (\%)^{1.5}] / [M\ (\%)^{1.4}]\} \times F_{PM10}$

$PM_{2.5}$ Emission Factor (lb/hr) = $\{[C \times s\ (\%)^{1.2}] / [M\ (\%)^{1.3}]\} \times F_{PM2.5}$

[c] Control efficiency taken from Table XI-A of the *SCAQMD CEQA Handbook* for Post-demolition Stabilization (SCAQMD, 2007).

Table 5.1A.13 Offsite Motor Vehicle Exhaust and Fugitive Dust Emissions

Offsite Vehicle Usage During Simple-Cycle Block Construction

Vehicle Type	Number per Day															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks [a]	0.00	0.00	1.00	1.00	1.00	2.00	2.00	2.00	2.00	2.00	1.00	1.00	1.00	0.50	0.50	0.50
Material Hauling Trucks [b]	5.80	13.80	15.50	15.50	19.50	23.70	26.00	23.20	19.00	7.00	6.00	7.00	5.00	1.40	1.40	1.40
Construction Worker Commute [c]	24.00	54.00	88.00	184.00	224.00	316.00	380.00	458.00	512.00	392.00	338.00	248.00	160.00	104.00	34.00	28.00

Notes:

[a] Offsite Delivery Trucks include trucks transporting "Consumables & Supplies", as provided in 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx'. It was assumed that these trucks travel directly to AEC.

[b] Material Hauling Trucks include trucks transporting "Fill Material", "Mechanical Equipment", "Electrical Equip. & Mtrls", "Piping, Supports, & Valves", "Concrete and Rebar", "Steel/Architectural", "Contractor Mobilization", "Contractor Demobilization", "Construction Equipment", "GT'S", "Generators", and "Main Transformers", as provided in 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx'.

[c] Assumed 1 commute per 1 worker; number of workers taken from 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx'.

Offsite Vehicle CO Emissions from Simple-Cycle Block Construction

Vehicle Type	CO Emissions (lb/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks	0.00	0.00	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.01	0.01	0.01
Material Hauling Trucks	0.21	0.50	0.56	0.56	0.70	0.86	0.94	0.84	0.69	0.25	0.22	0.25	0.18	0.05	0.05	0.05
Construction Worker Commute	1.53	3.44	5.60	11.72	14.26	20.12	24.20	29.17	32.60	24.96	21.52	15.79	10.19	6.62	2.17	1.78
Offsite Total (lb/day)	**1.74**	**3.94**	**6.18**	**12.29**	**14.98**	**21.01**	**25.17**	**30.03**	**33.32**	**25.25**	**21.76**	**16.06**	**10.39**	**6.68**	**2.22**	**1.84**
Vehicle Type	**CO Emissions (lb/month)**															
	36	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**
Offsite Delivery Trucks	0.00	0.00	0.36	0.36	0.36	0.73	0.73	0.73	0.73	0.73	0.36	0.36	0.36	0.18	0.18	0.18
Material Hauling Trucks	4.82	11.46	12.88	12.88	16.20	19.69	21.60	19.27	15.78	5.82	4.98	5.82	4.15	1.16	1.16	1.16
Construction Worker Commute	35.15	79.09	128.89	269.49	328.08	462.82	556.56	670.80	749.89	574.13	495.04	363.23	234.34	152.32	49.80	41.01
Offsite Total (lb/month)	**39.97**	**90.55**	**142.13**	**282.73**	**344.64**	**483.24**	**578.89**	**690.80**	**766.40**	**580.68**	**500.39**	**369.41**	**238.86**	**153.67**	**51.14**	**42.35**
Offsite Total (tpy)	**2.57**															

Offsite Vehicle VOC Emissions from Simple-Cycle Block Construction

Vehicle Type	VOC Emissions (lb/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks	0.000	0.000	0.004	0.004	0.004	0.007	0.007	0.007	0.007	0.007	0.004	0.004	0.004	0.002	0.002	0.002
Material Hauling Trucks	0.053	0.125	0.140	0.140	0.177	0.215	0.236	0.210	0.172	0.063	0.054	0.063	0.045	0.013	0.013	0.013
Construction Worker Commute	0.027	0.062	0.101	0.210	0.256	0.361	0.434	0.524	0.585	0.448	0.386	0.283	0.183	0.119	0.039	0.032
Offsite Total (lb/day)	**0.080**	**0.187**	**0.245**	**0.354**	**0.436**	**0.583**	**0.677**	**0.741**	**0.765**	**0.519**	**0.444**	**0.351**	**0.232**	**0.133**	**0.053**	**0.047**
Vehicle Type	**VOC Emissions (lb/month)**															
	36	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**
Offsite Delivery Trucks	0.00	0.00	0.09	0.09	0.09	0.17	0.17	0.17	0.17	0.17	0.09	0.09	0.09	0.04	0.04	0.04
Material Hauling Trucks	1.21	2.87	3.23	3.23	4.06	4.94	5.42	4.83	3.96	1.46	1.25	1.46	1.04	0.29	0.29	0.29
Construction Worker Commute	0.63	1.42	2.31	4.84	5.89	8.31	9.99	12.04	13.46	10.31	8.89	6.52	4.21	2.73	0.89	0.74
Offsite Total (lb/month)	**1.84**	**4.29**	**5.63**	**8.15**	**10.04**	**13.42**	**15.58**	**17.05**	**17.59**	**11.94**	**10.22**	**8.06**	**5.33**	**3.07**	**1.23**	**1.07**
Offsite Total (tpy)	**0.06**															

Offsite Vehicle SO_X Emissions from Simple-Cycle Block Construction

Vehicle Type	SO_X Emissions (lb/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks	0.0000	0.0000	0.0005	0.0005	0.0005	0.0009	0.0009	0.0009	0.0009	0.0009	0.0005	0.0005	0.0005	0.0002	0.0002	0.0002
Material Hauling Trucks	0.0067	0.0160	0.0180	0.0180	0.0227	0.0275	0.0302	0.0270	0.0221	0.0081	0.0070	0.0081	0.0058	0.0016	0.0016	0.0016
Construction Worker Commute	0.0042	0.0095	0.0155	0.0325	0.0396	0.0558	0.0671	0.0809	0.0905	0.0693	0.0597	0.0438	0.0283	0.0184	0.0060	0.0049
Offsite Total (lb/day)	**0.0110**	**0.0256**	**0.0340**	**0.0510**	**0.0627**	**0.0843**	**0.0983**	**0.1088**	**0.1135**	**0.0783**	**0.0672**	**0.0524**	**0.0345**	**0.0202**	**0.0079**	**0.0068**
Vehicle Type	**SO_X Emissions (lb/month)**															
	36	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**
Offsite Delivery Trucks	0.000	0.000	0.011	0.011	0.011	0.022	0.022	0.022	0.022	0.022	0.011	0.011	0.011	0.005	0.005	0.005
Material Hauling Trucks	0.155	0.369	0.414	0.414	0.521	0.633	0.695	0.620	0.508	0.187	0.160	0.187	0.134	0.037	0.037	0.037
Construction Worker Commute	0.098	0.219	0.358	0.748	0.910	1.284	1.544	1.861	2.080	1.593	1.373	1.008	0.650	0.423	0.138	0.114
Offsite Total (lb/month)	**0.253**	**0.588**	**0.783**	**1.173**	**1.442**	**1.939**	**2.261**	**2.503**	**2.610**	**1.802**	**1.545**	**1.206**	**0.795**	**0.465**	**0.181**	**0.157**
Offsite Total (tpy)	**0.009**															

Table 5.1A.13 Offsite Motor Vehicle Exhaust and Fugitive Dust Emissions

Offsite Vehicle NO_X Emissions from Simple-Cycle Block Construction

Vehicle Type	NO_X Emissions (lb/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks	0.00	0.00	0.12	0.12	0.12	0.24	0.24	0.24	0.22	0.22	0.11	0.11	0.11	0.05	0.05	0.05
Material Hauling Trucks	1.47	3.50	3.93	3.93	4.95	6.01	6.60	5.89	3.89	1.43	1.23	1.43	1.02	0.29	0.29	0.29
Construction Worker Commute	0.13	0.30	0.49	1.02	1.25	1.76	2.11	2.55	2.57	1.97	1.70	1.25	0.80	0.52	0.17	0.14
Offsite Total (lb/day)	**1.60**	**3.80**	**4.54**	**5.08**	**6.31**	**8.01**	**8.95**	**8.67**	**6.68**	**3.62**	**3.04**	**2.79**	**1.94**	**0.86**	**0.51**	**0.48**
Vehicle Type	**NO_X Emissions (lb/month)**															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks	0.00	0.00	2.77	2.77	2.77	5.55	5.55	5.55	4.98	4.98	2.49	2.49	2.49	1.24	1.24	1.24
Material Hauling Trucks	33.84	80.52	90.44	90.44	113.78	138.29	151.71	135.37	89.51	32.98	28.27	32.98	23.55	6.60	6.60	6.60
Construction Worker Commute	3.07	6.91	11.26	23.54	28.66	40.43	48.62	58.60	59.19	45.32	39.07	28.67	18.50	12.02	3.93	3.24
Offsite Total (lb/month)	**36.91**	**87.43**	**104.48**	**116.76**	**145.22**	**184.27**	**205.88**	**199.52**	**153.67**	**83.27**	**69.83**	**64.13**	**44.54**	**19.86**	**11.77**	**11.08**
Offsite Total (tpy)	**0.73**															

Offsite Vehicle PM_{10} Emissions from Simple-Cycle Block Construction

Vehicle Type	PM_{10} Emissions (lb/day) [a]															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks	0.000	0.000	0.013	0.013	0.013	0.025	0.025	0.025	0.025	0.025	0.013	0.013	0.013	0.006	0.006	0.006
Material Hauling Trucks	0.231	0.549	0.617	0.617	0.776	0.943	1.035	0.924	0.725	0.267	0.229	0.267	0.191	0.053	0.053	0.053
Construction Worker Commute	0.540	1.215	1.979	4.138	5.038	7.107	8.547	10.301	11.514	8.815	7.601	5.577	3.598	2.339	0.765	0.630
Offsite Total (lb/day)	**0.771**	**1.764**	**2.609**	**4.768**	**5.827**	**8.076**	**9.607**	**11.250**	**12.264**	**9.107**	**7.842**	**5.857**	**3.801**	**2.398**	**0.824**	**0.689**
Vehicle Type	**PM_{10} Emissions (lb/month) [a]**															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks	0.00	0.00	0.29	0.29	0.29	0.58	0.58	0.58	0.58	0.58	0.29	0.29	0.29	0.15	0.15	0.15
Material Hauling Trucks	5.31	12.64	14.19	14.19	17.85	21.70	23.81	21.24	16.67	6.14	5.26	6.14	4.39	1.23	1.23	1.23
Construction Worker Commute	12.42	27.93	45.52	95.18	115.88	163.47	196.58	236.93	264.82	202.75	174.82	128.27	82.75	53.79	17.59	14.48
Offsite Total (lb/month)	**17.73**	**40.57**	**60.01**	**109.67**	**134.02**	**185.75**	**220.97**	**258.75**	**282.06**	**209.47**	**180.37**	**134.70**	**87.43**	**55.16**	**18.96**	**15.86**
Offsite Total (tpy)	**0.96**															

Notes:

[a] PM_{10} Emissions include emissions from exhaust and paved roads.

Offsite Vehicle $PM_{2.5}$ Emissions from Simple-Cycle Block Construction

Vehicle Type	$PM_{2.5}$ Emissions (lb/day) [a]															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks	0.000	0.000	0.004	0.004	0.004	0.008	0.008	0.008	0.008	0.008	0.004	0.004	0.004	0.002	0.002	0.002
Material Hauling Trucks	0.078	0.185	0.208	0.208	0.261	0.317	0.348	0.311	0.224	0.083	0.071	0.083	0.059	0.017	0.017	0.017
Construction Worker Commute	0.147	0.331	0.539	1.127	1.372	1.936	2.328	2.805	3.135	2.400	2.069	1.518	0.980	0.637	0.208	0.171
Offsite Total (lb/day)	**0.225**	**0.516**	**0.751**	**1.339**	**1.637**	**2.261**	**2.684**	**3.124**	**3.366**	**2.490**	**2.144**	**1.605**	**1.042**	**0.655**	**0.227**	**0.190**
Vehicle Type	**$PM_{2.5}$ Emissions (lb/month) [a]**															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks	0.00	0.00	0.09	0.09	0.09	0.18	0.18	0.18	0.18	0.18	0.09	0.09	0.09	0.04	0.04	0.04
Material Hauling Trucks	1.79	4.25	4.77	4.77	6.01	7.30	8.01	7.15	5.15	1.90	1.63	1.90	1.36	0.38	0.38	0.38
Construction Worker Commute	3.38	7.61	12.40	25.92	31.56	44.52	53.54	64.53	72.09	55.20	47.59	34.92	22.53	14.64	4.79	3.94
Offsite Total (lb/month)	**5.17**	**11.86**	**17.26**	**30.79**	**37.66**	**52.00**	**61.73**	**71.85**	**77.42**	**57.27**	**49.31**	**36.91**	**23.97**	**15.07**	**5.21**	**4.37**
Offsite Total (tpy)	**0.27**															

Notes:

[a] $PM_{2.5}$ Emissions include emissions from exhaust and paved roads.

Table 5.1A.13 Offsite Motor Vehicle Exhaust and Fugitive Dust Emissions

Offsite Vehicle CO_2 Emissions from Simple-Cycle Block Construction

Vehicle Type	CO_2 Emissions (metric tons/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks	0.000	0.000	0.024	0.024	0.024	0.049	0.049	0.049	0.049	0.049	0.024	0.024	0.024	0.012	0.012	0.012
Material Hauling Trucks	0.327	0.777	0.873	0.873	1.098	1.334	1.464	1.306	1.070	0.394	0.338	0.394	0.281	0.079	0.079	0.079
Construction Worker Commute	0.250	0.562	0.915	1.914	2.330	3.287	3.953	4.765	5.326	4.078	3.516	2.580	1.664	1.082	0.354	0.291
Offsite Total (metric tons/day)	**0.576**	**1.339**	**1.812**	**2.811**	**3.452**	**4.670**	**5.466**	**6.119**	**6.445**	**4.521**	**3.878**	**2.998**	**1.970**	**1.173**	**0.445**	**0.382**
Vehicle Type	**CO_2 Emissions (metric tons/month)**															
	36	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**
Offsite Delivery Trucks	0.00	0.00	0.56	0.56	0.56	1.12	1.12	1.12	1.12	1.12	0.56	0.56	0.56	0.28	0.28	0.28
Material Hauling Trucks	7.51	17.87	20.07	20.07	25.25	30.69	33.67	30.04	24.60	9.06	7.77	9.06	6.47	1.81	1.81	1.81
Construction Worker Commute	5.74	12.92	21.06	44.03	53.60	75.61	90.92	109.59	122.51	93.79	80.87	59.34	38.28	24.88	8.14	6.70
Offsite Total (metric tons/month)	**13.25**	**30.79**	**41.69**	**64.66**	**79.41**	**107.42**	**125.71**	**140.75**	**148.23**	**103.98**	**89.20**	**68.96**	**45.32**	**26.98**	**10.23**	**8.79**
Offsite Total (metric tons/year)	**1,046.10**															

Offsite Vehicle N_2O Emissions from Simple-Cycle Block Construction

Vehicle Type	N_2O Emissions (metric tons/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks	0.00000000	0.00000000	0.00000007	0.00000007	0.00000007	0.00000013	0.00000013	0.00000013	0.00000013	0.00000013	0.00000007	0.00000007	0.00000007	0.00000003	0.00000003	0.00000003
Material Hauling Trucks	0.00000111	0.00000265	0.00000298	0.00000298	0.00000374	0.00000455	0.00000499	0.00000445	0.00000365	0.00000134	0.00000115	0.00000134	0.00000096	0.00000027	0.00000027	0.00000027
Construction Worker Commute	0.00000254	0.00000572	0.00000931	0.00001947	0.00002371	0.00003345	0.00004022	0.00004847	0.00005419	0.00004149	0.00003577	0.00002625	0.00001693	0.00001101	0.00000360	0.00000296
Offsite Total (metric tons/day)	**0.0000037**	**0.0000084**	**0.0000124**	**0.0000225**	**0.0000275**	**0.0000381**	**0.0000453**	**0.0000531**	**0.0000580**	**0.0000430**	**0.0000370**	**0.0000277**	**0.0000180**	**0.0000113**	**0.0000039**	**0.0000033**
Vehicle Type	**N_2O Emissions (metric tons/month)**															
	36	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**
Offsite Delivery Trucks	0.0000000	0.0000000	0.0000015	0.0000015	0.0000015	0.0000030	0.0000030	0.0000030	0.0000030	0.0000030	0.0000015	0.0000015	0.0000015	0.0000008	0.0000008	0.0000008
Material Hauling Trucks	0.0000256	0.0000609	0.0000684	0.0000684	0.0000861	0.0001047	0.0001148	0.0001025	0.0000839	0.0000309	0.0000265	0.0000309	0.0000221	0.0000062	0.0000062	0.0000062
Construction Worker Commute	0.0000584	0.0001315	0.0002142	0.0004479	0.0005453	0.0007692	0.0009250	0.0011149	0.0012464	0.0009543	0.0008228	0.0006037	0.0003895	0.0002532	0.0000828	0.0000682
Offsite Total (metric tons/month)	**0.000084**	**0.000192**	**0.000284**	**0.000518**	**0.000633**	**0.000877**	**0.001043**	**0.001220**	**0.001333**	**0.000988**	**0.000851**	**0.000636**	**0.000413**	**0.000260**	**0.000090**	**0.000075**
Offsite Total (metric tons/year)	**0.00906**															

Offsite Vehicle CH_4 Emissions from Simple-Cycle Block Construction

Vehicle Type	CH_4 Emissions (metric tons/day)															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Offsite Delivery Trucks	0.00000000	0.00000000	0.00000007	0.00000007	0.00000007	0.00000014	0.00000014	0.00000014	0.00000014	0.00000014	0.00000007	0.00000007	0.00000007	0.00000004	0.00000004	0.00000004
Material Hauling Trucks	0.00000118	0.00000282	0.00000316	0.00000316	0.00000398	0.00000483	0.00000530	0.00000473	0.00000388	0.00000143	0.00000122	0.00000143	0.00000102	0.00000029	0.00000029	0.00000029
Construction Worker Commute	0.00001221	0.00002747	0.00004476	0.00009359	0.00011393	0.00016072	0.00019328	0.00023295	0.00026041	0.00019938	0.00017191	0.00012614	0.00008138	0.00005290	0.00001729	0.00001424
Offsite Total (metric tons/day)	**0.000013**	**0.000030**	**0.000048**	**0.000097**	**0.000118**	**0.000166**	**0.000199**	**0.000238**	**0.000264**	**0.000201**	**0.000173**	**0.000128**	**0.000082**	**0.000053**	**0.000018**	**0.000015**
Vehicle Type	**CH_4 Emissions (metric tons/month)**															
	36	**37**	**38**	**39**	**40**	**41**	**42**	**43**	**44**	**45**	**46**	**47**	**48**	**49**	**50**	**51**
Offsite Delivery Trucks	0.0000000	0.0000000	0.0000016	0.0000016	0.0000016	0.0000032	0.0000032	0.0000032	0.0000032	0.0000032	0.0000016	0.0000016	0.0000016	0.0000008	0.0000008	0.0000008
Material Hauling Trucks	0.0000272	0.0000647	0.0000727	0.0000727	0.0000915	0.0001112	0.0001220	0.0001089	0.0000891	0.0000328	0.0000282	0.0000328	0.0000235	0.0000066	0.0000066	0.0000066
Construction Worker Commute	0.0002808	0.0006317	0.0010294	0.0021525	0.0026204	0.0036967	0.0044453	0.0053578	0.0059895	0.0045857	0.0039540	0.0029012	0.0018717	0.0012166	0.0003977	0.0003276
Offsite Total (metric tons/month)	**0.000308**	**0.000696**	**0.001104**	**0.002227**	**0.002714**	**0.003811**	**0.004571**	**0.005470**	**0.006082**	**0.004622**	**0.003984**	**0.002936**	**0.001897**	**0.001224**	**0.000405**	**0.000335**
Offsite Total (metric tons/year)	**0.04064**															

Offsite Construction Vehicle Activity for Simple-Cycle Block Construction

Vehicle Type	Roundtrip Miles/Day	Working Days per Month [a]
Offsite Delivery Trucks [b]	13.8	23
Material Hauling Trucks [c]	40.0	23
Construction Worker Commute [b]	29.4	23

Notes:

[a] Per 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx'.

[b] Roundtrip miles/day for Offsite Delivery Trucks and Construction Worker Commute taken as the Urban, South Coast Air Basin C-NW and H-W values, respectively, from Table 4.2 of Appendix D of the *CalEEMod User's Guide* (ENVIRON, 2013).

[c] Roundtrip miles/day for Material Hauling Trucks taken as the default from Section 4.5 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

Table 5.1A.14 Equations Used to Calculate Criteria Pollutant and GHG Emissions

Equations Used to Calculate Emissions from Simple-Cycle Block Construction

Emission Source	Pollutant(s)	Equation	Variables
Construction Equipment Exhaust	CO, VOC, NO_X, SO_X, PM_{10}, and $PM_{2.5}$	E_m = EF x N x Hp x L x H / 453.6	E_m = Emissions (lb/month)
			EF = Emission factor (g/bhp-hr)
			N = Number of pieces of equipment
			Hp = Average horsepower
			L = Average load factor
			H = Hours per month
			453.6 = Conversion from g to lb
		$E_d = E_m$ / D	E_d = Emissions (lb/day)
			E_m = Emissions (lb/month)
			D = Number of construction days per month
		$E_t = \Sigma E_m$ / 2,000	E_t = Emissions (tpy)
			E_m = Emissions (lb/month)
			2,000 = Conversion from lb to tons
	CO_2	E_m = N x FC x EF x H x 0.001	E_m = Emissions (metric tons/month)
			N = Number of pieces of equipment
			FC = Fuel consumption (gallons/hour)
			EF = Emission factor (kg/gallon)
			H = Hours per month
			0.001 = Conversion from kg to metric tons
		$E_d = E_m$ / D	E_d = Emissions (metric tons/day)
			E_m = Emissions (metric tons/month)
			D = Number of construction days per month
		$E_t = \Sigma E_m$	E_t = Emissions (metric tons/year)
			E_m = Emissions (metric tons/month)
	CH_4 and N_2O	E_m = N x FC x EF x H / 1,000 x 0.001	E_m = Emissions (metric tons/month)
			N = Number of pieces of equipment
			FC = Fuel consumption (gallons/hour)
			EF = Emission factor (g/gallon)
			H = Hours per month
			1,000 = Conversion from g to kg
			0.001 = Conversion from kg to metric tons
		$E_d = E_m$ / D	E_d = Emissions (metric tons/day)
			E_m = Emissions (metric tons/month)
			D = Number of construction days per month
		$E_t = \Sigma E_m$	E_t = Emissions (metric tons/year)
			E_m = Emissions (metric tons/month)
Onsite and Offsite Vehicle Exhaust and Paved and Unpaved Road Fugitive PM_{10} and $PM_{2.5}$	CO, VOC, NO_X, SO_X, PM_{10}, and $PM_{2.5}$	E_d = N x VMT x EF / 453.6	E_d = Emissions (lb/day)
			N = Number of vehicles
			VMT = Vehicle miles traveled per day (miles/day)
			EF = EMFAC2014 emission factor (g/mile). Paved and unpaved road fugitive PM_{10} and $PM_{2.5}$ emission factors calculated per Sections 13.2.1 and 13.2.2 of *AP-42*, respectively (EPA, 2011; EPA, 2006)
			453.6 = Conversion from g to lb
		$E_m = E_d$ x D	E_m = Emissions (lb/month)
			E_d = Emissions (lb/day)
			D = Number of construction days per month
		$E_t = \Sigma E_m$ / 2,000	E_t = Emissions (tpy)
			E_m = Emissions (lb/month)
			2,000 = Conversion from lb to tons

Table 5.1A.14 Equations Used to Calculate Criteria Pollutant and GHG Emissions

Equations Used to Calculate Emissions from Simple-Cycle Block Construction

Emission Source	Pollutant(s)	Equation	Variables
Onsite and Offsite Vehicle Exhaust	CO_2	E_d = N x VMT / FE x EF x 0.001	E_d = Emissions (metric tons/day)
			N = Number of vehicles
			VMT = Vehicle miles traveled per day (miles/day)
			FE = Fuel economy (mpg)
			EF = Emission factor (kg/gallon)
			0.001 = Conversion from kg to metric tons
		$E_m = E_d$ x D	E_m = Emissions (metric tons/month)
			E_d = Emissions (metric tons/day)
			D = Number of construction days per month
		$E_t = \Sigma E_m$	E_t = Emissions (metric tons/year)
			E_m = Emissions (metric tons/month)
	CH_4 and N_2O	E_d = N x VMT x EF / 1,000 x 0.001	E_d = Emissions (metric tons/day)
			N = Number of vehicles
			VMT = Vehicle miles traveled per day (miles/day)
			EF = Emission factor (g/mile)
			1,000 = Conversion from g to kg
			0.001 = Conversion from kg to metric tons
		$E_m = E_d$ x D	E_m = Emissions (metric tons/month)
			E_d = Emissions (metric tons/day)
			D = Number of construction days per month
		$E_t = \Sigma E_m$	E_t = Emissions (metric tons/year)
			E_m = Emissions (metric tons/month)
Onsite Fugitive PM_{10} and $PM_{2.5}$ from Truck Dumping/Loading	PM_{10} and $PM_{2.5}$	E_d = T x 1.2641662 x EF / D	E_d = Emissions (lb/day)
			T = Tons of material dumped
			1.2641662 = Conversion from cubic yards to tons
			EF = Fugitive PM_{10} and $PM_{2.5}$ emission factors (lb/ton), calculated per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).
			D = Number of construction days per month
		$E_m = E_d$ x D	E_m = Emissions (lb/month)
			E_d = Emissions (lb/day)
			D = Number of construction days per month
		$E_t = \Sigma E_m$ / 2,000	E_t = Emissions (tpy)
			E_m = Emissions (lb/month)
			2,000 = Conversion from lb to tons
Onsite Fugitive PM_{10} and $PM_{2.5}$ from Grading	PM_{10} and $PM_{2.5}$	E_d = EF x A / W x 43,560 / 5,280 / D	E_d = Emissions (lb/day)
			EF = Fugitive PM_{10} and $PM_{2.5}$ emission factors (lb/mile), calculated per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).
			A = Site disturbed (acres/month)
			W = Grading equipment blade width (ft)
			43,560 = Conversion factor from square feet to acres
			5,280 = Conversion factor from feet to miles
			D = Number of construction days per month
		$E_m = E_d$ x D	E_m = Emissions (lb/month)
			E_d = Emissions (lb/day)
			D = Number of construction days per month
		$E_t = \Sigma E_m$ / 2,000	E_t = Emissions (tpy)
			E_m = Emissions (lb/month)
			2,000 = Conversion from lb to tons
Onsite Fugitive PM_{10} and $PM_{2.5}$ from Bulldozing	PM_{10} and $PM_{2.5}$	E_d = EF x H / D	E_d = Emissions (lb/day)
			EF = Fugitive PM_{10} and $PM_{2.5}$ emission factors (lb/mile), calculated per Section 4.3 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).
			H = Hours per month for all bulldozers
			D = Number of construction days per month
		$E_m = E_d$ x D	E_m = Emissions (lb/month)
			E_d = Emissions (lb/day)
			D = Number of construction days per month
		$E_t = \Sigma E_m$ / 2,000	E_t = Emissions (tpy)
			E_m = Emissions (lb/month)
			2,000 = Conversion from lb to tons

Table 5.1A.15 Number of Onsite Construction Equipment and Motor Vehicles

Number of Onsite Equipment for Simple-Cycle Block Construction

Onsite Equipment	Number per Month [a]															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Water Truck	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Excavator	0	2	2	2	2	2	2	0	0	0	0	0	0	0	0	0
Grader	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0
Cranes [b]	2	4	6	6	6	6	6	4	4	2	2	2	0	0	0	0
Tractor/Loader/Backhoe [c]	0	2	2	2	2	2	2	2	2	2	0	0	0	0	0	0
Rubber Tired Loader [d]	2	2	4	4	4	4	2	2	2	2	2	2	0	0	0	0
Crawler Tractor [e]	0	4	4	4	0	0	0	0	0	0	0	0	0	0	0	0
Air Compressor	0	4	4	4	4	4	4	4	4	4	0	0	0	0	0	0
Forklift	4	4	4	4	4	4	4	4	4	4	0	0	0	0	0	0
Roller [f]	0	4	4	4	4	4	4	0	0	0	0	0	0	0	0	0
Other General Industrial Equipment [g]	0	0	4	4	12	8	8	4	0	0	0	0	0	0	0	0

Notes:
[a] Equipment counts taken from 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx'.
[b] Numbers presented for Cranes include the equipment counts for the 75 Ton Hydraulic Crane, the 35 Ton Hydraulic Crane, and the Heavy Lift Gantry Crane.
[c] Numbers presented for Tractor/Loader/Backhoe include the equipment counts for the Backhoe.
[d] Numbers presented for Rubber Tired Loader include the equipment counts for the Front End Loader.
[e] Numbers presented for Crawler Tractor include the equipment counts for the Dozer
[f] Numbers presented for Roller include the equipment counts for the Compactor.
[g] Numbers presented for Other General Industrial Equipment include the equipment counts for the Pile Driver and the Light Towers.

Number of Onsite Motor Vehicles for Simple-Cycle Block Construction

Vehicle Type	Number per Month [a]															
	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Onsite Pick-up Truck	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Onsite Stake Truck	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2

Notes:
[a] Vehicle counts taken from 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx'.

Table 5.1A.16 Construction Equipment Exhaust Criteria Pollutant Emission Factors

Construction Equipment Emission Factors for Simple Cycle Block Construction

Equipment [a]	Percent Usage [b]	Hours per Month [c]	Horsepower [d]	Load Factor [d]	Emission Factors (g/bhp-hr) [e]						Fuel Consumption (gallons/hour) [g]
					CO	VOC	NO_X	SO_X [f]	PM_{10}	$PM_{2.5}$	
Water Truck [h]	50%	115	400	0.38	2.200	0.060	0.260	0.005	0.008	0.008	7.50
Excavator	85%	196	163	0.38	3.700	0.060	0.260	0.005	0.008	0.008	2.93
Grader	80%	184	175	0.41	2.200	0.060	0.260	0.005	0.008	0.008	3.21
Cranes	65%	150	226	0.29	2.200	0.060	0.260	0.005	0.008	0.008	3.28
Tractor/Loader/Backhoe	55%	127	98	0.37	3.700	0.060	0.260	0.005	0.008	0.008	1.61
Rubber Tired Loader	55%	127	200	0.36	2.200	0.060	0.260	0.005	0.008	0.008	3.88
Crawler Tractor	80%	184	208	0.43	2.200	0.060	0.260	0.005	0.008	0.008	4.57
Air Compressor	80%	184	78	0.48	3.700	0.060	0.260	0.006	0.008	0.008	1.78
Forklift	75%	173	89	0.20	3.700	0.060	0.260	0.005	0.008	0.008	0.87
Roller	60%	138	81	0.38	3.700	0.060	0.260	0.005	0.008	0.008	1.71
Other General Industrial Equipment	70%	161	88	0.34	3.700	0.060	0.260	0.005	0.008	0.008	1.31

Notes:

[a] Assumed all equipment is fired with diesel fuel, per Section 4.2 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

[b] Percent Usage assumed typical of power plant construction.

[c] Hours per month calculated based on the following schedule, per 'Alamitos Manpower, Construction Trucks, Construction Equipment 05.26.15.xlsx'.

Work hours per day: 10
Work days per month: 23

[d] Construction equipment horsepower and load factor taken from Table 3.3 of Appendix D of the *CalEEMod User's Guide* (ENVIRON, 2013).

[e] Unless otherwise noted, construction equipment emission factors taken from Table 3.5 of Appendix D of the *CalEEMod User's Guide* (ENVIRON, 2013), assuming Tier 4 Final engine controls .

[f] SO_X construction equipment emission factors taken from Table 3.4 of Appendix D of the *CalEEMod User's Guide* (ENVIRON, 2013) for the year 2020.

[g] Fuel consumption based on consumption in the OFFROAD2011 model for the South Coast Air Basin in the year 2020; value estimated by dividing the reported consumption (lb/year) by the reported activity (hours/year) and by the density of diesel fuel (assumed to be 7 lb/gallon). Since the OFFROAD2011 output did not include data for an Air Compressor, its fuel consumption was assumed to be best represented by that for Other Construction Equipment.

[h] Horsepower, load factor, and emission factors for Off-Highway Trucks were assumed representative of Water Trucks.

Table 5.1A.17 Onsite and Offsite Motor Vehicle Criteria Pollutant Emission Factors

Vehicle Emission Factors for Simple-Cycle Block Construction

Vehicle Type	Vehicle Class [a]	Exhaust Emission Factors (g/mile) [b]									Paved Road Emission Factors (g/mile) [c]		Fuel Economy (mpg) [d]
		CO	VOC	SO_X	NO_X 2020	NO_X 2021	PM_{10} 2020	PM_{10} 2021	$PM_{2.5}$ 2020	$PM_{2.5}$ 2021	PM_{10}	$PM_{2.5}$	
Onsite Pick-up Truck	Light-duty Truck	2.706	0.167	0.011	0.238	0.215	0.060	0.060	0.032	0.032	N/A	N/A	21.961
Onsite Stake Truck	Heavy-duty Diesel	4.191	1.041	0.030	19.741	19.621	0.141	0.135	0.077	0.071	N/A	N/A	5.781
Offsite Delivery Trucks	Heavy-duty Diesel	0.521	0.123	0.015	3.963	3.555	0.117	0.115	0.054	0.052	0.300	0.075	5.781
Material Hauling Trucks	Heavy/Medium-duty Diesel	0.410	0.103	0.013	2.877	2.323	0.151	0.132	0.077	0.059	0.300	0.075	7.252
Construction Worker Commute	Light-duty Auto/Truck	0.982	0.018	0.003	0.086	0.078	0.047	0.046	0.019	0.019	0.300	0.075	24.806

Notes:

[a] The vehicle classes are represented as follows:

Light-duty Truck: Assumed to be 50% LDT1 Gas and 50% LDT2 Gas values.

Heavy-duty Diesel: Assumed to be 100% HHDT DSL values, per Section 4.5 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

Heavy/Medium-duty Diesel: 50% HHDT DSL and 50% MHDT DSL values, per Section 4.5 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

Light-duty Auto/Truck: 50% LDA Gas, 25% LDT1 Gas, and 25% LDT2 Gas values, per Section 4.5 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

[b] Exhaust emission factors from EMFAC2014 for the South Coast Air Basin, calendar year 2020 for CO, VOC, and SO_X. Calendar years 2020 and 2021 were used for NO_X, PM_{10}, and $PM_{2.5}$. A speed of 5 mph was assumed for onsite vehicles; a speed of 40 mph was assumed for offsite vehicles and worker commutes, which is consistent with the CalEEMod defaults. An average temperature of 68°F and humidity of 55% were used per Table B-1 of *CT-EMFAC: A Computer Model to Estimate Transportation Project Emissions* (UC Davis, 2007).

[c] Paved road emission factors calculated using CalEEMod methodology, as described below.

[d] Fuel economy from the EMFAC2014 Web Database (http://www.arb.ca.gov/emfac/2014/) for the South Coast Air Basin, calendar year 2020.

Derivation of Paved Road Emission Factors

Vehicles on Paved Roads

Parameter	PM_{10}	$PM_{2.5}$
Average Weight [a]	2.4	2.4
k [b]	1.0	0.25
sL [a]	0.1	0.1
Emission Factor (g/mile) [c]	0.300	0.075

Notes:

[a] Average Weight and sL taken as the CalEEMod defaults for the Long Beach climate region of the South Coast Air Basin.

[b] k taken from Table 13.2.1-1 of Section 13.2.1 of *AP-42* (EPA, 2011).

[c] Emission factor calculated using Equation 1 from Section 13.2.1 of *AP-42* (EPA, 2011):

$\text{Emission Factor (g/mile)} = k \text{ (g/mile)} \times [sL \text{ (g/m}^2)]^{0.91} \times [\text{Average Weight (tons)}]^{1.02}$

Table 5.1A.18 Onsite and Offsite Greenhouse Gas Emission Factors

Greenhouse Gas Emission Factors for Simple-Cycle Block Construction

Fuel / Category Type	Emission Factor	Emission Factor Units	Emission Factor Source
CO_2 Emission Factors			
Gasoline	8.778	kg CO_2/gallon	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.1. April.
Diesel	10.206	kg CO_2/gallon	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.1. April.
N_2O Emission Factors			
Gasoline Passenger Car Model Year 2012 [a]	0.0036	g N_2O/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.5. April.
Gasoline Light-duty Truck Model Year 2012 [a]	0.0066	g N_2O/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.5. April.
Diesel Heavy-duty Truck Model Year 1960 - 2012 [a]	0.0048	g N_2O/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.5. April.
Diesel Off-road Vehicle	0.256	g N_2O/gallon	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.7. April.
CH_4 Emission Factors			
Gasoline Passenger Car Model Year 2012 [a]	0.0173	g CH_4/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.5. April.
Gasoline Light-duty Truck Model Year 2012 [a]	0.0163	g CH_4/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.5. April.
Diesel Heavy-duty Truck Model Year 1960 - 2012 [a]	0.0051	g CH_4/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.5. April.
Diesel Off-road Vehicle	0.576	g CH_4/gallon	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.7. April.

Notes:
[a] Model Year 2012 was the most recent year of emission factors available. As a result, it was assumed representative of vehicles used for this project.

Table 5.1A.19 AEC Onsite Construction Exhaust and Fugitive Emissions Summary

Onsite CO Emissions

CO Emissions by Month (months 1–17)

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Combined-Cycle Block Construction																	
Total (lb/month)	0.20	0.20	0.20	0.20	0.20	0.20	1,534.31	1,617.91	1,941.70	1,770.63	1,831.83	1,809.88	1,809.88	1,740.40	1,606.88	1,606.88	1,542.53
Total (lb/day)	0.01	0.01	0.01	0.01	0.01	0.01	66.71	70.34	84.42	76.98	79.64	78.69	78.69	75.67	69.86	69.86	67.07
Simple-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Total Onsite CO Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**0.20**	**1,534.31**	**1,617.91**	**1,941.70**	**1,770.63**	**1,831.83**	**1,809.88**	**1,809.88**	**1,740.40**	**1,606.88**	**1,606.88**	**1,542.53**
Pounds per Day	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**66.71**	**70.34**	**84.42**	**76.98**	**79.64**	**78.69**	**78.69**	**75.67**	**69.86**	**69.86**	**67.07**
Yearly Maximums	**10,507**	**12,317**	**14,057**	**15,664**	**17,271**	**18,813**	**20,330**	**20,407**	**20,471**	**20,211**	**20,147**	**20,021**	**19,917**	**19,720**	**19,592**	**19,550**	**19,508**
Maximum Pounds per Day	**91.3**																
Maximum Pounds per Hour [a]	**9.13**																
Maximum Pounds per Month	**2,101**																
Month with Maximum	**Months 38 or 39**																
Maximum Pounds per Year	**20,471**																
Maximum Average Pounds per Hour [b]	**2.34**																
Year with Maximum	**Months 9-20**																
Tons per Year	**10.2**																

CO Emissions by Month (months 18–34)

Construction Step	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																	
Total (lb/month)	1,517.48	1,610.78	1,682.12	1,682.12	1,705.93	1,705.93	1,705.93	1,612.64	1,612.64	1,565.11	1,565.11	1,565.11	1,471.82	400.54	352.91	352.91	0.20
Total (lb/day)	65.98	70.03	73.14	73.14	74.17	74.17	74.17	70.11	70.11	68.05	68.05	68.05	63.99	17.41	15.34	15.34	0.01
Simple-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Total Onsite CO Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	**1,517.48**	**1,610.78**	**1,682.12**	**1,682.12**	**1,705.93**	**1,705.93**	**1,705.93**	**1,612.64**	**1,612.64**	**1,565.11**	**1,565.11**	**1,565.11**	**1,471.82**	**400.54**	**352.91**	**352.91**	**0.20**
Pounds per Day	**65.98**	**70.03**	**73.14**	**73.14**	**74.17**	**74.17**	**74.17**	**70.11**	**70.11**	**68.05**	**68.05**	**68.05**	**63.99**	**17.41**	**15.34**	**15.34**	**0.01**
Yearly Maximums	**19,531**	**19,485**	**18,275**	**16,946**	**15,617**	**13,911**	**12,205**	**10,953**	**11,101**	**11,589**	**12,125**	**12,400**	**12,518**	**12,640**	**13,246**	**13,742**	**14,143**

Onsite VOC Emissions

VOC Emissions by Month (months 1–17)

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Combined-Cycle Block Construction																	
Total (lb/month)	0.01	0.01	0.01	0.01	0.01	0.01	32.90	34.33	41.07	36.65	37.71	38.27	38.27	37.53	35.87	35.87	35.27
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	1.43	1.49	1.79	1.59	1.64	1.66	1.66	1.63	1.56	1.56	1.53
Simple-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Total Onsite VOC Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**0.01**	**32.90**	**34.33**	**41.07**	**36.65**	**37.71**	**38.27**	**38.27**	**37.53**	**35.87**	**35.87**	**35.27**
Pounds per Day	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**1.43**	**1.49**	**1.79**	**1.59**	**1.64**	**1.66**	**1.66**	**1.63**	**1.56**	**1.56**	**1.53**
Yearly Maximums	**221**	**259**	**297**	**333**	**368**	**404**	**439**	**442**	**446**	**444**	**446**	**448**	**449**	**448**	**448**	**449**	**449**
Maximum Pounds per Day	**2.07**																
Maximum Pounds per Hour [a]	**0.21**																
Maximum Pounds per Month	**47.6**																
Month with Maximum	**Months 38 or 39**																
Maximum Pounds per Year	**450**																
Maximum Average Pounds per Hour [b]	**0.051**																
Year with Maximum	**Months 19-30**																
Tons per Year	**0.23**																

VOC Emissions by Month (months 18–34)

Construction Step	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																	
Total (lb/month)	34.87	36.38	38.45	38.45	39.22	39.22	39.22	37.71	37.71	36.41	36.41	36.41	34.90	9.29	7.75	7.75	0.01
Total (lb/day)	1.52	1.58	1.67	1.67	1.71	1.71	1.71	1.64	1.64	1.58	1.58	1.58	1.52	0.40	0.34	0.34	0.00
Simple-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Total Onsite VOC Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	**34.87**	**36.38**	**38.45**	**38.45**	**39.22**	**39.22**	**39.22**	**37.71**	**37.71**	**36.41**	**36.41**	**36.41**	**34.90**	**9.29**	**7.75**	**7.75**	**0.01**
Pounds per Day	**1.52**	**1.58**	**1.67**	**1.67**	**1.71**	**1.71**	**1.71**	**1.64**	**1.64**	**1.58**	**1.58**	**1.58**	**1.52**	**0.40**	**0.34**	**0.34**	**0.00**
Yearly Maximums	**450**	**450**	**423**	**393**	**362**	**323**	**284**	**256**	**258**	**268**	**279**	**280**	**278**	**275**	**287**	**299**	**307**

Onsite NO_X Emissions

NO_X Emissions by Month (months 1–17)

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Combined-Cycle Block Construction																	
Total (lb/month)	0.02	0.02	0.02	0.02	0.02	0.02	230.72	239.57	308.95	305.48	312.79	329.49	329.49	340.57	312.83	312.83	328.98
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	10.03	10.42	13.43	13.28	13.60	14.33	14.33	14.81	13.60	13.60	14.30
Simple-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Total Onsite NO_X Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**0.02**	**230.72**	**239.57**	**308.95**	**305.48**	**312.79**	**329.49**	**329.49**	**340.57**	**312.83**	**312.83**	**328.98**
Pounds per Day	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**10.03**	**10.42**	**13.43**	**13.28**	**13.60**	**14.33**	**14.33**	**14.81**	**13.60**	**13.60**	**14.30**
Yearly Maximums	**1,727**	**2,057**	**2,397**	**2,710**	**3,023**	**3,352**	**3,679**	**3,782**	**3,900**	**3,948**	**4,017**	**4,079**	**4,124**	**4,163**	**4,190**	**4,240**	**4,290**
Maximum Pounds per Day	**16.3**																
Maximum Pounds per Hour [a]	**1.63**																
Maximum Pounds per Month	**375**																
Month with Maximum	**Months 22, 23, or 24**																
Maximum Pounds per Year	**4,352**																
Maximum Average Pounds per Hour [b]	**0.50**																
Year with Maximum	**Months 19-30**																
Tons per Year	**2.18**																

NO_X Emissions by Month (months 18–34)

Construction Step	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																	
Total (lb/month)	327.22	333.78	357.07	357.07	374.71	374.71	374.71	368.15	368.15	362.54	362.54	362.54	355.98	123.89	88.62	88.62	0.01
Total (lb/day)	14.23	14.51	15.52	15.52	16.29	16.29	16.29	16.01	16.01	15.76	15.76	15.76	15.48	5.39	3.85	3.85	0.00
Simple-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Total Onsite NO_X Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	**327.22**	**333.78**	**357.07**	**357.07**	**374.71**	**374.71**	**374.71**	**368.15**	**368.15**	**362.54**	**362.54**	**362.54**	**355.98**	**123.89**	**88.62**	**88.62**	**0.01**
Pounds per Day	**14.23**	**14.51**	**15.52**	**15.52**	**16.29**	**16.29**	**16.29**	**16.01**	**16.01**	**15.76**	**15.76**	**15.76**	**15.48**	**5.39**	**3.85**	**3.85**	**0.00**
Yearly Maximums	**4,323**	**4,352**	**4,142**	**3,874**	**3,605**	**3,230**	**2,856**	**2,534**	**2,342**	**2,184**	**2,030**	**1,831**	**1,621**	**1,407**	**1,380**	**1,376**	**1,361**

Table 5.1A.19 AEC Onsite Construction Exhaust and Fugitive Emissions Summary

Onsite SO_X Emissions

	SO_X Emissions by Month																																	
Construction Step	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**
Combined-Cycle Block Construction																																		
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	2.66	2.77	3.27	2.88	2.98	2.96	2.96	2.84	2.73	2.73	2.66	2.63	2.78	2.92	2.92	2.95	2.95	2.95	2.80	2.80	2.69	2.69	2.69	2.54	0.59	0.52	0.52	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.12	0.14	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.11	0.12	0.13	0.13	0.13	0.13	0.13	0.12	0.12	0.12	0.12	0.12	0.11	0.03	0.02	0.02	0.00
Simple-Cycle Block Construction																																		
Total (lb/month)																																		
Total (lb/day)																																		
Total Onsite SO_X Emissions (Construction Equipment and Vehicles)																																		
Pounds per Month	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.66**	**2.77**	**3.27**	**2.88**	**2.98**	**2.96**	**2.96**	**2.84**	**2.73**	**2.73**	**2.66**	**2.63**	**2.78**	**2.92**	**2.92**	**2.95**	**2.95**	**2.95**	**2.80**	**2.80**	**2.69**	**2.69**	**2.69**	**2.54**	**0.59**	**0.52**	**0.52**	**0.00**
Pounds per Day	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.12**	**0.12**	**0.14**	**0.13**	**0.13**	**0.13**	**0.13**	**0.12**	**0.12**	**0.12**	**0.12**	**0.11**	**0.12**	**0.13**	**0.13**	**0.13**	**0.13**	**0.13**	**0.12**	**0.12**	**0.12**	**0.12**	**0.12**	**0.11**	**0.03**	**0.02**	**0.02**	**0.00**
Yearly Maximums	**18**	**20**	**23**	**26**	**29**	**31**	**34**	**34**	**34**	**34**	**34**	**34**	**34**	**34**	**34**	**34**	**34**	**34**	**34**	**31**	**29**	**27**	**24**	**21**	**19**	**19**	**20**	**22**	**22**	**22**	**22**	**24**	**25**	**25**
Maximum Pounds per Day	**0.17**																																	
Maximum Pounds per Hour [a]	**0.017**																																	
Maximum Pounds per Month	**3.93**																																	
Month with Maximum	**Months 38 or 39**																																	
Maximum Pounds per Year	**34.3**																																	
Maximum Average Pounds per Hour [b]	**0.0039**																																	
Year with Maximum	**Months 9-20**																																	
Tons per Year	**0.017**																																	

Onsite Exhaust PM_{10} Emissions

	Exhaust PM_{10} Emissions by Month																																	
Construction Step	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**
Combined-Cycle Block Construction																																		
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	4.08	4.25	5.01	4.37	4.50	4.52	4.52	4.37	4.22	4.22	4.07	4.02	4.22	4.45	4.45	4.50	4.50	4.50	4.30	4.30	4.12	4.12	4.12	3.92	0.94	0.84	0.84	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.18	0.22	0.19	0.20	0.20	0.20	0.19	0.18	0.18	0.18	0.17	0.18	0.19	0.19	0.20	0.20	0.20	0.19	0.19	0.18	0.18	0.18	0.17	0.04	0.04	0.04	0.00
Simple-Cycle Block Construction																																		
Total (lb/month)																																		
Total (lb/day)																																		
Total Onsite Exhaust PM_{10} Emissions (Construction Equipment and Vehicles)																																		
Pounds per Month	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**4.08**	**4.25**	**5.01**	**4.37**	**4.50**	**4.52**	**4.52**	**4.37**	**4.22**	**4.22**	**4.07**	**4.02**	**4.22**	**4.45**	**4.45**	**4.50**	**4.50**	**4.50**	**4.30**	**4.30**	**4.12**	**4.12**	**4.12**	**3.92**	**0.94**	**0.84**	**0.84**	**0.00**
Pounds per Day	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.18**	**0.18**	**0.22**	**0.19**	**0.20**	**0.20**	**0.20**	**0.19**	**0.18**	**0.18**	**0.18**	**0.17**	**0.18**	**0.19**	**0.19**	**0.20**	**0.20**	**0.20**	**0.19**	**0.19**	**0.18**	**0.18**	**0.18**	**0.17**	**0.04**	**0.04**	**0.04**	**0.00**
Yearly Maximums	**27**	**31**	**36**	**40**	**44**	**48**	**52**	**52**	**52**	**52**	**52**	**52**	**52**	**52**	**52**	**52**	**52**	**52**	**51**	**48**	**45**	**41**	**36**	**32**	**29**	**30**	**32**	**34**	**35**	**36**	**36**	**38**	**40**	**41**
Maximum Pounds per Day	**0.28**																																	
Maximum Pounds per Hour [a]	**0.028**																																	
Maximum Pounds per Month	**6.35**																																	
Month with Maximum	**Months 38 or 39**																																	
Maximum Pounds per Year	**52.5**																																	
Maximum Average Pounds per Hour [b]	**0.0060**																																	
Year with Maximum	**Months 9-20**																																	
Tons per Year	**0.026**																																	

Onsite Fugitive PM_{10} Emissions

	Fugitive PM_{10} Emissions by Month																																	
Construction Step	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**
Combined-Cycle Block Construction																																		
Total (lb/month)	7.93	7.93	7.93	7.93	7.93	7.93	59.65	59.65	59.65	75.50	75.50	75.50	75.50	75.50	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	7.93	7.93	7.93	7.93
Total (lb/day)	0.34	0.34	0.34	0.34	0.34	0.34	2.59	2.59	2.59	3.28	3.28	3.28	3.28	3.28	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	0.34	0.34	0.34	0.34
Simple-Cycle Block Construction																																		
Total (lb/month)																																		
Total (lb/day)																																		
Total Onsite Fugitive PM_{10} Emissions (Grading, Bulldozing, Truck Dumping/Loading, and Onsite Construction Vehicles)																																		
Pounds per Month	**7.93**	**7.93**	**7.93**	**7.93**	**7.93**	**7.93**	**59.65**	**59.65**	**59.65**	**75.50**	**75.50**	**75.50**	**75.50**	**75.50**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**7.93**	**7.93**	**7.93**	**7.93**
Pounds per Day	**0.34**	**0.34**	**0.34**	**0.34**	**0.34**	**0.34**	**2.59**	**2.59**	**2.59**	**3.28**	**3.28**	**3.28**	**3.28**	**3.28**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**0.34**	**0.34**	**0.34**	**0.34**
Yearly Maximums	**453**	**521**	**588**	**648**	**707**	**767**	**827**	**835**	**843**	**851**	**843**	**835**	**827**	**819**	**811**	**811**	**811**	**811**	**811**	**751**	**692**	**632**	**572**	**505**	**485**	**576**	**667**	**759**	**739**	**719**	**699**	**738**	**778**	**818**
Maximum Pounds per Day	**6.91**																																	
Maximum Pounds per Hour [a]	**0.69**																																	
Maximum Pounds per Month	**159**																																	
Month with Maximum	**Months 37, 38, or 39**																																	
Maximum Pounds per Year	**905**																																	
Maximum Average Pounds per Hour [b]	**0.10**																																	
Year with Maximum	**Months 36-47**																																	
Tons per Year	**0.45**																																	

Table 5.1A.19 AEC Onsite Construction Exhaust and Fugitive Emissions Summary

Total Onsite PM_{10} Emissions (Exhaust and Fugitive)

	Total PM_{10} Emissions by Month																																	
Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Pounds per Month	7.93	7.93	7.93	7.93	7.93	7.93	63.73	63.90	64.66	79.87	80.00	80.02	80.02	79.87	71.80	71.80	71.65	71.60	71.80	72.02	72.02	72.07	72.07	72.07	71.87	71.87	71.70	71.70	71.70	71.50	8.87	8.76	8.76	7.93
Pounds per Day	0.34	0.34	0.34	0.34	0.34	0.34	2.77	2.78	2.81	3.47	3.48	3.48	3.48	3.47	3.12	3.12	3.12	3.11	3.12	3.13	3.13	3.13	3.13	3.13	3.12	3.12	3.12	3.12	3.12	3.11	0.39	0.38	0.38	0.34
Yearly Maximums	480	552	624	688	752	815	879	887	895	902	895	887	879	871	863	863	862	862	862	799	736	673	609	537	514	606	699	793	774	754	735	776	818	859
Maximum Pounds per Day	7.18																																	
Maximum Pounds per Hour [a]	0.72																																	
Maximum Pounds per Month	165																																	
Month with Maximum	Months 38 or 39																																	
Maximum Pounds per Year	948																																	
Maximum Average Pounds per Hour [b]	0.11																																	
Year with Maximum	Months 36-47																																	
Tons per Year	0.47																																	

Onsite Exhaust $PM_{2.5}$ Emissions

	Exhaust $PM_{2.5}$ Emissions by Month																																	
Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																																		
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	4.07	4.24	5.00	4.35	4.48	4.50	4.50	4.35	4.21	4.21	4.06	4.01	4.21	4.43	4.43	4.48	4.48	4.48	4.28	4.28	4.11	4.11	4.11	3.91	0.94	0.83	0.83	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.18	0.22	0.19	0.19	0.20	0.20	0.19	0.18	0.18	0.18	0.17	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.17	0.04	0.04	0.04	0.00
Simple-Cycle Block Construction																																		
Total (lb/month)																																		
Total (lb/day)																																		
Total Onsite Exhaust $PM_{2.5}$ Emissions (Construction Equipment and Vehicles)																																		
Pounds per Month	0.00	0.00	0.00	0.00	0.00	0.00	4.07	4.24	5.00	4.35	4.48	4.50	4.50	4.35	4.21	4.21	4.06	4.01	4.21	4.43	4.43	4.48	4.48	4.48	4.28	4.28	4.11	4.11	4.11	3.91	0.94	0.83	0.83	0.00
Pounds per Day	0.00	0.00	0.00	0.00	0.00	0.00	0.18	0.18	0.22	0.19	0.19	0.20	0.20	0.19	0.18	0.18	0.18	0.17	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.18	0.18	0.18	0.17	0.04	0.04	0.04	0.00
Yearly Maximums	27	31	35	40	44	48	52	52	52	52	52	52	52	52	52	51	51	51	51	48	44	41	36	32	29	30	32	34	35	36	36	38	40	41
Maximum Pounds per Day	0.28																																	
Maximum Pounds per Hour [a]	0.028																																	
Maximum Pounds per Month	6.34																																	
Month with Maximum	Months 38 or 39																																	
Maximum Pounds per Year	52.3																																	
Maximum Average Pounds per Hour [b]	0.0060																																	
Year with Maximum	Months 9-20																																	
Tons per Year	0.026																																	

Onsite Fugitive $PM_{2.5}$ Emissions

	Fugitive $PM_{2.5}$ Emissions by Month																																	
Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																																		
Total (lb/month)	0.79	0.79	0.79	0.79	0.79	0.79	18.42	18.42	18.42	20.01	20.01	20.01	20.01	20.01	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	0.79	0.79	0.79	0.79
Total (lb/day)	0.03	0.03	0.03	0.03	0.03	0.03	0.80	0.80	0.80	0.87	0.87	0.87	0.87	0.87	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.03	0.03	0.03	0.03
Simple-Cycle Block Construction																																		
Total (lb/month)																																		
Total (lb/day)																																		
Total Onsite Fugitive $PM_{2.5}$ Emissions (Grading, Bulldozing, Truck Dumping/Loading, and Onsite Construction Vehicles)																																		
Pounds per Month	0.79	0.79	0.79	0.79	0.79	0.79	18.42	18.42	18.42	20.01	20.01	20.01	20.01	20.01	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	0.79	0.79	0.79	0.79
Pounds per Day	0.03	0.03	0.03	0.03	0.03	0.03	0.80	0.80	0.80	0.87	0.87	0.87	0.87	0.87	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.03	0.03	0.03	0.03
Yearly Maximums	120	139	158	177	195	214	232	233	234	235	234	233	232	231	231	231	231	231	231	212	194	175	157	138	123	170	216	263	248	234	219	223	227	231
Maximum Pounds per Day	2.86																																	
Maximum Pounds per Hour [a]	0.29																																	
Maximum Pounds per Month	85.7																																	
Month with Maximum	Months 37, 38, or 39																																	
Maximum Pounds per Year	263																																	
Maximum Average Pounds per Hour [b]	0.030																																	
Year with Maximum	Months 28-39																																	
Tons per Year	0.13																																	

Table 5.1A.19 AEC Onsite Construction Exhaust and Fugitive Emissions Summary

Total Onsite $PM_{2.5}$ Emissions (Exhaust and Fugitive)

	Total $PM_{2.5}$ Emissions by Month																																	
Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Pounds per Month	0.79	0.79	0.79	0.79	0.79	0.79	22.49	22.67	23.42	24.36	24.49	24.51	24.51	24.36	23.42	23.42	23.28	23.22	23.42	23.65	23.65	23.70	23.70	23.70	23.50	23.50	23.32	23.32	23.32	23.12	1.73	1.63	1.63	0.79
Pounds per Day	0.03	0.03	0.03	0.03	0.03	0.03	0.98	0.99	1.02	1.06	1.06	1.07	1.07	1.06	1.02	1.02	1.01	1.01	1.02	1.03	1.03	1.03	1.03	1.03	1.02	1.02	1.01	1.01	1.01	1.01	0.08	0.07	0.07	0.03
Yearly Maximums	147	170	194	217	239	262	284	285	286	286	286	285	284	283	282	282	282	282	282	260	238	216	193	170	152	200	248	297	283	269	255	261	267	272
Maximum Pounds per Day	3.13																																	
Maximum Pounds per Hour [a]	0.31																																	
Maximum Pounds per Month	72.1																																	
Month with Maximum	Months 38 or 39																																	
Maximum Pounds per Year	297																																	
Maximum Average Pounds per Hour [b]	0.034																																	
Year with Maximum	Months 28-39																																	
Tons per Year	0.15																																	

Onsite CO_2 Emissions

	CO_2 Emissions by Month																																	
Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																																		
Total (metric tons/month)	0.01	0.01	0.01	0.01	0.01	0.01	110.00	115.82	137.49	117.74	122.60	126.11	126.11	124.60	112.70	112.70	108.60	107.08	110.41	117.25	117.25	119.07	119.07	119.07	115.74	115.74	110.73	110.73	110.73	107.40	27.73	24.08	24.08	0.01
Total (metric tons/day)	0.00	0.00	0.00	0.00	0.00	0.00	4.78	5.04	5.98	5.12	5.33	5.48	5.48	5.42	4.90	4.90	4.72	4.66	4.80	5.10	5.10	5.18	5.18	5.18	5.03	5.03	4.81	4.81	4.81	4.67	1.21	1.05	1.05	0.00
Simple-Cycle Block Construction																																		
Total (metric tons/month)																																		
Total (metric tons/day)																																		
Total Onsite CO_2 Emissions (Construction Equipment and Vehicles)																																		
Metric Tons per Month	0.01	0.01	0.01	0.01	0.01	0.01	110.00	115.82	137.49	117.74	122.60	126.11	126.11	124.60	112.70	112.70	108.60	107.08	110.41	117.25	117.25	119.07	119.07	119.07	115.74	115.74	110.73	110.73	110.73	107.40	27.73	24.08	24.08	0.01
Metric Tons per Day	0.00	0.00	0.00	0.00	0.00	0.00	4.78	5.04	5.98	5.12	5.33	5.48	5.48	5.42	4.90	4.90	4.72	4.66	4.80	5.10	5.10	5.18	5.18	5.18	5.03	5.03	4.81	4.81	4.81	4.67	1.21	1.05	1.05	0.00
Yearly Maximums	730	856	981	1,093	1,206	1,314	1,422	1,422	1,423	1,403	1,404	1,401	1,394	1,384	1,375	1,373	1,371	1,373	1,373	1,290	1,197	1,104	985	866	791	826	890	960	987	1,007	1,019	1,072	1,119	1,156
Maximum Metric Tons per Day	7.82																																	
Maximum Metric Tons per Hour [a]	0.78																																	
Maximum Metric Tons per Month	180																																	
Month with Maximum	Months 38 or 39																																	
Maximum Metric Tons per Year	1,423																																	
Maximum Average Metric Tons per Hour [b]	0.16																																	
Year with Maximum	Months 9-20																																	

Onsite N_2O Emissions

	N_2O Emissions by Month																																	
Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																																		
Total (metric tons/month)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00276	0.00290	0.00345	0.00295	0.00307	0.00316	0.00316	0.00312	0.00282	0.00282	0.00272	0.00268	0.00277	0.00294	0.00294	0.00298	0.00298	0.00298	0.00290	0.00290	0.00277	0.00277	0.00277	0.00269	0.00070	0.00060	0.00060	0.00000
Total (metric tons/day)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00012	0.00013	0.00015	0.00013	0.00013	0.00014	0.00014	0.00014	0.00012	0.00012	0.00012	0.00012	0.00012	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00012	0.00012	0.00012	0.00012	0.00003	0.00003	0.00003	0.00000
Simple-Cycle Block Construction																																		
Total (metric tons/month)																																		
Total (metric tons/day)																																		
Total Onsite N_2O Emissions (Construction Equipment and Vehicles)																																		
Metric Tons per Month	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00276	0.00290	0.00345	0.00295	0.00307	0.00316	0.00316	0.00312	0.00282	0.00282	0.00272	0.00268	0.00277	0.00294	0.00294	0.00298	0.00298	0.00298	0.00290	0.00290	0.00277	0.00277	0.00277	0.00269	0.00070	0.00060	0.00060	0.00000
Metric Tons per Day	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00012	0.00013	0.00015	0.00013	0.00013	0.00014	0.00014	0.00014	0.00012	0.00012	0.00012	0.00012	0.00012	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00013	0.00012	0.00012	0.00012	0.00012	0.00003	0.00003	0.00003	0.00000
Yearly Maximums	0.01828	0.02144	0.02456	0.02738	0.03021	0.03293	0.03561	0.03562	0.03565	0.03514	0.03518	0.03509	0.03491	0.03465	0.03443	0.03438	0.03433	0.03439	0.03440	0.03233	0.02999	0.02766	0.02468	0.02169	0.01981	0.02070	0.02231	0.02404	0.02474	0.02522	0.02554	0.02685	0.02803	0.02897
Maximum Metric Tons per Day	0.00020																																	
Maximum Metric Tons per Hour [a]	0.000020																																	
Maximum Metric Tons per Month	0.0045																																	
Month with Maximum	Months 38 or 39																																	
Maximum Metric Tons per Year	0.036																																	
Maximum Average Metric Tons per Hour [b]	0.0000041																																	
Year with Maximum	Months 9-20																																	

Onsite CH_4 Emissions

	CH_4 Emissions by Month																																	
Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																																		
Total (metric tons/month)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00620	0.00653	0.00775	0.00663	0.00691	0.00711	0.00711	0.00702	0.00635	0.00635	0.00612	0.00603	0.00622	0.00661	0.00661	0.00671	0.00671	0.00671	0.00652	0.00652	0.00624	0.00624	0.00624	0.00605	0.00156	0.00136	0.00136	0.00000
Total (metric tons/day)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00027	0.00028	0.00034	0.00029	0.00030	0.00031	0.00031	0.00031	0.00028	0.00028	0.00027	0.00026	0.00027	0.00029	0.00029	0.00029	0.00029	0.00029	0.00028	0.00028	0.00027	0.00027	0.00027	0.00026	0.00007	0.00006	0.00006	0.00000
Simple-Cycle Block Construction																																		
Total (metric tons/month)																																		
Total (metric tons/day)																																		
Total Onsite CH_4 Emissions (Construction Equipment and Vehicles)																																		
Metric Tons per Month	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00620	0.00653	0.00775	0.00663	0.00691	0.00711	0.00711	0.00702	0.00635	0.00635	0.00612	0.00603	0.00622	0.00661	0.00661	0.00671	0.00671	0.00671	0.00652	0.00652	0.00624	0.00624	0.00624	0.00605	0.00156	0.00136	0.00136	0.00000
Metric Tons per Day	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00027	0.00028	0.00034	0.00029	0.00030	0.00031	0.00031	0.00031	0.00028	0.00028	0.00027	0.00026	0.00027	0.00029	0.00029	0.00029	0.00029	0.00029	0.00028	0.00028	0.00027	0.00027	0.00027	0.00026	0.00007	0.00006	0.00006	0.00000
Yearly Maximums	0.04113	0.04824	0.05526	0.06161	0.06796	0.07408	0.08011	0.08013	0.08021	0.07906	0.07914	0.07894	0.07855	0.07797	0.07747	0.07736	0.07725	0.07737	0.07738	0.07273	0.06748	0.06223	0.05552	0.04881	0.04457	0.04657	0.05019	0.05409	0.05566	0.05675	0.05746	0.06041	0.06307	0.06517
Maximum Metric Tons per Day	0.00044																																	
Maximum Metric Tons per Hour [a]	0.000044																																	
Maximum Metric Tons per Month	0.010																																	
Month with Maximum	Months 38 or 39																																	
Maximum Metric Tons per Year	0.080																																	
Maximum Average Metric Tons per Hour [b]	0.0000092																																	
Year with Maximum	Months 9-20																																	

Table 5.1A.19 AEC Onsite Construction Exha

Onsite CO Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Simple-Cycle Block Construction																	
Total (lb/month)		454.26	1,760.44	2,101.01	2,101.01	1,839.96	1,682.79	1,594.44	1,006.08	848.91	753.86	354.08	354.08	170.68	170.68	170.68	170.68
Total (lb/day)		19.75	76.54	91.35	91.35	80.00	73.16	69.32	43.74	36.91	32.78	15.39	15.39	7.42	7.42	7.42	7.42
Total Onsite CO Emissions (Construction Equipment and Veh																	
Pounds per Month	**0.00**	**454.26**	**1,760.44**	**2,101.01**	**2,101.01**	**1,839.96**	**1,682.79**	**1,594.44**	**1,006.08**	**848.91**	**753.86**	**354.08**	**354.08**	**170.68**	**170.68**	**170.68**	**170.68**
Pounds per Day	**0.00**	**19.75**	**76.54**	**91.35**	**91.35**	**80.00**	**73.16**	**69.32**	**43.74**	**36.91**	**32.78**	**15.39**	**15.39**	**7.42**	**7.42**	**7.42**	**7.42**
Yearly Maximums	**14,497**	**14,851**	**14,567**	**12,978**	**11,047**	**9,117**											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite VOC Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Simple-Cycle Block Construction																	
Total (lb/month)		11.48	40.07	47.62	47.62	37.03	34.48	32.07	21.48	18.93	16.34	9.85	9.85	4.85	4.85	4.85	4.85
Total (lb/day)		0.50	1.74	2.07	2.07	1.61	1.50	1.39	0.93	0.82	0.71	0.43	0.43	0.21	0.21	0.21	0.21
Total Onsite VOC Emissions (Construction Equipment and Ve																	
Pounds per Month	**0.00**	**11.48**	**40.07**	**47.62**	**47.62**	**37.03**	**34.48**	**32.07**	**21.48**	**18.93**	**16.34**	**9.85**	**9.85**	**4.85**	**4.85**	**4.85**	**4.85**
Pounds per Day	**0.00**	**0.50**	**1.74**	**2.07**	**2.07**	**1.61**	**1.50**	**1.39**	**0.93**	**0.82**	**0.71**	**0.43**	**0.43**	**0.21**	**0.21**	**0.21**	**0.21**
Yearly Maximums	**317**	**327**	**320**	**285**	**242**	**199**											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite NO_X Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Simple-Cycle Block Construction																	
Total (lb/month)		52.78	176.69	209.41	209.41	163.49	152.45	142.01	96.11	85.04	73.81	45.71	45.71	24.04	24.04	24.04	24.04
Total (lb/day)		2.29	7.68	9.10	9.10	7.11	6.63	6.17	4.18	3.70	3.21	1.99	1.99	1.05	1.05	1.05	1.05
Total Onsite NO_X Emissions (Construction Equipment and Vel																	
Pounds per Month	**0.00**	**52.78**	**176.69**	**209.41**	**209.41**	**163.49**	**152.45**	**142.01**	**96.11**	**85.04**	**73.81**	**45.71**	**45.71**	**24.04**	**24.04**	**24.04**	**24.04**
Pounds per Day	**0.00**	**2.29**	**7.68**	**9.10**	**9.10**	**7.11**	**6.63**	**6.17**	**4.18**	**3.70**	**3.21**	**1.99**	**1.99**	**1.05**	**1.05**	**1.05**	**1.05**
Yearly Maximums	**1,407**	**1,453**	**1,424**	**1,271**	**1,086**	**900**											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Table 5.1A.19 AEC Onsite Construction Exha

Onsite SO_X Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Simple-Cycle Block Construction																	
Total (lb/month)		0.92	3.32	3.93	3.93	3.06	2.85	2.66	1.80	1.60	1.39	0.79	0.79	0.38	0.38	0.38	0.38
Total (lb/day)		0.04	0.14	0.17	0.17	0.13	0.12	0.12	0.08	0.07	0.06	0.03	0.03	0.02	0.02	0.02	0.02
Total Onsite SO_X Emissions (Construction Equipment and Vel																	
Pounds per Month	**0.00**	**0.92**	**3.32**	**3.93**	**3.93**	**3.06**	**2.85**	**2.66**	**1.80**	**1.60**	**1.39**	**0.79**	**0.79**	**0.38**	**0.38**	**0.38**	**0.38**
Pounds per Day	**0.00**	**0.04**	**0.14**	**0.17**	**0.17**	**0.13**	**0.12**	**0.12**	**0.08**	**0.07**	**0.06**	**0.03**	**0.03**	**0.02**	**0.02**	**0.02**	**0.02**
Yearly Maximums	**26**	**27**	**27**	**24**	**20**	**16**											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite Exhaust PM_{10} Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Simple-Cycle Block Construction																	
Total (lb/month)		1.53	5.35	6.35	6.35	4.94	4.60	4.28	2.87	2.53	2.18	1.32	1.32	0.65	0.65	0.65	0.65
Total (lb/day)		0.07	0.23	0.28	0.28	0.21	0.20	0.19	0.12	0.11	0.09	0.06	0.06	0.03	0.03	0.03	0.03
Total Onsite Exhaust PM_{10} Emissions (Construction Equipme																	
Pounds per Month	**0.00**	**1.53**	**5.35**	**6.35**	**6.35**	**4.94**	**4.60**	**4.28**	**2.87**	**2.53**	**2.18**	**1.32**	**1.32**	**0.65**	**0.65**	**0.65**	**0.65**
Pounds per Day	**0.00**	**0.07**	**0.23**	**0.28**	**0.28**	**0.21**	**0.20**	**0.19**	**0.12**	**0.11**	**0.09**	**0.06**	**0.06**	**0.03**	**0.03**	**0.03**	**0.03**
Yearly Maximums	**42**	**44**	**43**	**38**	**32**	**27**											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite Fugitive PM_{10} Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Simple-Cycle Block Construction																	
Total (lb/month)		47.58	158.86	158.86	158.86	47.58	47.58	47.58	47.58	47.58	47.58	47.58	47.58	47.57	47.57	47.57	47.57
Total (lb/day)		2.07	6.91	6.91	6.91	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07
Total Onsite Fugitive PM_{10} Emissions (Grading, Bulldozing, Tr																	
Pounds per Month	**0.00**	**47.58**	**158.86**	**158.86**	**158.86**	**47.58**	**47.58**	**47.58**	**47.58**	**47.58**	**47.58**	**47.58**	**47.58**	**47.57**	**47.57**	**47.57**	**47.57**
Pounds per Day	**0.00**	**2.07**	**6.91**	**6.91**	**6.91**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**
Yearly Maximums	**857**	**905**	**905**	**793**	**682**	**571**											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Table 5.1A.19 AEC Onsite Construction Exha

Total Onsite PM_{10} Emissions (Exhaust and Fu

Parameter	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Pounds per Month	0.00	49.11	164.21	165.21	165.21	52.52	52.18	51.86	50.45	50.11	49.76	48.90	48.90	48.22	48.22	48.22	48.22
Pounds per Day	0.00	2.14	7.14	7.18	7.18	2.28	2.27	2.25	2.19	2.18	2.16	2.13	2.13	2.10	2.10	2.10	2.10
Yearly Maximums	900	948	948	832	715	598											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite Exhaust $PM_{2.5}$ Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Simple-Cycle Block Construction																	
Total (lb/month)		1.52	5.33	6.34	6.34	4.93	4.59	4.26	2.85	2.51	2.17	1.30	1.30	0.63	0.63	0.63	0.63
Total (lb/day)		0.07	0.23	0.28	0.28	0.21	0.20	0.19	0.12	0.11	0.09	0.06	0.06	0.03	0.03	0.03	0.03
Total Onsite Exhaust $PM_{2.5}$ Emissions (Construction Equipme																	
Pounds per Month	0.00	1.52	5.33	6.34	6.34	4.93	4.59	4.26	2.85	2.51	2.17	1.30	1.30	0.63	0.63	0.63	0.63
Pounds per Day	0.00	0.07	0.23	0.28	0.28	0.21	0.20	0.19	0.12	0.11	0.09	0.06	0.06	0.03	0.03	0.03	0.03
Yearly Maximums	42	43	43	38	32	26											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite Fugitive $PM_{2.5}$ Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)																	
Total (lb/day)																	
Simple-Cycle Block Construction																	
Total (lb/month)		4.76	65.72	65.72	65.72	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76
Total (lb/day)		0.21	2.86	2.86	2.86	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Total Onsite Fugitive $PM_{2.5}$ Emissions (Grading, Bulldozing, T																	
Pounds per Month	0.00	4.76	65.72	65.72	65.72	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76
Pounds per Day	0.00	0.21	2.86	2.86	2.86	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Yearly Maximums	235	240	240	179	118	57											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Table 5.1A.19 AEC Onsite Construction Exha

Total Onsite $PM_{2.5}$ Emissions (Exhaust and Fu

Parameter	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Pounds per Month	0.00	6.28	71.05	72.06	72.06	9.68	9.34	9.02	7.61	7.27	6.92	6.06	6.06	5.39	5.39	5.39	5.39
Pounds per Day	0.00	0.27	3.09	3.13	3.13	0.42	0.41	0.39	0.33	0.32	0.30	0.26	0.26	0.23	0.23	0.23	0.23
Yearly Maximums	277	283	283	217	150	84											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite CO_2 Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (metric tons/month)																	
Total (metric tons/day)																	
Simple-Cycle Block Construction																	
Total (metric tons/month)		43.94	151.23	179.86	179.86	138.59	130.01	119.98	80.04	71.46	61.43	37.83	37.83	17.78	17.78	17.78	17.78
Total (metric tons/day)		1.91	6.58	7.82	7.82	6.03	5.65	5.22	3.48	3.11	2.67	1.64	1.64	0.77	0.77	0.77	0.77
Total Onsite CO_2 Emissions (Construction Equipment and Vel																	
Metric Tons per Month	0.00	43.94	151.23	179.86	179.86	138.59	130.01	119.98	80.04	71.46	61.43	37.83	37.83	17.78	17.78	17.78	17.78
Metric Tons per Day	0.00	1.91	6.58	7.82	7.82	6.03	5.65	5.22	3.48	3.11	2.67	1.64	1.64	0.77	0.77	0.77	0.77
Yearly Maximums	1,194	1,232	1,206	1,072	910	748											
Maximum Metric Tons per Day																	
Maximum Metric Tons per Hour [a]																	
Maximum Metric Tons per Month																	
Month with Maximum																	
Maximum Metric Tons per Year																	
Maximum Average Metric Tons per Hour [b]																	
Year with Maximum																	

Onsite N_2O Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (metric tons/month)																	
Total (metric tons/day)																	
Simple-Cycle Block Construction																	
Total (metric tons/month)		0.00110	0.00379	0.00451	0.00451	0.00347	0.00326	0.00301	0.00200	0.00179	0.00154	0.00095	0.00095	0.00044	0.00044	0.00044	0.00044
Total (metric tons/day)		0.00005	0.00016	0.00020	0.00020	0.00015	0.00014	0.00013	0.00009	0.00008	0.00007	0.00004	0.00004	0.00002	0.00002	0.00002	0.00002
Total Onsite N_2O Emissions (Construction Equipment and Vel																	
Metric Tons per Month	0.00000	0.00110	0.00379	0.00451	0.00451	0.00347	0.00326	0.00301	0.00200	0.00179	0.00154	0.00095	0.00095	0.00044	0.00044	0.00044	0.00044
Metric Tons per Day	0.00000	0.00005	0.00016	0.00020	0.00020	0.00015	0.00014	0.00013	0.00009	0.00008	0.00007	0.00004	0.00004	0.00002	0.00002	0.00002	0.00002
Yearly Maximums	0.02991	0.03086	0.03020	0.02685	0.02279	0.01872											
Maximum Metric Tons per Day																	
Maximum Metric Tons per Hour [a]																	
Maximum Metric Tons per Month																	
Month with Maximum																	
Maximum Metric Tons per Year																	
Maximum Average Metric Tons per Hour [b]																	
Year with Maximum																	

Onsite CH_4 Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (metric tons/month)																	
Total (metric tons/day)																	
Simple-Cycle Block Construction																	
Total (metric tons/month)		0.00247	0.00853	0.01014	0.01014	0.00781	0.00733	0.00676	0.00451	0.00402	0.00346	0.00213	0.00213	0.00099	0.00099	0.00099	0.00099
Total (metric tons/day)		0.00011	0.00037	0.00044	0.00044	0.00034	0.00032	0.00029	0.00020	0.00017	0.00015	0.00009	0.00009	0.00004	0.00004	0.00004	0.00004
Total Onsite CH_4 Emissions (Construction Equipment and Vel																	
Metric Tons per Month	0.00000	0.00247	0.00853	0.01014	0.01014	0.00781	0.00733	0.00676	0.00451	0.00402	0.00346	0.00213	0.00213	0.00099	0.00099	0.00099	0.00099
Metric Tons per Day	0.00000	0.00011	0.00037	0.00044	0.00044	0.00034	0.00032	0.00029	0.00020	0.00017	0.00015	0.00009	0.00009	0.00004	0.00004	0.00004	0.00004
Yearly Maximums	0.06730	0.06942	0.06795	0.06041	0.05127	0.04212											
Maximum Metric Tons per Day																	
Maximum Metric Tons per Hour [a]																	
Maximum Metric Tons per Month																	
Month with Maximum																	
Maximum Metric Tons per Year																	
Maximum Average Metric Tons per Hour [b]																	
Year with Maximum																	

Notes:

[a] The hours per da 10 hours/day

[b] The hours per year are assumed to allow operation 24 hours per day, 7 days per week des 8,760 hours/year

Table 5.1A.20 AEC Offsite Construction Exhaust and Fugitive Emissions Summary

Offsite CO Emissions

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Combined-Cycle Block Construction																		
Total (lb/month)	8.11	18.25	18.25	20.28	24.33	36.50	311.72	380.81	481.63	503.23	703.01	761.52	799.14	833.58	887.97	905.73	900.70	908.15
Total (lb/day)	0.35	0.79	0.79	0.88	1.06	1.59	13.55	16.56	20.94	21.88	30.57	33.11	34.75	36.24	38.61	39.38	39.16	39.48
Simple-Cycle Block Construction																		
Total (lb/month)																		
Total (lb/day)																		
Total Offsite CO Emissions (Construction Vehicles)																		
Pounds per Month	8.11	18.25	18.25	20.28	24.33	36.50	311.72	380.81	481.63	503.23	703.01	761.52	799.14	833.58	887.97	905.73	900.70	908.15
Pounds per Day	0.35	0.79	0.79	0.88	1.06	1.59	13.55	16.56	20.94	21.88	30.57	33.11	34.75	36.24	38.61	39.38	39.16	39.48
Yearly Maximums	3,268	4,059	4,874	5,744	6,629	7,506	8,377	8,859	9,195	9,436	9,662	9,672	9,627	9,518	9,389	9,184	8,933	8,659

Construction Step	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
	CO Emissions by Month																	
Combined-Cycle Block Construction																		
Total (lb/month)	793.34	716.67	723.06	729.15	712.93	716.98	690.13	703.84	683.38	654.82	626.46	557.21	488.29	235.47	101.39	85.17		
Total (lb/day)	34.49	31.16	31.44	31.70	31.00	31.17	30.01	30.60	29.71	28.47	27.24	24.23	21.23	10.24	4.41	3.70		
Simple-Cycle Block Construction																		
Total (lb/month)																		39.97
Total (lb/day)																		1.74
Total Offsite CO Emissions (Construction Vehicles)																		
Pounds per Month	793.34	716.67	723.06	729.15	712.93	716.98	690.13	703.84	683.38	654.82	626.46	557.21	488.29	235.47	101.39	85.17	0.00	39.97
Pounds per Day	34.49	31.16	31.44	31.70	31.00	31.17	30.01	30.60	29.71	28.47	27.24	24.23	21.23	10.24	4.41	3.70	0.00	1.74
Yearly Maximums	8,308	8,003	7,522	6,900	6,256	5,543	4,866	4,267	3,705	3,304	2,994	2,851	2,872	3,075	3,606	4,085	4,500	4,870

Maximum Pounds per Day	39.5
Maximum Pounds per Hour [a]	3.95
Maximum Pounds per Month	908
Month with Maximum	18
Maximum Pounds per Year	9,672
Maximum Average Pounds per Hour [b]	1.10
Year with Maximum	Months 12-23
Tons per Year	4.84

Offsite VOC Emissions

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Combined-Cycle Block Construction																		
Total (lb/month)	0.18	0.41	0.41	0.46	0.55	0.83	36.49	43.09	59.79	65.12	115.11	123.89	126.48	119.72	125.89	121.65	112.25	103.72
Total (lb/day)	0.01	0.02	0.02	0.02	0.02	0.04	1.59	1.87	2.60	2.83	5.00	5.39	5.50	5.21	5.47	5.29	4.88	4.51
Simple-Cycle Block Construction																		
Total (lb/month)																		
Total (lb/day)																		
Total Offsite VOC Emissions (Construction Vehicles)																		
Pounds per Month	0.18	0.41	0.41	0.46	0.55	0.83	36.49	43.09	59.79	65.12	115.11	123.89	126.48	119.72	125.89	121.65	112.25	103.72
Pounds per Day	0.01	0.02	0.02	0.02	0.02	0.04	1.59	1.87	2.60	2.83	5.00	5.39	5.50	5.21	5.47	5.29	4.88	4.51
Yearly Maximums	446	573	692	817	939	1,050	1,153	1,182	1,184	1,170	1,152	1,082	1,005	919	835	741	647	560

Construction Step	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
	VOC Emissions by Month																	
Combined-Cycle Block Construction																		
Total (lb/month)	65.13	45.40	46.13	46.26	45.90	45.99	40.74	36.40	31.88	27.17	25.55	26.98	24.44	16.86	2.30	1.93		
Total (lb/day)	2.83	1.97	2.01	2.01	2.00	2.00	1.77	1.58	1.39	1.18	1.11	1.17	1.06	0.73	0.10	0.08		
Simple-Cycle Block Construction																		
Total (lb/month)																		1.84
Total (lb/day)																		0.08
Total Offsite VOC Emissions (Construction Vehicles)																		
Pounds per Month	65.13	45.40	46.13	46.26	45.90	45.99	40.74	36.40	31.88	27.17	25.55	26.98	24.44	16.86	2.30	1.93	0.00	1.84
Pounds per Day	2.83	1.97	2.01	2.01	2.00	2.00	1.77	1.58	1.39	1.18	1.11	1.17	1.06	0.73	0.10	0.08	0.00	0.08
Yearly Maximums	484	443	414	370	326	280	236	200	169	145	128	116	104	97	98	107	116	124

Maximum Pounds per Day	5.50
Maximum Pounds per Hour [a]	0.55
Maximum Pounds per Month	126
Month with Maximum	13
Maximum Pounds per Year	1,184
Maximum Average Pounds per Hour [b]	0.14
Year with Maximum	Months 9-20
Tons per Year	0.59

Offsite NO_X Emissions

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Combined-Cycle Block Construction																		
Total (lb/month)	0.75	1.68	1.68	1.87	2.24	3.36	903.70	945.76	1,333.49	1,463.51	2,674.20	2,875.73	2,928.47	2,733.17	2,867.00	2,746.54	2,502.38	2,274.46
Total (lb/day)	0.03	0.07	0.07	0.08	0.10	0.15	39.29	41.12	57.98	63.63	116.27	125.03	127.32	118.83	124.65	119.41	108.80	98.89
Simple-Cycle Block Construction																		
Total (lb/month)																		
Total (lb/day)																		
Total Offsite NO_X Emissions (Construction Vehicles)																		
Pounds per Month	0.75	1.68	1.68	1.87	2.24	3.36	903.70	945.76	1,333.49	1,463.51	2,674.20	2,875.73	2,928.47	2,733.17	2,867.00	2,746.54	2,502.38	2,274.46
Pounds per Day	0.03	0.07	0.07	0.08	0.10	0.15	39.29	41.12	57.98	63.63	116.27	125.03	127.32	118.83	124.65	119.41	108.80	98.89
Yearly Maximums	10,208	13,136	15,867	18,732	21,477	23,977	26,248	26,665	26,482	25,926	25,239	23,341	21,242	18,978	16,800	14,391	12,004	9,833

Construction Step	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36
	NO_X Emissions by Month																	
Combined-Cycle Block Construction																		
Total (lb/month)	1,320.73	762.61	776.81	777.24	776.10	776.38	664.45	555.37	457.65	359.35	331.58	392.08	361.45	254.95	6.40	5.37		
Total (lb/day)	57.42	33.16	33.77	33.79	33.74	33.76	28.89	24.15	19.90	15.62	14.42	17.05	15.72	11.08	0.28	0.23		
Simple-Cycle Block Construction																		
Total (lb/month)																		36.91
Total (lb/day)																		1.60
Total Offsite NO_X Emissions (Construction Vehicles)																		
Pounds per Month	1,320.73	762.61	776.81	777.24	776.10	776.38	664.45	555.37	457.65	359.35	331.58	392.08	361.45	254.95	6.40	5.37	0.00	36.91
Pounds per Day	57.42	33.16	33.77	33.79	33.74	33.76	28.89	24.15	19.90	15.62	14.42	17.05	15.72	11.08	0.28	0.23	0.00	1.60
Yearly Maximums	7,950	6,991	6,483	5,713	4,941	4,165	3,426	2,849	2,398	2,057	1,843	1,695	1,509	1,347	1,246	1,323	1,387	1,451

Maximum Pounds per Day	127
Maximum Pounds per Hour [a]	12.7
Maximum Pounds per Month	2,928
Month with Maximum	13
Maximum Pounds per Year	26,665
Maximum Average Pounds per Hour [b]	3.04
Year with Maximum	Months 8-19
Tons per Year	13.3

Table 5.1A.20 AEC Offsite Construction Exhaust and Fugitive Emissions Summary

Offsite SO_x Emissions

	SO_x Emissions by Month																																			
Construction Step	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
Combined-Cycle Block Construction																																				
Total (lb/month)	0.02	0.04	0.04	0.04	0.05	0.08	3.22	3.80	5.26	5.72	10.04	10.81	11.05	10.48	11.02	10.66	9.86	9.13	5.81	4.11	4.17	4.18	4.15	4.16	3.70	3.34	2.94	2.54	2.38	2.47	2.23	1.52	0.22	0.19		
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.17	0.23	0.25	0.44	0.47	0.48	0.46	0.48	0.46	0.43	0.40	0.25	0.18	0.18	0.18	0.18	0.18	0.16	0.15	0.13	0.11	0.10	0.11	0.10	0.07	0.01	0.01		
Simple-Cycle Block Construction																																				
Total (lb/month)																																				0.25
Total (lb/day)																																				0.01
Total Offsite SO_x Emissions (Construction Vehicles)																																				
Pounds per Month	**0.02**	**0.04**	**0.04**	**0.04**	**0.05**	**0.08**	**3.22**	**3.80**	**5.26**	**5.72**	**10.04**	**10.81**	**11.05**	**10.48**	**11.02**	**10.66**	**9.86**	**9.13**	**5.81**	**4.11**	**4.17**	**4.18**	**4.15**	**4.16**	**3.70**	**3.34**	**2.94**	**2.54**	**2.38**	**2.47**	**2.23**	**1.52**	**0.22**	**0.19**	**0.00**	**0.25**
Pounds per Day	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.14**	**0.17**	**0.23**	**0.25**	**0.44**	**0.47**	**0.48**	**0.46**	**0.48**	**0.46**	**0.43**	**0.40**	**0.25**	**0.18**	**0.18**	**0.18**	**0.18**	**0.18**	**0.16**	**0.15**	**0.13**	**0.11**	**0.10**	**0.11**	**0.10**	**0.07**	**0.01**	**0.01**	**0.00**	**0.01**
Yearly Maximums	**39.12**	**50.16**	**60.60**	**71.58**	**82.21**	**92.01**	**101.07**	**103.66**	**103.97**	**102.88**	**101.34**	**95.45**	**88.80**	**81.45**	**74.30**	**66.22**	**58.09**	**50.61**	**43.95**	**40.37**	**37.79**	**33.84**	**29.84**	**25.69**	**21.79**	**18.67**	**16.12**	**14.35**	**13.25**	**12.81**	**12.60**	**12.87**	**13.96**	**15.54**	**16.90**	**18.10**

Maximum Pounds per Day	**0.48**
Maximum Pounds per Hour [a]	**0.048**
Maximum Pounds per Month	**11.1**
Month with Maximum	**13**
Maximum Pounds per Year	**104**
Maximum Average Pounds per Hour [b]	**0.012**
Year with Maximum	**Months 9-20**
Tons per Year	**0.052**

Offsite Exhaust PM_{10} Emissions [c]

	Exhaust PM_{10} Emissions by Month																																			
Construction Step	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
Combined-Cycle Block Construction																																				
Total (lb/month)	2.07	4.66	4.66	5.18	6.21	9.32	148.46	174.84	233.23	249.66	403.81	435.59	448.96	440.61	465.69	459.68	437.31	419.44	308.44	246.58	249.50	251.05	246.92	247.95	230.80	224.00	209.77	193.47	184.20	173.40	153.78	84.25	25.87	21.73		
Total (lb/day)	0.09	0.20	0.20	0.23	0.27	0.41	6.45	7.60	10.14	10.85	17.56	18.94	19.52	19.16	20.25	19.99	19.01	18.24	13.41	10.72	10.85	10.92	10.74	10.78	10.03	9.74	9.12	8.41	8.01	7.54	6.69	3.66	1.12	0.94		
Simple-Cycle Block Construction																																				
Total (lb/month)																																				17.73
Total (lb/day)																																				0.77
Total Offsite Exhaust PM_{10} Emissions (Construction Vehicles)																																				
Pounds per Month	**2.07**	**4.66**	**4.66**	**5.18**	**6.21**	**9.32**	**148.46**	**174.84**	**233.23**	**249.66**	**403.81**	**435.59**	**448.96**	**440.61**	**465.69**	**459.68**	**437.31**	**419.44**	**308.44**	**246.58**	**249.50**	**251.05**	**246.92**	**247.95**	**230.80**	**224.00**	**209.77**	**193.47**	**184.20**	**173.40**	**153.78**	**84.25**	**25.87**	**21.73**	**0.00**	**17.73**
Pounds per Day	**0.09**	**0.20**	**0.20**	**0.23**	**0.27**	**0.41**	**6.45**	**7.60**	**10.14**	**10.85**	**17.56**	**18.94**	**19.52**	**19.16**	**20.25**	**19.99**	**19.01**	**18.24**	**13.41**	**10.72**	**10.85**	**10.92**	**10.74**	**10.78**	**10.03**	**9.74**	**9.12**	**8.41**	**8.01**	**7.54**	**6.69**	**3.66**	**1.12**	**0.94**	**0.00**	**0.77**
Yearly Maximums	**1,678**	**2,125**	**2,561**	**3,022**	**3,476**	**3,907**	**4,317**	**4,477**	**4,549**	**4,565**	**4,567**	**4,410**	**4,222**	**4,004**	**3,787**	**3,531**	**3,265**	**3,012**	**2,766**	**2,611**	**2,449**	**2,225**	**1,996**	**1,749**	**1,519**	**1,329**	**1,165**	**1,065**	**1,005**	**1,007**	**1,054**	**1,159**	**1,357**	**1,541**	**1,699**	**1,834**

Maximum Pounds per Day	**20.2**
Maximum Pounds per Hour [a]	**2.02**
Maximum Pounds per Month	**466**
Month with Maximum	**15**
Maximum Pounds per Year	**4,567**
Maximum Average Pounds per Hour [b]	**0.52**
Year with Maximum	**Months 11-22**
Tons per Year	**2.28**

Offsite Exhaust $PM_{2.5}$ Emissions [c]

	Exhaust $PM_{2.5}$ Emissions by Month																																			
Construction Step	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
Combined-Cycle Block Construction																																				
Total (lb/month)	0.56	1.27	1.27	1.41	1.69	2.54	50.85	57.74	77.96	83.86	139.52	150.39	154.47	149.92	158.24	155.21	146.31	138.83	97.74	74.49	75.44	75.86	74.73	75.01	69.11	66.03	61.07	55.56	52.83	50.78	45.24	25.15	7.04	5.92		
Total (lb/day)	0.02	0.06	0.06	0.06	0.07	0.11	2.21	2.51	3.39	3.65	6.07	6.54	6.72	6.52	6.88	6.75	6.36	6.04	4.25	3.24	3.28	3.30	3.25	3.26	3.00	2.87	2.66	2.42	2.30	2.21	1.97	1.09	0.31	0.26		
Simple-Cycle Block Construction																																				
Total (lb/month)																																				5.17
Total (lb/day)																																				0.22
Total Offsite Exhaust $PM_{2.5}$ Emissions (Construction Vehicles)																																				
Pounds per Month	**0.56**	**1.27**	**1.27**	**1.41**	**1.69**	**2.54**	**50.85**	**57.74**	**77.96**	**83.86**	**139.52**	**150.39**	**154.47**	**149.92**	**158.24**	**155.21**	**146.31**	**138.83**	**97.74**	**74.49**	**75.44**	**75.86**	**74.73**	**75.01**	**69.11**	**66.03**	**61.07**	**55.56**	**52.83**	**50.78**	**45.24**	**25.15**	**7.04**	**5.92**	**0.00**	**5.17**
Pounds per Day	**0.02**	**0.06**	**0.06**	**0.06**	**0.07**	**0.11**	**2.21**	**2.51**	**3.39**	**3.65**	**6.07**	**6.54**	**6.72**	**6.52**	**6.88**	**6.75**	**6.36**	**6.04**	**4.25**	**3.24**	**3.28**	**3.30**	**3.25**	**3.26**	**3.00**	**2.87**	**2.66**	**2.42**	**2.30**	**2.21**	**1.97**	**1.09**	**0.31**	**0.26**	**0.00**	**0.22**
Yearly Maximums	**569**	**723**	**872**	**1,029**	**1,182**	**1,327**	**1,463**	**1,510**	**1,527**	**1,524**	**1,516**	**1,452**	**1,376**	**1,291**	**1,207**	**1,110**	**1,010**	**917**	**829**	**776**	**727**	**658**	**588**	**514**	**444**	**387**	**338**	**308**	**290**	**289**	**300**	**326**	**379**	**429**	**472**	**509**

Maximum Pounds per Day	**6.88**
Maximum Pounds per Hour [a]	**0.69**
Maximum Pounds per Month	**158**
Month with Maximum	**15**
Maximum Pounds per Year	**1,527**
Maximum Average Pounds per Hour [b]	**0.17**
Year with Maximum	**Months 9-20**
Tons per Year	**0.76**

Offsite CO_2 Emissions

	CO_2 Emissions by Month																																			
Construction Step	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
Combined-Cycle Block Construction																																				
Total (metric tons/month)	1.04	2.34	2.34	2.60	3.13	4.69	160.62	190.36	261.82	284.41	494.02	531.90	544.59	518.53	545.44	528.97	490.80	456.59	296.46	213.92	217.09	217.87	215.78	216.30	194.10	177.10	158.06	137.97	129.88	132.01	118.70	78.66	13.02	10.94		
Total (metric tons/day)	0.05	0.10	0.10	0.11	0.14	0.20	6.98	8.28	11.38	12.37	21.48	23.13	23.68	22.54	23.71	23.00	21.34	19.85	12.89	9.30	9.44	9.47	9.38	9.40	8.44	7.70	6.87	6.00	5.65	5.74	5.16	3.42	0.57	0.48		
Simple-Cycle Block Construction																																				
Total (metric tons/month)																																				13.25
Total (metric tons/day)																																				0.58
Total Offsite CO_2 Emissions (Construction Vehicles)																																				
Metric Tons per Month	**1.04**	**2.34**	**2.34**	**2.60**	**3.13**	**4.69**	**160.62**	**190.36**	**261.82**	**284.41**	**494.02**	**531.90**	**544.59**	**518.53**	**545.44**	**528.97**	**490.80**	**456.59**	**296.46**	**213.92**	**217.09**	**217.87**	**215.78**	**216.30**	**194.10**	**177.10**	**158.06**	**137.97**	**129.88**	**132.01**	**118.70**	**78.66**	**13.02**	**10.94**	**0.00**	**13.25**
Metric Tons per Day	**0.05**	**0.10**	**0.10**	**0.11**	**0.14**	**0.20**	**6.98**	**8.28**	**11.38**	**12.37**	**21.48**	**23.13**	**23.68**	**22.54**	**23.71**	**23.00**	**21.34**	**19.85**	**12.89**	**9.30**	**9.44**	**9.47**	**9.38**	**9.40**	**8.44**	**7.70**	**6.87**	**6.00**	**5.65**	**5.74**	**5.16**	**3.42**	**0.57**	**0.48**	**0.00**	**0.58**
Yearly Maximums	**1,939**	**2,483**	**2,999**	**3,542**	**4,068**	**4,556**	**5,008**	**5,144**	**5,167**	**5,123**	**5,056**	**4,778**	**4,462**	**4,112**	**3,770**	**3,383**	**2,992**	**2,631**	**2,307**	**2,129**	**1,994**	**1,789**	**1,583**	**1,367**	**1,164**	**1,000**	**865**	**772**	**713**	**691**	**684**	**706**	**776**	**867**	**945**	**1,014**

Maximum Metric Tons per Day	**23.7**
Maximum Metric Tons per Hour [a]	**2.37**
Maximum Metric Tons per Month	**545**
Month with Maximum	**15**
Maximum Metric Tons per Year	**5,167**
Maximum Average Metric Tons per Hour [b]	**0.59**
Year with Maximum	**Months 9-20**

Offsite N_2O Emissions

	N_2O Emissions by Month																																			
Construction Step	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
Combined-Cycle Block Construction																																				
Total (metric tons/month)	0.00001	0.00002	0.00002	0.00002	0.00003	0.00004	0.00068	0.00081	0.00109	0.00116	0.00187	0.00202	0.00208	0.00205	0.00216	0.00214	0.00203	0.00195	0.00144	0.00116	0.00118	0.00118	0.00116	0.00117	0.00109	0.00106	0.00099	0.00091	0.00087	0.00082	0.00072	0.00040	0.00012	0.00010		
Total (metric tons/day)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00003	0.00004	0.00005	0.00005	0.00008	0.00009	0.00009	0.00009	0.00009	0.00009	0.00009	0.00008	0.00006	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00005	0.00004	0.00004	0.00004	0.00004	0.00003	0.00002	0.00001	0.00000		
Simple-Cycle Block Construction																																				
Total (metric tons/month)																																				0.00008
Total (metric tons/day)																																				0.00000
Total Offsite N_2O Emissions (Construction Vehicles)																																				
Metric Tons per Month	**0.00001**	**0.00002**	**0.00002**	**0.00002**	**0.00003**	**0.00004**	**0.00068**	**0.00081**	**0.00109**	**0.00116**	**0.00187**	**0.00202**	**0.00208**	**0.00205**	**0.00216**	**0.00214**	**0.00203**	**0.00195**	**0.00144**	**0.00116**	**0.00118**	**0.00118**	**0.00116**	**0.00117**	**0.00109**	**0.00106**	**0.00099**	**0.00091**	**0.00087**	**0.00082**	**0.00072**	**0.00040**	**0.00012**	**0.00010**	**0.00000**	**0.00008**
Metric Tons per Day	**0.00000**	**0.00000**	**0.00000**	**0.00000**	**0.00000**	**0.00000**	**0.00003**	**0.00004**	**0.00005**	**0.00005**	**0.00008**	**0.00009**	**0.00009**	**0.00009**	**0.00009**	**0.00009**	**0.00009**	**0.00008**	**0.00006**	**0.00005**	**0.00005**	**0.00005**	**0.00005**	**0.00005**	**0.00005**	**0.00005**	**0.00004**	**0.00004**	**0.00004**	**0.00004**	**0.00003**	**0.00002**	**0.00001**	**0.00000**	**0.00000**	**0.00000**
Yearly Maximums	**0.00778**	**0.00986**	**0.01188**	**0.01402**	**0.01614**	**0.01814**	**0.02005**	**0.02081**	**0.02116**	**0.02125**	**0.02127**	**0.02056**	**0.01971**	**0.01872**	**0.01773**	**0.01656**	**0.01533**	**0.01417**	**0.01304**	**0.01232**	**0.01156**	**0.01050**	**0.00942**	**0.00826**	**0.00717**	**0.00628**	**0.00550**	**0.00503**	**0.00475**	**0.00476**	**0.00498**	**0.00548**	**0.00641**	**0.00728**	**0.00802**	**0.00866**

Maximum Metric Tons per Day	**0.000094**
Maximum Metric Tons per Hour [a]	**0.000009**
Maximum Metric Tons per Month	**0.0022**
Month with Maximum	**15**
Maximum Metric Tons per Year	**0.021**
Maximum Average Metric Tons per Hour [b]	**0.0000024**
Year with Maximum	**Months 11-22**

Offsite CH_4 Emissions

	CH_4 Emissions by Month																																			
Construction Step	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**
Combined-Cycle Block Construction																																				
Total (metric tons/month)	0.00005	0.00011	0.00011	0.00012	0.00014	0.00021	0.00159	0.00195	0.00243	0.00252	0.00335	0.00363	0.00384	0.00409	0.00437	0.00450	0.00454	0.00464	0.00424	0.00392	0.00396	0.00399	0.00390	0.00392	0.00380	0.00391	0.00382	0.00369	0.00353	0.00311	0.00272	0.00127	0.00058	0.00049		
Total (metric tons/day)	0.00000	0.00000	0.00000	0.00001	0.00001	0.00001	0.00007	0.00008	0.00011	0.00011	0.00015	0.00016	0.00017	0.00018	0.00019	0.00020	0.00020	0.00020	0.00018	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017	0.00017	0.00016	0.00015	0.00014	0.00012	0.00006	0.00003	0.00002		
Simple-Cycle Block Construction																																				
Total (metric tons/month)																																				0.00031
Total (metric tons/day)																																				0.00001
Total Offsite CH_4 Emissions (Construction Vehicles)																																				
Metric Tons per Month	**0.00005**	**0.00011**	**0.00011**	**0.00012**	**0.00014**	**0.00021**	**0.00159**	**0.00195**	**0.00243**	**0.00252**	**0.00335**	**0.00363**	**0.00384**	**0.00409**	**0.00437**	**0.00450**	**0.00454**	**0.00464**	**0.00424**	**0.00392**	**0.00396**	**0.00399**	**0.00390**	**0.00392**	**0.00380**	**0.00391**	**0.00382**	**0.00369**	**0.00353**	**0.00311**	**0.00272**	**0.00127**	**0.00058**	**0.00049**	**0.00000**	**0.00031**
Metric Tons per Day	**0.00000**	**0.00000**	**0.00000**	**0.00001**	**0.00001**	**0.00001**	**0.00007**	**0.00008**	**0.00011**	**0.00011**	**0.00015**	**0.00016**	**0.00017**	**0.00018**	**0.00019**	**0.00020**	**0.00020**	**0.00020**	**0.00018**	**0.00017**	**0.00017**	**0.00017**	**0.00017**	**0.00017**	**0.00017**	**0.00017**	**0.00017**	**0.00016**	**0.00015**	**0.00014**	**0.00012**	**0.00006**	**0.00003**	**0.00002**	**0.00000**	**0.00001**
Yearly Maximums	**0.01619**	**0.01998**	**0.02396**	**0.02822**	**0.03261**	**0.03701**	**0.04144**	**0.04409**	**0.04606**	**0.04759**	**0.04906**	**0.04961**	**0.04990**	**0.04987**	**0.04969**	**0.04915**	**0.04833**	**0.04732**	**0.04579**	**0.04427**	**0.04162**	**0.03825**	**0.03475**	**0.03085**	**0.02724**	**0.02414**	**0.02133**	**0.01973**	**0.01876**	**0.01904**	**0.02050**	**0.02325**	**0.02806**	**0.03210**	**0.03559**	**0.03852**

Maximum Metric Tons per Day	**0.00026**
Maximum Metric Tons per Hour [a]	**0.000026**
Maximum Metric Tons per Month	**0.0061**
Month with Maximum	**44**
Maximum Metric Tons per Year	**0.050**
Maximum Average Metric Tons per Hour [b]	**0.0000057**
Year with Maximum	**Months 13-24**

Table 5.1A.20 AEC Offsite Construction Exha

Offsite CO Emissions

Construction Step	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction															
Total (lb/month)															
Total (lb/day)															
Simple-Cycle Block Construction															
Total (lb/month)	90.55	142.13	282.73	344.64	483.24	578.89	690.80	766.40	580.68	500.39	369.41	238.86	153.67	51.14	42.35
Total (lb/day)	3.94	6.18	12.29	14.98	21.01	25.17	30.03	33.32	25.25	21.76	16.06	10.39	6.68	2.22	1.84
Total Offsite CO Emissions (Construction Vehicles)															
Pounds per Month	**90.55**	**142.13**	**282.73**	**344.64**	**483.24**	**578.89**	**690.80**	**766.40**	**580.68**	**500.39**	**369.41**	**238.86**	**153.67**	**51.14**	**42.35**
Pounds per Day	**3.94**	**6.18**	**12.29**	**14.98**	**21.01**	**25.17**	**30.03**	**33.32**	**25.25**	**21.76**	**16.06**	**10.39**	**6.68**	**2.22**	**1.84**
Yearly Maximums	**5,069**	**5,132**	**5,041**	**4,800**											
Maximum Pounds per Day															
Maximum Pounds per Hour [a]															
Maximum Pounds per Month															
Month with Maximum															
Maximum Pounds per Year															
Maximum Average Pounds per Hour [b]															
Year with Maximum															
Tons per Year															

Offsite VOC Emissions

Construction Step	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction															
Total (lb/month)															
Total (lb/day)															
Simple-Cycle Block Construction															
Total (lb/month)	4.29	5.63	8.15	10.04	13.42	15.58	17.05	17.59	11.94	10.22	8.06	5.33	3.07	1.23	1.07
Total (lb/day)	0.19	0.24	0.35	0.44	0.58	0.68	0.74	0.76	0.52	0.44	0.35	0.23	0.13	0.05	0.05
Total Offsite VOC Emissions (Construction Vehicles)															
Pounds per Month	**4.29**	**5.63**	**8.15**	**10.04**	**13.42**	**15.58**	**17.05**	**17.59**	**11.94**	**10.22**	**8.06**	**5.33**	**3.07**	**1.23**	**1.07**
Pounds per Day	**0.19**	**0.24**	**0.35**	**0.44**	**0.58**	**0.68**	**0.74**	**0.76**	**0.52**	**0.44**	**0.35**	**0.23**	**0.13**	**0.05**	**0.05**
Yearly Maximums	**127**	**126**	**122**	**115**											
Maximum Pounds per Day															
Maximum Pounds per Hour [a]															
Maximum Pounds per Month															
Month with Maximum															
Maximum Pounds per Year															
Maximum Average Pounds per Hour [b]															
Year with Maximum															
Tons per Year															

Offsite NO_X Emissions

Construction Step	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction															
Total (lb/month)															
Total (lb/day)															
Simple-Cycle Block Construction															
Total (lb/month)	87.43	104.48	116.76	145.22	184.27	205.88	199.52	153.67	83.27	69.83	64.13	44.54	19.86	11.77	11.08
Total (lb/day)	3.80	4.54	5.08	6.31	8.01	8.95	8.67	6.68	3.62	3.04	2.79	1.94	0.86	0.51	0.48
Total Offsite NO_X Emissions (Construction Vehicles)															
Pounds per Month	**87.43**	**104.48**	**116.76**	**145.22**	**184.27**	**205.88**	**199.52**	**153.67**	**83.27**	**69.83**	**64.13**	**44.54**	**19.86**	**11.77**	**11.08**
Pounds per Day	**3.80**	**4.54**	**5.08**	**6.31**	**8.01**	**8.95**	**8.67**	**6.68**	**3.62**	**3.04**	**2.79**	**1.94**	**0.86**	**0.51**	**0.48**
Yearly Maximums	**1,459**	**1,391**	**1,299**	**1,193**											
Maximum Pounds per Day															
Maximum Pounds per Hour [a]															
Maximum Pounds per Month															
Month with Maximum															
Maximum Pounds per Year															
Maximum Average Pounds per Hour [b]															
Year with Maximum															
Tons per Year															

Table 5.1A.20 AEC Offsite Construction Exha

Offsite SO_X Emissions

Construction Step	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction															
Total (lb/month)															
Total (lb/day)															
Simple-Cycle Block Construction															
Total (lb/month)	0.59	0.78	1.17	1.44	1.94	2.26	2.50	2.61	1.80	1.54	1.21	0.79	0.47	0.18	0.16
Total (lb/day)	0.03	0.03	0.05	0.06	0.08	0.10	0.11	0.11	0.08	0.07	0.05	0.03	0.02	0.01	0.01
Total Offsite SO_X Emissions (Construction Vehicles)															
Pounds per Month	**0.59**	**0.78**	**1.17**	**1.44**	**1.94**	**2.26**	**2.50**	**2.61**	**1.80**	**1.54**	**1.21**	**0.79**	**0.47**	**0.18**	**0.16**
Pounds per Day	**0.03**	**0.03**	**0.05**	**0.06**	**0.08**	**0.10**	**0.11**	**0.11**	**0.08**	**0.07**	**0.05**	**0.03**	**0.02**	**0.01**	**0.01**
Yearly Maximums	**18.64**	**18.52**	**17.92**	**16.90**											
Maximum Pounds per Day															
Maximum Pounds per Hour [a]															
Maximum Pounds per Month															
Month with Maximum															
Maximum Pounds per Year															
Maximum Average Pounds per Hour [b]															
Year with Maximum															
Tons per Year															

Offsite Exhaust PM_{10} Emissions [c]

Construction Step	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction															
Total (lb/month)															
Total (lb/day)															
Simple-Cycle Block Construction															
Total (lb/month)	40.57	60.01	109.67	134.02	185.75	220.97	258.75	282.06	209.47	180.37	134.70	87.43	55.16	18.96	15.86
Total (lb/day)	1.76	2.61	4.77	5.83	8.08	9.61	11.25	12.26	9.11	7.84	5.86	3.80	2.40	0.82	0.69
Total Offsite Exhaust PM_{10} Emissions (Construction Vehicle															
Pounds per Month	**40.57**	**60.01**	**109.67**	**134.02**	**185.75**	**220.97**	**258.75**	**282.06**	**209.47**	**180.37**	**134.70**	**87.43**	**55.16**	**18.96**	**15.86**
Pounds per Day	**1.76**	**2.61**	**4.77**	**5.83**	**8.08**	**9.61**	**11.25**	**12.26**	**9.11**	**7.84**	**5.86**	**3.80**	**2.40**	**0.82**	**0.69**
Yearly Maximums	**1,904**	**1,918**	**1,877**	**1,784**											
Maximum Pounds per Day															
Maximum Pounds per Hour [a]															
Maximum Pounds per Month															
Month with Maximum															
Maximum Pounds per Year															
Maximum Average Pounds per Hour [b]															
Year with Maximum															
Tons per Year															

Offsite Exhaust $PM_{2.5}$ Emissions [c]

Construction Step	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction															
Total (lb/month)															
Total (lb/day)															
Simple-Cycle Block Construction															
Total (lb/month)	11.86	17.26	30.79	37.66	52.00	61.73	71.85	77.42	57.27	49.31	36.91	23.97	15.07	5.21	4.37
Total (lb/day)	0.52	0.75	1.34	1.64	2.26	2.68	3.12	3.37	2.49	2.14	1.60	1.04	0.66	0.23	0.19
Total Offsite Exhaust $PM_{2.5}$ Emissions (Construction Vehicle															
Pounds per Month	**11.86**	**17.26**	**30.79**	**37.66**	**52.00**	**61.73**	**71.85**	**77.42**	**57.27**	**49.31**	**36.91**	**23.97**	**15.07**	**5.21**	**4.37**
Pounds per Day	**0.52**	**0.75**	**1.34**	**1.64**	**2.26**	**2.68**	**3.12**	**3.37**	**2.49**	**2.14**	**1.60**	**1.04**	**0.66**	**0.23**	**0.19**
Yearly Maximums	**528**	**531**	**519**	**493**											
Maximum Pounds per Day															
Maximum Pounds per Hour [a]															
Maximum Pounds per Month															
Month with Maximum															
Maximum Pounds per Year															
Maximum Average Pounds per Hour [b]															
Year with Maximum															
Tons per Year															

Offsite CO_2 Emissions

Construction Step	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction															
Total (metric tons/month)															
Total (metric tons/day)															
Simple-Cycle Block Construction															
Total (metric tons/month)	30.79	41.69	64.66	79.41	107.42	125.71	140.75	148.23	103.98	89.20	68.96	45.32	26.98	10.23	8.79
Total (metric tons/day)	1.34	1.81	2.81	3.45	4.67	5.47	6.12	6.44	4.52	3.88	3.00	1.97	1.17	0.44	0.38
Total Offsite CO_2 Emissions (Construction Vehicles)															
Metric Tons per Month	**30.79**	**41.69**	**64.66**	**79.41**	**107.42**	**125.71**	**140.75**	**148.23**	**103.98**	**89.20**	**68.96**	**45.32**	**26.98**	**10.23**	**8.79**
Metric Tons per Day	**1.34**	**1.81**	**2.81**	**3.45**	**4.67**	**5.47**	**6.12**	**6.44**	**4.52**	**3.88**	**3.00**	**1.97**	**1.17**	**0.44**	**0.38**
Yearly Maximums	**1,046**	**1,042**	**1,011**	**955**											
Maximum Metric Tons per Day															
Maximum Metric Tons per Hour [a]															
Maximum Metric Tons per Month															
Month with Maximum															
Maximum Metric Tons per Year															
Maximum Average Metric Tons per Hour [b]															
Year with Maximum															

Offsite N_2O Emissions

Construction Step	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction															
Total (metric tons/month)															
Total (metric tons/day)															
Simple-Cycle Block Construction															
Total (metric tons/month)	0.00019	0.00028	0.00052	0.00063	0.00088	0.00104	0.00122	0.00133	0.00099	0.00085	0.00064	0.00041	0.00026	0.00009	0.00008
Total (metric tons/day)	0.00001	0.00001	0.00002	0.00003	0.00004	0.00005	0.00005	0.00006	0.00004	0.00004	0.00003	0.00002	0.00001	0.00000	0.00000
Total Offsite N_2O Emissions (Construction Vehicles)															
Metric Tons per Month	**0.00019**	**0.00028**	**0.00052**	**0.00063**	**0.00088**	**0.00104**	**0.00122**	**0.00133**	**0.00099**	**0.00085**	**0.00064**	**0.00041**	**0.00026**	**0.00009**	**0.00008**
Metric Tons per Day	**0.00001**	**0.00001**	**0.00002**	**0.00003**	**0.00004**	**0.00005**	**0.00005**	**0.00006**	**0.00004**	**0.00004**	**0.00003**	**0.00002**	**0.00001**	**0.00000**	**0.00000**
Yearly Maximums	**0.00899**	**0.00906**	**0.00886**	**0.00842**											
Maximum Metric Tons per Day															
Maximum Metric Tons per Hour [a]															
Maximum Metric Tons per Month															
Month with Maximum															
Maximum Metric Tons per Year															
Maximum Average Metric Tons per Hour [b]															
Year with Maximum															

Offsite CH_4 Emissions

Construction Step	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction															
Total (metric tons/month)															
Total (metric tons/day)															
Simple-Cycle Block Construction															
Total (metric tons/month)	0.00070	0.00110	0.00223	0.00271	0.00381	0.00457	0.00547	0.00608	0.00462	0.00398	0.00294	0.00190	0.00122	0.00041	0.00033
Total (metric tons/day)	0.00003	0.00005	0.00010	0.00012	0.00017	0.00020	0.00024	0.00026	0.00020	0.00017	0.00013	0.00008	0.00005	0.00002	0.00001
Total Offsite CH_4 Emissions (Construction Vehicles)															
Metric Tons per Month	**0.00070**	**0.00110**	**0.00223**	**0.00271**	**0.00381**	**0.00457**	**0.00547**	**0.00608**	**0.00462**	**0.00398**	**0.00294**	**0.00190**	**0.00122**	**0.00041**	**0.00033**
Metric Tons per Day	**0.00003**	**0.00005**	**0.00010**	**0.00012**	**0.00017**	**0.00020**	**0.00024**	**0.00026**	**0.00020**	**0.00017**	**0.00013**	**0.00008**	**0.00005**	**0.00002**	**0.00001**
Yearly Maximums	**0.04011**	**0.04064**	**0.03994**	**0.03805**											
Maximum Metric Tons per Day															
Maximum Metric Tons per Hour [a]															
Maximum Metric Tons per Month															
Month with Maximum															
Maximum Metric Tons per Year															
Maximum Average Metric Tons per Hour [b]															
Year with Maximum															

Notes:
[a] The hours per d 10 hours/day
[b] The hours per year are assumed to allow operation 24 hours per day, 7 days per week c 8,760 hours/year
[c] There are no offsite activities generating fugitive dust during construction of the combined-cycle and simple-cycle blocks.

Table 5.1A.21 AEC Onsite & Offsite Construction Exhaust and Fugitive Emissions Summary

Onsite & Offsite CO Emissions

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Combined-Cycle Block Construction																	
Total (lb/month)	8.32	18.46	18.46	20.48	24.54	36.71	1,846.04	1,998.72	2,423.32	2,273.87	2,534.84	2,571.40	2,609.02	2,573.98	2,494.84	2,512.61	2,443.23
Total (lb/day)	0.36	0.80	0.80	0.89	1.07	1.60	80.26	86.90	105.36	98.86	110.21	111.80	113.44	111.91	108.47	109.24	106.23
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite CO Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	**8.32**	**18.46**	**18.46**	**20.48**	**24.54**	**36.71**	**1,846.04**	**1,998.72**	**2,423.32**	**2,273.87**	**2,534.84**	**2,571.40**	**2,609.02**	**2,573.98**	**2,494.84**	**2,512.61**	**2,443.23**
Pounds per Day	**0.36**	**0.80**	**0.80**	**0.89**	**1.07**	**1.60**	**80.26**	**86.90**	**105.36**	**98.86**	**110.21**	**111.80**	**113.44**	**111.91**	**108.47**	**109.24**	**106.23**
Yearly Maximums	**13,775**	**16,376**	**18,931**	**21,408**	**23,900**	**26,319**	**28,707**	**29,266**	**29,666**	**29,647**	**29,809**	**29,693**	**29,544**	**29,238**	**28,980**	**28,734**	**28,441**
Maximum Pounds per Day	**113**																
Maximum Pounds per Hour [a]	**11.3**																
Maximum Pounds per Month	**2,609**																
Month with Maximum	**13**																
Maximum Pounds per Year	**29,809**																
Maximum Average Pounds per Hour [b]	**3.40**																
Year with Maximum	**Months 11-22**																
Tons per Year	**14.9**																

									CO Emissions by Month								
Construction Step	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																	
Total (lb/month)	2,425.63	2,404.11	2,398.78	2,405.18	2,435.08	2,418.86	2,422.91	2,302.77	2,316.47	2,248.50	2,219.93	2,191.58	2,029.03	888.83	588.38	454.30	85.38
Total (lb/day)	105.46	104.53	104.29	104.57	105.87	105.17	105.34	100.12	100.72	97.76	96.52	95.29	88.22	38.64	25.58	19.75	3.71
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite CO Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	**2,425.63**	**2,404.11**	**2,398.78**	**2,405.18**	**2,435.08**	**2,418.86**	**2,422.91**	**2,302.77**	**2,316.47**	**2,248.50**	**2,219.93**	**2,191.58**	**2,029.03**	**888.83**	**588.38**	**454.30**	**85.38**
Pounds per Day	**105.46**	**104.53**	**104.29**	**104.57**	**105.87**	**105.17**	**105.34**	**100.12**	**100.72**	**97.76**	**96.52**	**95.29**	**88.22**	**38.64**	**25.58**	**19.75**	**3.71**
Yearly Maximums	**28,190**	**27,793**	**26,278**	**24,468**	**22,517**	**20,167**	**17,748**	**15,819**	**15,368**	**15,294**	**15,430**	**15,394**	**15,369**	**15,513**	**16,321**	**17,348**	**18,228**

Onsite & Offsite VOC Emissions

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Combined-Cycle Block Construction																	
Total (lb/month)	0.20	0.43	0.43	0.47	0.57	0.84	69.39	77.41	100.85	101.77	152.82	162.15	164.75	157.25	161.76	157.52	147.53
Total (lb/day)	0.01	0.02	0.02	0.02	0.02	0.04	3.02	3.37	4.38	4.42	6.64	7.05	7.16	6.84	7.03	6.85	6.41
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite VOC Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	**0.20**	**0.43**	**0.43**	**0.47**	**0.57**	**0.84**	**69.39**	**77.41**	**100.85**	**101.77**	**152.82**	**162.15**	**164.75**	**157.25**	**161.76**	**157.52**	**147.53**
Pounds per Day	**0.01**	**0.02**	**0.02**	**0.02**	**0.02**	**0.04**	**3.02**	**3.37**	**4.38**	**4.42**	**6.64**	**7.05**	**7.16**	**6.84**	**7.03**	**6.85**	**6.41**
Yearly Maximums	**667**	**832**	**989**	**1,150**	**1,307**	**1,454**	**1,592**	**1,624**	**1,630**	**1,614**	**1,598**	**1,530**	**1,453**	**1,367**	**1,284**	**1,190**	**1,096**
Maximum Pounds per Day	**7.16**																
Maximum Pounds per Hour [a]	**0.72**																
Maximum Pounds per Month	**165**																
Month with Maximum	**13**																
Maximum Pounds per Year	**1,630**																
Maximum Average Pounds per Hour [b]	**0.19**																
Year with Maximum	**Months 9-20**																
Tons per Year	**0.82**																

									VOC Emissions by Month								
Construction Step	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																	
Total (lb/month)	138.58	101.51	83.85	84.58	85.49	85.12	85.21	78.44	74.11	68.29	63.58	61.97	61.88	33.74	24.61	10.05	1.95
Total (lb/day)	6.03	4.41	3.65	3.68	3.72	3.70	3.70	3.41	3.22	2.97	2.76	2.69	2.69	1.47	1.07	0.44	0.08
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite VOC Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	**138.58**	**101.51**	**83.85**	**84.58**	**85.49**	**85.12**	**85.21**	**78.44**	**74.11**	**68.29**	**63.58**	**61.97**	**61.88**	**33.74**	**24.61**	**10.05**	**1.95**
Pounds per Day	**6.03**	**4.41**	**3.65**	**3.68**	**3.72**	**3.70**	**3.70**	**3.41**	**3.22**	**2.97**	**2.76**	**2.69**	**2.69**	**1.47**	**1.07**	**0.44**	**0.08**
Yearly Maximums	**1,011**	**934**	**866**	**807**	**732**	**649**	**564**	**492**	**458**	**437**	**424**	**408**	**394**	**380**	**384**	**396**	**415**

Onsite & Offsite NO_X Emissions

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Combined-Cycle Block Construction																	
Total (lb/month)	0.76	1.70	1.70	1.88	2.26	3.38	1,134.42	1,185.33	1,642.44	1,769.00	2,986.99	3,205.21	3,257.96	3,073.73	3,179.84	3,059.38	2,831.37
Total (lb/day)	0.03	0.07	0.07	0.08	0.10	0.15	49.32	51.54	71.41	76.91	129.87	139.36	141.65	133.64	138.25	133.02	123.10
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite NO_X Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	**0.76**	**1.70**	**1.70**	**1.88**	**2.26**	**3.38**	**1,134.42**	**1,185.33**	**1,642.44**	**1,769.00**	**2,986.99**	**3,205.21**	**3,257.96**	**3,073.73**	**3,179.84**	**3,059.38**	**2,831.37**
Pounds per Day	**0.03**	**0.07**	**0.07**	**0.08**	**0.10**	**0.15**	**49.32**	**51.54**	**71.41**	**76.91**	**129.87**	**139.36**	**141.65**	**133.64**	**138.25**	**133.02**	**123.10**
Yearly Maximums	**11,935**	**15,192**	**18,264**	**21,442**	**24,500**	**27,329**	**29,927**	**30,447**	**30,382**	**29,873**	**29,256**	**27,420**	**25,366**	**23,141**	**20,990**	**18,631**	**16,293**
Maximum Pounds per Day	**142**																
Maximum Pounds per Hour [a]	**14.2**																
Maximum Pounds per Month	**3,258**																
Month with Maximum	**13**																
Maximum Pounds per Year	**30,447**																
Maximum Average Pounds per Hour [b]	**3.48**																
Year with Maximum	**Months 8-19**																
Tons per Year	**15.2**																

									NO_X Emissions by Month								
Construction Step	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																	
Total (lb/month)	2,601.68	1,654.51	1,119.68	1,133.89	1,151.95	1,150.81	1,151.09	1,032.60	923.53	820.18	721.88	694.12	748.06	485.35	343.57	95.01	5.39
Total (lb/day)	113.12	71.94	48.68	49.30	50.08	50.04	50.05	44.90	40.15	35.66	31.39	30.18	32.52	21.10	14.94	4.13	0.23
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite NO_X Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	**2,601.68**	**1,654.51**	**1,119.68**	**1,133.89**	**1,151.95**	**1,150.81**	**1,151.09**	**1,032.60**	**923.53**	**820.18**	**721.88**	**694.12**	**748.06**	**485.35**	**343.57**	**95.01**	**5.39**
Pounds per Day	**113.12**	**71.94**	**48.68**	**49.30**	**50.08**	**50.04**	**50.05**	**44.90**	**40.15**	**35.66**	**31.39**	**30.18**	**32.52**	**21.10**	**14.94**	**4.13**	**0.23**
Yearly Maximums	**14,156**	**12,302**	**11,133**	**10,357**	**9,318**	**8,172**	**7,021**	**5,959**	**5,191**	**4,581**	**4,087**	**3,674**	**3,317**	**2,916**	**2,727**	**2,622**	**2,684**

Table 5.1A.21 AEC Onsite & Offsite Construction Exhaust and Fugitive Emissions Summary

Onsite & Offsite SO_X Emissions

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
	SO_X Emissions by Month																																	
Combined-Cycle Block Construction																																		
Total (lb/month)	0.02	0.04	0.04	0.04	0.05	0.08	5.87	6.57	8.52	8.60	13.02	13.77	14.02	13.33	13.75	13.40	12.52	11.76	8.59	7.02	7.09	7.13	7.10	7.10	6.50	6.13	5.63	5.22	5.07	5.01	2.82	2.05	0.74	0.19
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.26	0.29	0.37	0.37	0.57	0.60	0.61	0.58	0.60	0.58	0.54	0.51	0.37	0.31	0.31	0.31	0.31	0.31	0.28	0.27	0.24	0.23	0.22	0.22	0.12	0.09	0.03	0.01
Simple-Cycle Block Construction																																		
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite SO_X Emissions (Construction Equipment and Vehicles)																																		
Pounds per Month	**0.02**	**0.04**	**0.04**	**0.04**	**0.05**	**0.08**	**5.87**	**6.57**	**8.52**	**8.60**	**13.02**	**13.77**	**14.02**	**13.33**	**13.75**	**13.40**	**12.52**	**11.76**	**8.59**	**7.02**	**7.09**	**7.13**	**7.10**	**7.10**	**6.50**	**6.13**	**5.63**	**5.22**	**5.07**	**5.01**	**2.82**	**2.05**	**0.74**	**0.19**
Pounds per Day	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.26**	**0.29**	**0.37**	**0.37**	**0.57**	**0.60**	**0.61**	**0.58**	**0.60**	**0.58**	**0.54**	**0.51**	**0.37**	**0.31**	**0.31**	**0.31**	**0.31**	**0.31**	**0.28**	**0.27**	**0.24**	**0.23**	**0.22**	**0.22**	**0.12**	**0.09**	**0.03**	**0.01**
Yearly Maximums	**57**	**71**	**84**	**98**	**111**	**123**	**135**	**138**	**138**	**137**	**135**	**129**	**123**	**115**	**108**	**100**	**92**	**84**	**78**	**72**	**67**	**61**	**54**	**46**	**41**	**38**	**37**	**36**	**35**	**35**	**35**	**36**	**39**	**41**
Maximum Pounds per Day	**0.61**																																	
Maximum Pounds per Hour [a]	**0.061**																																	
Maximum Pounds per Month	**14.0**																																	
Month with Maximum	**12**																																	
Maximum Pounds per Year	**138**																																	
Maximum Average Pounds per Hour [b]	**0.016**																																	
Year with Maximum	**Months 8-19**																																	
Tons per Year	**0.069**																																	

Onsite & Offsite Exhaust PM_{10} Emissions

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
	Exhaust PM_{10} Emissions by Month																																	
Combined-Cycle Block Construction																																		
Total (lb/month)	2.07	4.66	4.66	5.18	6.21	9.32	152.54	179.09	238.24	254.03	408.30	440.11	453.48	444.98	469.91	463.90	441.39	423.46	312.66	251.03	253.95	255.55	251.41	252.45	235.10	228.29	213.89	197.59	188.32	177.32	154.72	85.08	26.70	21.73
Total (lb/day)	0.09	0.20	0.20	0.23	0.27	0.41	6.63	7.79	10.36	11.04	17.75	19.14	19.72	19.35	20.43	20.17	19.19	18.41	13.59	10.91	11.04	11.11	10.93	10.98	10.22	9.93	9.30	8.59	8.19	7.71	6.73	3.70	1.16	0.94
Simple-Cycle Block Construction																																		
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite Exhaust PM_{10} Emissions (Construction Equipment and Vehicles)																																		
Pounds per Month	**2.07**	**4.66**	**4.66**	**5.18**	**6.21**	**9.32**	**152.54**	**179.09**	**238.24**	**254.03**	**408.30**	**440.11**	**453.48**	**444.98**	**469.91**	**463.90**	**441.39**	**423.46**	**312.66**	**251.03**	**253.95**	**255.55**	**251.41**	**252.45**	**235.10**	**228.29**	**213.89**	**197.59**	**188.32**	**177.32**	**154.72**	**85.08**	**26.70**	**21.73**
Pounds per Day	**0.09**	**0.20**	**0.20**	**0.23**	**0.27**	**0.41**	**6.63**	**7.79**	**10.36**	**11.04**	**17.75**	**19.14**	**19.72**	**19.35**	**20.43**	**20.17**	**19.19**	**18.41**	**13.59**	**10.91**	**11.04**	**11.11**	**10.93**	**10.98**	**10.22**	**9.93**	**9.30**	**8.59**	**8.19**	**7.71**	**6.73**	**3.70**	**1.16**	**0.94**
Yearly Maximums	**1,704**	**2,156**	**2,596**	**3,061**	**3,520**	**3,955**	**4,369**	**4,530**	**4,601**	**4,617**	**4,619**	**4,462**	**4,274**	**4,056**	**3,839**	**3,583**	**3,317**	**3,064**	**2,818**	**2,660**	**2,494**	**2,266**	**2,033**	**1,781**	**1,548**	**1,359**	**1,197**	**1,099**	**1,040**	**1,042**	**1,090**	**1,197**	**1,397**	**1,582**
Maximum Pounds per Day	**20.4**																																	
Maximum Pounds per Hour [a]	**2.04**																																	
Maximum Pounds per Month	**470**																																	
Month with Maximum	**15**																																	
Maximum Pounds per Year	**4,619**																																	
Maximum Average Pounds per Hour [b]	**0.53**																																	
Year with Maximum	**Months 10-21**																																	
Tons per Year	**2.31**																																	

Onsite & Offsite Fugitive PM_{10} Emissions

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
	Fugitive PM_{10} Emissions by Month																																	
Combined-Cycle Block Construction																																		
Total (lb/month)	7.93	7.93	7.93	7.93	7.93	7.93	59.65	59.65	59.65	75.50	75.50	75.50	75.50	75.50	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	67.58	7.93	7.93	7.93	7.93
Total (lb/day)	0.34	0.34	0.34	0.34	0.34	0.34	2.59	2.59	2.59	3.28	3.28	3.28	3.28	3.28	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	2.94	0.34	0.34	0.34	0.34
Simple-Cycle Block Construction																																		
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite Fugitive PM_{10} Emissions (Dismemberment, Debris Loading, Grading, Bulldozing, Truck Dumping/Loading, and Onsite Construction Vehicles)																																		
Pounds per Month	**7.93**	**7.93**	**7.93**	**7.93**	**7.93**	**7.93**	**59.65**	**59.65**	**59.65**	**75.50**	**75.50**	**75.50**	**75.50**	**75.50**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**67.58**	**7.93**	**7.93**	**7.93**	**7.93**
Pounds per Day	**0.34**	**0.34**	**0.34**	**0.34**	**0.34**	**0.34**	**2.59**	**2.59**	**2.59**	**3.28**	**3.28**	**3.28**	**3.28**	**3.28**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**2.94**	**0.34**	**0.34**	**0.34**	**0.34**
Yearly Maximums	**453**	**521**	**588**	**648**	**707**	**767**	**827**	**835**	**843**	**851**	**843**	**835**	**827**	**819**	**811**	**811**	**811**	**811**	**811**	**751**	**692**	**632**	**572**	**505**	**485**	**576**	**667**	**759**	**739**	**719**	**699**	**738**	**778**	**818**
Maximum Pounds per Day	**6.91**																																	
Maximum Pounds per Hour [a]	**0.69**																																	
Maximum Pounds per Month	**159**																																	
Month with Maximum	**Months 37, 38, or 39**																																	
Maximum Pounds per Year	**905**																																	
Maximum Average Pounds per Hour [b]	**0.10**																																	
Year with Maximum	**Months 36-47**																																	
Tons per Year	**0.45**																																	

Table 5.1A.21 AEC Onsite & Offsite Construction Exhaust and Fugitive Emissions Summary

Total Onsite & Offsite PM_{10} Emissions (Exhaust and Fugitive)

Total PM_{10} Emissions by Month

Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Pounds per Month	10.00	12.59	12.59	13.11	14.14	17.25	212.19	238.74	297.88	329.53	483.81	515.61	528.98	520.49	537.49	531.48	508.96
Pounds per Day	0.43	0.55	0.55	0.57	0.61	0.75	9.23	10.38	12.95	14.33	21.04	22.42	23.00	22.63	23.37	23.11	22.13
Yearly Maximums	2,157	2,676	3,184	3,709	4,228	4,722	5,196	5,364	5,444	5,468	5,461	5,297	5,101	4,875	4,650	4,394	4,128

Parameter	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Pounds per Month	491.04	380.24	318.60	321.52	323.13	318.99	320.02	302.67	295.87	281.47	265.17	255.90	244.90	162.65	93.01	34.63	29.66
Pounds per Day	21.35	16.53	13.85	13.98	14.05	13.87	13.91	13.16	12.86	12.24	11.53	11.13	10.65	7.07	4.04	1.51	1.29
Yearly Maximums	3,875	3,628	3,411	3,185	2,898	2,605	2,286	2,033	1,935	1,864	1,858	1,779	1,761	1,789	1,936	2,175	2,399

Maximum Pounds per Day	23.4
Maximum Pounds per Hour [a]	2.34
Maximum Pounds per Month	537
Month with Maximum	15
Maximum Pounds per Year	5,468
Maximum Average Pounds per Hour [b]	0.62
Year with Maximum	Months 10-21
Tons per Year	2.73

Onsite & Offsite Exhaust $PM_{2.5}$ Emissions

Exhaust $PM_{2.5}$ Emissions by Month

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Combined-Cycle Block Construction																	
Total (lb/month)	0.57	1.27	1.27	1.41	1.70	2.54	54.92	61.98	82.96	88.21	144.00	154.90	158.97	154.27	162.45	159.41	150.37
Total (lb/day)	0.02	0.06	0.06	0.06	0.07	0.11	2.39	2.69	3.61	3.84	6.26	6.73	6.91	6.71	7.06	6.93	6.54
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite Exhaust $PM_{2.5}$ Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	0.57	1.27	1.27	1.41	1.70	2.54	54.92	61.98	82.96	88.21	144.00	154.90	158.97	154.27	162.45	159.41	150.37
Pounds per Day	0.02	0.06	0.06	0.06	0.07	0.11	2.39	2.69	3.61	3.84	6.26	6.73	6.91	6.71	7.06	6.93	6.54
Yearly Maximums	596	754	907	1,068	1,226	1,375	1,515	1,562	1,579	1,576	1,568	1,503	1,428	1,343	1,259	1,161	1,062

Construction Step	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																	
Total (lb/month)	142.83	101.95	78.92	79.87	80.34	79.21	79.50	73.39	70.31	65.18	59.66	56.93	54.69	46.17	25.98	7.88	5.92
Total (lb/day)	6.21	4.43	3.43	3.47	3.49	3.44	3.46	3.19	3.06	2.83	2.59	2.48	2.38	2.01	1.13	0.34	0.26
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite Exhaust $PM_{2.5}$ Emissions (Construction Equipment and Vehicles)																	
Pounds per Month	142.83	101.95	78.92	79.87	80.34	79.21	79.50	73.39	70.31	65.18	59.66	56.93	54.69	46.17	25.98	7.88	5.92
Pounds per Day	6.21	4.43	3.43	3.47	3.49	3.44	3.46	3.19	3.06	2.83	2.59	2.48	2.38	2.01	1.13	0.34	0.26
Yearly Maximums	968	880	824	771	699	625	546	473	417	370	342	325	324	336	364	418	470

Maximum Pounds per Day	7.06
Maximum Pounds per Hour [a]	0.71
Maximum Pounds per Month	162
Month with Maximum	15
Maximum Pounds per Year	1,579
Maximum Average Pounds per Hour [b]	0.18
Year with Maximum	Months 9-20
Tons per Year	0.79

Onsite & Offsite Fugitive $PM_{2.5}$ Emissions

Fugitive $PM_{2.5}$ Emissions by Month

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Combined-Cycle Block Construction																	
Total (lb/month)	0.79	0.79	0.79	0.79	0.79	0.79	18.42	18.42	18.42	20.01	20.01	20.01	20.01	20.01	19.22	19.22	19.22
Total (lb/day)	0.03	0.03	0.03	0.03	0.03	0.03	0.80	0.80	0.80	0.87	0.87	0.87	0.87	0.87	0.84	0.84	0.84
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite Fugitive $PM_{2.5}$ Emissions (Dismemberment, Debris Loading, Grading, Bulldozing, Truck Dumping/Loading, and Onsite Construction Vehicles)																	
Pounds per Month	0.79	0.79	0.79	0.79	0.79	0.79	18.42	18.42	18.42	20.01	20.01	20.01	20.01	20.01	19.22	19.22	19.22
Pounds per Day	0.03	0.03	0.03	0.03	0.03	0.03	0.80	0.80	0.80	0.87	0.87	0.87	0.87	0.87	0.84	0.84	0.84
Yearly Maximums	120	139	158	177	195	214	232	233	234	235	234	233	232	231	231	231	231

Construction Step	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																	
Total (lb/month)	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	0.79	0.79	0.79	0.79
Total (lb/day)	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.03	0.03	0.03	0.03
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite Fugitive $PM_{2.5}$ Emissions (Dismemberment, Debris Loading, Grading, Bulldozing, Truck Dumping/Loading, and Onsite Construction Vehicles)																	
Pounds per Month	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	19.22	0.79	0.79	0.79	0.79
Pounds per Day	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.84	0.03	0.03	0.03	0.03
Yearly Maximums	231	231	212	194	175	157	138	123	170	216	263	248	234	219	223	227	231

Maximum Pounds per Day	2.86
Maximum Pounds per Hour [a]	0.29
Maximum Pounds per Month	65.7
Month with Maximum	Months 37, 38, or 39
Maximum Pounds per Year	263
Maximum Average Pounds per Hour [b]	0.030
Year with Maximum	Months 28-39
Tons per Year	0.13

Table 5.1A.21 AEC Onsite & Offsite Construction Exhaust and Fugitive Emissions Summary

Total Onsite & Offsite $PM_{2.5}$ Emissions (Exhaust and Fugitive)

Total $PM_{2.5}$ Emissions by Month

Parameter	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Pounds per Month	1.36	2.06	2.06	2.21	2.49	3.33	73.34	80.41	101.38	108.22	164.01	174.91	178.98	174.28	181.66	178.63	169.59
Pounds per Day	0.06	0.09	0.09	0.10	0.11	0.14	3.19	3.50	4.41	4.71	7.13	7.60	7.78	7.58	7.90	7.77	7.37
Yearly Maximums	716	893	1,066	1,245	1,422	1,589	1,747	1,795	1,813	1,811	1,802	1,736	1,660	1,574	1,489	1,392	1,292
Maximum Pounds per Day	7.90																
Maximum Pounds per Hour [a]	0.79																
Maximum Pounds per Month	182																
Month with Maximum	15																
Maximum Pounds per Year	1,813																
Maximum Average Pounds per Hour [b]	0.21																
Year with Maximum	Months 9-20																
Tons per Year	0.91																

Parameter	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Pounds per Month	162.05	121.17	98.14	99.09	99.56	98.43	98.71	92.61	89.53	84.40	78.88	76.15	73.91	46.97	26.78	8.67	6.71
Pounds per Day	7.05	5.27	4.27	4.31	4.33	4.28	4.29	4.03	3.89	3.67	3.43	3.31	3.21	2.04	1.16	0.38	0.29
Yearly Maximums	1,199	1,111	1,036	965	875	782	683	596	586	586	605	573	558	555	588	645	701

Onsite & Offsite CO_2 Emissions

CO_2 Emissions by Month

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Combined-Cycle Block Construction																	
Total (metric tons/month)	1.05	2.35	2.35	2.61	3.14	4.70	270.62	306.18	399.31	402.15	616.62	658.01	670.69	643.13	658.15	641.67	599.41
Total (metric tons/day)	0.05	0.10	0.10	0.11	0.14	0.20	11.77	13.31	17.36	17.48	26.81	28.61	29.16	27.96	28.62	27.90	26.06
Simple-Cycle Block Construction																	
Total (metric tons/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (metric tons/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite CO_2 Emissions (Construction Equipment and Vehicles)																	
Metric Tons per Month	1.05	2.35	2.35	2.61	3.14	4.70	270.62	306.18	399.31	402.15	616.62	658.01	670.69	643.13	658.15	641.67	599.41
Metric Tons per Day	0.05	0.10	0.10	0.11	0.14	0.20	11.77	13.31	17.36	17.48	26.81	28.61	29.16	27.96	28.62	27.90	26.06
Yearly Maximums	2,669	3,339	3,980	4,635	5,274	5,871	6,430	6,566	6,591	6,526	6,461	6,179	5,856	5,495	5,145	4,756	4,363
Maximum Metric Tons per Day	29.2																
Maximum Metric Tons per Hour [a]	2.92																
Maximum Metric Tons per Month	671																
Month with Maximum	13																
Maximum Metric Tons per Year	6,591																
Maximum Average Metric Tons per Hour [b]	0.75																
Year with Maximum	Months 9-20																

Construction Step	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																	
Total (metric tons/month)	563.66	406.87	331.16	334.33	336.94	334.85	335.38	309.84	292.84	268.78	248.70	240.60	239.40	146.43	102.74	37.10	10.95
Total (metric tons/day)	24.51	17.69	14.40	14.54	14.65	14.56	14.58	13.47	12.73	11.69	10.81	10.46	10.41	6.37	4.47	1.61	0.48
Simple-Cycle Block Construction																	
Total (metric tons/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (metric tons/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Onsite & Offsite CO_2 Emissions (Construction Equipment and Vehicles)																	
Metric Tons per Month	563.66	406.87	331.16	334.33	336.94	334.85	335.38	309.84	292.84	268.78	248.70	240.60	239.40	146.43	102.74	37.10	10.95
Metric Tons per Day	24.51	17.69	14.40	14.54	14.65	14.56	14.58	13.47	12.73	11.69	10.81	10.46	10.41	6.37	4.47	1.61	0.48
Yearly Maximums	4,004	3,680	3,419	3,191	2,894	2,568	2,233	1,955	1,827	1,755	1,731	1,700	1,697	1,704	1,778	1,895	2,023

Onsite & Offsite N_2O Emissions

N_2O Emissions by Month

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Combined-Cycle Block Construction																	
Total (metric tons/month)	0.00001	0.00002	0.00002	0.00002	0.00003	0.00004	0.00344	0.00372	0.00453	0.00411	0.00494	0.00518	0.00524	0.00517	0.00499	0.00496	0.00475
Total (metric tons/day)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00015	0.00016	0.00020	0.00018	0.00021	0.00023	0.00023	0.00022	0.00022	0.00022	0.00021
Simple-Cycle Block Construction																	
Total (metric tons/month)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Total (metric tons/day)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Total Onsite & Offsite N_2O Emissions (Construction Equipment and Vehicles)																	
Metric Tons per Month	0.00001	0.00002	0.00002	0.00002	0.00003	0.00004	0.00344	0.00372	0.00453	0.00411	0.00494	0.00518	0.00524	0.00517	0.00499	0.00496	0.00475
Metric Tons per Day	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00015	0.00016	0.00020	0.00018	0.00021	0.00023	0.00023	0.00022	0.00022	0.00022	0.00021
Yearly Maximums	0.02607	0.03130	0.03644	0.04141	0.04634	0.05107	0.05566	0.05643	0.05681	0.05639	0.05645	0.05565	0.05463	0.05337	0.05216	0.05094	0.04967
Maximum Metric Tons per Day	0.00023																
Maximum Metric Tons per Hour [a]	0.000023																
Maximum Metric Tons per Month	0.0052																
Month with Maximum	13																
Maximum Metric Tons per Year	0.057																
Maximum Average Metric Tons per Hour [b]	0.0000065																
Year with Maximum	Months 9-20																

Construction Step	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																	
Total (metric tons/month)	0.00463	0.00421	0.00410	0.00411	0.00417	0.00415	0.00415	0.00399	0.00396	0.00376	0.00369	0.00364	0.00351	0.00142	0.00101	0.00073	0.00010
Total (metric tons/day)	0.00020	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018	0.00017	0.00017	0.00016	0.00016	0.00016	0.00015	0.00006	0.00004	0.00003	0.00000
Simple-Cycle Block Construction																	
Total (metric tons/month)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Total (metric tons/day)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Total Onsite & Offsite N_2O Emissions (Construction Equipment and Vehicles)																	
Metric Tons per Month	0.00463	0.00421	0.00410	0.00411	0.00417	0.00415	0.00415	0.00399	0.00396	0.00376	0.00369	0.00364	0.00351	0.00142	0.00101	0.00073	0.00010
Metric Tons per Day	0.00020	0.00018	0.00018	0.00018	0.00018	0.00018	0.00018	0.00017	0.00017	0.00016	0.00016	0.00016	0.00015	0.00006	0.00004	0.00003	0.00000
Yearly Maximums	0.04856	0.04743	0.04464	0.04155	0.03816	0.03410	0.02995	0.02698	0.02698	0.02781	0.02907	0.02949	0.02998	0.03052	0.03233	0.03444	0.03624

Onsite & Offsite CH_4 Emissions

CH_4 Emissions by Month

Construction Step	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Combined-Cycle Block Construction																	
Total (metric tons/month)	0.00005	0.00011	0.00011	0.00012	0.00014	0.00021	0.00779	0.00848	0.01018	0.00915	0.01025	0.01074	0.01094	0.01111	0.01072	0.01085	0.01066
Total (metric tons/day)	0.00000	0.00000	0.00000	0.00001	0.00001	0.00001	0.00034	0.00037	0.00044	0.00040	0.00045	0.00047	0.00048	0.00048	0.00047	0.00047	0.00046
Simple-Cycle Block Construction																	
Total (metric tons/month)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Total (metric tons/day)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Total Onsite & Offsite CH_4 Emissions (Construction Equipment and Vehicles)																	
Metric Tons per Month	0.00005	0.00011	0.00011	0.00012	0.00014	0.00021	0.00779	0.00848	0.01018	0.00915	0.01025	0.01074	0.01094	0.01111	0.01072	0.01085	0.01066
Metric Tons per Day	0.00000	0.00000	0.00000	0.00001	0.00001	0.00001	0.00034	0.00037	0.00044	0.00040	0.00045	0.00047	0.00048	0.00048	0.00047	0.00047	0.00046
Yearly Maximums	0.05732	0.06821	0.07922	0.08983	0.10056	0.11108	0.12155	0.12422	0.12627	0.12665	0.12820	0.12856	0.12845	0.12783	0.12716	0.12650	0.12558
Maximum Metric Tons per Day	0.00054																
Maximum Metric Tons per Hour [a]	0.000054																
Maximum Metric Tons per Month	0.012																
Month with Maximum	39																
Maximum Metric Tons per Year	0.13																
Maximum Average Metric Tons per Hour [b]	0.000015																
Year with Maximum	Months 12-23																

Construction Step	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34
Combined-Cycle Block Construction																	
Total (metric tons/month)	0.01068	0.01046	0.01053	0.01056	0.01070	0.01061	0.01063	0.01032	0.01043	0.01006	0.00993	0.00977	0.00916	0.00428	0.00263	0.00194	0.00049
Total (metric tons/day)	0.00046	0.00045	0.00046	0.00046	0.00047	0.00046	0.00046	0.00045	0.00045	0.00044	0.00043	0.00042	0.00040	0.00019	0.00011	0.00008	0.00002
Simple-Cycle Block Construction																	
Total (metric tons/month)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Total (metric tons/day)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Total Onsite & Offsite CH_4 Emissions (Construction Equipment and Vehicles)																	
Metric Tons per Month	0.01068	0.01046	0.01053	0.01056	0.01070	0.01061	0.01063	0.01032	0.01043	0.01006	0.00993	0.00977	0.00916	0.00428	0.00263	0.00194	0.00049
Metric Tons per Day	0.00046	0.00045	0.00046	0.00046	0.00047	0.00046	0.00046	0.00045	0.00045	0.00044	0.00043	0.00042	0.00040	0.00019	0.00011	0.00008	0.00002
Yearly Maximums	0.12469	0.12317	0.11700	0.10910	0.10048	0.09027	0.07966	0.07181	0.07071	0.07152	0.07382	0.07442	0.07579	0.07796	0.08366	0.09113	0.09727

Table 5.1A.21 AEC Onsite & Offsite Construc

Onsite & Offsite CO Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	494.23	1,851.00	2,243.14	2,383.74	2,184.60	2,166.03	2,173.33	1,696.88	1,615.31	1,334.54	854.47	723.48	409.54	324.35	221.83	213.04
Total (lb/day)	0.00	21.49	80.48	97.53	103.64	94.98	94.18	94.49	73.78	70.23	58.02	37.15	31.46	17.81	14.10	9.64	9.26
Total Onsite & Offsite CO Emissions (Construction Equipmen																	
Pounds per Month	**0.00**	**494.23**	**1,851.00**	**2,243.14**	**2,383.74**	**2,184.60**	**2,166.03**	**2,173.33**	**1,696.88**	**1,615.31**	**1,334.54**	**854.47**	**723.48**	**409.54**	**324.35**	**221.83**	**213.04**
Pounds per Day	**0.00**	**21.49**	**80.48**	**97.53**	**103.64**	**94.98**	**94.18**	**94.49**	**73.78**	**70.23**	**58.02**	**37.15**	**31.46**	**17.81**	**14.10**	**9.64**	**9.26**
Yearly Maximums	**18,997**	**19,721**	**19,636**	**18,109**	**16,088**	**13,917**											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite & Offsite VOC Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	13.32	44.37	53.25	55.78	47.07	47.90	47.65	38.52	36.52	28.27	20.08	17.92	10.19	7.92	6.08	5.92
Total (lb/day)	0.00	0.58	1.93	2.32	2.43	2.05	2.08	2.07	1.67	1.59	1.23	0.87	0.78	0.44	0.34	0.26	0.26
Total Onsite & Offsite VOC Emissions (Construction Equipme																	
Pounds per Month	**0.00**	**13.32**	**44.37**	**53.25**	**55.78**	**47.07**	**47.90**	**47.65**	**38.52**	**36.52**	**28.27**	**20.08**	**17.92**	**10.19**	**7.92**	**6.08**	**5.92**
Pounds per Day	**0.00**	**0.58**	**1.93**	**2.32**	**2.43**	**2.05**	**2.08**	**2.07**	**1.67**	**1.59**	**1.23**	**0.87**	**0.78**	**0.44**	**0.34**	**0.26**	**0.26**
Yearly Maximums	**433**	**451**	**448**	**411**	**364**	**314**											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite & Offsite NO_X Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	89.69	264.12	313.88	326.17	308.71	336.72	347.89	295.63	238.71	157.08	115.54	109.85	68.58	43.90	35.81	35.12
Total (lb/day)	0.00	3.90	11.48	13.65	14.18	13.42	14.64	15.13	12.85	10.38	6.83	5.02	4.78	2.98	1.91	1.56	1.53
Total Onsite & Offsite NO_X Emissions (Construction Equipme																	
Pounds per Month	**0.00**	**89.69**	**264.12**	**313.88**	**326.17**	**308.71**	**336.72**	**347.89**	**295.63**	**238.71**	**157.08**	**115.54**	**109.85**	**68.58**	**43.90**	**35.81**	**35.12**
Pounds per Day	**0.00**	**3.90**	**11.48**	**13.65**	**14.18**	**13.42**	**14.64**	**15.13**	**12.85**	**10.38**	**6.83**	**5.02**	**4.78**	**2.98**	**1.91**	**1.56**	**1.53**
Yearly Maximums	**2,794**	**2,904**	**2,883**	**2,663**	**2,385**	**2,094**											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Table 5.1A.21 AEC Onsite & Offsite Construc

Onsite & Offsite SO_X Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	1.17	3.91	4.72	5.11	4.50	4.79	4.92	4.30	4.21	3.19	2.33	2.00	1.18	0.85	0.57	0.54
Total (lb/day)	0.00	0.05	0.17	0.21	0.22	0.20	0.21	0.21	0.19	0.18	0.14	0.10	0.09	0.05	0.04	0.02	0.02
Total Onsite & Offsite SO_X Emissions (Construction Equipme																	
Pounds per Month	**0.00**	**1.17**	**3.91**	**4.72**	**5.11**	**4.50**	**4.79**	**4.92**	**4.30**	**4.21**	**3.19**	**2.33**	**2.00**	**1.18**	**0.85**	**0.57**	**0.54**
Pounds per Day	**0.00**	**0.05**	**0.17**	**0.21**	**0.22**	**0.20**	**0.21**	**0.21**	**0.19**	**0.18**	**0.14**	**0.10**	**0.09**	**0.05**	**0.04**	**0.02**	**0.02**
Yearly Maximums	**43**	**45**	**45**	**42**	**38**	**33**											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite & Offsite Exhaust PM_{10} Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	19.26	45.92	66.36	116.02	138.96	190.35	225.25	261.62	284.59	211.65	181.69	136.02	88.08	55.81	19.61	16.51
Total (lb/day)	0.00	0.84	2.00	2.89	5.04	6.04	8.28	9.79	11.37	12.37	9.20	7.90	5.91	3.83	2.43	0.85	0.72
Total Onsite & Offsite Exhaust PM_{10} Emissions (Construction																	
Pounds per Month	**0.00**	**19.26**	**45.92**	**66.36**	**116.02**	**138.96**	**190.35**	**225.25**	**261.62**	**284.59**	**211.65**	**181.69**	**136.02**	**88.08**	**55.81**	**19.61**	**16.51**
Pounds per Day	**0.00**	**0.84**	**2.00**	**2.89**	**5.04**	**6.04**	**8.28**	**9.79**	**11.37**	**12.37**	**9.20**	**7.90**	**5.91**	**3.83**	**2.43**	**0.85**	**0.72**
Yearly Maximums	**1,742**	**1,878**	**1,947**	**1,956**	**1,910**	**1,810**											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite & Offsite Fugitive PM_{10} Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	47.58	158.86	158.86	158.86	47.58	47.58	47.58	47.58	47.58	47.58	47.58	47.58	47.57	47.57	47.57	47.57
Total (lb/day)	0.00	2.07	6.91	6.91	6.91	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07	2.07
Total Onsite & Offsite Fugitive PM_{10} Emissions (Dismemberm																	
Pounds per Month	**0.00**	**47.58**	**158.86**	**158.86**	**158.86**	**47.58**	**47.58**	**47.58**	**47.58**	**47.58**	**47.58**	**47.58**	**47.58**	**47.57**	**47.57**	**47.57**	**47.57**
Pounds per Day	**0.00**	**2.07**	**6.91**	**6.91**	**6.91**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**	**2.07**
Yearly Maximums	**857**	**905**	**905**	**793**	**682**	**571**											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Table 5.1A.21 AEC Onsite & Offsite Construc

Total Onsite & Offsite PM_{10} Emissions (Exhau

Parameter	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Pounds per Month	0.00	66.84	204.78	225.22	274.88	186.54	237.93	272.82	309.20	332.17	259.23	229.27	183.60	135.65	103.38	67.18	64.07
Pounds per Day	0.00	2.91	8.90	9.79	11.95	8.11	10.34	11.86	13.44	14.44	11.27	9.97	7.98	5.90	4.49	2.92	2.79
Yearly Maximums	2,599	2,782	2,851	2,750	2,592	2,381											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite & Offsite Exhaust $PM_{2.5}$ Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	6.69	17.19	23.60	37.13	42.58	56.59	65.99	74.70	79.94	59.44	50.61	38.21	24.61	15.70	5.85	5.00
Total (lb/day)	0.00	0.29	0.75	1.03	1.61	1.85	2.46	2.87	3.25	3.48	2.58	2.20	1.66	1.07	0.68	0.25	0.22
Total Onsite & Offsite Exhaust $PM_{2.5}$ Emissions (Construction																	
Pounds per Month	0.00	6.69	17.19	23.60	37.13	42.58	56.59	65.99	74.70	79.94	59.44	50.61	38.21	24.61	15.70	5.85	5.00
Pounds per Day	0.00	0.29	0.75	1.03	1.61	1.85	2.46	2.87	3.25	3.48	2.58	2.20	1.66	1.07	0.68	0.25	0.22
Yearly Maximums	514	553	571	569	551	519											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite & Offsite Fugitive $PM_{2.5}$ Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (lb/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (lb/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Simple-Cycle Block Construction																	
Total (lb/month)	0.00	4.76	65.72	65.72	65.72	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76
Total (lb/day)	0.00	0.21	2.86	2.86	2.86	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Total Onsite & Offsite Fugitive $PM_{2.5}$ Emissions (Dismemberm																	
Pounds per Month	0.00	4.76	65.72	65.72	65.72	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76
Pounds per Day	0.00	0.21	2.86	2.86	2.86	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21
Yearly Maximums	235	240	240	179	118	57											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Table 5.1A.21 AEC Onsite & Offsite Construc

Total Onsite & Offsite $PM_{2.5}$ Emissions (Exhau

Parameter	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Pounds per Month	0.00	11.44	82.91	89.32	102.84	47.34	61.34	70.75	79.46	84.69	64.20	55.37	42.97	29.37	20.46	10.60	9.76
Pounds per Day	0.00	0.50	3.60	3.88	4.47	2.06	2.67	3.08	3.45	3.68	2.79	2.41	1.87	1.28	0.89	0.46	0.42
Yearly Maximums	750	793	811	748	669	576											
Maximum Pounds per Day																	
Maximum Pounds per Hour [a]																	
Maximum Pounds per Month																	
Month with Maximum																	
Maximum Pounds per Year																	
Maximum Average Pounds per Hour [b]																	
Year with Maximum																	
Tons per Year																	

Onsite & Offsite CO_2 Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (metric tons/month)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total (metric tons/day)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Simple-Cycle Block Construction																	
Total (metric tons/month)	0.00	57.19	182.02	221.55	244.52	218.00	237.43	245.69	220.78	219.69	165.41	127.03	106.79	63.10	44.75	28.01	26.57
Total (metric tons/day)	0.00	2.49	7.91	9.63	10.63	9.48	10.32	10.68	9.60	9.55	7.19	5.52	4.64	2.74	1.95	1.22	1.16
Total Onsite & Offsite CO_2 Emissions (Construction Equipmer																	
Metric Tons per Month	0.00	57.19	182.02	221.55	244.52	218.00	237.43	245.69	220.78	219.69	165.41	127.03	106.79	63.10	44.75	28.01	26.57
Metric Tons per Day	0.00	2.49	7.91	9.63	10.63	9.48	10.32	10.68	9.60	9.55	7.19	5.52	4.64	2.74	1.95	1.22	1.16
Yearly Maximums	2,139	2,246	2,252	2,115	1,921	1,703											
Maximum Metric Tons per Day																	
Maximum Metric Tons per Hour [a]																	
Maximum Metric Tons per Month																	
Month with Maximum																	
Maximum Metric Tons per Year																	
Maximum Average Metric Tons per Hour [b]																	
Year with Maximum																	

Onsite & Offsite N_2O Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (metric tons/month)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Total (metric tons/day)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Simple-Cycle Block Construction																	
Total (metric tons/month)	0.00000	0.00118	0.00398	0.00479	0.00503	0.00411	0.00413	0.00405	0.00322	0.00312	0.00253	0.00180	0.00158	0.00086	0.00070	0.00053	0.00052
Total (metric tons/day)	0.00000	0.00005	0.00017	0.00021	0.00022	0.00018	0.00018	0.00018	0.00014	0.00014	0.00011	0.00008	0.00007	0.00004	0.00003	0.00002	0.00002
Total Onsite & Offsite N_2O Emissions (Construction Equipmer																	
Metric Tons per Month	0.00000	0.00118	0.00398	0.00479	0.00503	0.00411	0.00413	0.00405	0.00322	0.00312	0.00253	0.00180	0.00158	0.00086	0.00070	0.00053	0.00052
Metric Tons per Day	0.00000	0.00005	0.00017	0.00021	0.00022	0.00018	0.00018	0.00018	0.00014	0.00014	0.00011	0.00008	0.00007	0.00004	0.00003	0.00002	0.00002
Yearly Maximums	0.03794	0.03952	0.03919	0.03591	0.03165	0.02714											
Maximum Metric Tons per Day																	
Maximum Metric Tons per Hour [a]																	
Maximum Metric Tons per Month																	
Month with Maximum																	
Maximum Metric Tons per Year																	
Maximum Average Metric Tons per Hour [b]																	
Year with Maximum																	

Onsite & Offsite CH_4 Emissions

Construction Step	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Combined-Cycle Block Construction																	
Total (metric tons/month)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Total (metric tons/day)	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
Simple-Cycle Block Construction																	
Total (metric tons/month)	0.00000	0.00278	0.00922	0.01125	0.01237	0.01053	0.01114	0.01133	0.00998	0.01011	0.00808	0.00611	0.00506	0.00289	0.00222	0.00140	0.00133
Total (metric tons/day)	0.00000	0.00012	0.00040	0.00049	0.00054	0.00046	0.00048	0.00049	0.00043	0.00044	0.00035	0.00027	0.00022	0.00013	0.00010	0.00006	0.00006
Total Onsite & Offsite CH_4 Emissions (Construction Equipmer																	
Metric Tons per Month	0.00000	0.00278	0.00922	0.01125	0.01237	0.01053	0.01114	0.01133	0.00998	0.01011	0.00808	0.00611	0.00506	0.00289	0.00222	0.00140	0.00133
Metric Tons per Day	0.00000	0.00012	0.00040	0.00049	0.00054	0.00046	0.00048	0.00049	0.00043	0.00044	0.00035	0.00027	0.00022	0.00013	0.00010	0.00006	0.00006
Yearly Maximums	0.10288	0.10795	0.10806	0.10105	0.09121	0.08017											
Maximum Metric Tons per Day																	
Maximum Metric Tons per Hour [a]																	
Maximum Metric Tons per Month																	
Month with Maximum																	
Maximum Metric Tons per Year																	
Maximum Average Metric Tons per Hour [b]																	
Year with Maximum																	

Notes:

[a] The hours per da 10 hours/day

[b] The hours per year are assumed to allow operation 24 hours per day, 7 days per week des 8,760 hours/year

Appendix 5.1B
Commissioning and Operational Emission Estimates

APPENDIX 5.1B

Commissioning and Operational Emission Estimates (Criteria and Greenhouse Gas)

Tables presented in this Appendix are as follows:

Alamitos Energy Center
Table 5.1B.1
Summary of Commissioning Emission Estimates: Combined-Cycle Turbines
October 2015

			Unabated Emission Rate (lb/hr)			Total Unabated Emissions (lb)			Reduction (%)			Abated Emission Rate (lb/hr)			Abated Emission Rate (g/s)			Total Abated Emissions (lb)				
Activity	Duration (hr)	CTG Load (%)	NO_X	CO	VOC	NO_X	CO	VOC	NO_X (SCR)	CO (OxCat)	VOC (OxCat)	NO_X	CO	VOC	NO_X	CO	VOC	NO_X	CO	VOC	SO_2 [2]	$PM_{10/2.5}$ [2]
CTG Testing (Full Speed No Load, FSNL)	48	10	130	1,900	270	6,240	91,200	12,960	0%	0%	0%	***130***	***1,900***	270	***16.4***	***239***	34.0	6,240	91,200	12,960	233	408
Steam Blows [1]	120	40	68.3	32.4	3.00	8,190	3,888	360	0%	0%	0%	***68.3***	32.4	3.00	***8.60***	4.08	0.38	8,190	3,888	360	583	1,020
Set Unit HRSG & Steam Safety Valves	12	40	68.3	32.4	3.00	819	389	36.0	0%	0%	0%	68.3	32.4	3.00	8.60	4.08	0.38	819	389	36.0	58.3	102
Steam Blows - Restoration																						
DLN Emissions Tuning	12	50	47.3	23.8	2.00	567	285	24.0	0%	0%	0%	47.3	23.8	2.00	5.95	2.99	0.25	567	285	24.0	58.3	102
Emissions Tuning	12	60	52.5	24.8	2.00	630	298	24.0	0%	0%	0%	52.5	24.8	2.00	6.62	3.13	0.25	630	298	24.0	58.3	102
Emissions Tuning	12	80	63.0	29.2	2.50	756	350	30.0	0%	0%	0%	***63.0***	29.2	2.50	***7.94***	3.67	0.32	756	350	30.0	58.3	102
Restart CTGs and Run HRSG in Bypass Mode. STG Bypass Valve Tuning. HRSG Blow Down and Drum Tuning																						
Verify STG on Turning Gear. Establish Vacuum in ACC Ext Bypass Blowdown to ACC (Combined Blows). Commence Tuning on ACC Controls. Finalize Bypass Valve Tuning. ACC Cleaning.	168	80	63.0	29.2	2.50	10,584	4,899	420	78%	78%	35%	13.9	6.42	1.63	1.75	0.81	0.20	2,328	1,078	273	816	1,428
CT Base Load Testing/Tuning	24	100	73.5	34.6	3.00	1,764	829	72.0	78%	78%	35%	16.2	7.60	1.95	2.04	0.96	0.25	388	182	46.8	117	204
Load Test STG / Combined-Cycle (2X1) Tuning	48	50	47.3	23.8	2.00	2,268	1,140	96.0	78%	78%	35%	10.4	5.23	1.30	1.31	0.66	0.16	499	251	62.4	233	408
STG Load Test/Combined-Cycle Tuning	96	80	63.0	29.2	2.50	6,048	2,799	240	78%	78%	35%	13.9	6.42	1.63	1.75	0.81	0.20	1,331	616	156	467	816
RATA / Pre-performance Testing / Source Testing	84	80	63.0	29.2	2.50	5,292	2,449	210	78%	78%	35%	13.9	6.42	1.63	1.75	0.81	0.20	1,164	539	137	408	714
Source Testing & Drift Test Day 1	24	50	47.3	23.8	2.00	1,134	570	48.0	78%	78%	35%	10.4	5.23	1.30	1.31	0.66	0.16	249	125	31.2	117	204
Source Testing & Drift Test Day 2	24	50	47.3	23.8	2.00	1,134	570	48.0	78%	78%	35%	10.4	5.23	1.30	1.31	0.66	0.16	249	125	31.2	117	204
Source Testing & Drift Test Day 3	24	50	47.3	23.8	2.00	1,134	570	48.0	78%	78%	35%	10.4	5.23	1.30	1.31	0.66	0.16	249	125	31.2	117	204
Source Testing & Drift Test Day 4	24	50	47.3	23.8	2.00	1,134	570	48.0	78%	78%	35%	10.4	5.23	1.30	1.31	0.66	0.16	249	125	31.2	117	204
Source Testing & Drift Test Day 5	24	50	47.3	23.8	2.00	1,134	570	48.0	78%	78%	35%	10.4	5.23	1.30	1.31	0.66	0.16	249	125	31.2	117	204
Source Testing & Drift Test Day 6	24	50	47.3	23.8	2.00	1,134	570	48.0	78%	78%	35%	10.4	5.23	1.30	1.31	0.66	0.16	249	125	31.2	117	204
Source Testing & Drift Test Day 7	24	50	47.3	23.8	2.00	1,134	570	48.0	78%	78%	35%	10.4	5.23	1.30	1.31	0.66	0.16	249	125	31.2	117	204
Performance Testing	132	100	73.5	34.6	3.00	9,702	4,562	396	78%	78%	35%	16.2	7.60	1.95	2.04	0.96	0.25	2,134	1,004	257	642	1,122
CALISO Certification & Testing / PPA Testing	60	75	60.9	28.1	2.50	3,654	1,685	150	78%	78%	35%	13.4	6.18	1.63	1.69	0.78	0.20	804	371	97.5	292	510
Total for One CTG	**996**					**64,452**	**118,766**	**15,354**										**27,597**	**101,328**	**14,682**	**4,841**	**8,466**
Total for Two CTGs (One 2x1 Block)	**1,992**					**128,904**	**237,532**	**30,708**										**55,194**	**202,656**	**29,364**	**9,681**	**16,932**

Notes:
1. Part Load removal efficiencies for NQ, VOC, and CO require validation from HRSG and catalyst supplier.
2. SO_2 and $PM_{10/2.5}$ emissions during commissioning are expected to be no greater than full load operations. Therefore, emissions were calculated using the maximum hourly emission rates for normal operation, as summarized below.

Maximum Emission Rates	lb/hr
SO_2	4.86
$PM_{10/2.5}$	8.50

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Alamitos Energy Center
Table 5.1B.2
Summary of Commissioning Emission Estimates: Simple-Cycle Turbines
October 2015

			Unabated Emission Rate (lb/hr)			Total Unabated Emissions (lb)			Reduction (%)			Abated Emission Rate (lb/hr)			Abated Emission Rate (g/s)			Total Abated Emissions (lb)				
Activity	Duration (hr)	CTG Load (%)	NO_x	CO	VOC	NO_x	CO	VOC	NO_x (SCR)	CO (OxCat)	VOC (OxCat)	NO_x	CO	VOC	NO_x	CO	VOC	NO_x	CO	VOC	SO_2 [2]	$PM_{10/2.5}$ [2]
Unit 1 Testing (Full Speed No Load, FSNL)	4	5	40.1	244	5.08	160	976	20.3	0%	0%	0%	***40.1***	***244***	5.08	***5.05***	***30.7***	0.64	160	976	20.3	6.48	24.9
Unit 1 DLN Emissions Tuning [1]	12	100	82.0	360	4.56	984	4,320	54.7	75%	75%	33%	20.5	***90.0***	3.06	2.58	***11.3***	0.38	246	1,080	36.7	19.4	74.8
Unit 1 Emissions Tuning [1]	12	75	66.0	290	4.00	792	3,478	48.0	75%	75%	33%	16.5	***72.5***	2.68	2.08	***9.13***	0.34	198	869	32.2	19.4	74.8
Unit 1 Base Load Testing	12	75	66.0	290	1.71	792	3,478	20.5	75%	75%	33%	16.5	72.5	1.15	2.08	9.13	0.14	198	869	13.7	19.4	74.8
No Operation																						
Install Temporary Emissions Test Equipment																						
Refire Unit 1	12	100	82.0	360	4.56	984	4,320	54.7	75%	75%	33%	20.5	90.0	3.06	2.58	11.3	0.38	246	1,080	36.7	19.4	74.8
Unit 1 Source Testing & Drift Test Day 1-5; RATA / Pre-performance Testing / Part 60 / 75 Certification and Source Testing	168	100	82.0	360	4.56	13,776	60,480	766	75%	75%	33%	20.5	90.0	3.06	2.58	11.3	0.38	3,444	15,120	513	272	1,047
Unit 1 Water Wash & Performance Preparation	24	100	82.0	360	4.56	1,968	8,640	109	75%	75%	33%	20.5	90.0	3.06	2.58	11.3	0.38	492	2,160	73.3	38.9	150
Unit 1 Performance Testing	24	100	82.0	360	4.56	1,968	8,640	109	75%	75%	33%	20.5	90.0	3.06	2.58	11.3	0.38	492	2,160	73.3	38.9	150
Install Temporary Emissions Test Equipment																						
Unit 1 CALISO Certification	12	100	82.0	360	4.56	984	4,320	54.7	75%	75%	33%	20.5	90.0	3.06	2.58	11.3	0.38	246	1,080	36.7	19.4	74.8
Total for One CTG	**280**					**22,408**	**98,651**	**1,238**										**5,722**	**25,395**	**836**	**454**	**1,744**
Total for Four CTGs	**1,120**					**89,633**	**394,605**	**4,952**										**22,889**	**101,579**	**3,345**	**1,814**	**6,978**

Notes:
1. After commissioning, tuning is expected to occur twice a year.
2. SO_2 and $PM_{10/2.5}$ emissions during commissioning are expected to be no greater than full load operations. Therefore, emissions were calculated using the maximum hourly emission rates for normal operation, as summarized below.

Maximum Emission Rates	lb/hr
SO_2	1.62
$PM_{10/2.5}$	6.23

Alamitos Energy Center
Table 5.1B.3
Combined-Cycle: GE 7FA.05 Performance Data
October 2015

Alamitos 2x1 7FA emissions data

Case Number	1	2	3	4	5	6	7	8	9	10	11
CTG Model	7FA.05	7FA.05	7FA.05	7FA.05	7FA.05	7FA.05	7FA.05	7FA.05	7FA.05	7FA.05	7FA.05
CTG Fuel Type	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
CTG Load (as % of emissions compliant load range)	max	average	min	max	max	average	min	max	max	average	min
CTG Inlet Air Cooling	Off	Off	Off	On	Off	Off	Off	On	Off	Off	Off
Fuel Sulfur Content (grains/100 standard cubic feet)	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Ambient Conditions	Low	Low	Low	Average	Average	Average	Average	High	High	High	High
Ambient Temperature, F	28.0	28.0	28.0	65.3	65.3	65.3	65.3	107	107	107	107
Ambient Relative Humidity, %	76%	76%	76%	87%	87%	87%	87%	11%	11%	11%	11%
Atmospheric Pressure, psia	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
Combustion Turbine Performance											
CTG Inlet Air Conditioning Effectiveness, % (ONE CTG)	N/A	N/A	N/A	90%	N/A	N/A	N/A	90%	N/A	N/A	N/A
Inlet Loss, in. H_2O	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95	3.95
Exhaust Loss, in. H_2O	15.2	10.0	6.55	14.9	14.9	9.26	6.08	14.6	12.1	7.84	6.22
CTG Load Level (percent of Base Load)	BASE	75%	45%	BASE	BASE	75%	44%	BASE	BASE	75%	48%
Gross CTG Output, kW (ONE CTG)	236,645	177,484	106,017	229,659	227,708	170,781	101,102	217,778	194,136	145,602	92,797
Gross CTG Heat Rate, Btu/kWh (LHV) (ONE CTG)	8,671	9,122	11,742	8,834	8,867	9,184	11,660	8,918	9,035	9,639	12,136
Gross CTG Heat Rate, Btu/kWh (HHV) (ONE CTG)	9,614	10,114	13,019	9,795	9,832	10,183	12,928	9,888	10,018	10,688	13,456
Net CTG Output, kW (ONE CTG)	235,907	176,746	105,279	228,921	226,970	170,043	100,364	217,040	193,398	144,864	92,059
Net CTG Heat Rate, Btu/kWh (LHV) (ONE CTG)	8,698	9,160	11,824	8,862	8,896	9,224	11,746	8,948	9,069	9,688	12,233
Net CTG Heat Rate, Btu/kWh (HHV) (ONE CTG)	9,644	10,157	13,111	9,827	9,864	10,227	13,023	9,922	10,056	10,742	13,564
CTG Heat Input, MMBtu/h (LHV) (ONE CTG)	2,052	1,619	1,245	2,029	2,019	1,568	1,179	1,942	1,754	1,403	1,126
CTG Heat Input, MMBtu/h (HHV) (ONE CTG)	2,275	1,795	1,380	2,250	2,239	1,739	1,307	2,153	1,945	1,556	1,249
CTG Exhaust Flow, 10^3 lb/h (ONE CTG)	4,368	3,533	2,802	4,296	4,298	3,378	2,702	4,266	3,858	3,074	2,731
CTG Exhaust Temperature, F (ONE CTG)	1,104	1,112	1,215	1,142	1,142	1,153	1,215	1,119	1,162	1,204	1,215
Gross 2x1 Combined-Cycle, kW	692,905	529,868	355,002	688,980	684,653	519,700	342,082	628,950	569,016	435,703	307,722
Net 2x1 Combined-Cycle, kW	680,779	516,621	344,352	672,444	668,221	505,408	331,820	612,912	554,506	423,721	297,721
Gross STG Output, kW	219,615	174,900	142,968	229,662	229,237	178,138	139,878	193,394	180,744	144,499	122,128
GT Exhaust Composition % Weight (ONE CTG)											
O_2	13.85%	14.07%	14.35%	13.58%	13.64%	13.75%	14.30%	13.88%	14.08%	14.04%	14.91%
CO_2	6.10%	5.95%	5.77%	6.13%	6.10%	6.03%	5.67%	5.91%	5.91%	5.93%	5.36%
H_2O	5.12%	5.00%	4.85%	6.08%	6.01%	5.95%	5.66%	6.04%	5.25%	5.27%	4.81%
N_2	73.58%	73.62%	73.67%	72.86%	72.90%	72.92%	73.03%	72.82%	73.41%	73.41%	73.57%
Ar	1.25%	1.25%	1.25%	1.24%	1.24%	1.24%	1.24%	1.24%	1.25%	1.25%	1.25%
Fuel Sulfur Content (grains/100 standard cubic feet)	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
Catalyst Inlet Exhaust Analysis - % Mole Basis - Wet (ONE CTG / HRSG TRAIN)											
Ar	0.89%	0.89%	0.89%	0.88%	0.88%	0.88%	0.88%	0.88%	0.89%	0.89%	0.89%
CO_2	3.94%	3.85%	3.73%	3.94%	3.92%	3.88%	3.65%	3.80%	3.81%	3.83%	3.47%
H_2O	8.08%	7.90%	7.67%	9.55%	9.43%	9.35%	8.90%	9.48%	8.28%	8.31%	7.60%
N_2	74.72%	74.80%	74.89%	73.57%	73.65%	73.69%	73.86%	73.52%	74.47%	74.46%	74.74%
O_2	12.31%	12.52%	12.77%	12.01%	12.07%	12.16%	12.66%	12.27%	12.50%	12.47%	13.26%
Ave Mol Wt (based on % mol)	28.5	28.5	28.5	28.3	28.3	28.3	28.3	28.3	28.4	28.4	28.5
Total											
SO_2, lb/hr (after SO_2 oxidation)	4.86	3.84	2.95	4.81	4.78	3.72	2.79	4.60	4.16	3.33	2.67
SO_3, lb/hr (after SO_2 oxidation)	4.86	3.84	2.95	4.81	4.78	3.72	2.79	4.60	4.16	3.33	2.67
Stack Exit Temperature, F	216	178	170	213	215	175	170	221	223	198	184
Stack Diameter, ft (estimated)	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Stack Flow, 10^3 lb/h	4,368	3,533	2,802	4,296	4,298	3,378	2,702	4,266	3,858	3,074	2,731
Stack Flow, 10^3 acfm	1,264	964	755	1,244	1,248	923	731	1,251	1,129	867	752
Stack Exit Velocity, ft/s	67.0	51.2	40.0	66.0	66.2	48.9	38.8	66.3	59.9	46.0	39.9
NO_X (Catalyst Inlet), ppmvd (dry, 15% O_2)	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00	9.00
CO (Catalyst Inlet), ppmvd (dry, 15% O_2)	7.08	7.27	7.52	6.97	7.01	7.10	7.59	7.24	7.31	7.28	8.12
VOC (Catalyst Inlet), ppmvd (dry, 15% O_2)	1.10	1.13	1.17	1.08	1.09	1.10	1.18	1.13	1.14	1.13	1.26
Stack NO_X Emissions with the Effects of Selective Catalytic Reduction (SCR) (ONE CTG / HRSG TRAIN)											
NO_X, ppmvd (dry, 15% O_2)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
NO_X, ppmvd (dry)	2.90	2.83	2.75	3.01	2.99	2.95	2.79	2.92	2.84	2.85	2.59
NO_X, ppmvw (wet)	2.69	2.63	2.55	2.74	2.73	2.70	2.56	2.66	2.62	2.63	2.40
NO_X, lb/h as NO_2	16.5	13.0	10.0	16.3	16.2	12.6	9.47	15.6	14.1	11.3	9.05
NO_X, lb/MMBtu (LHV) as NO_2	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080	0.0080
NO_X, lb/MMBtu (HHV) as NO_2	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072	0.0072
SCR NH_3 slip, ppmvd (dry, 15% O_2)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
SCR NH_3 slip, lb/h	15.3	12.0	9.26	15.1	15.0	11.7	8.77	14.4	13.0	10.4	8.38
Ammonia Use, lb/h	43.0	34.0	26.1	42.5	42.3	32.9	24.7	40.7	36.8	29.4	23.6
Stack CO Emissions with the Effects of Catalytic Reduction (CO Catalyst) (ONE CTG / HRSG TRAIN)											
CO, ppmvd (dry, 15% O_2)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
CO, ppmvd (dry)	2.90	2.83	2.75	3.01	2.99	2.95	2.79	2.92	2.84	2.85	2.59

Alamitos Energy Center
Table 5.1B.3
Combined-Cycle: GE 7FA.05 Performance Data
October 2015

Alamitos 2x1 7FA emissions data

Case Number	1	2	3	4	5	6	7	8	9	10	11
CO, ppmvw (wet)	2.69	2.63	2.55	2.74	2.73	2.70	2.56	2.66	2.62	2.63	2.40
CO, lb/h	10.0	7.92	6.09	9.93	9.88	7.67	5.77	9.50	8.58	6.87	5.51
CO, lb/MMBtu (LHV)	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049	0.0049
CO, lb/MMBtu (HHV)	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044	0.0044
Stack SO_2 Emissions (ONE CTG / HRSG TRAIN)											
Assumed SO_2 oxidation rate in CO Catalyst for SO_3 calculation, vol%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Assumed SO_2 oxidation rate in SCR for SO_3 calculation, vol%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
SO_2, ppmvd (dry, 15% O_2)	0.37	0.37	0.37	0.36	0.36	0.36	0.36	0.36	0.37	0.37	0.36
SO_2, ppmvd (dry)	0.54	0.52	0.51	0.55	0.54	0.54	0.50	0.53	0.52	0.52	0.47
SO_2, ppmvw (wet)	0.49	0.48	0.47	0.49	0.49	0.49	0.46	0.48	0.48	0.48	0.43
SO_2, lb/h	4.86	3.84	2.95	4.81	4.78	3.72	2.79	4.60	4.16	3.33	2.67
SO_2, lb/MMBtu (LHV)	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024	0.0024
SO_2, lb/MMBtu (HHV)	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021	0.0021
Stack VOC Emissions with the Effects of Catalytic Reduction (CO Catalyst) (ONE CTG / HRSG TRAIN)											
VOC, ppmvd (dry, 15% O_2)	0.55	0.57	0.58	0.54	0.55	0.55	0.59	0.56	0.57	0.57	0.63
VOC, ppmvd (dry)	0.80	0.80	0.80	0.81	0.81	0.82	0.82	0.82	0.81	0.81	0.82
VOC, ppmvw (wet)	0.74	0.74	0.75	0.74	0.74	0.75	0.76	0.75	0.75	0.75	0.76
VOC, lb/h as CH_4 (includes VOC correction as applied to CTG)	1.58	1.28	1.02	1.54	1.54	1.21	0.97	1.53	1.40	1.11	1.00
VOC, lb/MMBtu (LHV)	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0008	0.0009
VOC, lb/MMBtu (HHV)	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0007	0.0008
PM_{10} from the CTG and Duct Burner											
PM_{10} Emissions - Front and Back Half Catch											
PM_{10}, lb/h (from the CTG)	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70
PM_{10}, lb/h (from the Burner)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PM_{10}, lb/h (total from CTG and Burner)	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70	6.70
PM_{10} with the Effects of SO_2 Oxidation [includes $(NH_4)_2$-(SO_4)] (ONE CTG / HRSG TRAIN)											
PM_{10} Emissions - Front and Back Half Catch											
PM_{10}, lb/h (incl. Ammonium Sulfate, assuming 100% conversion from SO_3)	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50
PM_{10}, lb/MMBtu (LHV)	0.0041	0.0053	0.0068	0.0042	0.0042	0.0054	0.0072	0.0044	0.0048	0.0061	0.0075
PM_{10}, lb/MMBtu (HHV)	0.0037	0.0047	0.0062	0.0038	0.0038	0.0049	0.0065	0.0039	0.0044	0.0055	0.0068
$PM_{2.5}$ with the Effects of SO_2 Oxidation [includes $(NH_4)_2$-(SO_4)] (ONE CTG / HRSG TRAIN)											
$PM_{2.5}$ Emissions - Front and Back Half Catch											
$PM_{2.5}$, lb/h	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50
$PM_{2.5}$, lb/MMBtu (LHV)	0.0041	0.0053	0.0068	0.0042	0.0042	0.0054	0.0072	0.0044	0.0048	0.0061	0.0075
$PM_{2.5}$, lb/MMBtu (HHV)	0.0037	0.0047	0.0062	0.0038	0.0038	0.0049	0.0065	0.0039	0.0044	0.0055	0.0068
Total Effects of SO_2 Oxidation (ONE CTG / HRSG TRAIN)											
Total SO_2 to SO_3 conversion rate for SO_3 calculation, %vol	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Total Amount of SO_2 converted to SO_3 for SO_3 calculation, lb/h	4.86	3.84	2.95	4.81	4.78	3.72	2.79	4.60	4.16	3.33	2.67
Maximum Stack Ammonium Sulfate [$(NH_4)_2$-(SO_4)] (assuming 100% conversion from SO_3), lb/h	10.0	7.91	6.08	9.92	9.87	7.67	5.76	9.49	8.57	6.86	5.50
Maximum Stack H_2SO_4 (assuming 100% conversion from SO_3 to H_2SO_4), lb/h	7.44	5.87	4.52	7.36	7.33	5.69	4.28	7.05	6.36	5.09	4.09

Notes:

1. Dry air composition is as follows:
   - N_2: 78.1%
   - O_2: 21.0%
   - Ar: 0.9%
   - CO_2: 0.03%
2. Estimated emissions based on GE performance runs provided by AES on 12/23, "AES_EXTERNAL_12_22_2014_Alamitos.xlsx" and "AES_EXTERNAL_12_22_2014_Huntington Beach.xlsx"
3. As the CTG performance and emissions information utilized does not reflect guaranteed values currently offered by GE, it is recommended that additional and suitable margin be applied to the values to account for differences between expected and guaranteed CTG emissions values.
4. Ammonium sulfates created downstream of the SCR are included in front half particulates and front & back half particulates. It is assumed that 100% SO_3 is converted to ammonium sulfates in order to account for "worst case" particulate emissions.
5. CO catalyst VOC destruction rate of 50% is assumed.
6. Sulfur content in fuel gas is assumed to be 0.75 grains/100 SCF.
7. As OEM project specific information is not available, an SO_2 to SO_3 conversion rate of 100% is assumed. Use of a high conversion rate is recommended for purposes of establishing permit limitations and emissions levels to provide additional margin.
8. Ammonia use is calculated with 19% aqueous ammonia and factors in ammonia slip.
9. Information presented is not reflective of emissions control equipment guaranteed performance levels as this information is not presently available. Engineer reserves the ability to adjust information to reflect guaranteed and OEM specific information when available.
10. Information presented is intended to reflect a conservative approach to estimated stack emissions; however, no additional margin has been applied to the emissions rates.
11. Steam turbine and combined-cycle performance information presented is preliminary and for information purposes. Information is subject to change based on equipment supplier feedback and equipment selection.
12. No margin has been included in the information provided. It is recommended that additional margin be added for the purposes of establishing permit limitations.

Alamitos Energy Center
Table 5.1B.4
Combined-Cycle: Summary of Startup and Shutdown Emission Estimates
October 2015

Hot/Warm Start Emissions

Temperature and Pollutant		Startup	Duration (min)	Catalyst Inlet (lb/hr)	Inlet Over Duration (lb)	Design Reduction (%)	Transient Reduction (%)	Net Reduction (%)	Total Outlet (lb)	Emissions per Event (lb)
Event Time (min)										**30**
20°F	NO_X	T0-T10	10	64	11	80	40	32	7	
	NO_X	T10-T20	10	95	16	80	90	72	4	
	NO_X	T20-T30	10	75	13	80	100	80	3	
	NO_X Total	**Total Startup**	**30**						**14**	**17**
	CO	T0-T10	10	738	123	80	75	60	49	
	CO	T10-T20	10	1,351	225	80	90	72	63	
	CO	T20-T30	10	59	10	80	100	80	2	
	CO Total	**Total Startup**	**30**						**114**	**137**
	VOC	T0-T10	10	84	14	50	75	38	9	
	VOC	T10-T20	10	127	21	50	90	45	12	
	VOC	T20-T30	10	5.3	0.9	50	100	50	0.4	
	VOC Total	**Total Startup**	**30**						**21**	**25**
59°F	NO_X	T0-T10	10	63	11	80	40	32	7	
	NO_X	T10-T20	10	86	14	80	90	72	4	
	NO_X	T20-T30	10	68	11	80	100	80	2	
	NO_X Total	**Total Startup**	**30**						**13**	**16**
	CO	T0-T10	10	646	108	80	75	60	43	
	CO	T10-T20	10	1,183	197	80	90	72	55	
	CO	T20-T30	10	52	9	80	100	80	2	
	CO Total	**Total Startup**	**30**						**100**	**120**
	VOC	T0-T10	10	79	13	45	75	34	9	
	VOC	T10-T20	10	118	20	45	90	41	12	
	VOC	T20-T30	10	5	0.8	45	100	45	0.5	
	VOC Total	**Total Startup**	**30**						**22**	**25**
100°F	NO_X	T0-T10	10	62	10	80	40	32	7	
	NO_X	T10-T20	10	75	13	80	90	72	4	
	NO_X	T20-T30	10	62	10	80	100	80	2	
	NO_X Total	**Total Startup**	**30**						**13**	**15**
	CO	T0-T10	10	501	83	80	75	60	33	
	CO	T10-T20	10	917	153	80	90	72	43	
	CO	T20-T30	10	40	7	80	100	80	1	
	CO Total	**Total Startup**	**30**						**77**	**93**
	VOC	T0-T10	10	57	9	45	75	34	6	
	VOC	T10-T20	10	85	14	45	90	41	8	
	VOC	T20-T30	10	4	1	45	100	45	0.3	
	VOC Total	**Total Startup**	**30**						**14**	**18**

Notes:
1. Data includes a 20% margin.

Alamitos Energy Center
Table 5.1B.4
Combined-Cycle: Summary of Startup and Shutdown Emission Estimates
October 2015

Cold Start Emissions

Temperature and Pollutant		Startup	Duration (min)	Catalyst Inlet (lb/hr)	Inlet Over Duration (lb)	Design Reduction (%)	Transient Reduction (%)	Net Reduction (%)	Total Outlet (lb)	Emissions per Event (lb)
Event Time (min)										**60**
20°F	NO_X	T0-T10	10	64	11	80	0	0	11	
	NO_X	T10-T20	10	95	16	80	0	0	16	
	NO_X	T20-T30	10	75	13	80	0	0	13	
	NO_X	T30-T40	10	75	13	80	70	56	6	
	NO_X	T40-T50	10	75	13	80	85	68	4	
	NO_X	T50-T60	10	75	13	80	100	80	3	
	NO_X Total	**Total Startup**	**60**						**53**	**61**
	CO	T0-T10	10	738	123	80	30	24	93	
	CO	T10-T20	10	1,351	225	80	35	28	162	
	CO	T20-T30	10	59	10	80	50	40	6	
	CO	T30-T40	10	59	10	80	75	60	4	
	CO	T40-T50	10	59	10	80	90	72	3	
	CO	T50-T60	10	59	10	80	100	80	2	
	CO Total	**Total Startup**	**60**						**270**	**325**
	VOC	T0-T10	10	84	14	50	30	15	12	
	VOC	T10-T20	10	127	21	50	35	18	17	
	VOC	T20-T30	10	5	0.8	50	50	25	0.6	
	VOC	T30-T40	10	5	0.8	50	75	38	0.5	
	VOC	T40-T50	10	5	0.8	50	90	45	0.4	
	VOC	T50-T60	10	5	0.8	50	100	50	0.4	
	VOC Total	**Total Startup**	**60**						**31**	**36**
59°F	NO_X	T0-T10	10	63	11	80	0	0	11	
	NO_X	T10-T20	10	86	14	80	0	0	14	
	NO_X	T20-T30	10	68	11	80	0	0	11	
	NO_X	T30-T40	10	68	11	80	70	56	5	
	NO_X	T40-T50	10	68	11	80	85	68	4	
	NO_X	T50-T60	10	68	11	80	100	80	2	
	NO_X Total	**Total Startup**	**60**						**47**	**57**
	CO	T0-T10	10	646	108	80	30	24	82	
	CO	T10-T20	10	1,183	197	80	35	28	142	
	CO	T20-T30	10	52	9	80	50	40	5	
	CO	T30-T40	10	52	9	80	75	60	3	
	CO	T40-T50	10	52	9	80	90	72	2	
	CO	T50-T60	10	52	9	80	100	80	2	
	CO Total	**Total Startup**	**60**						**236**	**287**
	VOC	T0-T10	10	79	13	50	30	15	11	
	VOC	T10-T20	10	118	20	50	35	18	16	
	VOC	T20-T30	10	5	0.8	50	50	25	0.6	
	VOC	T30-T40	10	5	0.8	50	75	38	0.5	
	VOC	T40-T50	10	5	0.8	50	90	45	0.5	
	VOC	T50-T60	10	5	0.8	50	100	50	0.4	
	VOC Total	**Total Startup**	**60**						**29**	**36**
100°F	NO_X	T0-T10	10	62.4	10.4	80	0	0	10	
	NO_X	T10-T20	10	75	12.5	80	0	0	13	
	NO_X	T20-T30	10	62	10.3	80	0	0	10	
	NO_X	T30-T40	10	62	10.3	80	70	56	5	
	NO_X	T40-T50	10	62	10.3	80	85	68	3	
	NO_X	T50-T60	10	62	10.3	80	100	80	2	
	NO_X Total	**Total Startup**	**60**						**43**	**53**
	CO	T0-T10	10	500.7	85.5	80	30	24	63	
	CO	T10-T20	10	916.8	152.8	80	35	28	110	
	CO	T20-T30	10	40	6.7	80	50	40	4	
	CO	T30-T40	10	40	6.7	80	75	60	3	
	CO	T40-T50	10	40	6.7	80	90	72	2	
	CO	T50-T60	10	40	6.7	80	100	80	1	
	CO Total	**Total Startup**	**60**						**183**	**220**
	VOC	T0-T10	10	56.6	9.4	50	30	15	8	
	VOC	T10-T20	10	84.9	14.2	50	35	18	12	
	VOC	T20-T30	10	3.5	0.6	50	50	25	0.4	
	VOC	T30-T40	10	3.5	0.6	50	75	38	0.4	
	VOC	T40-T50	10	3.5	0.6	50	90	45	0.3	
	VOC	T50-T60	10	3.5	0.6	50	100	50	0.3	
	VOC Total	**Total Startup**	**60**						**21**	**25**

Notes:
1. Data includes a 20% margin.

Alamitos Energy Center
Table 5.1B.4
Combined-Cycle: Summary of Startup and Shutdown Emission Estimates
October 2015

Shutdown Emissions

Temperature and Pollutant		Shutdown	Duration (min)	Catalyst Inlet (lb/hr)	Inlet Over Duration (lb)	Design Reduction (%)	Transient Reduction (%)	Net Reduction (%)	Total Outlet (lb)	Emissions per Event (lb)
Event Time (min)										**30**
20°F	NO_X	T0-T10	10	53	9	80	100	80	2	
	NO_X	T10-T20	10	17	3	80	100	80	0.6	
	NO_X	T20-T30	10	100	17	80	80	64	6	
	NO_X Total	**Total Shutdown**	**30**						**9**	**10**
	CO	T0-T10	10	1,531	255	80	100	80	51	
	CO	T10-T20	10	1,092	182	80	100	80	36	
	CO	T20-T30	10	439	73	80	85	68	23	
	CO Total	**Total Shutdown**	**30**						110	133
	VOC	T0-T10	10	128	21	50	100	50	11	
	VOC	T10-T20	10	168	28	50	100	50	14	
	VOC	T20-T30	10	21	3	50	85	43	2	
	VOC Total	**Total Shutdown**	**30**						**27**	**32**
59°F	NO_X	T0-T10	10	44	7	80	100	80	1	
	NO_X	T10-T20	10	16	3	80	100	80	0.5	
	NO_X	T20-T30	10	92	15	80	80	64	6	
	NO_X Total	**Total Shutdown**	**30**						**8**	**9**
	CO	T0-T10	10	1,229	205	80	100	80	41	
	CO	T10-T20	10	1,057	176	80	100	80	35	
	CO	T20-T30	10	430	72	80	85	68	23	
	CO Total	**Total Shutdown**	**30**						**99**	**119**
	VOC	T0-T10	10	81	13	45	100	45	7	
	VOC	T10-T20	10	162	27	45	100	45	15	
	VOC	T20-T30	10	19	3	45	85	38	2	
	VOC Total	**Total Shutdown**	**30**						**24**	**29**
100°F	NO_X	T0-T10	10	30	5	80	100	80	1	
	NO_X	T10-T20	10	18	3	80	100	80	0.6	
	NO_X	T20-T30	10	85	14	80	80	64	5	
	NO_X Total	**Total Shutdown**	**30**						**7**	**8**
	CO	T0-T10	10	758	126	80	100	80	25	
	CO	T10-T20	10	1,014	169	80	100	80	34	
	CO	T20-T30	10	408	68	80	85	68	22	
	CO Total	**Total Shutdown**	**30**						**81**	**97**
	VOC	T0-T10	10	49	8	45	100	45	5	
	VOC	T10-T20	10	148	25	45	100	45	14	
	VOC	T20-T30	10	18	3	45	85	38	2	
	VOC Total	**Total Shutdown**	**30**						**21**	**24**

Notes:
1. Data includes a 20% margin.

Alamitos Energy Center
Table 5.1B.5
Combined-Cycle: Summary of Operation Emissions – Criteria Pollutants
October 2015

Scenario	1	2	3	4	5	6	7	8	9	10	11
Ambient Temperature (°F)	28.0	28.0	28.0	65.3	65.3	65.3	65.3	107	107	107	107
Relative Humidity (%)	76%	76%	76%	87%	87%	87%	87%	11%	11%	11%	11%
Load (%)	max	average	min	max	max	average	min	max	max	average	min
Fuel Input (MMBtu/hr HHV)	2,275	1,795	1,380	2,250	2,239	1,739	1,307	2,153	1,945	1,556	1,249
NO_X Emissions											
per turbine (lb/hr) [a]	16.5	13.0	10.0	16.3	16.2	12.6	9.47	15.6	14.1	11.3	9.05
per turbine (lb/day) [b]	452	378	313	441	440	362	295	420	387	326	279
per turbine (lb/month) [c]	12,990	10,622	8,574	12,734	12,681	10,215	8,083	12,130	11,100	9,182	7,665
all turbines (lb/month) [c]	25,981	21,243	17,148	25,468	25,361	20,430	16,166	24,260	22,201	18,364	15,330
per turbine (lb/year) [d]	-	-	-	80,323	80,003	65,157	52,324	-	-	-	-
per turbine (tpy) [d]	-	-	-	40.2	40.0	32.6	26.2	-	-	-	-
all turbines (tpy) [d]	-	-	-	80.3	80.0	65.2	52.3	-	-	-	-
CO Emissions											
per turbine (lb/hr) [a]	10.0	7.92	6.09	9.93	9.88	7.67	5.77	9.50	8.58	6.87	5.51
per turbine (lb/day) [b]	944	898	859	858	857	810	769	711	692	655	625
per turbine (lb/month) [c]	23,953	22,510	21,264	21,911	21,879	20,378	19,080	18,505	17,878	16,710	15,787
all turbines (lb/month) [c]	47,905	45,020	42,527	43,823	43,758	40,755	38,160	37,010	35,756	33,420	31,573
per turbine (lb/year) [d]	-	-	-	164,204	164,009	154,970	147,156	-	-	-	-
per turbine (tpy) [d]	-	-	-	82.1	82.0	77.5	73.6	-	-	-	-
all turbines (tpy) [d]	-	-	-	164	164	155	147	-	-	-	-
VOC Emissions											
per turbine (lb/hr) [a]	1.58	1.28	1.02	1.54	1.54	1.21	0.97	1.53	1.40	1.11	1.00
per turbine (lb/day) [b]	159	153	147	152	152	145	140	124	121	115	112
per turbine (lb/month) [c]	4,634	4,430	4,251	4,420	4,420	4,196	4,034	3,662	3,569	3,376	3,296
all turbines (lb/month) [c]	9,268	8,860	8,501	8,839	8,840	8,392	8,068	7,323	7,139	6,753	6,593
per turbine (lb/year) [d]	-	-	-	33,583	33,585	32,238	31,261	-	-	-	-
per turbine (tpy) [d]	-	-	-	16.8	16.8	16.1	15.6	-	-	-	-
all turbines (tpy) [d]	-	-	-	33.6	33.6	32.2	31.3	-	-	-	-
SO_2 Emissions [e]											
per turbine (lb/hr) [a]	4.86	3.84	2.95	4.81	4.78	3.72	2.79	4.60	4.16	3.33	2.67
per turbine (lb/day) [b]	117	92.1	70.8	115	115	89.2	67.0	110	100	79.8	64.1
per turbine (lb/month) [c]	3,618	2,855	2,195	3,577	3,560	2,765	2,078	3,424	3,093	2,474	1,986
all turbines (lb/month) [c]	7,236	5,709	4,390	7,154	7,120	5,531	4,157	6,849	6,185	4,949	3,971
per turbine (lb/year) [d]	-	-	-	7,391	7,356	5,714	4,295	-	-	-	-
per turbine (tpy) [d]	-	-	-	3.70	3.68	2.86	2.15	-	-	-	-
all turbines (tpy) [d]	-	-	-	7.39	7.36	5.71	4.29	-	-	-	-
PM Emissions											
per turbine (lb/hr) [a]	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50	8.50
per turbine (lb/day) [b]	204	204	204	204	204	204	204	204	204	204	204
per turbine (lb/month) [c]	6,324	6,324	6,324	6,324	6,324	6,324	6,324	6,324	6,324	6,324	6,324
all turbines (lb/month) [c]	12,648	12,648	12,648	12,648	12,648	12,648	12,648	12,648	12,648	12,648	12,648
per turbine (lb/year) [d]	-	-	-	39,202	39,202	39,202	39,202	-	-	-	-
per turbine (tpy) [d]	-	-	-	19.6	19.6	19.6	19.6	-	-	-	-
all turbines (tpy) [d]	-	-	-	39.2	39.2	39.2	39.2	-	-	-	-

Notes:

[a] The hourly emission rates are for the turbine in normal operation only (i.e., excludes startup or shutdown emissions).

[b] The daily emission rates include the number of daily starts and stops per the PPA (1 cold start, 1 warm start, and 2 shutdowns per day).

[c] The monthly emission rates assume 31 days and include 2 cold starts, 15 warm starts, 45 hot starts, and 62 shutdowns per month.

[d] The annual emission rate assumes 4,100 hours of operation, 24 cold starts, 100 warm starts, 376 hot starts, and 500 shutdowns per year.

[e] Hourly, daily, and monthly SO_2 emissions assume a peak fuel sulfur content of 0.75 gr/100 scf, while annual SO_2 emissions assume an annual average fuel sulfur content of 0.25 gr/100 cf.

Alamitos Energy Center
Table 5.1B.6
Combined-Cycle: Summary of Operation Emissions – Air Toxics
October 2015

Assumptions:

Maximum Heat Input Case:	Base load operation	
Total Operations (per turbine - includes startup and shutdown hours):	4,612	hrs/yr
Gas Heat Content:	1,020	MMBtu/MMscf
Maximum Hourly Heat Input (per turbine):	2,275	MMBtu/hr (HHV)
Average Annual Heat Input (per turbine):	2,250	MMBtu/hr (HHV)
Number of Turbines:	2	

Proposed Project	Emission Factors		Emissions (per Turbine)			Emissions (Facility Total)		
Compound	lb/MMscf [a]	lb/MMBtu [a]	lb/hr	lb/yr	tpy	lb/hr	lb/yr	tpy
Ammonia [b]	5 ppm	-	15.3	69,582	34.8	30.5	139,163	69.6
Acetaldehyde	4.08E-02	4.00E-05	0.091	415	0.21	0.18	830	0.41
Acrolein	6.53E-03	6.40E-06	0.015	66.4	0.033	0.029	133	0.066
Benzene	1.22E-02	1.20E-05	0.027	124	0.062	0.055	249	0.12
1,3-Butadiene	4.39E-04	4.30E-07	0.0010	4.46	0.0022	0.0020	8.92	0.0045
Ethylbenzene	3.26E-02	3.20E-05	0.073	332	0.17	0.15	664	0.33
Formaldehyde [c]	3.67E-01	3.60E-04	0.82	3,735	1.87	1.64	7,470	3.73
Hexane	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	1.33E-03	1.30E-06	0.0030	13.5	0.0067	0.0059	27.0	0.013
PAHs [d]	2.24E-03	2.20E-06	0.0025	11.4	0.0057	0.0050	22.8	0.011
Propylene (Propene)	NA	NA	NA	NA	NA	NA	NA	NA
Propylene Oxide	2.96E-02	2.90E-05	0.066	301	0.15	0.13	602	0.30
Toluene	1.33E-01	1.30E-04	0.30	1,349	0.67	0.59	2,697	1.35
Xylene	6.53E-02	6.40E-05	0.15	664	0.33	0.29	1,328	0.66
TOTAL HAPs				**7,016**	**3.51**		**14,031**	**7.02**
TOTAL TACs				**3,864**	**1.93**		**7,728**	**3.86**

Notes:
NA = Not applicable
[a] Obtained from Table 3.1-3 of *AP-42* (EPA, 2000), with the exception of formaldehyde and ammonia. Units of lb/MMscf calculated by multiplying lb/MMBtu by the gas heat content.
[b] Based on the operating exhaust NH_3 limit of 5 ppmv @ 15% O_2 and an F-factor of 8,710.
[c] Emission factor was modified to reflect the SCAQMD's formaldehyde emission factor of $3.6x10^{-4}$.
[d] Per Section 3.1.4.3 of *AP-42* (EPA, 2000), PAH emissions were assumed to be controlled up to 50% through the use of an oxidation catalyst.

Alamitos Energy Center
Table 5.1B.7
Simple-Cycle: GE LMS-100PB Performance Data
October 2015

Alamitos Energy Center LMS-100PB Emissions Data

Case Number	1	2	3	4	5	6	7	8	9	10	11
GE Case Number	100	101	102	103	104	105	106	122	123	124	125
CTG Model	LMS100PB	LMS100PB	LMS100PB	LMS100PB	LMS100PB	LMS100PB	LMS100PB	LMS100PB	LMS100PB	LMS100PB	LMS100PB
CTG Fuel Type	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG	NG
CTG Load Level (percent of Base Load)	100	75	50	100	100	75	50	100	100	75	50
CTG Inlet Air Cooling	Off	Off	Off	On	Off	Off	Off	On	Off	Off	Off
Ambient Conditions	Low	Low	Low	Average	Average	Average	Average	High	High	High	High
Ambient Temperature, F	28.0	28.0	28.0	65.3	65.3	65.3	65.3	107	107	107	107
Ambient Relative Humidity, %	76.3	76.3	76.3	86.8	86.8	86.8	86.8	10.7	10.7	10.7	10.7
Atmospheric Pressure, psia	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
Combustion Turbine Performance											
Inlet Loss, in. H_2O	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Exhaust Loss, in. H_2O	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Gross CTG Output, kW (ONE CTG)	100,317	75,011	49,671	99,215	98,788	73,878	48,916	82,840	70,821	52,867	34,887
Gross CTG Heat Rate, Btu/kWh (LHV) (ONE CTG)	7,893	8,592	10,032	7,950	7,960	8,618	10,073	8,312	8,747	9,715	11,594
Gross CTG Heat Rate, Btu/kWh (HHV) (ONE CTG)	8,761	9,538	11,135	8,825	8,836	9,566	11,181	9,226	9,710	10,783	12,869
Net CTG Output, kW (ONE CTG)	98,966	73,661	48,321	97,864	97,437	72,527	47,565	81,489	69,470	51,516	33,536
Net CTG Heat Rate, Btu/kWh (LHV) (ONE CTG)	8,001	8,750	10,312	8,060	8,070	8,778	10,359	8,449	8,917	9,969	12,061
Net CTG Heat Rate, Btu/kWh (HHV) (ONE CTG)	8,881	9,712	11,446	8,946	8,958	9,744	11,498	9,379	9,898	11,066	13,388
CTG Heat Input, MMBtu/h (LHV) (ONE CTG)	792	645	498	789	786	637	493	689	619	514	404
CTG Heat Input, MMBtu/h (HHV) (ONE CTG)	879	715	553	876	873	707	547	764	688	570	449
CTG Exhaust Flow, 10^3 lb/h (ONE CTG)	1,755	1,479	1,161	1,726	1,721	1,463	1,152	1,525	1,385	1,176	938
CTG Exhaust Temperature, F (ONE CTG)	789	816	888	797	798	814	883	837	868	908	981
4 LMS-100PB Gross, KW	401,268	300,045	198,686	396,860	395,152	295,511	195,663	331,360	283,284	211,467	139,549
4 LMS-100PB Gross Heat Rate, Btu/kWh (LHV)	7,893	8,592	10,032	7,950	7,960	8,618	10,073	8,312	8,747	9,715	11,594
Gross Heat Rate, Btu/kWh (LHV) (ONE CTG)	7,893	8,592	10,032	7,950	7,960	8,618	10,073	8,312	8,747	9,715	11,594
Aux Load and Transformer Losses	15,007	13,122	11,245	14,957	14,926	13,025	11,178	13,691	12,804	11,453	10,071
Net KW's for 4 LMS-100PB	386,261	286,924	187,440	381,903	380,226	282,485	184,485	317,669	270,480	200,014	129,478
Net Plant Heat Rate (all 4 LMS-100PB), Btu/kWh (LHV)	8,200	8,985	10,633	8,261	8,272	9,015	10,683	8,670	9,161	10,271	12,496
Net Plant Heat Rate (all 4 LMS-100PB), Btu/kWh (HHV)	9,102	9,974	11,803	9,170	9,182	10,007	11,858	9,623	10,169	11,401	13,870
CTG Exhaust Composition % Weight - Wet (ONE CTG)											
O_2	14.3	14.6	14.7	14.0	14.0	14.4	14.5	14.0	14.3	14.5	14.6
CO_2	5.84	5.64	5.55	5.91	5.91	5.63	5.53	5.84	5.78	5.65	5.58
H_2O	4.89	4.73	4.66	5.70	5.71	5.60	5.53	5.95	5.14	5.03	4.97
N_2	73.7	73.8	73.8	73.1	73.1	73.1	73.1	72.9	73.5	73.6	73.6
Ar	1.26	1.26	1.26	1.25	1.25	1.25	1.25	1.24	1.25	1.25	1.25
Catalyst Inlet Exhaust Analysis - % Mole Basis - Wet (ONE CTG / HRSG TRAIN)											
Ar	0.90	0.90	0.90	0.88	0.88	0.88	0.88	0.88	0.89	0.89	0.89
CO_2	3.77	3.65	3.59	3.80	3.80	3.62	3.56	3.77	3.75	3.66	3.61
H_2O	7.73	7.48	7.37	8.97	8.97	8.80	8.70	9.07	7.98	7.80	7.70
N_2	74.9	75.0	75.0	73.9	73.9	73.9	74.0	73.8	74.7	74.7	74.8
O_2	12.7	13.0	13.1	12.4	12.4	12.7	12.9	12.4	12.7	12.9	13.0
Ave Mol Wt (based on % mol)	28.4	28.5	28.5	28.3	28.3	28.3	28.3	28.3	28.4	28.4	28.4
Stack Exit Temperature, F	789	816	888	797	798	814	883	837	868	908	981
Stack Diameter, ft (estimated)	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
Stack Flow, 10^3 lb/h	1,755	1,479	1,161	1,726	1,721	1,463	1,152	1,525	1,385	1,176	938
Stack Flow, 10^3 acfm	938	807	670	933	931	802	665	852	789	689	579
Stack Exit Velocity, ft/s	109	94.0	78.0	109	108	93.3	77.4	99.2	91.8	80.3	67.4
NO_X (Catalyst Inlet), ppmvd (dry, 15% O_2)	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
CO (Catalyst Inlet), ppmvd (dry, 15% O_2)	100	100	125	100	100	100	125	100	100	100	125
VOC (Catalyst Inlet), ppmvd (dry, 15% O_2)	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Estimated Maximum Emissions (at CTG Exhaust) x (GE Data, One CTG]											
NO_X, ppmvd (15% O_2)	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0
NO_X as NO_2, lb/hr	82.3	67.0	51.8	82.0	81.7	66.2	51.2	71.5	64.4	53.4	42.0
CO, ppmvd (15% O_2)	100	100	125	100	100	100	125	100	100	100	125
CO, lb/hr	200	163	158	200	199	161	156	174	157	130	128
VOC, ppmvd (15% O_2)	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
VOC, lb/hr	4.59	3.74	2.89	4.57	4.56	3.69	2.86	3.99	3.59	2.98	2.34
Fuel Sulfur Content, gr/100 scf	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75	0.75
PM_{10}, lb/hr	4.33	0.00	0.00	4.33	4.33	0.00	0.00	4.33	4.33	0.00	0.00
SO_2, lb/hr	1.62	1.32	1.02	1.62	1.61	1.31	1.01	1.41	1.27	1.05	0.83
SO_3, lb/hr	0.11	0.09	0.07	0.11	0.11	0.09	0.07	0.09	0.08	0.07	0.05
Estimated Maximum Emissions (at Stack) x (GE Data, One CTG]											
NO_X, ppmvd (15% O_2)	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50
NO_X as NO_2, lb/hr	8.23	6.70	5.18	8.20	8.17	6.62	5.12	7.15	6.44	5.34	4.20
CO, ppmvd (15% O_2)	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
CO, lb/hr	8.01	6.52	5.04	7.98	7.96	6.44	4.99	6.97	6.27	5.20	4.09
VOC, ppmvd (15% O_2)	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
VOC, lb/hr	2.30	1.87	1.44	2.29	2.28	1.85	1.43	2.00	1.80	1.49	1.17
NH_3, ppmvd (15% O_2)	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
NH_3, lb/hr	6.09	4.96	3.83	6.07	6.05	4.90	3.79	5.30	4.77	3.95	3.11
PM_{10}, lb/hr	6.23	6.23	6.23	6.23	6.23	6.23	6.23	6.23	6.23	6.23	6.23
Sulfur, Stack Ammonium Sulfate and PM Calculations with 0.75 grain/100 scf Sulfur - PEC Calculation (One CTG)											
Fuel Sulfur Content, gr/100 scf	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Fuel Molecular Weight, lbm/lbmol	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7
Fuel Flow, lb/hr	38,300	31,176	24,101	38,151	38,035	30,795	23,833	33,304	29,965	24,842	19,565
SCFM Fuel (LHV)	14,480	11,787	9,112	14,424	14,380	11,643	9,011	12,591	11,329	9,392	7,397
Elemental Sulfur Molar Weight	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1
SO_2 Molar Weight	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1	64.1
SO_3 Molar Weight	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1	80.1
Ammonium Sulfate Molar Weight	132	132	132	132	132	132	132	132	132	132	132
H_2SO_4 Molar Weight	98.1	98.1	98.1	98.1	98.1	98.1	98.1	98.1	98.1	98.1	98.1
Elemental Sulfur in Fuel, lb/hr	0.62	0.51	0.39	0.62	0.62	0.50	0.39	0.54	0.49	0.40	0.32
Moles of Sulfur in Fuel, lbmol/hr	0.02	0.02	0.01	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.01
% Sulfur Oxidized to SO_2, assumed	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%	90%
% Sulfur Oxidized to SO_3, assumed	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%
Conservative SO_2 Calculation at CTG Exhaust, 90% oxidation assumption, lb/hr	1.12	0.91	0.70	1.11	1.11	0.90	0.69	0.97	0.87	0.72	0.57
Conservative SO_3 Calculation at CTG Exhaust, 10% oxidation assumption, lb/hr	0.15	0.13	0.10	0.15	0.15	0.12	0.10	0.13	0.12	0.10	0.08
SO_2 Moles at Catalyst Inlet	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.01
Assumed SO_2 oxidation rate in CO Catalyst for SO_3 calculation, vol%	43%	43%	43%	43%	43%	43%	43%	43%	43%	43%	43%
Assumed SO_2 oxidation rate in SCR for SO_3 calculation, vol%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%
SO_3, lb/hr created in CO Catalyst	0.60	0.49	0.38	0.60	0.60	0.48	0.37	0.52	0.47	0.39	0.31
SO_3, lb/hr created in SCR Catalyst	0.01	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.01	0.01	0.00
SO_3, lb/hr from Catalysts	0.61	0.50	0.38	0.61	0.61	0.49	0.38	0.53	0.48	0.40	0.31
Total SO_3, lb/hr (Catalysts plus initial fuel SO_3)	0.77	0.62	0.48	0.76	0.76	0.62	0.48	0.67	0.60	0.50	0.39
Maximum Stack Ammonium Sulfate [$(NH_4)_2$-(SO_4)] (assuming 100% conversion from SO_3), lb/h	1.26	1.03	0.79	1.26	1.25	1.02	0.79	1.10	0.99	0.82	0.65
Maximum Stack H_2SO_4 (assuming 100% conversion from SO_3 to H_2SO_4), lb/h	0.94	0.76	0.59	0.93	0.93	0.75	0.58	0.82	0.73	0.61	0.48
Total PM_{10} at Stack, lb/h per 1 LMS-100PB	5.60	1.03	0.79	5.59	5.59	1.02	0.79	5.43	5.32	0.82	0.65

Alamitos Energy Center
Table 5.1B.7
Simple-Cycle: GE LMS-100PB Performance Data
October 2015

Alamitos Energy Center LMS-100PB Emissions Data

Case Number	1	2	3	4	5	6	7	8	9	10	11
Catalyst Ammonia Usage - PEC Calculation (One CTG)											
Total Catalyst NO_X Removal, lb/hr	74.0	60.3	46.6	73.8	73.5	59.5	46.1	64.4	57.9	48.0	37.8
NO_X Removal Efficiency, %	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
NO_X Molar Weight	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0	46.0
NH_3 Molar Weight	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0
NH_3 required for NO_X Removal, lb/hr	27.4	22.3	17.2	27.3	27.2	22.0	17.0	23.8	21.4	17.7	14.0
NH_3 Slip (assumed to be NH_3 in Stack), lb/hr	6.09	4.96	3.83	6.07	6.05	4.90	3.79	5.30	4.77	3.95	3.11
Total Ammonia Usage	33.5	27.2	21.1	33.3	33.2	26.9	20.8	29.1	26.2	21.7	17.1
19% Aqueous Ammonia Solution, lb NH_3/ft^3	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0
Total Aqueous Ammonia Usage, gph per 1 LMS-100PB	22.8	18.5	14.3	22.7	22.6	18.3	14.2	19.8	17.8	14.8	11.6
19% Aqueous Ammonia Usage, lb/hr per CTG	176	144	111	176	175	142	110	153	138	114	90
THE BELOW IS FROM GE PERFORMANCE AND EMISSIONS 2.10.15											
Exh Wght % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)											
AR	1.26	1.26	1.26	1.25	1.25	1.25	1.25	1.24	1.25	1.25	1.25
N_2	73.7	73.8	73.8	73.1	73.1	73.1	73.1	72.9	73.5	73.6	73.6
O_2	14.3	14.6	14.7	14.0	14.0	14.4	14.5	14.0	14.3	14.5	14.6
CO_2	5.84	5.64	5.55	5.91	5.91	5.63	5.53	5.84	5.78	5.65	5.58
H_2O	4.89	4.73	4.66	5.70	5.71	5.60	5.53	5.95	5.14	5.03	4.97
SO_2											
CO	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
HC	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NO_X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Exh Mole % Dry (NOT FOR USE IN ENVIRONMENTAL PERMITS)											
AR	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
N_2	81.2	81.0	81.0	81.2	81.2	81.1	81.0	81.2	81.1	81.1	81.0
O_2	13.7	14.0	14.1	13.6	13.6	14.0	14.1	13.7	13.8	14.0	14.1
CO_2	4.09	3.94	3.88	4.18	4.18	3.97	3.90	4.14	4.06	3.96	3.91
H_2O	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SO_2	0.00	0.02	0.02	0.00	0.00	0.02	0.02	0.02	0.02	0.02	0.02
CO	0.02	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01
HC	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00
NO_X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	----------	----------	----------	----------
Exh Mole % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)											
AR	0.90	0.90	0.90	0.88	0.88	0.88	0.88	0.88	0.89	0.89	0.89
N_2	74.9	75.0	75.0	73.9	73.9	73.9	74.0	73.6	74.6	74.6	74.7
O_2	12.7	13.0	13.1	12.4	12.4	12.7	12.9	12.4	12.7	12.9	13.0
CO_2	3.77	3.65	3.59	3.80	3.80	3.62	3.56	3.75	3.73	3.65	3.61
H_2O	7.73	7.48	7.37	8.97	8.97	8.80	8.70	9.34	8.10	7.94	7.85
SO_2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CO	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
HC	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NO_X	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Alamitos Energy Center
Table 5.1B.8
Simple-Cycle: Summary of Startup and Shutdown Emission Estimates
October 2015

Startup Emissions

Pollutant	Startup	Duration (min)	Catalyst Inlet (lb/hr)	Inlet Over Duration (lb)	Design Reduction (%)	Transient Reduction (%)	Net Reduction (%)	Total Outlet (lb)	Emissions per Event (lb)
NO_X	T0-T10 [1, 2]	10		4.94	90%	0%	0%	4.94	
NO_X	T10-T20 [3]	10	82.0	13.7	90%	50%	45%	7.52	
NO_X	T20-T30 [3]	10	82.0	13.7	90%	100%	90%	1.37	
NO_X	**Total Startup**	**30**						**13.8**	**16.6**
CO	T0-T10 [1, 2]	10		31.7	96%	83.3%	80%	6.34	
CO	T10-T20 [4]	10	485	80.8	96%	100%	96%	3.25	
CO	T20-T30 [4]	10	485	80.8	96%	100%	96%	3.25	
CO	**Total Startup**	**30**						**12.8**	**15.4**
VOC	T0-T10 [1, 2]	10		1.00	50%	83.3%	42%	0.58	
VOC	T10-T20 [5]	10	10.5	1.75	50%	100%	50%	0.88	
VOC	T20-T30 [5]	10	10.5	1.75	50%	100%	50%	0.88	
VOC	**Total Startup**	**30**						**2.33**	**2.80**

Notes:
1. First fire occurs 4 minutes after initiation of the "10 Minute Start" timeline.
2. For the 10 Minute Start, emissions are per GE LMS-100PB Estimated GT 10 Minute Startup Emissions at GT Exhaust Flange, dated 02-12-15.
3. For T10 through T30, NO_X emissions (lb/hr) are based on Case 104 of GE-provided AES Southland (LMS-100PB Perf & Emissions) New Fuel 02.10.15 Cust Copy R1:
-No NO_X reduction occurs until catalyst is up to temperature and ammonia is injected, hence no reduction during the T0 to T10 timeframe.
-It is assumed that the NO_X reduction commences at minute 15 and that design reduction occurs 50% of the time.
-Emissions per event include a 20% engineers' margin.
4. CO emissions (lb/hr) are based on a spike factor of 485 lb/hr for 20 minutes:
-During the T0 to T10 timeline, the exhaust is >700°F at T5 (1 minute after ignition); therefore, the Transient % of Design is calculated based on 5 minutes out of 6 (hence 83.3%).
-Emissions per event include a 20% engineers' margin.
5. VOC emissions (lb/hr) are based on a spike factor of 10.5 lb/hr for 20 minutes:
-During the T0 to T10 timeline, the exhaust is >700°F at T5 (1 minute after ignition); therefore, the Transient % of Design is calculated based on 5 minutes out of 6 (hence 83.3%).
-Emissions per event include a 20% engineers' margin.

Shutdown Emissions

Pollutant	Shutdown	Duration (min)	Inlet (lb)	Transient (% of Design)	Design Reduction (%)	Transient Reduction (%)	Net Reduction (%)	Emissions per Event (lb)
NO_X	0-13 minutes*	13.0	5.67	100%	90%	50%	45%	3.12
CO	0-13 minutes*	13.0	54.0	100%	96%	50%	48%	28.1
VOC	0-13 minutes*	13.0	4.08	100%	50%	50%	25%	3.06

Notes:
Emissions are per GE LMS-100PB Est Shutdown Emissions GT Exh, dated 01-06-15.
It is conservatively assumed that the catalyst efficiency will be 50% during shutdown.

Alamitos Energy Center
Table 5.1B.9
Simple-Cycle: Summary of Operation Emissions – Criteria Pollutants
October 2015

Scenario	1	2	3	4	5	6	7	8	9	10	11
Ambient Temperature (°F)	28.0	28.0	28.0	65.3	65.3	65.3	65.3	107	107	107	107
Relative Humidity (%)	76.3	76.3	76.3	86.8	86.8	86.8	86.8	10.7	10.7	10.7	10.7
Load (%)	100	75	50	100	100	75	50	100	100	75	50
Fuel Input (MMBtu/hr HHV)	879	715	553	876	873	707	547	764	688	570	449
NO_X Emissions											
per turbine (lb/hr) [a]	8.23	6.70	5.18	8.20	8.17	6.62	5.12	7.15	6.44	5.34	4.20
per turbine (lb/day) [b]	225	191	156	224	224	189	155	201	185	160	134
per turbine (lb/month) [c]	6,977	5,907	4,844	6,955	6,937	5,850	4,803	6,227	5,725	4,955	4,162
all turbines (lb/month) [c]	27,910	23,628	19,375	27,819	27,750	23,399	19,214	24,907	22,900	19,820	16,648
per turbine (lb/year) [d]	-	-	-	26,244	26,194	23,084	20,093	-	-	-	-
per turbine (tpy) [d]	-	-	-	13.1	13.1	11.5	10.0	-	-	-	-
all turbines (tpy) [d]	-	-	-	52.5	52.4	46.2	40.2	-	-	-	-
CO Emissions											
per turbine (lb/hr) [a]	8.01	6.52	5.04	7.98	7.96	6.44	4.99	6.97	6.27	5.20	4.09
per turbine (lb/day) [b]	268	234	201	267	267	232	200	244	228	204	179
per turbine (lb/month) [c]	8,303	7,260	6,225	8,281	8,264	7,205	6,185	7,572	7,083	6,333	5,561
all turbines (lb/month) [c]	33,213	29,042	24,899	33,125	33,057	28,819	24,742	30,288	28,333	25,333	22,243
per turbine (lb/year) [d]	-	-	-	37,712	37,664	34,634	31,720	-	-	-	-
per turbine (tpy) [d]	-	-	-	18.9	18.8	17.3	15.9	-	-	-	-
all turbines (tpy) [d]	-	-	-	75.4	75.3	69.3	63.4	-	-	-	-
VOC Emissions											
per turbine (lb/hr) [a]	2.30	1.87	1.44	2.29	2.28	1.85	1.43	2.00	1.80	1.49	1.17
per turbine (lb/day) [b]	63.5	53.9	44.3	63.3	63.2	53.4	43.9	56.8	52.2	45.3	38.2
per turbine (lb/month) [c]	1,969	1,670	1,374	1,963	1,958	1,654	1,362	1,759	1,620	1,405	1,184
all turbines (lb/month) [c]	7,876	6,681	5,495	7,850	7,831	6,617	5,450	7,038	6,478	5,619	4,734
per turbine (lb/year) [d]	-	-	-	7,502	7,488	6,621	5,786	-	-	-	-
per turbine (tpy) [d]	-	-	-	3.75	3.74	3.31	2.89	-	-	-	-
all turbines (tpy) [d]	-	-	-	15.0	15.0	13.2	11.6	-	-	-	-
SO_2 Emissions [e]											
per turbine (lb/hr) [a]	1.62	1.32	1.02	1.62	1.61	1.31	1.01	1.41	1.27	1.05	0.83
per turbine (lb/day) [b]	39.0	31.7	24.5	38.8	38.7	31.4	24.3	33.9	30.5	25.3	19.9
per turbine (lb/month) [c]	1,209	984	761	1,204	1,200	972	752	1,051	946	784	617
all turbines (lb/month) [c]	4,835	3,936	3,043	4,816	4,801	3,888	3,009	4,204	3,783	3,136	2,470
per turbine (lb/year) [d]	-	-	-	1,908	1,902	1,540	1,192	-	-	-	-
per turbine (tpy) [d]	-	-	-	0.95	0.95	0.77	0.60	-	-	-	-
all turbines (tpy) [d]	-	-	-	3.82	3.80	3.08	2.38	-	-	-	-
PM Emissions											
per turbine (lb/hr) [a]	6.23	6.23	6.23	6.23	6.23	6.23	6.23	6.23	6.23	6.23	6.23
per turbine (lb/day) [b]	150	150	150	150	150	150	150	150	150	150	150
per turbine (lb/month) [c]	4,638	4,638	4,638	4,638	4,638	4,638	4,638	4,638	4,638	4,638	4,638
all turbines (lb/month) [c]	18,550	18,550	18,550	18,550	18,550	18,550	18,550	18,550	18,550	18,550	18,550
per turbine (lb/year) [d]	-	-	-	14,700	14,700	14,700	14,700	-	-	-	-
per turbine (tpy) [d]	-	-	-	7.35	7.35	7.35	7.35	-	-	-	-
all turbines (tpy) [d]	-	-	-	29.4	29.4	29.4	29.4	-	-	-	-

Notes:

[a] The hourly emission rates are for the turbine in normal operation only (i.e., excludes startup or shutdown emissions).

[b] The daily emission rates include the number of daily starts and stops per the PPA (2 starts and 2 shutdowns per day).

[c] The monthly emission rates assume 31 days and include 62 starts and 62 shutdowns per month.

[d] The annual emission rate assumes 2,000 hours of operation, 500 starts, and 500 shutdowns per year.

[e] Hourly, daily, and monthly SO_2 emissions assume a peak fuel sulfur content of 0.75 gr/100 cf, while annual SO_2 emissions assume an annual average fuel sulfur content of 0.25 gr/100 cf.

Alamitos Energy Center
Table 5.1B.10
Simple-Cycle: Summary of Operation Emissions – Air Toxics
October 2015

Assumptions:

Maximum Heat Input Case:	Base load operation	
Total Operations (per turbine - includes startup and shutdown hours):	2,358	hrs/yr
Gas Heat Content:	1,020	MMBtu/MMscf
Maximum Hourly Heat Input (per turbine):	879	MMBtu/hr (HHV)
Average Annual Heat Input (per turbine):	876	MMBtu/hr (HHV)
Number of Turbines:	4	

Proposed Project	Emission Factors		Emissions (per Turbine)			Emissions (Facility Total)		
Compound	**lb/MMscf [a]**	**lb/MMBtu [a]**	**lb/hr**	**lb/yr**	**tpy**	**lb/hr**	**lb/yr**	**tpy**
Ammonia [b]	5 ppm	-	6.09	14,309	7.15	24.4	57,235	28.6
Acetaldehyde	4.08E-02	4.00E-05	0.035	82.6	0.041	0.14	330	0.17
Acrolein	6.53E-03	6.40E-06	0.0056	13.2	0.0066	0.022	52.9	0.026
Benzene	1.22E-02	1.20E-05	0.011	24.8	0.012	0.042	99	0.050
1,3-Butadiene	4.39E-04	4.30E-07	0.00038	0.89	0.00044	0.0015	3.55	0.0018
Ethylbenzene	3.26E-02	3.20E-05	0.028	66.1	0.033	0.11	264	0.13
Formaldehyde [c]	3.67E-01	3.60E-04	0.32	743	0.37	1.27	2,973	1.49
Hexane	NA	NA	NA	NA	NA	NA	NA	NA
Naphthalene	1.33E-03	1.30E-06	0.0011	2.68	0.0013	0.0046	10.7	0.0054
PAHs [d]	2.24E-03	2.20E-06	0.0010	2.27	0.0011	0.0039	9.09	0.0045
Propylene (Propene)	NA	NA	NA	NA	NA	NA	NA	NA
Propylene Oxide	2.96E-02	2.90E-05	0.025	59.9	0.030	0.10	240	0.12
Toluene	1.33E-01	1.30E-04	0.11	268	0.13	0.46	1,074	0.54
Xylene	6.53E-02	6.40E-05	0.056	132	0.066	0.22	529	0.26
TOTAL HAPs				**1,396**	**0.70**		**5,585**	**2.79**
TOTAL TACs				**769**	**0.38**		**3,076**	**1.54**

Notes:
NA = Not applicable
[a] Obtained from Table 3.1-3 of *AP-42* (EPA, 2000), with the exception of formaldehyde and ammonia. Units of lb/MMscf calculated by multiplying lb/MMBtu by the gas heat content.
[b] Based on the operating exhaust NH_3 limit of 5 ppmv @ 15% O_2 and an F-factor of 8,710.
[c] Emission factor was modified to reflect the SCAQMD's formaldehyde emission factor of $3.6x10^{-4}$.
[d] Per Section 3.1.4.3 of *AP-42* (EPA, 2000), PAH emissions were assumed to be controlled up to 50% through the use of an oxidation catalyst.

Alamitos Energy Center
Table 5.1B.11
Auxiliary Boiler: Performance Data
October 2015

Performance Data

Parameter	Units	Estimated/ Expected Value	Note
Gross Steaming Capacity	pph	58,537	
Net Steaming Capacity	pph	50,000	
Design Pressure	psig	540	
Design Steam Conditions		saturated	
Design Max Turndown Capability	%	25	
Design Max Heat Input	MMBtu/hr (HHV)	70.8	1, 2, and 3
Design Min Heat Input (at max turndown)	MMBtu/hr (HHV)	17.8	1
Estimated Exhaust Temp at Max Heat Input	°F	318	1
Estimated Exhaust Temp at Min Heat Input	°F	256	1
Estimated Exhaust Gas Flow at Max Heat Input	ACFM	29,473	1
Estimated Exhaust Gas Flow at Min Heat Input	ACFM	6,860	1
Estimated Stack Emissions			
NO_X	ppmvd @ 3% oxygen	5	1
NO_X	lb/MMBtu (HHV)	0.006	1
CO	ppmvd @ 3% oxygen	50	1
CO	lb/MMBtu (HHV)	0.04	1
VOC	lb/MMBtu (HHV)	0.004	1
PM_{10}	lb/MMBtu (HHV)	0.0043	1
SO_2	lb/MMBtu (HHV)	0.00068	4
NH_3	ppmvd @ 3% oxygen	5	1
NH_3	lb/MMBtu (HHV)	0.0022	
Estimated Exhaust Gas Analysis (analysis will vary across the operating load range)			
CO_2	% by wt	13.0	2
H_2O	% by wt	10.0	2
N_2	% by wt	72.6	2
O_2	% by wt	4.36	2
Stack Height	ft	80	
Stack Diameter	in	36	

Notes:

1. Reflects representative aux boiler OEM provided information. SPC recommends AES add margin to the stated for the purposes of air modeling and development of air permit application values.

2. Reflects the following gas analysis (%vol): 74.246% methane, 1.473% ethane, 11.909% propane, 0.177% butane, 0.034% pentane, 1.232% hexane, 0.529% CO_2, 9.686% N_2, 0.891% O_2.

3. Auxiliary boiler sizing reflects conservative design assumptions for use in establishing permit limits. Final equipment size and selection (based on major equipment OEM selection) during detailed design phase will likely reduce aux boiler size to ~50-60 MMBtu/hr.

4. Calculated as follows: 0.25 gr/100 scf x 1,000,000 Btu/MMBtu x 2 lb SO_2/lb S / (7,000 gr/lb x 1,050 Btu/scf x 100 scf).

Alamitos Energy Center
Table 5.1B.11
Auxiliary Boiler: Performance Data
October 2015

Auxiliary Boiler Startup Emissions

	NO_X	CO	VOC	NO_X	CO	VOC	Duration	Fuel Consumption
Startup	lb/event	lb/event	lb/event	lb/hr	lb/hr	lb/hr	min/event	MMBtu/hr (HHV)
Cold (Aux Boiler)	4.22	4.34	4.69	Steady State Guarantees			170	41.36
Warm (Aux Boiler)	2.11	2.17	2.34	Steady State Guarantees			85	41.36
Hot (Aux Boiler)	0.62	0.64	0.69	Steady State Guarantees			25	41.36

Notes:
1. Emissions are based on achieving BACT levels at the end of the startup duration.
2. BACT levels are 2 ppmvd @ 15% O_2 for NO_X, CO, and VOC and 5 ppmvd @ 15% O_2 for NH_3.
3. Values presented here are not for for Guarantee. See the Guarantee performance section for further reference.

Auxiliary Boiler Emission Rates

	NO_X	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$	NH3	Fuel Use (MMbtu)
Hourly Emissions (lb/hr)	0.42	2.83	0.28	0.048	0.30	0.30	-	70.8
Daily Emissions (lb/day)	5.80	35.0	4.16	0.60	3.77	3.77	-	878
Monthly Emissions (lb/month)	174	1,051	125	17.9	113	113	-	26,327
Annual Emissions (lb/year)	2,054	12,384	1,473	211	1,333	1,333	694	310,096
Annual Emissions (tpy)	1.03	6.19	0.74	0.11	0.67	0.67	0.35	--

Notes:
1. Hourly emissions are based on the maximum hourly firing rate.
2. Daily emissions are the monthly emissions averaged over 30 days.
3. Monthly and annual emissions assume two cold starts, four warm starts, and four hot starts per month, and operation at the maximum hourly firing rate.

Alamitos Energy Center
Table 5.1B.12
Auxiliary Boiler: SCR Performance Data
October 2015

SCR Performance Data

Parameter	Units	Manufacturer Guarantee	Note
SCR Details			
Manufacturer and Model	B&W FM Series		
Active Catalyst Material	Vanadium		With a homogeneous honeycomb matrix
Catalyst Volume	ft^3	46	
Catalyst Area	ft^2	28	
Reactor Dimensions (L x W x H)	inches	87 x 65 x 44	
Space Velocity	hr^{-1}	485	
Area Velocity	ft/hr	47,800	
Reducing Agent	19% Aqueous Ammonia		Obtained from Combined-cycle Power Block Ammonia Tank
Ammonia Injection Rate - Max	lb/hr	1.1	
Ammonia Injection Rate - Min	lb/hr	0.3	
Operating Temperature Range	°F	415 - 628	
Catalyst Life	Years	3	
Stack Emissions			
Ammonia Slip	ppmvd at 3% O_2	5	
NO_X	ppmvd at 3% O_2	5	

Alamitos Energy Center
Table 5.1B.13
Auxiliary Boiler: Summary of Operation Emissions – Criteria Pollutants
October 2015

NO_X Emissions	
(lb/hr) [a]	0.42
(lb/day) [b]	5.80
(lb/month) [c]	174
(lb/year) [d]	2,054
(tpy) [d]	1.03
CO Emissions	
(lb/hr) [a]	2.83
(lb/day) [b]	35.0
(lb/month) [c]	1,051
(lb/year) [d]	12,384
(tpy) [d]	6.19
VOC Emissions	
(lb/hr) [a]	0.28
(lb/day) [b]	4.16
(lb/month) [c]	125
(lb/year) [d]	1,473
(tpy) [d]	0.74
SO_2 Emissions	
(lb/hr) [a]	0.048
(lb/day) [b]	0.60
(lb/month) [c]	17.9
(lb/year) [d]	211
(tpy) [d]	0.11
PM Emissions	
(lb/hr) [a]	0.30
(lb/day) [b]	3.77
(lb/month) [c]	113
(lb/year) [d]	1,333
(tpy) [d]	0.67

Notes:

[a] The hourly emission rates are for the auxiliary boiler in normal operation only (i.e., excludes startup or shutdown emissions).

[b] The daily emission rates are the monthly emission rates averaged over 30 days.

[c] The monthly emission rates assume 31 days of operation at the maximum hourly firing rate, with 2 cold starts, 4 warm starts, and 4 hot starts.

[d] The annual emission rates assume 8,760 hours of operation at the maximum hourly firing rate, with 24 cold starts, 48 warm starts, and 48 hot starts.

Alamitos Energy Center
Table 5.1B.14
Auxiliary Boiler: Summary of Operation Emissions – Air Toxics
October 2015

Assumptions:

Total Operations:	8,760	hrs/yr
Gas Heat Content:	1,020	MMBtu/MMscf
Maximum Hourly Heat Input:	70.8	MMBtu/hr (HHV)
Maximum Annual Heat Input [a]:	310,096	MMBtu/yr (HHV)

Proposed Project	Emission Factors		Emissions		
Compound	**lb/MMscf [b]**	**lb/MMBtu [b]**	**lb/hr**	**lb/yr**	**tpy**
2-Methylnaphthalene	2.40E-05	2.35E-08	1.67E-06	7.30E-03	3.65E-06
3-Methylchloranthrene	1.80E-06	1.76E-09	1.25E-07	5.47E-04	2.74E-07
7,12-Dimethylbenz(a)anthracene	1.60E-05	1.57E-08	1.11E-06	4.86E-03	2.43E-06
Acenaphthene	1.80E-06	1.76E-09	1.25E-07	5.47E-04	2.74E-07
Acenaphthylene	1.80E-06	1.76E-09	1.25E-07	5.47E-04	2.74E-07
Anthracene	2.40E-06	2.35E-09	1.67E-07	7.30E-04	3.65E-07
Benz(a)anthracene	1.80E-06	1.76E-09	1.25E-07	5.47E-04	2.74E-07
Benzene	2.10E-03	2.06E-06	1.46E-04	6.38E-01	3.19E-04
Benzo(a)pyrene	1.20E-06	1.18E-09	8.33E-08	3.65E-04	1.82E-07
Benzo(b)fluoranthene	1.80E-06	1.76E-09	1.25E-07	5.47E-04	2.74E-07
Benzo(g,h,i)perylene	1.20E-06	1.18E-09	8.33E-08	3.65E-04	1.82E-07
Benzo(k)fluoranthene	1.80E-06	1.76E-09	1.25E-07	5.47E-04	2.74E-07
Butane	2.10E+00	2.06E-03	1.46E-01	6.38E+02	3.19E-01
Chrysene	1.80E-06	1.76E-09	1.25E-07	5.47E-04	2.74E-07
Dibenzo(a,h)anthracene	1.20E-06	1.18E-09	8.33E-08	3.65E-04	1.82E-07
Dichlorobenzene	1.20E-03	1.18E-06	8.33E-05	3.65E-01	1.82E-04
Ethane	3.10E+00	3.04E-03	2.15E-01	9.42E+02	4.71E-01
Fluoranthene	3.00E-06	2.94E-09	2.08E-07	9.12E-04	4.56E-07
Fluorene	2.80E-06	2.75E-09	1.94E-07	8.51E-04	4.26E-07
Formaldehyde	7.50E-02	7.35E-05	5.21E-03	2.28E+01	1.14E-02
Hexane	1.80E+00	1.76E-03	1.25E-01	5.47E+02	2.74E-01
Indeno(1,2,3-cd)pyrene	1.80E-06	1.76E-09	1.25E-07	5.47E-04	2.74E-07
Naphthalene	6.10E-04	5.98E-07	4.23E-05	1.85E-01	9.27E-05
Pentane	2.60E+00	2.55E-03	1.80E-01	7.90E+02	3.95E-01
Phenanathrene	1.70E-05	1.67E-08	1.18E-06	5.17E-03	2.58E-06
Propane	1.60E+00	1.57E-03	1.11E-01	4.86E+02	2.43E-01
Pyrene	5.00E-06	4.90E-09	3.47E-07	1.52E-03	7.60E-07
Toluene	3.40E-03	3.33E-06	2.36E-04	1.03E+00	5.17E-04
Arsenic	2.00E-04	1.96E-07	1.39E-05	6.08E-02	3.04E-05
Barium	4.40E-03	4.31E-06	3.05E-04	1.34E+00	6.69E-04
Beryllium	1.20E-05	1.18E-08	8.33E-07	3.65E-03	1.82E-06
Cadmium	1.10E-03	1.08E-06	7.64E-05	3.34E-01	1.67E-04
Chromium	1.40E-03	1.37E-06	9.72E-05	4.26E-01	2.13E-04
Cobalt	8.40E-05	8.24E-08	5.83E-06	2.55E-02	1.28E-05
Copper	8.50E-04	8.33E-07	5.90E-05	2.58E-01	1.29E-04
Manganese	3.80E-04	3.73E-07	2.64E-05	1.16E-01	5.78E-05
Mercury	2.60E-04	2.55E-07	1.80E-05	7.90E-02	3.95E-05
Molybdenum	1.10E-03	1.08E-06	7.64E-05	3.34E-01	1.67E-04
Nickel	2.10E-03	2.06E-06	1.46E-04	6.38E-01	3.19E-04
Selenium	2.40E-05	2.35E-08	1.67E-06	7.30E-03	3.65E-06
Vanadium	2.30E-03	2.25E-06	1.60E-04	6.99E-01	3.50E-04
Zinc	2.90E-02	2.84E-05	2.01E-03	8.82E+00	4.41E-03
TOTAL HAPs				**1,212**	**0.61**
TOTAL TACs				**575**	**0.29**

Notes:
[a] The auxiliary boiler will operate at the maximum hourly firing rate and will have two cold starts, four warm starts, and four hot starts per month.
[b] Obtained from Tables 1.4-3 and 1.4-4 of *AP-42* (EPA, 1998). Units of lb/MMBtu calculated by dividing lb/MMscf by the gas heat content.

Alamitos Energy Center
Table 5.1B.15
Facility Wide Natural Gas Fuel Use
October 2015

Hours/Year/Unit

GE 7FA.05	4,612
GE LMS-100PB	2,358
Auxiliary Boiler	8,760

Number of Units

GE 7FA.05	2
GE LMS-100PB	4
Auxiliary Boiler	1

Max Fuel Use	GE 7FA.05 (per unit)	GE LMS-100PB (per unit)	Auxiliary Boiler	Total
Max Fuel Use Per Hour (MMBtu)	2,275	879	70.8	8,137
Max Fuel Use Per Day (MMBtu)	54,604	21,094	878	194,460
Annual Average Fuel Use Per Year (MMBtu)	10,374,700	2,064,775	310,096	29,318,594

Maximum daily fuel use is based on the maximum rated heat capacity multiplied by 24 hours/day

Alamitos Energy Center
Table 5.1B.16
Summary of Facility Operation Emissions – Greenhouse Gas Pollutants
October 2015

Facility Heat Input

GE 7FA.05 Natural Gas Use (PTE):	20,749,400	MMBtu/yr
GE LMS-100PB Natural Gas Use (PTE):	8,259,098	MMBtu/yr
Auxiliary Boiler Natural Gas Use (PTE):	310,096	MMBtu/yr
AEC Total Natural Gas Use (PTE):	29,318,594	MMBtu/yr

GHG Netting

Pollutant	AEC PTE Emissions (metric tons/year)
CO_2	1,551,247
CH_4	51.4
N_2O	67.3
CO_2 Equivalent (Total) [a]	1,572,580

Notes:

[a] The following global warming potentials were used to estimate CO_2 Equivalents, per Table B.1 of TCR's *2015 Climate Registry Default Emission Factors* (TCR, 2015):

CH_4 = 25
N_2O = 298

GHG Emission Factors

Pollutant	Combined-Cycle Emission Factor (kg/MMBtu)	Simple-Cycle Emission Factor (kg/MMBtu)	Boiler Emission Factor (kg/MMBtu)
CO_2 [a]	52.91	52.91	52.91
CH_4 [b]	0.00095	0.0038	0.00095
N_2O [b]	0.00285	0.00095	0.00095

Notes:

[a] CO_2 emission factor from Table 12.1 of TCR's *2015 Climate Registry Default Emission Factors* (TCR, 2015).

[b] CH_4 and N_2O emission factors from Table 12.5 of TCR's *2015 Climate Registry Default Emission Factors* (TCR, 2015).

Alamitos Energy Center
Table 5.1B.17
Oil-Water Separator Calculations
October 2015

1. Estimated volume throughput of water (an instantaneous gpm):
This value will be driven by the tank rated flow rate. At this stage, we estimate that the most conservative rated flow rate will be 400 gpm.
It is estimated that there will be one 5,000 gallon capacity, 400 gpm rated above ground oil/water separator tank for the Simple-Cycle Power Block.
It is estimated that there will be one 5,000 gallon capacity, 400 gpm rated above ground oil/water separator tank for the Combined-Cycle Power Block.
2. Total expected annual volume (in gallons):
The estimated annual volume is: 130,000 gallons for the Simple-Cycle Power Block and 855,000 gallons for the Combined-Cycle Power Block.

Area for LMS-100PB Components at AEC					
	L	**W**	**Count**	**Total Area**	
	(ft)	(ft)		(ft^2)	
Lube Oil Skids	23	11	4	1,012	
GSU Transformers	35	22	2	1,540	
Aux Transformers	10	10	4	400	
Fin Fan Cooler Pump Skid	8	15	2	240	
Gas Conditioning	123	40	1	4,920	
GT Fuel Gas Skid	20	12	2	480	
LMS-100PB Miscellaneous Skids	20	20	1	400	
Ammonia Containment and Unloading	95	75	1	7,125	
Sum of LMS-100PB Area				**16,117**	
Area for 7FA.05 Components at AEC					
Total Containment Area				106,000	ft^2
Oil-Water Separator Throughput at AEC					
One 10 Year Storm, 24 Hour Rain Event (LMS-100PB Area)				4,607	ft^3
One 10 Year Storm, 24 Hour Rain Event (7FA.05 Area)				30,298	ft^3
Rain Event (LMS-100PB Area)				34,459	gallons
Rain Event (7FA.05 Area)				226,632	gallons
Amnt. of time it will take LMS-100PB 400 gpm system to process event				86	minutes
Amnt. of time it will take 7FA.05 400 gpm system to process event				567	minutes
Tank Capacity (LMS-100PB Area)				5,000	gallons
Tank Capacity (7FA.05 Area)				5,000	gallons
Expected Annual Volume of Water Processed by LMS-100PB Tank				16,466	ft^3
Expected Annual Volume of Water Processed by 7FA.05 Tank				108,297	ft^3
Expected Annual Volume of Water Processed by All Tanks				124,763	ft^3
				933,226	**gallons**

Notes:
Source: 'HB and Alamitos Oil-Water Separator Tank and Sump Estimate for LMS 100.xlsx' and 'HB and Alamitos Oil-Water Separator Tank and Sump Estimate for 2x1FA.xlsx'.
1. It is assumed that the components listed will have their own containment dikes with normally shut drains. Dike contents will be pumped to an above ground separator.
2. Mechanical components located within enclosures are not counted because the oil drains on these enclosures would normally be shut.
3. Los Alamitos 10-year, 24 hour storm event ~ 3.43 inches
Source: Los Angeles County Hydrology Manual (Los Angeles County Department of Public Works, 2006)
4. Long Beach Yearly Average Precipitation ~ 12.26 inches (30 Year Average)
Source: National Oceanic & Atmospheric Administration Annual Average Precipitation for 1981-2010

VOC Emission Calculations

Annual				Monthly Maximum [b]		
Actual Annual Volume (gal/yr)	Rounded Annual Volume (gal/yr)	VOC Emission Factor (lb VOC/gal) [a]	Annual VOC Emissions (lbs/year)	Max Monthly Volume (gal/month)	Monthly VOC Emissions (lbs/month)	Daily VOC Emissions (lbs/day) [c]
933,226	930,000	0.0002	186.00	232,500	46.50	1.55

Notes:
[a] Derived from Table 5.1-3 of *AP-42* (EPA, 2015). VOC Emission Factor = 0.2 lb/1,000 gallons, which accounts for gasketed covers on the OWS.
[b] Assumption: 25% precipitation falls in a single month.
[c] Daily emissions are based on a 30-day average month.

Alamitos Energy Center
Table 5.1B.18
SF_6 Calculations
October 2015

Project Data [a]		Calculation Factors		Annual Emissions		
AEC Electric Breakers [a]	Total SF_6 (lbs)	Annual Leak Rate [b]	SF_6 GWP [c]	Annual SF_6 Emissions (lbs/year)	Annual SF_6 Emissions (metric tons/year)	CO_2e (metric tons/year)
1200A 230 kV	230	0.1%	22,800	0.23	0.00010	2.38
1200A 230 kV	230	0.1%	22,800	0.23	0.00010	2.38
1200A 230 kV	230	0.1%	22,800	0.23	0.00010	2.38
3000A 230 kV	230	0.1%	22,800	0.23	0.00010	2.38
10000A 18 kV	25	0.1%	22,800	0.025	0.000011	0.26
10000A 18 kV	25	0.1%	22,800	0.025	0.000011	0.26
10000A 18 kV	25	0.1%	22,800	0.025	0.000011	0.26
2000A 230 kV	216	0.1%	22,800	0.22	0.000098	2.23
GCB 18 kV	24	0.1%	22,800	0.024	0.000011	0.25
GCB 18 kV	24	0.1%	22,800	0.024	0.000011	0.25
GCB 18 kV	24	0.1%	22,800	0.024	0.000011	0.25
GCB 18 kV	24	0.1%	22,800	0.024	0.000011	0.25
Total	**1,307**	**0.1%**	**22,800**	**1.31**	**0.00059**	**13.5**

Notes:

[a] Project data provided in 'Alamtios and HB SF6_arb.xlsx' and 'Alamitos and HB SF6 LMS 100.xlsx'. Electrical breakers include three 18-kilovolt transmission breakers, five 230-kilvolt transmission breakers, and four 18-kilovolt generator circuit breakers.

[b] Assumed based on *SF_6 Leak Rates from High Voltage Circuit Breakers - U.S. EPA Investigates Potential Greenhouse Gas Emission Sources* , a paper prepared by J. Blackman of the EPA, M. Averyt of ICF Consulting, and Z. Taylor of ICF Consulting.

[c] GWP from Table B.1 of TCR's *2015 Climate Registry Default Emission Factors* (TCR, 2015).

Alamitos Energy Center
Table 5.1B.19
Summary of Vehicle Emissions Associated with Project Operation – Criteria Pollutants and GHG
October 2015

Criteria Pollutant Emissions for Operation

Emission Source	Number [a]	Miles per Roundtrip [b]	Criteria Pollutant Emissions (lb/year) [c, d]					
			CO	VOC	SO_X	NO_X	PM_{10}	$PM_{2.5}$
Operation Worker Commute	36	33.2	944.90	16.96	2.62	82.55	44.75	18.65
Material Deliveries	17	13.8	3.23	0.76	0.10	24.60	0.73	0.34
		Total (lb/year)	**948.13**	**17.72**	**2.72**	**107.15**	**45.48**	**18.98**

Notes:

[a] Number of operational staff (daily) and material deliveries (monthly) based on engineering estimates in 'LMS7F Alamitos and HB Table 5 12_11_7 02 15.xlsx'.

[b] Roundtrip miles/day for Operation Worker Commute and Material Deliveries taken as the Urban, South Coast Air Basin C-W and C-NW values, respectively, from Table 4.2 of Appendix D of the *CalEEMod User's Guide* (ENVIRON, 2013).

[c] Calculations assume that workers would be onsite: 365 days/year

[d] Calculations assume that material deliveries would occur: 12 months/year

Greenhouse Gas Emissions for Operation

Emission Source	Number [a]	Miles per Roundtrip [b]	GHG Emissions (metric tons/year) [c, d]			CO_2-Equivalent Emissions (metric tons/year) [e]
			CO_2	N_2O	CH_4	
Operation Worker Commute	36	33.2	159.60	0.001570	0.007547	160.25
Material Deliveries	17	13.8	5.06	0.000014	0.000014	5.06
		Total (metric tons/year)	**164.65**	**0.001584**	**0.007561**	**165.31**

Notes:

[a] Number of operational staff (daily) and material deliveries (monthly) based on engineering estimates in 'LMS7F Alamitos and HB Table 5 12_11_7 02 15.xlsx'.

[b] Roundtrip miles/day for Operation Worker Commute and Material Deliveries taken as the Urban, South Coast Air Basin C-W and C-NW values, respectively, from Table 4.2 of Appendix D of the *CalEEMod User's Guide* (ENVIRON, 2013).

[c] Calculations assume that workers would be onsite: 365 days/year

[d] Calculations assume that material deliveries would occur: 12 months/year

[e] CO_2-equivalent emissions based on the following global warming potentials from 40 CFR 98, Table A-1:

CH_4: 25

N_2O: 298

Alamitos Energy Center
Table 5.1B.20
Equations Used to Calculate Criteria Pollutant and GHG Emissions
October 2015

Emission Source	Pollutant(s)	Equation	Variables
Operation Worker Commute Vehicle Exhaust	CO, VOC, NO_X, SO_X, PM_{10}, and $PM_{2.5}$	E = N x VMT x D x EF / 453.6	E = Emissions (lb/year)
			N = Number of vehicles per day
			VMT = Vehicle miles traveled per roundtrip (miles/trip). Assumes one vehicle trip per day.
			D = Number of operational days per year
			EF = EMFAC2014 emission factor (g/mile)
			453.6 = Conversion from g to lb
Material Deliveries Vehicle Exhaust	CO, VOC, NO_X, SO_X, PM_{10}, and $PM_{2.5}$	E = N x VMT x M x EF / 453.6	E = Emissions (lb/year)
			N = Number of vehicles per month
			VMT = Vehicle miles traveled per roundtrip (miles/trip)
			M = Number of operational months per year
			EF = EMFAC2014 emission factor (g/mile)
			453.6 = Conversion from g to lb
Operation Worker Commute Vehicle Exhaust	CO_2	E = N x VMT x D / FE x EF x 0.001	E = Emissions (metric tons/year)
			N = Number of vehicles per day
			VMT = Vehicle miles traveled per roundtrip (miles/trip). Assumes one vehicle trip per day.
			D = Number of operational days per year
			FE = Fuel economy (mpg)
			EF = Emission factor (kg/gallon)
			0.001 = Conversion from kg to metric tons
	CH_4 and N_2O	E = N x VMT x D x EF / 1,000 x 0.001	E = Emissions (metric tons/year)
			N = Number of vehicles per day
			VMT = Vehicle miles traveled per roundtrip (miles/trip). Assumes one vehicle trip per day.
			D = Number of operational days per year
			EF = Emission factor (g/mile)
			1,000 = Conversion from g to kg
			0.001 = Conversion from kg to metric tons
Material Deliveries Vehicle Exhaust	CO_2	E = N x VMT x M / FE x EF x 0.001	E = Emissions (metric tons/year)
			N = Number of vehicles per month
			VMT = Vehicle miles traveled per roundtrip (miles/trip)
			M = Number of operational months per year
			FE = Fuel economy (mpg)
			EF = Emission factor (kg/gallon)
			0.001 = Conversion from kg to metric tons
	CH_4 and N_2O	E = N x VMT x M x EF / 1,000 x 0.001	E = Emissions (metric tons/year)
			N = Number of vehicles per month
			VMT = Vehicle miles traveled per roundtrip (miles/trip)
			M = Number of operational months per year
			EF = Emission factor (g/mile)
			1,000 = Conversion from g to kg
			0.001 = Conversion from kg to metric tons

Alamitos Energy Center
Table 5.1B.21
Vehicle Emission Factors for Operation - Criteria Pollutants
October 2015

Vehicle Emission Factors for Operation

Vehicle Type	Vehicle Class [a]	Exhaust Emission Factors (g/mile) [b, c]						Fuel Economy (mpg) [d]
		CO	VOC	SO_X	NO_X	PM_{10} [e]	$PM_{2.5}$ [e]	
Operation Worker Commute	Light-duty Auto/Truck	0.982	0.018	0.003	0.086	0.047	0.019	23.993
Material Deliveries	Heavy-duty Diesel	0.521	0.123	0.015	3.963	0.117	0.054	5.684

Notes:

[a] The vehicle classes are represented as follows:

Light-duty Auto/Truck: 50% LDA Gas, 25% LDT1 Gas, and 25% LDT2 Gas values, per Section 4.5 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

Heavy-duty Diesel: 100% HHDT DSL values, per Section 4.5 of Appendix A of the *CalEEMod User's Guide* (ENVIRON, 2013).

[b] The Combined-Cycle and Simple-Cycle Power Blocks are projected to begin commercial operation in April 2020 and September 2021, respectively, based on information provided by AES. Therefore, 2020 emission factors were conservatively used.

[c] Exhaust emission factors from EMFAC2014 for the South Coast Air Basin (Los Angeles County), calendar year 2020. A speed of 40 mph was assumed for offsite vehicles and worker commutes, which is consistent with the CalEEMod defaults. An average temperature of 68°F and humidity of 55% were used per Table B-1 of *CT-EMFAC: A Computer Model to Estimate Transportation Project Emissions* (UC Davis, 2007).

[d] Fuel economy from the EMFAC2014 Web Database (http://www.arb.ca.gov/emfac/2014/) for the South Coast Air Basin (Los Angeles County), calendar year 2020, aggregated speed. Values were estimated by dividing the VMT (miles/day) by the Fuel Consumption (gal/day).

[e] Because of the small number of vehicles, it is assumed that the fugitive dust emissions from paved roads are negligible. As such, paved road emission factors are not included in these values.

Alamitos Energy Center
Table 5.1B.22
Vehicle Emission Factors for Operation - GHG
October 2015

Vehicle Emission Factors for Operation

Fuel / Category Type	Emission Factor	Emission Factor Units	Emission Factor Source
CO_2 Emission Factors			
Gasoline	8.78	kg CO_2/gallon	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.1. April.
Diesel	10.21	kg CO_2/gallon	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.1. April.
N_2O Emission Factors			
Gasoline Passenger Car Model Year 2012 [a]	0.0036	g N_2O/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.5. April.
Diesel Heavy-duty Truck Model Year 1960 - 2012 [a]	0.0048	g N_2O/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.5. April.
CH_4 Emission Factors			
Gasoline Passenger Car Model Year 2012 [a]	0.0173	g CH_4/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.5. April.
Diesel Heavy-duty Truck Model Year 1960 - 2012 [a]	0.0051	g CH_4/mile	The Climate Registry. 2015. *2015 Climate Registry Default Emission Factors* . Table 13.5. April.

Notes:
[a] Model Year 2012 was the most recent year of emission factors available. As a result, it was assumed representative of vehicles used for this project.

Alamitos Energy Center
Table 5.1B.23
Simple-Cycle: GHG BACT Analysis
October 2015

Performance Data

Data for 1 LMS-100PB	100 Percent Load	75 Percent Load	50 Percent Load
Net Electrical Output (kW)	97,864	72,527	47,565
Net Heat Rate (Btu/kWh-LHV)	8,060	8,778	10,359
Gross Heat Rate (Btu/kWh-LHV)	7,950	8,618	10,073
Gross Electrical Output (kW)	99,215	73,878	48,916

GHG Efficiency Calculations

Parameter	Value	Notes
Average Net Heat Rate (Btu/kWh-LHV)	9,066	
Average Gross Heat Rate (Btu/kWh-LHV)	8,880	
Operating Hours/Year	2,000	
Number of Startups and Shutdowns/Year/CTG	500	
Duration of Startup (to Baseload) (Hours)	0.17	Assumed 10 minutes from first fire to full load operation
Duration of Shutdown (Baseload to No Fuel Combustion) (Hours)	0.22	Assumed 13 minutes from full load operation to no fuel combustion
Startup Hours/Year	83	500 * 0.17
Shutdown Hours/Year	108	500 * 0.22
Startup Net Heat Rate (Btu/kWh-LHV)	25,897	Assumed 2.5 times the 50% load heat rate
Shutdown Net Heat Rate (Btu/kWh-LHV)	15,538	Assumed 1.5 times the 50% load heat rate
Overall Net Heat Rate (Btu/kWh-LHV)	10,026	
Net lb CO_2/MWh	1,054	Based on 52.91 kg CO_2/MMBtu-HHV, converted to LHV using an LHV/HHV factor of 0.9009
Net lb CO_2/MWh (with 8% Degradation)	1,138	1,054 Net lb CO_2/MWh * 1.08

Alamitos Energy Center
Table 5.1B.24
Combined-Cycle: GHG BACT Analysis
October 2015

1x1 Performance Data

1 on 1 Configuration	Minimum CTG Turndown (Approximately 44% CTG Load)	First Intermediate Point (Approximately 63% CTG Load)	Second Intermediate Point (Approximately 81% CTG Load)	Base Load (100% CTG Load)
Net Plant Electrical Output (kW)	169,219	218,066	268,635	328,051
Net Plant Heat Rate (Btu/kWh-LHV)	7,061	6,327	6,275	6,155
Gross Heat Rate (Btu/kWh-LHV)	6,664	6,034	6,003	5,911
Net Heat Rate (Btu/kWh-HHV)	7,834	7,020	6,962	6,829
Gross Power Output (kW)	179,299	228,654	280,802	341,561
Average Net Electrical Output (kW)	245,993			

2x1 Performance Data

2 on 1 Configuration	Minimum CTG Turndown (Approximately 44% CTG Load)	First Intermediate Point (Approximately 63% CTG Load)	Second Intermediate Point (Approximately 81% CTG Load)	Base Load (100% CTG Load)
Net Plant Electrical Output (kW)	349,244	446,187	547,390	665,162
Net Plant Heat Rate (Btu/kWh-LHV)	6,842	6,184	6,159	6,071
Gross Heat Rate (Btu/kWh-LHV)	6,485	5,912	5,925	5,869
Net Heat Rate (Btu/kWh-HHV)	7,592	6,862	6,834	6,736
Gross Power Output (kW)	368,492	466,722	568,975	688,095
Average Net Electrical Output (kW)	501,996			

GHG Efficiency Calculations

Parameter	Value	Notes
1 on 1 Operating Hours/Year	900	Assumed
2 on 1 Operating Hours/Year	3,200	Assumed
Average Net 1 on 1 Heat Rate (Btu/kWh-LHV)	6,454	
Average Net 2 on 1 Heat Rate (Btu/kWh-LHV)	6,314	
Operating Hours/Year	4,100	
Number of Hot/Warm Startups/Year	476	For two turbines
Number of Cold Startups/Year	24	For two turbines
Number of Shutdowns/Year	500	For two turbines
Duration of Hot/Warm Startup (to Baseload) (Hours)	0.25	First fire to base load reached in 15 minutes
Duration of Cold Startup (to Baseload) (Hours)	0.33	First fire to base load reached in 20 minutes
Duration of Shutdown (Baseload to No Fuel Combustion) (Hours)	0.50	Baseload to no fuel combustion reached in 30 minutes
Startup Hours/Year	127	476 * 0.25 + 24 * 0.33
Shutdown Hours/Year	250	500 * 0.50
Startup Net Heat Rate (Btu/kWh-LHV)	17,651	Assumed 2.5 times the 44% load heat rate
Shutdown Net Heat Rate (Btu/kWh-LHV)	10,591	Assumed 1.5 times the 44% load heat rate
Overall Net Heat Rate (Btu/kWh-LHV)	6,903	
Net lb CO_2/MWh	725	Based on 52.91 kg CO_2/MMBtu-HHV, converted to LHV using an LHV/HHV factor of 0.9009.
Net lb CO_2/MWh (with 8% Degradation)	784	730 Net lb CO_2/MWh * 1.08
Capacity Factor (%)	31.37	

Alamitos Energy Center
Table 5.1B.25
Comparison of Supplemental AFC to AFC (December 2013)
October 2015

Parameter	Supplemental AFC	AFC (December 2013)
Net Generating Capacity (MW)	1,040	1,936
Energy		
Net Heat Rate (Btu/kWh, LHV)	10,026 (Simple-cycle Block) 6,903 (Combined-cycle Block)	8,062
Maximum Fuel Consumption (MMBtu/hr)	8,137	18,103
Average Fuel Consumption (MMBtu/yr)	29,318,594	60,892,017
Operation Emissions		
GHG Emissions (MT CO_2e/yr)	1,572,593	3,284,949
NO_X Emissions (tpy)	134	272
CO Emissions (tpy)	246	372
VOC Emissions (tpy)	49.4	188
SO_2 Emissions (tpy)	11.3	20.8
PM_{10} Emissions (tpy)	69.3	99.5
$PM_{2.5}$ Emissions (tpy)	69.3	99.5
Construction Emissions		
GHG Emissions (MT CO_2e/yr)	6,611	3,671
NO_X Emissions (tpy)	15.2	18.7
CO Emissions (tpy)	14.9	12.9
VOC Emissions (tpy)	0.82	1.91
SO_2 Emissions (tpy)	0.069	0.031
PM_{10} Emissions (tpy)	2.73	4.02
$PM_{2.5}$ Emissions (tpy)	0.91	1.53

Appendix 5.1C
Dispersion Modeling and Climate Information

APPENDIX 5.1C

Dispersion Modeling and Climate Information

Tables presented in this Appendix are as follows:

Figures presented in this Appendix are as follows:

Alamitos Energy Center
Table 5.1C.1
Commissioning Stack Parameters
October 2015

Point Sources

Scenario	Source ID	Easting (X) (m)	Northing (Y) (m)	Base Elevation (m)	Stack Height (m)	Temperature [a] (K)	Exit Velocity [a] (m/s)	Stack Diameter (m)
GE 7FA.05, 10% Load	7FA01	398058	3736934	4.57	42.7	361	9.33	6.10
	7FA02	398058	3736890	4.57	42.7	361	9.33	6.10
	Aux Boiler	398086	3736829	4.57	24.4	432	21.2	0.91
GE 7FA.05, 40% Load	7FA01	398058	3736934	4.57	42.7	359	11.9	6.10
	7FA02	398058	3736890	4.57	42.7	359	11.9	6.10
	Aux Boiler	398086	3736829	4.57	24.4	432	21.2	0.91
GE 7FA.05, 80% Load	7FA01	398058	3736934	4.57	42.7	366	16.1	6.10
	7FA02	398058	3736890	4.57	42.7	366	16.1	6.10
	Aux Boiler	398086	3736829	4.57	24.4	432	21.2	0.91
GE LMS-100-PB, 5% Load	7FA01	398058	3736934	4.57	42.7	350/350	12.2/11.8	6.10
	7FA02	398058	3736890	4.57	42.7	350/350	12.2/11.8	6.10
	LMS01	398252	3737139	4.57	24.4	728	10.0	4.11
	LMS02	398252	3737124	4.57	24.4	728	10.0	4.11
	LMS03	398251	3737012	4.57	24.4	728	10.0	4.11
	LMS04	398251	3736997	4.57	24.4	728	10.0	4.11
	Aux Boiler	398086	3736829	4.57	24.4	432	21.2	0.91
GE LMS-100-PB, 75% Load	7FA01	398058	3736934	4.57	42.7	350/350	12.2/11.8	6.10
	7FA02	398058	3736890	4.57	42.7	350/350	12.2/11.8	6.10
	LMS01	398252	3737139	4.57	24.4	748	23.8	4.11
	LMS02	398252	3737124	4.57	24.4	748	23.8	4.11
	LMS03	398251	3737012	4.57	24.4	748	23.8	4.11
	LMS04	398251	3736997	4.57	24.4	748	23.8	4.11
	Aux Boiler	398086	3736829	4.57	24.4	432	21.2	0.91
GE LMS-100-PB, Full Load	7FA01	398058	3736934	4.57	42.7	350/350	12.2/11.8	6.10
	7FA02	398058	3736890	4.57	42.7	350/350	12.2/11.8	6.10
	LMS01	398252	3737139	4.57	24.4	694	33.3	4.11
	LMS02	398252	3737124	4.57	24.4	694	33.3	4.11
	LMS03	398251	3737012	4.57	24.4	694	33.3	4.11
	LMS04	398251	3736997	4.57	24.4	694	33.3	4.11
	Aux Boiler	398086	3736829	4.57	24.4	432	21.2	0.91

[a] Temperature and exit velocities shown for the GE 7FA.05 turbines during commissioning of the simple-cycle block are based on the worst case load analysis results for 1-hour NO_2 and CO (Scenario 03) and annual NO_2, PM_{10}, and $PM_{2.5}$ (Scenario 07), respectfully.

Alamitos Energy Center
Table 5.1C.2
Commissioning Emission Rates
October 2015

Short-Term Pollutant Commissioning Emissions

Scenario	Source ID	1-hour NO_2 (g/s)	1-hour NO_2 (lb/hr)	1-hour CO (g/s)	1-hour CO (lb/hr)	8-hour CO (g/s)	8-hour CO (lb/hr)
GE 7FA.05, 10% Load	7FA01	16.4	130	239	1,900	239	1,900
	7FA02	16.4	130	239	1,900	239	1,900
	Aux Boiler	0.054	0.42	0.36	2.83	0.30	2.37
GE 7FA.05, 40% Load	7FA01	8.60	68.3	Emission rates are captured by another modeled commissioning or operation scenario			
	7FA02	8.60	68.3				
	Aux Boiler	0.054	0.42				
GE 7FA.05, 80% Load	7FA01	7.94	63.0				
	7FA02	7.94	63.0				
	Aux Boiler	0.054	0.42				
GE LMS-100, 5% Load	7FA01	7.69	61.0	41.0	325	12.0	95.2
	7FA02	7.69	61.0	41.0	325	12.0	95.2
	LMS01	5.05	40.1	30.7	244	30.7	244
	LMS02	5.05	40.1	30.7	244	30.7	244
	LMS03	5.05	40.1	30.7	244	30.7	244
	LMS04	5.05	40.1	30.7	244	30.7	244
	Aux Boiler	0.054	0.42	0.36	2.83	0.30	2.37
GE LMS-100, 75% Load	7FA01	Emission rates are captured by another modeled commissioning or operation scenario		41.0	325	12.0	95.2
	7FA02			41.0	325	12.0	95.2
	LMS01			9.13	72.5	9.13	72.5
	LMS02			9.13	72.5	9.13	72.5
	LMS03			9.13	72.5	9.13	72.5
	LMS04			9.13	72.5	9.13	72.5
	Aux Boiler			0.36	2.83	0.30	2.37
GE LMS-100, Full Load	7FA01			41.0	325	12.0	95.2
	7FA02			41.0	325	12.0	95.2
	LMS01			11.3	90.0	11.3	90.0
	LMS02			11.3	90.0	11.3	90.0
	LMS03			11.3	90.0	11.3	90.0
	LMS04			11.3	90.0	11.3	90.0
	Aux Boiler			0.36	2.83	0.30	2.37

Annual Pollutant Commissioning Emissions

Scenario	Source ID	Annual NO_2 (g/s)	Annual NO_2 (lb/hr)	Annual PM_{10} (g/s)	Annual PM_{10} (lb/hr)	Annual $PM_{2.5}$ (g/s)	Annual $PM_{2.5}$ (lb/hr)
GE 7FA.05 [a]	7FA01	1.15	9.12	0.69	5.44	0.69	5.44
	7FA02	1.15	9.12	0.69	5.44	0.69	5.44
	Aux Boiler	0.030	0.23	0.019	0.15	0.019	0.15
GE LMS-100 [b]	7FA01	0.75	5.97	0.56	4.48	0.56	4.48
	7FA02	0.75	5.97	0.56	4.48	0.56	4.48
	LMS01	0.37	2.95	0.24	1.88	0.24	1.88
	LMS02	0.37	2.95	0.24	1.88	0.24	1.88
	LMS03	0.37	2.95	0.24	1.88	0.24	1.88
	LMS04	0.37	2.95	0.24	1.88	0.24	1.88
	Aux Boiler	0.030	0.23	0.019	0.15	0.019	0.15

[a] GE 7FA.05 annual emissions include emissions from commissioning as well as annual operation.

[b] GE LMS-100 annual emissions include emissions from commissioning as well as annual operation.

Alamitos Energy Center
Table 5.1C.3
Commissioning Building Parameters
October 2015

GE 7FA.05 Commissioning

Building Name	Number of Tiers	Tier Number	Base Elevation (m)	Tier Height (m)	Number of Corners	Corner 1 East (X) (m)	Corner 1 North (Y) (m)	Corner 2 East (X) (m)	Corner 2 North (Y) (m)	Corner 3 East (X) (m)	Corner 3 North (Y) (m)	Corner 4 East (X) (m)	Corner 4 North (Y) (m)	Corner 5 East (X) (m)	Corner 5 North (Y) (m)	Corner 6 East (X) (m)	Corner 6 North (Y) (m)	Corner 7 East (X) (m)	Corner 7 North (Y) (m)	Corner 8 East (X) (m)	Corner 8 North (Y) (m)
HRSG01	1	1	4.57	28.9	4	398062	3736938	398091	3736937	398091	3736929	398062	3736930								
HRSG02	1	1	4.57	28.9	4	398062	3736894	398091	3736893	398091	3736885	398062	3736886								
7FAAIR01	1	1	4.57	22.8	8	398140	3736939	398133	3736939	398129	3736937	398119	3736937	398119	3736927	398129	3736927	398133	3736925	398140	3736925
7FAAIR02	1	1	4.57	22.8	8	398140	3736894	398132	3736895	398129	3736893	398119	3736893	398119	3736883	398129	3736883	398132	3736881	398139	3736881
ACC	1	1	4.57	31.7	4	398086	3736791	398176	3736789	398175	3736727	398085	3736729								
WALL	1	1	4.57	10.7	7	398037	3736937	398037	3736882	398038	3736882	398038	3736961	398093	3736959	398093	3736960	398038	3736962		
U12	1	1	4.57	39.7	4	397950	3737089	397950	3737116	398009	3737116	398009	3737089								
U3	1	1	4.57	37.0	4	398083	3737113	398110	3737113	398110	3737071	398083	3737071								
U4	1	1	4.57	37.0	4	398142	3737113	398171	3737113	398171	3737070	398142	3737070								
U5	1	1	4.57	47.2	4	398159	3736658	398190	3736658	398190	3736636	398159	3736636								
U6	1	1	4.57	47.2	4	398158	3736608	398190	3736608	398190	3736584	398158	3736584								

GE LMS-100 Commissioning

Building Name	Number of Tiers	Tier Number	Base Elevation (m)	Tier Height (m)	Number of Corners	Corner 1 East (X) (m)	Corner 1 North (Y) (m)	Corner 2 East (X) (m)	Corner 2 North (Y) (m)	Corner 3 East (X) (m)	Corner 3 North (Y) (m)	Corner 4 East (X) (m)	Corner 4 North (Y) (m)	Corner 5 East (X) (m)	Corner 5 North (Y) (m)	Corner 6 East (X) (m)	Corner 6 North (Y) (m)	Corner 7 East (X) (m)	Corner 7 North (Y) (m)	Corner 8 East (X) (m)	Corner 8 North (Y) (m)
CTG01	1	1	4.57	11.4	6	398251	3737156	398254	3737156	398256	3737146	398256	3737140	398249	3737140	398249	3737146				
CTG02	1	1	4.57	11.4	6	398249	3737122	398255	3737122	398255	3737116	398253	3737107	398250	3737107	398249	3737116				
CTG03	1	1	4.57	11.4	6	398250	3737029	398253	3737029	398255	3737020	398255	3737014	398248	3737014	398248	3737019				
CTG04	1	1	4.57	11.4	6	398248	3736995	398254	3736995	398254	3736989	398252	3736980	398250	3736980	398248	3736989				
LMSAIR01	1	1	4.57	14.6	4	398258	3737153	398271	3737153	398271	3737165	398258	3737165								
LMSAIR02	1	1	4.57	14.6	4	398258	3737110	398270	3737110	398270	3737098	398258	3737098								
LMSAIR03	1	1	4.57	14.6	4	398257	3737026	398269	3737026	398269	3737038	398257	3737038								
LMSAIR04	1	1	4.57	14.6	4	398257	3736983	398269	3736983	398269	3736970	398257	3736970								
HRSG01	1	1	4.57	28.9	4	398062	3736938	398091	3736937	398091	3736929	398062	3736930								
HRSG02	1	1	4.57	28.9	4	398062	3736894	398091	3736893	398091	3736885	398062	3736886								
7FAAIR01	1	1	4.57	22.8	8	398140	3736939	398133	3736939	398129	3736937	398119	3736937	398119	3736927	398129	3736927	398133	3736925	398140	3736925
7FAAIR02	1	1	4.57	22.8	8	398140	3736894	398132	3736895	398129	3736893	398119	3736893	398119	3736883	398129	3736883	398132	3736881	398139	3736881
ACC	1	1	4.57	31.7	4	398086	3736791	398176	3736789	398175	3736727	398085	3736729								
WALL	1	1	4.57	10.7	7	398037	3736937	398037	3736882	398038	3736882	398038	3736961	398093	3736959	398093	3736960	398038	3736962		
U12	1	1	4.57	39.7	4	397950	3737089	397950	3737116	398009	3737116	398009	3737089								
U3	1	1	4.57	37.0	4	398083	3737113	398110	3737113	398110	3737071	398083	3737071								
U4	1	1	4.57	37.0	4	398142	3737113	398171	3737113	398171	3737070	398142	3737070								
U5	1	1	4.57	47.2	4	398159	3736658	398190	3736658	398190	3736636	398159	3736636								
U6	1	1	4.57	47.2	4	398158	3736608	398190	3736608	398190	3736584	398158	3736584								

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Table 5.1C.4
Commissioning Results
October 2015

Scenario	Year	NO_2 (μg/m^3) [a]	CO (μg/m^3)	
		1-hour	1-hour	8-hour
GE 7FA.05, 10% Load	2006	62.9	1,145	788
	2007	61.7	1,122	704
	2008	63.3	1,151	682
	2009	60.9	1,108	735
	2011	67.6	1,231	835
GE 7FA.05, 40% Load	2006	27.9	-	-
	2007	27.1	-	-
	2008	29.4	-	-
	2009	26.7	-	-
	2011	29.2	-	-
GE 7FA.05, 80% Load	2006	19.5	-	-
	2007	19.5	-	-
	2008	21.0	-	-
	2009	18.5	-	-
	2011	19.7	-	-
GE LMS-100, 5% Load [b]	2006	49.7	361	184
	2007	49.3	363	186
	2008	51.1	373	185
	2009	49.4	363	217
	2011	61.9	470	240
GE LMS-100, 75% Load [b]	2006	-	176	39.9
	2007	-	180	39.2
	2008	-	177	36.6
	2009	-	166	39.3
	2011	-	193	39.1
GE LMS-100, Full Load [b]	2006	-	175	39.1
	2007	-	180	37.5
	2008	-	177	34.7
	2009	-	166	37.8
	2011	-	192	37.8

[a] The maximum 1-hour NO_2 concentrations include an ambient NO_2 ratio of 0.80 (EPA, 2011).

[b] The modeled impacts for the GE LMS-100 commissioning scenarios include impacts from the auxiliary boiler and the GE 7FA.05 turbines operating in emissions scenario CC03.

Scenario	Year	NO_2 (μg/m^3) [d]	PM_{10} (μg/m^3)	$PM_{2.5}$ (μg/m^3)
		Annual	Annual	Annual
GE 7FA.05 [d]	2006	0.26	0.21	0.21
	2007	0.24	0.19	0.19
	2008	0.23	0.19	0.19
	2009	0.24	0.19	0.19
	2011	0.24	0.19	0.19
GE LMS-100 [e]	2006	0.20	0.19	0.19
	2007	0.18	0.18	0.18
	2008	0.19	0.18	0.18
	2009	0.18	0.17	0.17
	2011	0.19	0.18	0.18

[c] The maximum annual NO_2 concentrations include an ambient NO_2 ratio of 0.75 (EPA, 2005).

[d] Annual commissioning impacts are based on total emissions from commissioning and annual operation of 2 GE 7FA.05 turbines operating in exhaust scenario CC07 and the auxiliary boiler.

[e] Annual commissioning impacts are based on total emissions from operation of 2 GE 7FA.05 turbines operating in exhaust scenario CC07 and the auxiliary boiler, and commissioning and annual operation of 4 GE LMS-100 turbines operating in exhaust scenario SC06 for NO_2 and SC07 for PM_{10} and $PM_{2.5}$.

Alamitos Energy Center
Table 5.1C.5
Operational Stack Parameters
October 2015

Point Sources

Scenario	Source ID	Easting (X) (m)	Northing (Y) (m)	Base Elevation (m)	Stack Height (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
CC01	GE 7FA.05-01	398058	3736934	4.57	42.7	375	20.4	6.10
	GE 7FA.05-02	398058	3736890	4.57	42.7	375	20.4	6.10
CC02	GE 7FA.05-01	398058	3736934	4.57	42.7	354	15.6	6.10
	GE 7FA.05-02	398058	3736890	4.57	42.7	354	15.6	6.10
CC03	GE 7FA.05-01	398058	3736934	4.57	42.7	350	12.2	6.10
	GE 7FA.05-02	398058	3736890	4.57	42.7	350	12.2	6.10
CC04	GE 7FA.05-01	398058	3736934	4.57	42.7	374	20.1	6.10
	GE 7FA.05-02	398058	3736890	4.57	42.7	374	20.1	6.10
CC05	GE 7FA.05-01	398058	3736934	4.57	42.7	375	20.2	6.10
	GE 7FA.05-02	398058	3736890	4.57	42.7	375	20.2	6.10
CC06	GE 7FA.05-01	398058	3736934	4.57	42.7	353	14.9	6.10
	GE 7FA.05-02	398058	3736890	4.57	42.7	353	14.9	6.10
CC07	GE 7FA.05-01	398058	3736934	4.57	42.7	350	11.8	6.10
	GE 7FA.05-02	398058	3736890	4.57	42.7	350	11.8	6.10
CC08	GE 7FA.05-01	398058	3736934	4.57	42.7	378	20.2	6.10
	GE 7FA.05-02	398058	3736890	4.57	42.7	378	20.2	6.10
CC09	GE 7FA.05-01	398058	3736934	4.57	42.7	379	18.3	6.10
	GE 7FA.05-02	398058	3736890	4.57	42.7	379	18.3	6.10
CC10	GE 7FA.05-01	398058	3736934	4.57	42.7	365	14.0	6.10
	GE 7FA.05-02	398058	3736890	4.57	42.7	365	14.0	6.10
CC11	GE 7FA.05-01	398058	3736934	4.57	42.7	358	12.2	6.10
	GE 7FA.05-02	398058	3736890	4.57	42.7	358	12.2	6.10
SC01	GE LMS-100-01	398252	3737139	4.57	24.4	693	33.3	4.11
	GE LMS-100-02	398252	3737124	4.57	24.4	693	33.3	4.11
	GE LMS-100-03	398251	3737012	4.57	24.4	693	33.3	4.11
	GE LMS-100-04	398251	3736997	4.57	24.4	693	33.3	4.11
SC02	GE LMS-100-01	398252	3737139	4.57	24.4	709	28.7	4.11
	GE LMS-100-02	398252	3737124	4.57	24.4	709	28.7	4.11
	GE LMS-100-03	398251	3737012	4.57	24.4	709	28.7	4.11
	GE LMS-100-04	398251	3736997	4.57	24.4	709	28.7	4.11
SC03	GE LMS-100-01	398252	3737139	4.57	24.4	749	23.8	4.11
	GE LMS-100-02	398252	3737124	4.57	24.4	749	23.8	4.11
	GE LMS-100-03	398251	3737012	4.57	24.4	749	23.8	4.11
	GE LMS-100-04	398251	3736997	4.57	24.4	749	23.8	4.11
SC04	GE LMS-100-01	398252	3737139	4.57	24.4	698	33.1	4.11
	GE LMS-100-02	398252	3737124	4.57	24.4	698	33.1	4.11
	GE LMS-100-03	398251	3737012	4.57	24.4	698	33.1	4.11
	GE LMS-100-04	398251	3736997	4.57	24.4	698	33.1	4.11
SC05	GE LMS-100-01	398252	3737139	4.57	24.4	699	33.0	4.11
	GE LMS-100-02	398252	3737124	4.57	24.4	699	33.0	4.11
	GE LMS-100-03	398251	3737012	4.57	24.4	699	33.0	4.11
	GE LMS-100-04	398251	3736997	4.57	24.4	699	33.0	4.11
SC06	GE LMS-100-01	398252	3737139	4.57	24.4	707	28.4	4.11
	GE LMS-100-02	398252	3737124	4.57	24.4	707	28.4	4.11
	GE LMS-100-03	398251	3737012	4.57	24.4	707	28.4	4.11
	GE LMS-100-04	398251	3736997	4.57	24.4	707	28.4	4.11
SC07	GE LMS-100-01	398252	3737139	4.57	24.4	746	23.6	4.11
	GE LMS-100-02	398252	3737124	4.57	24.4	746	23.6	4.11
	GE LMS-100-03	398251	3737012	4.57	24.4	746	23.6	4.11
	GE LMS-100-04	398251	3736997	4.57	24.4	746	23.6	4.11
SC08	GE LMS-100-01	398252	3737139	4.57	24.4	720	30.2	4.11
	GE LMS-100-02	398252	3737124	4.57	24.4	720	30.2	4.11
	GE LMS-100-03	398251	3737012	4.57	24.4	720	30.2	4.11
	GE LMS-100-04	398251	3736997	4.57	24.4	720	30.2	4.11
SC09	GE LMS-100-01	398252	3737139	4.57	24.4	738	28.0	4.11
	GE LMS-100-02	398252	3737124	4.57	24.4	738	28.0	4.11
	GE LMS-100-03	398251	3737012	4.57	24.4	738	28.0	4.11
	GE LMS-100-04	398251	3736997	4.57	24.4	738	28.0	4.11
SC10	GE LMS-100-01	398252	3737139	4.57	24.4	760	24.5	4.11
	GE LMS-100-02	398252	3737124	4.57	24.4	760	24.5	4.11
	GE LMS-100-03	398251	3737012	4.57	24.4	760	24.5	4.11
	GE LMS-100-04	398251	3736997	4.57	24.4	760	24.5	4.11
SC11	GE LMS-100-01	398252	3737139	4.57	24.4	801	20.5	4.11
	GE LMS-100-02	398252	3737124	4.57	24.4	801	20.5	4.11
	GE LMS-100-03	398251	3737012	4.57	24.4	801	20.5	4.11
	GE LMS-100-04	398251	3736997	4.57	24.4	801	20.5	4.11
AB	Auxiliary Boiler	398086	3736829	4.57	24.4	432	21.2	0.91

Alamitos Energy Center
Table 5.1C.6
Operational Emission Rates
October 2015

GE 7FA.05 Per Turbine Emission Rates

Exhaust	1-hour NO_2 [a]		1-hour CO [a]		8-hour CO [b]		1-hour SO_2		3-hour SO_2		24-hour SO_2		24-hour PM_{10}		24-hour $PM_{2.5}$		Annual NO_2 [c]		Annual PM_{10} [c]		Annual $PM_{2.5}$ [c]	
Scenario	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)
CC01	7.69	61.0	41.0	325	12.3	97.9	0.61	4.86	0.61	4.86	0.61	4.86	1.07	8.50	1.07	8.50	-	-	-	-	-	-
CC02	7.69	61.0	41.0	325	12.2	96.4	0.48	3.84	0.48	3.84	0.48	3.84	1.07	8.50	1.07	8.50	-	-	-	-	-	-
CC03	7.69	61.0	41.0	325	12.0	95.2	0.37	2.95	0.37	2.95	0.37	2.95	1.07	8.50	1.07	8.50	-	-	-	-	-	-
CC04	7.18	57.0	36.2	287	11.0	87.4	0.61	4.81	0.61	4.81	0.61	4.81	1.07	8.50	1.07	8.50	1.16	9.17	0.56	4.48	0.56	4.48
CC05	7.18	57.0	36.2	287	11.0	87.4	0.60	4.78	0.60	4.78	0.60	4.78	1.07	8.50	1.07	8.50	1.15	9.13	0.56	4.48	0.56	4.48
CC06	7.18	57.0	36.2	287	10.8	85.9	0.47	3.72	0.47	3.72	0.47	3.72	1.07	8.50	1.07	8.50	0.94	7.44	0.56	4.48	0.56	4.48
CC07	7.18	57.0	36.2	287	10.7	84.6	0.35	2.79	0.35	2.79	0.35	2.79	1.07	8.50	1.07	8.50	0.75	5.97	0.56	4.48	0.56	4.48
CC08	6.68	53.0	27.7	220	8.81	69.9	0.58	4.60	0.58	4.60	0.58	4.60	1.07	8.50	1.07	8.50	-	-	-	-	-	-
CC09	6.68	53.0	27.7	220	8.73	69.3	0.52	4.16	0.52	4.16	0.52	4.16	1.07	8.50	1.07	8.50	-	-	-	-	-	-
CC10	6.68	53.0	27.7	220	8.58	68.1	0.42	3.33	0.42	3.33	0.42	3.33	1.07	8.50	1.07	8.50	-	-	-	-	-	-
CC11	6.68	53.0	27.7	220	8.46	67.2	0.34	2.67	0.34	2.67	0.34	2.67	1.07	8.50	1.07	8.50	-	-	-	-	-	-

GE LMS-100 Per Turbine Emission Rates

Exhaust	1-hour NO_2 [d]		1-hour CO [d]		8-hour CO [e]		1-hour SO_2		3-hour SO_2		24-hour SO_2		24-hour PM_{10}		24-hour $PM_{2.5}$		Annual NO_2 [f]		Annual PM_{10} [f]		Annual $PM_{2.5}$ [f]	
Scenario	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)
SC01	2.78	22.0	5.77	45.8	2.20	17.5	0.20	1.62	0.20	1.62	0.20	1.62	0.79	6.23	0.79	6.23	-	-	-	-	-	-
SC02	2.72	21.6	5.71	45.3	2.04	16.2	0.17	1.32	0.17	1.32	0.17	1.32	0.79	6.23	0.79	6.23	-	-	-	-	-	-
SC03	2.67	21.2	5.66	44.9	1.89	15.0	0.13	1.02	0.13	1.02	0.13	1.02	0.79	6.23	0.79	6.23	-	-	-	-	-	-
SC04	2.78	22.0	5.76	45.8	2.20	17.4	0.20	1.62	0.20	1.62	0.20	1.62	0.79	6.23	0.79	6.23	0.38	3.00	0.21	1.68	0.21	1.68
SC05	2.77	22.0	5.76	45.7	2.19	17.4	0.20	1.61	0.20	1.61	0.20	1.61	0.79	6.23	0.79	6.23	0.38	2.99	0.21	1.68	0.21	1.68
SC06	2.72	21.6	5.71	45.3	2.04	16.2	0.16	1.31	0.16	1.31	0.16	1.31	0.79	6.23	0.79	6.23	0.33	2.64	0.21	1.68	0.21	1.68
SC07	2.67	21.2	5.66	44.9	1.89	15.0	0.13	1.01	0.13	1.01	0.13	1.01	0.79	6.23	0.79	6.23	0.29	2.29	0.21	1.68	0.21	1.68
SC08	2.74	21.7	5.73	45.5	2.09	16.6	0.18	1.41	0.18	1.41	0.18	1.41	0.79	6.23	0.79	6.23	-	-	-	-	-	-
SC09	2.71	21.5	5.70	45.3	2.02	16.0	0.16	1.27	0.16	1.27	0.16	1.27	0.79	6.23	0.79	6.23	-	-	-	-	-	-
SC10	2.67	21.2	5.67	45.0	1.91	15.1	0.13	1.05	0.13	1.05	0.13	1.05	0.79	6.23	0.79	6.23	-	-	-	-	-	-
SC11	2.63	20.9	5.63	44.7	1.79	14.2	0.10	0.83	0.10	0.83	0.10	0.83	0.79	6.23	0.79	6.23	-	-	-	-	-	-

Auxiliary Boiler Emission Rates

Exhaust	1-hour NO_2		1-hour CO		8-hour CO		1-hour SO_2		3-hour SO_2		24-hour SO_2		24-hour PM_{10}		24-hour $PM_{2.5}$		Annual NO_2		Annual PM_{10}		Annual $PM_{2.5}$	
Scenario	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)
AB	0.054	0.42	0.36	2.83	0.30	2.37	0.0061	0.048	0.0061	0.048	0.0031	0.025	0.020	0.16	0.020	0.16	0.030	0.23	0.019	0.15	0.019	0.15

[a] Hourly CO and NO_2 emission rates for the GE 7FA.05s are based on cold startup events.

[b] 8-hour CO emission rates for the GE 7FA.05s are based on one cold start, one warm start, two shutdowns, and the balance of the period at steady-state operation.

[c] Annual emission rates for the GE 7FA.05s are based on 24 cold startups, 100 warm startups, 376 hot startups, 500 shutdowns, and 4,100 hours of steady-state operation.

[d] Hourly CO and NO_2 emission rates for the GE LMS-100s are based on one startup, one shutdown, and the balance of the hour at steady-state operation.

[e] 8-hour CO emission rates for the GE LMS-100s are based on two startups, two shutdowns, and the balance of the period at steady-state operation.

[f] Annual emission rates for the GE LMS-100s are based on 500 hot startups, 500 shutdowns, and 2,000 hours of steady-state operation.

Alamitos Energy Center
Table 5.1C.7
Operational Building Parameters
October 2015

Building Name	Number of Tiers	Tier Number	Base Elevation (m)	Tier Height (m)	Number of Corners	Corner 1 East (X) (m)	Corner 1 North (Y) (m)	Corner 2 East (X) (m)	Corner 2 North (Y) (m)	Corner 3 East (X) (m)	Corner 3 North (Y) (m)	Corner 4 East (X) (m)	Corner 4 North (Y) (m)	Corner 5 East (X) (m)	Corner 5 North (Y) (m)	Corner 6 East (X) (m)	Corner 6 North (Y) (m)	Corner 7 East (X) (m)	Corner 7 North (Y) (m)	Corner 8 East (X) (m)	Corner 8 North (Y) (m)
CTG01	1	1	4.57	11.4	6	398251	3737156	398254	3737156	398256	3737146	398256	3737140	398249	3737140	398249	3737146				
CTG02	1	1	4.57	11.4	6	398249	3737122	398255	3737122	398255	3737116	398253	3737107	398250	3737107	398249	3737116				
CTG03	1	1	4.57	11.4	6	398250	3737029	398253	3737029	398255	3737020	398255	3737014	398248	3737014	398248	3737019				
CTG04	1	1	4.57	11.4	6	398248	3736995	398254	3736995	398254	3736989	398252	3736980	398250	3736980	398248	3736989				
LMSAIR01	1	1	4.57	14.6	4	398258	3737153	398271	3737153	398271	3737165	398258	3737165								
LMSAIR02	1	1	4.57	14.6	4	398258	3737110	398270	3737110	398270	3737098	398258	3737098								
LMSAIR03	1	1	4.57	14.6	4	398257	3737026	398269	3737026	398269	3737038	398257	3737038								
LMSAIR04	1	1	4.57	14.6	4	398257	3736983	398269	3736983	398269	3736970	398257	3736970								
HRSG01	1	1	4.57	28.9	4	398062	3736938	398091	3736937	398091	3736929	398062	3736930								
HRSG02	1	1	4.57	28.9	4	398062	3736894	398091	3736893	398091	3736885	398062	3736886								
7FAAIR01	1	1	4.57	22.8	8	398140	3736939	398133	3736939	398129	3736937	398119	3736937	398119	3736927	398129	3736927	398133	3736925	398140	3736925
7FAAIR02	1	1	4.57	22.8	8	398140	3736894	398132	3736895	398129	3736893	398119	3736893	398119	3736883	398129	3736883	398132	3736881	398139	3736881
ACC	1	1	4.57	31.7	4	398086	3736791	398176	3736789	398175	3736727	398085	3736729								
WALL	1	1	4.57	10.7	7	398037	3736937	398037	3736882	398038	3736882	398038	3736961	398093	3736959	398093	3736960	398038	3736962		
U12	1	1	4.57	39.7	4	397950	3737089	397950	3737116	398009	3737116	398009	3737089								
U3	1	1	4.57	37.0	4	398083	3737113	398110	3737113	398110	3737071	398083	3737071								
U4	1	1	4.57	37.0	4	398142	3737113	398171	3737113	398171	3737070	398142	3737070								
U5	1	1	4.57	47.2	4	398159	3736658	398190	3736658	398190	3736636	398159	3736636								
U6	1	1	4.57	47.2	4	398158	3736608	398190	3736608	398190	3736584	398158	3736584								

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28°F Ambient Temperature Scenarios

			NO_2 (µg/m^3) [b]		CO (µg/m^3)		SO_2 (µg/m^3)				PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
Scenario Description [a]	Exhaust Scenario	Year	1-hour	1-hour (federal) [c]	1-hour	8-hour	1-hour	1-hour (federal) [d]	3-hour	24-hour	24-hour	24-hour [c]
GE 7FA.05 Max. Load/ GE LMS-100 Max. Load	CC01/SC01/AB	2006	17.8	15.1	101	18.7	1.72	1.52	1.52	0.42	0.97	0.80
		2007	19.3	13.2	111	18.1	1.89	1.29	1.32	0.43	0.98	0.71
		2008	17.8	12.6	107	17.0	1.73	1.33	1.20	0.36	0.83	0.74
		2009	17.3	12.5	101	19.0	1.66	1.31	1.17	0.40	0.98	0.77
		2011	19.0	14.2	103	20.6	1.83	1.54	1.25	0.43	1.01	0.75
GE 7FA.05 Max. Load/ GE LMS-100 Ave. Load	CC01/SC02/AB	2006	18.1	15.5	101	18.8	1.69	1.52	1.50	0.42	1.04	0.87
		2007	19.7	14.0	112	18.3	1.86	1.30	1.33	0.43	1.06	0.77
		2008	18.6	13.1	108	17.2	1.73	1.33	1.20	0.37	0.89	0.80
		2009	18.0	12.9	102	19.1	1.65	1.31	1.17	0.40	1.06	0.85
		2011	19.4	14.8	104	20.7	1.78	1.54	1.26	0.43	1.09	0.82
GE 7FA.05 Max. Load/ GE LMS-100 Min. Load	CC01/SC03/AB	2006	18.6	16.1	102	19.0	1.63	1.48	1.44	0.42	1.14	0.95
		2007	20.2	15.0	114	18.5	1.81	1.28	1.32	0.43	1.17	0.83
		2008	19.6	14.1	109	17.4	1.70	1.30	1.17	0.36	0.98	0.88
		2009	19.0	13.9	104	19.3	1.63	1.28	1.17	0.39	1.15	0.92
		2011	19.9	15.9	106	20.8	1.69	1.51	1.24	0.43	1.18	0.91
GE 7FA.05 Ave. Load/ GE LMS-100 Max. Load	CC02/SC01/AB	2006	23.0	19.8	138	28.6	1.85	1.60	1.62	0.50	1.22	1.01
		2007	24.8	17.2	148	24.8	2.00	1.47	1.49	0.51	1.29	0.88
		2008	23.1	17.6	148	25.2	1.84	1.42	1.32	0.43	1.07	0.92
		2009	21.4	17.2	131	27.8	1.72	1.45	1.38	0.46	1.15	0.99
		2011	25.3	18.6	144	28.4	2.06	1.62	1.40	0.48	1.17	0.94
GE 7FA.05 Ave. Load/ GE LMS-100 Ave. Load	CC02/SC02/AB	2006	23.5	19.9	139	28.6	1.84	1.60	1.60	0.50	1.28	1.07
		2007	25.2	17.3	149	24.9	1.98	1.47	1.49	0.51	1.35	0.92
		2008	23.5	17.6	148	25.3	1.84	1.42	1.32	0.43	1.12	0.98
		2009	21.6	17.6	131	27.9	1.70	1.45	1.38	0.46	1.22	1.04
		2011	25.8	18.9	146	28.5	2.01	1.63	1.40	0.48	1.23	1.00
GE 7FA.05 Ave. Load/ GE LMS-100 Min. Load	CC02/SC03/AB	2006	24.0	20.6	139	28.7	1.78	1.58	1.54	0.50	1.36	1.15
		2007	25.6	18.3	150	25.1	1.92	1.46	1.49	0.51	1.44	0.97
		2008	24.0	17.7	148	25.5	1.81	1.42	1.32	0.43	1.21	1.04
		2009	22.1	18.0	132	27.9	1.66	1.45	1.38	0.46	1.31	1.11
		2011	26.2	19.6	148	28.6	1.91	1.61	1.35	0.48	1.32	1.08
GE 7FA.05 Min. Load/ GE LMS-100 Max. Load	CC03/SC01/AB	2006	27.6	24.2	172	35.8	1.81	1.50	1.58	0.48	1.48	1.24
		2007	28.4	21.1	172	30.9	1.86	1.40	1.42	0.50	1.54	1.02
		2008	27.4	22.0	178	30.8	1.76	1.41	1.32	0.42	1.29	1.06
		2009	25.2	22.0	167	34.2	1.61	1.44	1.38	0.45	1.37	1.19
		2011	30.1	23.3	183	35.9	1.96	1.59	1.46	0.49	1.47	1.11
GE 7FA.05 Min. Load/ GE LMS-100 Ave. Load	CC03/SC02/AB	2006	28.1	24.2	172	35.8	1.80	1.50	1.56	0.49	1.52	1.26
		2007	28.8	21.2	173	31.0	1.84	1.40	1.42	0.50	1.60	1.08
		2008	27.8	22.0	178	30.9	1.76	1.41	1.32	0.42	1.33	1.12
		2009	25.3	22.0	167	34.2	1.59	1.45	1.38	0.45	1.41	1.23
		2011	30.6	23.3	184	36.0	1.95	1.58	1.47	0.49	1.49	1.14
GE 7FA.05 Min. Load/ GE LMS-100 Min. Load	CC03/SC03/AB	2006	28.7	24.3	172	35.9	1.75	1.50	1.50	0.48	1.60	1.33
		2007	29.3	21.4	174	31.1	1.79	1.40	1.42	0.50	1.68	1.15
		2008	28.4	22.1	178	31.0	1.72	1.41	1.32	0.42	1.39	1.18
		2009	25.3	22.0	168	34.3	1.54	1.44	1.38	0.45	1.49	1.28
		2011	31.3	23.4	186	36.0	1.90	1.53	1.43	0.49	1.51	1.21

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65.3°F Ambient Temperature Scenarios

				NO_2 (µg/m^3) [b]			CO (µg/m^3)			SO_2 (µg/m^3)				PM_{10} (µg/m^3)		$PM_{2.5}$ (µg/m^3)	
Scenario Description [a]	Exhaust Scenario	Year	1-hour	1-hour (federal) [c]	1-hour	8-hour	1-hour		1-hour	1-hour (federal) [d]	3-hour	24-hour		24-hour	Annual	24-hour [c]	Annual
GE 7FA.05 Max. Load with Evap./ GE LMS-100 Max. Load with Evap.	CC04/SC04/AB	2006	17.1	14.5	0.15	91.0	17.3		1.74	1.54	1.54	0.43		0.98	0.10	0.81	0.10
		2007	18.7	12.9	0.14	102	16.7		1.92	1.31	1.35	0.44		0.99	0.094	0.71	0.094
		2008	17.2	12.2	0.14	96.7	15.8		1.76	1.35	1.22	0.37		0.84	0.096	0.75	0.096
		2009	16.7	12.0	0.14	91.5	17.5		1.68	1.32	1.19	0.41		0.98	0.091	0.78	0.091
		2011	18.5	13.7	0.15	94.1	18.9		1.86	1.56	1.27	0.44		1.02	0.099	0.76	0.099
GE 7FA.05 Max. Load with Evap./ GE LMS-100 Max. Load	CC04/SC05/AB	2006	17.1	14.5	0.15	91.0	17.3		1.74	1.54	1.54	0.43		0.98	0.10	0.81	0.10
		2007	18.6	12.9	0.14	102	16.7		1.92	1.31	1.35	0.44		0.99	0.094	0.71	0.094
		2008	17.2	12.2	0.14	96.7	15.8		1.76	1.35	1.22	0.37		0.84	0.096	0.75	0.096
		2009	16.7	12.0	0.14	91.5	17.5		1.68	1.33	1.19	0.41		0.98	0.091	0.78	0.091
		2011	18.5	13.7	0.15	94.1	18.9		1.86	1.56	1.27	0.44		1.02	0.099	0.76	0.099
GE 7FA.05 Max. Load with Evap./ GE LMS-100 Ave. Load	CC04/SC06/AB	2006	17.5	15.0	0.15	92.0	17.4		1.69	1.52	1.50	0.43		1.05	0.11	0.89	0.11
		2007	19.1	13.7	0.14	103	17.0		1.87	1.30	1.34	0.44		1.08	0.098	0.78	0.098
		2008	18.1	12.8	0.14	97.9	15.9		1.74	1.33	1.20	0.37		0.91	0.10	0.81	0.10
		2009	17.5	12.6	0.14	92.8	17.7		1.66	1.31	1.19	0.40		1.07	0.095	0.86	0.095
		2011	19.0	14.4	0.15	95.4	19.0		1.78	1.55	1.26	0.43		1.10	0.10	0.84	0.10
GE 7FA.05 Max. Load with Evap./ GE LMS-100 Min. Load	CC04/SC07/AB	2006	18.0	15.7	0.15	93.3	17.6		1.66	1.51	1.46	0.43		1.16	0.11	0.96	0.11
		2007	19.5	14.6	0.14	104	17.2		1.84	1.30	1.34	0.44		1.19	0.10	0.84	0.10
		2008	19.1	13.9	0.15	99.4	16.1		1.73	1.32	1.19	0.37		1.00	0.11	0.90	0.11
		2009	18.5	13.6	0.14	94.4	17.8		1.65	1.30	1.19	0.40		1.17	0.10	0.93	0.10
		2011	19.4	15.5	0.15	96.6	19.1		1.72	1.54	1.26	0.43		1.20	0.11	0.93	0.11
GE 7FA.05 Max. Load/ GE LMS-100 Max. Load with Evap.	CC05/SC04/AB	2006	17.0	14.4	0.15	90.1	17.2		1.71	1.51	1.51	0.42		0.97	0.10	0.80	0.10
		2007	18.5	12.8	0.14	101	16.6		1.88	1.29	1.31	0.43		0.98	0.093	0.71	0.093
		2008	17.1	12.1	0.14	95.8	15.6		1.72	1.32	1.19	0.36		0.83	0.095	0.75	0.095
		2009	16.6	11.9	0.13	91.0	17.4		1.65	1.30	1.16	0.40		0.98	0.090	0.78	0.090
		2011	18.4	13.6	0.14	93.2	18.7		1.82	1.53	1.25	0.43		1.01	0.098	0.76	0.098
GE 7FA.05 Max. Load/ GE LMS-100 Max. Load	CC05/SC05/AB	2006	17.0	14.4	0.15	90.1	17.2		1.71	1.51	1.51	0.42		0.97	0.10	0.81	0.10
		2007	18.5	12.8	0.14	101	16.6		1.88	1.29	1.32	0.43		0.98	0.093	0.71	0.093
		2008	17.1	12.1	0.14	95.8	15.6		1.72	1.33	1.19	0.36		0.83	0.095	0.75	0.095
		2009	16.6	11.9	0.13	91.0	17.4		1.65	1.30	1.16	0.40		0.98	0.090	0.78	0.090
		2011	18.4	13.6	0.14	93.2	18.7		1.83	1.53	1.25	0.43		1.01	0.098	0.76	0.098
GE 7FA.05 Max. Load/ GE LMS-100 Ave. Load	CC05/SC06/AB	2006	17.4	14.9	0.15	91.3	17.2		1.66	1.49	1.47	0.42		1.05	0.10	0.88	0.10
		2007	18.9	13.6	0.14	102	16.8		1.83	1.28	1.31	0.43		1.07	0.097	0.77	0.097
		2008	18.0	12.7	0.14	97.1	15.7		1.70	1.31	1.18	0.36		0.90	0.10	0.81	0.10
		2009	17.5	12.5	0.13	92.2	17.5		1.63	1.29	1.16	0.39		1.07	0.094	0.86	0.094
		2011	18.9	14.3	0.15	94.5	18.9		1.75	1.52	1.24	0.42		1.10	0.10	0.83	0.10
GE 7FA.05 Max. Load/ GE LMS-100 Min. Load	CC05/SC07/AB	2006	17.9	15.6	0.15	92.6	17.4		1.62	1.48	1.43	0.42		1.15	0.11	0.96	0.11
		2007	19.4	14.5	0.14	103	17.1		1.80	1.28	1.31	0.43		1.18	0.10	0.83	0.10
		2008	18.9	13.8	0.14	98.5	16.0		1.69	1.30	1.17	0.36		0.99	0.11	0.89	0.11
		2009	18.5	13.6	0.14	93.8	17.6		1.62	1.28	1.16	0.39		1.16	0.10	0.93	0.10
		2011	19.3	15.4	0.15	95.7	19.0		1.68	1.51	1.23	0.42		1.19	0.11	0.92	0.11

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65.3°F Ambient Temperature Scenarios

Scenario Description [a]	Exhaust Scenario	Year	NO_2 (µg/m^3) [b] 1-hour	NO_2 1-hour (federal) [c]	NO_2 Annual	CO (µg/m^3) 1-hour	CO 8-hour	SO_2 (µg/m^3) 1-hour	SO_2 1-hour (federal) [d]	SO_2 3-hour	SO_2 24-hour	PM_{10} (µg/m^3) 24-hour	PM_{10} Annual	$PM_{2.5}$ (µg/m^3) 24-hour [c]	$PM_{2.5}$ Annual
GE 7FA.05 Ave. Load/ GE LMS-100 Max. Load with Evap.	CC06/SC04/AB	2006	22.6	19.2	0.19	128	26.7	1.89	1.62	1.65	0.51	1.27	0.15	1.05	0.15
		2007	24.1	16.9	0.17	136	23.2	2.02	1.50	1.52	0.52	1.34	0.14	0.91	0.14
		2008	22.4	17.1	0.18	136	23.5	1.86	1.47	1.36	0.44	1.11	0.14	0.95	0.14
		2009	20.9	16.8	0.17	122	26.0	1.75	1.49	1.43	0.47	1.19	0.13	1.03	0.13
		2011	24.1	18.2	0.18	135	26.4	2.02	1.64	1.44	0.49	1.21	0.14	0.97	0.14
GE 7FA.05 Ave. Load/ GE LMS-100 Max. Load	CC06/SC05/AB	2006	22.6	19.2	0.19	128	26.7	1.89	1.62	1.65	0.51	1.27	0.15	1.05	0.15
		2007	24.1	16.9	0.17	136	23.2	2.02	1.50	1.52	0.52	1.34	0.14	0.91	0.14
		2008	22.4	17.1	0.18	136	23.5	1.86	1.47	1.37	0.44	1.12	0.14	0.95	0.14
		2009	20.9	16.8	0.17	122	26.0	1.75	1.49	1.43	0.47	1.19	0.13	1.03	0.13
		2011	24.1	18.2	0.18	135	26.4	2.02	1.64	1.45	0.49	1.21	0.14	0.97	0.14
GE 7FA.05 Ave. Load/ GE LMS-100 Ave. Load	CC06/SC06/AB	2006	23.2	19.4	0.19	129	26.8	1.86	1.60	1.61	0.51	1.33	0.15	1.11	0.15
		2007	24.5	16.9	0.17	137	23.4	1.98	1.50	1.52	0.52	1.40	0.14	0.95	0.14
		2008	22.8	17.3	0.18	136	23.7	1.84	1.46	1.37	0.44	1.16	0.14	1.01	0.14
		2009	21.1	17.2	0.17	122	26.0	1.71	1.49	1.43	0.47	1.26	0.14	1.08	0.14
		2011	24.7	18.5	0.18	137	26.5	1.98	1.63	1.42	0.49	1.26	0.14	1.03	0.14
GE 7FA.05 Ave. Load/ GE LMS-100 Min. Load	CC06/SC07/AB	2006	23.7	20.0	0.19	129	26.8	1.83	1.60	1.57	0.51	1.41	0.16	1.19	0.16
		2007	25.0	18.0	0.18	139	23.6	1.95	1.50	1.52	0.52	1.49	0.14	1.00	0.14
		2008	23.4	17.3	0.18	136	23.8	1.83	1.46	1.37	0.44	1.25	0.15	1.07	0.15
		2009	21.7	17.6	0.17	122	26.1	1.69	1.49	1.43	0.47	1.35	0.14	1.14	0.14
		2011	25.6	19.3	0.18	139	26.6	1.95	1.63	1.40	0.49	1.35	0.15	1.11	0.15
GE 7FA.05 Min. Load/ GE LMS-100 Max. Load with Evap.	CC07/SC04/AB	2006	26.6	23.2	0.19	156	33.0	1.77	1.45	1.55	0.47	1.52	0.18	1.27	0.18
		2007	27.3	20.4	0.18	156	28.5	1.81	1.36	1.38	0.49	1.58	0.17	1.04	0.17
		2008	26.5	21.1	0.18	161	28.4	1.72	1.37	1.28	0.41	1.32	0.17	1.08	0.17
		2009	24.2	21.3	0.17	152	31.4	1.57	1.40	1.35	0.44	1.40	0.17	1.22	0.17
		2011	29.1	22.3	0.18	167	33.2	1.92	1.56	1.44	0.48	1.51	0.17	1.13	0.17
GE 7FA.05 Min. Load/ GE LMS-100 Max. Load	CC07/SC05/AB	2006	26.6	23.2	0.19	156	33.0	1.77	1.45	1.55	0.47	1.52	0.18	1.27	0.18
		2007	27.3	20.4	0.18	156	28.5	1.81	1.36	1.38	0.49	1.58	0.17	1.04	0.17
		2008	26.5	21.1	0.18	161	28.4	1.72	1.37	1.28	0.41	1.32	0.17	1.08	0.17
		2009	24.2	21.3	0.17	152	31.4	1.57	1.40	1.35	0.44	1.40	0.17	1.22	0.17
		2011	29.1	22.3	0.18	167	33.2	1.92	1.56	1.44	0.48	1.52	0.17	1.13	0.17
GE 7FA.05 Min. Load/ GE LMS-100 Ave. Load	CC07/SC06/AB	2006	27.2	23.2	0.19	156	33.0	1.74	1.45	1.51	0.47	1.55	0.19	1.29	0.19
		2007	27.7	20.4	0.18	157	28.6	1.77	1.36	1.38	0.49	1.63	0.17	1.10	0.17
		2008	26.9	21.2	0.18	161	28.4	1.70	1.37	1.28	0.41	1.36	0.18	1.15	0.18
		2009	24.2	21.3	0.17	152	31.5	1.53	1.40	1.35	0.44	1.44	0.17	1.26	0.17
		2011	29.6	22.4	0.18	168	33.2	1.89	1.53	1.43	0.48	1.54	0.18	1.17	0.18
GE 7FA.05 Min. Load/ GE LMS-100 Min. Load	CC07/SC07/AB	2006	27.8	23.3	0.19	156	33.1	1.71	1.45	1.47	0.47	1.63	0.19	1.36	0.19
		2007	28.3	20.5	0.18	159	28.8	1.74	1.35	1.37	0.49	1.71	0.18	1.17	0.18
		2008	27.4	21.3	0.18	161	28.5	1.69	1.38	1.28	0.41	1.42	0.18	1.20	0.18
		2009	24.3	21.4	0.17	152	31.6	1.50	1.40	1.35	0.44	1.52	0.17	1.31	0.17
		2011	30.3	22.4	0.18	170	33.3	1.86	1.50	1.41	0.48	1.56	0.18	1.23	0.18

Alamitos Energy Center
Table 5.1C.8a
Operational Results – Load Analysis
October 2015

107°F Ambient Temperature Scenarios

			NO_2 (µg/m^3) [b]		CO (µg/m^3)		SO_2 (µg/m^3)				PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
Scenario Description [a]	Exhaust Scenario	Year	1-hour	1-hour (federal) [c]	1-hour	8-hour	1-hour	1-hour (federal) [d]	3-hour	24-hour	24-hour	24-hour [c]
GE 7FA.05 Max. Load with Evap./ GE LMS-100 Max. Load with Evap.	CC08/SC08/AB	2006	16.2	13.6	71.9	14.1	1.63	1.45	1.44	0.40	1.00	0.84
		2007	17.5	12.4	80.0	13.8	1.79	1.24	1.25	0.41	1.01	0.74
		2008	16.5	11.7	74.8	12.8	1.64	1.27	1.14	0.35	0.86	0.77
		2009	16.2	11.4	71.5	14.1	1.58	1.25	1.11	0.38	1.02	0.81
		2011	17.8	13.2	75.1	15.2	1.74	1.47	1.20	0.41	1.05	0.79
GE 7FA.05 Max. Load with Evap./ GE LMS-100 Max. Load	CC08/SC09/AB	2006	16.4	13.9	72.4	14.1	1.60	1.43	1.41	0.40	1.04	0.86
		2007	17.7	12.7	80.5	13.9	1.76	1.23	1.25	0.41	1.05	0.76
		2008	16.9	12.0	75.4	12.8	1.63	1.26	1.13	0.34	0.89	0.79
		2009	16.5	11.8	72.1	14.2	1.57	1.23	1.11	0.37	1.06	0.84
		2011	18.0	13.6	75.6	15.3	1.70	1.46	1.19	0.41	1.09	0.82
GE 7FA.05 Max. Load with Evap./ GE LMS-100 Ave. Load	CC08/SC10/AB	2006	16.7	14.4	73.4	14.2	1.56	1.41	1.37	0.40	1.11	0.92
		2007	18.0	13.4	81.5	14.0	1.72	1.21	1.24	0.40	1.14	0.81
		2008	17.6	12.8	76.5	13.0	1.61	1.24	1.11	0.34	0.95	0.86
		2009	17.3	12.6	73.3	14.3	1.55	1.22	1.10	0.37	1.13	0.90
		2011	18.3	14.4	76.3	15.4	1.63	1.44	1.17	0.40	1.16	0.88
GE 7FA.05 Max. Load with Evap./ GE LMS-100 Min. Load	CC08/SC11/AB	2006	17.2	15.3	74.7	14.4	1.51	1.39	1.32	0.39	1.22	1.02
		2007	18.5	14.5	82.8	14.3	1.67	1.19	1.23	0.40	1.25	0.87
		2008	18.6	13.9	78.0	13.2	1.59	1.21	1.09	0.33	1.05	0.93
		2009	18.5	13.7	74.9	14.4	1.52	1.19	1.09	0.37	1.23	0.98
		2011	19.3	15.5	77.2	15.5	1.55	1.41	1.15	0.40	1.26	0.97
GE 7FA.05 Max. Load/ GE LMS-100 Max. Load with Evap.	CC09/SC08/AB	2006	17.0	14.4	75.9	15.2	1.58	1.40	1.40	0.39	1.04	0.86
		2007	18.6	13.0	85.4	14.5	1.75	1.21	1.22	0.40	1.06	0.76
		2008	17.2	12.2	79.6	13.7	1.59	1.24	1.10	0.34	0.89	0.80
		2009	16.7	12.0	75.1	15.1	1.53	1.22	1.08	0.37	1.04	0.84
		2011	19.5	13.8	82.9	16.1	1.79	1.42	1.17	0.40	1.08	0.82
GE 7FA.05 Max. Load/ GE LMS-100 Max. Load	CC09/SC09/AB	2006	17.2	14.6	76.4	15.2	1.55	1.38	1.38	0.39	1.07	0.90
		2007	18.8	13.3	85.9	14.6	1.72	1.20	1.22	0.40	1.10	0.79
		2008	17.6	12.5	80.1	13.7	1.58	1.22	1.10	0.34	0.93	0.83
		2009	17.1	12.2	75.7	15.1	1.50	1.20	1.08	0.37	1.08	0.87
		2011	19.7	14.1	83.4	16.2	1.74	1.41	1.15	0.40	1.11	0.85
GE 7FA.05 Max. Load/ GE LMS-100 Ave. Load	CC09/SC10/AB	2006	17.6	15.1	77.4	15.3	1.51	1.36	1.34	0.39	1.14	0.96
		2007	19.1	14.0	86.9	14.7	1.68	1.18	1.21	0.40	1.18	0.83
		2008	18.3	13.3	81.2	13.9	1.56	1.20	1.08	0.34	0.99	0.88
		2009	17.8	13.1	76.8	15.3	1.48	1.18	1.07	0.36	1.15	0.94
		2011	20.0	14.9	84.5	16.3	1.67	1.39	1.14	0.39	1.19	0.92
GE 7FA.05 Max. Load/ GE LMS-100 Min. Load	CC09/SC11/AB	2006	18.1	15.9	78.6	15.4	1.45	1.34	1.29	0.38	1.25	1.05
		2007	19.5	15.0	88.2	15.0	1.63	1.17	1.20	0.39	1.30	0.90
		2008	19.2	14.4	82.7	14.1	1.54	1.17	1.07	0.33	1.09	0.97
		2009	18.9	14.2	78.4	15.4	1.46	1.15	1.07	0.36	1.25	1.01
		2011	20.4	16.0	85.6	16.4	1.58	1.37	1.12	0.39	1.29	1.01

Alamitos Energy Center
Table 5.1C.8a
Operational Results – Load Analysis
October 2015

107°F Ambient Temperature Scenarios

Scenario Description [a]	Exhaust Scenario	Year	NO_2 (µg/m^3) [b] 1-hour	NO_2 (µg/m^3) [b] 1-hour (federal) [c]	CO (µg/m^3) 1-hour	CO (µg/m^3) 8-hour	SO_2 (µg/m^3) 1-hour	SO_2 (µg/m^3) 1-hour (federal) [d]	SO_2 (µg/m^3) 3-hour	SO_2 (µg/m^3) 24-hour	PM_{10} (µg/m^3) 24-hour	$PM_{2.5}$ (µg/m^3) 24-hour [c]
GE 7FA.05 Ave. Load/ GE LMS-100 Max. Load with Evap.	CC10/SC08/AB	2006	21.1	17.7	97.9	20.7	1.68	1.43	1.48	0.44	1.25	1.04
		2007	22.6	15.2	106	18.3	1.80	1.31	1.32	0.45	1.32	0.91
		2008	20.6	15.5	101	18.4	1.64	1.28	1.18	0.38	1.10	0.96
		2009	19.4	15.2	92.9	20.2	1.55	1.29	1.24	0.41	1.19	1.01
		2011	23.0	16.7	106	21.4	1.83	1.47	1.33	0.45	1.24	0.97
GE 7FA.05 Ave. Load/ GE LMS-100 Max. Load	CC10/SC09/AB	2006	21.4	17.9	98.6	20.7	1.66	1.42	1.45	0.44	1.27	1.07
		2007	22.7	15.6	106	18.3	1.78	1.31	1.31	0.45	1.35	0.93
		2008	20.8	15.5	101	18.5	1.62	1.28	1.17	0.38	1.12	0.98
		2009	19.5	15.4	93.2	20.2	1.53	1.29	1.24	0.41	1.22	1.04
		2011	23.3	17.0	106	21.5	1.80	1.46	1.31	0.45	1.26	1.00
GE 7FA.05 Ave. Load/ GE LMS-100 Ave. Load	CC10/SC10/AB	2006	21.8	18.3	100	20.7	1.62	1.41	1.41	0.44	1.34	1.12
		2007	23.0	16.5	107	18.5	1.74	1.30	1.31	0.45	1.41	0.96
		2008	21.2	15.6	102	18.6	1.60	1.28	1.17	0.38	1.18	1.02
		2009	20.1	15.8	93.9	20.3	1.50	1.29	1.24	0.41	1.28	1.11
		2011	24.0	17.5	107	21.5	1.74	1.44	1.27	0.44	1.31	1.07
GE 7FA.05 Ave. Load/ GE LMS-100 Min. Load	CC10/SC11/AB	2006	22.3	18.9	101	20.8	1.58	1.39	1.36	0.43	1.45	1.21
		2007	23.5	17.5	109	18.7	1.69	1.30	1.30	0.44	1.52	1.03
		2008	22.1	16.6	103	18.8	1.58	1.28	1.17	0.38	1.28	1.10
		2009	21.1	16.4	94.6	20.4	1.46	1.29	1.24	0.41	1.38	1.18
		2011	24.8	18.5	109	21.6	1.69	1.42	1.23	0.44	1.41	1.14
GE 7FA.05 Min. Load/ GE LMS-100 Max. Load with Evap.	CC11/SC08/AB	2006	23.8	19.8	112	23.8	1.61	1.31	1.42	0.42	1.41	1.17
		2007	24.7	17.5	117	20.9	1.68	1.23	1.23	0.44	1.49	1.01
		2008	22.9	17.9	115	20.9	1.54	1.22	1.14	0.37	1.24	1.05
		2009	21.3	17.9	106	23.2	1.45	1.25	1.20	0.39	1.32	1.15
		2011	25.9	19.1	122	25.1	1.79	1.43	1.33	0.43	1.42	1.08
GE 7FA.05 Min. Load/ GE LMS-100 Max. Load	CC11/SC09/AB	2006	24.0	19.8	112	23.8	1.59	1.30	1.39	0.42	1.44	1.19
		2007	24.8	17.5	117	21.0	1.65	1.23	1.23	0.44	1.52	1.03
		2008	23.1	17.9	115	21.0	1.52	1.22	1.14	0.37	1.26	1.07
		2009	21.4	17.9	106	23.2	1.42	1.25	1.20	0.39	1.35	1.17
		2011	26.3	19.2	122	25.1	1.75	1.39	1.31	0.43	1.43	1.10
GE 7FA.05 Min. Load/ GE LMS-100 Ave. Load	CC11/SC10/AB	2006	24.4	20.0	113	23.9	1.55	1.30	1.35	0.42	1.50	1.25
		2007	25.2	17.6	118	21.1	1.61	1.22	1.23	0.43	1.58	1.08
		2008	23.5	18.0	115	21.1	1.50	1.21	1.14	0.37	1.31	1.11
		2009	21.6	17.9	106	23.3	1.39	1.25	1.20	0.39	1.41	1.21
		2011	26.9	19.3	123	25.1	1.69	1.37	1.28	0.43	1.45	1.15
GE 7FA.05 Min. Load/ GE LMS-100 Min. Load	CC11/SC11/AB	2006	25.0	20.7	115	24.0	1.51	1.30	1.30	0.41	1.58	1.33
		2007	25.6	18.8	120	21.3	1.56	1.22	1.23	0.43	1.67	1.14
		2008	24.0	18.1	115	21.3	1.47	1.21	1.14	0.36	1.39	1.19
		2009	22.2	18.2	106	23.3	1.35	1.25	1.20	0.39	1.50	1.29
		2011	27.7	20.1	125	25.2	1.63	1.33	1.24	0.43	1.50	1.23

[a] All modeled scenarios include two GE 7FA.05 turbines, four GE LMS-100 turbines, and the auxiliary boiler.

[b] The maximum 1-hour and annual NO_2 concentrations include ambient NO_2 ratios of 0.80 (EPA, 2011) and 0.75 (EPA, 2005), respectively.

[c] The federal 1-hour NO_2 and 24-hour $PM_{2.5}$ results are the high-8th-high impacts modeled.

[d] The federal 1-hour SO_2 results are the high-4th-high impacts modeled.

Alamitos Energy Center
Table 5.1C.8b
Operational Results – SCAQMD Rule 2005
October 2015

GE 7FA.05 Unit 1

Year	1-hour Concentration (µg/m³) [a, b]	1-hour Federal Concentration (µg/m³) [a, b]	Annual Concentration (µg/m³) [a, c]
2006	13.0	13.0	0.081
2007	12.7	12.7	0.074
2008	13.6	13.6	0.075
2009	12.7	12.7	0.073
2011	13.3	13.3	0.075

GE 7FA.05 Unit 2

Year	1-hour Concentration (µg/m³) [a, b]	1-hour Federal Concentration (µg/m³) [a, b]	Annual Concentration (µg/m³) [a, c]
2006	13.1	13.1	0.08
2007	12.6	12.6	0.07
2008	13.8	13.8	0.07
2009	12.7	12.7	0.07
2011	13.3	13.3	0.07

GE LMS-100 Unit 1

Year	1-hour Concentration (µg/m³) [a, b]	1-hour Federal Concentration (µg/m³) [a, b]	Annual Concentration (µg/m³) [a, c]
2006	2.71	2.71	0.012
2007	2.54	2.54	0.011
2008	2.93	2.93	0.011
2009	2.73	2.73	0.011
2011	4.37	4.37	0.012

GE LMS-100 Unit 2

Year	1-hour Concentration (µg/m³) [a, b]	1-hour Federal Concentration (µg/m³) [a, b]	Annual Concentration (µg/m³) [a, c]
2006	2.68	2.68	0.013
2007	2.57	2.57	0.011
2008	2.97	2.97	0.011
2009	2.70	2.70	0.011
2011	7.06	7.06	0.012

GE LMS-100 Unit 3

Year	1-hour Concentration (µg/m³) [a, b]	1-hour Federal Concentration (µg/m³) [a, b]	Annual Concentration (µg/m³) [a, c]
2006	2.71	2.71	0.013
2007	2.57	2.57	0.011
2008	3.04	3.04	0.011
2009	2.73	2.73	0.011
2011	4.48	4.48	0.012

GE LMS-100 Unit 4

Year	1-hour Concentration (µg/m³) [a, b]	1-hour Federal Concentration (µg/m³) [a, b]	Annual Concentration (µg/m³) [a, c]
2006	2.74	2.74	0.013
2007	2.58	2.58	0.011
2008	3.00	3.00	0.011
2009	2.74	2.74	0.011
2011	4.40	4.40	0.012

Auxiliary Boiler

Year	1-hour Concentration (µg/m³) [a]	1-hour Federal Concentration (µg/m³) [a]	Annual Concentration (µg/m³) [a]
2006	1.18	1.18	0.032
2007	1.22	1.22	0.032
2008	1.22	1.22	0.035
2009	1.21	1.21	0.048
2011	1.19	1.19	0.053

[a] The maximum 1-hour and annual NO_2 concentrations include ambient NO_2 ratios of 0.80 (EPA, 2011) and 0.75 (EPA, 2005), respectively.
[b] The modeled impact for the 1-hour NO_2 AAQS for the GE 7FA.05 and GE LMS-100 units are based on exhaust scenarios CC03 and SC03, respectively.
[c] The modeled impact for the annual NO_2 AAQS for the GE 7FA.05 and GE LMS-100 units are based on exhaust scenarios CC07 and SC07, respectively.

Alamitos Energy Center
Table 5.1C.8c
Operational Results – Class II SIL and Increment
October 2015

Year	NO_2 (µg/m³) [a]		CO (µg/m³)		PM_{10} (µg/m³)	
	1-hour [b]	Annual [c]	1-hour [b]	8-hour [b]	24-hour [c]	Annual [c]
2006	28.7	0.19	172	35.9	1.63	0.19
2007	29.3	0.18	174	31.1	1.71	0.18
2008	28.4	0.18	178	31.0	1.42	0.18
2009	25.3	0.17	168	34.3	1.52	0.17
2011	31.3	0.18	186	36.0	1.56	0.18

[a] The maximum 1-hour and annual NO_2 concentrations include ambient NO_2 ratios of 0.80 (EPA, 2011) and 0.75 (EPA, 2005), respectively.

[b] The modeled impact for the 1-hour NO_2, 1-hour CO, and 8-hour CO Class II SILs and Increments for the GE 7FA.05 and GE LMS-100 units are based on exhaust scenarios CC03 and SC03, respectively.

[c] The modeled impact for the annual NO_2 and PM_{10} Class II SILs and Increments for the GE 7FA.05 and GE LMS-100 units are based on exhaust scenarios CC07 and SC07, respectively.

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Table 5.1C.8d
Operational Results – Class I SIL and Increment
October 2015

Annual NO_2 Concentrations ($\mu g/m^3$) at 50 km Receptor Ring [a, b]

Year	2006	2007	2008	2009	2011
All	0.0035	0.0033	0.0037	0.0046	0.0041
GE 7FA.05 Unit 1	0.0010	9.6E-04	0.0011	0.0014	0.0012
GE 7FA.05 Unit 2	0.0010	9.6E-04	0.0011	0.0014	0.0012
GE LMS-100 Unit 1	3.7E-04	3.4E-04	3.7E-04	4.4E-04	4.0E-04
GE LMS-100 Unit 2	3.7E-04	3.4E-04	3.7E-04	4.4E-04	4.0E-04
GE LMS-100 Unit 3	3.7E-04	3.5E-04	3.8E-04	4.4E-04	4.0E-04
GE LMS-100 Unit 4	3.6E-04	3.5E-04	3.8E-04	4.4E-04	4.0E-04
Auxiliary Boiler	7.5E-05	6.8E-05	8.3E-05	1.1E-04	8.3E-05

24-hour PM_{10} Concentrations ($\mu g/m^3$) at 50 km Receptor Ring [c]

Year	2006	2007	2008	2009	2011
All	0.0482	0.0355	0.0414	0.0561	0.0441
GE 7FA.05 Unit 1	0.0104	0.0091	0.0104	0.0127	0.0107
GE 7FA.05 Unit 2	0.0105	0.0091	0.0104	0.0127	0.0107
GE LMS-100 Unit 1	0.0067	0.0050	0.0051	0.0076	0.0056
GE LMS-100 Unit 2	0.0067	0.0050	0.0051	0.0076	0.0056
GE LMS-100 Unit 3	0.0067	0.0050	0.0051	0.0076	0.0056
GE LMS-100 Unit 4	0.0067	0.0050	0.0051	0.0076	0.0056
Auxiliary Boiler	4.8E-04	4.5E-04	4.4E-04	4.6E-04	5.5E-04

Annual PM_{10} Concentrations ($\mu g/m^3$) at 50 km Receptor Ring [c]

Year	2006	2007	2008	2009	2011
All	0.0034	0.0032	0.0037	0.0046	0.0040
GE 7FA.05 Unit 1	0.0010	0.0010	0.0011	0.0014	0.0012
GE 7FA.05 Unit 2	0.0010	0.0010	0.0011	0.0014	0.0012
GE LMS-100 Unit 1	3.5E-04	3.3E-04	3.6E-04	4.2E-04	3.8E-04
GE LMS-100 Unit 2	3.5E-04	3.3E-04	3.6E-04	4.2E-04	3.8E-04
GE LMS-100 Unit 3	3.5E-04	3.3E-04	3.6E-04	4.3E-04	3.8E-04
GE LMS-100 Unit 4	3.5E-04	3.3E-04	3.6E-04	4.3E-04	3.8E-04
Auxiliary Boiler	6.0E-05	6.0E-05	7.0E-05	9.0E-05	7.0E-05

[a] The maximum annual NO_2 concentrations include an ambient NO_2 ratio of 0.75 (EPA, 2005).

[b] The modeled impact for the annual NO_2 Class I SIL and Increment for the GE 7FA.05 and GE LMS-100 units are based on exhaust scenarios CC07 and SC07, respectively.

[c] The modeled impact for the 24-hour and annual PM_{10} Class I SILs and Increments for the GE 7FA.05 and GE LMS-100 units are based on exhaust scenarios CC07 and SC07, respectively.

Alamitos Energy Center
Table 5.1C.9
Competing Source Stack Parameters
October 2015

Point Sources

Facility	Source ID	Easting (X) (m)	Northing (Y) (m)	Base Elevation (m)	Stack Height (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
AEC	7FA01	398058	3736934	4.57	42.7	350	12.2	6.10
	7FA02	398058	3736890	4.57	42.7	350	12.2	6.10
	LMS01	398252	3737139	4.57	24.4	749	23.8	4.11
	LMS02	398252	3737124	4.57	24.4	749	23.8	4.11
	LMS03	398251	3737012	4.57	24.4	749	23.8	4.11
	LMS04	398251	3736997	4.57	24.4	749	23.8	4.11
	AUXBOILER	398086	3736829	4.57	24.4	432	21.2	0.91
Haynes Generating Station (Haynes)	Haynes Unit 11	398554	3736805	2.74	45.7	627	21.6	4.11
	Haynes Unit 12	398554	3736811	2.67	45.7	627	21.6	4.11
	Haynes Unit 13	398554	3736912	2.60	45.7	627	21.6	4.11
	Haynes Unit 14	398554	3736919	2.61	45.7	627	21.6	4.11
	Haynes Unit 15	398554	3737019	2.60	45.7	627	21.6	4.11
	Haynes Unit 16	398554	3737025	2.60	45.7	627	21.6	4.11
	Haynes Boiler 1	398601	3736258	3.20	73.2	386	17.1	5.33
	Haynes Boiler 2	398601	3736293	3.20	73.2	384	15.7	5.33
	CCGS Unit 9	398652	3736693	3.54	42.7	368	19.1	5.79
	CCGS Unit 10	398652	3736739	3.54	42.7	368	19.1	5.79
Beta Offshore (Beta)	16607301	395222	3716431	0	18.3	661	31.1	0.30
	16607302	395222	3716431	0	18.3	641	30.0	0.30
	16607303	395222	3716431	0	18.3	585	24.2	0.30
	16607304	394082	3717932	0	18.3	663	28.7	0.30
	16607305	394082	3717932	0	18.3	684	34.7	0.30
	16607306	394082	3717932	0	18.3	583	21.1	0.30
	16607307	395265	3716554	0	18.3	671	39.4	0.61
	16607308	395265	3716554	0	18.3	671	38.1	0.61
	16607309	395265	3716554	0	18.3	677	37.5	0.61
	16607310	395265	3716554	0	18.3	671	81.2	0.76
	16607311	395265	3716554	0	18.3	669	81.1	0.76
	16607312	395265	3716554	0	18.3	668	81.4	0.76
	16607313	395265	3716554	0	22.9	464	8.35	0.51

Volume Sources

Facility	Source ID	Base Elevation (m)	Release Height (m)	Initial Horizontal Dimension (m)	Initial Vertical Dimension (m)
Shipping Lanes (800 sources)	704601 - 764625	0	50.0	186	23.3

Competing source data provided by SCAQMD.

Alamitos Energy Center
Table 5.1C.10
Competing Source Emission Rates
October 2015

Emission Rates for PSD 1-hour NO_2 Competing Source Modeling

Facility	Source ID	1-hour NO_2 (g/s)	1-hour NO_2 (lb/hr)
AEC	7FA01	7.69	61.0
	7FA02	7.69	61.0
	LMS01	2.67	21.2
	LMS02	2.67	21.2
	LMS03	2.67	21.2
	LMS04	2.67	21.2
	AUXBOILER	0.054	0.42
Haynes	Haynes Unit 11	3.12	24.7
	Haynes Unit 12	3.12	24.7
	Haynes Unit 13	3.12	24.7
	Haynes Unit 14	3.12	24.7
	Haynes Unit 15	3.12	24.7
	Haynes Unit 16	3.12	24.7
	Haynes Boiler 1	1.69	13.4
	Haynes Boiler 2	1.69	13.4
	CCGS Unit 9	2.17	17.2
	CCGS Unit 10	2.17	17.2
Beta	16607301	1.90	15.0
	16607302	1.90	15.0
	16607303	1.90	15.0
	16607304	1.90	15.0
	16607305	1.90	15.0
	16607306	1.90	15.0
	16607307	0.37	2.90
	16607308	0.31	2.50
	16607309	0.35	2.80
	16607310	2.52	20.0
	16607311	2.48	19.7
	16607312	2.48	19.7
	16607313	10.3	81.6
Shipping Lanes (Total for 800 sources)	704601 - 764625	171	1,357

Competing source data provided by SCAQMD.

Alamitos Energy Center
Table 5.1C.11
Competing Source Results
October 2015

1-hour NO_2 Concentrations ($\mu g/m^3$) [a, b]

Year	2006	2007	2008	2009	2011
All (Max. Impact)	105	108	108	105	99
AEC (Max. Contribution)	6.54	6.36	6.76	6.87	6.75
Haynes (Max. Contribution)	48.0	48.0	48.0	48.0	48.0
Beta (Max. Contribution)	0.36	0.61	0.33	0.37	0.73
Ships (Max. Contribution)	101	104	105	102	97.8

[a] The maximum 1-hour NO_2 concentrations include an ambient NO_2 ratio of 0.80 (EPA, 2011). Maximum impacts are the high-8th-high, while the maximum contributions are the highest of the 8th through 25th high.

[b] The modeled impact for the 1-hour NO_2 competing source assessment for the GE 7FA.05 and GE LMS-100 units are based on exhaust scenarios CC03 and SC03, respectively.

Alamitos Energy Center
Table 5.1C.12
Combined-Cycle Power Block 1 Construction with AGS Units 1 - 6 Operation Stack Parameters
October 2015

Construction Point Sources

Source ID	Stack Release Type (Beta)	Easting (X) (m)	Northing (Y) (m)	Base Elevation (m)	Stack Height (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
7FA01	Horizontal	398050	3736725	4.57	4.60	533	18.0	0.127
7FA02	Horizontal	398075	3736725	4.57	4.60	533	18.0	0.127
7FA03	Horizontal	398100	3736725	4.57	4.60	533	18.0	0.127
7FA04	Horizontal	398125	3736725	4.57	4.60	533	18.0	0.127
7FA05	Horizontal	398150	3736725	4.57	4.60	533	18.0	0.127
7FA06	Horizontal	398175	3736725	4.57	4.60	533	18.0	0.127
7FA07	Horizontal	398050	3736750	4.57	4.60	533	18.0	0.127
7FA08	Horizontal	398075	3736750	4.57	4.60	533	18.0	0.127
7FA09	Horizontal	398100	3736750	4.57	4.60	533	18.0	0.127
7FA10	Horizontal	398125	3736750	4.57	4.60	533	18.0	0.127
7FA11	Horizontal	398150	3736750	4.57	4.60	533	18.0	0.127
7FA12	Horizontal	398175	3736750	4.57	4.60	533	18.0	0.127
7FA13	Horizontal	398050	3736775	4.57	4.60	533	18.0	0.127
7FA14	Horizontal	398075	3736775	4.57	4.60	533	18.0	0.127
7FA15	Horizontal	398100	3736775	4.57	4.60	533	18.0	0.127
7FA16	Horizontal	398125	3736775	4.57	4.60	533	18.0	0.127
7FA17	Horizontal	398150	3736775	4.57	4.60	533	18.0	0.127
7FA18	Horizontal	398175	3736775	4.57	4.60	533	18.0	0.127
7FA19	Horizontal	398050	3736800	4.57	4.60	533	18.0	0.127
7FA20	Horizontal	398075	3736800	4.57	4.60	533	18.0	0.127
7FA21	Horizontal	398100	3736800	4.57	4.60	533	18.0	0.127
7FA22	Horizontal	398125	3736800	4.57	4.60	533	18.0	0.127
7FA23	Horizontal	398150	3736800	4.57	4.60	533	18.0	0.127
7FA24	Horizontal	398175	3736800	4.57	4.60	533	18.0	0.127
7FA25	Horizontal	398050	3736825	4.57	4.60	533	18.0	0.127
7FA26	Horizontal	398075	3736825	4.57	4.60	533	18.0	0.127
7FA27	Horizontal	398100	3736825	4.57	4.60	533	18.0	0.127
7FA28	Horizontal	398125	3736825	4.57	4.60	533	18.0	0.127
7FA29	Horizontal	398150	3736825	4.57	4.60	533	18.0	0.127
7FA30	Horizontal	398175	3736825	4.57	4.60	533	18.0	0.127
7FA31	Horizontal	398050	3736850	4.57	4.60	533	18.0	0.127
7FA32	Horizontal	398075	3736850	4.57	4.60	533	18.0	0.127
7FA33	Horizontal	398100	3736850	4.57	4.60	533	18.0	0.127
7FA34	Horizontal	398125	3736850	4.57	4.60	533	18.0	0.127
7FA35	Horizontal	398150	3736850	4.57	4.60	533	18.0	0.127
7FA36	Horizontal	398175	3736850	4.57	4.60	533	18.0	0.127
7FA37	Horizontal	398050	3736875	4.57	4.60	533	18.0	0.127
7FA38	Horizontal	398075	3736875	4.57	4.60	533	18.0	0.127
7FA39	Horizontal	398100	3736875	4.57	4.60	533	18.0	0.127
7FA40	Horizontal	398125	3736875	4.57	4.60	533	18.0	0.127
7FA41	Horizontal	398150	3736875	4.57	4.60	533	18.0	0.127
7FA42	Horizontal	398175	3736875	4.57	4.60	533	18.0	0.127
7FA43	Horizontal	398050	3736900	4.57	4.60	533	18.0	0.127
7FA44	Horizontal	398075	3736900	4.57	4.60	533	18.0	0.127
7FA45	Horizontal	398100	3736900	4.57	4.60	533	18.0	0.127
7FA46	Horizontal	398125	3736900	4.57	4.60	533	18.0	0.127
7FA47	Horizontal	398150	3736900	4.57	4.60	533	18.0	0.127
7FA48	Horizontal	398175	3736900	4.57	4.60	533	18.0	0.127
7FA49	Horizontal	398050	3736925	4.57	4.60	533	18.0	0.127
7FA50	Horizontal	398075	3736925	4.57	4.60	533	18.0	0.127
7FA51	Horizontal	398100	3736925	4.57	4.60	533	18.0	0.127
7FA52	Horizontal	398125	3736925	4.57	4.60	533	18.0	0.127
7FA53	Horizontal	398150	3736925	4.57	4.60	533	18.0	0.127
7FA54	Horizontal	398175	3736925	4.57	4.60	533	18.0	0.127
7FA55	Horizontal	398050	3736950	4.57	4.60	533	18.0	0.127
7FA56	Horizontal	398075	3736950	4.57	4.60	533	18.0	0.127
7FA57	Horizontal	398100	3736950	4.57	4.60	533	18.0	0.127
7FA58	Horizontal	398125	3736950	4.57	4.60	533	18.0	0.127
7FA59	Horizontal	398150	3736950	4.57	4.60	533	18.0	0.127
7FA60	Horizontal	398175	3736950	4.57	4.60	533	18.0	0.127

Alamitos Energy Center
Table 5.1C.12
Combined-Cycle Power Block 1 Construction with AGS Units 1 - 6 Operation Stack Parameters
October 2015

Construction Area Poly Sources

Source ID	Base Elevation (m)	Release Height (m)	Number of Vertices	Vertical Dimension (m)	Easting (X1) (m)	Northing (Y1) (m)	Easting (X2) (m)	Northing (Y2) (m)	Easting (X3) (m)	Northing (Y3) (m)	Easting (X4) (m)	Northing (Y4) (m)
FUG	4.57	0.00	4	1.00	398185	3736725	398045	3736725	398045	3736960	398185	3736960

Operational Point Sources

Source ID	Easting (X) (m)	Northing (Y) (m)	Base Elevation (m)	Stack Height (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
AGS Unit 1	397965	3737095	4.57	61.0	456	19.0	3.58
AGS Unit 2	397993	3737095	4.57	61.0	472	26.2	3.65
AGS Unit 3	398096	3737050	4.57	60.7	366	10.7	5.31
AGS Unit 4	398157	3737050	4.57	60.7	359	11.1	5.17
AGS Unit 5	398135	3736650	4.57	58.2	388	17.7	5.58
AGS Unit 6	398135	3736600	4.57	58.2	387	16.8	5.61

Alamitos Energy Center
Table 5.1C.13
Combined-Cycle Power Block 1 Construction with AGS Units 1 - 6 Operation Emission Rates
October 2015

Emission Rates for 1-hour, 3-hour, 8-hour, and 24-hour Modeling

	1-hour NO_2		1-hour NO_2 (federal)		1-hour CO		8-hour CO		1-hour SO_2		3-hour SO_2		24-hour SO_2		24-hour PM_{10}		24-hour $PM_{2.5}$	
Source ID	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)
FUG	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.017	0.14	0.0046	0.036
EXH	0.205	1.63	0.205	1.63	1.06	8.44	1.06	8.44	0.0018	0.0142	0.0018	0.0142	7.5E-04	0.0059	1.0E-03	0.0082	1.0E-03	0.0082
AGS Unit 1	1.71	13.6	1.71	13.6	42.8	340	42.8	340	0.14	1.11	0.14	1.11	0.14	1.11	0.25	1.96	0.25	1.96
AGS Unit 2	1.63	12.9	1.63	12.9	31.4	249	31.4	249	0.13	1.06	0.13	1.06	0.13	1.06	0.25	1.96	0.25	1.96
AGS Unit 3	3.04	24.1	3.04	24.1	39.6	314	39.6	314	0.25	1.98	0.25	1.98	0.25	1.98	0.46	3.69	0.46	3.69
AGS Unit 4	1.97	15.6	1.97	15.6	5.93	47.1	5.93	47.1	0.25	1.99	0.25	1.99	0.25	1.99	0.46	3.69	0.46	3.69
AGS Unit 5	3.00	23.8	3.00	23.8	87.7	696	87.7	696	0.35	2.80	0.35	2.80	0.35	2.80	0.66	5.23	0.66	5.23
AGS Unit 6	3.07	24.4	3.07	24.4	38.2	303	38.2	303	0.35	2.81	0.35	2.81	0.35	2.81	0.66	5.23	0.66	5.23
Maximum Month	22		22		9		9		9		9		9		12		12	

Emission Rates for Annual Modeling

	Annual NO_2		Annual PM_{10}		Annual $PM_{2.5}$	
Source ID	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)
FUG	-	-	0.012	0.097	0.0034	0.027
EXH	0.063	0.50	7.5E-04	0.0059	7.4E-04	0.0059
AGS Unit 1	1.71	13.6	0.25	1.96	0.25	1.96
AGS Unit 2	1.63	12.9	0.25	1.96	0.25	1.96
AGS Unit 3	3.04	24.1	0.46	3.69	0.46	3.69
AGS Unit 4	1.97	15.6	0.46	3.69	0.46	3.69
AGS Unit 5	3.00	23.8	0.66	5.23	0.66	5.23
AGS Unit 6	3.07	24.4	0.66	5.23	0.66	5.23
Maximum Months	19-30		10-21		10-21	

Emission rates for exhaust sources are the total for all sources.

Alamitos Energy Center
Table 5.1C.14
Combined-Cycle Power Block 1 Construction with AGS Units 1 - 6 Operation Building Parameters
October 2015

Building Name	Number of Tiers	Tier Number	Base Elevation (m)	Tier Height (m)	Number of Corners	Corner 1 East (X) (m)	Corner 1 North (Y) (m)	Corner 2 East (X) (m)	Corner 2 North (Y) (m)	Corner 3 East (X) (m)	Corner 3 North (Y) (m)	Corner 4 East (X) (m)	Corner 4 North (Y) (m)
U12	1	1	4.57	39.7	4	397950	3737089	397950	3737116	398009	3737116	398009	3737089
U3	1	1	4.57	37.0	4	398083	3737113	398110	3737113	398110	3737071	398083	3737071
U4	1	1	4.57	37.0	4	398142	3737113	398171	3737113	398171	3737070	398142	3737070
U5	1	1	4.57	47.2	4	398159	3736658	398190	3736658	398190	3736636	398159	3736636
U6	1	1	4.57	47.2	4	398158	3736608	398190	3736608	398190	3736584	398158	3736584

Alamitos Energy Center
Table 5.1C.15
Combined-Cycle Power Block 1 Construction with AGS Units 1 - 6 Operation Results
October 2015

		NO_2 (μg/m^3) [a]			CO (μg/m^3)		SO_2 (μg/m^3)				PM_{10} (μg/m^3)		$PM_{2.5}$ (μg/m^3)	
Source	Year	1-hour	1-hour (federal) [b]	Annual	1-hour	8-hour	1-hour	1-hour (federal) [c]	3-hour	24-hour	24-hour	Annual	24-hour [b]	Annual
ALL		12.6	12.5	1.79	206	142	1.28	1.22	1.18	0.43	7.31	2.04	1.64	0.65
Exhaust	2006	12.6	12.5	1.40	81.7	67.6	0.14	0.14	0.13	0.037	0.051	0.022	0.042	0.022
Fugitive		-	-	-	-	-	-	-	-	-	7.19	1.91	1.51	0.53
AGS Operation		10.2	9.38	0.84	203	140	1.27	1.21	1.18	0.43	0.79	0.21	0.62	0.21
ALL		12.7	12.6	1.85	209	141	1.31	1.23	1.20	0.39	6.75	2.08	1.61	0.67
Exhaust	2007	12.7	12.6	1.42	82.1	67.6	0.14	0.14	0.13	0.035	0.049	0.023	0.044	0.023
Fugitive		-	-	-	-	-	-	-	-	-	6.62	1.95	1.48	0.54
AGS Operation		10.3	9.61	0.79	206	139	1.31	1.22	1.20	0.38	0.71	0.20	0.56	0.20
ALL		12.6	12.6	1.87	210	145	1.30	1.23	1.16	0.36	7.04	2.05	1.63	0.67
Exhaust	2008	12.6	12.6	1.40	81.7	68.2	0.14	0.14	0.13	0.034	0.048	0.022	0.043	0.022
Fugitive		-	-	-	-	-	-	-	-	-	6.93	1.91	1.46	0.53
AGS Operation		10.4	9.70	0.84	207	143	1.29	1.23	1.16	0.36	0.66	0.21	0.54	0.21
ALL		12.6	12.4	1.82	206	164	1.37	1.23	1.24	0.45	6.62	1.96	1.50	0.64
Exhaust	2009	12.6	12.4	1.40	81.3	65.3	0.14	0.14	0.13	0.036	0.049	0.022	0.044	0.022
Fugitive		-	-	-	-	-	-	-	-	-	6.55	1.83	1.34	0.51
AGS Operation		10.2	9.59	0.79	203	161	1.37	1.23	1.24	0.44	0.82	0.20	0.57	0.20
ALL		12.6	12.2	1.86	277	183	1.59	1.28	1.16	0.43	6.74	1.96	1.61	0.64
Exhaust	2011	12.6	12.2	1.43	81.3	71.1	0.14	0.13	0.13	0.034	0.047	0.023	0.042	0.023
Fugitive		-	-	-	-	-	-	-	-	-	6.68	1.83	1.47	0.51
AGS Operation		11.6	9.75	0.81	275	181	1.58	1.28	1.16	0.43	0.79	0.20	0.52	0.20

[a] The maximum 1-hour and annual NO_2 concentrations include ambient NO_2 ratios of 0.80 (EPA, 2011) and 0.75 (EPA, 2005), respectively.

[b] The federal 1-hour NO_2 and 24-hour $PM_{2.5}$ results are the high-8th-high impacts modeled.

[c] The federal 1-hour SO_2 results are the high-4th-high impacts modeled.

Alamitos Energy Center
Table 5.1C.16
Combined-Cycle Power Block 1 Operation with Simple-Cycle Power Block 2 Construction and AGS Units 3, 4, and 6 Operation Stack Parameters
October 2015

Construction Point Sources

Source ID	Stack Release Type (Beta)	Easting (X) (m)	Northing (Y) (m)	Base Elevation (m)	Stack Height (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
LMS01	Horizontal	398200	3736850	4.572	4.60	533	18.0	0.127
LMS02	Horizontal	398225	3736850	4.572	4.60	533	18.0	0.127
LMS03	Horizontal	398250	3736850	4.572	4.60	533	18.0	0.127
LMS04	Horizontal	398275	3736850	4.572	4.60	533	18.0	0.127
LMS05	Horizontal	398200	3736875	4.572	4.60	533	18.0	0.127
LMS06	Horizontal	398225	3736875	4.572	4.60	533	18.0	0.127
LMS07	Horizontal	398250	3736875	4.572	4.60	533	18.0	0.127
LMS08	Horizontal	398275	3736875	4.572	4.60	533	18.0	0.127
LMS09	Horizontal	398200	3736900	4.572	4.60	533	18.0	0.127
LMS10	Horizontal	398225	3736900	4.572	4.60	533	18.0	0.127
LMS11	Horizontal	398250	3736900	4.572	4.60	533	18.0	0.127
LMS12	Horizontal	398275	3736900	4.572	4.60	533	18.0	0.127
LMS13	Horizontal	398200	3736925	4.572	4.60	533	18.0	0.127
LMS14	Horizontal	398225	3736925	4.572	4.60	533	18.0	0.127
LMS15	Horizontal	398250	3736925	4.572	4.60	533	18.0	0.127
LMS16	Horizontal	398275	3736925	4.572	4.60	533	18.0	0.127
LMS17	Horizontal	398200	3736950	4.572	4.60	533	18.0	0.127
LMS18	Horizontal	398225	3736950	4.572	4.60	533	18.0	0.127
LMS19	Horizontal	398250	3736950	4.572	4.60	533	18.0	0.127
LMS20	Horizontal	398275	3736950	4.572	4.60	533	18.0	0.127
LMS21	Horizontal	398200	3736975	4.572	4.60	533	18.0	0.127
LMS22	Horizontal	398225	3736975	4.572	4.60	533	18.0	0.127
LMS23	Horizontal	398250	3736975	4.572	4.60	533	18.0	0.127
LMS24	Horizontal	398275	3736975	4.572	4.60	533	18.0	0.127
LMS25	Horizontal	398200	3737000	4.572	4.60	533	18.0	0.127
LMS26	Horizontal	398225	3737000	4.572	4.60	533	18.0	0.127
LMS27	Horizontal	398250	3737000	4.572	4.60	533	18.0	0.127
LMS28	Horizontal	398275	3737000	4.572	4.60	533	18.0	0.127
LMS29	Horizontal	398200	3737025	4.572	4.60	533	18.0	0.127
LMS30	Horizontal	398225	3737025	4.572	4.60	533	18.0	0.127
LMS31	Horizontal	398250	3737025	4.572	4.60	533	18.0	0.127
LMS32	Horizontal	398275	3737025	4.572	4.60	533	18.0	0.127
LMS33	Horizontal	398200	3737050	4.572	4.60	533	18.0	0.127
LMS34	Horizontal	398225	3737050	4.572	4.60	533	18.0	0.127
LMS35	Horizontal	398250	3737050	4.572	4.60	533	18.0	0.127
LMS36	Horizontal	398275	3737050	4.572	4.60	533	18.0	0.127
LMS37	Horizontal	398200	3737075	4.57	4.60	533	18.0	0.127
LMS38	Horizontal	398225	3737075	4.57	4.60	533	18.0	0.127
LMS39	Horizontal	398250	3737075	4.57	4.60	533	18.0	0.127
LMS40	Horizontal	398275	3737075	4.57	4.60	533	18.0	0.127
LMS41	Horizontal	398200	3737100	4.57	4.60	533	18.0	0.127
LMS42	Horizontal	398225	3737100	4.57	4.60	533	18.0	0.127
LMS43	Horizontal	398250	3737100	4.57	4.60	533	18.0	0.127
LMS44	Horizontal	398275	3737100	4.57	4.60	533	18.0	0.127
LMS45	Horizontal	398200	3737125	4.57	4.60	533	18.0	0.127
LMS46	Horizontal	398225	3737125	4.57	4.60	533	18.0	0.127
LMS47	Horizontal	398250	3737125	4.57	4.60	533	18.0	0.127
LMS48	Horizontal	398275	3737125	4.57	4.60	533	18.0	0.127
LMS49	Horizontal	398200	3737150	4.57	4.60	533	18.0	0.127
LMS50	Horizontal	398225	3737150	4.57	4.60	533	18.0	0.127
LMS51	Horizontal	398250	3737150	4.57	4.60	533	18.0	0.127
LMS52	Horizontal	398275	3737150	4.57	4.60	533	18.0	0.127
LMS53	Horizontal	398200	3737175	4.57	4.60	533	18.0	0.127
LMS54	Horizontal	398225	3737175	4.57	4.60	533	18.0	0.127
LMS55	Horizontal	398250	3737175	4.57	4.60	533	18.0	0.127
LMS56	Horizontal	398275	3737175	4.57	4.60	533	18.0	0.127
LMS57	Horizontal	398200	3736825	4.57	4.60	533	18.0	0.127
LMS58	Horizontal	398225	3736825	4.57	4.60	533	18.0	0.127
LMS59	Horizontal	398200	3736800	4.57	4.60	533	18.0	0.127
LMS60	Horizontal	398225	3736800	4.57	4.60	533	18.0	0.127
LMS61	Horizontal	398200	3736775	4.57	4.60	533	18.0	0.127
LMS62	Horizontal	398225	3736775	4.57	4.60	533	18.0	0.127
LMS63	Horizontal	398200	3736750	4.57	4.60	533	18.0	0.127
LMS64	Horizontal	398225	3736750	4.57	4.60	533	18.0	0.127
LMS65	Horizontal	398200	3736725	4.57	4.60	533	18.0	0.127
LMS66	Horizontal	398225	3736725	4.57	4.60	533	18.0	0.127

Alamitos Energy Center
Table 5.1C.16
Combined-Cycle Power Block 1 Operation with Simple-Cycle Power Block 2 Construction and AGS Units 3, 4, and 6 Operation Stack Parameters
October 2015

Construction Area Poly Sources

Source ID	Base Elevation (m)	Release Height (m)	Number of Vertices	Vertical Dimension (m)	Easting (X1) (m)	Northing (Y1) (m)	Easting (X2) (m)	Northing (Y2) (m)	Easting (X3) (m)	Northing (Y3) (m)
FUG	4.57	0.00	8	1.00	398275	3737175	398275	3736850	398235	3736850

Source ID	Easting (X4) (m)	Northing (Y4) (m)	Easting (X5) (m)	Northing (Y5) (m)	Easting (X6) (m)	Northing (Y6) (m)	Easting (X7) (m)	Northing (Y7) (m)	Easting (X8) (m)	Northing (Y8) (m)
FUG	398235	3736725	398185	3736725	398185	3736960	398200	3736960	398200	3737175

Operational Point Sources

Source ID	Scenario	Easting (X) (m)	Northing (Y) (m)	Base Elevation (m)	Stack Height (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
7FA01-02	State 1-hour SO_2	398058	3736934	4.57	42.7	354	15.6	6.10
7FA02-02		398058	3736890	4.57	42.7	354	15.6	6.10
7FA01-03	1-hour NO_2, CO	398058	3736934	4.57	42.7	350	12.2	6.10
7FA02-03		398058	3736890	4.57	42.7	350	12.2	6.10
7FA01-06	Federal 1-hour SO_2, 3-hour SO_2, 24-hour SO_2	398058	3736934	4.57	42.7	353	14.9	6.10
7FA02-06		398058	3736890	4.57	42.7	353	14.9	6.10
7FA01-07	Annual NO_2, PM_{10}, $PM_{2.5}$	398058	3736934	4.57	42.7	350	11.8	6.10
7FA02-07		398058	3736890	4.57	42.7	350	11.8	6.10
Auxiliary Boiler	All	398086	3736829	4.57	24.4	432	21.2	0.91
AGS Unit 3	All	398096	3737050	4.57	60.7	366	10.7	5.31
AGS Unit 4	All	398157	3737050	4.57	60.7	359	11.1	5.17
AGS Unit 6	All	398135	3736600	4.57	58.2	387	16.8	5.61

Alamitos Energy Center

Table 5.1C.17

Combined-Cycle Power Block 1 Operation with Simple-Cycle Power Block 2 Construction and AGS Units 3, 4, and 6 Operation Emission Rates

October 2015

Emission Rates for 1-hour, 3-hour, 8-hour, and 24-hour Modeling

	1-hour NO_2		1-hour NO_2 (federal)		1-hour CO		8-hour CO		1-hour SO_2		1-hour SO_2 (federal)		3-hour SO_2		24-hour SO_2		24-hour PM_{10}		24-hour $PM_{2.5}$	
Source ID	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)
FUG	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	0.036	0.29	0.015	0.12
EXH [a]	0.11	0.91	0.11	0.91	1.15	9.13	1.15	9.13	0.0022	0.017	0.0022	0.017	0.0022	0.017	0.0009	0.0071	0.0015	0.012	0.0014	0.011
7FA01 [b]	7.69	61.0	7.69	61.0	41.0	325	12.0	95.2	0.48	3.84	0.47	3.72	0.47	3.72	0.47	3.72	1.07	8.50	1.07	8.50
7FA02 [b]	7.69	61.0	7.69	61.0	41.0	325	12.0	95.2	0.48	3.84	0.47	3.72	0.47	3.72	0.47	3.72	1.07	8.50	1.07	8.50
Auxiliary Boiler	0.05	0.42	0.054	0.42	0.36	2.83	0.30	2.37	0.0061	0.048	0.006	0.048	0.01	0.048	0.0031	0.025	0.02	0.16	0.02	0.16
AGS Unit 3	3.04	24.1	3.04	24.1	39.6	314	39.6	314	0.25	1.98	0.25	1.98	0.25	1.98	0.25	1.98	0.46	3.69	0.46	3.69
AGS Unit 4	1.97	15.6	1.97	15.6	5.93	47.1	5.93	47.1	0.25	1.99	0.25	1.99	0.25	1.99	0.25	1.99	0.46	3.69	0.46	3.69
AGS Unit 6	3.07	24.4	3.07	24.4	38.2	303	38.2	303	0.35	2.81	0.35	2.81	0.35	2.81	0.35	2.81	0.66	5.23	0.66	5.23
Maximum Month	38		38		38		38		38		38		38		38		38		38	

Emission Rates for Annual Modeling

	Annual NO_2		Annual PM_{10}		Annual $PM_{2.5}$	
Source ID	(g/s)	(lb/hr)	(g/s)	(lb/hr)	(g/s)	(lb/hr)
FUG	-	-	0.013	0.10	0.0035	0.027
EXH [a]	0.021	0.17	0.00063	0.0050	0.00062	0.0050
7FA01 [b]	0.75	5.97	0.56	4.48	0.56	4.48
7FA02 [b]	0.75	5.97	0.56	4.48	0.56	4.48
Auxiliary Boiler	0.030	0.23	0.019	0.15	0.019	0.15
AGS Unit 3	3.04	24.1	0.46	3.69	0.46	3.69
AGS Unit 4	1.97	15.6	0.46	3.69	0.46	3.69
AGS Unit 6	3.07	24.4	0.66	5.23	0.66	5.23
Maximum Months	36-47		36-47		36-47	

[a] Emission rates for exhaust sources are the total for all sources.

[b] Emission rates for the GE 7FA.05 turbines are for the load scenario resulting in the worst-case modeled impacts for the combined-cycle block.

Alamitos Energy Center

Table 5.1C.18

Combined-Cycle Power Block 1 Operation with Simple-Cycle Power Block 2 Construction and AGS Units 3, 4, and 6 Operation Building Parameters

October 2015

Building Name	Number of Tiers	Tier Number	Base Elevation (m)	Tier Height (m)	Number of Corners	Corner 1 East (X) (m)	Corner 1 North (Y) (m)	Corner 2 East (X) (m)	Corner 2 North (Y) (m)	Corner 3 East (X) (m)	Corner 3 North (Y) (m)	Corner 4 East (X) (m)	Corner 4 North (Y) (m)	Corner 5 East (X) (m)	Corner 5 North (Y) (m)	Corner 6 East (X) (m)	Corner 6 North (Y) (m)	Corner 7 East (X) (m)	Corner 7 North (Y) (m)	Corner 8 East (X) (m)	Corner 8 North (Y) (m)
HRSG01	1	1	4.57	28.9	4	398062	3736938	398091	3736937	398091	3736929	398062	3736930								
HRSG02	1	1	4.57	28.9	4	398062	3736894	398091	3736893	398091	3736885	398062	3736886								
7FAAIR01	1	1	4.57	22.8	8	398140	3736939	398133	3736939	398129	3736937	398119	3736937	398119	3736927	398129	3736927	398133	3736925	398140	3736925
7FAAIR02	1	1	4.57	22.8	8	398140	3736894	398132	3736895	398129	3736893	398119	3736893	398119	3736883	398129	3736883	398132	3736881	398139	3736881
ACC	1	1	4.57	31.7	4	398086	3736791	398176	3736789	398175	3736727	398085	3736729								
WALL	1	1	4.57	10.7	7	398037	3736937	398037	3736882	398038	3736882	398038	3736961	398093	3736959	398093	3736960	398038	3736962		
U12	1	1	4.57	39.7	4	397950	3737089	397950	3737116	398009	3737116	398009	3737089								
U3	1	1	4.57	37.0	4	398083	3737113	398110	3737113	398110	3737071	398083	3737071								
U4	1	1	4.57	37.0	4	398142	3737113	398171	3737113	398171	3737070	398142	3737070								
U5	1	1	4.57	47.2	4	398159	3736658	398190	3736658	398190	3736636	398159	3736636								
U6	1	1	4.57	47.2	4	398158	3736608	398190	3736608	398190	3736584	398158	3736584								

Alamitos Energy Center
Table 5.1C.19
Combined-Cycle Power Block 1 Operation with Simple-Cycle Power Block 2 Construction and AGS Units 3, 4, and 6 Operation Results
October 2015

		NO_2 (µg/m³) [a]			CO (µg/m³)		SO_2 (µg/m³)				PM_{10} (µg/m³)		$PM_{2.5}$ (µg/m³)	
Source	Year	1-hour	1-hour (federal) [b]	Annual	1-hour	8-hour	1-hour	1-hour (federal) [c]	3-hour	24-hour	24-hour	Annual	24-hour [b]	Annual
ALL		29.4	26.6	0.93	225	92.5	2.20	2.14	2.05	0.69	12.2	2.22	4.89	0.76
Exhaust		6.20	5.99	0.41	77.5	57.5	0.15	0.14	0.13	0.033	0.053	0.016	0.046	0.016
Fugitive	2006	-	-	-	-	-	-	-	-	-	11.9	2.00	4.09	0.53
AEC Operation		25.7	24.1	0.18	172	35.7	1.61	1.58	1.48	0.49	1.42	0.17	1.23	0.17
AGS Operation		7.67	7.08	0.56	103	65.3	0.98	0.94	0.91	0.31	0.58	0.14	0.46	0.14
ALL		29.6	24.5	0.86	226	96.3	2.29	2.08	1.99	0.68	12.4	2.11	4.93	0.72
Exhaust		6.15	5.97	0.41	76.9	51.7	0.14	0.14	0.12	0.032	0.051	0.016	0.045	0.016
Fugitive	2007	-	-	-	-	-	-	-	-	-	12.2	1.90	4.26	0.50
AEC Operation		24.8	21.0	0.16	165	30.4	1.61	1.45	1.48	0.48	1.40	0.16	0.91	0.16
AGS Operation		7.79	7.30	0.54	95.7	64.4	1.00	0.96	0.93	0.29	0.53	0.14	0.40	0.14
ALL		29.8	25.1	0.88	228	89.7	2.22	2.04	1.91	0.58	12.8	2.21	5.05	0.75
Exhaust		6.21	6.00	0.41	77.7	54.5	0.15	0.14	0.12	0.031	0.051	0.016	0.047	0.016
Fugitive	2008	-	-	-	-	-	-	-	-	-	12.2	1.99	4.29	0.53
AEC Operation		26.6	21.7	0.16	178	30.5	1.73	1.45	1.34	0.40	1.16	0.15	0.95	0.15
AGS Operation		7.71	7.29	0.57	94.1	61.6	0.99	0.95	0.90	0.26	0.48	0.15	0.39	0.15
ALL		28.9	25.6	0.88	229	104.5	2.28	2.15	2.06	0.70	12.1	2.24	5.02	0.75
Exhaust		6.24	5.90	0.41	78.0	52.7	0.15	0.14	0.14	0.031	0.050	0.016	0.046	0.016
Fugitive	2009	-	-	-	-	-	-	-	-	-	11.5	2.02	4.18	0.54
AEC Operation		24.9	21.8	0.16	167	33.6	1.54	1.47	1.41	0.45	1.31	0.16	1.12	0.16
AGS Operation		7.72	7.24	0.54	94.3	74.0	0.97	0.96	0.96	0.32	0.59	0.14	0.42	0.14
ALL		31.2	26.2	0.88	234	93.0	2.25	2.20	1.94	0.64	12.8	2.10	4.75	0.72
Exhaust		6.21	5.99	0.42	77.6	53.6	0.15	0.14	0.12	0.031	0.050	0.017	0.045	0.017
Fugitive	2011	-	-	-	-	-	-	-	-	-	11.8	1.88	4.13	0.50
AEC Operation		26.2	23.0	0.16	175	35.4	1.64	1.53	1.34	0.46	1.41	0.16	0.98	0.16
AGS Operation		7.79	7.42	0.53	114	65.0	1.04	0.98	0.89	0.27	0.50	0.13	0.38	0.13

[a] The maximum 1-hour and annual NO_2 concentrations include ambient NO_2 ratios of 0.80 (EPA, 2011) and 0.75 (EPA, 2005), respectively.

[b] The federal 1-hour NO_2 and 24-hour $PM_{2.5}$ results are the high-8th-high impacts modeled.

[c] The federal 1-hour SO_2 results are the high-4th-high impacts modeled.

Alamitos Energy Center
Table 5.1C.20a
First Quarter Wind Table
October 2015

Frequency Distribution (Hours)
Date Range: January 1 - March 31 (2006-2009 and 2011)

Wind Speed (m/s) Wind Direction (from)	0.25 - 0.5	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
N	0	437	162	1	0	0	0	600
NNE	0	922	141	3	0	0	0	1,066
NE	0	876	83	13	1	0	0	973
ENE	0	782	86	23	0	0	0	891
E	0	565	112	21	1	0	0	699
ESE	0	308	62	15	0	0	0	385
SE	0	297	183	57	13	1	0	551
SSE	0	239	213	53	3	0	0	508
S	0	211	308	35	1	0	0	555
SSW	0	198	282	29	0	0	0	509
SW	0	202	129	26	1	0	0	358
WSW	0	277	138	67	4	0	0	486
W	0	857	649	453	48	1	0	2,008
WNW	0	526	176	53	0	0	0	755
NW	0	178	20	1	0	0	0	199
NNW	0	157	24	2	0	0	0	183
Total	0	7,032	2,768	852	72	2	0	10,726

0 Calm Winds
98 Missing Winds

Alamitos Energy Center
Table 5.1C.20b
Second Quarter Wind Table
October 2015

Frequency Distribution (Hours)
Date Range: April 1 - June 30 (2006-2009 and 2011)

Wind Speed (m/s) Wind Direction (from)	0.25 - 0.5	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
N	0	164	13	2	0	0	0	179
NNE	0	283	19	0	0	0	0	302
NE	0	444	14	1	0	0	0	459
ENE	0	364	21	3	0	0	0	388
E	0	365	43	3	0	0	0	411
ESE	0	291	78	2	0	0	0	371
SE	0	494	332	24	0	0	0	850
SSE	0	448	451	24	0	0	0	923
S	0	385	682	57	2	0	0	1,126
SSW	0	254	511	53	0	0	0	818
SW	0	160	218	32	0	0	0	410
WSW	0	229	143	71	10	0	0	453
W	0	947	991	663	48	0	0	2,649
WNW	0	794	322	116	3	0	0	1,235
NW	0	160	14	2	0	0	0	176
NNW	0	106	4	0	0	0	0	110
Total	0	5,888	3,856	1,053	63	0	0	10,860

0 Calm Winds
60 Missing Winds

Alamitos Energy Center
Table 5.1C.20c
Third Quarter Wind Table
October 2015

Frequency Distribution (Hours)
Date Range: July 1 - September 30 (2006-2009 and 2011)

Wind Speed (m/s) Wind Direction (from)	0.25 - 0.5	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
N	0	217	9	4	0	0	0	230
NNE	0	350	3	1	0	0	0	354
NE	0	497	10	2	0	0	0	509
ENE	0	384	11	0	0	0	0	395
E	0	319	24	0	0	0	0	343
ESE	0	250	37	2	0	0	0	289
SE	0	448	203	11	0	0	0	662
SSE	0	451	331	21	0	0	0	803
S	0	368	568	28	0	0	0	964
SSW	0	224	452	25	0	0	0	701
SW	0	177	197	14	0	0	0	388
WSW	0	228	117	9	0	0	0	354
W	0	1,127	972	506	3	0	0	2,608
WNW	0	1,174	484	233	1	0	0	1,892
NW	0	252	29	4	0	0	0	285
NNW	0	136	4	0	0	0	0	140
Total	0	6,602	3,451	860	4	0	0	10,917

0 Calm Winds
146 Missing Winds

Alamitos Energy Center
Table 5.1C.20d
Fourth Quarter Wind Table
October 2015

Frequency Distribution (Hours)
Date Range: October 1 - December 31 (2006-2009 and 2011)

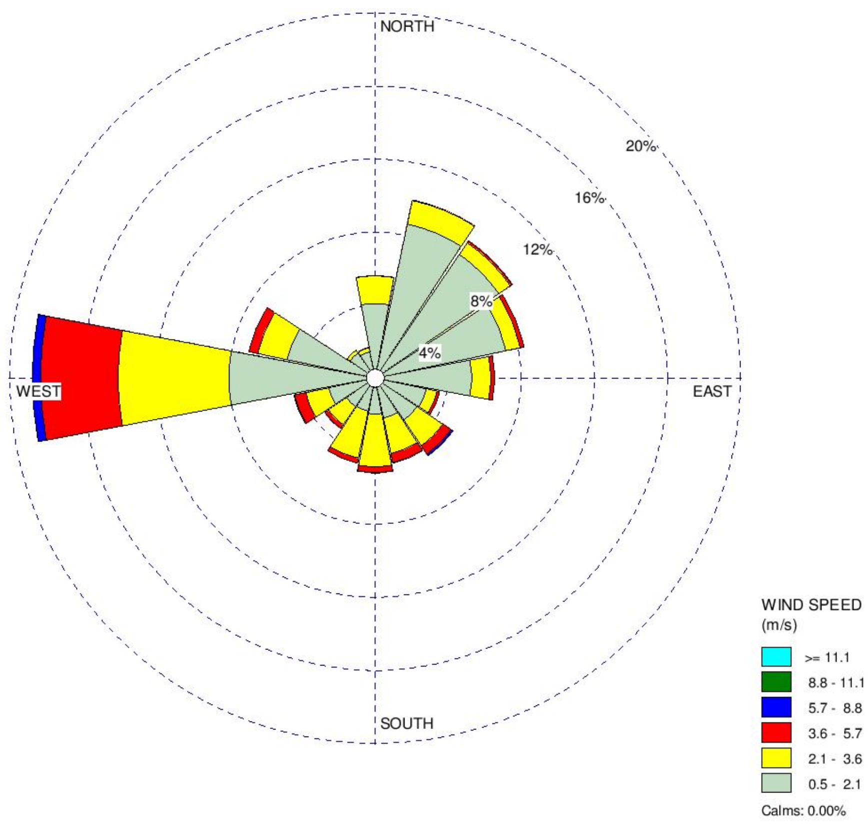
Wind Speed (m/s) Wind Direction (from)	0.25 - 0.5	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
N	0	492	154	17	3	0	0	666
NNE	0	1,033	111	46	10	0	0	1,200
NE	0	1,070	82	40	9	0	1	1,202
ENE	0	834	73	35	1	0	0	943
E	0	545	113	30	5	3	1	697
ESE	0	259	41	11	0	0	1	312
SE	0	262	100	25	12	2	1	402
SSE	0	194	153	21	2	1	0	371
S	0	235	235	20	1	0	1	492
SSW	0	228	208	21	1	0	0	458
SW	0	176	94	11	2	0	0	283
WSW	0	299	133	42	4	0	0	478
W	0	974	627	242	37	0	0	1,880
WNW	0	776	264	67	15	0	0	1,122
NW	0	230	28	4	2	1	0	265
NNW	0	172	24	6	1	0	0	203
Total	0	7,779	2,440	638	105	7	5	10,974

1 Calm Wind
42 Missing Winds

Alamitos Energy Center
Figure 5.1C-1a
First Quarter Wind Rose
October 2015

Date Range: January 1 – March 31 (2006-2009 and 2011)

WIND ROSE PLOT:	DISPLAY:
AERMET 14134 Meteorological Data **SCAQMD Long Beach Station**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 1/1/2006 - 00:00 **End Date: 3/31/2011 - 23:00**	MODELER:	
	CALM WINDS: **0.00%**	TOTAL COUNT: **10726 hrs.**	
	AVG. WIND SPEED: **1.87 m/s**	DATE: **10/19/2015**	PROJECT NO.:

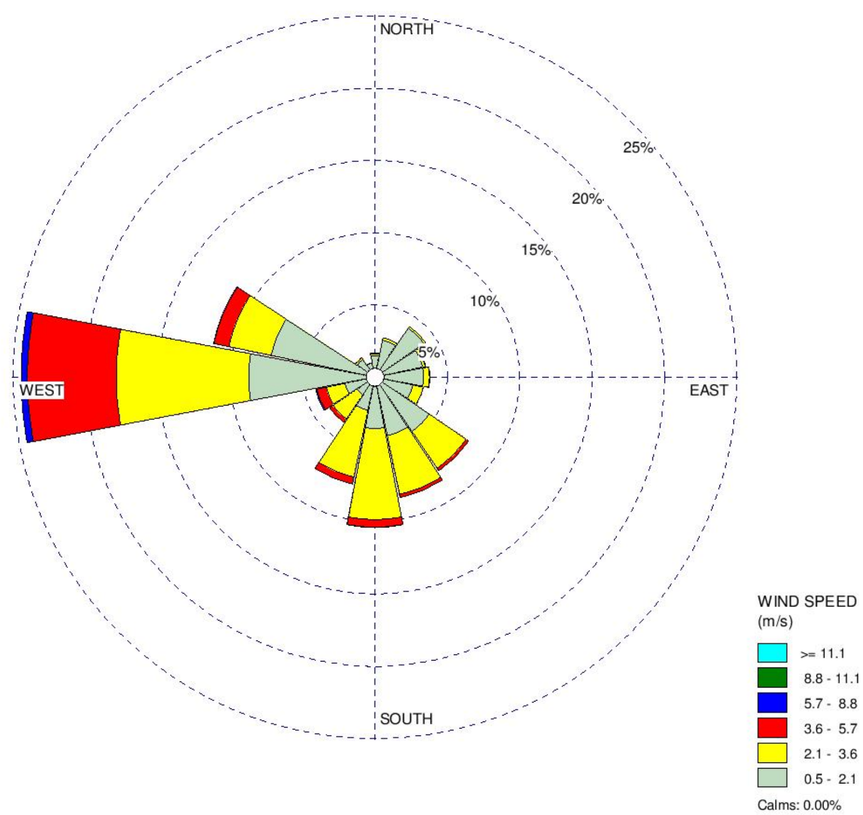
WRPLOT View - Lakes Environmental Software

Alamitos Energy Center
Figure 5.1C-1b
Second Quarter Wind Rose
October 2015

Date Range: April 1 – June 30 (2006-2009 and 2011)

WIND ROSE PLOT:
AERMET 14134 Meteorological Data
SCAQMD Long Beach Station

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 4/1/2006 - 00:00 **End Date: 6/30/2011 - 23:00**	MODELER:	
	CALM WINDS: **0.00%**	TOTAL COUNT: **10860 hrs.**	
	AVG. WIND SPEED: **2.05 m/s**	DATE: **10/19/2015**	PROJECT NO.:

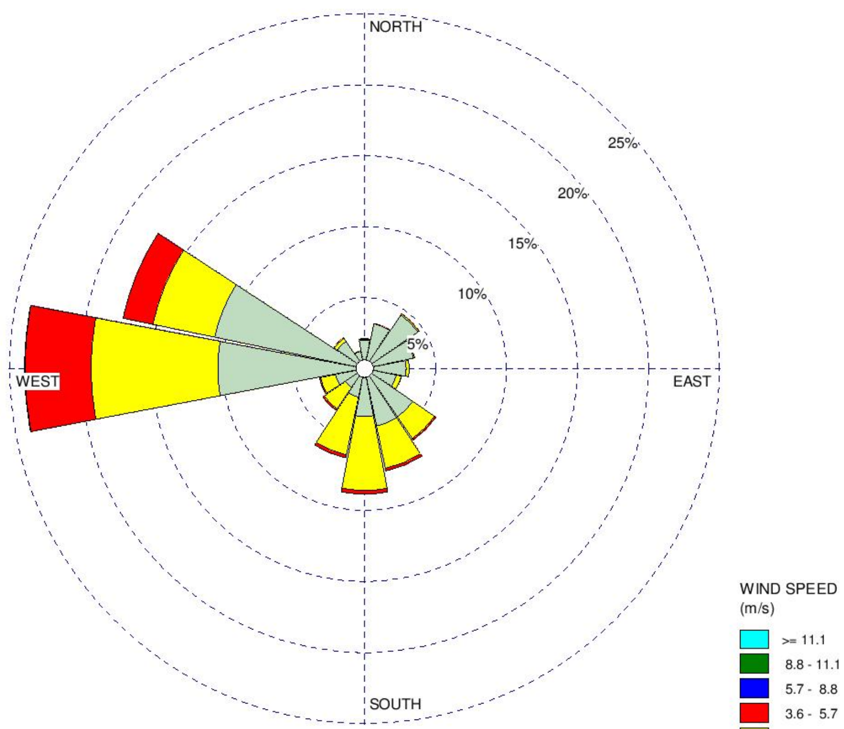
WRPLOT View - Lakes Environmental Software

Alamitos Energy Center
Figure 5.1C-1c
Third Quarter Wind Rose
October 2015

Date Range: July 1 – September 30 (2006-2009 and 2011)

WIND ROSE PLOT:
AERMET 14134 Meteorological Data
SCAQMD Long Beach Station

DISPLAY:
Wind Speed
Direction (blowing from)



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	AVG. WIND SPEED: **1.86 m/s**	DATE: **10/19/2015**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Alamitos Energy Center
Figure 5.1C-1d
Fourth Quarter Wind Rose
October 2015

Date Range: October 1 – December 31 (2006-2009 and 2011)

WIND ROSE PLOT:	DISPLAY:
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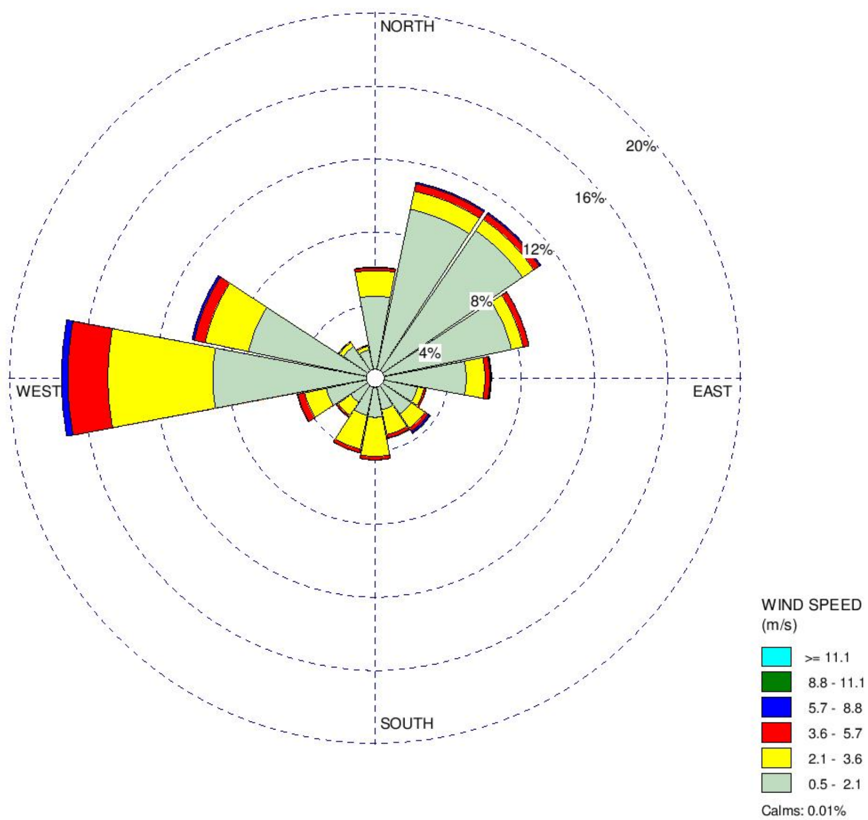

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	AVG. WIND SPEED: **1.77 m/s**	DATE: **10/19/2015**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

Alamitos Energy Center
Figure 5.1C-1e
Annual Wind Rose
October 2015

Date Range: January 1 – December 31 (2006-2009 and 2011)

WIND ROSE PLOT:
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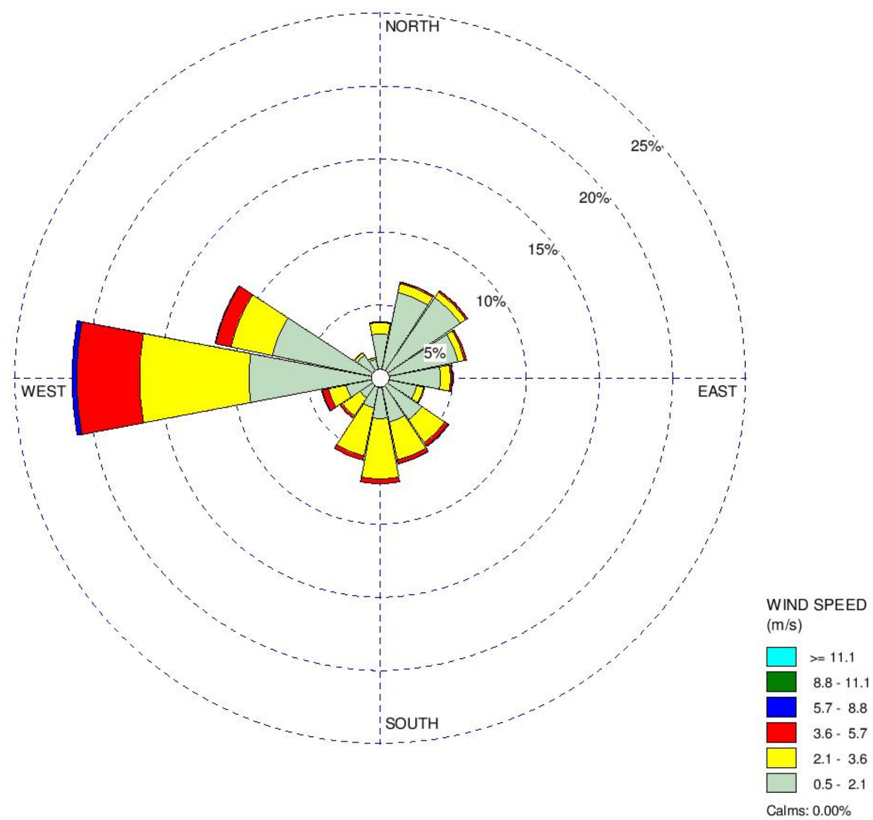
SCAQMD Long Beach Station

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
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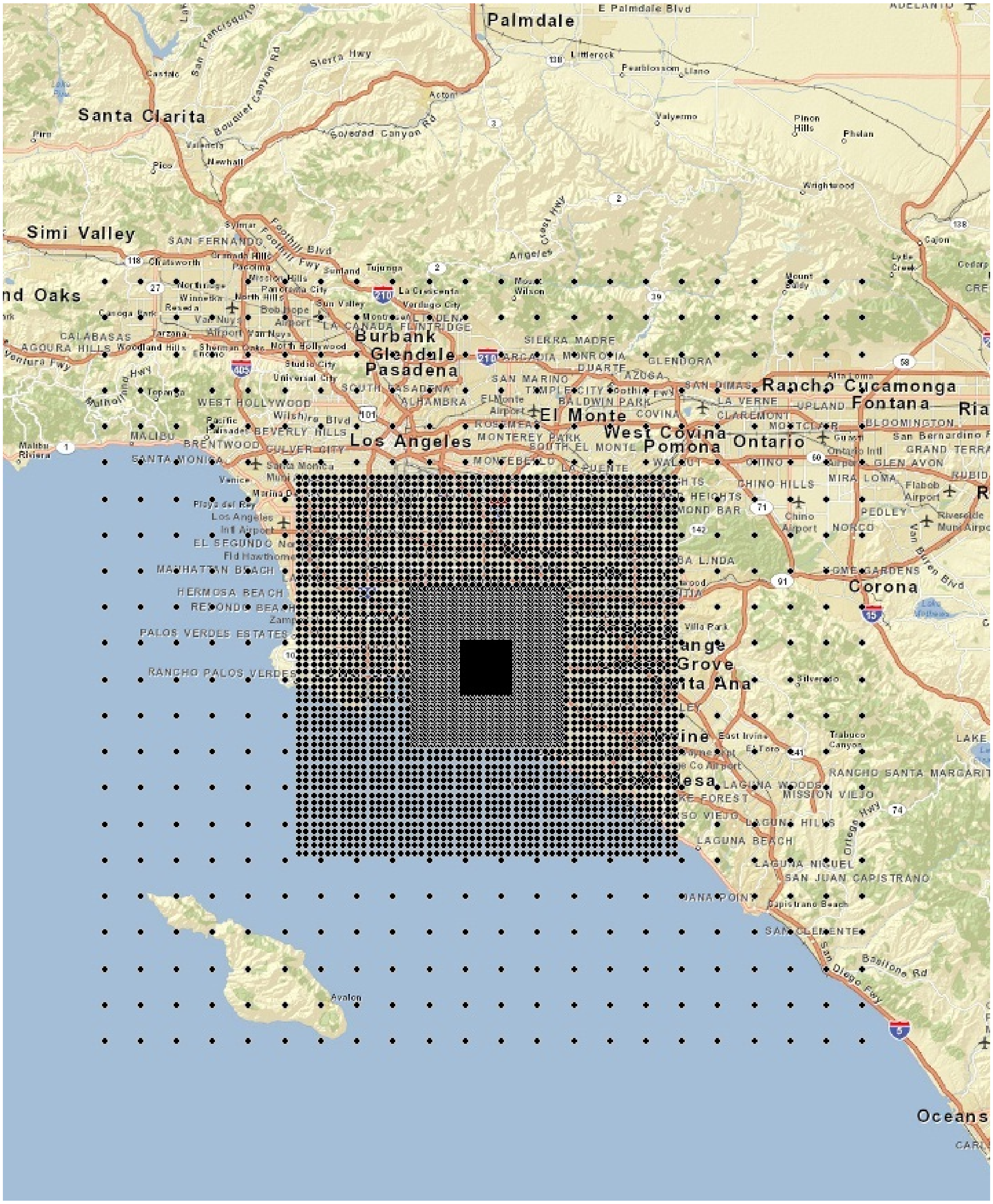
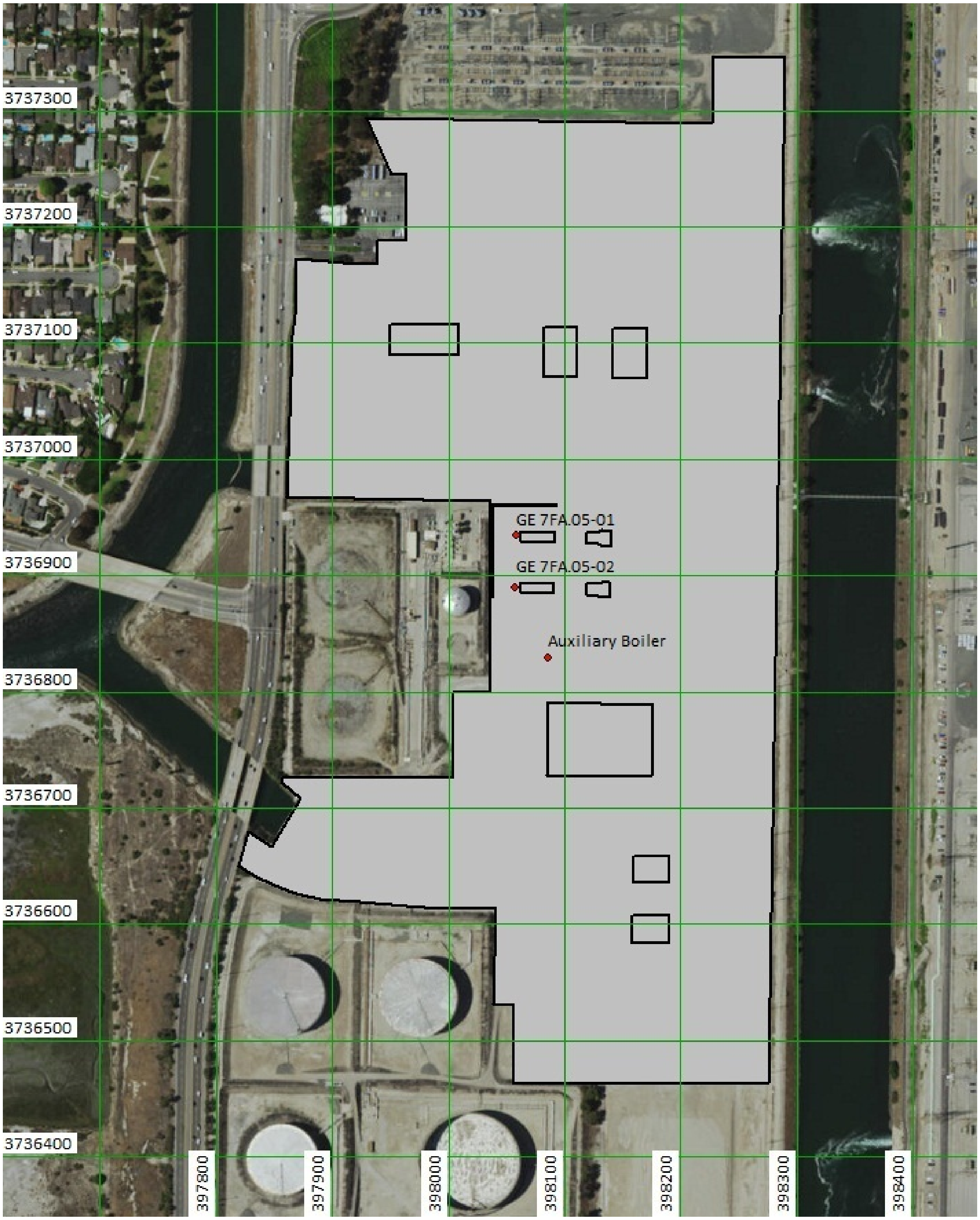
WRPLOT View - Lakes Environmental Software

Alamitos Energy Center
Figure 5.1C-2
Receptor Grid for AEC Modeling
October 2015



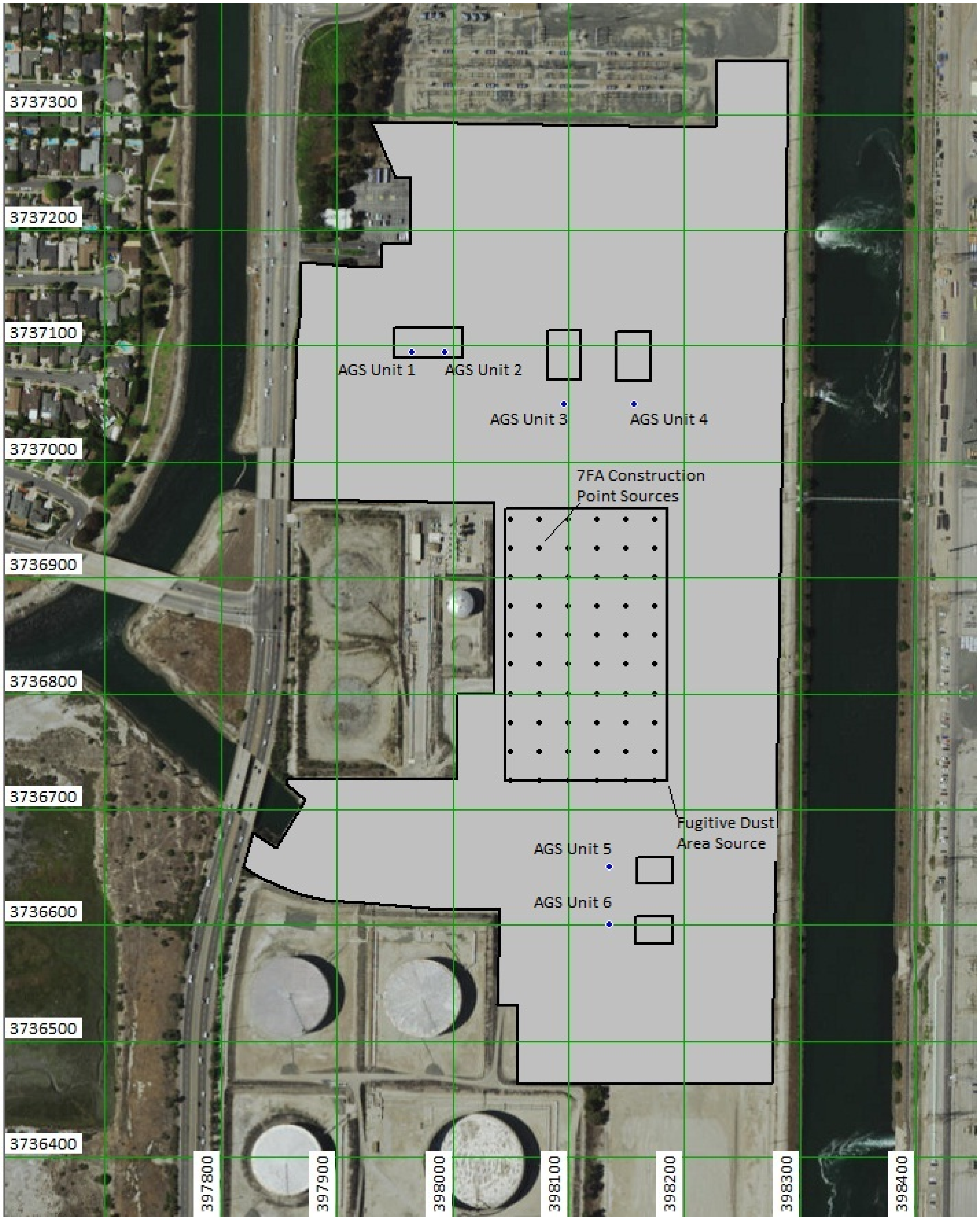
Alamitos Energy Center
Figure 5.1C-3
AERMOD 7FA.05 Commissioning Model Setup
October 2015



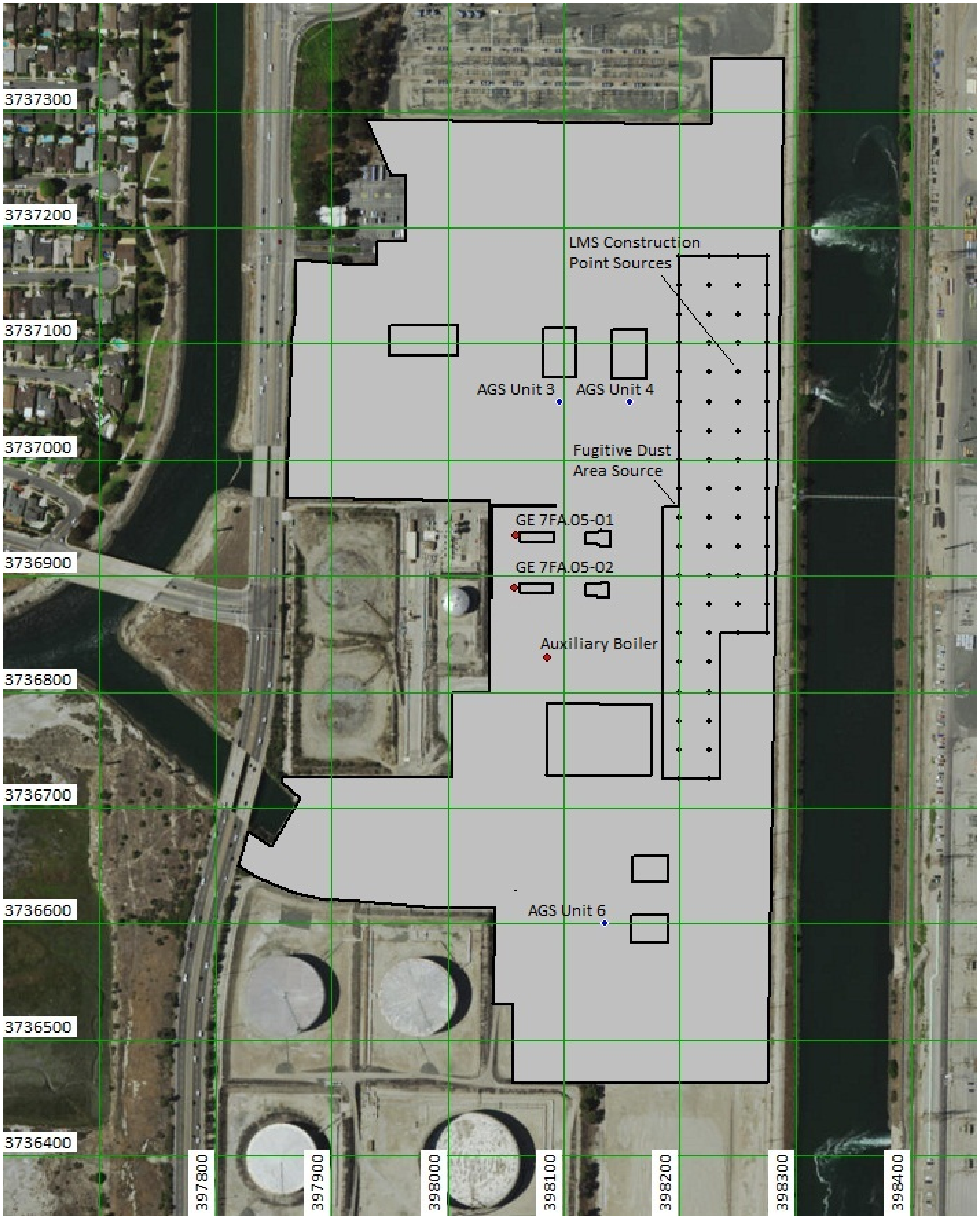
Alamitos Energy Center
Figure 5.1C-4
AERMOD LMS-100 Commissioning Model Setup
October 2015

Alamitos Energy Center
Figure 5.1C-5
AERMOD Operational Model Setup
October 2015

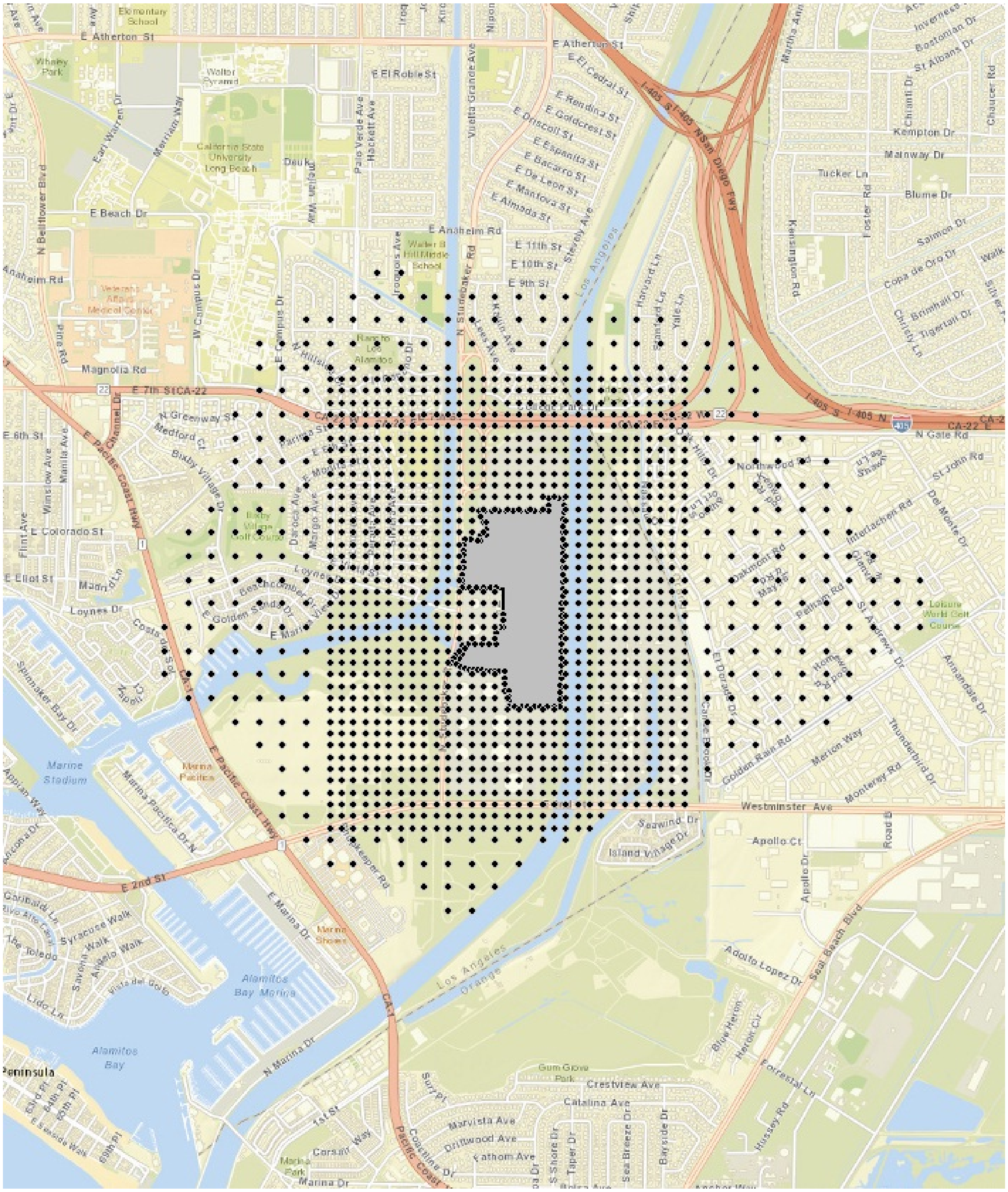
Alamitos Energy Center
Figure 5.1C-6
AERMOD Combined-Cycle Power Block 1 Construction with AGS Units 1 – 6 Operation Model Setup
October 2015



Alamitos Energy Center
Figure 5.1C-7
AERMOD Combined-Cycle Power Block 1 Operation with Simple-Cycle Power Block 2 Construction and AGS Units 3, 4, and 6 Operation
Model Setup
October 2015



Alamitos Energy Center
Figure 5.1C-8
Competing Source Receptor Grid
October 2015



Appendix 5.1D
Criteria Pollutant and Greenhouse Gas BACT Analysis

BACT Determination for the Alamitos Energy Center

Prepared for

AES Alamitos Energy, LLC

Submitted to

South Coast Air Quality Management District
EPA Region IX

October 2015

CH2MHILL®

Contents

Acronyms and Abbreviations

°F	degree(s) Fahrenheit
AEC	Alamitos Energy Center
AES	Alamitos Energy, LLC
AGS	Alamitos Generating Station
BAAQMD	Bay Area Air Quality Management District
BACT	best available control technology
Btu/kWh	British thermal units per kilowatt-hour
CARB	California Air Resources Board
CCS	carbon capture and storage
CEC	California Energy Commission
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
CPUC	California Public Utilities Commission
CPV	Competitive Power Ventures
CTG	combustion turbine generator
DLN	dry low NO_x
DOE	U.S. Department of Energy
EOR	enhanced oil recovery
EPA	U.S. Environmental Protection Agency
GE	General Electric
GHG Tailoring Rule	Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule
GHG	greenhouse gases
GJ	gigajoule(s)
H_2	hydrogen
HFC	hydrofluorocarbon
hp	horsepower
HRSG	heat recovery steam generator
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram(s)
LAER	Lowest Achievable Emission Rate
lb	pound(s)
lb/event	pound(s) per event
lb/hr	pound(s) per hour
lb/MWh	pound(s) per megawatt-hour
Mandatory Reporting Rule	EPA Final Mandatory Reporting of Greenhouse Gases Rule
MMBtu	million British thermal units
MMBtu/hr	million British thermal units per hour
$MTCO_2$/MWh	metric ton(s) of carbon dioxide per megawatt-hour
MW	megawatt(s)
MWh	megawatt-hour(s)
N_2	nitrogen
N_2O	nitrous oxide
N/A	not applicable
NATCARB	National Carbon Sequestration Database and Geographic Information System
NETL	National Energy Technology Laboratory
NGCC	natural gas combined-cycle

NO	nitric oxide
NO_2	nitrogen dioxide
NO_x	oxides of nitrogen
NSR	New Source Review
O_2	oxygen
OTC	once-through cooling
PFC	perfluorocarbons
PM	particulate matter
PM_{10}	and particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
ppm	part(s) per million
ppmv	part(s) per million by volume
ppmvd	part(s) per million dry volume
PSA	pressure swing adsorption
PSD	Prevention of Significant Deterioration
psig	pound(s) of force per square inch gauge
PTE	Potential to Emit
RACT	Retrofit Available Control Technology
RPS	Renewable Portfolio Standard
SCAQMD	South Coast Air Quality Management District
scf	standard cubic feet
SCR	selective catalytic reduction
SF_6	sulfur hexafluoride
SJVAPCD	San Joaquin Valley Air Pollution Control District
SNCR	selective non-catalytic reduction
SO_2	sulfur dioxide
SoCalCarb	Southern California Carbon Sequestration Research Consortium
SoCalGas	Southern California Gas
SO_x	sulfur oxides
STG	steam turbine generator
tpy	ton(s) per year
VOC	volatile organic compound
WestCarb	West Coast Regional Carbon Sequestration Partnership

SECTION 1

Project Description

1.1 Project Overview

AES Alamitos Energy, LLC (AES) proposes to construct the Alamitos Energy Center (AEC or project) at the existing AES Alamitos Generating Station (AGS) site at 690 N. Studebaker Road, Long Beach, CA 90803. The AEC will consist of two power blocks, with one power block consisting of a two-on-one combined-cycle power block with a capacity of 640 megawatts (MW) and a second power block consisting of four simple-cycle gas turbines with a capacity of 400 MW.

The combined-cycle power block will consist of two General Electric (GE) Frame 7FA.05 combustion turbine generators (CTG), one steam turbine generator (STG), an auxiliary boiler, an ammonia tank, an oil water separator and an air-cooled condenser. Each CTG will be equipped with an unfired heat recovery steam generator (HRSG). The CTGs will use dry low oxides of nitrogen (NO_x) (DLN) burners and selective catalytic reduction (SCR) to limit NO_x emissions to 2 parts per million by volume (ppmv). Emissions of carbon monoxide (CO) will be limited to 2 ppmv and volatile organic compounds (VOC) to 2 ppmv through the use of best combustion practices and an oxidation catalyst. Best combustion practices and burning pipeline-quality natural gas will minimize emissions of the remaining pollutants.

The simple-cycle power block will consist of four GE LMS-100 CTGs, an ammonia storage tank, an oil water separator, and an air-cooled fin-fan cooler. The CTGs will use DLN burners and SCR to limit NO_x emissions to 2.5 ppmv. Emissions of CO will be limited to 4 ppmv and VOC to 2 ppmv through the use of best combustion practices and an oxidation catalyst. Best combustion practices and burning pipeline-quality natural gas will minimize emissions of the remaining pollutants.

The auxiliary boiler will be a natural-gas-fired unit, including flue gas recirculation and SCR to reduce NO_x and CO emissions to 5 ppmv and 50 ppmv, respectively. The auxiliary boiler will be used to reduce the startup duration of the combined-cycle power block, thereby reducing air emissions.

Authorization for the construction and operation of the AEC will be through the California Energy Commission (CEC) licensing process and the SCAQMD New Source Review/Prevention of Significant Deterioration (NSR/PSD) permitting process. Because the AEC includes the use of steam to generate electricity, the project is also categorized as one of the 28 major PSD source categories (40 Code of Federal Regulations [CFR] 52.21(b)(1)(i)). Therefore, the project is subject to PSD permitting requirements if the Potential to Emit (PTE) from the project exceeds 100 tons per year (tpy) for any regulated pollutant.

The project PTE is expected to exceed the major source threshold for at least one of the PSD-regulated pollutants. Therefore, the project will be considered a major stationary source in accordance with PSD regulations. The SCAQMD has also been delegated partial PSD permitting authority.[1] Therefore, the PSD BACT analysis is being submitted to the SCAQMD as part of the permitting process.

1.2 Project Objectives

The AEC's key design objective is to provide up to 1,040 MW of environmentally responsible, cost-effective, operationally flexible, and efficient generating capacity to the western Los Angeles Basin Local Reliability Area in general, and specifically to the coastal area of Los Angeles County. The project would serve local area reliability needs, southern California energy demand, and provide controllable generation to allow the integration of the ever-increasing contribution of intermittent renewable energy into the electrical grid. The project will displace older and less efficient generation in southern California, and has been designed to start and stop very quickly and be able to quickly ramp up and down through a wide range of generating capacity. As more renewable electrical resources are brought on line as a result of electric utilities meeting California's Renewable Portfolio Standard

[1] http://www.epa.gov/region09/air/permit/pdf/full-scagmd-psd-delegation.pdf

(RPS), projects strategically located within load centers and designed for fast starts and ramp-up and down capability, such as the AEC, will be critical in supporting both local electrical reliability and grid stability.

The project objectives are also contingent on the use of the offset exemption contained within SCAQMD's Rule 1304(a)(2), which allows for the replacement of older, less-efficient electric utility steam boilers with specific new generation technologies on a MW-to-MW basis (that is, the replacement MW are equal to or less than the MW from the electric utility steam boilers). The offset exemption in Rule 1304(a)(2) requires the electric utility steam boiler to be replaced with one of several specific technologies, including the combined-cycle configuration proposed for the AEC.

The basic project objectives include, but are not limited to, the following:

- Develop a project capable of providing energy, generating capacity and ancillary electrical services (voltage support, spinning reserve, inertia) to satisfy Los Angeles Basin Local Reliability Area requirements and transmission grid support, particularly in the western sub-area of the Los Angeles Basin.
- Provide fast starting and stopping, flexible, controllable generation with the ability to ramp up and down through a wide range of electrical output to allow the integration of the renewable energy into the electrical grid in satisfaction of California's Renewable Portfolio Standard, displacing older and less-efficient generation.
- Utilize the existing brownfield power plant site and infrastructure, including the existing Alamitos Generating Station (AGS) switchyard and related facilities, the Southern California Edison (SCE) switchyard and transmission facilities, the Southern California Gas Company (SoCalGas) natural gas pipeline system, the Long Beach Water Department (LBWD) water connections, process water supply lines, existing fire suppression and emergency service facilities, and the administration, maintenance and certain warehouse buildings.
- Use qualifying technology under the South Coast Air Quality Management District's (SCAQMD) Rule 1304(a)(2) that allows for the replacement of older, less-efficient electric utility steam boilers with specific new generation technologies on a megawatt to megawatt basis (that is, the replacement megawatts are equal or less than the megawatts from the electric utility steam boilers).

Locating the project on an existing power plant site avoids the need to construct new linear facilities, including gas and water supply lines, discharge lines, and transmission interconnections. This reduces potential offsite environmental impacts, and the cost of construction. The proposed AEC site meets all project siting objectives.

The AEC will provide power to the grid to help meet the need for electricity and to help replace dirtier, less efficient fossil fuel generation resources. The AEC will enhance the reliability of the state's electrical system by providing power generation near the centers of electrical demand and providing fast response generating capacity to enable increased renewable energy development. Additionally, as demonstrated by the analyses contained in the CEC licensing documentation, the project would not result in any significant environmental impacts.

SECTION 2

Criteria Pollutant BACT Analysis

Based on SCAQMD's BACT definition and major source thresholds (SCAQMD Rules 1302 and 1303), a BACT analysis is required for the uncontrolled emissions of NO_x, VOC, CO, sulfur oxides (SO_x), and particulate matter less than 10 microns in diameter (PM_{10}) and particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). Also, the U.S. Environmental Protection Agency (EPA) requires a BACT analysis for the emissions of greenhouse gases (GHGs) as part of the PSD permit application required under the EPA Tailoring Rule. The GHG BACT analysis is included in the following section.

AES plans to rely on the response characteristics of the GE CTGs and auxiliary boiler to provide a wide range of efficient, operationally flexible, fast-start, fast-ramping capacity to allow for the efficient integration of renewable energy sources into the California electrical grid. Table 2-1 presents the proposed permit levels for the combined- and simple-cycle CTGs.

TABLE 2-1

Maximum Pollutant Emission Rates for Operation of the AEC

Pollutant	Emission Limits (at 15% O_2)		
	One GE 7FA.05 [a]	**One GE LMS-100PB [b]**	**One Auxiliary Boiler [c]**
VOC	2 ppmv (averaged over 1-hour)	2 ppmv (averaged over 1-hour)	0.28 lb/hr
CO	2 ppmv (averaged over 1-hour)	4 ppmv (averaged over 1-hour)	50 ppmv (averaged over 1-hour)
NO_x	2 ppmv (averaged over 1-hour)	2.5 ppmv (averaged over 1-hour)	5 ppmv (averaged over 1-hour)
SO_x	<0.75 grain of sulfur per 100 dry standard cubic feet of natural gas		0.048 lb/hr
$PM_{10/2.5}$	8.50 lb/hr	6.23 lb/hr	0.30 lb/hr
Ammonia	5 ppmv	5 ppmv	5 ppmv
GHG [d]	784 lb CO_2/MWh (Net)	1,138 lb CO_2/MWh (Net)	N/A

[a] Maximum values are for each turbine at an ambient temperature of 32°F and excludes startups and shutdowns.

[b] Maximum values are for each turbine at an ambient temperature of 65.8°F and excludes startups and shutdowns.

[c] Maximum hourly emission rates assume 100 percent load.

[d] Includes an 8 percent degradation.

Notes:

CO_2 = carbon dioxide

°F = degrees Fahrenheit

N/A = not applicable (i.e., BACT analysis not required)

O_2 = oxygen

lb/hr = pound(s) per hour

lb/MWh = pound(s) per megawatt-hour

The following discussion presents an assessment of the BACT for the AEC and includes the following components:

- Outline of the methodology used to conduct the criteria pollutant BACT analyses
- Discussion of the available technology options for controlling NO_x, CO, VOC, PM_{10}, $PM_{2.5}$, and SO_x emissions
- Presentation of the proposed BACT emission levels identified for the AEC

2.1 Methodology for Evaluating the Criteria Pollutant BACT Emission Levels

The NO_x, CO, VOC, PM_{10}, $PM_{2.5}$, and SO_x BACT analysis for the AEC is based on EPA's top-down analysis method. The following top-down analysis steps are listed in EPA's *New Source Review Workshop Manual* (EPA, 1990):

- Step 1: Identify all control technologies
- Step 2: Eliminate technically infeasible options
- Step 3: Rank remaining control technologies by control effectiveness
- Step 4: Evaluate the most-effective controls, and document the results
- Step 5: Select the BACT

As part of the control technology ranking step (Step 3), emission limits for other recently permitted natural-gas-fired combustion turbines were compiled based on a search of the various federal, state, and local BACT, Retrofit Available Control Technology (RACT), and Lowest Achievable Emission Rate (LAER) databases. The following databases were included in the search:

- **EPA RACT/BACT/LAER Clearinghouse (EPA, 2015)**
  - Search included the NO_x, CO, VOC, particulate matter (PM), and sulfur dioxide (SO_2) BACT/LAER determinations for combined-cycle and simple-cycle combustion turbines with permit dates between 2001 and September 2015.
- **California Air Pollution Control Officers Association/California Air Resources Board (CARB) BACT Clearinghouse (CARB, 2015)**
  - Search included the BACT determinations listed in CARB's BACT clearinghouse for combined-cycle and simple-cycle turbines from all California air districts.
- **Local Air Pollution Control Districts BACT Guidelines/Clearinghouses:**
  - **SCAQMD BACT Guidelines (SCAQMD, 2015)**
    - Search included the BACT determinations for combined-cycle and simple-cycle gas turbines listed in SCAQMD BACT Guidelines for major sources.
  - **Bay Area Air Quality Management District (BAAQMD) BACT/Toxics BACT Guidelines (BAAQMD, 2015)**
    - Search included the BACT determinations for combined-cycle and simple-cycle turbines equal to or greater than 40 MW in Section 2, Combustion Sources, in the BAAQMD BACT Guidelines.
  - **San Joaquin Valley Air Pollution Control District (SJVAPCD) BACT Clearinghouse (SJVAPCD, 2015)**
    - Search included the BACT determinations listed under the SJVAPCD BACT Guideline Section 3.4.2 (combined- and simple-cycle, uniform-load gas turbines greater than 50 MW)
- **BACT Analyses for Recently Permitted Combustion Turbine CEC Projects (CEC, 2015)**
  - Review included the BACT analysis for the Pio Pico, GWF Tracy, Hanford, and Henrietta projects, the Oakley Generating Station Project, the Mariposa Energy Project, the Russell City Energy Center, the Los Esteros Critical Energy Facility – Phase 1 and Phase 2, the Palmdale Hybrid Power Project, the El Segundo Power Project, the Carlsbad Power Project, and the Watson Cogeneration and Electric Reliability Project.

The natural-gas-fired combustion turbine permit emission limits for each of the BACT pollutants at other recently permitted facilities were then compared to the proposed emission limits for the AEC, as set forth in Table 2-1. If the emission limits at other facilities were less than the values in Table 2-1, additional research was conducted to find which turbine technology had been selected and whether the facilities had been constructed (Step 3). If it could be demonstrated that other units with lower emission rates either had not yet been built or used a different turbine technology than that selected for the AEC, the proposed emission limits for the AEC were determined to be BACT (Step 5).

2.2 Criteria Pollutant BACT Analysis

2.2.1 NO_x

NO_x is a byproduct of the combustion of an air-and-fuel mixture in a high-temperature environment. NO_x is formed when the heat of combustion causes the nitrogen (N_2) molecules in the combustion air to dissociate into individual N_2 atoms, which then combine with oxygen (O_2) atoms to form nitric oxide (NO) and nitrogen dioxide (NO_2). The principal form of nitrogen oxide produced during turbine combustion is NO, but NO reacts quickly to form NO_2, creating a mixture of NO and NO_2 commonly called NO_x.

2.2.1.1 Identification of NO_x Emissions Control Technologies – Step 1

Several combustion and post-combustion technologies are available for controlling turbine NO_x emissions. Combustion controls minimize the amount of NO_x created during the combustion process, and post-combustion controls remove NO_x from the exhaust stream after the combustion has occurred. Following are the three basic strategies for reducing NO_x during the combustion process:

1. Reduction of the peak combustion temperature
2. Reduction in the amount of time the air and fuel mixture is exposed to the high combustion temperature
3. Reduction in the O_2 level in the primary combustion zone

Following is a discussion of the potential control technologies for combined-cycle and simple-cycle combustion turbines:

NO_x Combustion Control Technologies. The two combustion controls for combustion turbines are (1) the use of water or steam injection, and (2) DLN combustors, which include lean premix and catalytic combustors.

Water or Steam Injection. The injection of water or steam into the combustor of a gas turbine quenches the flame and absorbs heat, reducing the combustion temperature. This temperature reduction reduces the formation of thermal NO_x. Water or steam injection also allows more fuel to be burned without overheating critical turbine parts, increasing the combustion turbine maximum power output. Combined with a post-combustion control technology, water or injection can achieve NO_x emission levels of 25 part(s) per million dry volume (ppmvd) at 15 percent O_2, but with the added economic, energy, and environmental expense of using water.

DLN Combustors. Conventional combustors are diffusion-controlled. The fuel and air are injected separately, with combustion occurring at the stoichiometric interfaces. This method of combustion results in combustion "hot spots," which produce higher levels of NO_x. The lean premix and catalytic technologies are two types of DLN combustors that are available alternatives to the conventional combustors to reduce NO_x combustion "hot spots."

In the lean premix combustor, which is the most popular DLN combustor available, the combustors reduce the formation of thermal NO_x through the following: (1) using excess air to reduce the flame temperature (i.e., lean combustion); (2) reducing combustor residence time to limit exposure in a high-temperature environment; (3) mixing fuel and air in an initial "pre-combustion" stage to produce a lean and uniform fuel/air mixture that is delivered to a secondary stage where combustion takes place; and/or (4) achieving two-stage rich/lean combustion using a primary fuel-rich combustion stage to limit the amount of O_2 available to combine with N_2 and then a secondary lean burn-stage to complete combustion in a cooler environment. Lean premix combustors have only been developed for gas-fired turbines. The more-advanced designs are capable of achieving a 70- to 90 percent NO_x reduction with a vendor-guaranteed NO_x concentration of 9 to 25 ppmvd.

Catalytic combustors use a catalyst to allow the combustion reaction to take place with a lower peak flame temperature to reduce thermal NO_x formation. The catalytic combustor uses a flameless catalytic combustion module, followed by completion of combustion (at lower temperatures) downstream of the catalyst.

Post-combustion NO_x Control Technologies. Three post-combustion controls are available for combustion turbines: (1) SCR, (2) SCONOx™ (that is, EMx), and (3) selective non-catalytic reduction (SNCR). Both SCR and EMx control technologies use a catalyst bed to control the NO_x emissions and, combined with DLN or water injection, are capable of achieving NO_x emissions levels of 2.0 ppmvd for combined-cycle gas turbines and 2.5 ppmvd for simple-cycle combustion turbines. EMx uses a hydrogen regeneration gas to convert the NO_x to elemental N_2 and water. SNCR also uses ammonia to control NO_x emissions but without a catalyst.

Selective Catalytic Reduction. SCR is a post-combustion control technology designed to control NO_x emissions from gas turbines. The SCR system is placed inside the exhaust ductwork and consists of a catalyst bed with an ammonia injection grid located upstream of the catalyst. The ammonia reacts with the NO_x and O_2 in the presence of a catalyst to form N_2 and water. The catalyst consists of a support system with a catalyst coating typically of titanium dioxide, vanadium pentoxide, or zeolite. A small amount of ammonia is not consumed in the reaction and is emitted in the exhaust stream; this is referred to as "ammonia slip."

EMx System. The EMx system uses a single catalyst to remove NO_x emissions in the turbine exhaust gas by oxidizing NO to NO_2 and then absorbing NO_2 onto the catalytic surface using a potassium carbonate absorber coating. The potassium carbonate coating reacts with NO_2 to form potassium nitrites and nitrates, which are deposited onto the catalyst surface. The optimal temperature window for operation of the EMx catalyst is from 300 to 700 degrees Fahrenheit (°F). EMx does not use ammonia, so there are no ammonia emissions from this catalyst system (CARB, 2004).

When all of the potassium carbonate absorber coating has been converted to N_2 compounds, NO_x can no longer be absorbed and the catalyst must be regenerated. Regeneration is accomplished by passing a dilute hydrogen-reducing gas across the surface of the catalyst in the absence of O_2. Hydrogen in the gas reacts with the nitrites and nitrates to form water and N_2. Carbon dioxide (CO_2) in the gas reacts with the potassium nitrite and nitrates to form potassium carbonate, which is the absorbing surface coating on the catalyst. The regeneration gas is produced by reacting natural gas with a carrier gas (such as steam) over a steam-reforming catalyst (CARB, 2004).

Selective Non-catalytic Reduction. SNCR involves injection of ammonia or urea with proprietary conditioners into the exhaust gas stream without a catalyst. SNCR technology requires gas temperatures in the range of 1,600 to 2,100°F[2]. This technology is not available for combustion turbines because gas turbine exhaust temperatures are below the minimum temperature required of 1,600°F.

2.2.1.2 Eliminate Technically Infeasible Options – Step 2

Pre-combustion NO_x Control Technologies

Water or Steam Injection. The use of water or steam injection is considered a feasible technology for reducing NO_x emissions to 25 ppmvd when firing natural gas under most ambient conditions. Combined with SCR, water or steam injection can achieve the proposed NO_x emission levels but at a slightly lower thermal efficiency as compared to DLN combustors.

DLN Combustors. The use of DLN combustors is a feasible technology for reducing NO_x emissions from the AEC. DLN combustors are capable of achieving 9 to 25 ppmvd NO_x emissions over a relatively large operating range (70 to 100 percent load), and when combined with SCR can achieve the proposed NO_x emission levels.

The XONON™ technology has been demonstrated successfully in a 1.5-MW simple-cycle pilot facility, and it is commercially available for turbines rated up to 10 MW, but catalytic combustors such as XONON™ have not been demonstrated on an industrial E Class gas turbine. Therefore, the technology is not considered feasible for the proposed AEC.

[2] http://www.icac.com/i4a/pages/index.cfm?pageid=3399

Post-combustion NO_x Control Technologies

Selective Catalytic Reduction. The use of SCR, with an ammonia slip of less than 5 part(s) per million (ppm), is considered a feasible technology for reducing NO_x emissions to the proposed levels.

EMx System. In the Palmdale Hybrid Power Project PSD permit, EPA noted that it appears EMx has only been demonstrated to achieve 2.5 ppm NO_x (EPA, 2011a). In addition, the BAAQMD concluded in a recent permitting case that "it is clear that EMx is not as developed as SCR at this time and cannot achieve the same level of emissions performance that SCR is capable of" (BAAQMD, 2011). Therefore, EMx technology is not considered feasible for achieving the proposed levels.

Selective Non-catalytic Reduction. SNCR requires a temperature window that is higher than the exhaust temperatures from natural-gas-fired combustion turbine installations. Therefore, SNCR is not considered technically feasible for the proposed AEC.

2.2.1.3 NO_x Control Technology Ranking – Step 3

Based on the preceding discussion, the use of water injection, DLN combustors, and SCR are the effective and technically feasible NO_x control technologies available for the AEC. DLN combustors were selected because these allow for lower NO_x emission rates (9 ppmvd) from the combustion turbine over either water or steam (wet) injection (25 ppmvd). Furthermore, DLN combustors result in a very slight improvement in thermal efficiency over the wet injection NO_x control alternative and reduce the AEC's water consumption. When used in combination with SCR, these technologies will control NO_x emissions to the proposed levels.

Applicable BACT clearinghouse determinations and the BAAQMD, CARB, SCAQMD, and SJVAPCD BACT determinations were reviewed to identify which NO_x emission rates have been achieved in practice for other natural-gas-fired combustion turbine projects. The results of this review for combined-cycle combustion turbines are presented in Table 2-2A and simple-cycle combustion turbines in Table 2-2B.

TABLE 2-2A
Summary of NO_x Emission Limits for Combined-cycle Combustion Turbines
Technology Ranking for Turbines

Facility	Facility ID Number	NO_x Emission Limit at 15 percent O_2
CPV St. Charles	MD-0040	2.0 ppm (3-hour)
Bosque County Power Plant	TX-0540	2.0 ppm (24-hour)
Lake Side Power Plant	UT-0067	2.0 ppm (3-hour)
Empire Power Plant	NY-0100	2.0 ppm (3-hour) without duct burners
Tracy Substation Expansion Project	NV-0035	2.0 ppm (3-hour)
Langley Gulch Power Plant	ID-0018	2.0 ppm (3-hour)
Palomar Escondido – SDG&E	2001-AFC-24	2.0 ppm (1-hour); 2.0 ppm (3-hour) with duct burners or transient hour of +25 MW
Warren County Facility	VA-0308	2.0 ppm with or without duct burners
Ivanpah Energy Center, L.P.	NV-0038	2.0 ppm (1-hour) without duct burners; 13.96 lb/hr with duct burners
Gila Bend Power Generating Station	AZ-0038	2.0 ppm (1-hour)
Duke Energy Arlington Valley	AZ-0043	2.0 ppm (1-hour)
Colusa II Generation Station	2006-AFC-9	2.0 ppm (1-hour)
Avenal Energy – Avenal Power Center, LLC	2008-AFC-1	2.0 ppm (1-hour)
Russell City Energy Center	2001-AFC-7	2.0 ppm (1-hour)
CPV Warren	VA-0291	2.0 ppm (1-hour)
IDC Bellingham	CA-1050	2.0 ppm/1.5 ppm (1-hour)

TABLE 2-2A
Summary of NO_x Emission Limits for Combined-cycle Combustion Turbines
Technology Ranking for Turbines

Facility	Facility ID Number	NO_x Emission Limit at 15 percent O_2
Oakley Generating Station	2009-AFC-4	2.0 ppm (1-hour)
GWF Tracy Combined-cycle Project	2008-AFC-7	2.0 ppm (1-hour)
Watson Cogeneration Project	2009-AFC-1	2.0 ppm (1-hour)
Magnolia Power Project	CA-1097	2.0 ppm (3-hour)
Otay Mesa Energy Center, LLC	CA-1177	2.0 ppm (1-hour)
FPL Turkey Point Power Plant	FL-0263	2.0 ppm (24-hour)
FPL West County Energy Center	FL-0286	2.0 ppm (24-hour)
Linden Generating Station – PSEG Fossil, LLC	NJ-0058	2.0 ppm
Caithnes Bellport Energy Center	NY-0095	2.0 ppm
Athens Generating Plant	NY-0098	2.0 ppm (3-hour)
El Segundo Repower Project	115663	2.0 ppm (1-hour)
LADWP Scattergood	800075	2.0 ppm (1-hour)
Wanapa Energy Center	OR-0041	2.0 ppm (3-hour)
King Power Station	TX-0590	2.0 ppm (1-hour)
Warren County Power Plant – Dominion	VA-0315	2.0 ppm (1-hour)
Western Midway Sunset Power Project	99-AFC-09	2.0 ppm (1-hour)
Sacramento Municipal Utility District	CA-0997	2.0 ppm

Note: This table does not include all projects listed in the BACT databases. The purpose of this table is to present a summary of the most-stringent emission limits and to highlight any projects with an emission limit less than 2.0 ppm NO_x identified during the database search.

Source: EPA RACT/BACT/LAER Clearinghouse and the California Energy Commission (EPA, 2015 and CEC, 2015)

Combined-cycle Review

The review of these recent determinations, presented in Table 2-2A, shows that one facility, IDC Bellingham Project, has been issued a lower NO_x emission limit than the proposed BACT emission limit for the AEC of 2.0 ppm NO_x. The IDC Bellingham Project was never built; therefore, that emission limit was never achieved in practice. As a result, the proposed emission rate of 2.0 ppm (1-hour) for the AEC is the lowest NO_x emission rate achieved in practice for similar sources and, therefore, is proposed as the BACT NO_x emission limit.

Simple-cycle Review

Table 2-2B presents the recent BACT determinations for simple-cycle projects and shows that the proposed BACT emission limit for the AEC of 2.5 ppm NO_x is consistent with recent BACT determinations for simple-cycle turbines.

Auxiliary Boiler

The AEC auxiliary boiler proposes to use low-NO_x burners and SCR to control NO_x emissions to 5 ppm. A review of EPA's RACT/BACT/LAER Clearinghouse does not produce any projects with NO_x determinations as low as proposed for the AEC's auxiliary boiler (the lowest determination being 7 ppm for the Stockton Cogen project – RBLC – CA-1206). A review of the SCAQMD's recent permitting actions for the El Segundo Power Redevelopment Project (ID 115663) shows that the proposed AEC auxiliary boiler's NO_x emission rate of 5 ppmvd is consistent with the SCAQMD's recent auxiliary boiler BACT determination (July 2015) for the El Segundo project's auxiliary boiler.

TABLE 2-2B
Summary of NO_x Emission Limits for Simple-cycle Combustion Turbines
Technology Ranking for Turbines

Facility	Facility ID Number	NO_x Emission Limit at 15 percent O_2
Lambie Energy Center	CA-1098	2.5 ppm (3-hour)
El Cajon Energy, LLC	CA-1174	2.5 ppm (1-hour)
Escondido Energy Center	CA-1175	2.5 ppm (1-hour)
Orange Grover Project	CA-1176	2.5 ppm (1-hour)
Rincon Power Plant	GA-0098	2.5 ppm
Bayonne Energy Center	NJ-0075	2.5 ppm
Kearny Generating Station – PSEG Fossil, LLC	NJ-0076	2.5 ppm (3-hour)
Howard Down Station	NJ-0077	2.5 ppm (3-hour)
Jasper County Generating Facility – SCE&G	SC-0064	2.5 ppm
Tenaska Bear Garden Station	VA-0250	2.5 ppm (3-hour)
Carlsbad Energy Center	07-AFC-06C	2.5 ppm (1-hour)
Pio Pico Energy Center	11-AFC-1C	2.5 ppm (1-hour)
Canyon Power Plant	07-AFC-9C	2.5 ppm (1-hour)
LADWP Scattergood Generating Station	800075	2.5 ppm (1-hour)
LADWP Haynes Generating Station	800074	2.5 ppm (1-hour)
El Segundo Power Redevelopment Project	115663	2.5 ppm (1-hour)

Note: This table does not include all projects listed in the BACT databases. The purpose of this table is to present a summary of the most-stringent emission limits and to highlight any projects with an emission limit less than 2.5 ppm NO_x identified during the database search.

Source: EPA RACT/BACT/LAER Clearinghouse and the California Energy Commission (EPA, 2015 and CEC, 2015)

2.2.1.4 Evaluate Most-effective Controls and Document Results – Step 4

Based on the information presented in this BACT analysis, the proposed NO_x emission rates (combined-cycle of 2.0 ppm, simple-cycle of 2.5 ppm, and auxiliary boiler of 5 ppm) are the lowest NO_x emission rates achieved in practice at similar sources. Therefore, an assessment of the economic and environmental impacts is not necessary.

2.2.1.5 NO_x BACT Selection – Step 5

The proposed BACT for NO_x emissions from the AEC is the use of DLN combustors with SCR to control NO_x emissions from the CTGs and flue gas recirculation and SCR to control NO_x emissions from the auxiliary boiler.

2.2.2 CO

CO is discharged into the atmosphere when some of the fuel remains unburned or is only partially burned (incomplete combustion) during the combustion process. CO emissions are also affected by the gas turbine operating load conditions. CO emissions can be higher for gas turbines operating at low loads than for similar gas turbines operating at higher loads (EPA, 2006).

2.2.2.1 Identification of CO Emissions Control Technologies – Step 1

Effective combustor design and post-combustion control using an oxidation catalyst are two technologies (discussed below) for controlling CO emissions from a combustion turbine. As noted in the NO_x BACT analysis, the EMx and XONON technologies were determined to not be feasible for the AEC.

Best Combustion Control. CO is formed during the combustion process as a result of incomplete combustion of the carbon present in the fuel. The formation of CO is limited by designing the combustion system to completely oxidize the fuel carbon to CO_2. This is achieved by ensuring that the combustor is designed to allow complete mixing of the combustion air and fuel at combustion temperatures (in excess of 1,800°F) with an excess of combustion air. Higher combustion temperatures tend to reduce the formation of CO but increase the formation of NO_x. The application of water injection or staged combustion (DLN combustors) tends to lower combustion temperatures (in order to reduce NO_x formation), potentially increasing CO formation. However, using good combustor design and following best operating practices will minimize the formation of CO while reducing the combustion temperature and NO_x emissions.

Oxidation Catalyst. An oxidation catalyst is typically a precious metal catalyst bed located in the HRSG. The catalyst enhances oxidation of CO to CO_2, without the addition of any reactant. Oxidation catalysts have been successfully installed on numerous simple- and combined-cycle combustion turbines.

2.2.2.2 Eliminate Technically Infeasible Options – Step 2

Using good combustor design, following best operating practices, and using an oxidation catalyst are technically feasible options for controlling CO emissions from the proposed AEC.

2.2.2.3 CO Control Technology Ranking – Step 3

Based on the preceding discussion, using best combustor control and an oxidation catalyst are technically feasible combustion turbine control technologies available to control CO emissions. Accordingly, AES proposes to control CO emissions using both methods to meet the proposed levels.

Applicable BACT clearinghouse determinations and the SCAQMD, EPA, BAAQMD, CARB, and SJVAPCD BACT determinations were reviewed to determine whether CO emission rates less than the proposed AEC levels have been achieved in practice for other natural-gas-fired combustion turbine projects. The results of this review for combined-cycle combustion turbines are presented in Table 2-3A and simple-cycle combustion turbines in Table 2-3B. As these tables demonstrate, most projects have CO emission rates that are the same as or higher than the CO emission rate proposed for the AEC.

TABLE 2-3A
Summary of CO Emission Limits for Combined-cycle Combustion Turbines
Emission Control Ranking for Turbines

Facility	Facility ID Number	CO Emission Limit at 15 percent O_2
Lawrence Energy	OH-0248	2.0 ppm without duct burners
Berrien Energy, LLC	MI-0366	2.0 ppm without duct burners (3-hour)
COB Energy Facility	OR-0039	2.0 ppm (4-hour)
Avenal Energy – Avenal Power Center, LLC	2008-AFC-1	2.0 ppm (3-hour)
Wallula Power Plant	WA-0291	2.0 ppm (3-hour)
Duke Energy Arlington Valley (AVEFII)	AZ-0043	2.0 ppm (3-hour)
Wanapa Energy Center	OR-0041	2.0 ppm (3-hour)
Vernon City Light and Power	CA-1096	2.0 ppm (3-hour)
Mariposa Energy Project	2009-AFC-3	2.0 ppm (3-hour)
Palmdale Hybrid Power Plant Project	08-AFC-9	2.0 ppm without duct burners (1-hour)
Wansley Combined-cycle Energy Facility	GA-0102	2.0 ppm with duct burners
McIntosh Combined-cycle Facility	GA-0105	2.0 ppm with duct burners
Sumas Energy 2 Generation Facility	WA-0315	2.0 ppm (1-hour)

TABLE 2-3A
Summary of CO Emission Limits for Combined-cycle Combustion Turbines
Emission Control Ranking for Turbines

Facility	Facility ID Number	CO Emission Limit at 15 percent O_2
Oakley Generating Station	2009-AFC-4	2.0 ppm (1-hour)
Goldendale Energy	WA-302	2.0 ppm (1-hour)
IDC Bellingham	CA-1050	2.0 ppm (1-hour)
Russell City Energy Center	2001-AFC-7	2.0 ppm with duct burners (1-hour)
Watson Cogeneration Project	2009-AFC-1	2.0 ppm with duct burners (1-hour)
Magnolia Power Project	CA-1097	2.0 ppm with duct burners (1-hour)
Kelson Ridge	MD-0033	2.0 ppm (3-hour)
Liberty Generating Station	NJ-0043	2.0 ppm
Linden Generating Station – PSEG Fossil, LLC	NJ-0058	2.0 ppm
Cogen Technologies Linden Venture, L.P.	NJ-0059	2.0 ppm
Caithnes Bellport Energy Center	NY-0095	2.0 ppm
LADWP Scattergood	800075	2.0 ppm (1-hour)
El Segundo Repower Project	115663	2.0 ppm (1-hour)
CPV Warren	VA-0291	1.3 ppm without duct burners; 1.2 ppm with duct burners
Warren County Power Station - Dominion	VA-0308	1.3 ppm without duct burners
Kleen Energy Systems	CT-0151	0.9 ppm (1-hour)

Note: This table does not include all projects listed in the BACT databases. The purpose of this table is to present a summary of the most-stringent emission limits and to highlight any projects with an emission limit less than 2.0 ppm CO identified during the database search.

Source: EPA RACT/BACT/LAER Clearinghouse and the California Energy Commission (EPA, 2015 and CEC, 2015).

TABLE 2-3B
Summary of CO Emission Limits for Simple-cycle Combustion Turbines
Emission Control Ranking for Turbines

Facility	Facility ID Number	CO Emission Limit at 15 percent O_2
Great River Energy – Elk River Station	MN-0075	4.0 ppm (4-hour)
Carlsbad Energy Center	07-AFC-06C	4.0 ppm (1-hour)
Pio Pico Energy Center	11-AFC-1C	4.0 ppm (1-hour)
Canyon Power Plant	07-AFC-9C	4.0 ppm (1-hour)
LADWP Scattergood Generating Station	800075	4.0 ppm (1-hour)
LADWP Haynes Generating Station	800074	4.0 ppm (1-hour)
El Segundo Power Redevelopment Project	115663	4.0 ppm (1-hour)

Note: This table does not include all projects listed in the BACT databases. The purpose of this table is to present a summary of the most-stringent emission limits and to highlight any projects with an emission limit less than 4.0 ppm CO identified during the database search.

Source: EPA RACT/BACT/LAER Clearinghouse and the California Energy Commission (EPA, 2015 and CEC, 2015).

Combined-cycle Review

Three recent BACT determinations have lower CO emission rates than the AEC combined-cycle units. These three projects are discussed below.

Competitive Power Ventures (CPV) Warren and Warren County Power Station. The CPV Warren and Warren County Power Station are the same project as Dominion Resources Service, Inc. purchased the CPV Warren Project. The final PSD permit includes CO emission limits of 1.5 ppm and 2.4 ppm, on a 1-hour averaging basis for operating conditions without and with duct burners, respectively. Based on publically available information, the Warren County Power Station became operational in December 2014. Therefore, this level of control has not been demonstrated in practice on a long-term basis.

Kleen Energy Systems. The Kleen Energy Systems facility conducted the initial source tests in June 2011. Based on a November 2011 letter from the Connecticut Department of Energy & Environmental Protection, the facility was able to successfully demonstrate compliance with the CO emission limits of 0.9 ppm (1-hour). However, the Kleen Energy Systems air permit exempts CO emissions during load rate changes (i.e., non-steady state operation) from the CO 1-hour averaging period, which has the effect of relaxing the standard if frequent load rate changes occurred over the course of the averaging period.[3]

Conclusion. With the exception of the Kleen Energy System facility, the proposed AEC CO emission rate of 2.0 ppmvd (1-hour) is the lowest CO emission rate achieved in practice during all phases of operation excluding startup and shutdowns.

Simple-cycle Review

The recent simple-cycle BACT determinations are consistent with the proposed AEC BACT level of 4.0 ppm.

Auxiliary Boiler

The AEC auxiliary boiler proposes to use low-NO_x burners and good combustion design to control CO emissions to 50 ppm. A review of the SCAQMD's recent permitting actions for the El Segundo Power Redevelopment Project (Facility ID 115663) shows that the AEC auxiliary boiler's CO emission rate of 50 ppmvd is consistent with the SCAQMD's recent auxiliary boiler BACT determination (July 2015) for the El Segundo Power Redevelopment Project's auxiliary boiler.

2.2.2.4 Evaluate Most Effective Controls and Document Results – Step 4

The proposed CO emission rates for the AEC are consistent with recent CO BACT determinations achieved or verified with long-term compliance records for other similar facilities. Therefore, an assessment of the economic and environmental impacts is not necessary.

2.2.2.5 CO BACT Selection – Step 5

The proposed BACT for CO emissions from the AEC is good combustion design and the installation of an oxidation catalyst system for the combustion turbines and low-NO_x burners and good combustion design for the auxiliary boiler.

2.2.3 VOC

The pollutants commonly classified as VOC are discharged into the atmosphere when some of the fuel remains unburned or is only partially burned (incomplete combustion) during the combustion process

2.2.3.1 Identification of VOC Emissions Control Technologies – Step 1

Effective combustor design and post-combustion control using an oxidation catalyst are two technologies for controlling VOC emissions from a combustion turbine. The industrial combustion turbines proposed for the AEC are able to achieve relatively low, uncontrolled VOC emissions of approximately 4 ppmvd because the combustors

[3] This source shall not exceed the emission limits stated herein at any time as determined in accordance with the applicable averaging periods defined in Part III of this permit or as specified in an approved stack test protocol, **except during periods of start-up, shut-down, shifts between loads**, fuel switching, equipment cleaning, emergency, and/or malfunction.

have a firing temperature of approximately 2,500°F with an exhaust temperature of approximately 1,000°F. A DLN-equipped combustion turbine that incorporates an oxidation catalyst system can achieve VOC emissions in the 2 ppmvd range. As noted in the NO_x BACT analysis, the EMx and XONON technologies were determined to not be feasible for the AEC.

Best Combustion Control. As previously discussed, VOC is formed during the combustion process as a result of incomplete combustion of the carbon present in the fuel. The formation of VOC is limited by designing the combustion system to completely oxidize the fuel carbon to CO_2. This is achieved by ensuring that the combustor is designed to allow complete mixing of the combustion air and fuel at combustion temperatures with an excess of combustion air. Higher combustion temperatures tend to reduce the formation of VOC but increase the formation of NO_x. The application of water injection or staged combustion (DLN combustors) tends to lower combustion temperatures (to reduce NO_x formation), potentially increasing VOC formation. However, good combustor design and best operating practices will minimize the formation of VOC while reducing the combustion temperature and NO_x emissions.

Oxidation Catalyst. An oxidation catalyst is typically a precious metal catalyst bed located in the exhaust duct. The catalyst enhances oxidation of VOC to CO_2 without the addition of any reactant. Oxidation catalysts have been successfully installed on numerous simple- and combined-cycle combustion turbines.

2.2.3.2 Eliminate Technically Infeasible Options – Step 2

Good combustor design and the use of an oxidation catalyst are both technically feasible options for controlling VOC emissions from the proposed AEC.

2.2.3.3 VOC Control Technology Ranking – Step 3

Based on the preceding discussion, using good combustor control and an oxidation catalyst are technically feasible combustion turbine control technologies available to control VOC emissions. Accordingly, a VOC emission limit of 2.0 ppmvd (1-hour) for both the combined- and simple-cycle turbines is proposed.

Applicable BACT clearinghouse determinations and the SCAQMD, EPA, BAAQMD, CARB, and SJVAPCD BACT determinations were reviewed to determine whether VOC emission rates less than the proposed AEC levels have been achieved in practice for other natural-gas-fired combustion turbine projects. The results of this review for combined-cycle combustion turbines are presented in Table 2-4A and simple-cycle combustion turbines in Table 2-4B.

Combined-cycle Review

Based on a review of Table 2-4A, a number of recent combined-cycle projects have been permitted and are operational with VOC limits lower than the AEC's proposed 2.0 ppm limit. All of these projects employ the use of good combustion control and the use of an oxidation catalyst to control VOC emissions, identical to the AEC. Given the AEC's use of the same control technologies, it is reasonable to assume the AEC will emit VOC at comparable emission rates as these projects. However, a review of the air permits for some of these facilities shows that compliance with these lower emissions are determined using test methods other than the SCAQMD's Reference Method 25.3. As such, the proposed combined-cycle level of 2.0 ppm is proposed as BACT. Furthermore, the SCAQMD's recent (July 2015) VOC BACT determination for the El Segundo Repower Project's GE Frame 7FA.05 combined-cycle units was 2 ppm, consistent with the proposed AEC VOC emission limits.

TABLE 2-4A
Summary of VOC Emission Limits for Combined-cycle Combustion Turbines
Emission Control Ranking for Turbines

Facility	Facility ID Number	VOC Emission Limit at 15 percent O_2
Florida Power and Light Martin Plant	FL-0244	1.3 ppm without duct burners
Duke Energy Arlington Valley (AVEFII)	AZ-0043	1 ppm without duct burners (3-hour)
Fairbault Energy Park	MN-0071	1.5 ppm without duct burners

TABLE 2-4A
Summary of VOC Emission Limits for Combined-cycle Combustion Turbines
Emission Control Ranking for Turbines

Facility	Facility ID Number	VOC Emission Limit at 15 percent O_2
VA Power – Possum Point	VA-0255	1.2 ppm without duct burners
Los Esteros Critical Energy Facility – Phase 2c	2003-AFC-2	2.0 ppm with duct burners (3-hour)
GWF Tracy Combined-cycle Project	2008-AFC-7	1.5 ppm without duct burners (3-hour); 2.0 ppm with duct burners (3-hour)
Avenal Energy – Avenal Power Center, LLC	2008-AFC-1	1.4 ppm without duct burners; 2.0 ppm with duct burners (3-hour)
Watson Cogeneration Project	2009-AFC-1	2.0 ppm without duct burners (1-hour); 2.0 ppm with duct burners (1-hour)
Palmdale Hybrid Power Plant Project	SE 09-01	1.4 without duct burners (1-hour); 2.0 ppm with duct burners (1-hour)
Victorville Hybrid Gas-Solar	2007-AFC-1	1.4 ppm without duct burners; 2.0 ppm with duct burners
Colusa II Generation Station	2006-AFC-9	1.38 ppm without duct burners; 2.0 ppm with duct burners
FPL Turkey Point Power Plant	FL-0263	1.6 ppm without duct burners; 1.9 with duct burners
West Deptford Energy	NJ-0074	1.9 ppm (1-hour)
Plant McDonough Combined-cycle	GA-0127	1.0 ppm (1-hour) without; 1.8 ppm with duct burners (3-hour)
King Power Station	TX-0590	1.8 ppm (3-hour)
CPV Cunningham Creek	VA-0261	1.8 ppm
FPL West County Energy Center Unit 3	FL-0303	1.2 ppm with duct burners; 1.5 with duct burners
FPL West County Energy Center	FL-0286	1.5 ppm
Gila Bend Power Generating Station	AZ-0038	1.4 ppm with duct burners
Western Midway Sunset Power Project	99-AFC-09	1.4 ppm (3-hour)
Genova Arkansas I, LLC	AR-0070	1.4 ppm
CPV Atlantic Power Generating Facility	FL-0219	1.4 ppm
El Paso Broward Energy Center	FL-0225	1.4 ppm
El Paso Manatee Energy Center	FL-0226	1.4 ppm
El Paso Belle Glade Energy Center	FL-0227	1.4 ppm
Ninemile Point Electric Generating Plant	LA-0254	1.4 ppm (1-hour)
Mountainview Power	CA-0949	1.4 ppm
Sacramento Municipal Utility District	CA-0997	1.4 ppm
FPL Manatee Plant – Unit 3	FL-0245	1.3 ppm
Teco Bayside Power Station	FL-0246	1.3 ppm
Cogen Technologies Linden Venture, L.P.	NJ-0059	1.2 ppm
Conectiv Bethlehem, Inc.	PA-0189	1.2 ppm
Liberty Generating Station	NJ-0043	1.0 ppm (no duct burners)
Empire Power Plant	NY-0100	1.0 ppm (no duct burners)
Fairbault Energy Park	MN-0053	1.0 ppm (3-hour) (no duct burners)

TABLE 2-4A
Summary of VOC Emission Limits for Combined-cycle Combustion Turbines
Emission Control Ranking for Turbines

Facility	Facility ID Number	VOC Emission Limit at 15 percent O_2
Oakley Generating Station	2009-AFC-4	1.0 ppm (1-hour) (no duct burners)
Sutter – Calpine	1997-AFC-02	1.0 ppm with duct burners (calendar day average)
Russell City Energy Center	2001-AFC-7	1.0 ppm with duct burners (1-hour)
LADWP Scattergood Generating Station	800075	2.0 ppm (1-hour)
El Segundo Repower Project	115663	2.0 ppm (1-hour)
CPV Warren	VA-0291	0.7 without duct burners; 1.6 with duct burners; (3-hour)
Warren County Facility	VA-0308	0.7 without duct burners; 1.0 with duct burners
Chouteau Power Plant	OK-0129	0.3 ppm (3-hour) with duct burners

Note: This table does not include all projects listed in the BACT databases. The purpose of this table is to present a summary of the most-stringent emission limits and to highlight any projects with an emission limit less than 2.0 ppm VOC identified during the database search.

Source: EPA RACT/BACT/LAER Clearinghouse and the CEC (EPA, 2012 and CEC, 2012).

Simple-cycle Review

Based on a review of Table 2-4b, a number of recent simple-cycle projects have been permitted and are operational with VOC limits lower than the AEC's proposed 2.0 ppm limit. All of these projects employ the use of good combustion control and the use of an oxidation catalyst to control VOC emissions, identical to the AEC. Given the same level of control, it's reasonable to assume the AEC will emit VOC at comparable emission rates as these projects. However, a review of the air permits for some of these facilities shows that compliance with these lower emissions are determined using test methods other than the SCAQMD's Reference Method 25.3. As such, the proposed simple-cycle level of 2.0 ppm is proposed as BACT. Furthermore, the SCAQMD's recent (July 2015) VOC BACT determination for the El Segundo Repower Project's GE LMS-100 simple-cycle units was 2 ppm, consistent with the proposed AEC VOC emission limits.

TABLE 2-4B
Summary of VOC Emission Limits for Simple-cycle Combustion Turbines
Emission Control Ranking for Turbines

Facility	Facility ID Number	VOC Emission Limit at 15 percent O_2
Indigo Energy Facility	CA-0951	2.0 ppm
LA Dept. of Water & Power	CA-0952	2.0 ppm
Alliance Colton – Century	CA-0953	2.0 ppm
El Colton, LLC	CA-1095	2.0 ppm (3-hour)
LADWP Haynes Generating Station	800074	2.0 ppm (1-hour)
LADWP Scattergood Generating Station	800075	2.0 ppm (1-hour)
El Segundo Repower Project	115663	2.0 ppm (1-hour)
Escondido Energy Center, LLC	CA-1175	2.0 ppm (1-hour)
Orange Grover Project	CA-1176	2.0 ppm (1-hour)
Rincon Power Plant	GA-0098	2.0 ppm
Renaissance Power, LLC	MI-0267	2.0 ppm

TABLE 2-4B
Summary of VOC Emission Limits for Simple-cycle Combustion Turbines
Emission Control Ranking for Turbines

Facility	Facility ID Number	VOC Emission Limit at 15 percent O_2
El Paso Belle Glade Energy Center	FL-0227	1.4 ppm
Deerfield Beach Energy Center	FL-0228	1.4 ppm
Pompano Beach Energy Center	FL-0229	1.4 ppm
FPL Manatee Plant – Unit 3	FL-0245	1.3 ppm
Progress Bartow Power Plant	FL-0285	1.2 ppm

Note: This table does not include all projects listed in the BACT databases. The purpose of this table is to present a summary of the most-stringent emission limits and to highlight any projects with an emission limit less than 2.0 ppm VOC identified during the database search.

Source: EPA RACT/BACT/LAER Clearinghouse and the CEC (EPA, 2012 and CEC, 2012).

Auxiliary Boiler

The AEC auxiliary boiler proposes to use low-NO_x burners, clean burning natural gas, and good combustion design to control VOC emissions. A review of the SCAQMD's recent permitting actions for the El Segundo Power Redevelopment Project (Facility ID 115663) shows that the AEC auxiliary boiler's emission controls are consistent with the SCAQMD's recent BACT determination (July 2015) for the El Segundo Power Redevelopment Project's auxiliary boiler.

2.2.3.4 Evaluate Most Effective Controls and Document Results – Step 4

The proposed combined- and simple-cycle VOC emission rate of 2.0 ppmvd (1-hour) is not the lowest VOC emission rate shown, but is consistent with most BACT determinations and recent BACT determinations issued by the SCAQMD.

2.2.3.5 VOC BACT Selection – Step 5

The proposed BACT for VOC emissions from the AEC is good combustion design and the installation of an oxidation catalyst system to control VOC emissions from the combustion turbines to 2.0 ppmvd (1-hour) and low-NO_x burners, clean burning natural gas, and good combustion design for the auxiliary boiler.

2.2.4 PM_{10} and $PM_{2.5}$

PM from natural gas combustion has been estimated to be less than 1 micron in equivalent aerodynamic diameter, has filterable and condensable fractions, and is usually hydrocarbons of larger molecular weight that are not fully combusted (EPA, 2006). Because the PM is less than 2.5 microns in diameter, the BACT control technology discussion assumes the control technologies for PM_{10} and $PM_{2.5}$ are the same.

2.2.4.1 Identification of PM_{10} and $PM_{2.5}$ Emissions Control Technologies – Step 1

Pre-combustion Particulate Control Technologies. The major sources of PM_{10} and $PM_{2.5}$ emissions from a natural-gas-fired gas turbine equipped with SCR for post-combustion control of NO_x are: (1) the conversion of fuel sulfur to sulfates and ammonium sulfates; (2) unburned hydrocarbons that can lead to the formation of PM in the exhaust stack; and (3) PM in the ambient air entering the gas turbine through the inlet air filtration system, and the aqueous ammonia dilution air. Therefore, the use of clean-burning, low-sulfur fuels such as natural gas will result in minimal formation of PM_{10} and $PM_{2.5}$ during combustion. Best combustion practices will ensure proper air/fuel mixing ratios to achieve complete combustion, minimizing emissions of unburned hydrocarbons that can lead to formation of PM at the stack. In addition to good combustion, use of high-efficiency filtration on the inlet air and SCR dilution air system will minimize the entrainment of PM into the exhaust stream.

Post-combustion Particulate Control Technologies. Two post-combustion control technologies designed to reduce PM emissions from industrial sources are electrostatic precipitators and baghouses. However, neither of these control technologies is appropriate for use on natural-gas-fired turbines because of the very low levels and small aerodynamic diameter of PM from natural gas combustion.

2.2.4.2 Eliminate Technically Infeasible Options – Step 2

Electrostatic precipitators and baghouses are typically used on solid/liquid-fuel fired or other types of sources with high PM emission concentrations, and are not used in natural-gas-fired applications, which have inherently low PM emission concentrations. Therefore, electrostatic precipitators and baghouses are not considered technically feasible control technologies. However, best combustion practices, clean-burning fuels, and inlet air filtration are considered technically feasible for control of PM_{10} and $PM_{2.5}$ emissions from the AEC.

2.2.4.3 PM_{10} and $PM_{2.5}$ Control Technology Ranking – Step 3

The use of best combustion practices, clean-burning fuels, and inlet air filtration are the technically feasible natural-gas-fired turbine control technologies proposed by AES to control PM_{10} and $PM_{2.5}$ emissions to 8.5 pound(s) per hour (lb/hr) for the combined-cycle turbines and 6.23 lb/hr for the simple-cycle turbines. Furthermore, because no add-on control devices are technically feasible to control PM emissions from natural-gas-fired turbines, there would be little an applicant could do beyond using best combustion practices and using clean-burning fuels to control particulate emissions.

2.2.4.4 Evaluate Most Effective Controls and Document Results – Step 4

Based on the information presented in this BACT analysis, using proposed good combustion practice and pipeline-quality natural gas to control $PM_{10}/PM_{2.5}$ emissions to 8.5 lb/hr for the combined-cycle turbines, 6.23 lb/hr for the simple-cycle turbines, and auxiliary boiler are consistent with BACT at other similar sources. Therefore, an assessment of the economic and environmental impacts is not necessary.

2.2.4.5 PM_{10} and $PM_{2.5}$ BACT Selection – Step 5

The BACT for $PM_{10}/PM_{2.5}$ emissions from the AEC is using good combustion practices and pipeline-quality natural gas to control $PM_{10}/PM_{2.5}$ emissions.

2.2.5 SO_2

Emissions of SO_2 are entirely a function of the sulfur content in the fuel rather than any combustion variables. During the combustion process, essentially all the sulfur in the fuel is oxidized to SO_2.

2.2.5.1 Identification of SO_2 Emissions Control Technologies – Step 1

Two primary mechanisms are used to reduce SO_2 emissions from combustion sources: (1) reduce the amount of sulfur in the fuel, and (2) remove the sulfur from the combustion exhaust gases.

Limiting the amount of sulfur in the fuel is a common practice for natural-gas-fired turbines and boilers. For instance, natural-gas-fired turbines in California are typically required to combust only California Public Utilities Commission (CPUC) pipeline-quality natural gas with a sulfur content of less than 1 grain of sulfur per 100 standard cubic feet (scf). The AEC would be supplied with natural gas from the Southern California Gas (SoCalGas) pipeline, which is limited by tariff Rule 30 to a maximum total fuel sulfur content of less than 0.75 grain of sulfur per 100 scf. Therefore, the use of pipeline-quality natural gas with low sulfur content is a BACT control technique for SO_2.

There are two principal types of post-combustion control technologies for SO_2—wet scrubbing and dry scrubbing. Wet scrubbers use an alkaline solution to remove the SO_2 from the exhaust gases. Dry scrubbers use an SO_2 sorbent injected as powder or slurry to remove the SO_2 from the exhaust stream. However, the SO_2 concentrations in the natural gas exhaust gases are too low for the scrubbing technologies to work effectively or to be technically feasible.

2.2.5.2 Eliminate Technically Infeasible Options – Step 2

Use of pipeline-quality natural gas with very low sulfur content is technically feasible for the AEC. However, because sulfur emissions from natural-gas-fired turbines and auxiliary boilers are extremely low when using pipeline-quality natural gas, the two post-combustion SO_2 controls for natural-gas fired turbines and boilers (wet and dry scrubbers) are not technically feasible.

2.2.5.3 SO_2 Control Technology Ranking – Step 3

Use of pipeline-quality natural gas with very low sulfur content is the only technically feasible SO_2 control technology for natural-gas-fired turbines and auxiliary boilers, and it is the most effective SO_2 control technology used by all other natural-gas-fired turbines in California. Therefore, using pipeline-quality natural gas with a regulatory limit of 0.75 grain of sulfur per 100 scf of natural gas for the AEC is BACT for SO_2.

2.2.5.4 Evaluate Most Effective Controls and Document Results – Step 4

Based on the information presented in this BACT analysis, the use of pipeline-quality natural gas with a maximum of 0.75 grain of sulfur per 100 scf of natural gas as a BACT control technique for SO_2 will achieve the lowest SO_2 emission rates achieved in practice at other similar sources. Therefore, an assessment of the economic and environmental impacts is not necessary.

2.2.5.5 SO_2 BACT Selection – Step 5

The BACT for SO_2 from the AEC is use of pipeline-quality natural gas with a sulfur content of less than 0.75 grain of sulfur per 100 scf of natural gas.

2.2.6 BACT for Startups and Shutdowns

Startup and shutdown events are a normal part of the power plant operation, but they involve NO_x, CO, and VOC emissions rates that are highly variable and greater than emissions during steady-state operation[4]. This is because emission control systems are not fully functional during these events. In the case of the DLN combustors, the turbines must achieve a minimum operating rate before these systems are functional. Likewise, the SCR and oxidation catalyst systems must be heated to a specific minimum temperature before the catalyst systems become effective. Furthermore, startup and shutdown emissions are dependent on a number of project-specific factors; therefore, permitted startup and shutdown emission limits are highly variable. For these reasons, BACT for startup and shutdown will consider only the duration of these events.

2.2.6.1 Control Devices and Techniques to Limit Startup and Shutdown Emissions

The available approach to reducing startup and shutdown emissions from combustion turbines is to use best work practices. By following the plant equipment manufacturers' recommendations, power plant operators can limit the duration of each startup and shutdown event to the minimum duration achievable. Plant operators also use their own operational experience with their particular turbines and ancillary equipment to optimize startup and shutdown emissions. The proposed numerical emission limits for the startups and shutdowns are outlined below.

2.2.6.2 Determination of BACT Emissions Limit for Startups and Shutdowns

Startups. The combustion turbine vendor (GE) has determined a turbine startup period of 15 to 20 minutes (hot/warm and cold starts) from first fire to full load operation for the combined-cycle turbines and 10 minutes from first fire to full load operation for the simple-cycle turbines. This startup period does not include the warm-up time required by the SCR and oxidation catalyst systems, which, for the combined-cycle turbines, is affected by the length of time the system has been inactive, as the length of time is related to the temperature and pressure of the steam cycle. For the combined-cycle turbines, two startup cases (hot/warm and cold) were provided based on engineering estimates to reflect the different length of time between combustion turbine activity. Table 2-5 presents the proposed startup emissions and durations proposed as BACT.

[4] Because $PM_{10/2.5}$ and SO_2 emissions are dependent on the amount of fuel combusted, $PM_{10/2.5}$ and SO_2 emissions during startup and shutdown would be less than full load operations since less fuel is consumed as compared to full load operations.

TABLE 2-5
Facility Startup Emission Rates Per Turbine

Startup	NO_x (lb/event)	CO (lb/event)	VOC (lb/event)	NO_x (lb/hr)	CO (lb/hr)	VOC (lb/hr)	Duration (minutes/event)
Combined-cycle Turbines							
Cold	61	325	36	61	325	36	60
Hot/Warm	17	137	25	25.2	142	25.8	30
Simple-cycle Turbines							
Start	16.6	15.4	2.80	20.7	19.4	3.95	30

lb/event = pound(s) per event

Shutdowns. The turbine vendor also supplied the emission estimates for a typical shutdown event occurring over 30 minutes for the combined-cycle turbines and 13 minutes for the simple-cycle turbines. The shutdown process begins with the combustion turbine reducing load until the DLN system is no longer functional but the SCR and oxidation remain functional. Table 2-6 presents the shutdown emissions and duration proposed as BACT.

TABLE 2-6
Facility Shutdown Emission Rates Per Turbine

	NO_x (lb/event)	CO (lb/event)	VOC (lb/event)	NO_x (lb/hr)	CO (lb/hr)	VOC (lb/hr)	Duration (minutes/event)
Combined-cycle Shutdown	10.0	133	32.0	18.2	138	32.8	30
Simple-cycle Shutdown	3.12	28.1	3.06	9.56	34.4	4.86	13

2.2.6.3 Summary of the Proposed BACT for Startups and Shutdowns

AES proposes to limit individual startup and shutdown durations and emissions to an enforceable BACT permit limit, as shown in Tables 2-5 and 2-6.

SECTION 3

GHG BACT

3.1 Introduction

This BACT evaluation was prepared to address GHG emissions from the AEC, and the evaluation follows EPA regulations and guidance for BACT analyses as well as EPA's PSD and Title V Permitting Guidance for Greenhouse Gases (EPA, 2011b). GHG pollutants are emitted during the combustion process when fossil fuels are burned. One of the possible ways to reduce GHG emissions from fossil fuel combustion is to use inherently lower GHG-emitting fuels and to minimize the use of fuel, which in this case is achieved by using thermally efficient CTGs, well-designed HRSGs, and STGs to generate additional power from the heat of the CTG exhaust. In the AEC process, the fossil fuel burned will be pipeline-quality natural gas, which is the lowest GHG-emitting fossil fuel available. The AEC gas turbines selected to meet the project's objectives have a high operating turndown rate while maintaining a high thermal efficiency.

3.1.1 Regulatory Overview

Based on a series of actions, including the 2007 Supreme Court decision, the 2009 EPA Endangerment Finding and Cause and Contribute Finding, and the 2010 Light-Duty Vehicle Rule, GHGs became subject to permitting under the CAA. In May 2010, EPA issued the GHG permitting rule officially known as the "Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule" (GHG Tailoring Rule), in which EPA defined six GHG pollutants (collectively combined and measured as carbon dioxide equivalent [CO_2e]) as NSR-regulated pollutants and, therefore, subject to PSD permitting when new projects emitted those pollutants above certain threshold levels. Under the GHG Tailoring Rule, beginning July 1, 2011, new sources with a GHG PTE equal to or greater than 100,000 tpy of CO_2e would be considered a major source and would be required to undergo PSD permitting, including preparation of a BACT analysis for GHG emissions. Modifications to existing major sources (CO_2e PTE of 100,000 tpy or greater) that result in an increase of CO_2e greater than 75,000 tpy would be similarly required to obtain a PSD permit, which includes a GHG BACT analysis. However, in July 2014, the U.S. Supreme Court ruled that EPA could not regulate GHG emissions alone. As a result, new sources with a GHG PTE equal to or greater than 100,000 tpy of CO_2e are no longer required to obtain a PSD permit specifically for GHG emissions. Rather, a BACT analysis to evaluate GHG emissions control would only be required if the new source would require a PSD permit as a result of criteria pollutant PTE. The project results in emission increases above the new source PSD thresholds for at least one criteria pollutant. Therefore, the project is subject to the GHG Tailoring Rule, and is required to conduct a GHG BACT analysis.

3.1.2 BACT Evaluation Overview

BACT requirements are intended to ensure that a proposed project will incorporate control systems that reflect the latest control technologies that have been demonstrated in practice for the type of facility under review. BACT is defined under the CAA (42 U.S.C. Section 7479[3]) as follows:

> *The term "best available control technology" means an emission limitation based on the maximum degree of reduction of each pollutant subject to regulation under this chapter emitted from or which results from any major emitting facility, which the permitting authority, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such facility through application of production processes and available methods, systems, and techniques, including fuel cleaning, clean fuels, or treatment or innovative fuel combustion techniques for control of each such pollutant. BACT is defined as the emission control means an emission limitation (including opacity limits) based on the maximum degree of reduction which is achievable for each pollutant, taking into account energy, environmental, and economic impacts, and other costs. ….*

EPA guidance specifies that a BACT analysis should be performed using a top-down approach in which all applicable control technologies are evaluated based on their effectiveness and are then ranked by decreasing level of control. If the most-effective control technology is not being selected for the project, the control technologies on the list are evaluated as to whether they are infeasible because of energy, environmental, and/or economic impacts. The most effective control technology in the ranked list that cannot be so eliminated is then defined as BACT for that pollutant and process. A further analysis must be conducted to establish the emission limit that is BACT, based on determining the lowest emission limit that is expected to be consistently achievable over the life of the plant, taking into account site-specific and project-specific requirements.

For a facility subject to the GHG Tailoring Rule, the six covered GHG pollutants are:

- CO_2
- Nitrous oxide (N_2O)
- Methane (CH_4)
- Hydrofluorocarbons (HFC)
- Perfluorocarbons (PFC)
- Sulfur hexafluoride (SF_6)

Although the top-down BACT analysis is applied to GHGs, there are "unique" issues in the analysis for GHGs that do not arise in BACT for criteria pollutants (EPA, 2011b). For example, EPA recognizes that the range of potentially available control options for BACT Step 1 is currently limited and emphasizes the importance of energy efficiency in BACT reviews. Specifically, EPA states that (EPA, 2011b):

> *The application of methods, systems, or techniques to increase energy efficiency is a key GHG-reducing opportunity that falls under the category of "lower-polluting processes/practices." Use of inherently lower-emitting technologies, including energy efficiency measures, represents an opportunity for GHG reductions in these BACT reviews. In some cases, a more energy efficient process or project design may be used effectively alone; whereas in other cases, an energy efficient measure may be used effectively in tandem with end-of-stack controls to achieve additional control of criteria pollutants.*

Based on this reasoning, EPA provides permitting authorities with the discretion to use energy-efficient measures as "the foundation for a BACT analysis for GHGs . . ." (EPA, 2011b).

3.2 GHG BACT Analysis

3.2.1 Assumptions

During the completion of the GHG BACT analysis, the following assumptions were made:

- The AEC BACT analysis for criteria pollutants will result in the installation of an SCR system for NO_x emissions reduction for the turbines and auxiliary boiler and an oxidation catalyst for control of CO and VOCs for each turbine.

- During actual combustion turbine operation, the oxidation catalyst may result in minimal increases in CO_2 from the oxidation of any CO and CH_4 in the flue gas. However, the EPA Final Mandatory Reporting of Greenhouse Gases Rule (Mandatory Reporting Rule) (40 CFR 98) factors for estimating CO_2e emissions from natural gas combustion assume complete combustion of the fuel. While the oxidation catalyst has the potential of incrementally increasing CO_2 emissions, these emissions are already accounted for in the Mandatory Reporting Rule factors and included in the CO_2e totals.

- Similarly, the SCR catalyst may result in an increase in N_2O emissions. Although quantifying the increase is difficult, it is generally estimated to be very small or negligible. From the AEC GHG emissions inventory, the estimated N_2O emissions only total 67.3 metric tons per year. Therefore, even if there were an order-of-magnitude increase in N_2O as a result of the SCR, the impact to CO_2e emissions would be insignificant as compared to total estimated AEC CO_2e emissions.

Use of the SCR and oxidation catalyst slightly decreases the project's thermal efficiency due to backpressure on the turbines (these impacts are already included in the emission inventory) and, as noted above, may create a marginal but unquantifiable increase to N_2O emissions. Although elimination of the NO_x and CO/VOC controls could conceivably be considered as an option within the GHG BACT, the environmental benefits of the NO_x, CO, and VOC controls are assumed to outweigh the marginal increase to GHG emissions. Therefore, even if carried forward through the GHG BACT analysis, they would be eliminated in Step 4 because of other environmental impacts. Therefore, these controls were not considered within the BACT analysis.

3.2.2 BACT Determination

The top-down GHG BACT determination for the combustion turbines and auxiliary boiler is presented below. This BACT analysis is based on one combined-cycle power block consisting of two combustion turbines with unfired HRSGs, a steam turbine, and an auxiliary boiler, and one simple-cycle power block consisting of four simple-cycle combustion turbines.

The primary GHG of concern for the AEC is CO_2. This analysis primarily presents the GHG BACT analysis for CO_2 emissions because CH_4 and N_2O emissions are insignificant, at less than two percent of facility GHG CO_2e emissions. The AEC will emit insignificant quantities of SF_6, HFC, or PFC pollutants, used in electrical switch gear and comfort cooling systems. Therefore, the primary sources of GHG emissions would be the natural-gas-fired combustion turbines and the natural-gas-fired auxiliary boiler.

This determination follows EPA's top-down analysis method, as specified in EPA's GHG Permitting Guidance (EPA, 2011b). The following top-down analysis steps are listed in EPA's *New Source Review Workshop Manual* (EPA, 1990):

- Step 1: Identify all control technologies
- Step 2: Eliminate technically infeasible options
- Step 3: Rank remaining control technologies by control effectiveness
- Step 4: Evaluate most effective controls and document results
- Step 5: Select BACT

Each of these steps, described in the following sections, was conducted for GHG emissions from the CTGs. The following top-down BACT analysis has been prepared in accordance with EPA's *New Source Review Workshop Manual* (EPA, 1990) and takes into account energy, environmental, economic, and other costs associated with each alternative technology.

The previous and current emission limits reported for combined-cycle and simple-cycle combustion turbines were based on a search of the various federal, state, and local BACT, RACT, and LAER databases. The search included the following databases:

- EPA BACT/LAER Clearinghouse (EPA, 2015)
  - Search included the CO_2 BACT/LAER determinations for combined-cycle and simple-cycle combustion turbines (greater than 25 MW) with permit dates for the years 2001 through 2015.
- BACT Analyses for Recently Permitted Combined-cycle and Simple-cycle CEC Projects (CEC, 2015)

3.2.2.1 Identification of Available GHG Emissions Control Technologies – Step 1

There are two basic alternatives for limiting GHG emissions from the AEC equipment:

- Carbon capture and storage (CCS)
- Thermal efficiency

The proposed AEC design and operation will consist of one combined-cycle power block, one simple-cycle power block, and an auxiliary boiler. The combined-cycle power block will consist of two natural-gas-fired GE Frame 7FA.05 CTGs with unfired HRSGs, one STG, and an auxiliary boiler to facilitate fast start capabilities. The simple-cycle power block will consist of four GE LMS-100 CTGs. AES has determined that this configuration is the only alternative that meets all of the project objectives as further detailed in Section 1.2. Several of the primary objectives of the AEC are to backstop variable renewable resources with a multiple stage generator project that incorporates fast start capability, a high degree of turndown, fast ramping capability, and a high thermal efficiency. Therefore, other potentially lower emitting renewable generation technologies were not evaluated in this BACT analysis because this would change the fundamental business purpose of the AEC.

This is consistent with EPA's March 2011 *PSD and Title V Permitting Guidance for Greenhouse Gases,* which states:

> *EPA has recognized that a Step 1 list of options need not necessarily include inherently lower polluting processes that would fundamentally redefine the nature of the source proposed by the permit applicant…", and "…the permitting authority should keep in mind that BACT, in most cases, should not regulate the applicant's purpose or objective for the proposed facility… (p. 26).*

The only identified GHG emission "control" options are post-combustion CCS and thermal efficiency of the proposed generation facility.

Carbon Capture and Storage. CCS technology is composed of three main components: (1) CO_2 capture and/or compression, (2) transport, and (3) storage.

CO_2 Capture and Compression. CCS systems involve use of adsorption or absorption processes to separate and capture CO_2 from the flue gas, with subsequent desorption to produce a concentrated CO_2 stream. The concentrated CO_2 is then compressed to "supercritical" temperature and pressure, a state in which CO_2 exists neither as a liquid nor a gas, but instead has physical properties of both liquids and gases. The supercritical CO_2 would then be transported to an appropriate location for underground injection into a suitable geological storage reservoir, such as a deep saline aquifer, depleted coal seam, ocean storage site, or used in crude oil production for enhanced oil recovery.

The capture of CO_2 from gas streams can be accomplished using either physical or chemical solvents or solid sorbents. Applicability of different processes to particular applications will depend on temperature, pressure, CO_2 concentration, and contaminants in the gas or exhaust stream. Although CO_2 separation processes have been used for years in the oil and gas industries, the characteristics of the gas streams are markedly different than power plant exhaust. CO_2 separation from power plant exhaust has been demonstrated in large pilot-scale tests, but it has not been commercially implemented in full-scale power plant applications.

After separation, the CO_2 must be compressed to supercritical temperature and pressure for suitable pipeline transport and geologic storage properties. Although compressor systems for such applications are proven, commercially available technologies, specialized equipment is required, and operating energy requirements are very high.

CO_2 Transport. The supercritical CO_2 would then be transported to an appropriate location for injection into a suitable storage reservoir. The transport options may include pipeline or truck transport, or in the case of ocean storage, transport by ocean-going vessels.

Because of the extremely high pressures, as well as the unique thermodynamic and dense-phase fluid properties of supercritical CO_2, specialized designs are required for CO_2 pipelines. Control of potential propagation fractures and corrosion also require careful attention to contaminants such as oxygen, nitrogen, methane, water, and hydrogen sulfide.

While transport of CO_2 via pipeline is proven technology, doing so in urban areas will present additional concerns. Development of new rights-of-way in congested areas would require significant resources for planning and execution, and public concern about potential for leakage may present additional barriers.

CO_2 Storage. CO_2 storage methods include geologic sequestration, oceanic storage, and mineral carbonation. Oceanic storage has not been demonstrated in practice, as discussed below. Geologic sequestration is the process of injecting captured CO_2 into deep subsurface rock formations for long-term storage, which includes the use of a deep saline aquifer or depleted coal seams, as well as the use of compressed CO_2 to enhance oil recovery in crude oil production operations.

Under geologic sequestration, a suitable geological formation is identified close to the proposed project, and the captured CO_2 from the process is compressed and transported to the sequestration location. CO_2 is injected into that formation at a high pressure and to depths generally greater than 2,625 feet (800 meters). Below this depth, the pressurized CO_2 remains "supercritical" and behaves like a liquid. Supercritical CO_2 is denser and takes up less space than gaseous CO_2. Once injected, the CO_2 occupies pore spaces in the surrounding rock, like water in a sponge. Saline water that already resides in the pore space would be displaced by the denser CO_2. Over time, the CO_2 can dissolve in residual water, and chemical reactions between the dissolved CO_2 and rock can create solid carbonate minerals, more permanently trapping the CO_2.

The U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL), via the West Coast Regional Carbon Sequestration Partnership (WestCarb) has researched potential geologic storage locations including those in southern California. This information has been presented in NETL's 2010 *Carbon Sequestration Atlas of the United States and Canada*[5], NETL's National Carbon Sequestration Database and Geographic Information System (NATCARB) database[6], and Southern California Carbon Sequestration Research Consortium's (SoCalCarb) Carbon Atlas[7]. As shown in Figures 1 and 2, a number of deep saline aquifers and oil and gas reservoirs have been found to be potentially suitable for CO_2 storage. No potential for storage in depleted coal seams or basalt formations was identified.

The *Carbon Sequestration Atlas* lists the deep saline formations in Ventura and Los Angeles Basins as the "most promising" locations in southern California, and it states that "California may also be a candidate for CO_2 storage in offshore basins, although the lack of available data has limited the assessment of their CO_2 storage potential to areas where oil and gas exploration has occurred." The atlas also notes the potential for use of oil and gas reservoirs in the Los Angeles and Ventura Basins, although it states that "Reservoirs in highly fractured shales within the Santa Maria and Ventura Basins are not good candidates for CO_2 storage."

Funded via the American Recovery and Reinvestment Act, the Wilmington Graben project is an ongoing, comprehensive research program for characterization of the potential for CO_2 storage in the Pliocene and Miocene sediments offshore from Los Angeles and Long Beach. The study includes analysis of existing and new well cores, seismic studies, engineering analysis of potential pipeline systems, and risk analyses. However, no pilot studies of CO_2 injection into onshore or offshore geologic formations in the vicinity of the project site have been conducted to date.

Thermal Efficiency. Because CO_2 emissions are directly related to the quantity of fuel burned, the less fuel burned per amount of energy produced (greater energy efficiency), the lower the GHG emissions per unit of energy produced. As a means of quantifying feasible energy efficiency levels, the State of California established an emissions performance standard for California power plants. California Senate Bill 1368 limits long-term investments in baseload generation by the state's utilities to power plants that meet an emissions performance standard jointly established by the CEC and the CPUC. CEC regulations establish a standard for baseload generation (that is, with capacity factors in excess of 60 percent) of 1,100 pounds (or 0.55 ton) CO_2 per megawatt-hour (MWh). This emission standard corresponds to a heat rate of approximately 9,400 British thermal units per kilowatt-hour (Btu/kWh) (CEC, 2010).

In addition to the state regulations, EPA promulgated New Source Performance Standard Subpart TTTT, which includes two potentially applicable GHG emission limits for newly constructed combustion turbines. These limits are summarized below.

> Newly constructed or reconstructed stationary combustion turbine that supplies more than its design efficiency times its potential electric output as net-electric sales on a 3-year rolling average basis and combusts more than 90 percent natural gas on a heat input basis on a 12-operating-month rolling average basis - 450 kilograms (kg) of CO_2 per MWh of gross energy output (1,000 pounds [lb] of CO_2 per MWh); or 470 kg of CO_2 per MWh of net energy output (1,030 lb CO_2/MWh)
>
> Newly constructed or reconstructed stationary combustion turbine that supplies its design efficiency times its potential electric output or less as net-electric sales on a 3-year rolling average basis and combusts more than 90 percent natural gas on a heat input basis on a 12-operating-month rolling average basis - 50 kg CO_2 per gigajoule (GJ) of heat input (120 lb CO_2 per million British thermal units [MMBtu])

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[5] http://www.netl.doe.gov/technologies/carbon_seq/refshelf/atlasIII/index.html

[6] http://www.netl.doe.gov/technologies/carbon_seq/natcarb/storage.html

[7] http://socalcarb.org/atlas.html

The applicable emission standard depends on whether a combustion turbine sells more electricity than its potential electrical output, which is calculated by multiplying the design efficiency and the potential electrical output, and combusts more than 90 percent natural gas. Assuming the combined-cycle power block will generate more electricity than the potential electrical output, the AEC will need to comply with the 1,000 lb of CO_2 per MWh emission limit. The AEC is exclusively fueled by natural gas with a combined-cycle power block design efficiency of approximately 56 percent. The AEC's combined-cycle GHG efficiency is estimated at 784 lb of CO_2 per MWh (net), assuming an 8 percent performance degradation (see Attachment 1), which clearly complies with Subpart TTTT's emission limit of 1,000 lb of CO_2 per MWh.

The AEC simple-cycle power block design efficiency is 41 percent and the potential AEC simple-cycle power block's electrical output threshold is 1,436,640 MWh-Net (based on the design efficiency of 41 percent and the net electrical output of 400 MW for 8,760 hours per year). The AEC simple-cycle power block's potential annual net electric sales are 943,200 MWh-Net, assuming 400 MWs-Net of generation and 2,358 hours per year of operation (2,000 operating hours plus 250 startup and 108 shutdown hours). Since the annual net electric sales are less than the electric output threshold, the AEC simple-cycle power block must comply with Subpart TTTT emission limit of 50 kg CO_2 per GJ of heat input (120 lb CO_2/MMBtu). As a natural-gas fired facility, the AEC is expected to emit CO_2 at a rate of 117 lb CO_2/MMBtu, thereby complying with the applicable emission limit in Subpart TTTT.

The AEC is a highly efficient multiple-staged generator project that incorporates a high degree of turndown, fast start, and ramping capability that will support grid reliability as renewable generating sources comprise a larger share of California's energy production. This allows an increased use of wind power and other renewable energy sources, with backup power available from the AEC. A natural-gas-fired plant such as the AEC uses a relatively small amount of electricity to operate the facility compared to the energy in the fossil fuel combusted. Therefore, minimal benefit occurs in terms of energy efficiency and GHG emission reductions of the facility associated with lowering electricity usage at the facility compared to increasing the thermal efficiency of the process.

The addition of the high thermal efficiency of the AEC's generation to the state's electricity system will facilitate the integration of renewable resources in California's generation supply and will displace other less-efficient, higher GHG-emitting generation.

California's RPS requirement was increased from 20 percent by 2010 to 33 percent by 2020, with the adoption of Senate Bill 2 on April 12, 2011. To meet the new RPS requirements, the amount of dispatchable, high-efficiency, natural gas generation used as regulation resources, fast-ramping resources, or load-following or supplemental energy dispatches will have to be significantly increased. Additionally, Senate Bill 350 will increase the RPS requirements to 50 percent by 2030. The AEC will aid in the effort to meet California's aggressive RPS standard, because a significant attribute of the AEC is that the combined- and simple-cycle facility can operate similarly to a peaking plant but at higher thermal efficiency.

Based on design, the AEC will allow a rapid startup of the combustion turbines, with the combined-cycle combustion turbines capable of achieving full load operation within 15 minutes of initiating a startup (with the exception of the 24 cold starts for the combined-cycle turbines). The simple-cycle power block can achieve full load operation within 10 minutes of initiating a startup. The maximum electrical load ramp rate is 10 percent per minute when operating at the minimum operating rate.

In summary, using the GE Frame 7FA.05 and LMS-100 turbines allows the project goals to be met, while maintaining a higher efficiency than comparable combustion turbine applications. The ability to produce fast-ramping power to augment renewable power sources to the grid make the AEC a highly energy-efficient system.

3.2.2.2 Eliminate Technically Infeasible Options – Step 2

The second step for the BACT analysis is to eliminate technically infeasible options from the control technologies identified in Step 1. For each option that was identified, a technology evaluation was conducted to assess its technical feasibility. The technology is feasible only when it is available and applicable. A technology that is not commercially available for the scale of the project was considered infeasible. An available technology is considered applicable only if it can be reasonably installed and operated on the proposed project.

Carbon Capture and Storage. Although many believe that CCS will allow the future use of fossil fuels while minimizing GHG emissions, there are a number of technical barriers concerning the use of this technology for the AEC, as follows:

- No full-scale systems for solvent-based carbon capture are currently in operation to capture CO_2 from dilute exhaust steams such as those from natural-gas-fired electrical generation systems at the scale proposed for the AEC.
- Use of captured CO_2 for enhanced oil recovery (EOR) is widely believed to represent the practical first opportunity for CCS deployment; however, identification of suitable oil reservoirs with the necessary willing and able owners and operators is not feasible for the AEC to undertake. Oil and gas production in the vicinity of the AEC is available for EOR; however, only pilot-scale projects are known in the region and only estimates are available on the capacity of these miscible oil fields.
- Little experience exists with other types of storage systems, such as deep saline aquifers (geological sequestration) or ocean systems (ocean sequestration). These storage systems are not commercially available technology.
- Because of the developmental nature of CCS technology, vendors and contractors do not provide turn-key offerings; separate contracting would be required for capture system design and construction; compression and pipeline system routing, siting and licensing, engineering and construction; and geologic storage system design, deployment, operations, and monitoring. Because no individual facility could be expected to take on all of these requirements to implement a control technology, this demonstrates that the technology as a whole is not yet commercially available.
- Significant legal uncertainties continue to exist regarding relationship between land surface ownership rights and subsurface (pore space) ownership, and potential conflicts with other uses of land such as exploitation of mineral rights, management of risks and liabilities, and so on.
- The potential for frequent startup and shutdown, as well as intended rapid load fluctuations, of generation units at the AEC facility makes CCS impractical for two reasons – inability of capture systems to startup in the same short time frame as combustion turbines, and infeasibility for potential users of the CO_2 such as EOR systems to use uncertain and intermittent flows. As described above, the units at the AEC facility are designed to accommodate rapidly fluctuating power and steam demands from renewable electrical generation sources.

These issues are discussed in more detail below.

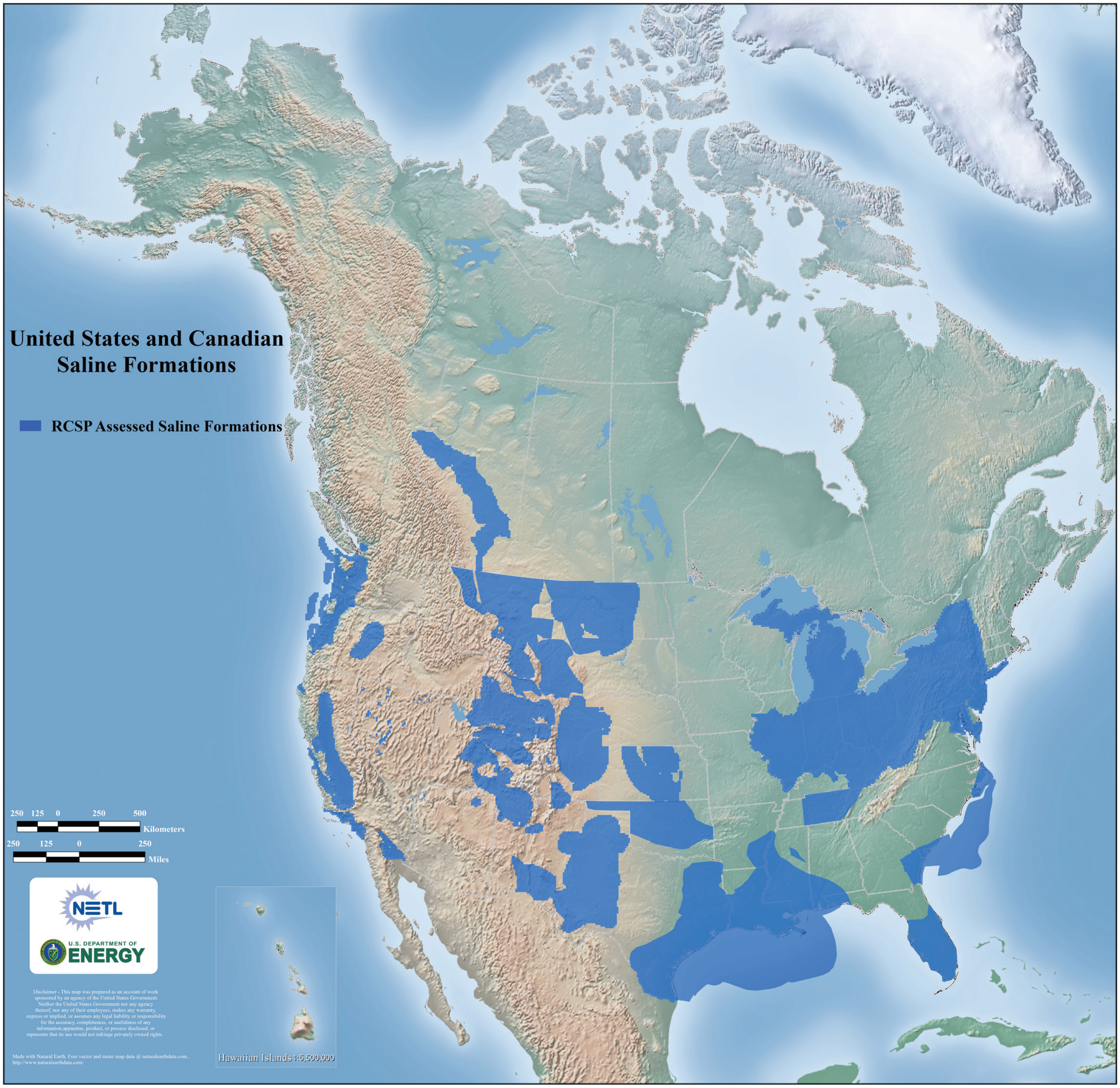


FIGURE 1
United States and Canadian Saline Formations
AES Huntington Beach Energy Project
Huntington Beach, California

CH2MHILL

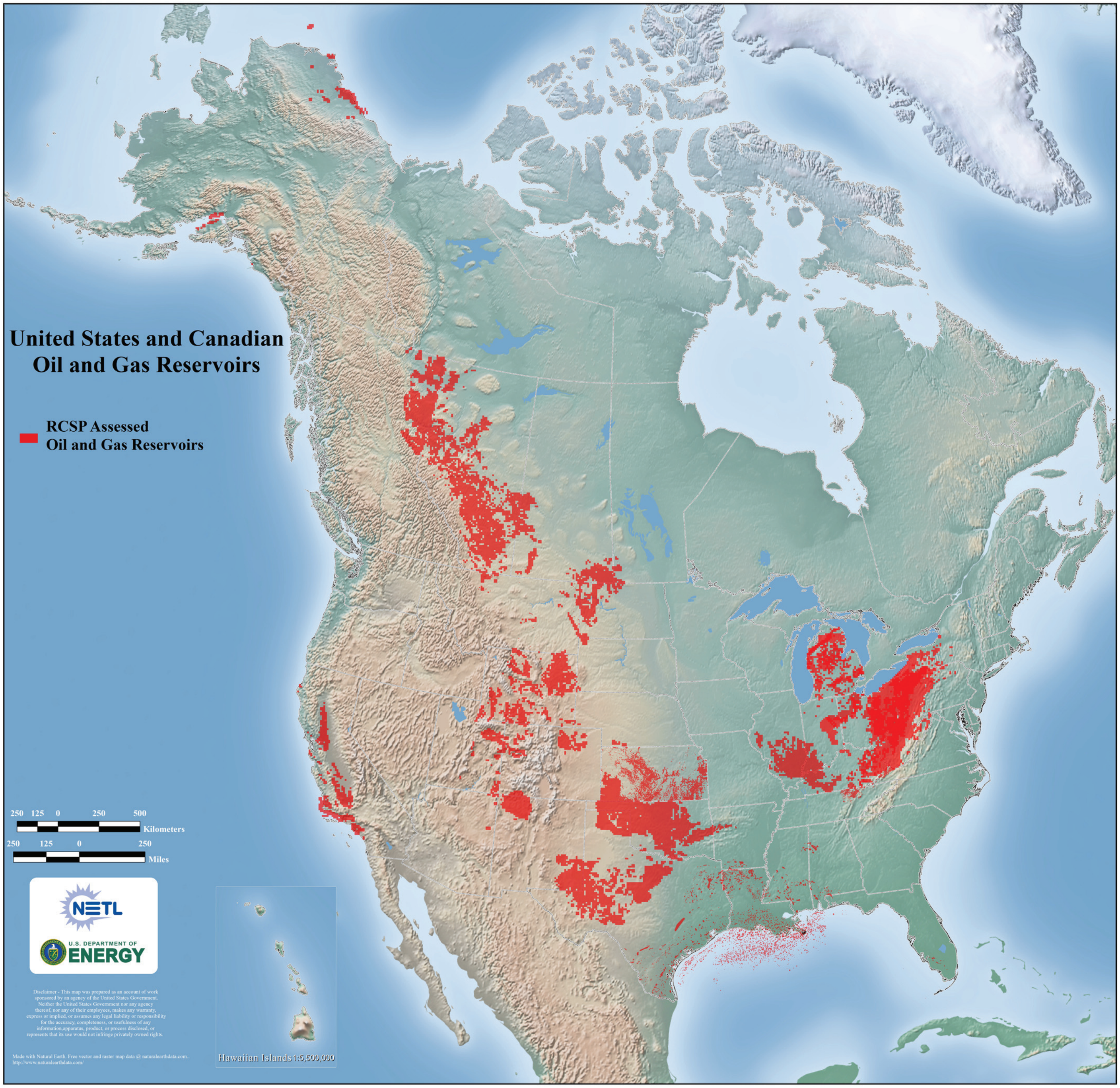


FIGURE 2
United States and Canadian Oil and Gas Reservoirs
AES Huntington Beach Energy Project
Huntington Beach, California

As suggested in EPA's *New Source Review Workshop Manual*, control technologies should be demonstrated in practice on full-scale operations to be considered available within a BACT analysis: "Technologies which have not yet been applied to (or permitted for) full scale operations need not be considered available; an applicant should be able to purchase or construct a process or control device that has already been demonstrated in practice" (EPA, 1990). As discussed in more detail below, carbon capture technology has not been demonstrated in practice in power plant applications. Other process industries do have carbon capture systems that are demonstrated in practice; however, the technology used for these processes cannot be applied to power plants at the scale of the AEC.

Three fundamental types of carbon capture systems are employed throughout various process and energy industries: sorbent adsorption, physical absorption, and chemical absorption. Use of carbon capture systems on power plant exhaust is inherently different from other commercial-scale systems currently in operation, mainly because of the concentration of CO_2 and other constituents in the gas streams.

For example, CO_2 is separated from petroleum in refinery hydrogen plants in a number of locations, but this is typically accomplished on the product gas from a steam CH_4 reforming process that contains primarily hydrogen (H_2), unreacted CH_4, and CO_2. Based on the stoichiometry of the reforming process, the CO_2 concentration is approximately 80 percent by weight, and the gas pressure is approximately 350 pounds of force per square inch gauge (psig). Because of the high concentration and high pressure, a pressure swing adsorption (PSA) process is used for the separation. In the PSA process, all non-hydrogen components, including CO_2 and CH_4, are adsorbed onto the solid media under high pressure; after the sorbent becomes saturated, the pressure is reduced to near atmospheric conditions to desorb these components. The CO_2/CH_4 mixture in the PSA tail gas is then typically recycled to the reformer process boilers to recover the heating value; however, where the CO_2 is to be sold, an additional amine absorption process would be required to separate the CO_2 from CH_4. In its May 2011 *DOE/NETL Advanced Carbon Dioxide Capture R&D Program: Technology Update*, NETL notes the different applications for chemical solvent absorption, physical solvent absorption, and sorbent adsorption processes. As noted in Section 4.B, "When the fluid component has a high concentration in the feed stream (for example, 10 percent or more), a PSA mechanism is more appropriate" (NETL, 2011).

In another example, at the Dakota Gasification Company's Great Plains Synfuels Plant in North Dakota, CO_2 is separated from intermediate fuel streams produced from gasification of coal. The gas from which the CO_2 is separated is a mixture of primarily H_2, CH_4, and 30 to 35 percent CO_2; a physical absorption process (Rectisol) is used. In contrast, as noted on page 29 of the *Report of the Interagency Task Force on Carbon Capture and Storage* (DOE and EPA, 2010), CO_2 concentrations for natural-gas-fired systems are in the range of 3 to 5 percent. This adds significant technical challenges to separation of CO_2 from natural-gas-fired power plant exhaust as compared to other systems.

In Section 4.A of the above-referenced technology update, NETL notes this difference between pre-combustion CO_2 capture, such as that from the North Dakota plant, versus the post-combustion capture, such as that required from a natural-gas-fired power plant: "Physical solvents are well suited for pre-combustion capture of CO_2 from syngas at elevated pressures; whereas, chemical solvents are more attractive for CO_2 capture from dilute low-pressure post-combustion flue gas" (NETL, 2011).

In the 2010 report noted above, the task force discusses four currently operating post-combustion CO_2 capture systems associated with power production. All four are on coal-based power plants where CO_2 concentrations are higher (typically 12 to 15 percent), with none noted for natural gas-based power plants (typically 3 to 5 percent).

The DOE/NETL is a key player in the nation's efforts to realize commercial deployment of CCS technology. A downloadable database of worldwide CCS projects is available on the NETL website[8]. Filtering this database for projects that involve both capture and storage, which are based on post-combustion capture technology (the only technology applicable to natural gas turbine systems) and are shown as "active" with "injection ongoing" or "plant in operation," yields four projects. Three projects, one of which is a pilot-scale process noted in the interagency task force report as described above, are listed at a capacity of 274 tons per day (100,000 tpy), and

[8] http://www.netl.doe.gov/technologies/carbon_seq/global/database/index.html

the fourth has a capacity of only 50 tons per day. Post-combustion CCS has not been accomplished on a scale of the AEC facility. Furthermore, scale-up involving a substantial increase in size from pilot scale to commercial scale is unusual in chemical processes and would represent significant technical risk.

A chemical solvent CCS approach would be required to capture the approximate 3 to 5 percent CO_2 emitted from the flue gas generated from the natural-gas-fired systems (combined-cycle) used at the AEC facility. To date, a chemical solvent technology has not been demonstrated at the operating scale proposed.

As detailed in the August 2010 report, one goal of the task force is to bring 5 to 10 commercial demonstration projects online by 2016. With demonstration projects still years away, clearly the technology is not currently commercially available at the scale necessary to operate the AEC facility. It is notable that several projects, including those with DOE funding or loan guarantees, were cancelled in 2011, making it further unlikely that technical information required to scale up these processes can be accomplished in the near future. For example, the AEP Mountaineer site (AEP; a former DOE demonstration commercial-scale project) was to expand capture capacity to 100,000 tpy; however, to date only the “Project Validation Facility” was completed and only accomplished capture of a total of 50,000 metric tons and storage of 37,000 metric tons of CO_2. AEP recently announced that the larger project will be cancelled after completion of the front-end engineering design because of uncertain economic and policy conditions.

EPA’s Fact Sheet and Ambient Air Quality Impact Report for the Palmdale project states that “commercial CO_2 recovery plants have been in existence since the late 1970s, with at least one plant capturing CO_2 from gas turbines”. However, on review of the fact sheet referenced for the gas turbine project[9], it is notable that the referenced project is not a commercial-scale operation; rather, it is a pilot study at a commercial power plant. The pilot system captured 365 tons per day of CO_2 from the power plant, in the range of the power pilot tests noted above. Full-scale capture of power plant CO_2 has not yet been accomplished anywhere in the world.

The interagency task force report notes the lack of demonstration in practice:

> *Current technologies could be used to capture CO_2 from new and existing fossil energy power plants; however, they are not ready for widespread implementation primarily because they have not been demonstrated at the scale necessary to establish confidence for power plant application. Since the CO_2 capture capacities used in current industrial processes are generally much smaller than the capacity required for the purposes of GHG emissions mitigation at a typical power plant, there is considerable uncertainty associated with capacities at volumes necessary for commercial deployment.* (DOE and EPA, 2010)

The ability to inject into deep saline aquifers as an alternative to EOR reservoirs is a major focus of the NETL research program. Although it is believed that saline aquifers are a viable opportunity, there are many uncertainties. Risk of mobilization of natural elements such as manganese, cobalt, nickel, iron, uranium, and barium into potable aquifers is of concern. Technical considerations for site selection include geologic siting, monitoring and verification programs, post-injection site care, long-term stewardship, property rights, and other issues.

At least one planned saline aquifer pilot project is underway in the Lower San Joaquin Valley near Bakersfield, California (the Kimberlina Saline Formation), that may act as a possible candidate location for geologic sequestration and storage. According to WestCarb, a pilot project plant operated by Clean Energy Systems is targeting the Vedder Sandstone formation at a depth of approximately 8,000 feet, where there is a beaded stream unit of saline formation that may be favorable for CO_2 storage. It is unclear when the project is planned for full scale testing, and no plans are currently available to build a pipeline within the area to transport CO_2 to the test site. As noted above, the Wilmington Graben project is a large-scale study of the potential for geologic storage in offshore formations near Los Angeles; however, no indications of near-term plans for pilot testing were noted in NETL or SoCalCarb’s websites.

[9] http://www.powermag.com/coal/2064.html

As noted above, presumably the CO_2 could be used for EOR applications within the Los Angeles and Ventura Basins, but the exact location, time frame, and needed flow rates for those existing or future EORs are unclear because this information is typically treated as being a trade secret. During a study to evaluate the "future oil recovery potential in the major oil basins and large oil fields in California," the DOE concluded that a number of oil fields in the Los Angeles Basin are "amendable to miscible CO_2-EOR." Two of those oil fields, the Santa Fe Springs and Dominquez fields, are located approximately 30 miles from the AEC facility. However, the feasibility of obtaining the necessary permits to build infrastructure and a pipeline to transport CO_2 to these fields through a densely urbanized area is uncertain.

Figure 3 from the Interagency Task Force report shows that no existing CO_2 pipelines are shown in California. The report does note that nationally there are "many smaller pipelines connecting sources with specific customers"; however, based on lack of natural or captured CO_2 sources in southern California, it is assumed that no pipelines exist. The SoCalCarb carbon atlas shows a number of existing pipelines in the region; however, these are petroleum product pipelines. As noted above, because of high pressures, potential for propagation facture, and other issues, CO_2 pipeline design is highly specialized, and product pipelines would not be suitable for re-use of CO_2 transport.

Regarding CO_2 storage security, the CCS task force report (DOE and EPA, 2010) notes such uncertainties:

> *"The technical community believes that many aspects of the science related to geologic storage security are relatively well understood. For example, the Intergovernmental Panel on Climate Change (IPCC) concluded that "it is considered likely that 99 percent or more of the injected CO_2 will be retained for 1,000 years" (IPCC, 2005). However, additional information (including data from large-scale field projects, such as the Kimberlina project, with comprehensive monitoring) is needed to confirm predictions of the behavior of natural systems in response to introduced CO_2 and to quantify rates for long-term processes that contribute to trapping and, therefore, risk profiles (IPCC, 2005). "*

Field data from the Kimberlina CCS pilot project will provide additional information regarding storage security for that and other locations. Meanwhile, some uncertainties will remain regarding safety and permanence aspects of storage in these types of formations.

The effectiveness of ocean sequestration as a full-scale method for CO_2 capture and storage is unclear given the limited availability of injection pilot tests and the ecological impacts to shallow and deep ocean ecosystems. Ocean sequestration is conducted by injecting supercritical liquid CO_2 from either a stationary or towed pipeline at targeted depth interval, typically below 3,000 feet. CO_2 is injected below the thermocline, creating either a rising droplet or a dense phase plume and sinking bottom gravity current. Through NETL, extensive research is being conducted by the Monterey Bay Aquarium Research Institute on the behavior of CO_2 hydrates and dispersion of these hydrates within the various depth horizons of the marine environment; however, the experiments are small in scale and the results may not be applicable to larger-scale injection projects in the near future. Long-term effects on the marine environment, including pH excursions, are ongoing, making the use of ocean sequestration technically infeasible at the current time. The feasibility of implementing a commercially available sequestration approach is further brought into question, with the IPCC stating:

> *Ocean storage, however, is in the research phase and will not retain CO_2 permanently as the CO_2 will re-equilibrate with the atmosphere over the course of several centuries…Before the option of ocean injection can be deployed, significant research is needed into its potential biological impacts to clarify the nature and scope of environmental consequences, especially in the longer term…Clarification of the nature and scope of long-term environmental consequences of ocean storage requires further research.*
> (IPCC, 2005).

Questions may also arise regarding the international legal implications of injecting industrial generated CO_2 into the ocean, which may eventually migrate to other international waters.

CCS technology development is dominated by vendors that are attempting to commercialize carbon capture technologies and by academia-led teams (largely funded by DOE) that are leading research into the geologic systems. The ability for electric utilities to contract for turn-key CCS systems simply does not exist at this time.

Most current carbon capture systems are based on amine or chilled ammonia technology, which are chemical absorption processes. Although capture system startup and shutdown time of vendor processes could not be confirmed within this BACT analysis, clearly both types of processes would require durations that exceed the time required for the AEC turbine startup or load response. As described above, the AEC may start or stop turbines, and it may adjust the load on the operating turbines rapidly to meet grid reliability demands. In contrast, both amine and chilled ammonia systems require startup of countercurrent liquid-gas absorption towers and either chilling of the ammonia solution or heating of regeneration columns for the amine systems. It is technically infeasible for the carbon capture systems to startup and shut down or to make large adjustments in gas volume in the time frames required to serve this type of operation effectively; this means that portions of the AEC operation would run without CO_2 capture even with implementation of a CCS system. Alternatively, the CCS system could be operated at a minimum load during periods of expected operation. However, this approach would consume energy, offsetting some of the benefit.

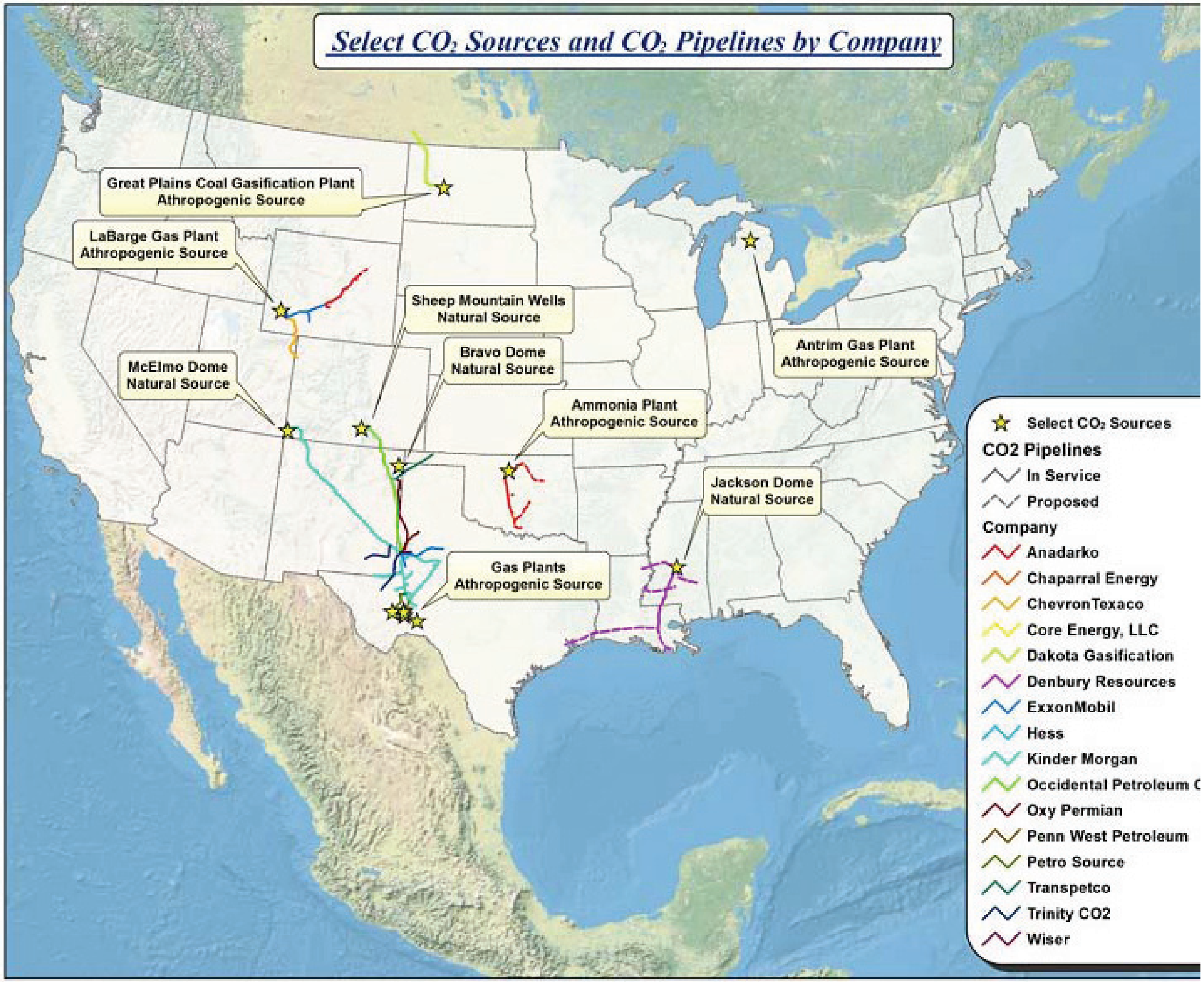
Finally, the potential to sell CO_2 to industrial or oil and gas operations is infeasible for an operation such as this, where daily operation of the AEC depends on grid dispatch needs, particularly to offset reductions from renewable energy sources. Even if a potential EOR opportunity could be identified, such an operation would typically need a steady supply of CO_2. Intermittent CO_2 supply from potentially short duration with uncertain daily operation would be virtually impossible to sell on the market, making the EOR option unviable. Therefore, CCS technology would be better suited for applications with low variability in operating conditions.

In the EPA PSD and Title V GHG Permitting Guidance, the issues noted above are summarized: "A number of ongoing research, development, and demonstration projects may make CCS technologies more widely applicable *in the future*" (EPA, 2011b; italics added). From page 36 of this guidance, it is noted:

> *While CCS is a promising technology, EPA does not believe that at this time CCS will be a technically feasible BACT option in certain cases. As noted above, to establish that an option is technically infeasible, the permitting record should show that an available control option has neither been demonstrated in practice nor is available and applicable to the source type under review. EPA recognizes the significant logistical hurdles that the installation and operation of a CCS system presents and that sets it apart from other add-on controls that are typically used to reduce emissions of other regulated pollutants and already have an existing reasonably accessible infrastructure in place to address waste disposal and other offsite needs. Logistical hurdles for CCS may include obtaining contracts for offsite land acquisition (including the availability of land), the need for funding (including, for example, government subsidies), timing of available transportation infrastructure, and developing a site for secure long-term storage. Not every source has the resources to overcome the offsite logistical barriers necessary to apply CCS technology to its operations, and smaller sources will likely be more constrained in this regard.* (EPA, 2011b)

The CCS alternative is not considered technically feasible for the AEC, and it should therefore be eliminated from further consideration in Step 2. However, at the suggestion of EPA team members on other recent projects, economic feasibility issues will be discussed in Step 4.

Thermal Efficiency. Thermal efficiency is a standard measurement metric for combined-cycle facilities; therefore, it is technically feasible as a control technology for BACT consideration.



Source: Figure B-1 from the “Report of the Interagency Task Force on Carbon Capture and Storage”, August 2010.

FIGURE 3
Existing and Planned CO2 Pipelines in the United States with Sources
AES Huntington Beach Energy Project
Huntington Beach, California

CH2MHILL.

3.2.2.3 Combustion Turbine GHG Control Technology Ranking – Step 3

Because CCS is not technically feasible, the only remaining technically feasible GHG control technology for the AEC is thermal efficiency. While CCS will be discussed further in Step 4, and if it were technically feasible would rank higher than thermal efficiency for GHG control, thermal efficiency is the only technically feasible control technology that is commercially available and applicable for the AEC.

3.2.2.4 Evaluate Most Effective Controls – Step 4

Step 4 of the BACT analysis is to evaluate the remaining technically feasible controls and consider whether energy, environmental, and/or economic impacts associated with the remaining control technologies would justify selection of a less-effective control technology. The top-down approach specifies that the evaluation begin with the most-effective technology.

Carbon Capture and Sequestration. As demonstrated in Step 2, CCS is not a technically feasible alternative for the AEC. Nonetheless, at the suggestion of the EPA team members on other recent projects, economic feasibility of CCS technology is reviewed in this step. Control options considered in this step therefore include application of CCS technology and plant energy thermal efficiency. As demonstrated below, CCS is clearly not economically feasible for the AEC.

On page 42 of the EPA PSD and Title V Permitting Guidance, it is suggested that detailed cost estimates and vendor quotes should not be required where it can be determined from a qualitative standpoint that a control strategy would not be cost effective:

> *With respect to the valuation of the economic impacts of [AES] control strategies, it may be appropriate in some cases to assess the cost effectiveness of a control option in a less detailed quantitative (or even qualitative) manner. For instance, when evaluating the cost effectiveness of CCS as a GHG control option, if the cost of building a new pipeline to transport the CO_2 is extraordinarily high and by itself would be considered cost prohibitive, it would not be necessary for the applicant to obtain a vendor quote and evaluate the cost effectiveness of a CO_2 capture system.* (EPA, 2011b)

The guidance document also acknowledges the current high costs of CCS technology:

> *EPA recognizes that at present CCS is an expensive technology, largely because of the costs associated with CO_2 capture and compression, and these costs will generally make the price of electricity from power plants with CCS uncompetitive compared to electricity from plants with other GHG controls. Even if not eliminated in Step 2 of the technical feasibility of the BACT analysis, on the basis of the current costs of CCS, we expect that CCS will often be eliminated from consideration in Step 4 of the economical feasibility of the BACT analysis, even in some cases where underground storage of the captured CO_2 near the power plant is feasible.* (EPA, 2011b)

The costs of constructing and operating CCS technology are indeed extraordinarily high, based on current technology. Even with the optimistic assumption that appropriate EOR opportunities could be identified in order to lower costs, compared to "pure" sequestration in deep saline aquifers, or through deep ocean storage, additional costs to the AEC would include the following:

- Licensing of scrubber technology and construction of carbon capture systems
- Significant reduction to plant output due to the high energy consumption of capture and compression systems
- Identification of oil and gas companies holding depleted oil reservoirs with appropriate characteristics for effective use of CO_2 for tertiary oil recovery, and negotiation with those parties for long-term contracts for CO_2 purchases
- Construction of compression systems and pipelines to deliver CO_2 to EOR or storage locations
- Hiring of labor to operate, maintain, and monitor the capture, compression, and transport systems
- Resolving issues regarding project risk that would jeopardize the ability to finance construction

The interagency task force report provides an estimate of capital and operating costs for carbon capture from natural gas systems: “For a [550-MWe net output] NGCC plant, the capital cost would increase by $340 million and an energy penalty of 15 percent would result from the inclusion of CO_2 capture” (DOE and EPA, 2010). Using the ”Capacity Factor Method” for prorating capital costs for similar systems of different sizes as suggested by the Association for the Advancement of Cost Engineering and other organizations, the CO_2 capture system capital cost for the AEC is estimated as at least $467 million. Based on an estimated AEC capital cost of $940 million to $1.11 million for the plant and equipment, the capture system alone would add approximately 50 percent to the cost of the overall plant equipment capital cost.

As noted above, the effort required to identify and negotiate with oil and gas companies that may be able to utilize the CO_2 would be substantial. Prospective EOR oil fields are located within the area, but no active commercial facilities exist within the Los Angeles Basin, making predictions for CO_2 demand generated by CCS difficult. And, because of the patchwork of oil well ownership, many parties could potentially be involved in negotiations over CO_2 value.

Because of the extremely high pressures required to transport and inject CO_2 under supercritical conditions, the compressors required are highly specialized. For example, the compressors for the Dakota Gasification Company system are of a unique eight-stage design. It is unclear whether the Task Force natural gas combined-cycle (NGCC) cost estimate noted above includes the required compression systems; if not, then this represents another substantial capital cost.

Pipelines must be designed to withstand the very high pressures (over 2,000 psig) and the potential for corrosion if any water is introduced into the system. As noted above, if CCS were otherwise technically and economically feasible for the AEC, the most realistic scenario could be to construct a pipeline from the Long Beach area to either the Santa Fe Springs or Dominquez oil fields near Los Angeles for EOR, assuming that permits and right-of-way agreements are obtained and there is an active EOR operation in this location. As noted above, the approximate distance of the pipeline to either of these two fields is approximately 30 miles. Based on engineering analysis by the designers of the Denbury CO_2 pipeline in Wyoming, costs for an 8-inch CO_2 pipeline are estimated at $600,000 per mile, for a total cost of $18 million. Therefore, the pipeline alone would represent an additional 2 percent increase to the capital cost assuming that the EOR opportunities could be realized; however, costs could be substantially higher to transport CO_2 to deep saline aquifer or ocean storage locations.

It is unlikely that financing could be approved for a project that combines CCS with generation, given the technical and financial risks. Also, as evidenced with utilities’ inability to obtain CPUC approval for integrated gasification / combined-cycle projects because of their unacceptable cost and risk to ratepayers (such as Wisconsin’s disapproval of the Wisconsin Electric Energy project), it is reasonable to assume that the same issues would apply in this case before the CEC.

In summary, capital costs for capture system and pipeline construction alone would almost double the project capital cost, and lost power sales resulting from the CCS system energy penalty would represent another major impact to the project financials and a multi-fold increase to project capital costs. Other costs, such as identification, negotiation, permitting studies, and engineering of EOR opportunities; operating labor and maintenance costs for capture, compression, and pipeline systems; uncertain financing terms or inability to finance; and difficulty in obtaining CEC approval would also impact the project. Also, it is unclear whether compression systems are included in the task force estimate of capture system costs. Not only is CCS not technically feasible at this project scale, as the above discussion demonstrates, but CCS is clearly not economically feasible for natural-gas-fired turbines at this time.

Thermal Efficiency. A search of the EPA’s RACT/BACT/LAER Clearinghouse was performed for NGCC projects. GHG permit information was found for one source—Westlake Vinyls Company LP Cogeneration Plant (LA-0256)—which was issued a permit in December 2011. The record for this source includes only hourly and annual CO_2e emission limitations and no information of costs estimated performed for the GHG BACT determination. Recent GHG determinations were completed for the Russell City Energy Center and the Palmdale Hybrid Power Project in California. Both projects proposed the use of combined-cycle configurations to produce commercial power, and the BACT analyses for both projects concluded that plant efficiency was the only feasible combustion control technology. However, the Palmdale project includes a 251-acre solar thermal field that generates up to 50 MWs during sunny days, which reduces the project's overall heat rate.

Because CCS is not technically or economically feasible, thermal efficiency remains the most effective, technically feasible, and economically feasible GHG control technology for the AEC. The operationally flexible turbine class and steam cycle designs selected for the AEC are the most thermally efficient for the project design objectives, operating at the projected annual capacity factor of approximately 50 percent. Table 3-1 compares the AEC heat rate with that of other recent combined- and simple-cycle projects permitted in California.

TABLE 3-1
Comparison of Heat Rates and GHG Performance Values of Recently Permitted Projects

Plant Performance Variable	Heat Rate (Btu/kWh)	GHG Performance ($MTCO_2$/MWh)
Alamitos Energy Center	6,314 – Combined-cycle 9,066 – Simple-cycle [a]	0.453 [a]
Watson Cogeneration Project [b]	5,027 to 6,327	0.219 to 0.318
Palmdale Hybrid Power Project	6,970 [c]	0.370 [c]
Russell City Energy Project	6,852 [d]	0.371 [e]
El Segundo Power Redevelopment Project	6,754 – Combined-cycle 8,458 – Simple-cycle [f]	0.409
Carlsbad Energy Center [g]	9,473	0.503

[a] The net heat rate at 65.3°F at site elevation, relative humidity of 86.8 percent, and no inlet air cooling. Heat rates averaged over the operating range of 50 to 100 percent load, with heat rates at higher load rates being more efficient. GHG performance based on plant-wide CO_2 emissions of 1,551,247 metric tons CO_2/year / (640 MWs * 4,612 hours/year + 400 MWs * 2,358 hours/year).

[b] From Watson Cogeneration Project Commission Final Decision.

[c] From Tables 3 and 4 of the Palmdale Hybrid Power Project Greenhouse Gas BACT Analysis (AECOM, 2011).

[d] Net design heat rate with no duct burners, from "GHG BACT Analysis Case Study, Russell City Energy Center; November 2009, updated February 3, 2010."

[e] From Russell City total heat input of 4,477 MMBtu/hr (from PSD Permit), generation of 653 MW was calculated utilizing design heat rate of 6,852 Btu/kWh. From reference document in footnote d above, 1-hour CO_2 limit is 242 $MTCO_2$/hr, which yields 0.371 MT CO_2/MWh.

[f] From El Segundo Power Redevelopment Project Revised Final Determination of Compliance, pages 9 and 11, July 9, 2015 (TN 205313-2).

[g] From Carlsbad Energy Center Project Amendments Final Decision, Greenhouse Gas Table 3, page 6.1-14, August 3, 2015 (TN 205625).

Note:

$MTCO_2$/MWh = metric tons of carbon dioxide per megawatt-hour

As shown in Table 3-1, when comparing the AEC heat rate and GHG performance values for other recently permitted California facilities, the AEC heat rate is consistent with these other recent projects. For instance, comparing the AEC overall plant efficiency to the Carlsbad project shows the benefits of the AEC's more efficient combined-cycle power block.

The AEC offers the flexibility of fast start and ramping capability of both combined- and simple-cycle configurations, as well as the high efficiency associated with the combined-cycle power block. Comparing the thermal efficiency of the AEC to other recently permitted California projects demonstrates that the AEC's thermal efficiency is consistent with other projects and the AEC thermal efficiency is proposed as BACT for GHGs.

3.2.2.5 GHG BACT Selection – Step 5

Based on the above analysis, the only remaining feasible and cost-effective option is the "Thermal Efficiency" option, which therefore is selected as BACT.

As shown above, the GE Frame 7FA.05 and LMS-100 combustion turbines operating as combined-cycle and simple-cycle power blocks compare favorably with other comparable turbines. The AEC turbines will combust natural gas to generate electricity from both the CTGs and STG. Therefore, the thermal efficiency for the project is best measured in terms of lb of CO_2 per MWh.

The performance of all CTGs degrades over time. Typically, turbine degradation at the time of recommended routine maintenance is up to 8 percent. Additionally, thermal efficiency can vary significantly with combustion turbine turndown and steam turbine/duct burning combinations. Finally, annual metrics for output-based limits on GHG emissions are affected by startup and shutdown periods because fuel is combusted before useful output of energy or steam. Therefore, the annual average thermal efficiency performance of any turbine will be greater than the optimal efficiency of a new turbine operating continuously at peak load over the lifetime of the turbine.

Based on the projected annual operating profile and equipment design specification provided by AES, the GHG BACT calculation for the AEC was determined in lb of CO_2 per MWh of energy output (on a gross basis). Included in this calculation is the inherent degradation in turbine performance over the lifetime of the AEC. The AEC proposed BACT level for GHG emissions is an emission rate of 878 lb CO_2/MWh of net energy output[10].

[10] 1,551,247 metric tons of CO_2/year / 3,894,880 MWh (640 MWs * 4,612 hours/year + 400 MW * 2,358 hours/year) * 2,204.62 lb/metric tons

SECTION 4

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Attachment 1
Greenhouse Gas BACT Analysis

Alamitos Energy Center
Table 5.1B.23
Simple-Cycle: GHG BACT Analysis
October 2015

Performance Data

Data for 1 LMS-100PB	100 Percent Load	75 Percent Load	50 Percent Load
Net Electrical Output (kW)	97,864	72,527	47,565
Net Heat Rate (Btu/kWh-LHV)	8,060	8,778	10,359
Gross Heat Rate (Btu/kWh-LHV)	7,950	8,618	10,073
Gross Electrical Output (kW)	99,215	73,878	48,916

GHG Efficiency Calculations

Parameter	Value	Notes
Average Net Heat Rate (Btu/kWh-LHV)	9,066	
Average Gross Heat Rate (Btu/kWh-LHV)	8,880	
Operating Hours/Year	2,000	
Number of Startups and Shutdowns/Year/CTG	500	
Duration of Startup (to Baseload) (Hours)	0.17	Assumed 10 minutes from first fire to full load operation
Duration of Shutdown (Baseload to No Fuel Combustion) (Hours)	0.22	Assumed 13 minutes from full load operation to no fuel combustion
Startup Hours/Year	83	500 * 0.17
Shutdown Hours/Year	108	500 * 0.22
Startup Net Heat Rate (Btu/kWh-LHV)	25,897	Assumed 2.5 times the 50% load heat rate
Shutdown Net Heat Rate (Btu/kWh-LHV)	15,538	Assumed 1.5 times the 50% load heat rate
Overall Net Heat Rate (Btu/kWh-LHV)	10,026	
Net lb CO_2/MWh	1,054	Based on 52.91 kg CO_2/MMBtu-HHV, converted to LHV using an LHV/HHV factor of 0.9009
Net lb CO_2/MWh (with 8% Degradation)	1,138	1,054 Net lb CO_2/MWh * 1.08

Alamitos Energy Center
Table 5.1B.24
Combined-Cycle: GHG BACT Analysis
October 2015

1x1 Performance Data

1 on 1 Configuration	Minimum CTG Turndown (Approximately 44% CTG Load)	First Intermediate Point (Approximately 63% CTG Load)	Second Intermediate Point (Approximately 81% CTG Load)	Base Load (100% CTG Load)
Net Plant Electrical Output (kW)	169,219	218,066	268,635	328,051
Net Plant Heat Rate (Btu/kWh-LHV)	7,061	6,327	6,275	6,155
Gross Heat Rate (Btu/kWh-LHV)	6,664	6,034	6,003	5,911
Net Heat Rate (Btu/kWh-HHV)	7,834	7,020	6,962	6,829
Gross Power Output (kW)	179,299	228,654	280,802	341,561
Average Net Electrical Output (kW)	245,993			

2x1 Performance Data

2 on 1 Configuration	Minimum CTG Turndown (Approximately 44% CTG Load)	First Intermediate Point (Approximately 63% CTG Load)	Second Intermediate Point (Approximately 81% CTG Load)	Base Load (100% CTG Load)
Net Plant Electrical Output (kW)	349,244	446,187	547,390	665,162
Net Plant Heat Rate (Btu/kWh-LHV)	6,842	6,184	6,159	6,071
Gross Heat Rate (Btu/kWh-LHV)	6,485	5,912	5,925	5,869
Net Heat Rate (Btu/kWh-HHV)	7,592	6,862	6,834	6,736
Gross Power Output (kW)	368,492	466,722	568,975	688,095
Average Net Electrical Output (kW)	501,996			

GHG Efficiency Calculations

Parameter	Value	Notes
1 on 1 Operating Hours/Year	900	Assumed
2 on 1 Operating Hours/Year	3,200	Assumed
Average Net 1 on 1 Heat Rate (Btu/kWh-LHV)	6,454	
Average Net 2 on 1 Heat Rate (Btu/kWh-LHV)	6,314	
Operating Hours/Year	4,100	
Number of Hot/Warm Startups/Year	476	For two turbines
Number of Cold Startups/Year	24	For two turbines
Number of Shutdowns/Year	500	For two turbines
Duration of Hot/Warm Startup (to Baseload) (Hours)	0.25	First fire to base load reached in 15 minutes
Duration of Cold Startup (to Baseload) (Hours)	0.33	First fire to base load reached in 20 minutes
Duration of Shutdown (Baseload to No Fuel Combustion) (Hours)	0.50	Baseload to no fuel combustion reached in 30 minutes
Startup Hours/Year	127	476 * 0.25 + 24 * 0.33
Shutdown Hours/Year	250	500 * 0.50
Startup Net Heat Rate (Btu/kWh-LHV)	17,651	Assumed 2.5 times the 44% load heat rate
Shutdown Net Heat Rate (Btu/kWh-LHV)	10,591	Assumed 1.5 times the 44% load heat rate
Overall Net Heat Rate (Btu/kWh-LHV)	6,903	
Net lb CO_2/MWh	725	Based on 52.91 kg CO_2/MMBtu-HHV, converted to LHV using an LHV/HHV factor of 0.9009.
Net lb CO_2/MWh (with 8% Degradation)	784	730 Net lb CO_2/MWh * 1.08
Capacity Factor (%)	31.37	

Appendix 5.1E
SCAQMD Permit Application Forms

AES Alamitos, LLC
690 North Studebaker Road
Long Beach, CA 90803
tel 562 493 7840
fax 562 493 7320

October 23, 2015

Mr. John Yee
Senior Air Quality Engineer
South Coast Air Quality Management District
21865 E. Copley Drive
Diamond Bar, California 91765-4178

Subject: AES Alamitos, LLC (Facility ID 115394)
Application for South Coast Air Quality Management District Permit to Construct and Modification to the Title V Permit to Operate

Dear Mr. Yee:

AES Alamitos, LLC (AES), a wholly-owned subsidiary of the AES Corporation, is submitting two copies of the application materials for a South Coast Air Quality Management District (SCAQMD) Permit to Construct for the Alamitos Energy Center (AEC) and a modification to the existing Title V Permit to Operate for Facility 115394.[1]

AEC is a natural-gas-fired electrical generating facility with a net generating capacity of 1,040 megawatts (MW) which will be constructed on the site of the AES Alamitos Generating Station (AGS) located in the City of Long Beach, California. AEC will consist of one two-on-one combined-cycle power block and one simple-cycle power block. The combined-cycle power block will consist of two General Electric (GE) Frame 7FA.05 natural-gas-fired combustion turbine generators with heat recovery steam generators, one steam turbine generator, one air-cooled condenser, and one natural-gas-fired auxiliary boiler. The simple-cycle power block will consist of four GE LMS-100 natural-gas-fired combustion turbine generators and four closed-loop cooling fin fan coolers. AEC will also include two oil/water separators, two 19 percent aqueous ammonia storage tanks, and ancillary facilities. The attached application is being submitted in conjunction with a Supplemental Application for Certification (SAFC) that was submitted to the California Energy Commission the week of October 23, 2015.

The AEC application relies on the provisions contained in SCAQMD Rule 1304(a)(2), which allows the replacement of older, less efficient electric utility steam boilers with specific new generation technologies on a MW-to-MW basis. The SCAQMD Rule 1304(b)(2) offset exemption, applicable to the combustion turbine generators only, will be met by permanently retiring AES-owned electric steam utility boilers. Table 1 shows a Rule 1304 schedule for all AES facilities within the SCAQMD's jurisdiction. All units proposed for retirement are owned by wholly-owned subsidiaries of the AES Corporation. The attached organizational chart illustrates the corporate structure of the subject

[1] The SCAQMD received a similar application on December 20, 2013. However, AES is modifying AEC's application to be consistent with a power purchase agreement awarded in November 2014.

limited liability corporations and demonstrates the common ownership of AES Redondo Beach, LLC; AES Huntington Beach, LLC; and AES Alamitos, LLC, per the requirements of SCAQMD Rule 1304(a)(2).

TABLE 1

AES Rule 1304(a)(2) Schedule

Project	Phase	First Fire or Shutdown Date	MW Gross
Huntington Beach Energy Project	Combined-Cycle Block [a]	10/1/2019	693.822
	HBGS Unit 1 Retired	11/1/2019	215
	RBGS Unit 7 Retired	10/1/2019	480
	Simple-Cycle Block [b]	11/1/2023	201.628
	HBGS Unit 2 Retired	12/31/2020	215
	MW Installed		895.45
	MW Retired		910
	Surplus MW		14.55
Redondo Beach Energy Project	Combined-Cycle Block	11/1/2019	546.4
	RBGS Unit 5 Retired	12/31/2019	175
	RBGS Unit 8 Retired	12/31/2019	480
	MW Installed		546.4
	MW Retired		655
	Surplus MW (HBEP & RBEP)		123.15
Alamitos Energy Center	Combined-Cycle Block [c]	10/1/2019	692.951
	AGS Unit 1 Retired	12/29/2019	175
	AGS Unit 2 Retired	12/29/2019	175
	AGS Unit 5 Retired	12/29/2019	480
	AGS Unit 3 Retired	12/31/2020	320
	Simple-Cycle Block [d]	6/1/2021	401.751
	MW Installed		1,094.702
	MW Retired		1,150
Total MWs Installed and Retired	Total MW Installed		2,536.552
	Total MW Retired		2,715.00

[a] Based on 65.8 degrees Fahrenheit (°F) with evaporative coolers operating.
[b] Based on 65.8°F with evaporative coolers operating.
[c] Based on 59°F without evaporative coolers operating.
[d] Based on 59°F without evaporative coolers operating.

HBEP = Huntington Beach Energy Project
HBGS = Huntington Beach Generating Station
RBEP = Redondo Beach Energy Project
RBGS = Redondo Beach Generating Station

Unlike the combustion turbine generators, the auxiliary boiler is not eligible for offsets exemption under SCAQMD Rule 1304(a)(2). Therefore, AES will surrender emission reduction credits to sufficiently offset the auxiliary boiler's volatile organic compounds (VOC) and respirable particulate matter (PM_{10}) emissions at a 1.2-to-1 ratio, consistent with SCAQMD Rule 1303(b)(2).

The contents of this application package include the required SCAQMD forms,[2] the manufacturers' emissions guarantees for the proposed oxidation catalyst and selective catalytic reduction systems, and the following sections from the SAFC:

- Section 1.0: Executive Summary
- Section 2.0: Project Description
- Section 5.1: Air Quality (includes Appendices 5.1A through 5.1G)
- Section 5.9: Public Health (includes Appendices 5.9A through 5.9C)
- Section 6.0: Alternatives

As described in Section 5.9 of the SAFC, AES conducted a health risk assessment (HRA) consistent with the SCAQMD's current practice of estimating toxic emissions from gas turbines using emission factors listed in Table 3.1-3 of the U.S. Environmental Protection Agency's (EPA) *AP-42, Compilation of Air Pollutant Emission Factors*. However, formaldehyde emissions were estimated using the SCAQMD formaldehyde emission factor of 3.6×10^{-4} pound(s) per million British thermal units previously provided by the SCAQMD. Toxic emissions from the auxiliary boiler were similarly estimated using emission factors listed in Tables 1.4-3 and 1.4-4 of EPA's *AP-42*. Summaries of the air toxics emissions included in the HRA are provided in Tables 5.1B.6, 5.1B.10, and 5.1B.14 of the attached SAFC Appendix 5.1B for the combined-cycle turbines, simple-cycle turbines, and auxiliary boiler, respectively.

A summary of the maximum incremental cancer risk (MICR), chronic hazard index, and acute hazard index at the point of maximum impact (PMI) locations have been included in Table 2. In accordance with SCAQMD Rule 1401, the results represent the predicted risk for each individual emission unit. Overall, the predicted MICR at the PMI is above the individual source significance threshold of 1 in 1 million for the GE 7FA.05 turbines, but below the significance threshold for the remaining combustion units. The facility cancer burden is 1×10^{-8}, which is well below the SCAQMD Rule 1401 threshold of 0.5. Additionally, the predicted chronic and acute hazard indices are below the SCAQMD individual source significance threshold of 1.0 for all proposed combustion units. Although the MICR for the GE 7FA.05 turbines exceeds the individual source significance threshold of 1 in 1 million, it is below the significance threshold with Best Available Control Technology for Toxics (T-BACT) of 10 in 1 million. The AEC design includes the use of an oxidation catalyst to reduce carbon monoxide (CO) and VOC emissions from the GE 7FA.05 turbines to the best available control levels of 2 parts per million (ppm) and 2 ppm, respectively. The oxidation catalyst has the added benefit of reducing hazardous air pollutant (HAP) emissions and is, therefore, considered T-BACT.[3]

---

[2] Per discussion with SCAQMD staff (Andrew Lee and John Yee) during the pre-application meeting for the Redondo Beach Energy Project on April 19, 2012, Form 500-C1 has not been included in the application package.

[3] *AP-42*, Section 3.1, Stationary Internal Combustion Processes Guidance Document, updated in 2000, page 3.1-7 — "The performance of these oxidation catalyst systems on combustion turbines results in 90-plus percent control of CO and about 85 to 90 percent control of formaldehyde. Similar emission reductions are expected on other HAP pollutants."

TABLE 2

AEC Health Risk Assessment Summary: Individual Units (BASIS: AP-42 Emission Factors) [a, b]

Risk	GE 7FA.05-01	GE 7FA.05-02	GE LMS 100-01	GE LMS 100-02	GE LMS 100-03	GE LMS 100-04	Auxiliary Boiler
MICR at the PMI [c] (per million)	1.5	1.5	0.12	0.12	0.12	0.12	0.40
Facility Cancer Burden	1×10^{-8}	--	--	--	--	--	--
Chronic Hazard Index at the PMI	0.0019	0.0019	0.00015	0.00015	0.00015	0.00015	0.011
Acute Hazard Index at the PMI	0.0073	0.0074	0.0026	0.0043	0.0027	0.0026	0.0026

[a] The results represent the predicted risk for each individual emission unit in accordance with SCAQMD Rule 1401.
[b] A source with a MICR less than 1 in 1 million individuals is considered to be less than significant. A source with a MICR less than 10 in 1 million individuals is considered less than significant if T-BACT is installed. A chronic or acute hazard index less than 1.0 for each source is considered to be a less-than-significant health risk.
[c] Cancer risk values are based on the Risk Management Policy (RMP) Derived Methodology.

Attached to this application are the dispersion modeling files, which includes files from the California Air Resources Board's Hotspots Analysis Reporting Program 2 used to conduct the HRA, and a check in the amount of $161,380.74 for the requisite permit application filing fee, consistent with the attached SCAQMD Fee Sheet. Please note that this fee includes payment for expedited permit processing.

Below, please find a statement certifying that all major California sources owned or operated by AES Corporation are in compliance with applicable air quality regulations:

> I, Stephen O'Kane, as a corporate office of AES Alamitos, LLC, certify that all major stationary sources, as defined in the jurisdiction where the facilities are located, that are owned or operated by AES in the State of California are subject to emission limitations and are in compliance or on a schedule for compliance with all applicable emission limitations and standards under the Clean Air Act.

AES looks forward to working with the SCAQMD during the review of the AEC application materials and the issuance of the SCAQMD Permit to Construct and modified Title V operating permit.

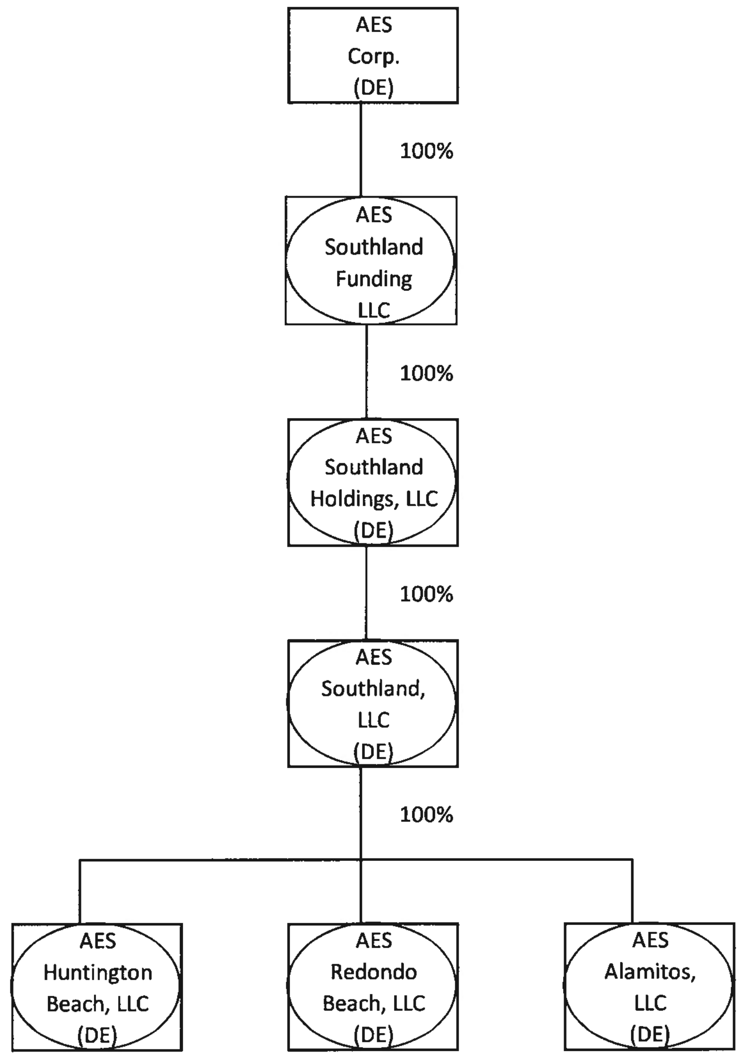
Sincerely,

Stephen O'Kane
Manager
AES Alamitos, LLC

Attachments: Two (2) hard copies of the application materials
Five (5) dispersion modeling file DVDs

cc: Stephen O'Kane/AES (cover letter only)
Jennifer Didlo/AES (cover letter only)
Jeffery Harris/ESH (cover letter only)
Samantha Pottenger/ESH (cover letter only)
Jerry Salamy/CH2M (cover letter only)

AES Southand
Legal Ownership Structure



South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (◉) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

690 N. Studebaker Road
Street Address

Long Beach, CA 90803
City, Zip

Stephen O'Kane — Manager
Contact Name — Title

5624937840 — Ext. — (562) 493-7320
Phone # — Ext. — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address
City, State Zip
Contact Name — Title
Phone # — Ext. — Fax #
E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (◉) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:

- ( ) New Construction (Permit to Construct)
- ( ) Equipment On-Site But Not Constructed or Operational
- ( ) Equipment Operating Without A Permit *
- ( ) Compliance Plan
- ( ) Registration/Certification
- ( ) Streamlined Standard Permit

7b. Facility Permits:

- (◉) Title V Application or Amendment (Refer to Title V Matrix)
- ( ) RECLAIM Facility Permit Amendment

7c. Equipment or Process with an Existing/Previous Application or Permit:

- ( ) Administrative Change
- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
- ( ) Change of Location
- ( ) Change of Location without Prior Approval *
- ( ) Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number: ______

* A Higher Permit Processing Fee and additional Annual Operating Fees (up to 3 full years) may apply (Rule 301(c)(1)(D)(i)).

8a. Estimated Start Date of Construction (mm/dd/yyyy): 06/01/2017
8b. Estimated End Date of Construction (mm/dd/yyyy): 08/31/2021
8c. Estimated Start Date of Operation (mm/dd/yyyy): 09/01/2021

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): Title V Permit Revision

10. For identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 0

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (◉) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? (◉) No ( ) Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (◉) Yes

16. Are there any schools (K-12) within 1000 feet of the facility property line? ( ) No (◉) Yes

Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: [signature]

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (◉) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/15/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) (◉) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (•) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

690 N. Studebaker Road
Street Address

Long Beach, CA 90803
City, Zip

Stephen O'Kane — Manager
Contact Name — Title

5624937840 — Ext. — (562) 493-7320
Phone # — Ext. — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address

City, State, Zip

Contact Name — Title

Phone # — Ext. — Fax #

E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (•) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:

- (•) New Construction (Permit to Construct)
- ( ) Equipment On-Site But Not Constructed or Operational
- ( ) Equipment Operating Without A Permit *
- ( ) Compliance Plan
- ( ) Registration/Certification
- ( ) Streamlined Standard Permit

7b. Facility Permits:

- ( ) Title V Application or Amendment (Refer to Title V Matrix)
- ( ) RECLAIM Facility Permit Amendment

7c. Equipment or Process with an Existing/Previous Application or Permit:

- ( ) Administrative Change
- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
- ( ) Change of Location
- ( ) Change of Location without Prior Approval *
- ( ) Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number:

* A Higher Permit Processing Fee and additional Annual Operating Fees (up to 3 full years) may apply (Rule 301(c)(1)(D)(i)).

8a. Estimated Start Date of Construction (mm/dd/yyyy): 06/01/2017

8b. Estimated End Date of Construction (mm/dd/yyyy): 03/31/2020

8c. Estimated Start Date of Operation (mm/dd/yyyy): 04/01/2020

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): Combined Cycle Combustion Turbines

10. For identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 1

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (•) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? (•) No ( ) Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (•) Yes

16. Are there any schools (K-12) within 1000 feet of the facility property line? ( ) No (•) Yes

Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: S. O'Kane

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (•) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/15/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) (•) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

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South Coast Air Quality Management District

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Stephen O'Kane — Manager
Contact Name — Title

5624937840 — Ext. — (562) 493-7320
Phone # — Ext. — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
☒ Check here if same as equipment location address

Address

City, State Zip

Contact Name — Title

Phone # — Ext. — Fax #

E-Mail:

Section D - Application Type

6. The Facility Is: ○ Not In RECLAIM or Title V ○ In RECLAIM ○ In Title V ◉ In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:

- ◉ New Construction (Permit to Construct)
- ○ Equipment On-Site But Not Constructed or Operational
- ○ Equipment Operating Without A Permit *
- ○ Compliance Plan
- ○ Registration/Certification
- ○ Streamlined Standard Permit

7b. Facility Permits:

- ○ Title V Application or Amendment (Refer to Title V Matrix)
- ○ RECLAIM Facility Permit Amendment

7c. Equipment or Process with an Existing/Previous Application or Permit:

- ○ Administrative Change
- ○ Alteration/Modification
- ○ Alteration/Modification without Prior Approval *
- ○ Change of Condition
- ○ Change of Condition without Prior Approval *
- ○ Change of Location
- ○ Change of Location without Prior Approval *
- ○ Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number: ____________

* A Higher Permit Processing Fee and additional Annual Operating Fees (up to 3 full years) may apply (Rule 301(c)(1)(D)(i)).

8a. Estimated Start Date of Construction (mm/dd/yyyy): 06/01/2017

8b. Estimated End Date of Construction (mm/dd/yyyy): 03/31/2020

8c. Estimated Start Date of Operation (mm/dd/yyyy): 04/01/2020

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): Combined Cycle Combustion Turbines

10. For identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 1

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) ◉ No ○ Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? ◉ No ○ Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ○ No ◉ Yes

16. Are there any schools (K-12) within 1000 feet of the facility property line? ○ No ◉ Yes

Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: S O'Kane

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ○ No ◉ Yes

20. Print Name: Stephen O'Kane

21. Date: 10/15/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) ◉ No ○ Yes

23. Check List: ☒ Authorized Signature/Date ☒ Form 400-CEQA ☒ Supplemental Form(s) (ie., Form 400-E-xx) ☒ Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED	PAYMENT TRACKING #	VALIDATION
			$		

DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (•) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

690 N. Studebaker Road
Street Address

Long Beach, CA 90803
City, Zip

Stephen O'Kane — Manager
Contact Name — Title

5624937840 — Ext. — (562) 493-7320
Phone # — Ext. — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address:
City: , State: Zip:
Contact Name: Title:
Phone #: Ext.: Fax #:
E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (•) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:

- (•) New Construction (Permit to Construct)
- ( ) Equipment On-Site But Not Constructed or Operational
- ( ) Equipment Operating Without A Permit *
- ( ) Compliance Plan
- ( ) Registration/Certification
- ( ) Streamlined Standard Permit

7b. Facility Permits:

- ( ) Title V Application or Amendment (Refer to Title V Matrix)
- ( ) RECLAIM Facility Permit Amendment

7c. Equipment or Process with an Existing/Previous Application or Permit:

- ( ) Administrative Change
- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
- ( ) Change of Location
- ( ) Change of Location without Prior Approval *
- ( ) Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number: ______

* A Higher Permit Processing Fee and additional Annual Operating Fees (up to 3 full years) may apply (Rule 301(c)(1)(D)(i)).

8a. Estimated Start Date of Construction (mm/dd/yyyy): 05/01/2020

8b. Estimated End Date of Construction (mm/dd/yyyy): 08/31/2021

8c. Estimated Start Date of Operation (mm/dd/yyyy): 09/01/2021

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): Simple Cycle Combustion Turbines

10. For Identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 3

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (•) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? (•) No ( ) Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (•) Yes

16. Are there any schools (K-12) within 1000 feet of the facility property line? ( ) No (•) Yes

Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: [signature]

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (•) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/15/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) (•) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #		CHECK #		AMOUNT RECEIVED $		PAYMENT TRACKING #		VALIDATION
DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (◉) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

690 N. Studebaker Road
Street Address

Long Beach, CA 90803
City, Zip

Stephen O'Kane — Manager
Contact Name — Title

5624937840 — Ext. — (562) 493-7320
Phone # — Ext. — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address:
City: , State: Zip:
Contact Name: Title:
Phone #: Ext.: Fax #:
E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (◉) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:
- (◉) New Construction (Permit to Construct)
- ( ) Equipment On-Site But Not Constructed or Operational
- ( ) Equipment Operating Without A Permit *
- ( ) Compliance Plan
- ( ) Registration/Certification
- ( ) Streamlined Standard Permit

7b. Facility Permits:
- ( ) Title V Application or Amendment (Refer to Title V Matrix)
- ( ) RECLAIM Facility Permit Amendment

7c. Equipment or Process with an Existing/Previous Application or Permit:
- ( ) Administrative Change
- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
- ( ) Change of Location
- ( ) Change of Location without Prior Approval *
- ( ) Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number: ______

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8a. Estimated Start Date of Construction (mm/dd/yyyy): 05/01/2020

8b. Estimated End Date of Construction (mm/dd/yyyy): 08/31/2021

8c. Estimated Start Date of Operation (mm/dd/yyyy): 09/01/2021

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): Simple Cycle Combustion Turbines

10. For Identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 3

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (◉) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? (◉) No ( ) Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (◉) Yes

16. Are there any schools (K-12) within 1000 feet of the facility property line? ( ) No (◉) Yes

Section F - Authorization/Signature *I hereby certify that all information contained herein and information submitted with this application are true and correct.*

17. Signature of Responsible Official: [signature]

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (◉) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/15/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) (◉) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (●) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

690 N. Studebaker Road
Street Address

Long Beach, CA 90803
City, Zip

Stephen O'Kane — Manager
Contact Name — Title

5624937840 — Ext. — (562) 493-7320
Phone # — Ext. — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address
City, State Zip
Contact Name — Title
Phone # — Ext. — Fax #
E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (●) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:
- (●) New Construction (Permit to Construct)
- ( ) Equipment On-Site But Not Constructed or Operational
- ( ) Equipment Operating Without A Permit *
- ( ) Compliance Plan
- ( ) Registration/Certification
- ( ) Streamlined Standard Permit

7b. Facility Permits:
- ( ) Title V Application or Amendment (Refer to Title V Matrix)
- ( ) RECLAIM Facility Permit Amendment

7c. Equipment or Process with an Existing/Previous Application or Permit:
- ( ) Administrative Change
- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
- ( ) Change of Location
- ( ) Change of Location without Prior Approval *
- ( ) Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number:

* A Higher Permit Processing Fee and additional Annual Operating Fees (up to 3 full years) may apply (Rule 301(c)(1)(D)(i)).

8a. Estimated Start Date of Construction (mm/dd/yyyy): 05/01/2020
8b. Estimated End Date of Construction (mm/dd/yyyy): 08/31/2021
8c. Estimated Start Date of Operation (mm/dd/yyyy): 09/01/2021

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): Simple Cycle Combustion Turbines

10. For identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 3

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (●) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? (●) No ( ) Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (●) Yes

16. Are there any schools (K-12) within 1000 feet of the facility property line? ( ) No (●) Yes

Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: [signature]

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (●) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/15/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) (●) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (◉) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

690 N. Studebaker Road
Street Address

Long Beach, CA 90803
City, Zip

Stephen O'Kane — Manager
Contact Name — Title

5624937840 Ext. — (562) 493-7320
Phone # — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address
City, State Zip
Contact Name, Title
Phone #, Ext., Fax #
E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (◉) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:

- (◉) New Construction (Permit to Construct)
- ( ) Equipment On-Site But Not Constructed or Operational
- ( ) Equipment Operating Without A Permit *
- ( ) Compliance Plan
- ( ) Registration/Certification
- ( ) Streamlined Standard Permit

7b. Facility Permits:

- ( ) Title V Application or Amendment (Refer to Title V Matrix)
- ( ) RECLAIM Facility Permit Amendment

7c. Equipment or Process with an Existing/Previous Application or Permit:

- ( ) Administrative Change
- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
- ( ) Change of Location
- ( ) Change of Location without Prior Approval *
- ( ) Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number: ______

* A Higher Permit Processing Fee and additional Annual Operating Fees (up to 3 full years) may apply (Rule 301(c)(1)(D)(i)).

8a. Estimated Start Date of Construction (mm/dd/yyyy): 05/01/2020
8b. Estimated End Date of Construction (mm/dd/yyyy): 08/31/2021
8c. Estimated Start Date of Operation (mm/dd/yyyy): 09/01/2021

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): Simple Cycle Combustion Turbines

10. For identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 3

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (◉) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? (◉) No ( ) Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (◉) Yes

16. Are there any schools (K-12) within 1000 feet of the facility property line? ( ) No (◉) Yes

Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: [signature]

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (◉) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/15/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) (◉) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (●) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

690 N. Studebaker Road
Street Address

Long Beach, CA 90803
City, Zip

Stephen O'Kane — Manager
Contact Name — Title

5624937840 — Ext. — (562) 493-7320
Phone # — Ext. — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address

City, State Zip

Contact Name — Title

Phone # — Ext. — Fax #

E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (●) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:

- (●) New Construction (Permit to Construct)
- ( ) Equipment On-Site But Not Constructed or Operational
- ( ) Equipment Operating Without A Permit *
- ( ) Compliance Plan
- ( ) Registration/Certification
- ( ) Streamlined Standard Permit

7b. Facility Permits:

- ( ) Title V Application or Amendment (Refer to Title V Matrix)
- ( ) RECLAIM Facility Permit Amendment

7c. Equipment or Process with an Existing/Previous Application or Permit:

- ( ) Administrative Change
- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
- ( ) Change of Location
- ( ) Change of Location without Prior Approval *
- ( ) Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number: ______

* A Higher Permit Processing Fee and additional Annual Operating Fees (up to 3 full years) may apply (Rule 301(c)(1)(D)(i)).

8a. Estimated Start Date of Construction (mm/dd/yyyy): 06/01/2017

8b. Estimated End Date of Construction (mm/dd/yyyy): 03/31/2020

8c. Estimated Start Date of Operation (mm/dd/yyyy): 04/01/2020

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): Auxiliary Boiler

10. For Identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 0

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (●) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? (●) No ( ) Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (●) Yes

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Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: [signature]

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (●) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/5/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) (●) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

South Coast AQMD

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (◉) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

690 N. Studebaker Road
Street Address

Long Beach, CA 90803
City / Zip

Stephen O'Kane — Manager
Contact Name / Title

5624937840 — Ext. — (562) 493-7320
Phone # / Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address
City, State Zip
Contact Name, Title
Phone #, Ext., Fax #
E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (◉) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:
- (◉) New Construction (Permit to Construct)
- ( ) Equipment On-Site But Not Constructed or Operational
- ( ) Equipment Operating Without A Permit *
- ( ) Compliance Plan
- ( ) Registration/Certification
- ( ) Streamlined Standard Permit

7b. Facility Permits:
- ( ) Title V Application or Amendment (Refer to Title V Matrix)
- ( ) RECLAIM Facility Permit Amendment

7c. Equipment or Process with an Existing/Previous Application or Permit:
- ( ) Administrative Change
- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
- ( ) Change of Location
- ( ) Change of Location without Prior Approval *
- ( ) Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number:

* A Higher Permit Processing Fee and additional Annual Operating Fees (up to 3 full years) may apply (Rule 301(c)(1)(D)(i)).

8a. Estimated Start Date of Construction (mm/dd/yyyy): 06/01/2017
8b. Estimated End Date of Construction (mm/dd/yyyy): 03/31/2020
8c. Estimated Start Date of Operation (mm/dd/yyyy): 04/01/2020

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): SCR/Oxidation Catalyst for Combined Cycle Combustion Turbines

10. For identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 1

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (◉) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? If Yes, provide NOV/NC#: (◉) No ( ) Yes

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (◉) Yes

16. Are there any schools (K-12) within 1000 feet of the facility property line? ( ) No (◉) Yes

Section F - Authorization/Signature *I hereby certify that all information contained herein and information submitted with this application are true and correct.*

17. Signature of Responsible Official: [signature]

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (◉) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/15/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) (◉) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (◉) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

690 N. Studebaker Road
Street Address

Long Beach, CA 90803
City Zip

Stephen O'Kane — Manager
Contact Name — Title

5624937840 — Ext. — (562) 493-7320
Phone # — Ext. — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address

City, State Zip

Contact Name — Title

Phone # — Ext. — Fax #

E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (◉) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:

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- ( ) Equipment On-Site But Not Constructed or Operational
- ( ) Equipment Operating Without A Permit *
- ( ) Compliance Plan
- ( ) Registration/Certification
- ( ) Streamlined Standard Permit

7b. Facility Permits:

- ( ) Title V Application or Amendment (Refer to Title V Matrix)
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7c. Equipment or Process with an Existing/Previous Application or Permit:

- ( ) Administrative Change
- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
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- ( ) Change of Location without Prior Approval *
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SCR/Oxidation Catalyst for Combined Cycle Combustion Turbines

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Section E - Facility Business Information

13. What type of business is being conducted at this equipment location?
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14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

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Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: [signature] S. O'Kane

18. Title of Responsible Official: Manager

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South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

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South Coast AQMD

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SCAQMD
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Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

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3. Owner's Business Name (If different from Business Name of Operator):

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Street Address

Long Beach, CA 90803
City, Zip

Stephen O'Kane — Manager
Contact Name — Title

5624937840 — Ext. — (562) 493-7320
Phone # — Ext. — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address

City, State, Zip

Contact Name — Title

Phone # — Ext. — Fax #

E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (◉) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

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- ( ) Compliance Plan
- ( ) Registration/Certification
- ( ) Streamlined Standard Permit

7b. Facility Permits:

- ( ) Title V Application or Amendment (Refer to Title V Matrix)
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- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
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8c. Estimated Start Date of Operation (mm/dd/yyyy): 09/01/2021

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17. Signature of Responsible Official: [signature] S O'Kane

18. Title of Responsible Official: Manager

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AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

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South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

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Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

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2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

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4. Equipment Location Is: (●) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

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City, Zip

Stephen O'Kane — Manager
Contact Name — Title

5624937840 Ext. — (562) 493-7320
Phone # — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address
City, State Zip
Contact Name — Title
Phone # Ext. — Fax #
E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (●) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

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- ( ) Title V Application or Amendment (Refer to Title V Matrix)
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9. Description of Equipment or Reason for Compliance Plan (list applicable rule):
SCR/Oxidation Catalyst for Simple Cycle Combustion Turbines

10. For identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 3

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Section E - Facility Business Information

13. What type of business is being conducted at this equipment location?
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17. Signature of Responsible Official: [signature]

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AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED	PAYMENT TRACKING #	VALIDATION
			$		

DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

South Coast AQMD

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

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4. Equipment Location Is: (◉) Fixed Location ( ) Various Location
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Street Address

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City, Zip

Stephen O'Kane — Manager
Contact Name — Title

5624937840 — Ext. — (562) 493-7320
Phone # — Ext. — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address
City, State Zip
Contact Name, Title
Phone #, Ext., Fax #
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Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (◉) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:

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7b. Facility Permits:

- ( ) Title V Application or Amendment (Refer to Title V Matrix)
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17. Signature of Responsible Official: [signature] O'Kane

18. Title of Responsible Official: Manager

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AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

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South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

Mail To:
SCAQMD
P.O. Box 4944
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South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

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8b. Estimated End Date of Construction (mm/dd/yyyy): 03/31/2021
8c. Estimated Start Date of Operation (mm/dd/yyyy): 04/01/2020

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): SCR for Auxiliary Boiler

10. For identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 0

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (●) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? (●) No ( ) Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (●) Yes

16. Are there any schools (K-12) within 1000 feet of the facility property line? ( ) No (●) Yes

Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: [signature] S. O'Kane

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (●) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/15/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) (●) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (●) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

690 N. Studebaker Road
Street Address

Long Beach, CA 90803
City, Zip

Stephen O'Kane — Contact Name; Manager — Title

5624937840 — Phone #; Ext.; (562) 493-7320 — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address

City, State, Zip

Contact Name, Title

Phone #, Ext., Fax #

E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (●) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:
- (●) New Construction (Permit to Construct)
- ( ) Equipment On-Site But Not Constructed or Operational
- ( ) Equipment Operating Without A Permit *
- ( ) Compliance Plan
- ( ) Registration/Certification
- ( ) Streamlined Standard Permit

7b. Facility Permits:
- ( ) Title V Application or Amendment (Refer to Title V Matrix)
- ( ) RECLAIM Facility Permit Amendment

7c. Equipment or Process with an Existing/Previous Application or Permit:
- ( ) Administrative Change
- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
- ( ) Change of Location
- ( ) Change of Location without Prior Approval *
- ( ) Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number: ______

* A Higher Permit Processing Fee and additional Annual Operating Fees (up to 3 full years) may apply (Rule 301(c)(1)(D)(i)).

8a. Estimated Start Date of Construction (mm/dd/yyyy): 06/01/2017

8b. Estimated End Date of Construction (mm/dd/yyyy): 03/31/2020

8c. Estimated Start Date of Operation (mm/dd/yyyy): 04/01/2020

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): 19% Aqueous Ammonia Tank for Combined Cycle Combustion Turbines

10. For Identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 0

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (●) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? (●) No ( ) Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (●) Yes

16. Are there any schools (K-12) within 1000 feet of the facility property line? ( ) No (●) Yes

Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: [signature]

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (●) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/5/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) (●) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (●) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

Street Address: 690 N. Studebaker Road
City: Long Beach, CA Zip: 90803
Contact Name: Stephen O'Kane Title: Manager
Phone #: 5624937840 Ext. Fax #: (562) 493-7320
E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address
City , State Zip
Contact Name Title
Phone # Ext. Fax #
E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (●) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:
- (●) New Construction (Permit to Construct)
- ( ) Equipment On-Site But Not Constructed or Operational
- ( ) Equipment Operating Without A Permit *
- ( ) Compliance Plan
- ( ) Registration/Certification
- ( ) Streamlined Standard Permit

7b. Facility Permits:
- ( ) Title V Application or Amendment (Refer to Title V Matrix)
- ( ) RECLAIM Facility Permit Amendment

7c. Equipment or Process with an Existing/Previous Application or Permit:
- ( ) Administrative Change
- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
- ( ) Change of Location
- ( ) Change of Location without Prior Approval *
- ( ) Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number: ____

* A Higher Permit Processing Fee and additional Annual Operating Fees (up to 3 full years) may apply (Rule 301(c)(1)(D)(i)).

8a. Estimated Start Date of Construction (mm/dd/yyyy): 05/01/2020
8b. Estimated End Date of Construction (mm/dd/yyyy): 08/31/2021
8c. Estimated Start Date of Operation (mm/dd/yyyy): 09/01/2021

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): 19% Aqueous Ammonia Tank for Simple Cycle Combustion Turbines

10. For identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 0

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (●) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? (●) No ( ) Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

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15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (●) Yes

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Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: [signature]

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (●) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/15/18

22. Do you claim confidentiality of data? (If Yes, see instructions.) (●) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

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South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (●) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

690 N. Studebaker Road
Street Address

Long Beach, CA 90803
City Zip

Stephen O'Kane — Manager
Contact Name — Title

5624937840 Ext. — (562) 493-7320
Phone # — Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address

City, State Zip

Contact Name — Title

Phone # Ext. — Fax #

E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (●) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:

- (●) New Construction (Permit to Construct)
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- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
- ( ) Change of Location
- ( ) Change of Location without Prior Approval *
- ( ) Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number: ____________

* A Higher Permit Processing Fee and additional Annual Operating Fees (up to 3 full years) may apply (Rule 301(c)(1)(D)(i)).

8a. Estimated Start Date of Construction (mm/dd/yyyy):	8b. Estimated End Date of Construction (mm/dd/yyyy):	8c. Estimated Start Date of Operation (mm/dd/yyyy):
06/01/2017	03/31/2020	04/01/2020

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): Oil/Water Separator System for Combined Cycle Combustion Turbines

10. For Identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 0

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (●) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? (●) No ( ) Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

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15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (●) Yes

16. Are there any schools (K-12) within 1000 feet of the facility property line? ( ) No (●) Yes

Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: [signature]

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (●) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/15/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) (●) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-A

Application Form for Permit or Plan Approval

List only one piece of equipment or process per form.

South Coast AQMD

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator to Appear on the Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Owner's Business Name (If different from Business Name of Operator):

Section B - Equipment Location Address

4. Equipment Location Is: (◉) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

690 N. Studebaker Road
Street Address

Long Beach, CA 90803
City, Zip

Stephen O'Kane — Manager
Contact Name, Title

5624937840 — Ext. — (562) 493-7320
Phone #, Ext., Fax #

E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

5. Permit and Correspondence Information:
[X] Check here if same as equipment location address

Address

City, State, Zip

Contact Name, Title

Phone #, Ext., Fax #

E-Mail:

Section D - Application Type

6. The Facility Is: ( ) Not In RECLAIM or Title V ( ) In RECLAIM ( ) In Title V (◉) In RECLAIM & Title V Programs

7. Reason for Submitting Application (Select only ONE):

7a. New Equipment or Process Application:

- (◉) New Construction (Permit to Construct)
- ( ) Equipment On-Site But Not Constructed or Operational
- ( ) Equipment Operating Without A Permit *
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7b. Facility Permits:

- ( ) Title V Application or Amendment (Refer to Title V Matrix)
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- ( ) Administrative Change
- ( ) Alteration/Modification
- ( ) Alteration/Modification without Prior Approval *
- ( ) Change of Condition
- ( ) Change of Condition without Prior Approval *
- ( ) Change of Location
- ( ) Change of Location without Prior Approval *
- ( ) Equipment Operating with an Expired/Inactive Permit *

Existing or Previous Permit/Application
If you checked any of the items in 7c., you MUST provide an existing Permit or Application Number:

* A Higher Permit Processing Fee and additional Annual Operating Fees (up to 3 full years) may apply (Rule 301(c)(1)(D)(i)).

8a. Estimated Start Date of Construction (mm/dd/yyyy): 05/01/2020

8b. Estimated End Date of Construction (mm/dd/yyyy): 08/31/2021

8c. Estimated Start Date of Operation (mm/dd/yyyy): 09/01/2021

9. Description of Equipment or Reason for Compliance Plan (list applicable rule): Oil/Water Separator System for Simple Cycle Combustion Turbines

10. For Identical equipment, how many additional applications are being submitted with this application? (Form 400-A required for each equipment / process) 0

11. Are you a Small Business as per AQMD's Rule 102 definition? (10 employees or less and total gross receipts are $500,000 or less OR a not-for-profit training center) (◉) No ( ) Yes

12. Has a Notice of Violation (NOV) or a Notice to Comply (NC) been issued for this equipment? (◉) No ( ) Yes
If Yes, provide NOV/NC#:

Section E - Facility Business Information

13. What type of business is being conducted at this equipment location? Electrical Power Generation

14. What is your business primary NAICS Code? (North American Industrial Classification System) 221112

15. Are there other facilities in the SCAQMD jurisdiction operated by the same operator? ( ) No (◉) Yes

16. Are there any schools (K-12) within 1000 feet of the facility property line? ( ) No (◉) Yes

Section F - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application are true and correct.

17. Signature of Responsible Official: [signature]

18. Title of Responsible Official: Manager

19. I wish to review the permit prior to issuance. (This may cause a delay in the application process.) ( ) No (◉) Yes

20. Print Name: Stephen O'Kane

21. Date: 10/15/15

22. Do you claim confidentiality of data? (If Yes, see instructions.) (◉) No ( ) Yes

23. Check List: [X] Authorized Signature/Date [X] Form 400-CEQA [X] Supplemental Form(s) (ie., Form 400-E-xx) [X] Fees Enclosed

AQMD USE ONLY	APPLICATION TRACKING #	CHECK #	AMOUNT RECEIVED $	PAYMENT TRACKING #	VALIDATION

DATE	APP REJ	DATE	APP REJ	CLASS I III	BASIC CONTROL	EQUIPMENT CATEGORY CODE	TEAM	ENGINEER	REASON/ACTION TAKEN

South Coast Air Quality Management District

Form 400-CEQA

California Environmental Quality Act (CEQA) Applicability

South Coast AQMD

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

The SCAQMD is required by state law, the California Environmental Quality Act (CEQA), to review discretionary permit project applications for potential air quality and other environmental impacts. This form is a screening tool to assist the SCAQMD in clarifying whether or not the project[1] has the potential to generate significant adverse environmental impacts that might require preparation of a CEQA document [CEQA Guidelines §15060(a)].[2] Refer to the attached instructions for guidance in completing this form.[3] For each Form 400-A application, also complete and submit one Form 400-CEQA. If submitting multiple Form 400-A applications for the same project at the same time, only one 400-CEQA form is necessary for the entire project. If you need assistance completing this form, contact Permit Services at (909) 396-3385 or (909) 396-2668.

Section A - Facility Information

1. Facility Name (Business Name of Operator To Appear On The Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Project Description:
1,040 MW Natural-Gas-Fired Combined Cycle Electrical Generating Facility

Section B - Review For Exemption From Further CEQA Action

Check "Yes" or "No" as applicable

	Yes	No	Is this application for:
1.	(•)	( )	**A CEQA and/or NEPA document previously or currently prepared that specifically evaluates this project?** If yes, attach a copy of the signed Notice of Determination to this form.
2.	( )	(•)	**A request for a change of permittee only (without equipment modifications)?**
3.	( )	(•)	**A functionally identical permit unit replacement with no increase in rating or emissions?**
4.	( )	(•)	**A change of daily VOC permit limit to a monthly VOC permit limit?**
5.	( )	(•)	**Equipment damaged as a result of a disaster during state of emergency?**
6.	( )	(•)	**A Title V** (i.e., Regulation XXX) **permit renewal (without equipment modifications)?**
7.	(•)	( )	**A Title V administrative permit revision?**
8.	( )	(•)	**The conversion of an existing permit into an initial Title V permit?**

If "**Yes**" is checked for any question in Section B, your application does not require additional evaluation for CEQA applicability. Skip to Section D - Signatures on page 2 and sign and date this form.

Section C - Review of Impacts Which May Trigger CEQA

Complete Parts I-VI by checking "Yes" or "No" as applicable. To avoid delays in processing your application(s), explain all "Yes" responses on a separate sheet and attach it to this form.

	Yes	No	Part I - General
1.	( )	( )	**Has this project generated any known public controversy regarding potential adverse impacts that may be generated by the project?** Controversy may be construed as concerns raised by local groups at public meetings; adverse media attention such as negative articles in newspapers or other periodical publications, local news programs, environmental justice issues, etc.
2.	( )	( )	**Is this project part of a larger project?** If yes, attach a separate sheet to briefly describe the larger project.
			Part II - Air Quality
3.	( )	( )	**Will there be any demolition, excavating, and/or grading construction activities that encompass an area exceeding 20,000 square feet?**
4.	( )	( )	**Does this project include the open outdoor storage of dry bulk solid materials that could generate dust?** If Yes, include a plot plan with the application package.

[1] A "project" means the whole of an action which has a potential for resulting in physical change to the environment, including construction activities, clearing or grading of land, improvements to existing structures, and activities or equipment involving the issuance of a permit. For example, a project might include installation of a new, or modification of an existing internal combustion engine, dry-cleaning facility, boiler, gas turbine, spray coating booth, solvent cleaning tank, etc.

[2] To download the CEQA guidelines, visit http://ceres.ca.gov/env_law/state.html.

[3] To download this form and the instructions, visit http://www.aqmd.gov/ceqa or http://www.aqmd.gov/permit

Section C - Review of Impacts Which May Trigger CEQA (cont.)			
	Yes	No	Part II - Air Quality (cont.)
5.	○	○	**Would this project result in noticeable off-site odors from activities that may not be subject to SCAQMD permit requirements?** For example, compost materials or other types of greenwaste (i.e., lawn clippings, tree trimmings, etc.) have the potential to generate odor complaints subject to Rule 402 – Nuisance.
6.	○	○	**Does this project cause an increase of emissions from marine vessels, trains and/or airplanes?**
7.	○	○	**Will the proposed project increase the QUANTITY of hazardous materials stored aboveground onsite or transported by mobile vehicle to or from the site by greater than or equal to the amounts associated with each compound on the attached Table 1?[4]**
			Part III – Water Resources
8.	○	○	**Will the project increase demand for water at the facility by more than 5,000,000 gallons per day?** The following examples identify some, but not all, types of projects that may result in a "yes" answer to this question: 1) projects that generate steam; 2) projects that use water as part of the air pollution control equipment; 3) projects that require water as part of the production process; 4) projects that require new or expansion of existing sewage treatment facilities; 5) projects where water demand exceeds the capacity of the local water purveyor to supply sufficient water for the project; and 6) projects that require new or expansion of existing water supply facilities.
9.	○	○	**Will the project require construction of new water conveyance infrastructure?** Examples of such projects are when water demands exceed the capacity of the local water purveyor to supply sufficient water for the project, or require new or modified sewage treatment facilities such that the project requires new water lines, sewage lines, sewage hook-ups, etc.
			Part IV – Transportation/Circulation
10.			**Will the project result in** (Check all that apply):
	○	○	**a. the need for more than 350 new employees?**
	○	○	**b. an increase in heavy-duty transport truck traffic to and/or from the facility by more than 350 truck round-trips per day?**
	○	○	**c. increase customer traffic by more than 700 visits per day?**
			Part V – Noise
11.	○	○	**Will the project include equipment that will generate noise GREATER THAN 90 decibels (dB) at the property line?**
			Part VI – Public Services
12.			**Will the project create a permanent need for new or additional public services in any of the following areas** (Check all that apply):
	○	○	**a. Solid waste disposal?** Check "No" if the projected potential amount of wastes generated by the project is less than five tons per day.
	○	○	**b. Hazardous waste disposal?** Check "No" if the projected potential amount of hazardous wastes generated by the project is less than 42 cubic yards per day (or equivalent in pounds).

REMINDER: *For each "Yes" response in Section C, attach all pertinent information including but not limited to estimated quantities, volumes, weights, etc.*

Section D - Signatures

I HEREBY CERTIFY THAT ALL INFORMATION CONTAINED HEREIN AND INFORMATION SUBMITTED WITH THIS APPLICATION IS TRUE AND CORRECT TO THE BEST OF MY KNOWLEDGE. I UNDERSTAND THAT THIS FORM IS A SCREENING TOOL AND THAT THE SCAQMD RESERVES THE RIGHT TO CONSIDER OTHER PERTINENT INFORMATION IN DETERMINING CEQA APPLICABILITY.

1. Signature of Responsible Official of Firm: S. O'Kane		2. Title of Responsible Official of Firm: Manager
3. Print Name of Responsible Official of Firm: Stephen O'Kane		4. Date Signed: 10/15/15
5. Phone # of Responsible Official of Firm: 5624937840	6. Fax # of Responsible Official of Firm: (562) 493-7320	7. Email of Responsible Official of Firm: stephen.okane@AES.com
8. Signature of Preparer, (If prepared by person other than responsible official of firm):		9. Title of Preparer:
10. Print Name of Preparer: Same as above.		11. Date Signed:
12. Phone # of Preparer:	13. Fax # of Preparer:	14. Email of Preparer:

THIS CONCLUDES FORM 400-CEQA. INCLUDE THIS FORM AND ANY ATTACHMENTS WITH FORM 400-A.

[4] Table 1 – Regulated Substances List and Threshold Quantities for Accidental Release Prevention can be found in the Instructions for Form 400-CEQA.

South Coast Air Quality Management District

Form 400-E-5
Selective Catalytic Reduction (SCR) System, Oxidation Catalyst, and Ammonia Catalyst

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

◉ Fixed Location ○ Various Locations

Section B - Equipment Description

Selective Catalytic Reduction (SCR)

SCR Catalyst	Manufacturer: Cormetech; Catalyst Active Material: Titanium/Vanadium/Tungsten Model Number: TBD; Type: Corrugated Fiberglass/Ceramic Size of Each Layer or Module: L: 1 ft. 6 in. W: 25 ft. 8.5 in. H: 71 ft. 7.2 in. No. of Layers or Modules: 1; Total Volume: 1289.00 cu. ft.; Total Weight: ____ lbs.
Reducing Agent	○ Urea ○ Anhydrous Ammonia ◉ Aqueous Ammonia 19.00 %; Injection Rate: 242.0 lb/hr
Reducing Agent Storage*	Diameter: 13 ft. ____ in. Height: 45 ft. ____ in. Capacity: 40000 gal Pressure Setting: 50 psia; * A separate permit may be needed for the storage equipment.
Space Velocity	Gas Flow Rate/Catalyst Volume: 96352.10 per hour
Area Velocity	Gas Flow Rate/Wetted Catalyst Surface Area: 67462.17 ft/hr
Manufacturer's Guarantee	NOx: 2 ppm $\%O_2$: 15; NOx: ____ gm/bhp-hr; Ammonia Slip: 5 ppm @ 15 $\%O_2$
Catalyst Life	5 years (expected)
Cost	Capital Cost: 452109; Installation Cost: 40188; Catalyst Replacement Cost: 512390

Oxidation Catalyst

Oxidation Catalyst	Manufacturer: BASF Corp.; Catalyst Active Material: Platinum Group Metals Model Number: TBD; Type: Corrugated SS Foil w/ Catalytic Washcoat Size of Each Layer or Module: L: ____ ft. 2.1 in. W: 26 ft. 2 in. H: 71 ft. 9.6 in. No. of Layers or Modules: 1; Total Volume: 265.8 cu. ft.; Total Weight: ____ lbs.
Space Velocity	Gas Flow Rate/Catalyst Volume: 467260.55 per hour
Manufacturer's Guarantee	VOC: 2 ppm; VOC: ____ gm/bhp-hr; $\%O_2$: 15 CO: 2 ppm; CO: ____ gm/bhp-hr; $\%O_2$: 15
Catalyst Life	3 years (expected)
Cost	Capital Cost: 532484; Installation Cost: 40188; Catalyst Replacement Cost: 432015

South Coast Air Quality Management District

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Section B - Equipment Description (cont.)

Ammonia Catalyst

Ammonia Catalyst	Manufacturer:____ Catalyst Active Material:____ Model Number:____ Type:____ Size of Each Layer or Module: L:____ ft.____ in. W:____ ft.____ in. H:____ ft.____ in. No. of Layers or Modules:____ Total Volume:____ cu. ft. Total Weight:____ lbs.
Space Velocity	Gas Flow Rate/Catalyst Volume:____ per hour
Manufacturer's Guarantee	NH_3:____ ppm %O_2:____
Catalyst Life	____ years (expected)
Cost	Capital Cost:____ Installation Cost:____ Catalyst Replacement Cost:____

Section C - Operation Information

Operating Temperature	Minimum Inlet Temperature: 570 °F (from cold start) Maximum Temperature: 692 °F Warm-up Time: 1 hr. ____ min. (maximum)
Operating Schedule	Normal: 24 hours/day 7 days/week 52 weeks/yr Maximum: 24 hours/day 7 days/week 52 weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info	Signature: [signature] Date: 10/15/15 Title: Manager Company Name: AES Alamitos, LLC	Name: Stephen O'Kane Phone #: 5624937840 Fax #: 5624937320 Email: stephen.okane@AES.com
Contact Info	Name: Same as above. Title: Company Name:	Phone #: Fax #: Email:

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Reducing Agent	○ Urea ○ Anhydrous Ammonia ◉ Aqueous Ammonia 19.00 %; Injection Rate: 242.0 lb/hr
Reducing Agent Storage*	Diameter: 13 ft. ____ in. Height: 45 ft. ____ in. Capacity: 40000 gal Pressure Setting: 50 psia * A separate permit may be needed for the storage equipment.
Space Velocity	Gas Flow Rate/Catalyst Volume: 96352.10 per hour
Area Velocity	Gas Flow Rate/Wetted Catalyst Surface Area: 67462.17 ft/hr
Manufacturer's Guarantee	NOx: 2 ppm %O_2: 15; NOx: ____ gm/bhp-hr; Ammonia Slip: 5 ppm @ 15 %O_2
Catalyst Life	5 years (expected)
Cost	Capital Cost: 452109; Installation Cost: 40188; Catalyst Replacement Cost: 512390

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Oxidation Catalyst	Manufacturer: BASF Corp.; Catalyst Active Material: Platinum Group Metals Model Number: TBD; Type: Corrugated SS Foil w/ Catalytic Washcoat Size of Each Layer or Module: L: ____ ft. 2.1 in. W: 26 ft. 2 in. H: 71 ft. 9.6 in. No. of Layers or Modules: 1; Total Volume: 265.8 cu. ft.; Total Weight: ____ lbs.
Space Velocity	Gas Flow Rate/Catalyst Volume: 467260.55 per hour
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Section B - Equipment Description (cont.)	
Ammonia Catalyst	
Ammonia Catalyst	Manufacturer: ____ Catalyst Active Material: ____ Model Number: ____ Type: ____ Size of Each Layer or Module: L: ____ ft. ____ in. W: ____ ft. ____ in. H: ____ ft. ____ in. No. of Layers or Modules: ____ Total Volume: ____ cu. ft. Total Weight: ____ lbs.
Space Velocity	Gas Flow Rate/Catalyst Volume: ____ per hour
Manufacturer's Guarantee	NH_3: ____ ppm %O_2: ____
Catalyst Life	____ years (expected)
Cost	Capital Cost: ____ Installation Cost: ____ Catalyst Replacement Cost: ____

Section C - Operation Information	
Operating Temperature	Minimum Inlet Temperature: 570 °F (from cold start) Maximum Temperature: 692 °F Warm-up Time: 1 hr. ____ min. (maximum)
Operating Schedule	Normal: 24 hours/day 7 days/week 52 weeks/yr Maximum: 24 hours/day 7 days/week 52 weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info	Signature: [signature] Date: 10/15/15 Title: Manager Company Name: AES Alamitos, LLC	Name: Stephen O'Kane Phone #: 5624937840 Fax #: 5624937320 Email: stephen.okane@AES.com
Contact Info	Name: Same as above. Title: Company Name:	Phone #: Fax #: Email:

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(●) Fixed Location ( ) Various Locations

Section B - Equipment Description

Selective Catalytic Reduction (SCR)

SCR Catalyst	Manufacturer: Cormetech; Catalyst Active Material: Titanium/Vanadium/Tungsten Model Number: CMHT; Type: Ceramic Honeycomb Size of Each Layer or Module: L: 11 ft. 6 in. W: 10 ft. 10 in. H: 11 ft. ___ in. No. of Layers or Modules: 1; Total Volume: 1370.42 cu. ft.; Total Weight: 78000 lbs.
Reducing Agent	( ) Urea ( ) Anhydrous Ammonia (●) Aqueous Ammonia 19.00 %; Injection Rate: 180 lb/hr
Reducing Agent Storage*	Diameter: 13 ft. ___ in. Height: 45 ft. ___ in. Capacity: 30000 gal Pressure Setting: 50 psia * A separate permit may be needed for the storage equipment.
Space Velocity	Gas Flow Rate/Catalyst Volume: 16859 per hour
Area Velocity	Gas Flow Rate/Wetted Catalyst Surface Area: 182639 ft/hr
Manufacturer's Guarantee	NOx: 2.5 ppm %O_2: 15; NOx: ___ gm/bhp-hr; Ammonia Slip: 5 ppm @ 15 %O_2
Catalyst Life	3 years (expected)
Cost	Capital Cost: $526,442.00; Installation Cost: $52,020.00; Catalyst Replacement Cost: 592664.

Oxidation Catalyst

Oxidation Catalyst	Manufacturer: BASF Corp.; Catalyst Active Material: Platinum Group Metals Model Number: Camet; Type: Corrugated SS Foil w/ Catalytic Washcoat Size of Each Layer or Module: L: 2 ft. 1.5 in. W: ___ ft. 2.5 in. H: 2 ft. ___ in. No. of Layers or Modules: 187; Total Volume: 165.57 cu. ft.; Total Weight: ___ lbs.
Space Velocity	Gas Flow Rate/Catalyst Volume: 139539 per hour
Manufacturer's Guarantee	VOC: 2 ppm; VOC: ___ gm/bhp-hr; %O_2: 15 CO: 4 ppm; CO: ___ gm/bhp-hr; %O_2: 15
Catalyst Life	3 years (expected)
Cost	Capital Cost: 619038; Installation Cost: 46818; Catalyst Replacement Cost: 504844

South Coast Air Quality Management District

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Selective Catalytic Reduction (SCR) System, Oxidation Catalyst, and Ammonia Catalyst

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Section B - Equipment Description (cont.)

Ammonia Catalyst

Ammonia Catalyst	Manufacturer: ______ Catalyst Active Material: ______ Model Number: ______ Type: ______ Size of Each Layer or Module: L: ____ ft. ____ in. W: ____ ft. ____ in. H: ____ ft. ____ in. No. of Layers or Modules: ______ Total Volume: ______ cu. ft. Total Weight: ______ lbs.
Space Velocity	Gas Flow Rate/Catalyst Volume: ______ per hour
Manufacturer's Guarantee	NH_3: ______ ppm %O_2: ______
Catalyst Life	______ years (expected)
Cost	Capital Cost: ______ Installation Cost: ______ Catalyst Replacement Cost: ______

Section C - Operation Information

Operating Temperature	Minimum Inlet Temperature: 500 °F (from cold start) Maximum Temperature: 870 °F (SCR) (500-1250F OxCat) Warm-up Time: ______ hr. 30 min. (maximum)
Operating Schedule	Normal: 24 hours/day 7 days/week 52 weeks/yr Maximum: 24 hours/day 7 days/week 52 weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info	Signature: [signature] Date: 10/15/15 Title: Manager Company Name: AES Alamitos, LLC	Name: Stephen O'Kane Phone #: 5624937840 Fax #: 5624937320 Email: stephen.okane@AES.com
Contact Info	Name: Same as above. Title: ______ Company Name: ______	Phone #: ______ Fax #: ______ Email: ______

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Section B - Equipment Description

	Selective Catalytic Reduction (SCR)
SCR Catalyst	Manufacturer: Cormetech; Catalyst Active Material: Titanium/Vanadium/Tungsten Model Number: CMHT; Type: Ceramic Honeycomb Size of Each Layer or Module: L: 11 ft. 6 in. W: 10 ft. 10 in. H: 11 ft. ___ in. No. of Layers or Modules: 1; Total Volume: 1370.42 cu. ft.; Total Weight: 78000 lbs.
Reducing Agent	( ) Urea ( ) Anhydrous Ammonia (●) Aqueous Ammonia 19.00 %; Injection Rate: 180 lb/hr
Reducing Agent Storage*	Diameter: 13 ft. ___ in. Height: 45 ft. ___ in. Capacity: 30000 gal Pressure Setting: 50 psia * A separate permit may be needed for the storage equipment.
Space Velocity	Gas Flow Rate/Catalyst Volume: 16859 per hour
Area Velocity	Gas Flow Rate/Wetted Catalyst Surface Area: 182639 ft/hr
Manufacturer's Guarantee	NOx: 2.5 ppm %O_2: 15; NOx: ___ gm/bhp-hr; Ammonia Slip: 5 ppm @ 15 %O_2
Catalyst Life	3 years (expected)
Cost	Capital Cost: $526,442.00; Installation Cost: $52,020.00; Catalyst Replacement Cost: 592664.
	Oxidation Catalyst
Oxidation Catalyst	Manufacturer: BASF Corp.; Catalyst Active Material: Platinum Group Metals Model Number: Camet; Type: Corrugated SS Foil w/ Catalytic Washcoat Size of Each Layer or Module: L: 2 ft. 1.5 in. W: ___ ft. 2.5 in. H: 2 ft. ___ in. No. of Layers or Modules: 187; Total Volume: 165.57 cu. ft.; Total Weight: ___ lbs.
Space Velocity	Gas Flow Rate/Catalyst Volume: 139539 per hour
Manufacturer's Guarantee	VOC: 2 ppm; VOC: ___ gm/bhp-hr; %O_2: 15 CO: 4 ppm; CO: ___ gm/bhp-hr; %O_2: 15
Catalyst Life	3 years (expected)
Cost	Capital Cost: 619038; Installation Cost: 46818; Catalyst Replacement Cost: 504844

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Selective Catalytic Reduction (SCR) System, Oxidation Catalyst, and Ammonia Catalyst

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Section B - Equipment Description (cont.)

Ammonia Catalyst

Ammonia Catalyst	Manufacturer: ______ Catalyst Active Material: ______ Model Number: ______ Type: ______ Size of Each Layer or Module: L: ____ ft. ____ in. W: ____ ft. ____ in. H: ____ ft. ____ in. No. of Layers or Modules: ______ Total Volume: ______ cu. ft. Total Weight: ______ lbs.
Space Velocity	Gas Flow Rate/Catalyst Volume: ______ per hour
Manufacturer's Guarantee	NH_3: ______ ppm %O_2: ______
Catalyst Life	______ years (expected)
Cost	Capital Cost: ______ Installation Cost: ______ Catalyst Replacement Cost: ______

Section C - Operation Information

Operating Temperature	Minimum Inlet Temperature: 500 °F (from cold start) Maximum Temperature: 870 °F (SCR) (500-1250F OxCat) Warm-up Time: ______ hr. 30 min. (maximum)
Operating Schedule	Normal: 24 hours/day 7 days/week 52 weeks/yr Maximum: 24 hours/day 7 days/week 52 weeks/yr

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Preparer Info	Signature: [signature] Date: 10/15/15 Title: Manager Company Name: AES Alamitos, LLC	Name: Stephen O'Kane Phone #: 5624937840 Fax #: 5624937320 Email: stephen.okane@AES.com
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SCR Catalyst	Manufacturer: Cormetech; Catalyst Active Material: Titanium/Vanadium/Tungsten Model Number: CMHT; Type: Ceramic Honeycomb Size of Each Layer or Module: L: 11 ft. 6 in. W: 10 ft. 10 in. H: 11 ft. ___ in. No. of Layers or Modules: 1; Total Volume: 1370.42 cu. ft.; Total Weight: 78000 lbs.
Reducing Agent	( ) Urea ( ) Anhydrous Ammonia (◉) Aqueous Ammonia 19.00 %; Injection Rate: 180 lb/hr
Reducing Agent Storage *	Diameter: 13 ft. ___ in. Height: 45 ft. ___ in. Capacity: 30000 gal Pressure Setting: 50 psia * A separate permit may be needed for the storage equipment.
Space Velocity	Gas Flow Rate/Catalyst Volume: 16859 per hour
Area Velocity	Gas Flow Rate/Wetted Catalyst Surface Area: 182639 ft/hr
Manufacturer's Guarantee	NOx: 2.5 ppm %O_2: 15; NOx: ___ gm/bhp-hr; Ammonia Slip: 5 ppm @ 15 %O_2
Catalyst Life	3 years (expected)
Cost	Capital Cost: $526,442.00; Installation Cost: $52,020.00; Catalyst Replacement Cost: 592664.

Oxidation Catalyst

Oxidation Catalyst	Manufacturer: BASF Corp.; Catalyst Active Material: Platinum Group Metals Model Number: Camet; Type: Corrugated SS Foil w/ Catalytic Washcoat Size of Each Layer or Module: L: 2 ft. 1.5 in. W: ___ ft. 2.5 in. H: 2 ft. ___ in. No. of Layers or Modules: 187; Total Volume: 165.57 cu. ft.; Total Weight: ___ lbs.
Space Velocity	Gas Flow Rate/Catalyst Volume: 139539 per hour
Manufacturer's Guarantee	VOC: 2 ppm; VOC: ___ gm/bhp-hr; %O_2: 15 CO: 4 ppm; CO: ___ gm/bhp-hr; %O_2: 15
Catalyst Life	3 years (expected)
Cost	Capital Cost: 619038; Installation Cost: 46818; Catalyst Replacement Cost: 504844

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Section B - Equipment Description (cont.)

Ammonia Catalyst

Ammonia Catalyst	Manufacturer: ____ Catalyst Active Material: ____ Model Number: ____ Type: ____ Size of Each Layer or Module: L: ____ ft. ____ in. W: ____ ft. ____ in. H: ____ ft. ____ in. No. of Layers or Modules: ____ Total Volume: ____ cu. ft. Total Weight: ____ lbs.
Space Velocity	Gas Flow Rate/Catalyst Volume: ____ per hour
Manufacturer's Guarantee	NH_3: ____ ppm %O_2: ____
Catalyst Life	____ years (expected)
Cost	Capital Cost: ____ Installation Cost: ____ Catalyst Replacement Cost: ____

Section C - Operation Information

Operating Temperature	Minimum Inlet Temperature: 500 °F (from cold start) Maximum Temperature: 870 °F (SCR) (500-1250F OxCat) Warm-up Time: ____ hr. 30 min. (maximum)
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Manufacturer's Guarantee	VOC: 2 ppm; VOC: ___ gm/bhp-hr; %O_2: 15 CO: 4 ppm; CO: ___ gm/bhp-hr; %O_2: 15
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Section B - Equipment Description (cont.)

Ammonia Catalyst

Ammonia Catalyst	**Manufacturer:**____ **Catalyst Active Material:**____ **Model Number:**____ **Type:**____ **Size of Each Layer or Module:** L:___ ft.___ in. W:___ ft.___ in. H:___ ft.___ in. **No. of Layers or Modules:**____ **Total Volume:**____ cu. ft. **Total Weight:**____ lbs.
Space Velocity	**Gas Flow Rate/Catalyst Volume:**____ per hour
Manufacturer's Guarantee	NH_3:____ ppm $\%O_2$:____
Catalyst Life	____ years (expected)
Cost	**Capital Cost:**____ **Installation Cost:**____ **Catalyst Replacement Cost:**____

Section C - Operation Information

Operating Temperature	**Minimum Inlet Temperature:** 500 °F (from cold start) **Maximum Temperature:** 870 °F (SCR) (500-1250F OxCat) **Warm-up Time:**____ hr. 30 min. (maximum)
Operating Schedule	**Normal:** 24 hours/day 7 days/week 52 weeks/yr **Maximum:** 24 hours/day 7 days/week 52 weeks/yr

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Contact Info	**Name:** Same as above. **Title:** **Company Name:**	**Phone #:** **Fax #:** **Email:**

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Check here if you claim that this form or its attachments contain confidential trade secret information. ☐

South Coast Air Quality Management District

Form 400-E-5

Selective Catalytic Reduction (SCR) System, Oxidation Catalyst, and Ammonia Catalyst

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

◉ Fixed Location ○ Various Locations

Section B - Equipment Description

Selective Catalytic Reduction (SCR)

SCR Catalyst	Manufacturer: B&W Catalyst Active Material: Vanadium Model Number: FM Series Type: Homogeneous Honeycomb Size of Each Layer or Module: L: 7 ft. 3 in. W: 5 ft. 5 in. H: 3 ft. 8 in. No. of Layers or Modules: 1 Total Volume: 46 cu. ft. Total Weight: ____ lbs.
Reducing Agent	○ Urea ○ Anhydrous Ammonia ◉ Aqueous Ammonia 19.00 % Injection Rate: 1.1 lb/hr
Reducing Agent Storage*	Diameter: 13 ft. ____ in. Height: 45 ft. ____ in. Capacity: 40000 gal Pressure Setting: 50 psia * A separate permit may be needed for the storage equipment.
Space Velocity	Gas Flow Rate/Catalyst Volume: 485 per hour
Area Velocity	Gas Flow Rate/Wetted Catalyst Surface Area: 47800 ft/hr
Manufacturer's Guarantee	NOx: 5 ppm $\%O_2$: 3 NOx: ____ gm/bhp-hr Ammonia Slip: 5 ppm @ 3 $\%O_2$
Catalyst Life	3 years (expected)
Cost	Capital Cost: TBD Installation Cost: TBD Catalyst Replacement Cost: TBD

Oxidation Catalyst

Oxidation Catalyst	Manufacturer: ____ Catalyst Active Material: ____ Model Number: ____ Type: ____ Size of Each Layer or Module: L: ____ ft. ____ in. W: ____ ft. ____ in. H: ____ ft. ____ in. No. of Layers or Modules: ____ Total Volume: ____ cu. ft. Total Weight: ____ lbs.
Space Velocity	Gas Flow Rate/Catalyst Volume: ____ per hour
Manufacturer's Guarantee	VOC: ____ ppm VOC: ____ gm/bhp-hr $\%O_2$: ____ CO: ____ ppm CO: ____ gm/bhp-hr $\%O_2$: ____
Catalyst Life	____ years (expected)
Cost	Capital Cost: ____ Installation Cost: ____ Catalyst Replacement Cost: ____

South Coast Air Quality Management District

Form 400-E-5

Selective Catalytic Reduction (SCR) System, Oxidation Catalyst, and Ammonia Catalyst

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section B - Equipment Description (cont.)

Ammonia Catalyst	
Ammonia Catalyst	Manufacturer: ______ Catalyst Active Material: ______ Model Number: ______ Type: ______ Size of Each Layer or Module: L: ____ ft. ____ in. W: ____ ft. ____ in. H: ____ ft. ____ in. No. of Layers or Modules: ______ Total Volume: ______ cu. ft. Total Weight: ______ lbs.
Space Velocity	Gas Flow Rate/Catalyst Volume: ______ per hour
Manufacturer's Guarantee	NH_3: ______ ppm %O_2: ______
Catalyst Life	______ years (expected)
Cost	Capital Cost: ______ Installation Cost: ______ Catalyst Replacement Cost: ______

Section C - Operation Information

Operating Temperature	Minimum Inlet Temperature: 415 °F (from cold start) Maximum Temperature: 628 °F Warm-up Time: 2 hr. 50 min. (maximum)
Operating Schedule	Normal: 12 hours/day 7 days/week 52 weeks/yr Maximum: 12 hours/day 7 days/week 52 weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info	Signature: [signature] Date: 10/15/15 Title: Manager Company Name: AES Alamitos, LLC	Name: Stephen O'Kane Phone #: 5624937840 Fax #: 5624937320 Email: stephen.okane@AES.com
Contact Info	Name: Same as above. Title: Company Name:	Phone #: Fax #: Email:

South Coast Air Quality Management District
Form 400-E-9a
External Combustion: Boiler/Heater

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Mail To: SCAQMD P.O. Box 4944 Diamond Bar, CA 91765-0944
Tel: (909) 396-3385 www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(◉) Fixed Location ( ) Various Locations

Section B - Equipment Description

Boiler/Heater	Manufacturer: Rentech; Model: D-Type; Serial No.: TBD Max. Heat Input Rating (Higher Heating Value - HHV): 71000000 BTU per hour Boiler Type: (◉) Water-Tube ( ) Fire-Tube
Burner	Manufacturer: JZHC/Coen; Model: RMB Number of burners: 1; Rating of each burner (HHV): 63 Type: (◉) Low NOx (please attach manufacturer's specifications) ( ) Other:
Blower	HP: 75
Fuel Type	Primary Fuel: (◉) Natural Gas ( ) LPG ( ) Refinery Gas* ( ) Digester Gas* ( ) Landfill Gas* ( ) Other*: ( ) Fuel Oil (Specify Grade): If Digester or Landfill Gas, List Higher Heating Value: Secondary or Stand-by Fuel: ( ) Natural Gas ( ) LPG ( ) Refinery Gas* ( ) Digester Gas* ( ) Landfill Gas* ( ) Other*: ( ) Fuel Oil (Specify Grade): If Digester or Landfill Gas, List Higher Heating Value: * If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content.
Type Of Controls (Check All That Apply)	☐ Low NOx Burner ☒ Flue Gas Recirculation ☐ Oxygen Trim ☐ CO Catalyst[1] ☒ Selective Catalytic Reduction (SCR)[1] ☐ Thermal DeNOx (Selective Non-Catalytic Reduction, SNCR)[1] ☐ Other (specify): [1] A separate permit is required, please see Form 400-E-GI for instructions.
Fuel Usage	Average Load ____ % OR Average Firing Rate (HHV): 71 MMBTU/hr

Section C - Process Description

Operating Parameters	Turn Down Ratio: 0.25; Percent Excess Air: 3 %
Operating Schedule	Normal: 12 hours/day, 7 days/week, 52 weeks/yr Maximum: 12 hours/day, 7 days/week, 52 weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info	Signature: [signature] Date: 10/15/15 Title: Manager Company Name: AES Alamitos, LLC	Name: Stephen O'Kane Phone #: 5624937840 Fax #: 5624937320 Email: stephen.okane@AES.com
Contact Info	Name: Same as above. Title: Company Name:	Phone #: Fax #: Email:

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Check here if you claim that this form or its attachments contain confidential trade secret information. ☐

South Coast Air Quality Management District
Form 400-E-9a
Emission Calculations

Given

Rating: 71000000 BTU/hour

HHV: 1050 BTU/ft^3

Operating Schedule:
11.75 hours/day
7 days/week
30 days/month
52 weeks/year
365 days/year

Fuel Usage:
74340 ft^3/hour
921430 ft^3/day
27642909 ft^3/month

Calculations

	EF	EF	HOURLY	DAILY	30 DAY AVE.	30 DAY NSR	ANNUAL
	lbs/mmcf	lb./mmbtu	lbs./day	lbs./day	lbs./day	lbs./day	lbs./yr
ROG	4.20	0.004	3.33	4.16	4.16	4.16	1473
NOx	6.30	0.006	4.99	5.80	5.80	5.80	2054
SOx	0.71	0.00068	0.57	0.60	0.60	0.60	211
CO	42.0	0.04	33.3	35.0	35.0	35.0	12384
PM_{10}	4.52	0.0043	3.58	3.77	3.77	3.77	1333

South Coast Air Quality Management District
Form 400-E-12
Gas Turbine

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(●) Fixed Location ( ) Various Locations

Section B - Equipment Description

Turbine	Manufacturer: General Electric — Model: 7FA.05 — Serial No.: TBD Size (based on Higher Heating Value - HHV): Manufacturer Maximum Input Rating: ______ MMBTU/hr ______ kWh Manufacturer Maximum Output Rating: 2,275.00 MMBTU/hr 235,907.00 kWh
Function (Check all that apply)	[X] Electrical Generation [ ] Driving Pump/Compressor [ ] Emergency Peaking Unit [X] Steam Generation [ ] Exhaust Gas Recovery [ ] Other (specify): ______
Cycle Type	( ) Simply Cycle ( ) Regenerative Cycle (●) Combined Cycle ( ) Other (specify): ______
Combustion Type	( ) Tubular (●) Can-Annular ( ) Annular
Fuel (Turbine)	[X] Natural Gas [ ] LPG [ ] Digester Gas* [ ] Landfill Gas* [ ] Propane [ ] Refinery Gas* [ ] Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).
Heat Recovery Steam Generator (HRSG)	Steam Turbine Capacity: 228.7 MW Low Pressure Steam Output Capacity: ______ lb/hr @ ______ °F High Pressure Steam Output Capacity: 1077167 lb/hr @ 1044 °F Superheated Steam Output Capacity: ______ lb/hr @ ______ °F
Duct Burner	Manufacturer: ______ Model: ______ Number of burners: ______ Rating of each burner (HHV): ______ Type: ( ) Low NOx (please attach manufacturer's specifications) ( ) Other: ______ Show all heat transfer surface locations with the HRSG and temperature profile
Fuel (Duct Burner)	( ) Natural Gas ( ) LPG ( ) Digester Gas* ( ) Landfill Gas* ( ) Propane ( ) Refinery Gas* ( ) Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section B - Equipment Description (Cont.)

Air Pollution Control

- ○ Selective Catalytic Reduction (SCR)* ○ Selective Non-Catalytic Reduction (SNCR)*
- ◉ Oxidation Catalyst* ○ Other (specify)*: ________
- ○ Steam/Water Injection: Injection Rate: ________ lbs. water/lbs. fuel, or ________ mole water/mole fuel

* Separate application is required.

Capital Cost: 532484 Installation Cost: 40188 Annual Operating Cost: ________

Oxidation Catalyst Data (If Applicable)

Manufacturer: BASF Corp. Model: TBD

Catalyst Dimensions: Length: ____ ft. 2.1 in. Width: 26 ft. 2 in. Height: 71 ft. 9.6 in.

Catalyst Cell Density: ________ cells/sq.in. Pressure Drop Across Catalyst: ________

Manufacturer's Guarantee: CO Control Efficiency: 77.8 % Catalyst Life: 3 yrs

VOC Control Efficiency: 33.3 % Operating Temp. Range: 570 °F

Space Velocity (gas flow rate/catalyst volume): 467260.55 Area Velocity (gas flow/wetted catalyst surface area): 73971.32

VOC Concentration into Catalyst: 1.3 PPMVD@ 15%O_2 CO Concentration inot Catalyst: 8.1 PPMVD@ 15%O_2

Section C - Operation Information

On-line Emissions Data

Pollutants	Maximum Emissions Before Control *		Maximum Emissions After Control	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG			2.0	1.58
NOx			2.0	16.5
CO			2.0	10.04
PM_{10}				8.5
SOx				4.86
NH_3			5.0	15.3

* Based on temperature, fuel consumption, and MW output.

Reference (attach data):

☒ Manufacturer Emission Data ☐ EPA Emission Factors ☐ AQMD Emission Factors ☐ Source Test

Stack or Vent Data

Stack Height: 140 ft. ____ in. Stack Diameter: 20 ft. ____ in.

Exhaust Temperature: 223 °F Exhaust Pressure: ________ inches water column

Exhaust Flow Rate: 1264000 CFM Oxygen Level: 14.91 %

South Coast Air Quality Management District
Form 400-E-12
Gas Turbine
This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section C - Operation Information (cont.)

Startup Data: No. of Startups per day: 2 No. of Startups per year: 500 Duration of each startup: 1 hrs.

Shutdown Data: No. of Shutdowns per day: 2 No. of Shutdowns per year: 500 Duration of each Shutdown: 0.50 hrs.

Startup and Shutdown Emissions Data

Pollutants	Startup Emissions		Shutdown Emissions	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG		36.0		32.8
NOx		61.0		18.2
CO		325		138
PM_{10}		8.5		8.5
SOx		4.86		4.86
NH_3				

Monitoring and Reporting

Continuous Emission Monitoring System (CEMS): CEMS Make: TBD
CEMS Model: TBD

Will the CEMS be used to measure both on-line and startup/shutdown emissions? (●) Yes ( ) No

The following parameters will be continuously monitored:

☒ NOx ☒ CO ☒ O_2
☒ Fuel Flow Rate ☒ Ammonia Injection Rate ☐ Other (specify): ______
☒ Ammonia Stack Concentration: Ammonia CEMS Make: TBD
Ammonia CEMS Model: TBD

Operating Schedule

Normal:	24 hours/day	7 days/week	52 weeks/yr
Maximum:	24 hours/day	7 days/week	52 weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info
Signature: [signature] Date: 10/15/15
Name: Stephen O'Kane
Title: Manager Company Name: AES Alamitos, LLC
Phone #: 5624937840 Fax #: 5624937320
Email: stephen.okane@AES.com

Contact Info
Name: Same as above.
Title: Company Name:
Phone #: Fax #:
Email:

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South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

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Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(●) Fixed Location ( ) Various Locations

Section B - Equipment Description

Turbine	Manufacturer: General Electric Model: 7FA.05 Serial No.: TBD Size (based on Higher Heating Value - HHV): Manufacturer Maximum Input Rating: ______ MMBTU/hr ______ kWh Manufacturer Maximum Output Rating: 2,275.00 MMBTU/hr 235,907.00 kWh
Function (Check all that apply)	☒ Electrical Generation ☐ Driving Pump/Compressor ☐ Emergency Peaking Unit ☒ Steam Generation ☐ Exhaust Gas Recovery ☐ Other (specify): ______
Cycle Type	( ) Simply Cycle ( ) Regenerative Cycle (●) Combined Cycle ( ) Other (specify): ______
Combustion Type	( ) Tubular (●) Can-Annular ( ) Annular
Fuel (Turbine)	☒ Natural Gas ☐ LPG ☐ Digester Gas* ☐ Landfill Gas* ☐ Propane ☐ Refinery Gas* ☐ Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).
Heat Recovery Steam Generator (HRSG)	Steam Turbine Capacity: 228.7 MW Low Pressure Steam Output Capacity: ______ lb/hr @ ______ °F High Pressure Steam Output Capacity: 1077167 lb/hr @ 1044 °F Superheated Steam Output Capacity: ______ lb/hr @ ______ °F
Duct Burner	Manufacturer: ______ Model: ______ Number of burners: ______ Rating of each burner (HHV): ______ Type: ( ) Low NOx (please attach manufacturer's specifications) ( ) Other: ______ Show all heat transfer surface locations with the HRSG and temperature profile
Fuel (Duct Burner)	( ) Natural Gas ( ) LPG ( ) Digester Gas* ( ) Landfill Gas* ( ) Propane ( ) Refinery Gas* ( ) Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).

Form 400-E-12
Gas Turbine

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section B - Equipment Description (Cont.)

Air Pollution Control

- ◯ Selective Catalytic Reduction (SCR)*
- ◯ Selective Non-Catalytic Reduction (SNCR)*
- ◉ Oxidation Catalyst*
- ◯ Other (specify)*: ______
- ◯ Steam/Water Injection: Injection Rate: ______ lbs. water/lbs. fuel, or ______ mole water/mole fuel

* Separate application is required.

Capital Cost: 532484 Installation Cost: 40188 Annual Operating Cost: ______

Oxidation Catalyst Data (If Applicable)

Manufacturer: BASF Corp. Model: TBD

Catalyst Dimensions: Length: ______ ft. 2.1 in. Width: 26 ft. 2 in. Height: 71 ft. 9.6 in.

Catalyst Cell Density: ______ cells/sq.in. Pressure Drop Across Catalyst: ______

Manufacturer's Guarantee: CO Control Efficiency: 77.8 % Catalyst Life: 3 yrs

VOC Control Efficiency: 33.3 % Operating Temp. Range: 570 °F

Space Velocity (gas flow rate/catalyst volume): 467260.55 Area Velocity (gas flow/wetted catalyst surface area): 73971.32

VOC Concentration into Catalyst: 1.3 PPMVD@ 15%O_2 CO Concentration inot Catalyst: 8.1 PPMVD@ 15%O_2

Section C - Operation Information

On-line Emissions Data

Pollutants	Maximum Emissions Before Control*		Maximum Emissions After Control	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG			2.0	1.58
NOx			2.0	16.5
CO			2.0	10.04
PM_{10}				8.5
SOx				4.86
NH_3			5.0	15.3

* Based on temperature, fuel consumption, and MW output.

Reference (attach data):

☒ Manufacturer Emission Data ☐ EPA Emission Factors ☐ AQMD Emission Factors ☐ Source Test

Stack or Vent Data

Stack Height: 140 ft. ______ in. Stack Diameter: 20 ft. ______ in.

Exhaust Temperature: 223 °F Exhaust Pressure: ______ inches water column

Exhaust Flow Rate: 1264000 CFM Oxygen Level: 14.91 %

South Coast Air Quality Management District

Form 400-E-12

Gas Turbine

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section C - Operation Information (cont.)

Startup Data: No. of Startups per day: 2 No. of Startups per year: 500 Duration of each startup: 1 hrs.

Shutdown Data: No. of Shutdowns per day: 2 No. of Shutdowns per year: 500 Duration of each Shutdown: 0.50 hrs.

Startup and Shutdown Emissions Data

Pollutants	Startup Emissions		Shutdown Emissions	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG		36.0		32.8
NOx		61.0		18.2
CO		325		138
PM_{10}		8.5		8.5
SOx		4.86		4.86
NH_3				

Monitoring and Reporting

Continuous Emission Monitoring System (CEMS): CEMS Make: TBD

CEMS Model: TBD

Will the CEMS be used to measure both on-line and startup/shutdown emissions? ◉ Yes ○ No

The following parameters will be continuously monitored:

☒ NOx ☒ CO ☒ O_2

☒ Fuel Flow Rate ☒ Ammonia Injection Rate ☐ Other (specify): ______

☒ Ammonia Stack Concentration: Ammonia CEMS Make: TBD

Ammonia CEMS Model: TBD

Operating Schedule

Normal:	24	hours/day	7	days/week	52	weeks/yr
Maximum:	24	hours/day	7	days/week	52	weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info

Signature: [signature] Date: 10/15/15

Title: Manager Company Name: AES Alamitos, LLC

Name: Stephen O'Kane

Phone #: 5624937840 Fax #: 5624937320

Email: stephen.okane@AES.com

Contact Info

Name: Same as above.

Title: Company Name:

Phone #: Fax #:

Email:

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Form 400-E-12
Gas Turbine

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Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(●) Fixed Location ( ) Various Locations

Section B - Equipment Description

Turbine	Manufacturer: General Electric Model: LMS-100PB Serial No.: TBD Size (based on Higher Heating Value - HHV): Manufacturer Maximum Input Rating: ______ MMBTU/hr ______ kWh Manufacturer Maximum Output Rating: 879.00 MMBTU/hr 98,966.00 kWh
Function (Check all that apply)	☒ Electrical Generation ☐ Driving Pump/Compressor ☐ Emergency Peaking Unit ☒ Steam Generation ☐ Exhaust Gas Recovery ☐ Other (specify): ______
Cycle Type	(●) Simply Cycle ( ) Regenerative Cycle ( ) Combined Cycle ( ) Other (specify): ______
Combustion Type	( ) Tubular (●) Can-Annular ( ) Annular
Fuel (Turbine)	☒ Natural Gas ☐ LPG ☐ Digester Gas* ☐ Landfill Gas* ☐ Propane ☐ Refinery Gas* ☐ Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).
Heat Recovery Steam Generator (HRSG)	Steam Turbine Capacity: ______ MW Low Pressure Steam Output Capacity: ______ lb/hr @ ______ °F High Pressure Steam Output Capacity: ______ lb/hr @ ______ °F Superheated Steam Output Capacity: ______ lb/hr @ ______ °F
Duct Burner	Manufacturer: ______ Model: ______ Number of burners: ______ Rating of each burner (HHV): ______ Type: ( ) Low NOx (please attach manufacturer's specifications) ( ) Other: ______ Show all heat transfer surface locations with the HRSG and temperature profile
Fuel (Duct Burner)	( ) Natural Gas ( ) LPG ( ) Digester Gas* ( ) Landfill Gas* ( ) Propane ( ) Refinery Gas* ( ) Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section B - Equipment Description (Cont.)

Air Pollution Control

- ○ Selective Catalytic Reduction (SCR)*
- ○ Selective Non-Catalytic Reduction (SNCR)*
- ⦿ Oxidation Catalyst*
- ○ Other (specify)*: ____
- ○ Steam/Water Injection: Injection Rate: ____ lbs. water/lbs. fuel, or ____ mole water/mole fuel

* Separate application is required.

Capital Cost: 619038 Installation Cost: 46818 Annual Operating Cost: ____

Oxidation Catalyst Data (If Applicable)

Manufacturer: BASF Corp.
Model: Camet

Catalyst Dimensions: Length: 2 ft. 1.5 in. Width: ____ ft. 2.5 in. Height: 2 ft. ____ in.

Catalyst Cell Density: ____ cells/sq.in. Pressure Drop Across Catalyst: 2

Manufacturer's Guarantee: CO Control Efficiency: ____ % Catalyst Life: 3 yrs

VOC Control Efficiency: ____ % Operating Temp. Range: 500 °F

Space Velocity (gas flow rate/catalyst volume): 139539 Area Velocity (gas flow/wetted catalyst surface area): 29071

VOC Concentration into Catalyst: 4 PPMVD@ 15%O_2 CO Concentration inot Catalyst: 125 PPMVD@ 15%O_2

Section C - Operation Information

On-line Emissions Data

Pollutants	Maximum Emissions Before Control *		Maximum Emissions After Control	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG			2.0	2.30
NOx			2.5	8.26
CO			4.0	8.05
PM_{10}				6.23
SOx				1.63
NH_3			5.0	6.09

* Based on temperature, fuel consumption, and MW output.

Reference (attach data):

- ☒ Manufacturer Emission Data
- ☐ EPA Emission Factors
- ☐ AQMD Emission Factors
- ☐ Source Test

Stack or Vent Data

Stack Height: 80 ft. ____ in. Stack Diameter: 13 ft. 6 in.

Exhaust Temperature: 981 °F Exhaust Pressure: ____ inches water column

Exhaust Flow Rate: 938000 CFM Oxygen Level: 14.7 %

Form 400-E-12
Gas Turbine

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section C - Operation Information (cont.)

Startup Data: No. of Startups per day: 2 No. of Startups per year: 500 Duration of each startup: 0.5 hrs.

Shutdown Data: No. of Shutdowns per day: 2 No. of Shutdowns per year: 500 Duration of each Shutdown: 0.22 hrs.

Startup and Shutdown Emissions Data

Pollutants	Startup Emissions PPM@15% O_2, dry	Startup Emissions lb/hour	Shutdown Emissions PPM@15% O_2, dry	Shutdown Emissions lb/hour
ROG		3.95		4.86
NOx		20.7		9.56
CO		19.4		34.4
PM_{10}		6.23		6.23
SOx		1.62		1.62
NH_3				

Monitoring and Reporting

Continuous Emission Monitoring System (CEMS): CEMS Make: TBD

CEMS Model: TBD

Will the CEMS be used to measure both on-line and startup/shutdown emissions? ◉ Yes ○ No

The following parameters will be continuously monitored:

☒ NOx ☒ CO ☒ O_2

☒ Fuel Flow Rate ☒ Ammonia Injection Rate ☐ Other (specify):

☒ Ammonia Stack Concentration: Ammonia CEMS Make: TBD

Ammonia CEMS Model: TBD

Operating Schedule

	hours/day	days/week	weeks/yr
Normal:	24	7	52
Maximum:	24	7	52

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info

Signature: [signature] Date: 10/15/15

Name: Stephen O'Kane

Phone #: 5624937840 Fax #: 5624937320

Title: Manager Company Name: AES Alamitos, LLC

Email: stephen.okane@AES.com

Contact Info

Name: Same as above.

Title: Company Name:

Phone #: Fax #:

Email:

THIS IS A PUBLIC DOCUMENT

Pursuant to the California Public Records Act, your permit application and any supplemental documentation are public records and may be disclosed to a third party. If you wish to claim certain limited information as exempt from disclosure because it qualifies as a trade secret, as defined in the District's Guidelines for Implementing the California Public Records Act, you must make such claim at the time of submittal to the District.

Check here if you claim that this form or its attachments contain confidential trade secret information. ☐

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

◉ Fixed Location ○ Various Locations

Section B - Equipment Description

Turbine	Manufacturer: General Electric; Model: LMS-100PB; Serial No.: TBD Size (based on Higher Heating Value - HHV): Manufacturer Maximum Input Rating: ______ MMBTU/hr ______ kWh Manufacturer Maximum Output Rating: 879.00 MMBTU/hr 98,966.00 kWh
Function (Check all that apply)	☒ Electrical Generation ☐ Driving Pump/Compressor ☐ Emergency Peaking Unit ☒ Steam Generation ☐ Exhaust Gas Recovery ☐ Other (specify): ______
Cycle Type	◉ Simply Cycle ○ Regenerative Cycle ○ Combined Cycle ○ Other (specify): ______
Combustion Type	○ Tubular ◉ Can-Annular ○ Annular
Fuel (Turbine)	☒ Natural Gas ☐ LPG ☐ Digester Gas* ☐ Landfill Gas* ☐ Propane ☐ Refinery Gas* ☐ Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).
Heat Recovery Steam Generator (HRSG)	Steam Turbine Capacity: ______ MW Low Pressure Steam Output Capacity: ______ lb/hr @ ______ °F High Pressure Steam Output Capacity: ______ lb/hr @ ______ °F Superheated Steam Output Capacity: ______ lb/hr @ ______ °F
Duct Burner	Manufacturer: ______ Model: ______ Number of burners: ______ Rating of each burner (HHV): ______ Type: ○ Low NOx (please attach manufacturer's specifications) ○ Other: ______ Show all heat transfer surface locations with the HRSG and temperature profile
Fuel (Duct Burner)	○ Natural Gas ○ LPG ○ Digester Gas* ○ Landfill Gas* ○ Propane ○ Refinery Gas* ○ Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

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Section B - Equipment Description (Cont.)

Air Pollution Control

○ Selective Catalytic Reduction (SCR)* ○ Selective Non-Catalytic Reduction (SNCR)*

◉ Oxidation Catalyst* ○ Other (specify)*: ______

○ Steam/Water Injection: Injection Rate: ______ lbs. water/lbs. fuel, or ______ mole water/mole fuel

* Separate application is required.

Capital Cost: 619038 Installation Cost: 46818 Annual Operating Cost: ______

Oxidation Catalyst Data (If Applicable)

Manufacturer: BASF Corp. Model: Camet

Catalyst Dimensions: Length: 2 ft. 1.5 in. Width: ______ ft. 2.5 in. Height: 2 ft. ______ in.

Catalyst Cell Density: ______ cells/sq.in. Pressure Drop Across Catalyst: 2

Manufacturer's Guarantee: CO Control Efficiency: ______ % Catalyst Life: 3 yrs

VOC Control Efficiency: ______ % Operating Temp. Range: 500 °F

Space Velocity (gas flow rate/catalyst volume): 139539 Area Velocity (gas flow/wetted catalyst surface area): 29071

VOC Concentration into Catalyst: 4 PPMVD@ 15%O_2 CO Concentration inot Catalyst: 125 PPMVD@ 15%O_2

Section C - Operation Information

On-line Emissions Data

Pollutants	Maximum Emissions Before Control *		Maximum Emissions After Control	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG			2.0	2.30
NOx			2.5	8.26
CO			4.0	8.05
PM_{10}				6.23
SOx				1.63
NH_3			5.0	6.09

* Based on temperature, fuel consumption, and MW output.

Reference (attach data):

☒ Manufacturer Emission Data ☐ EPA Emission Factors ☐ AQMD Emission Factors ☐ Source Test

Stack or Vent Data

Stack Height: 80 ft. ______ in. Stack Diameter: 13 ft. 6 in.

Exhaust Temperature: 981 °F Exhaust Pressure: ______ inches water column

Exhaust Flow Rate: 938000 CFM Oxygen Level: 14.7 %

South Coast Air Quality Management District

Form 400-E-12

Gas Turbine

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section C - Operation Information (cont.)

Startup Data: No. of Startups per day: 2 No. of Startups per year: 500 Duration of each startup: 0.5 hrs.

Shutdown Data: No. of Shutdowns per day: 2 No. of Shutdowns per year: 500 Duration of each Shutdown: 0.22 hrs.

Startup and Shutdown Emissions Data

Pollutants	Startup Emissions		Shutdown Emissions	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG		3.95		4.86
NOx		20.7		9.56
CO		19.4		34.4
PM_{10}		6.23		6.23
SOx		1.62		1.62
NH_3				

Monitoring and Reporting

Continuous Emission Monitoring System (CEMS): CEMS Make: TBD

CEMS Model: TBD

Will the CEMS be used to measure both on-line and startup/shutdown emissions? ◉ Yes ○ No

The following parameters will be continuously monitored:

☒ NOx ☒ CO ☒ O_2

☒ Fuel Flow Rate ☒ Ammonia Injection Rate ☐ Other (specify): ____

☒ Ammonia Stack Concentration: Ammonia CEMS Make: TBD

Ammonia CEMS Model: TBD

Operating Schedule

	hours/day	days/week	weeks/yr
Normal:	24	7	52
Maximum:	24	7	52

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info
Signature: [signature] Date: 10/15/15
Name: Stephen O'Kane
Phone #: 5624937840 Fax #: 5624937320
Title: Manager Company Name: AES Alamitos, LLC
Email: stephen.okane@AES.com

Contact Info
Name: Same as above. Phone #: Fax #:
Title: Company Name: Email:

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(●) Fixed Location ( ) Various Locations

Section B - Equipment Description

Turbine	Manufacturer: General Electric Model: LMS-100PB Serial No.: TBD Size (based on Higher Heating Value - HHV): Manufacturer Maximum Input Rating: ________ MMBTU/hr ________ kWh Manufacturer Maximum Output Rating: 879.00 MMBTU/hr 98,966.00 kWh
Function (Check all that apply)	[X] Electrical Generation [ ] Driving Pump/Compressor [ ] Emergency Peaking Unit [X] Steam Generation [ ] Exhaust Gas Recovery [ ] Other (specify): ________
Cycle Type	(●) Simply Cycle ( ) Regenerative Cycle ( ) Combined Cycle ( ) Other (specify): ________
Combustion Type	( ) Tubular (●) Can-Annular ( ) Annular
Fuel (Turbine)	[X] Natural Gas [ ] LPG [ ] Digester Gas* [ ] Landfill Gas* [ ] Propane [ ] Refinery Gas* [ ] Other*: ________ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).
Heat Recovery Steam Generator (HRSG)	Steam Turbine Capacity: ________ MW Low Pressure Steam Output Capacity: ________ lb/hr @ ________ °F High Pressure Steam Output Capacity: ________ lb/hr @ ________ °F Superheated Steam Output Capacity: ________ lb/hr @ ________ °F
Duct Burner	Manufacturer: ________ Model: ________ Number of burners: ________ Rating of each burner (HHV): ________ Type: ( ) Low NOx (please attach manufacturer's specifications) ( ) Other: ________ Show all heat transfer surface locations with the HRSG and temperature profile
Fuel (Duct Burner)	( ) Natural Gas ( ) LPG ( ) Digester Gas* ( ) Landfill Gas* ( ) Propane ( ) Refinery Gas* ( ) Other*: ________ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).

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Section B - Equipment Description (Cont.)

Air Pollution Control

○ Selective Catalytic Reduction (SCR)* ○ Selective Non-Catalytic Reduction (SNCR)*

◉ Oxidation Catalyst* ○ Other (specify)*: ____

○ Steam/Water Injection: Injection Rate: ____ lbs. water/lbs. fuel, or ____ mole water/mole fuel

* Separate application is required.

Capital Cost: 619038 Installation Cost: 46818 Annual Operating Cost: ____

Oxidation Catalyst Data (If Applicable)

Manufacturer: BASF Corp. Model: Camet

Catalyst Dimensions: Length: 2 ft. 1.5 in. Width: ____ ft. 2.5 in. Height: 2 ft. ____ in.

Catalyst Cell Density: ____ cells/sq.in. Pressure Drop Across Catalyst: 2

Manufacturer's Guarantee: CO Control Efficiency: ____ % Catalyst Life: 3 yrs

VOC Control Efficiency: ____ % Operating Temp. Range: 500 °F

Space Velocity (gas flow rate/catalyst volume): 139539 Area Velocity (gas flow/wetted catalyst surface area): 29071

VOC Concentration into Catalyst: 4 PPMVD@ 15%O_2 CO Concentration inot Catalyst: 125 PPMVD@ 15%O_2

Section C - Operation Information

On-line Emissions Data

Pollutants	Maximum Emissions Before Control *		Maximum Emissions After Control	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG			2.0	2.30
NOx			2.5	8.26
CO			4.0	8.05
PM_{10}				6.23
SOx				1.63
NH_3			5.0	6.09

* Based on temperature, fuel consumption, and MW output.

Reference (attach data):

☒ Manufacturer Emission Data ☐ EPA Emission Factors ☐ AQMD Emission Factors ☐ Source Test

Stack or Vent Data

Stack Height: 80 ft. ____ in. Stack Diameter: 13 ft. 6 in.

Exhaust Temperature: 981 °F Exhaust Pressure: ____ inches water column

Exhaust Flow Rate: 938000 CFM Oxygen Level: 14.7 %

South Coast Air Quality Management District

Form 400-E-12

Gas Turbine

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section C - Operation Information (cont.)

Startup Data: No. of Startups per day: 2 No. of Startups per year: 500 Duration of each startup: 0.5 hrs.

Shutdown Data: No. of Shutdowns per day: 2 No. of Shutdowns per year: 500 Duration of each Shutdown: 0.22 hrs.

Startup and Shutdown Emissions Data

Pollutants	Startup Emissions		Shutdown Emissions	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG		3.95		4.86
NOx		20.7		9.56
CO		19.4		34.4
PM_{10}		6.23		6.23
SOx		1.62		1.62
NH_3				

Monitoring and Reporting

Continuous Emission Monitoring System (CEMS): CEMS Make: TBD

CEMS Model: TBD

Will the CEMS be used to measure both on-line and startup/shutdown emissions? ◉ Yes ○ No

The following parameters will be continuously monitored:

☒ NOx ☒ CO ☒ O_2

☒ Fuel Flow Rate ☒ Ammonia Injection Rate ☐ Other (specify): ______

☒ Ammonia Stack Concentration: Ammonia CEMS Make: TBD

Ammonia CEMS Model: TBD

Operating Schedule

Normal:	24 hours/day	7 days/week	52 weeks/yr
Maximum:	24 hours/day	7 days/week	52 weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info

Signature: [signature] Date: 10/15/15

Title: Manager Company Name: AES Alamitos, LLC

Name: Stephen O'Kane

Phone #: 5624937840 Fax #: 5624937320

Email: stephen.okane@AES.com

Contact Info

Name: Same as above.

Title: Company Name:

Phone #: Fax #:

Email:

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South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

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Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(◉) Fixed Location ( ) Various Locations

Section B - Equipment Description

Turbine	Manufacturer: General Electric Model: LMS-100PB Serial No.: TBD Size (based on Higher Heating Value - HHV): Manufacturer Maximum Input Rating: ______ MMBTU/hr ______ kWh Manufacturer Maximum Output Rating: 879.00 MMBTU/hr 98,966.00 kWh
Function (Check all that apply)	☒ Electrical Generation ☐ Driving Pump/Compressor ☐ Emergency Peaking Unit ☒ Steam Generation ☐ Exhaust Gas Recovery ☐ Other (specify): ______
Cycle Type	(◉) Simply Cycle ( ) Regenerative Cycle ( ) Combined Cycle ( ) Other (specify): ______
Combustion Type	( ) Tubular (◉) Can-Annular ( ) Annular
Fuel (Turbine)	☒ Natural Gas ☐ LPG ☐ Digester Gas* ☐ Landfill Gas* ☐ Propane ☐ Refinery Gas* ☐ Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).
Heat Recovery Steam Generator (HRSG)	Steam Turbine Capacity: ______ MW Low Pressure Steam Output Capacity: ______ lb/hr @ ______ °F High Pressure Steam Output Capacity: ______ lb/hr @ ______ °F Superheated Steam Output Capacity: ______ lb/hr @ ______ °F
Duct Burner	Manufacturer: ______ Model: ______ Number of burners: ______ Rating of each burner (HHV): ______ Type: ( ) Low NOx (please attach manufacturer's specifications) ( ) Other: ______ Show all heat transfer surface locations with the HRSG and temperature profile
Fuel (Duct Burner)	( ) Natural Gas ( ) LPG ( ) Digester Gas* ( ) Landfill Gas* ( ) Propane ( ) Refinery Gas* ( ) Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).

South Coast Air Quality Management District
Form 400-E-12
Gas Turbine
This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section B - Equipment Description (Cont.)

Air Pollution Control

○ Selective Catalytic Reduction (SCR)* ○ Selective Non-Catalytic Reduction (SNCR)*
◉ Oxidation Catalyst* ○ Other (specify)*: ______
○ Steam/Water Injection: Injection Rate: ______ lbs. water/lbs. fuel, or ______ mole water/mole fuel
* Separate application is required.
Capital Cost: 619038 Installation Cost: 46818 Annual Operating Cost: ______

Oxidation Catalyst Data (If Applicable)

Manufacturer: BASF Corp. Model: Camet
Catalyst Dimensions: Length: 2 ft. 1.5 in. Width: ______ ft. 2.5 in. Height: 2 ft. ______ in.
Catalyst Cell Density: ______ cells/sq.in. Pressure Drop Across Catalyst: 2
Manufacturer's Guarantee: CO Control Efficiency: ______ % Catalyst Life: 3 yrs
VOC Control Efficiency: ______ % Operating Temp. Range: 500 °F
Space Velocity (gas flow rate/catalyst volume): 139539 Area Velocity (gas flow/wetted catalyst surface area): 29071
VOC Concentration into Catalyst: 4 PPMVD@ 15%O_2 CO Concentration inot Catalyst: 125 PPMVD@ 15%O_2

Section C - Operation Information

On-line Emissions Data

Pollutants	Maximum Emissions Before Control *		Maximum Emissions After Control	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG			2.0	2.30
NOx			2.5	8.26
CO			4.0	8.05
PM_{10}				6.23
SOx				1.63
NH_3			5.0	6.09

* Based on temperature, fuel consumption, and MW output.

Reference (attach data):
☒ Manufacturer Emission Data ☐ EPA Emission Factors ☐ AQMD Emission Factors ☐ Source Test

Stack or Vent Data

Stack Height: 80 ft. ______ in. Stack Diameter: 13 ft. 6 in.
Exhaust Temperature: 981 °F Exhaust Pressure: ______ inches water column
Exhaust Flow Rate: 938000 CFM Oxygen Level: 14.7 %

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section C - Operation Information (cont.)

Startup Data: No. of Startups per day: 2 No. of Startups per year: 500 Duration of each startup: 0.5 hrs.

Shutdown Data: No. of Shutdowns per day: 2 No. of Shutdowns per year: 500 Duration of each Shutdown: 0.22 hrs.

Startup and Shutdown Emissions Data

Pollutants	Startup Emissions		Shutdown Emissions	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG		3.95		4.86
NOx		20.7		9.56
CO		19.4		34.4
PM_{10}		6.23		6.23
SOx		1.62		1.62
NH_3				

Monitoring and Reporting

Continuous Emission Monitoring System (CEMS): CEMS Make: TBD

CEMS Model: TBD

Will the CEMS be used to measure both on-line and startup/shutdown emissions? ◉ Yes ○ No

The following parameters will be continuously monitored:

☒ NOx ☒ CO ☒ O_2

☒ Fuel Flow Rate ☒ Ammonia Injection Rate ☐ Other (specify):

☒ Ammonia Stack Concentration: Ammonia CEMS Make: TBD

Ammonia CEMS Model: TBD

Operating Schedule

Normal: 24 hours/day 7 days/week 52 weeks/yr

Maximum: 24 hours/day 7 days/week 52 weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info

Signature: [signature] Date: 10/5/15

Name: Stephen O'Kane

Title: Manager Company Name: AES Alamitos, LLC

Phone #: 5624937840 Fax #: 5624937320

Email: stephen.okane@AES.com

Contact Info

Name: Same as above.

Title: Company Name:

Phone #: Fax #:

Email:

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
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Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(●) Fixed Location ( ) Various Locations

Section B - Equipment Description

Turbine	Manufacturer: General Electric Model: 7FA.05 Serial No.: TBD Size (based on Higher Heating Value - HHV): Manufacturer Maximum Input Rating: ______ MMBTU/hr ______ kWh Manufacturer Maximum Output Rating: 2,275.00 MMBTU/hr 235,907.00 kWh
Function (Check all that apply)	[X] Electrical Generation [ ] Driving Pump/Compressor [ ] Emergency Peaking Unit [X] Steam Generation [ ] Exhaust Gas Recovery [ ] Other (specify): ______
Cycle Type	( ) Simply Cycle ( ) Regenerative Cycle (●) Combined Cycle ( ) Other (specify): ______
Combustion Type	( ) Tubular (●) Can-Annular ( ) Annular
Fuel (Turbine)	[X] Natural Gas [ ] LPG [ ] Digester Gas* [ ] Landfill Gas* [ ] Propane [ ] Refinery Gas* [ ] Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).
Heat Recovery Steam Generator (HRSG)	Steam Turbine Capacity: 228.7 MW Low Pressure Steam Output Capacity: ______ lb/hr @ ______ °F High Pressure Steam Output Capacity: 1077167 lb/hr @ 1044 °F Superheated Steam Output Capacity: ______ lb/hr @ ______ °F
Duct Burner	Manufacturer: ______ Model: ______ Number of burners: ______ Rating of each burner (HHV): ______ Type: ( ) Low NOx (please attach manufacturer's specifications) ( ) Other: ______ Show all heat transfer surface locations with the HRSG and temperature profile
Fuel (Duct Burner)	( ) Natural Gas ( ) LPG ( ) Digester Gas* ( ) Landfill Gas* ( ) Propane ( ) Refinery Gas* ( ) Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).

South Coast Air Quality Management District
Form 400-E-12
Gas Turbine
This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section B - Equipment Description (Cont.)

Air Pollution Control

- (●) Selective Catalytic Reduction (SCR)*
- ( ) Selective Non-Catalytic Reduction (SNCR)*
- ( ) Oxidation Catalyst*
- ( ) Other (specify)*: ______
- ( ) Steam/Water Injection: Injection Rate: ______ lbs. water/lbs. fuel, or ______ mole water/mole fuel

* Separate application is required.

Capital Cost: 452109 Installation Cost: 40188 Annual Operating Cost: ______

Oxidation Catalyst Data (If Applicable)

Manufacturer: ______ Model: ______

Catalyst Dimensions: Length: ______ ft. ______ in. Width: ______ ft. ______ in. Height: ______ ft. ______ in.

Catalyst Cell Density: ______ cells/sq.in. Pressure Drop Across Catalyst: ______

Manufacturer's Guarantee: CO Control Efficiency: ______ % Catalyst Life: ______ yrs

VOC Control Efficiency: ______ % Operating Temp. Range: ______ °F

Space Velocity (gas flow rate/catalyst volume): ______ Area Velocity (gas flow/wetted catalyst surface area): ______

VOC Concentration into Catalyst: ______ PPMVD@ 15%O_2 CO Concentration inot Catalyst: ______ PPMVD@ 15%O_2

Section C - Operation Information

On-line Emissions Data

Pollutants	Maximum Emissions Before Control*		Maximum Emissions After Control	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG			2.0	1.58
NOx			2.0	16.5
CO			2.0	10.04
PM_{10}				8.5
SOx				4.86
NH_3			5.0	15.3

* Based on temperature, fuel consumption, and MW output.

Reference (attach data):

- [X] Manufacturer Emission Data
- [ ] EPA Emission Factors
- [ ] AQMD Emission Factors
- [ ] Source Test

Stack or Vent Data

Stack Height: 140 ft. ______ in. Stack Diameter: 20 ft. ______ in.

Exhaust Temperature: 223 °F Exhaust Pressure: ______ inches water column

Exhaust Flow Rate: 1264000 CFM Oxygen Level: 14.91 %

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section C - Operation Information (cont.)

Startup Data: No. of Startups per day: 2 No. of Startups per year: 500 Duration of each startup: 1 hrs.

Shutdown Data: No. of Shutdowns per day: 2 No. of Shutdowns per year: 500 Duration of each Shutdown: 0.50 hrs.

Startup and Shutdown Emissions Data

Pollutants	Startup Emissions PPM@15% O_2, dry	Startup Emissions lb/hour	Shutdown Emissions PPM@15% O_2, dry	Shutdown Emissions lb/hour
ROG		36.0		32.8
NOx		61.0		18.2
CO		325		138
PM_{10}		8.5		8.5
SOx		4.86		4.86
NH_3				

Monitoring and Reporting

Continuous Emission Monitoring System (CEMS): CEMS Make: TBD

CEMS Model: TBD

Will the CEMS be used to measure both on-line and startup/shutdown emissions? ◉ Yes ○ No

The following parameters will be continuously monitored:

☒ NOx ☒ CO ☒ O_2

☒ Fuel Flow Rate ☒ Ammonia Injection Rate ☐ Other (specify): ____

☒ Ammonia Stack Concentration: Ammonia CEMS Make: TBD

Ammonia CEMS Model: TBD

Operating Schedule

Normal:	24 hours/day	7 days/week	52 weeks/yr
Maximum:	24 hours/day	7 days/week	52 weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info

Signature: [signature] Date: 10/5/15

Title: Manager Company Name: AES Alamitos, LLC

Name: Stephen O'Kane

Phone #: 5624937840 Fax #: 5624937320

Email: stephen.okane@AES.com

Contact Info

Name: Same as above.

Title: Company Name:

Phone #: Fax #:

Email:

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South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

South Coast AQMD

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Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(•) Fixed Location ( ) Various Locations

Section B - Equipment Description

Turbine	Manufacturer: General Electric Model: 7FA.05 Serial No.: TBD Size (based on Higher Heating Value - HHV): Manufacturer Maximum Input Rating: ______ MMBTU/hr ______ kWh Manufacturer Maximum Output Rating: 2,275.00 MMBTU/hr 235,907.00 kWh
Function (Check all that apply)	[X] Electrical Generation [ ] Driving Pump/Compressor [ ] Emergency Peaking Unit [X] Steam Generation [ ] Exhaust Gas Recovery [ ] Other (specify): ______
Cycle Type	( ) Simply Cycle ( ) Regenerative Cycle (•) Combined Cycle ( ) Other (specify): ______
Combustion Type	( ) Tubular (•) Can-Annular ( ) Annular
Fuel (Turbine)	[X] Natural Gas [ ] LPG [ ] Digester Gas* [ ] Landfill Gas* [ ] Propane [ ] Refinery Gas* [ ] Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).
Heat Recovery Steam Generator (HRSG)	Steam Turbine Capacity: 228.7 MW Low Pressure Steam Output Capacity: ______ lb/hr @ ______ °F High Pressure Steam Output Capacity: 1077167 lb/hr @ 1044 °F Superheated Steam Output Capacity: ______ lb/hr @ ______ °F
Duct Burner	Manufacturer: ______ Model: ______ Number of burners: ______ Rating of each burner (HHV): ______ Type: ( ) Low NOx (please attach manufacturer's specifications) ( ) Other: ______ Show all heat transfer surface locations with the HRSG and temperature profile
Fuel (Duct Burner)	( ) Natural Gas ( ) LPG ( ) Digester Gas* ( ) Landfill Gas* ( ) Propane ( ) Refinery Gas* ( ) Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

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Section B - Equipment Description (Cont.)

Air Pollution Control

- (●) Selective Catalytic Reduction (SCR)* ○ Selective Non-Catalytic Reduction (SNCR)*
- ○ Oxidation Catalyst* ○ Other (specify)*: ____
- ○ Steam/Water Injection: Injection Rate: ____ lbs. water/lbs. fuel, or ____ mole water/mole fuel

* Separate application is required.

Capital Cost: 452109 Installation Cost: 40188 Annual Operating Cost: ____

Oxidation Catalyst Data (If Applicable)

Manufacturer: ____ Model: ____

Catalyst Dimensions: Length: ____ ft. ____ in. Width: ____ ft. ____ in. Height: ____ ft. ____ in.

Catalyst Cell Density: ____ cells/sq.in. Pressure Drop Across Catalyst: ____

Manufacturer's Guarantee: CO Control Efficiency: ____ % Catalyst Life: ____ yrs

VOC Control Efficiency: ____ % Operating Temp. Range: ____ °F

Space Velocity (gas flow rate/catalyst volume): ____ Area Velocity (gas flow/wetted catalyst surface area): ____

VOC Concentration into Catalyst: ____ PPMVD@ 15%O_2 CO Concentration inot Catalyst: ____ PPMVD@ 15%O_2

Section C - Operation Information

On-line Emissions Data

Pollutants	Maximum Emissions Before Control *		Maximum Emissions After Control	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG			2.0	1.58
NOx			2.0	16.5
CO			2.0	10.04
PM_{10}				8.5
SOx				4.86
NH_3			5.0	15.3

* Based on temperature, fuel consumption, and MW output.

Reference (attach data):

☒ Manufacturer Emission Data ☐ EPA Emission Factors ☐ AQMD Emission Factors ☐ Source Test

Stack or Vent Data

Stack Height: 140 ft. ____ in. Stack Diameter: 20 ft. ____ in.

Exhaust Temperature: 223 °F Exhaust Pressure: ____ inches water column

Exhaust Flow Rate: 1264000 CFM Oxygen Level: 14.91 %

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

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Section C - Operation Information (cont.)

Startup Data	No. of Startups per day: 2	No. of Startups per year: 500	Duration of each startup: 1 hrs.	
Shutdown Data	No. of Shutdowns per day: 2	No. of Shutdowns per year: 500	Duration of each Shutdown: 0.50 hrs.	

Startup and Shutdown Emissions Data

Pollutants	Startup Emissions PPM@15% O_2, dry	Startup Emissions lb/hour	Shutdown Emissions PPM@15% O_2, dry	Shutdown Emissions lb/hour
ROG		36.0		32.8
NOx		61.0		18.2
CO		325		138
PM_{10}		8.5		8.5
SOx		4.86		4.86
NH_3				

Monitoring and Reporting

Continuous Emission Monitoring System (CEMS): CEMS Make: TBD

CEMS Model: TBD

Will the CEMS be used to measure both on-line and startup/shutdown emissions? (●) Yes ( ) No

The following parameters will be continuously monitored:

- [x] NOx
- [x] CO
- [x] O_2
- [x] Fuel Flow Rate
- [x] Ammonia Injection Rate
- [ ] Other (specify):
- [x] Ammonia Stack Concentration: Ammonia CEMS Make: TBD

Ammonia CEMS Model: TBD

Operating Schedule

	hours/day	days/week	weeks/yr
Normal:	24	7	52
Maximum:	24	7	52

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info

Signature: [signature] Date: 10/15/15

Name: Stephen O'Kane

Title: Manager Company Name: AES Alamitos, LLC

Phone #: 5624937840 Fax #: 5624937320

Email: stephen.okane@AES.com

Contact Info

Name: Same as above.

Title: Company Name:

Phone #: Fax #:

Email:

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South Coast Air Quality Management District
Form 400-E-12
Gas Turbine

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Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

◉ Fixed Location ○ Various Locations

Section B - Equipment Description

Turbine	Manufacturer: General Electric Model: LMS-100PB Serial No.: TBD Size (based on Higher Heating Value - HHV): Manufacturer Maximum Input Rating: ______ MMBTU/hr ______ kWh Manufacturer Maximum Output Rating: 879.00 MMBTU/hr 98,966.00 kWh
Function (Check all that apply)	☒ Electrical Generation ☐ Driving Pump/Compressor ☐ Emergency Peaking Unit ☒ Steam Generation ☐ Exhaust Gas Recovery ☐ Other (specify): ______
Cycle Type	◉ Simply Cycle ○ Regenerative Cycle ○ Combined Cycle ○ Other (specify): ______
Combustion Type	○ Tubular ◉ Can-Annular ○ Annular
Fuel (Turbine)	☒ Natural Gas ☐ LPG ☐ Digester Gas* ☐ Landfill Gas* ☐ Propane ☐ Refinery Gas* ☐ Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).
Heat Recovery Steam Generator (HRSG)	Steam Turbine Capacity: ______ MW Low Pressure Steam Output Capacity: ______ lb/hr @ ______ °F High Pressure Steam Output Capacity: ______ lb/hr @ ______ °F Superheated Steam Output Capacity: ______ lb/hr @ ______ °F
Duct Burner	Manufacturer: ______ Model: ______ Number of burners: ______ Rating of each burner (HHV): ______ Type: ○ Low NOx (please attach manufacturer's specifications) ○ Other: ______ Show all heat transfer surface locations with the HRSG and temperature profile
Fuel (Duct Burner)	○ Natural Gas ○ LPG ○ Digester Gas* ○ Landfill Gas* ○ Propane ○ Refinery Gas* ○ Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

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Section B - Equipment Description (Cont.)

Air Pollution Control

(◉) Selective Catalytic Reduction (SCR)* ( ) Selective Non-Catalytic Reduction (SNCR)* 0.5

( ) Oxidation Catalyst* ( ) Other (specify)*: ______

( ) Steam/Water Injection: Injection Rate: ______ lbs. water/lbs. fuel, or ______ mole water/mole fuel 0.22

* Separate application is required.

Capital Cost: 526442 Installation Cost: 52020 Annual Operating Cost: ______

Oxidation Catalyst Data (If Applicable)

Manufacturer: ______ Model: ______

Catalyst Dimensions: Length: ______ ft. ______ in. Width: ______ ft. ______ in. Height: ______ ft. ______ in.

Catalyst Cell Density: ______ cells/sq.in. Pressure Drop Across Catalyst: ______

Manufacturer's Guarantee: CO Control Efficiency: ______ % Catalyst Life: ______ yrs

VOC Control Efficiency: ______ % Operating Temp. Range: ______ °F

Space Velocity (gas flow rate/catalyst volume): ______ Area Velocity (gas flow/wetted catalyst surface area): ______

VOC Concentration into Catalyst: ______ PPMVD@ 15%O_2 CO Concentration inot Catalyst: ______ PPMVD@ 15%O_2

Section C - Operation Information

On-line Emissions Data

Pollutants	Maximum Emissions Before Control *		Maximum Emissions After Control	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG			2.0	2.30
NOx			2.5	8.26
CO			4.0	8.05
PM_{10}				6.23
SOx				1.63
NH_3			5.0	6.09

* Based on temperature, fuel consumption, and MW output.

Reference (attach data):

☒ Manufacturer Emission Data ☐ EPA Emission Factors ☐ AQMD Emission Factors ☐ Source Test

Stack or Vent Data

Stack Height: 80 ft. ______ in. Stack Diameter: 13 ft. 6 in.

Exhaust Temperature: 981 °F Exhaust Pressure: ______ inches water column

Exhaust Flow Rate: 938000 CFM Oxygen Level: 14.7 %

South Coast Air Quality Management District
Form 400-E-12
Gas Turbine
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Section C - Operation Information (cont.)

Startup Data	No. of Startups per day: 2 No. of Startups per year: 500 Duration of each startup: 0.5 hrs.
Shutdown Data	No. of Shutdowns per day: 2 No. of Shutdowns per year: 500 Duration of each Shutdown: 0.22 hrs.

Startup and Shutdown Emissions Data

Pollutants	Startup Emissions		Shutdown Emissions	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG		3.95		4.86
NOx		20.7		9.56
CO		19.4		34.4
PM_{10}		6.23		6.23
SOx		1.62		1.62
NH_3				

Monitoring and Reporting

Continuous Emission Monitoring System (CEMS): CEMS Make: TBD

CEMS Model: TBD

Will the CEMS be used to measure both on-line and startup/shutdown emissions? ◉ Yes ○ No

The following parameters will be continuously monitored:

☒ NOx ☒ CO ☒ O_2

☒ Fuel Flow Rate ☒ Ammonia Injection Rate ☐ Other (specify): ____

☒ Ammonia Stack Concentration: Ammonia CEMS Make: TBD

Ammonia CEMS Model: TBD

Operating Schedule

Normal:	24 hours/day	7 days/week	52 weeks/yr
Maximum:	24 hours/day	7 days/week	52 weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info

Signature: [signature] Date: 9/15/15

Name: Stephen O'Kane

Title: Manager Company Name: AES Alamitos, LLC

Phone #: 5624937840 Fax #: 5624937320

Email: stephen.okane@AES.com

Contact Info

Name: Same as above.

Title: Company Name:

Phone #: Fax #:

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South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

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Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

◉ Fixed Location ○ Various Locations

Section B - Equipment Description

Turbine	Manufacturer: General Electric Model: LMS-100PB Serial No.: TBD Size (based on Higher Heating Value - HHV): Manufacturer Maximum Input Rating: ________ MMBTU/hr ________ kWh Manufacturer Maximum Output Rating: 879.00 MMBTU/hr 98,966.00 kWh
Function (Check all that apply)	☒ Electrical Generation ☐ Driving Pump/Compressor ☐ Emergency Peaking Unit ☒ Steam Generation ☐ Exhaust Gas Recovery ☐ Other (specify): ________
Cycle Type	◉ Simply Cycle ○ Regenerative Cycle ○ Combined Cycle ○ Other (specify): ________
Combustion Type	○ Tubular ◉ Can-Annular ○ Annular
Fuel (Turbine)	☒ Natural Gas ☐ LPG ☐ Digester Gas* ☐ Landfill Gas* ☐ Propane ☐ Refinery Gas* ☐ Other*: ________ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).
Heat Recovery Steam Generator (HRSG)	Steam Turbine Capacity: ________ MW Low Pressure Steam Output Capacity: ________ lb/hr @ ________ °F High Pressure Steam Output Capacity: ________ lb/hr @ ________ °F Superheated Steam Output Capacity: ________ lb/hr @ ________ °F
Duct Burner	Manufacturer: ________ Model: ________ Number of burners: ________ Rating of each burner (HHV): ________ Type: ○ Low NOx (please attach manufacturer's specifications) ○ Other: ________ Show all heat transfer surface locations with the HRSG and temperature profile
Fuel (Duct Burner)	○ Natural Gas ○ LPG ○ Digester Gas* ○ Landfill Gas* ○ Propane ○ Refinery Gas* ○ Other*: ________ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

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Section B - Equipment Description (Cont.)

Air Pollution Control

- (◉) Selective Catalytic Reduction (SCR)*
- ( ) Selective Non-Catalytic Reduction (SNCR)*
- ( ) Oxidation Catalyst*
- ( ) Other (specify)*: ____
- ( ) Steam/Water Injection: Injection Rate: ____ lbs. water/lbs. fuel, or ____ mole water/mole fuel

* Separate application is required.

Capital Cost: 526442 Installation Cost: 52020 Annual Operating Cost: ____

Oxidation Catalyst Data (If Applicable)

Manufacturer: ____ Model: ____

Catalyst Dimensions: Length: ____ ft. ____ in. Width: ____ ft. ____ in. Height: ____ ft. ____ in.

Catalyst Cell Density: ____ cells/sq.in. Pressure Drop Across Catalyst: ____

Manufacturer's Guarantee: CO Control Efficiency: ____ % Catalyst Life: ____ yrs

VOC Control Efficiency: ____ % Operating Temp. Range: ____ °F

Space Velocity (gas flow rate/catalyst volume): ____ Area Velocity (gas flow/wetted catalyst surface area): ____

VOC Concentration into Catalyst: ____ PPMVD@ 15%O_2 CO Concentration inot Catalyst: ____ PPMVD@ 15%O_2

Section C - Operation Information

On-line Emissions Data

Pollutants	Maximum Emissions Before Control *		Maximum Emissions After Control	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG			2.0	2.30
NOx			2.5	8.26
CO			4.0	8.05
PM_{10}				6.23
SOx				1.63
NH_3			5.0	6.09

* Based on temperature, fuel consumption, and MW output.

Reference (attach data):

- [x] Manufacturer Emission Data
- [ ] EPA Emission Factors
- [ ] AQMD Emission Factors
- [ ] Source Test

Stack or Vent Data

Stack Height: 80 ft. ____ in. Stack Diameter: 13 ft. 6 in.

Exhaust Temperature: 981 °F Exhaust Pressure: ____ inches water column

Exhaust Flow Rate: 938000 CFM Oxygen Level: 14.7 %

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

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Section C - Operation Information (cont.)

Startup Data: No. of Startups per day: 2 No. of Startups per year: 500 Duration of each startup: 0.5 hrs.

Shutdown Data: No. of Shutdowns per day: 2 No. of Shutdowns per year: 500 Duration of each Shutdown: 0.22 hrs.

Startup and Shutdown Emissions Data

Pollutants	Startup Emissions		Shutdown Emissions	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG		3.95		4.86
NOx		20.7		9.56
CO		19.4		34.4
PM_{10}		6.23		6.23
SOx		1.62		1.62
NH_3				

Monitoring and Reporting

Continuous Emission Monitoring System (CEMS): CEMS Make: TBD

CEMS Model: TBD

Will the CEMS be used to measure both on-line and startup/shutdown emissions? ◉ Yes ○ No

The following parameters will be continuously monitored:

☒ NOx ☒ CO ☒ O_2

☒ Fuel Flow Rate ☒ Ammonia Injection Rate ☐ Other (specify):

☒ Ammonia Stack Concentration: Ammonia CEMS Make: TBD

Ammonia CEMS Model: TBD

Operating Schedule

Normal: 24 hours/day 7 days/week 52 weeks/yr

Maximum: 24 hours/day 7 days/week 52 weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info

Signature: [signature] Date: 10/15/15

Title: Manager Company Name: AES Alamitos, LLC

Name: Stephen O'Kane

Phone #: 5624937840 Fax #: 5624937320

Email: stephen.okane@AES.com

Contact Info

Name: Same as above.

Title: Company Name:

Phone #: Fax #:

Email:

South Coast Air Quality Management District

Form 400-E-12
Gas Turbine

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Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

◉ Fixed Location ○ Various Locations

Section B - Equipment Description

Turbine	Manufacturer: General Electric Model: LMS-100PB Serial No.: TBD Size (based on Higher Heating Value - HHV): Manufacturer Maximum Input Rating: ______ MMBTU/hr ______ kWh Manufacturer Maximum Output Rating: 879.00 MMBTU/hr 98,966.00 kWh
Function (Check all that apply)	☒ Electrical Generation ☐ Driving Pump/Compressor ☐ Emergency Peaking Unit ☒ Steam Generation ☐ Exhaust Gas Recovery ☐ Other (specify): ______
Cycle Type	◉ Simply Cycle ○ Regenerative Cycle ○ Combined Cycle ○ Other (specify): ______
Combustion Type	○ Tubular ◉ Can-Annular ○ Annular
Fuel (Turbine)	☒ Natural Gas ☐ LPG ☐ Digester Gas* ☐ Landfill Gas* ☐ Propane ☐ Refinery Gas* ☐ Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).
Heat Recovery Steam Generator (HRSG)	Steam Turbine Capacity: ______ MW Low Pressure Steam Output Capacity: ______ lb/hr @ ______ °F High Pressure Steam Output Capacity: ______ lb/hr @ ______ °F Superheated Steam Output Capacity: ______ lb/hr @ ______ °F
Duct Burner	Manufacturer: ______ Model: ______ Number of burners: ______ Rating of each burner (HHV): ______ Type: ○ Low NOx (please attach manufacturer's specifications) ○ Other: ______ Show all heat transfer surface locations with the HRSG and temperature profile
Fuel (Duct Burner)	○ Natural Gas ○ LPG ○ Digester Gas* ○ Landfill Gas* ○ Propane ○ Refinery Gas* ○ Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).

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Gas Turbine

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Section B - Equipment Description (Cont.)

Air Pollution Control

(●) Selective Catalytic Reduction (SCR)* ( ) Selective Non-Catalytic Reduction (SNCR)*

( ) Oxidation Catalyst* ( ) Other (specify)*: ____

( ) Steam/Water Injection: Injection Rate: ____ lbs. water/lbs. fuel, or ____ mole water/mole fuel

* Separate application is required.

Capital Cost: 526442 Installation Cost: 52020 Annual Operating Cost: ____

Oxidation Catalyst Data (If Applicable)

Manufacturer: ____ Model: ____

Catalyst Dimensions: Length: ____ ft. ____ in. Width: ____ ft. ____ in. Height: ____ ft. ____ in.

Catalyst Cell Density: ____ cells/sq.in. Pressure Drop Across Catalyst: ____

Manufacturer's Guarantee: CO Control Efficiency: ____ % Catalyst Life: ____ yrs

VOC Control Efficiency: ____ % Operating Temp. Range: ____ °F

Space Velocity (gas flow rate/catalyst volume): ____ Area Velocity (gas flow/wetted catalyst surface area): ____

VOC Concentration into Catalyst: ____ PPMVD@ 15%O_2 CO Concentration inot Catalyst: ____ PPMVD@ 15%O_2

Section C - Operation Information

On-line Emissions Data

Pollutants	Maximum Emissions Before Control *		Maximum Emissions After Control	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG			2.0	2.30
NOx			2.5	8.26
CO			4.0	8.05
PM_{10}				6.23
SOx				1.63
NH_3			5.0	6.09

* Based on temperature, fuel consumption, and MW output.

Reference (attach data):

☒ Manufacturer Emission Data ☐ EPA Emission Factors ☐ AQMD Emission Factors ☐ Source Test

Stack or Vent Data

Stack Height: 80 ft. ____ in. Stack Diameter: 13 ft. 6 in.

Exhaust Temperature: 981 °F Exhaust Pressure: ____ inches water column

Exhaust Flow Rate: 938000 CFM Oxygen Level: 14.7 %

South Coast Air Quality Management District
Form 400-E-12
Gas Turbine
This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section C - Operation Information (cont.)

Startup Data — No. of Startups per day: 2 No. of Startups per year: 500 Duration of each startup: 0.5 hrs.

Shutdown Data — No. of Shutdowns per day: 2 No. of Shutdowns per year: 500 Duration of each Shutdown: 0.22 hrs.

Startup and Shutdown Emissions Data

Pollutants	Startup Emissions		Shutdown Emissions	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG		3.95		4.86
NOx		20.7		9.56
CO		19.4		34.4
PM_{10}		6.23		6.23
SOx		1.62		1.62
NH_3				

Monitoring and Reporting

Continuous Emission Monitoring System (CEMS): CEMS Make: TBD
CEMS Model: TBD

Will the CEMS be used to measure both on-line and startup/shutdown emissions? ◉ Yes ○ No

The following parameters will be continuously monitored:

☒ NOx ☒ CO ☒ O_2
☒ Fuel Flow Rate ☒ Ammonia Injection Rate ☐ Other (specify):
☒ Ammonia Stack Concentration: Ammonia CEMS Make: TBD
Ammonia CEMS Model: TBD

Operating Schedule

	hours/day	days/week	weeks/yr
Normal:	24	7	52
Maximum:	24	7	52

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info
Signature: [signature] Date: 10/15/15
Title: Manager Company Name: AES Alamitos, LLC
Name: Stephen O'Kane
Phone #: 5624937840 Fax #: 5624937320
Email: stephen.okane@AES.com

Contact Info
Name: Same as above.
Title: Company Name:
Phone #: Fax #:
Email:

THIS IS A PUBLIC DOCUMENT
Pursuant to the California Public Records Act, your permit application and any supplemental documentation are public records and may be disclosed to a third party. If you wish to claim certain limited information as exempt from disclosure because it qualifies as a trade secret, as defined in the District's Guidelines for Implementing the California Public Records Act, you must make such claim at the time of submittal to the District.

Check here if you claim that this form or its attachments contain confidential trade secret information. ☐

South Coast Air Quality Management District
Form 400-E-12
Gas Turbine

South Coast AQMD

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Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

◉ Fixed Location ○ Various Locations

Section B - Equipment Description

Turbine	Manufacturer: General Electric Model: LMS-100PB Serial No.: TBD Size (based on Higher Heating Value - HHV): Manufacturer Maximum Input Rating: ______ MMBTU/hr ______ kWh Manufacturer Maximum Output Rating: 879.00 MMBTU/hr 98,966.00 kWh
Function (Check all that apply)	☒ Electrical Generation ☐ Driving Pump/Compressor ☐ Emergency Peaking Unit ☒ Steam Generation ☐ Exhaust Gas Recovery ☐ Other (specify): ______
Cycle Type	◉ Simply Cycle ○ Regenerative Cycle ○ Combined Cycle ○ Other (specify): ______
Combustion Type	○ Tubular ◉ Can-Annular ○ Annular
Fuel (Turbine)	☒ Natural Gas ☐ LPG ☐ Digester Gas* ☐ Landfill Gas* ☐ Propane ☐ Refinery Gas* ☐ Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).
Heat Recovery Steam Generator (HRSG)	Steam Turbine Capacity: ______ MW Low Pressure Steam Output Capacity: ______ lb/hr @ ______ °F High Pressure Steam Output Capacity: ______ lb/hr @ ______ °F Superheated Steam Output Capacity: ______ lb/hr @ ______ °F
Duct Burner	Manufacturer: ______ Model: ______ Number of burners: ______ Rating of each burner (HHV): ______ Type: ○ Low NOx (please attach manufacturer's specifications) ○ Other: ______ Show all heat transfer surface locations with the HRSG and temperature profile
Fuel (Duct Burner)	○ Natural Gas ○ LPG ○ Digester Gas* ○ Landfill Gas* ○ Propane ○ Refinery Gas* ○ Other*: ______ * (If Digester Gas, Landfill Gas, Refinery Gas, and/or Other are checked, attach fuel analysis indicating higher heating value and sulfur content).

Form 400-E-12
Gas Turbine

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section B - Equipment Description (Cont.)

Air Pollution Control

- (●) Selective Catalytic Reduction (SCR)*
- ( ) Selective Non-Catalytic Reduction (SNCR)*
- ( ) Oxidation Catalyst*
- ( ) Other (specify)*: ______
- ( ) Steam/Water Injection: Injection Rate: ______ lbs. water/lbs. fuel, or ______ mole water/mole fuel

* Separate application is required.

Capital Cost: 526442 Installation Cost: 52020 Annual Operating Cost: ______

Oxidation Catalyst Data (If Applicable)

Manufacturer: ______ Model: ______

Catalyst Dimensions: Length: ______ ft. ______ in. Width: ______ ft. ______ in. Height: ______ ft. ______ in.

Catalyst Cell Density: ______ cells/sq.in. Pressure Drop Across Catalyst: ______

Manufacturer's Guarantee: CO Control Efficiency: ______ % Catalyst Life: ______ yrs

VOC Control Efficiency: ______ % Operating Temp. Range: ______ °F

Space Velocity (gas flow rate/catalyst volume): ______ Area Velocity (gas flow/wetted catalyst surface area): ______

VOC Concentration into Catalyst: ______ PPMVD@ 15%O_2 CO Concentration inot Catalyst: ______ PPMVD@ 15%O_2

Section C - Operation Information

On-line Emissions Data

Pollutants	Maximum Emissions Before Control *		Maximum Emissions After Control	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG			2.0	2.30
NOx			2.5	8.26
CO			4.0	8.05
PM_{10}				6.23
SOx				1.63
NH_3			5.0	6.09

* Based on temperature, fuel consumption, and MW output.

Reference (attach data):

- [x] Manufacturer Emission Data
- [ ] EPA Emission Factors
- [ ] AQMD Emission Factors
- [ ] Source Test

Stack or Vent Data

Stack Height: 80 ft. ______ in. Stack Diameter: 13 ft. 6 in.

Exhaust Temperature: 981 °F Exhaust Pressure: ______ inches water column

Exhaust Flow Rate: 938000 CFM Oxygen Level: 14.7 %

South Coast Air Quality Management District

Form 400-E-12

Gas Turbine

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section C - Operation Information (cont.)

Startup Data: No. of Startups per day: 2 No. of Startups per year: 500 Duration of each startup: 0.5 hrs.

Shutdown Data: No. of Shutdowns per day: 2 No. of Shutdowns per year: 500 Duration of each Shutdown: 0.22 hrs.

Startup and Shutdown Emissions Data

Pollutants	Startup Emissions		Shutdown Emissions	
	PPM@15% O_2, dry	lb/hour	PPM@15% O_2, dry	lb/hour
ROG		3.95		4.86
NOx		20.7		9.56
CO		19.4		34.4
PM_{10}		6.23		6.23
SOx		1.62		1.62
NH_3				

Monitoring and Reporting

Continuous Emission Monitoring System (CEMS): CEMS Make: TBD

CEMS Model: TBD

Will the CEMS be used to measure both on-line and startup/shutdown emissions? ◉ Yes ○ No

The following parameters will be continuously monitored:

☒ NOx ☒ CO ☒ O_2

☒ Fuel Flow Rate ☒ Ammonia Injection Rate ☐ Other (specify):

☒ Ammonia Stack Concentration: Ammonia CEMS Make: TBD

Ammonia CEMS Model: TBD

Operating Schedule

Normal:	24	hours/day	7	days/week	52	weeks/yr
Maximum:	24	hours/day	7	days/week	52	weeks/yr

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info

Signature: [signature] Date: 10/15/15

Title: Manager Company Name: AES Alamitos, LLC

Name: Stephen O'Kane

Phone #: 5624937840 Fax #: 5624937320

Email: stephen.okane@AES.com

Contact Info

Name: Same as above.

Title: Company Name:

Phone #: Fax #:

Email:

South Coast Air Quality Management District

Form 400-E-18
Storage Tank

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various locations in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(◉) Fixed Location ( ) Various Locations

Tank Type (Select ONE)	( ) External Floating Roof Tank (EFRT) ( ) Internal Floating Roof Tank (IFRT) (◉) Horizontal Tank (HT) ( ) Vertical Fixed Roof Tank (VFRT) ( ) Domed External Roof Tank (DEFRT)
Identification	Tank Identification Number: TBD; Tank Contents/Product (include MSDS): 19% Aqueous Ammonia

Section B - Tank Information

Tank Characteristics

Shell Diameter (ft.): 13

Shell Length (ft.): 45

Shell Height (ft.): ____

Turnovers Per Year: 3

Is Tank Heated? ( ) Yes (◉) No

Is Tank Underground? ( ) Yes (◉) No

Net Throughput (gal/year): 97207.74

Self Support Roof: (◉) Yes ( ) No

Number of Columns? ____

Effective Column Diameter: ( ) 9" by 7" Built Up Column - 1.1 ( ) 8" Diameter Pipe - 0.7 ( ) Unknown - 1

External Shell Condition: (◉) Good ( ) Poor

Internal Shell Color: ( ) Light Rust ( ) Dense Rust ( ) Gunite Lining

External Shell Color: (◉) White/White ( ) Aluminum/Specular ( ) Aluminum/Diffuse ( ) Gray/Light ( ) Gray/Medium ( ) Red/Primer

Average Liquid Height (ft.) (Vertical Only): ____

Maximum Liquid Height (ft.) (Vertical Only): ____

Working Volume (gal.) (Vertical Only): ____

Actual Volume (gal.) (Vertical Only): ____

Paint Condition: (◉) Good ( ) Poor

Paint Color/Shade: (◉) White/White ( ) Aluminum/Diffuse ( ) Gray/Light ( ) Aluminum/Specular ( ) Gray/Medium ( ) Red/Primer

Roof Characteristics (Floating Roof Tank)

Roof Type: ( ) Pontoon ( ) Double Deck ( ) Dome Roof (Height____ ft.) ( ) Cone Roof (Height____ ft.)

Roof Fitting Category: ( ) Typical ( ) Detail

Roof Height (ft.): ____

Roof Paint Condition: ( ) Good ( ) Poor

Roof Color/Shade: ( ) White/White ( ) Aluminum/Diffuse ( ) Gray/Light ( ) Aluminum/Specular ( ) Gray/Medium ( ) Red/Primer

Deck Characteristics (Floating Roof Tank)

Deck Type: ( ) Welded ( ) Bolted

Deck Fitting Characteristics: ( ) Typical ( ) Detailed (Complete Deck Seam)

Construction:	Deck Seam Length (ft.):	Deck Seam:
( ) Sheet	____	( ) 5 ft. wide ( ) 6 ft. wide ( ) 7 ft. wide
( ) Panel	____	( ) 5 x 7.5 ft. ( ) 5 x 12 ft.

Tank Construction and Rim-Seal System (Floating Roof Tank)

Tank Construction: ( ) Welded ( ) Riveted

Primary Seal: ( ) Mechanical Shoe ( ) Liquid Mounted ( ) Vapor Mounted

Secondary Seal: ( ) Rim Mounted ( ) None ( ) Shoe Mounted

Breather Vent Setting

Vacuum Setting (psig): -1.25

Pressure Setting (psig): 50

* Section D of the application MUST be completed.

South Coast Air Quality Management District

Form 400-E-18 Storage Tank

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section B - Tank Information (cont.)

Site Selection

Nearest Major City: Long Beach, CA

Daily Average Ambient Temperature (°F): 64.2 Annual Average Minimum Temperature (°F): 54.8

Annual Average Maximum Temperature (°F): 74.2 Average Wind Speed (mph): 4.23

Annual Average Solar Insulation Factor (Btu / (ft^3 • ft • day)): ______

Tank Contents

Chemical Category: ○ Organic Liquids ○ Crude Oil ○ Petroleum Distillates

Liquid: ◉ Single ○ Multiple

If Multiple, Select Speciation Option: ○ Full Speciation ○ Partial Speciation ○ Various Weight Speciation ○ None

Section C - Operation Information

Vapor Control

Vapor Control During Loading or Unloading: ☐ Sparger ☒ Vapor Balance System ☐ Vapor Return Line ☐ Vented to Air Pollution Control Equipment [1]

[1] A separate permit is required. If APC equipment is already permitted, provide Permit or Device Number: ______

Vent Valve Data

Indicate Type of Setting and Vapor Disposal

	Number	Pressure Setting	Vaccum Setting	Discharging to (Check Appropriate Box)		
				Atmosphere	Vapor Control	Flare
Combination				☐	☐	☐
Pressure	1	50	-1.25	☒	☐	☐
Vaccum				☐	☐	☐
Open				☐	☐	☐

Materials

Name all liquids, vapors, gases, or mixtures of such material to be stored in this tank:
19% Aqueous Ammonia

If material is stored in a solution, supply the following information:

Name of Solvent: Water Name of Materials Dissolved: Ammonia

Concentration of Materials Dissolved: 19.00 % by Weight OR ______ % by Volume OR ______ lbs/gal

Section D - Roof/Deck Fitting

Section D is required for the following tanks: External Floating Roof Tank, Internal Floating Roof Tanks, or Domed External Floating Roof Tanks.

Select the number of fittings for each applicable question. Examples: __3__ Unbolted Cover, Ungasketed
______ Unbolted Cover, Gasketed

Roof/Deck Fitting Details

1. Access Hatch (24" diameter well)
   - ______ Bolted Cover, Gasketed
   - ______ Unbolted Cover, UnGasketed
   - ______ Unbolted Cover, Gasketed

2. Automatic Gauge Float Well (20" diameter well)
   - ______ Bolted Cover, Gasketed
   - ______ Unbolted Cover, Ungasketed
   - ______ Unbolted Cover, Gasketed

3. Column Well (24" diameter well)
   - ______ Built-Up Col - Sliding Cover, Gasketed
   - ______ Built-Up Col - Sliding Cover, Ungasketed
   - ______ Pipe Col - Flex, Fabric Sleeve Seal
   - ______ Pipe Col - Sliding Cover, Gasketed
   - ______ Pipe Col - Sliding Cover, Ungasketed

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Section D - Roof/Deck Fitting (cont.)

Roof/Deck Fitting Details (cont.)

4. Gauge Hatch/Sample Well (8" diameter well)
___________ Weighted Mechanical Actuation, Gasketed
___________ Weighted Mechanical Actuation, Ungasketed

5. Ladder Well (36" diameter)
___________ Sliding Cover, Gasketed
___________ Sliding Cover, Ungasketed

6. Rim Vent (6" diameter)
___________ Weighted Mechanical Actuation, Gasketed
___________ Weighted Mechanical Actuation, Ungasketed

7. Roof Drain (3" diameter)
___________ Open
___________ 90% Close

8. Roof Leg (3" diameter leg)
___________ Adjustable, Pontoon Area, Ungasketed
___________ Adjustable, Center Area, Ungasketed
___________ Adjustable, Double-Deck Roofs
___________ Fixed
___________ Adjustable, Pontoon Area, Gasketed
___________ Adjustable, Pontoon Area, Sock
___________ Adjustable, Center Area, Gasketed
___________ Adjustable, Center Area, Sock

9. Roof Leg or Hang Well
___________ Adjustable
___________ Fixed

10. Sample Pipe (24" diameter)
___________ Slotted Pipe – Sliding Cover, Gasketed
___________ Slotted Pipe – Sliding Cover, Ungasketed
___________ Slit Fabric Seal, 10% Open

11. Guided Pole/Sample Well
___________ Ungasketed, Sliding Cover, Without Float
___________ Ungasketed Sliding Cover, With Float
___________ Gasketed Sliding Cover, Without Float
___________ Gasketed Sliding Cover, With Float
___________ Gasketed Sliding Cover, With Pole Sleeve
___________ Gasketed Sliding Cover, With Pole Wiper
___________ Gasketed Sliding Cover, With Float, Wiper
___________ Gasketed Sliding Cover, With Float, Sleeve, Wiper
___________ Gasketed Sliding Cover, With Pole Sleeve, Wiper

12. ___________ **Stub Drain (1" diameter)**

13. Unslotted Guide – Pole Well
___________ Ungasketed, Sliding Cover
___________ Gasketed Sliding Cover
___________ Ungasketed Sliding Cover with Sleeve
___________ Gasketed Sliding Cover with Sleeve
___________ Gasketed Sliding Cover with Wiper

14. Vacuum Breaker (10" diameter well)
___________ Weighted Mechanical Actuation, Gasketed
___________ Weighted Mechanical Actuation, Ungasketed

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info	**Signature:** S O'Kane	**Date:** 10/15/15	**Name:** Stephen O'Kane	
	Title: Manager	**Company Name:** AES Alamitos, LLC	**Phone #:** 5624937840	**Fax #:** (562) 493-7320
			Email: stephen.okane@AES.com	
Contact Info	**Name:** Same as above.		**Phone #:**	**Fax #:**
	Title:	**Company Name:**	**Email:**	

South Coast AQMD

South Coast Air Quality Management District

Form 400-E-18
Storage Tank

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Mail To:
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Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various locations in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(•) Fixed Location ( ) Various Locations

Tank Type (Select ONE)	( ) External Floating Roof Tank (EFRT) ( ) Internal Floating Roof Tank (IFRT) (•) Horizontal Tank (HT) ( ) Vertical Fixed Roof Tank (VFRT) ( ) Domed External Roof Tank (DEFRT)
Identification	Tank Identification Number: TBD — Tank Contents/Product (include MSDS): 19% Aqueous Ammonia

Section B - Tank Information

Tank Characteristics

- Shell Diameter (ft.): 13
- Shell Length (ft.): 45
- Shell Height (ft.): ______
- Turnovers Per Year: 27
- Is Tank Heated? ( ) Yes (•) No
- Is Tank Underground? ( ) Yes (•) No
- Net Throughput (gal/year): 798912
- Self Support Roof: (•) Yes ( ) No
- Number of Columns? ______
- Effective Column Diameter: ( ) 9" by 7" Built Up Column - 1.1 ( ) 8" Diameter Pipe - 0.7 ( ) Unknown - 1
- External Shell Condition: (•) Good ( ) Poor
- Internal Shell Color: ( ) Light Rust ( ) Dense Rust ( ) Gunite Lining
- External Shell Color: (•) White/White ( ) Aluminum/Specular ( ) Aluminum/Diffuse ( ) Gray/Light ( ) Gray/Medium ( ) Red/Primer
- Average Liquid Height (ft.) (Vertical Only): ______
- Maximum Liquid Height (ft.) (Vertical Only): ______
- Working Volume (gal.) (Vertical Only): ______
- Actual Volume (gal.) (Vertical Only): ______
- Paint Condition: (•) Good ( ) Poor
- Paint Color/Shade: (•) White/White ( ) Gray/Light ( ) Gray/Medium ( ) Aluminum/Diffuse ( ) Aluminum/Specular ( ) Red/Primer

Roof Characteristics (Floating Roof Tank)

- Roof Type: ( ) Pontoon ( ) Double Deck ( ) Dome Roof (Height______ft.) ( ) Cone Roof (Height______ft.)
- Roof Fitting Category: ( ) Typical ( ) Detail
- Roof Height (ft.): ______
- Roof Paint Condition: ( ) Good ( ) Poor
- Roof Color/Shade: ( ) White/White ( ) Gray/Light ( ) Gray/Medium ( ) Aluminum/Diffuse ( ) Aluminum/Specular ( ) Red/Primer

Deck Characteristics (Floating Roof Tank)

- Deck Type: ( ) Welded ( ) Bolted
- Deck Fitting Characteristics: ( ) Typical ( ) Detailed (Complete Deck Seam)

Construction:	Deck Seam Length (ft.):	Deck Seam:
( ) Sheet	______	( ) 5 ft. wide ( ) 6 ft. wide ( ) 7 ft. wide
( ) Panel	______	( ) 5 x 7.5 ft. ( ) 5 x 12 ft.

Tank Construction and Rim-Seal System (Floating Roof Tank)

- Tank Construction: ( ) Welded ( ) Riveted
- Primary Seal: ( ) Mechanical Shoe ( ) Liquid Mounted ( ) Vapor Mounted
- Secondary Seal: ( ) Rim Mounted ( ) None ( ) Shoe Mounted

Breather Vent Setting

- Vacuum Setting (psig): -1.25
- Pressure Setting (psig): 50

* Section D of the application MUST be completed.

South Coast Air Quality Management District
Form 400-E-18
Storage Tank

South Coast AQMD

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Section B - Tank Information (cont.)

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Daily Average Ambient Temperature (°F): 64.2 Annual Average Minimum Temperature (°F): 54.8

Annual Average Maximum Temperature (°F): 74.2 Average Wind Speed (mph): 4.23

Annual Average Solar Insulation Factor (Btu / (ft^3 * ft * day)): ____________

Tank Contents

Chemical Category: ○ Organic Liquids ○ Crude Oil ○ Petroleum Distillates

Liquid: ◉ Single ○ Multiple

If Multiple, Select Speciation Option: ○ Full Speciation ○ Partial Speciation ○ Various Weight Speciation ○ None

Section C - Operation Information

Vapor Control

Vapor Control During Loading or Unloading: ☐ Sparger ☒ Vapor Balance System ☐ Vapor Return Line ☐ Vented to Air Pollution Control Equipment [1]

[1] A separate permit is required. If APC equipment is already permitted, provide Permit or Device Number: ____________

Vent Valve Data

Indicate Type of Setting and Vapor Disposal

	Number	Pressure Setting	Vaccum Setting	Discharging to (Check Appropriate Box)		
				Atmosphere	Vapor Control	Flare
Combination				☐	☐	☐
Pressure	1	50	-1.25	☒	☐	☐
Vaccum				☐	☐	☐
Open				☐	☐	☐

Materials

Name all liquids, vapors, gases, or mixtures of such material to be stored in this tank:
19% Aqueous Ammonia

If material is stored in a solution, supply the following information:

Name of Solvent: Water Name of Materials Dissolved: Ammonia

Concentration of Materials Dissolved: 19.00 % by Weight OR ________ % by Volume OR ________ lbs/gal

Section D - Roof/Deck Fitting

Section D is required for the following tanks: External Floating Roof Tank, Internal Floating Roof Tanks, or Domed External Floating Roof Tanks.

Select the number of fittings for each applicable question. Examples: __3__ Unbolted Cover, Ungasketed
_____ Unbolted Cover, Gasketed

Roof/Deck Fitting Details

1. Access Hatch (24" diameter well)
   - _____ Bolted Cover, Gasketed
   - _____ Unbolted Cover, UnGasketed
   - _____ Unbolted Cover, Gasketed

2. Automatic Gauge Float Well (20" diameter well)
   - _____ Bolted Cover, Gasketed
   - _____ Unbolted Cover, Ungasketed
   - _____ Unbolted Cover, Gasketed

3. Column Well (24" diameter well)
   - _____ Built-Up Col - Sliding Cover, Gasketed
   - _____ Built-Up Col - Sliding Cover, Ungasketed
   - _____ Pipe Col - Flex, Fabric Sleeve Seal
   - _____ Pipe Col - Sliding Cover, Gasketed
   - _____ Pipe Col - Sliding Cover, Ungasketed

Form 400-E-18
Storage Tank

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Section D - Roof/Deck Fitting (cont.)

Roof/Deck Fitting Details (cont.)

4. Gauge Hatch/Sample Well (8" diameter well)
- ________ Weighted Mechanical Actuation, Gasketed
- ________ Weighted Mechanical Actuation, Ungasketed

5. Ladder Well (36" diameter)
- ________ Sliding Cover, Gasketed
- ________ Sliding Cover, Ungasketed

6. Rim Vent (6" diameter)
- ________ Weighted Mechanical Actuation, Gasketed
- ________ Weighted Mechanical Actuation, Ungasketed

7. Roof Drain (3" diameter)
- ________ Open
- ________ 90% Close

8. Roof Leg (3" diameter leg)
- ________ Adjustable, Pontoon Area, Ungasketed
- ________ Adjustable, Center Area, Ungasketed
- ________ Adjustable, Double-Deck Roofs
- ________ Fixed
- ________ Adjustable, Pontoon Area, Gasketed
- ________ Adjustable, Pontoon Area, Sock
- ________ Adjustable, Center Area, Gasketed
- ________ Adjustable, Center Area, Sock

9. Roof Leg or Hang Well
- ________ Adjustable
- ________ Fixed

10. Sample Pipe (24" diameter)
- ________ Slotted Pipe – Sliding Cover, Gasketed
- ________ Slotted Pipe – Sliding Cover, Ungasketed
- ________ Slit Fabric Seal, 10% Open

11. Guided Pole/Sample Well
- ________ Ungasketed, Sliding Cover, Without Float
- ________ Ungasketed Sliding Cover, With Float
- ________ Gasketed Sliding Cover, Without Float
- ________ Gasketed Sliding Cover, With Float
- ________ Gasketed Sliding Cover, With Pole Sleeve
- ________ Gasketed Sliding Cover, With Pole Wiper
- ________ Gasketed Sliding Cover, With Float, Wiper
- ________ Gasketed Sliding Cover, With Float, Sleeve, Wiper
- ________ Gasketed Sliding Cover, With Pole Sleeve, Wiper

12. ________ **Stub Drain (1" diameter)**

13. Unslotted Guide – Pole Well
- ________ Ungasketed, Sliding Cover
- ________ Gasketed Sliding Cover
- ________ Ungasketed Sliding Cover with Sleeve
- ________ Gasketed Sliding Cover with Sleeve
- ________ Gasketed Sliding Cover with Wiper

14. Vacuum Breaker (10" diameter well)
- ________ Weighted Mechanical Actuation, Gasketed
- ________ Weighted Mechanical Actuation, Ungasketed

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info	**Signature:**	**Date:** 10/15/15	**Name:** Stephen O'Kane	
	Title: Manager	**Company Name:** AES Alamitos, LLC	**Phone #:** 5624937840	**Fax #:** (562) 493-7320
			Email: stephen.okane@AES.com	
Contact Info	**Name:** Same as above.		**Phone #:**	**Fax #:**
	Title:	**Company Name:**	**Email:**	

South Coast Air Quality Management District

Form 400-E-18
Storage Tank

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Forms 400-A, Form 400-CEQA, and Form 400-PS.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various locations in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(◉) Fixed Location ( ) Various Locations

Tank Type (Select ONE)	( ) External Floating Roof Tank (EFRT) ( ) Internal Floating Roof Tank (IFRT) (◉) Horizontal Tank (HT) ( ) Vertical Fixed Roof Tank (VFRT) ( ) Domed External Roof Tank (DEFRT)
Identification	Tank Identification Number: TBD Tank Contents/Product (include MSDS): Water and petroleum from Combined Cycle Power Block

Section B - Tank Information

Tank Characteristics	Shell Diameter (ft.): 5.33 — Shell Length (ft.): 30 — Shell Height (ft.): 5.46 — Turnovers Per Year: 163 Is Tank Heated? ( ) Yes (◉) No — Is Tank Underground? ( ) Yes (◉) No — Net Throughput (gal/year): 810059.1 — Self Support Roof: (◉) Yes ( ) No Number of Columns? ______ — Effective Column Diameter: ( ) 9" by 7" Built Up Column - 1.1 ( ) 8" Diameter Pipe - 0.7 ( ) Unknown - 1 External Shell Condition: (◉) Good ( ) Poor Internal Shell Color: ( ) Light Rust ( ) Dense Rust ( ) Gunite Lining External Shell Color: (◉) White/White ( ) Gray/Light ( ) Aluminum/Specular ( ) Gray/Medium ( ) Aluminum/Diffuse ( ) Red/Primer Average Liquid Height (ft.) (Vertical Only): ______ — Maximum Liquid Height (ft.) (Vertical Only): ______ — Working Volume (gal.) (Vertical Only): ______ — Actual Volume (gal.) (Vertical Only): ______ Paint Condition: (◉) Good ( ) Poor Paint Color/Shade: (◉) White/White ( ) Gray/Light ( ) Gray/Medium ( ) Aluminum/Diffuse ( ) Aluminum/Specular ( ) Red/Primer
Roof Characteristics (Floating Roof Tank)	Roof Type: ( ) Pontoon ( ) Double Deck ( ) Dome Roof (Height______ft.) ( ) Cone Roof (Height______ft.) Roof Fitting Category: ( ) Typical ( ) Detail Roof Height (ft.): ______ Roof Paint Condition: ( ) Good ( ) Poor Roof Color/Shade: ( ) White/White ( ) Gray/Light ( ) Gray/Medium ( ) Aluminum/Diffuse ( ) Aluminum/Specular ( ) Red/Primer
Deck Characteristics (Floating Roof Tank)	Deck Type: ( ) Welded ( ) Bolted Deck Fitting Characteristics: ( ) Typical ( ) Detailed (Complete Deck Seam) Construction: ( ) Sheet — Deck Seam Length (ft.): ______ — Deck Seam: ( ) 5 ft. wide ( ) 6 ft. wide ( ) 7 ft. wide Construction: ( ) Panel — Deck Seam Length (ft.): ______ — Deck Seam: ( ) 5 x 7.5 ft. ( ) 5 x 12 ft.
Tank Construction and Rim -Seal System (Floating Roof Tank)	Tank Construction: ( ) Welded ( ) Riveted Primary Seal: ( ) Mechanical Shoe ( ) Liquid Mounted ( ) Vapor Mounted Secondary Seal: ( ) Rim Mounted ( ) None ( ) Shoe Mounted
Breather Vent Setting	Vacuum Setting (psig): ______ — Pressure Setting (psig): ______

* Section D of the application MUST be completed.

South Coast Air Quality Management District

Form 400-E-18
Storage Tank

South Coast AQMD

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Section B - Tank Information (cont.)

Site Selection

Nearest Major City: Long Beach, CA

Daily Average Ambient Temperature (°F): 64.2 Annual Average Minimum Temperature (°F): 54.8

Annual Average Maximum Temperature (°F): 74.2 Average Wind Speed (mph): 4.23

Annual Average Solar Insulation Factor (Btu / (ft^3 * ft * day)): ____

Tank Contents

Chemical Category: ○ Organic Liquids ○ Crude Oil ○ Petroleum Distillates

Liquid: ◉ Single ○ Multiple

If Multiple, Select Speciation Option: ○ Full Speciation ○ Partial Speciation ○ Various Weight Speciation ○ None

Section C - Operation Information

Vapor Control

Vapor Control During Loading or Unloading: ☐ Sparger ☐ Vapor Balance System ☐ Vapor Return Line ☐ Vented to Air Pollution Control Equipment [1]

[1] A separate permit is required. If APC equipment is already permitted, provide Permit or Device Number: ____

Vent Valve Data

Indicate Type of Setting and Vapor Disposal

	Number	Pressure Setting	Vaccum Setting	Discharging to (Check Appropriate Box): Atmosphere	Vapor Control	Flare
Combination				☐	☐	☐
Pressure				☐	☐	☐
Vaccum				☐	☐	☐
Open	1			☒	☐	☐

Materials

Name all liquids, vapors, gases, or mixtures of such material to be stored in this tank:
Oil/water separator will contain primarily precipitation oils/lubricants.

If material is stored in a solution, supply the following information:

Name of Solvent: Water Name of Materials Dissolved: Petroleum Products

Concentration of Materials Dissolved: ____ % by Weight OR 0.00 % by Volume OR ____ lbs/gal

Section D - Roof/Deck Fitting

Section D is required for the following tanks: External Floating Roof Tank, Internal Floating Roof Tanks, or Domed External Floating Roof Tanks.

Select the number of fittings for each applicable question. Examples: 3 Unbolted Cover, Ungasketed ____ Unbolted Cover, Gasketed

Roof/Deck Fitting Details

1. Access Hatch (24" diameter well)
   - ____ Bolted Cover, Gasketed
   - ____ Unbolted Cover, UnGasketed
   - ____ Unbolted Cover, Gasketed
2. Automatic Gauge Float Well (20" diameter well)
   - ____ Bolted Cover, Gasketed
   - ____ Unbolted Cover, Ungasketed
   - ____ Unbolted Cover, Gasketed
3. Column Well (24" diameter well)
   - ____ Built-Up Col - Sliding Cover, Gasketed
   - ____ Built-Up Col - Sliding Cover, Ungasketed
   - ____ Pipe Col - Flex, Fabric Sleeve Seal
   - ____ Pipe Col - Sliding Cover, Gasketed
   - ____ Pipe Col - Sliding Cover, Ungasketed

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Storage Tank

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Section D - Roof/Deck Fitting (cont.)

Roof/Deck Fitting Details (cont.)

4. Gauge Hatch/Sample Well (8" diameter well)
- ___________ Weighted Mechanical Actuation, Gasketed
- ___________ Weighted Mechanical Actuation, Ungasketed

5. Ladder Well (36" diameter)
- ___________ Sliding Cover, Gasketed
- ___________ Sliding Cover, Ungasketed

6. Rim Vent (6" diameter)
- ___________ Weighted Mechanical Actuation, Gasketed
- ___________ Weighted Mechanical Actuation, Ungasketed

7. Roof Drain (3" diameter)
- ___________ Open
- ___________ 90% Close

8. Roof Leg (3" diameter leg)
- ___________ Adjustable, Pontoon Area, Ungasketed
- ___________ Adjustable, Center Area, Ungasketed
- ___________ Adjustable, Double-Deck Roofs
- ___________ Fixed
- ___________ Adjustable, Pontoon Area, Gasketed
- ___________ Adjustable, Pontoon Area, Sock
- ___________ Adjustable, Center Area, Gasketed
- ___________ Adjustable, Center Area, Sock

9. Roof Leg or Hang Well
- ___________ Adjustable
- ___________ Fixed

10. Sample Pipe (24" diameter)
- ___________ Slotted Pipe – Sliding Cover, Gasketed
- ___________ Slotted Pipe – Sliding Cover, Ungasketed
- ___________ Slit Fabric Seal, 10% Open

11. Guided Pole/Sample Well
- ___________ Ungasketed, Sliding Cover, Without Float
- ___________ Ungasketed Sliding Cover, With Float
- ___________ Gasketed Sliding Cover, Without Float
- ___________ Gasketed Sliding Cover, With Float
- ___________ Gasketed Sliding Cover, With Pole Sleeve
- ___________ Gasketed Sliding Cover, With Pole Wiper
- ___________ Gasketed Sliding Cover, With Float, Wiper
- ___________ Gasketed Sliding Cover, With Float, Sleeve, Wiper
- ___________ Gasketed Sliding Cover, With Pole Sleeve, Wiper

12. ___________ **Stub Drain (1" diameter)**

13. Unslotted Guide – Pole Well
- ___________ Ungasketed, Sliding Cover
- ___________ Gasketed Sliding Cover
- ___________ Ungasketed Sliding Cover with Sleeve
- ___________ Gasketed Sliding Cover with Sleeve
- ___________ Gasketed Sliding Cover with Wiper

14. Vacuum Breaker (10" diameter well)
- ___________ Weighted Mechanical Actuation, Gasketed
- ___________ Weighted Mechanical Actuation, Ungasketed

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info	Signature: S O'Kane	Date: 10/15/15	Name: Stephen O'Kane	
	Title: Manager	Company Name: AES Alamitos, LLC	Phone #: 5624937840	Fax #: (562) 493-7320
			Email: stephen.okane@AES.com	
Contact Info	Name: Same as above.		Phone #:	Fax #:
	Title:	Company Name:	Email:	

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South Coast Air Quality Management District

Form 400-E-18
Storage Tank

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Section A - Operator Information

Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various locations in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

◉ Fixed Location ○ Various Locations

Tank Type (Select ONE)	○ External Floating Roof Tank (EFRT) ○ Internal Floating Roof Tank (IFRT) ◉ Horizontal Tank (HT) ○ Vertical Fixed Roof Tank (VFRT) ○ Domed External Roof Tank (DEFRT)
Identification	Tank Identification Number: TBD Tank Contents/Product (include MSDS): Water and petroleum from Simple Cycle Power Block

Section B - Tank Information

Tank Characteristics	Shell Diameter (ft.): 5.33 Shell Length (ft.): 30 Shell Height (ft.): 5.46 Turnovers Per Year: 25 Is Tank Heated? ○ Yes ◉ No Is Tank Underground? ○ Yes ◉ No Net Throughput (gal/year): 123167. Self Support Roof: ◉ Yes ○ No Number of Columns? ____ Effective Column Diameter: ○ 9" by 7" Built Up Column - 1.1 ○ 8" Diameter Pipe - 0.7 ○ Unknown - 1 External Shell Condition: ◉ Good ○ Poor Internal Shell Color: ○ Light Rust ○ Dense Rust ○ Gunite Lining External Shell Color: ◉ White/White ○ Aluminum/Specular ○ Aluminum/Diffuse ○ Gray/Light ○ Gray/Medium ○ Red/Primer Average Liquid Height (ft.) (Vertical Only): ____ Maximum Liquid Height (ft.) (Vertical Only): ____ Working Volume (gal.) (Vertical Only): ____ Actual Volume (gal.) (Vertical Only): ____ Paint Condition: ◉ Good ○ Poor Paint Color/Shade: ◉ White/White ○ Aluminum/Diffuse ○ Gray/Light ○ Aluminum/Specular ○ Gray/Medium ○ Red/Primer
Roof Characteristics (Floating Roof Tank)	Roof Type: ○ Pontoon ○ Double Deck ○ Dome Roof (Height____ft.) ○ Cone Roof (Height____ft.) Roof Fitting Category: ○ Typical ○ Detail Roof Height (ft.): ____ Roof Paint Condition: ○ Good ○ Poor Roof Color/Shade: ○ White/White ○ Aluminum/Diffuse ○ Gray/Light ○ Aluminum/Specular ○ Gray/Medium ○ Red/Primer
Deck Characteristics (Floating Roof Tank)	Deck Type: ○ Welded ○ Bolted Deck Fitting Characteristics: ○ Typical ○ Detailed (Complete Deck Seam) Construction: ○ Sheet / ○ Panel Deck Seam Length (ft.): ____ / ____ Deck Seam: ○ 5 ft. wide ○ 6 ft. wide ○ 7 ft. wide ○ 5 x 7.5 ft. ○ 5 x 12 ft.
Tank Construction and Rim -Seal System (Floating Roof Tank)	Tank Construction: ○ Welded ○ Riveted Primary Seal: ○ Mechanical Shoe ○ Liquid Mounted ○ Vapor Mounted Secondary Seal: ○ Rim Mounted ○ None ○ Shoe Mounted
Breather Vent Setting	Vacuum Setting (psig): ____ Pressure Setting (psig): ____

* Section D of the application MUST be completed.

South Coast Air Quality Management District
Form 400-E-18
Storage Tank

South Coast AQMD

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Tel: (909) 396-3385
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Section B - Tank Information (cont.)

Site Selection

Nearest Major City: Long Beach, CA

Daily Average Ambient Temperature (˚F): 64.2 Annual Average Minimum Temperature (˚F): 54.8

Annual Average Maximum Temperature (˚F): 74.2 Average Wind Speed (mph): 4.23

Annual Average Solar Insulation Factor (Btu / (ft³ * ft * day)): ____________

Tank Contents

Chemical Category: ○ Organic Liquids ○ Crude Oil ○ Petroleum Distillates

Liquid: ◉ Single ○ Multiple

If Multiple, Select Speciation Option: ○ Full Speciation ○ Partial Speciation ○ Various Weight Speciation ○ None

Section C - Operation Information

Vapor Control

Vapor Control During Loading or Unloading: ☐ Sparger ☐ Vapor Balance System ☐ Vapor Return Line ☐ Vented to Air Pollution Control Equipment [1]

[1] A separate permit is required. If APC equipment is already permitted, provide Permit or Device Number: ____________

Vent Valve Data

Indicate Type of Setting and Vapor Disposal

	Number	Pressure Setting	Vaccum Setting	Discharging to (Check Appropriate Box)		
				Atmosphere	Vapor Control	Flare
Combination				☐	☐	☐
Pressure				☐	☐	☐
Vaccum				☐	☐	☐
Open	1			☒	☐	☐

Materials

Name all liquids, vapors, gases, or mixtures of such material to be stored in this tank:
Oil/water separator will contain primarily precipitation oils/lubricants.

If material is stored in a solution, supply the following information:

Name of Solvent: Water Name of Materials Dissolved: Petroleum Products

Concentration of Materials Dissolved: ________ % by Weight OR 0.00 % by Volume OR ________ lbs/gal

Section D - Roof/Deck Fitting

Section D is required for the following tanks: External Floating Roof Tank, Internal Floating Roof Tanks, or Domed External Floating Roof Tanks.

Select the number of fittings for each applicable question. Examples: 3 Unbolted Cover, Ungasketed
____ Unbolted Cover, Gasketed

Roof/Deck Fitting Details

1. Access Hatch (24" diameter well)
   - ____ Bolted Cover, Gasketed
   - ____ Unbolted Cover, UnGasketed
   - ____ Unbolted Cover, Gasketed

2. Automatic Gauge Float Well (20" diameter well)
   - ____ Bolted Cover, Gasketed
   - ____ Unbolted Cover, Ungasketed
   - ____ Unbolted Cover, Gasketed

3. Column Well (24" diameter well)
   - ____ Built-Up Col - Sliding Cover, Gasketed
   - ____ Built-Up Col - Sliding Cover, Ungasketed
   - ____ Pipe Col - Flex, Fabric Sleeve Seal
   - ____ Pipe Col - Sliding Cover, Gasketed
   - ____ Pipe Col - Sliding Cover, Ungasketed

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Section D - Roof/Deck Fitting (cont.)

Roof/Deck Fitting Details (cont.)

4. Gauge Hatch/Sample Well (8" diameter well)
- ________ Weighted Mechanical Actuation, Gasketed
- ________ Weighted Mechanical Actuation, Ungasketed

5. Ladder Well (36" diameter)
- ________ Sliding Cover, Gasketed
- ________ Sliding Cover, Ungasketed

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- ________ Weighted Mechanical Actuation, Gasketed
- ________ Weighted Mechanical Actuation, Ungasketed

7. Roof Drain (3" diameter)
- ________ Open
- ________ 90% Close

8. Roof Leg (3" diameter leg)
- ________ Adjustable, Pontoon Area, Ungasketed
- ________ Adjustable, Center Area, Ungasketed
- ________ Adjustable, Double-Deck Roofs
- ________ Fixed
- ________ Adjustable, Pontoon Area, Gasketed
- ________ Adjustable, Pontoon Area, Sock
- ________ Adjustable, Center Area, Gasketed
- ________ Adjustable, Center Area, Sock

9. Roof Leg or Hang Well
- ________ Adjustable
- ________ Fixed

10. Sample Pipe (24" diameter)
- ________ Slotted Pipe – Sliding Cover, Gasketed
- ________ Slotted Pipe – Sliding Cover, Ungasketed
- ________ Slit Fabric Seal, 10% Open

11. Guided Pole/Sample Well
- ________ Ungasketed, Sliding Cover, Without Float
- ________ Ungasketed Sliding Cover, With Float
- ________ Gasketed Sliding Cover, Without Float
- ________ Gasketed Sliding Cover, With Float
- ________ Gasketed Sliding Cover, With Pole Sleeve
- ________ Gasketed Sliding Cover, With Pole Wiper
- ________ Gasketed Sliding Cover, With Float, Wiper
- ________ Gasketed Sliding Cover, With Float, Sleeve, Wiper
- ________ Gasketed Sliding Cover, With Pole Sleeve, Wiper

12. ________ **Stub Drain (1" diameter)**

13. Unslotted Guide – Pole Well
- ________ Ungasketed, Sliding Cover
- ________ Gasketed Sliding Cover
- ________ Ungasketed Sliding Cover with Sleeve
- ________ Gasketed Sliding Cover with Sleeve
- ________ Gasketed Sliding Cover with Wiper

14. Vacuum Breaker (10" diameter well)
- ________ Weighted Mechanical Actuation, Gasketed
- ________ Weighted Mechanical Actuation, Ungasketed

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submitted with this application is true and correct.

Preparer Info	**Signature:** S O'Kane	**Date:** 10/15/15	**Name:** Stephen O'Kane	
	Title: Manager	**Company Name:** AES Alamitos, LLC	**Phone #:** 5624937840	**Fax #:** (562) 493-7320
			Email: stephen.okane@AES.com	
Contact Info	**Name:** Same as above.		**Phone #:**	**Fax #:**
	Title:	**Company Name:**	**Email:**	

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South Coast Air Quality Management District

Form 400-PS

Plot Plan And Stack Information Form

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Form 400A and Form 400-CEQA.

Mail To:
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P.O. Box 4944
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Tel: (909) 396-3385
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Section A - Operator Information

Facility Name (Business Name of Operator To Appears On The Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

◉ Fixed Location ○ Various Locations

Section B - Location Data

Plot Plan	Please attach a site map for the project with distances and scales. Identify and locate the proposed equipment on the map. A copy of the appropriate Thomas Brothers page, a web-based map, or a sketch that shows the major streets and location of the equipment is acceptable.
Location of Schools Nearby	**Is the facility located within a 1/4 mile radius (1,320 feet) of the outer boundary of a school?** ◉ Yes ○ No If yes, please provide name(s) of school(s) below: **School Name:** Rosie the Riveter Charter High — **School Name:** ____ **School Address:** 690 N. Studebaker Road, Long Beach, CA 90803 — **School Address:** ____ **Distance from stack or equipment vent to the outer boundary of the school:** 971 feet — **Distance from stack or equipment vent to the outer boundary of the school:** ____ feet **CA Health & Safety Code 42301.9:** "School" means any public or private school used for purposes of the education of more than 12 children in kindergarten or any of grades 1 to 12, inclusive, but does not include any private school in which education is primarily conducted in private homes.
Population Density	◉ Urban ○ Rural (<50% of land within 3 km radius accounted for by urban land use categories, i.e., multi-family dwelling or industrial.)
Zoning Classification	◉ **Mixed Use Residential Commercial Zone (M-U)** ○ **Service and Professional Zone (C-S)** ○ **Medium Commercial (C-3)** ○ **Heavy Commercial (C-4)** ○ **Commercial Manufacturing (C-M)**

Section C - Emission Release Parameters - Stacks, Vents

Stack Data	**Stack Height:** 140.00 feet (above ground level) — **What is the height of the closest building nearest the stack?** 95 feet **Stack Inside Diameter:** 240 inches — **Stack Flow:** 1264000 acfm — **Stack Temperature:** 223 °F **Rain Cap Present:** ○ Yes ◉ No — **Stack Orientation:** ◉ Vertical ○ Horizontal If the stack height is less than 2.5 times the closest building height (H), please provide information on any building within 5xH distance from the stack (attach additional sheet if necessary): **Building #/Name:** See SAFC Appendix 5.1C — **Building #/Name:** See SAFC Appendix 5.1C **Building Height:** ____ feet (above ground level) — **Building Height:** ____ feet (above ground level) **Building Width:** ____ feet — **Building Width:** ____ feet **Building Length:** ____ feet — **Building Length:** ____ feet
Receptor Distance From Equipment Stack or Roof Vents/Openings	**Distance to nearest residence or sensitive receptor*:** 971 feet **Distance to nearest business:** 1,148 feet
Building Information	**Are the emissions released from vents and/or openings from a building?** ○ Yes ◉ No If yes, please provide: **Building #/Name:** ____ — **Building Width:** ____ feet **Building Height:** ____ feet (above ground level) — **Building Length:** ____ feet

*AQMD Rule 1470 defines SENSITIVE RECEPTOR as meaning any residence including private homes, condominiums, apartments, and living quarters, schools as defined under paragraph (b)(57), preschools, daycare centers and health facilities such as hospitals or retirement and nursing homes. A sensitive receptor includes long term care hospitals, hospices, prisons, and dormitories or similar live-in housing.

South Coast Air Quality Management District

Form 400-PS

Plot Plan And Stack Information Form

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Form 400A and Form 400-CEQA.

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submittfgfed with this application is true and correct.

Signature of Preparer: [signature] O'Kane	**Title of Preparer:** Manager	**Preparer's Phone #:** (562) 493-7840 **Preparer's Email:** stephen.okane@AES.com
Contact Person: Stephen O'Kane **Contact's Email:** stephen.okane@AES.com	**Contact's Phone#:** 5624937840 **Contact's Fax#:** (562) 493-7320	**Date Signed:** 10/15/15

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Population Density	(●) Urban ( ) Rural (<50% of land within 3 km radius accounted for by urban land use categories, i.e., multi-family dwelling or industrial.)
Zoning Classification	(●) **Mixed Use Residential Commercial Zone (M-U)** ( ) **Service and Professional Zone (C-S)** ( ) **Medium Commercial (C-3)** ( ) **Heavy Commercial (C-4)** ( ) **Commercial Manufacturing (C-M)**

Section C - Emission Release Parameters - Stacks, Vents

Stack Data	**Stack Height:** 140.00 feet (above ground level) — **What is the height of the closest building nearest the stack?** 95 feet **Stack Inside Diameter:** 240 inches — **Stack Flow:** 1264000 acfm — **Stack Temperature:** 223 °F **Rain Cap Present:** ( ) Yes (●) No — **Stack Orientation:** (●) Vertical ( ) Horizontal If the stack height is less than 2.5 times the closest building height (H), please provide information on any building within 5xH distance from the stack (attach additional sheet if necessary): **Building #/Name:** See SAFC Appendix 5.1C — **Building #/Name:** See SAFC Appendix 5.1C **Building Height:** ____ feet (above ground level) — **Building Height:** ____ feet (above ground level) **Building Width:** ____ feet — **Building Width:** ____ feet **Building Length:** ____ feet — **Building Length:** ____ feet
Receptor Distance From Equipment Stack or Roof Vents/Openings	**Distance to nearest residence or sensitive receptor*:** 1,099 feet **Distance to nearest business:** 1,148 feet
Building Information	**Are the emissions released from vents and/or openings from a building?** ( ) Yes (●) No If yes, please provide: **Building #/Name:** ____ — **Building Width:** ____ feet **Building Height:** ____ feet (above ground level) — **Building Length:** ____ feet

*AQMD Rule 1470 defines SENSITIVE RECEPTOR as meaning any residence including private homes, condominiums, apartments, and living quarters, schools as defined under paragraph (b)(57), preschools, daycare centers and health facilities such as hospitals or retirement and nursing homes. A sensitive receptor includes long term care hospitals, hospices, prisons, and dormitories or similar live-in housing.

South Coast Air Quality Management District

Form 400-PS

Plot Plan And Stack Information Form

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Form 400A and Form 400-CEQA.

Section D - Authorization/Signature

I hereby certify that all information contained herein and information submittfgfed with this application is true and correct.

Signature of Preparer:	**Title of Preparer:**	**Preparer's Phone #:** (562) 493-7840
S OKane	Manager	**Preparer's Email:** stephen.okane@AES.com

Contact Person: Stephen O'Kane	**Contact's Phone#:** 5624937840	**Date Signed:** 10/15/15
Contact's Email: stephen.okane@AES.com	**Contact's Fax#:** (562) 493-7320	

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South Coast AQMD

South Coast Air Quality Management District

Form 400-PS

Plot Plan And Stack Information Form

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Form 400A and Form 400-CEQA.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator To Appears On The Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

◉ **Fixed Location** ○ **Various Locations**

Section B - Location Data

Plot Plan	Please attach a site map for the project with distances and scales. Identify and locate the proposed equipment on the map. A copy of the appropriate Thomas Brothers page, a web-based map, or a sketch that shows the major streets and location of the equipment is acceptable.
Location of Schools Nearby	**Is the facility located within a 1/4 mile radius (1,320 feet) of the outer boundary of a school?** ◉ Yes ○ No If yes, please provide name(s) of school(s) below: **School Name:** Rosie the Riveter Charter High — **School Name:** ____ **School Address:** 690 N. Studebaker Road, Long Beach, CA 90803 — **School Address:** ____ **Distance from stack or equipment vent to the outer boundary of the school:** 1,125 feet — **Distance from stack or equipment vent to the outer boundary of the school:** ____ feet **CA Health & Safety Code 42301.9:** "School" means any public or private school used for purposes of the education of more than 12 children in kindergarten or any of grades 1 to 12, inclusive, but does not include any private school in which education is primarily conducted in private homes.
Population Density	◉ Urban ○ Rural (<50% of land within 3 km radius accounted for by urban land use categories, i.e., multi-family dwelling or industrial.)
Zoning Classification	◉ **Mixed Use Residential Commercial Zone (M-U)** ○ **Service and Professional Zone (C-S)** ○ **Medium Commercial (C-3)** ○ **Heavy Commercial (C-4)** ○ **Commercial Manufacturing (C-M)**

Section C - Emission Release Parameters - Stacks, Vents

Stack Data	**Stack Height:** 80 feet (above ground level) — **What is the height of the closest building nearest the stack?** 48 feet **Stack Inside Diameter:** 162 inches — **Stack Flow:** 938000 acfm — **Stack Temperature:** 981 °F **Rain Cap Present:** ○ Yes ◉ No — **Stack Orientation:** ◉ Vertical ○ Horizontal If the stack height is less than 2.5 times the closest building height (H), please provide information on any building within 5xH distance from the stack (attach additional sheet if necessary): **Building #/Name:** See SAFC Appendix 5.1C — **Building #/Name:** See SAFC Appendix 5.1C **Building Height:** ____ feet (above ground level) — **Building Height:** ____ feet (above ground level) **Building Width:** ____ feet — **Building Width:** ____ feet **Building Length:** ____ feet — **Building Length:** ____ feet
Receptor Distance From Equipment Stack or Roof Vents/Openings	**Distance to nearest residence or sensitive receptor*:** 1,125 feet **Distance to nearest business:** 525 feet
Building Information	**Are the emissions released from vents and/or openings from a building?** ○ Yes ◉ No If yes, please provide: **Building #/Name:** ____ — **Building Width:** ____ feet **Building Height:** ____ feet (above ground level) — **Building Length:** ____ feet

*AQMD Rule 1470 defines SENSITIVE RECEPTOR as meaning any residence including private homes, condominiums, apartments, and living quarters, schools as defined under paragraph (b)(57), preschools, daycare centers and health facilities such as hospitals or retirement and nursing homes. A sensitive receptor includes long term care hospitals, hospices, prisons, and dormitories or similar live-in housing.

Form 400-PS

Plot Plan And Stack Information Form

This form must be accompanied by a completed Application for a Permit to Construct/Operate - Form 400A and Form 400-CEQA.

Section D - Authorization/Signature		
I hereby certify that all information contained herein and information submittfgfed with this application is true and correct.		
Signature of Preparer: S O'Kane	Title of Preparer: Manager	Preparer's Phone #: 5624937840 Preparer's Email: stephen.okane@AES.com
Contact Person: Stephen O'Kane Contact's Email: stephen.okane@AES.com	Contact's Phone#: (562) 493-7840 Contact's Fax#: (562) 493-7320	Date Signed: 10/15/15

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South Coast Air Quality Management District

Form 400-PS

Plot Plan And Stack Information Form

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South Coast AQMD

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator To Appears On The Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(●) Fixed Location ( ) Various Locations

Section B - Location Data

Plot Plan

Please attach a site map for the project with distances and scales. Identify and locate the proposed equipment on the map. A copy of the appropriate Thomas Brothers page, a web-based map, or a sketch that shows the major streets and location of the equipment is acceptable.

Location of Schools Nearby

Is the facility located within a 1/4 mile radius (1,320 feet) of the outer boundary of a school? (●) Yes ( ) No

If yes, please provide name(s) of school(s) below:

School Name: Rosie the Riveter Charter High

School Address: 690 N. Studebaker Road, Long Beach, CA 90803

Distance from stack or equipment vent to the outer boundary of the school: 1,135 feet

School Name: ______

School Address: ______

Distance from stack or equipment vent to the outer boundary of the school: ______ feet

CA Health & Safety Code 42301.9: "School" means any public or private school used for purposes of the education of more than 12 children in kindergarten or any of grades 1 to 12, inclusive, but does not include any private school in which education is primarily conducted in private homes.

Population Density

(●) Urban ( ) Rural (<50% of land within 3 km radius accounted for by urban land use categories, i.e., multi-family dwelling or industrial.)

Zoning Classification

(●) Mixed Use Residential Commercial Zone (M-U) ( ) Service and Professional Zone (C-S) ( ) Medium Commercial (C-3)

( ) Heavy Commercial (C-4) ( ) Commercial Manufacturing (C-M)

Section C - Emission Release Parameters - Stacks, Vents

Stack Data

Stack Height: 80 feet (above ground level)

What is the height of the closest building nearest the stack? 48 feet

Stack Inside Diameter: 162 inches

Stack Flow: 938000 acfm

Stack Temperature: 981 °F

Rain Cap Present: ( ) Yes (●) No

Stack Orientation: (●) Vertical ( ) Horizontal

If the stack height is less than 2.5 times the closest building height (H), please provide information on any building within 5xH distance from the stack (attach additional sheet if necessary):

Building #/Name: See SAFC Appendix 5.1C

Building Height: ______ feet (above ground level)

Building Width: ______ feet

Building Length: ______ feet

Building #/Name: See SAFC Appendix 5.1C

Building Height: ______ feet (above ground level)

Building Width: ______ feet

Building Length: ______ feet

Receptor Distance From Equipment Stack or Roof Vents/Openings

Distance to nearest residence or sensitive receptor*: 1,135 feet

Distance to nearest business: 525 feet

Building Information

Are the emissions released from vents and/or openings from a building? ( ) Yes (●) No

If yes, please provide:

Building #/Name: ______

Building Height: ______ feet (above ground level)

Building Width: ______ feet

Building Length: ______ feet

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South Coast Air Quality Management District

Form 400-PS

Plot Plan And Stack Information Form

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Section D - Authorization/Signature		
I hereby certify that all information contained herein and information submittfgfed with this application is true and correct.		
Signature of Preparer: [signature]	**Title of Preparer:** Manager	**Preparer's Phone #:** 5624937840 **Preparer's Email:** stephen.okane@AES.com
Contact Person: Stephen O'Kane **Contact's Email:** stephen.okane@AES.com	**Contact's Phone#:** (562) 493-7840 **Contact's Fax#:** (562) 493-7320	**Date Signed:** 10/15/15

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South Coast Air Quality Management District

Form 400-PS

Plot Plan And Stack Information Form

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Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator To Appear On The Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(◉) Fixed Location ( ) Various Locations

Section B - Location Data

Plot Plan	Please attach a site map for the project with distances and scales. Identify and locate the proposed equipment on the map. A copy of the appropriate Thomas Brothers page, a web-based map, or a sketch that shows the major streets and location of the equipment is acceptable.
Location of Schools Nearby	**Is the facility located within a 1/4 mile radius (1,320 feet) of the outer boundary of a school?** (◉) Yes ( ) No If yes, please provide name(s) of school(s) below: **School Name:** Rosie the Riveter Charter High — **School Name:** ____ **School Address:** 690 N. Studebaker Road, Long Beach, CA 90803 — **School Address:** ____ **Distance from stack or equipment vent to the outer boundary of the school:** 1,257 feet — **Distance from stack or equipment vent to the outer boundary of the school:** ____ feet **CA Health & Safety Code 42301.9:** "School" means any public or private school used for purposes of the education of more than 12 children in kindergarten or any of grades 1 to 12, inclusive, but does not include any private school in which education is primarily conducted in private homes.
Population Density	(◉) Urban ( ) Rural (<50% of land within 3 km radius accounted for by urban land use categories, i.e., multi-family dwelling or industrial.)
Zoning Classification	(◉) Mixed Use Residential Commercial Zone (M-U) ( ) Service and Professional Zone (C-S) ( ) Medium Commercial (C-3) ( ) Heavy Commercial (C-4) ( ) Commercial Manufacturing (C-M)

Section C - Emission Release Parameters - Stacks, Vents

Stack Data	**Stack Height:** 80 feet (above ground level) — **What is the height of the closest building nearest the stack?** 48 feet **Stack Inside Diameter:** 162 inches — **Stack Flow:** 938000 acfm — **Stack Temperature:** 981 °F **Rain Cap Present:** ( ) Yes (◉) No — **Stack Orientation:** (◉) Vertical ( ) Horizontal If the stack height is less than 2.5 times the closest building height (H), please provide information on any building within 5xH distance from the stack (attach additional sheet if necessary): **Building #/Name:** See SAFC Appendix 5.1C — **Building #/Name:** See SAFC Appendix 5.1C **Building Height:** ____ feet (above ground level) — **Building Height:** ____ feet (above ground level) **Building Width:** ____ feet — **Building Width:** ____ feet **Building Length:** ____ feet — **Building Length:** ____ feet
Receptor Distance From Equipment Stack or Roof Vents/Openings	**Distance to nearest residence or sensitive receptor*:** 1,257 feet **Distance to nearest business:** 525 feet
Building Information	**Are the emissions released from vents and/or openings from a building?** ( ) Yes (◉) No If yes, please provide: **Building #/Name:** ____ — **Building Width:** ____ feet **Building Height:** ____ feet (above ground level) — **Building Length:** ____ feet

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South Coast Air Quality Management District

Form 400-PS

Plot Plan And Stack Information Form

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Section D - Authorization/Signature			
I hereby certify that all information contained herein and information submittfgfed with this application is true and correct.			
Signature of Preparer: [signature]	**Title of Preparer:** Manager	**Preparer's Phone #:** 5624937840 **Preparer's Email:** stephen.okane@AES.com	
Contact Person: Stephen O'Kane **Contact's Email:** stephen.okane@AES.com	**Contact's Phone#:** (562) 493-7840 **Contact's Fax#:** (562) 493-7320		**Date Signed:** 10/15/15

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South Coast Air Quality Management District

Form 400-PS

Plot Plan And Stack Information Form

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South Coast AQMD

Mail To:
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P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator To Appears On The Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(●) Fixed Location ( ) Various Locations

Section B - Location Data

Plot Plan

Please attach a site map for the project with distances and scales. Identify and locate the proposed equipment on the map. A copy of the appropriate Thomas Brothers page, a web-based map, or a sketch that shows the major streets and location of the equipment is acceptable.

Location of Schools Nearby

Is the facility located within a 1/4 mile radius (1,320 feet) of the outer boundary of a school? (●) Yes ( ) No

If yes, please provide name(s) of school(s) below:

School Name: Rosie the Riveter Charter High

School Address: 690 N. Studebaker Road, Long Beach, CA 90803

Distance from stack or equipment vent to the outer boundary of the school: 1,283 feet

School Name: ____________

School Address: ____________

Distance from stack or equipment vent to the outer boundary of the school: ________ feet

CA Health & Safety Code 42301.9: "School" means any public or private school used for purposes of the education of more than 12 children in kindergarten or any of grades 1 to 12, inclusive, but does not include any private school in which education is primarily conducted in private homes.

Population Density

(●) Urban ( ) Rural (<50% of land within 3 km radius accounted for by urban land use categories, i.e., multi-family dwelling or industrial.)

Zoning Classification

(●) **Mixed Use Residential Commercial Zone (M-U)** ( ) **Service and Professional Zone (C-S)** ( ) **Medium Commercial (C-3)**

( ) **Heavy Commercial (C-4)** ( ) **Commercial Manufacturing (C-M)**

Section C - Emission Release Parameters - Stacks, Vents

Stack Data

Stack Height: 80 feet (above ground level)

What is the height of the closest building nearest the stack? 48 feet

Stack Inside Diameter: 162 inches

Stack Flow: 938000 acfm

Stack Temperature: 981 °F

Rain Cap Present: ( ) Yes (●) No

Stack Orientation: (●) Vertical ( ) Horizontal

If the stack height is less than 2.5 times the closest building height (H), please provide information on any building within 5xH distance from the stack (attach additional sheet if necessary):

Building #/Name: See SAFC Appendix 5.1C

Building Height: ________ feet (above ground level)

Building Width: ________ feet

Building Length: ________ feet

Building #/Name: See SAFC Appendix 5.1C

Building Height: ________ feet (above ground level)

Building Width: ________ feet

Building Length: ________ feet

Receptor Distance From Equipment Stack or Roof Vents/Openings

Distance to nearest residence or sensitive receptor*: 1,283 feet

Distance to nearest business: 525 feet

Building Information

Are the emissions released from vents and/or openings from a building? ( ) Yes (●) No

If yes, please provide:

Building #/Name: ____________

Building Height: ________ feet (above ground level)

Building Width: ________ feet

Building Length: ________ feet

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South Coast Air Quality Management District

Form 400-PS

Plot Plan And Stack Information Form

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Section D - Authorization/Signature				
I hereby certify that all information contained herein and information submittfgfed with this application is true and correct.				
Signature of Preparer: S O'Kane	**Title of Preparer:** Manager		**Preparer's Phone #:** 5624937840 **Preparer's Email:** stephen.okane@AES.com	
Contact Person: Stephen O'Kane **Contact's Email:** stephen.okane@AES.com		**Contact's Phone#:** (562) 493-7840 **Contact's Fax#:** (562) 493-7320		**Date Signed:** 10/15/15

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South Coast Air Quality Management District

Form 400-PS

Plot Plan And Stack Information Form

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Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

Facility Name (Business Name of Operator To Appears On The Permit): AES Alamitos, LLC

Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Address where the equipment will be operated (for equipment which will be moved to various location in AQMD's jurisdiction, please list the initial location site): 690 N. Studebaker Road, Long Beach, CA 90803

(◉) **Fixed Location** ( ) **Various Locations**

Section B - Location Data

Plot Plan

Please attach a site map for the project with distances and scales. Identify and locate the proposed equipment on the map. A copy of the appropriate Thomas Brothers page, a web-based map, or a sketch that shows the major streets and location of the equipment is acceptable.

Location of Schools Nearby

Is the facility located within a 1/4 mile radius (1,320 feet) of the outer boundary of a school? (◉) Yes ( ) No

If yes, please provide name(s) of school(s) below:

School Name: Rosie the Riveter Charter High

School Address: 690 N. Studebaker Road, Long Beach, CA 90803

Distance from stack or equipment vent to the outer boundary of the school: 1,319 feet

School Name: ______

School Address: ______

Distance from stack or equipment vent to the outer boundary of the school: ______ feet

CA Health & Safety Code 42301.9: "School" means any public or private school used for purposes of the education of more than 12 children in kindergarten or any of grades 1 to 12, inclusive, but does not include any private school in which education is primarily conducted in private homes.

Population Density

(◉) Urban ( ) Rural (<50% of land within 3 km radius accounted for by urban land use categories, i.e., multi-family dwelling or industrial.)

Zoning Classification

(◉) **Mixed Use Residential Commercial Zone (M-U)** ( ) **Service and Professional Zone (C-S)** ( ) **Medium Commercial (C-3)**

( ) **Heavy Commercial (C-4)** ( ) **Commercial Manufacturing (C-M)**

Section C - Emission Release Parameters - Stacks, Vents

Stack Data

Stack Height: 80 feet (above ground level)

What is the height of the closest building nearest the stack? 104 feet

Stack Inside Diameter: 36 inches

Stack Flow: 29473 acfm

Stack Temperature: 318 °F

Rain Cap Present: ( ) Yes (◉) No

Stack Orientation: (◉) Vertical ( ) Horizontal

If the stack height is less than 2.5 times the closest building height (H), please provide information on any building within 5xH distance from the stack (attach additional sheet if necessary):

Building #/Name: See SAFC Appendix 5.1C

Building Height: ______ feet (above ground level)

Building Width: ______ feet

Building Length: ______ feet

Building #/Name: See SAFC Appendix 5.1C

Building Height: ______ feet (above ground level)

Building Width: ______ feet

Building Length: ______ feet

Receptor Distance From Equipment Stack or Roof Vents/Openings

Distance to nearest residence or sensitive receptor*: 1,319 feet

Distance to nearest business: 1,050 feet

Building Information

Are the emissions released from vents and/or openings from a building? ( ) Yes (◉) No

If yes, please provide:

Building #/Name: ______

Building Height: ______ feet (above ground level)

Building Width: ______ feet

Building Length: ______ feet

*AQMD Rule 1470 defines SENSITIVE RECEPTOR as meaning any residence including private homes, condominiums, apartments, and living quarters, schools as defined under paragraph (b)(57), preschools, daycare centers and health facilities such as hospitals or retirement and nursing homes. A sensitive receptor includes long term care hospitals, hospices, prisons, and dormitories or similar live-in housing.

South Coast Air Quality Management District

Form 400-PS

Plot Plan And Stack Information Form

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Section D - Authorization/Signature		
I hereby certify that all information contained herein and information submittfgfed with this application is true and correct.		
Signature of Preparer: [signature] S O'Kane	**Title of Preparer:** Manager	**Preparer's Phone #:** 5624937840 **Preparer's Email:** stephen.okane@AES.com
Contact Person: Stephen O'Kane **Contact's Email:** stephen.okane@AES.com	**Contact's Phone#:** (562) 493-7840 **Contact's Fax#:** (562) 493-7320	**Date Signed:** 10/15/15

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South Coast Air Quality Management District

Form 400 - XPP

Express Permit Processing Request

Form 400-A, Form 400-CEQA and one or more 400-E-xx form(s) must accompany all submittals.

Mail To:
SCAQMD
P.O Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section A - Operator Information

1. Facility Name (Business Name of Operator To Appear On The Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Section B - Equipment Location Address

3. (●) Fixed Location ( ) Various Location
(For equipment operated at various locations, provide address of initial site.)

Street Address: 690 N. Studebaker Road
City: Long Beach, State: CA, Zip: 90803
Contact Name: Stephen O'Kane Title: Manager
Phone #: (562) 493-7840 Ext.: Fax #: (562) 493-7320
E-Mail: stephen.okane@AES.com

Section C - Permit Mailing Address

4. Permit and Correspondence Information:
☑ Check here if same as equipment location address

Address:
City: , State: Zip:
Contact Name: Title:
Phone #: Ext.: Fax #:
E-Mail:

Section D - Authorization/Signature

I understand that the Expedited Permit Processing fees must be submitted at the time of application submittal, and that the application may be subject to additional fees per Rule 301. I understand that requests for Express Permit Processing neither guarantees action by any specific date nor does it guarantee permit approval; that Express Permit Processing is subject to availability of qualified staff; and that once Express Permit Processing has commenced, the expedited fees will not be refunded. I hereby certify that all information contained herein and information submitted with the application are true and correct.

5. Signature of Responsible Official: SOKane	6. Title of Responsible Official: Manager
7. Print Name of Responsible Official: Stephen O'Kane	8. Date: 10/15/15
9. Phone #: (562) 493-7840	10. Fax #: (562) 493-7320

AQMD USE ONLY	APPLICATION TRACKING #	TYPE B C	EQUIPMENT CATEGORY CODE:	FEE SCHEDULE: $	VALIDATION
ENG. DATE A R	ENG. DATE A R	CLASS I III	ASSIGNMENT Unit Engineer	CHECK/MONEY ORDER #	AMOUNT $	TRACKING #

South Coast Air Quality Management District
Form 500-A2
Title V Application Certification

South Coast AQMD

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section I - Operator Information

1. **Facility Name** (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

2. **Valid AQMD Facility ID** (Available On Permit Or Invoice Issued By AQMD): 115394

3. This Certification is submitted with a (Check one):
   - a. (●) Title V Application (Initial, Revision or Renewal)
   - b. ( ) Supplement/Correction to a Title V Application
   - c. ( ) MACT Part 1

4. Is Form 500-C2 included with this Certification? ( ) Yes (●) No

Section II - Responsible Official Certification Statement

*Read each statement carefully and check each that applies – **You must check 3a or 3b.***

1. **For Initial, Permit Renewal, and Administrative Application Certifications:**
   - a. ( ) The facility, including equipment that are exempt from written permit per Rule 219, is currently operating and will continue to operate in compliance with all applicable requirement(s) identified in Section II and Section III of Form 500-C1,
     - i. ☐ except for those requirements that do not specifically pertain to such devices or equipment and that have been identified as "Remove" on Section III of Form 500-C1.
     - ii. ☐ except for those devices or equipment that have been identified on the completed and attached Form 500-C2 that will not be operating in compliance with the specified applicable requirement(s).
   - b. (●) The facility, including equipment that are exempt from written permit per Rule 219, will meet in a timely manner, all applicable requirements with future effective dates.
2. **For Permit Revision Application Certifications:**
   - a. ☑ The equipment or devices to which this permit revision applies, will in a timely manner comply with all applicable requirements identified in Section II and Section III of Form 500-C1.
3. **For MACT Hammer Certifications:**
   - a. ( ) The facility is subject to Section 112(j) of the Clean Air Act (Subpart B of 40 CFR part 63), also known as the MACT "hammer." The following information is submitted with a Title V application to comply with the Part 1 requirements of Section 112(j).
   - b. (●) The facility is not subject to Section 112(j) of the Clean Air Act (Subpart B of 40 CFR part 63).

Section III - Authorization/Signature

I certify under penalty of law that I am the responsible official for this facility as defined in AQMD Regulation XXX and that based on information and belief formed after reasonable inquiry, the statement and information in this document and in all attached application forms and other materials are true, accurate, and complete.

1. Signature of Responsible Official: S OKane	2. Title of Responsible Official: Manager
3. Print Name: Stephen O'Kane	4. Date: 10/15/15
5. Phone #: (562) 493-7840	6. Fax #: (562) 493-7320

7. Address of Responsible Official:

Street #	City	State	Zip
690 N. Studebaker Road	Long Beach	CA	90803

Acid Rain Facilities Only: Please Complete Section IV

Acid Rain facilities must certify their compliance status of the devices subject to applicable requirements under Title IV by an individual who meets the definition of Designated (or Alternate) Representative in 40 CFR Part 72.

Section IV - Designated Representative Certification Statement	
For Acid Rain Facilities Only: I am authorized to make this submission on behalf of the owners and operators of the affected source or affected units for which the submission is made. I certify under penalty of law that I have personally examined, and am familiar with, the statements and information submitted in this document and all its attachments. Based on my inquiry of those individuals with primary responsibility for obtaining the information, I certify that the statements and information are to the best of my knowledge and belief true, accurate, and complete. I am aware that there are significant penalties for submitting false statements and information or omitting required statements and information, including the possibility of fine or imprisonment.	
1. Signature of Designated Representative or Alternate: S O'Kane	2. Title of Designated Representative or Alternate: Manager
3. Print Name of Designated Representative or Alternate: Stephen O'Kane	4. Date: 10/15/15
5. Phone #: 5624937840	6. Fax #: (562) 493-7320
7. Address of Designated Representative or Alternate: 690 N. Studebaker Road (Street #), Long Beach (City), CA (State), 90803 (Zip)	

South Coast Air Quality Management District

Form 500-B

Title V List of Exempt Equipment

South Coast AQMD

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944
Tel: (909) 396-3385
www.aqmd.gov

Use this form for all application submittals requesting an initial Title V permit or permit renewal. If you are applying for a permit revision, you may also use this form to have your exempt equipment listing updated prior to renewing your permit.

This form is designed to summarize all of the equipment at a facility that is exempt per SCAQMD Rule 219 from SCAQMD permit requirements (e.g., I.C. Engines ≤ 50 BHP, Boilers < 2 MM BTU/hr etc.). This equipment can be listed according to category. However, if there is a specific device that is vented to control equipment, then the equipment must be listed separately. Trivial activities listed on the back of this form or the Technical Guidance Document do not have to be listed on this form. Note: If your facility is in the RECLAIM program, it is not necessary to repeat any equipment currently listed in Appendix A of the RECLAIM permit.

Section I - Operator Information

1. Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. Check box if facility is in RECLAIM program: ☒

4. Provide Current Permit Issue Date: 01/19/2012

5. Permit Revision No.: 23

Section II - Summary of Equipment Exempt from Permit Requirements (Including Portable)

Exempt Equipment Description [e.g., Small Boilers (75,000 BTU/hr-2,000,000 BTU/hr)]	Venting to Control (Device# or Application#)	Control Device Description	Basis for Exemption [e.g., Rule 219 (b)(2), 05/19/00]	Source Specific Rule [e.g., Rule 1146.2]

Trivial Activities

- Combustion emissions from propulsion of mobile sources, except for vessel emissions from Outer Continental Shelf sources
- Air-conditioning units used for human comfort that do not have applicable requirements under Title VI of the Act
- Ventilating units used for human comfort that do not exhaust air pollutants into the ambient air from any manufacturing/industrial or commercial process
- Non-commercial food preparation
- Consumer use of office equipment and products, not including printers or businesses primarily involved in photographic reproduction
- Janitorial services and consumer use of janitorial products
- Internal combustion engines used for landscaping purposes
- Laundry activities, except for dry-cleaning and steam boilers
- Bathroom/toilet vent emissions
- Emergency (backup) electrical generators at residential locations
- Tobacco smoking rooms and areas
- Blacksmith forges
- Plant maintenance and upkeep activities (e.g., grounds-keeping, general repairs, cleaning, painting, welding, plumbing, re-tarring roofs, installing insulation, and paving parking lots) provided these activities are not conducted as part of a manufacturing process, are not related to the source's primary business activity, and not otherwise triggering a permit modification[1]
- Repair or maintenance shop activities not related to the source's primary business activity, not including emissions from surface coating or de-greasing (solvent metal cleaning) activities, and not otherwise triggering a permit modification
- Portable electrical generators that can be moved by hand from one location to another[2]
- Hand-held equipment for buffing, polishing, cutting, drilling, sawing, grinding, turning or machining wood, metal or plastic
- Brazing, soldering and welding equipment, and cutting torches related to manufacturing and construction activities that do not result in emission of HAP metals[3]
- Bench-scale laboratory equipment used for physical or chemical analysis, but not lab fume hoods or vents[4]
- Routine calibration and maintenance of laboratory equipment or other analytical instruments
- Equipment used for quality control/assurance or inspection purposes, including sampling equipment used to withdraw materials for analysis
- Hydraulic and hydrostatic testing equipment
- Environmental chambers not using hazardous air pollutant (HAP) gasses
- Shock chambers
- Humidity chambers
- Solar simulators
- Fugitive emission related to movement of passenger vehicles, provided any required fugitive dust control plan or its equivalent is submitted
- Process water filtration systems and demineralizers
- Demineralized water tanks and demineralizer vents Air compressors and pneumatically operated equipment, including hand tools
- Batteries and battery charging stations, except at battery manufacturing plants
- Storage tanks, vessels and containers holding or storing liquid substances that will not emit any VOC or HAP[5]
- Storage tanks, reservoirs, and pumping and handling equipment of any size containing soaps, vegetable oil, grease, animal fat and nonvolatile aqueous salt solutions, provided appropriate lids and covers are utilized
- Equipment used to mix and package soaps, vegetable oil, grease, animal fat, and nonvolatile aqueous salt solutions, provided appropriate lids and covers are utilized
- Drop hammers or hydraulic presses for forging or metalworking
- Equipment used exclusively to slaughter animals, but not including other equipment at slaughterhouses, such as rendering cookers, boilers, heating plants, incinerators, and electrical power generating equipment
- Vents from continuous emissions monitors and other analyzers
- Natural gas pressure regulator vents, excluding venting at oil and gas production facilities
- Hand-held applicator equipment for hot melt adhesives with no VOC in the adhesive formulation
- Equipment used for surface coating, painting, dipping or spraying operations, except those that will emit VOC or HAP
- CO_2 lasers, used only on metals and other materials which do not emit HAP in the process
- Consumer use of paper trimmers/binders
- Electric or steam-heated drying ovens and autoclaves, but not the emissions from the articles or substance being processed in the ovens or autoclaves or the boilers delivering the steam
- Salt baths using nonvolatile salts that do not result in emissions of any regulated air pollutants
- Laser trimmers using dust collection to prevent fugitive emissions
- Boiler water treatment operations, not including cooling towers
- Oxygen scavenging (de-aeration) of water
- Ozone generators
- Fire suppression systems
- Emergency road flares
- Steam vents and safety relief valves
- Steam leaks
- Steam cleaning operations
- Steam sterilizers

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[1] Cleaning and painting activities qualify as trivial if they are not subject to VOC or HAP control requirements. Asphalt batch plant owners/operators must still get a permit if otherwise required.

[2] "Moved by hand" means it can be moved without the assistance of any motorized or non-motorized vehicle, conveyance or device.

[3] Brazing, soldering and welding equipment, and cutting torches related to manufacturing and construction activities that emit HAP metals are more appropriate for treatment as unpermitted equipment. Brazing, soldering, welding and cutting torches directly related to plant maintenance and upkeep and repair or maintenance shop activities that emit HAP metals are treated as trivial and listed separately in this appendix.

[4] Many lab fume hoods or vents might qualify for treatment as unpermitted equipment.

[5] Exemptions for storage tanks containing petroleum liquids or other volatile organic liquids should be based on size limits such as storage tank capacity and vapor pressure of liquids stored and are not appropriate for this list.

South Coast Air Quality Management District

Form 500-F1 (Title V)

Title IV - Acid Rain Phase II Facility Information Summary

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

This form shall be completed by Acid Rain facilities ONLY and shall accompany all requests for Phase II permit actions unique to Acid Rain facilities. Also attach a completed Form 500-A2. In addition, if an initial Title V permit, permit renewal, or permit revision is requested, attach Form 500-A1 and any supplemental Acid Rain forms (Forms 500-F2, 500-F3, and 500-F4), as appropriate.

Section I - General Information

1. Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

3. ORIS Code (5-Digit): ______________

4. This is an application for a (Check all that apply to the facility):

a. ☒ Phase II Acid Rain Permit or Revision (Complete Section II of this form)

b. ☐ Repowering Extension Plan or Revision (Complete Form 500-F2)

c. ☐ New Unit Exemption or Revision (Complete Form 500-F3)

d. ☐ Retired Unit Exemption or Revision (Complete Form 500-F4)

5. The requested permit action involves a(n) (Check one):

a. ○ Administrative Permit Revision

b. ◉ Significant Permit Revision

c. ○ Fast Track Permit Revision

d. ○ Automatic Permit Revision

e. ○ Other (specify): ______________

6. For all applications requesting a permit revision, provide a general description of the proposed changes (Attach additional sheets as necessary):

Section II - Phase II Acid Rain Device Summary

1. The following information is (Check one): a. ◉ New b. ○ Revised

AQMD Device #	EPA Unit #	Will device need a Repowering Extension Plan?	Has device started operations on or after 11/15/90?	Device Operations Start Date (mo/day/yr)	For devices starting-up after 11/15/90, provide date when Monitoring Certification will begin (mo/day/yr)
TBD	TBD	○ Yes ○ No	○ Yes ○ No		
		○ Yes ○ No	○ Yes ○ No		
		○ Yes ○ No	○ Yes ○ No		
		○ Yes ○ No	○ Yes ○ No		
		○ Yes ○ No	○ Yes ○ No		

To complete this application, type or print the information in the appropriate blanks.

Section I - General Information

1. **Facility Name:** Provide the name of the legal entity that operates the facility.

   AQMD Facility ID: Complete only if the facility has been issued a 6-digit identification or ID number by AQMD. If not, leave these boxes blank. An ID number will be assigned when the application is submitted.

   ORIS Code: Provide the 5-digit code that has been assigned to facility by Department of Energy.

2. Check all applicable boxes to indicate the type of Acid Rain application filed. If box 1a. is checked, complete Section II of this form. If box 1b. is checked, complete and attach Form 500-F2 - Title IV Phase II Acid Rain Repowering Extension Plan. If box 1c. is checked, complete and attach Form 500-F3 - Title IV Phase II Acid Rain New Unit Exemption Request. If box 1d. is checked, complete and attach Form 500-F4 - Title IV Phase II Acid Rain Retired Unit Exemption Request.

3. Check one box that best represents the type of permit action requested. If box 1e. is checked, in the space provided identify any additional elements regarding the application or the facility that need to be considered during the processing of this application (i.e., Initial Title V Permit Application).

4. If the application is a revision request, describe in general terms the changes that are proposed in the application revision request. Attach additional sheets as necessary.

Section II - Phase II Acid Rain Device Summary

1. Before completing this section, check one box to indicate whether this is a new application or a revision.

AQMD Device #:	Provide the identification number for each AQMD-assigned device subject to Phase II requirements.
EPA Unit #:	Provide the identification number for each EPA-assigned device subject to Phase II requirements.
Will device need a Repowering Extension Plan?:	Indicate with a "yes" or "no" if the device is or will be participating under a Repowering Extension Plan.
Has device started operations on or after 11/15/90?:	Indicate with a "yes" or "no" if the device was source tested or started operating on or after November 15, 1990.
Device Operations Start Date:	Complete this column only if the device was source tested or started operating on or after November 15, 1990. Provide the date (mo/day/yr) when the device started or will start operating. Note: If the date of beginning operations changes, an administrative permit revision application will be required.
For Devices starting-up after 11/15/90, provide date when Monitoring Certification will begin:	Complete this column only if the device was source tested or started operating on or after November 15, 1990. Provide the date (mo/day/yr) when compliance with the monitoring procedures for the device will begin. Refer to 40 CFR Part 75.4 to determine this date. Note: If the monitoring certification date changes, an administrative permit revision application will be required.

South Coast Air Quality Management District

Form 500-H

Title V - Compliance Assurance Monitoring (CAM) Applicability Determination for Initial, Renewal, & Significant Permit Revision

This form is required as part of an initial, significant permit revision, or renewal Title V application. If your Title V facility has control devices in use, the CAM rule may apply. Follow the instructions on the reverse side of this form to determine whether your facility is subject to CAM requirements.

Mail To:
SCAQMD
P.O. Box 4944
Diamond Bar, CA 91765-0944

Tel: (909) 396-3385
www.aqmd.gov

Section I - Operator Information

1. Facility Name (Business Name of Operator That Appears On Permit): AES Alamitos, LLC

2. Valid AQMD Facility ID (Available On Permit Or Invoice Issued By AQMD): 115394

Section II - CAM Status Summary for Emission Units

3. Based on the criteria in the instructions (check one and attach additional pages as necessary):

a. ☐ The emission units identified below are subject to the CAM rule[1] and a CAM plan[2] is attached for each affected emissions unit:

b. ☑ There are no emission units with control devices at this Title V facility that are subject to the CAM rule.

Emission Unit[3] (Application, Permit or Device No.)	Equipment Description[4]	Uncontrolled Emissions		Connected to Control Unit[3] (Application, Permit or Device No.)	Equipment Description[4]	Controlled Emissions	
		Pollutant	PTE[5] (tons/year)			Pollutant	PTE[5] (tons/year)

1 For more detailed information regarding the CAM rule applicability, refer to Title 40, Chapter I, Part 64, Section 64.1 of the Code of Federal Regulations (40 CFR Part 64, Section 64.1). This also can be accessed via the internet at: http://www.access.gpo.gov/nara/cfr/waisidx_99/40cfr64_99.html.

2 Only one CAM plan is required for a control device that is common to more than one emissions unit, or if an emissions unit is controlled by more than one control device similar in design and operation. If the control devices are not similar in design and operation, one plan is required for each control device.

3 List all new and existing emission units and the connected control devices either by AQMD application, permit or device number. When the emission unit is new and has not yet been assigned an application number, leave this column blank.

4 Provide a brief equipment description of the emission units and control devices by indicating equipment type, make, and model and serial numbers as appropriate.

5 Potential to Emit

Instructions for Determining Applicability to the CAM Rule

With the exception of emission units that are municipally-owned backup utility power units as described by 40 CFR Part 64, Section 64.2(b)(2)[1], the CAM rule is applicable to each emission unit (existing and new construction) at a Title V facility that meets ALL of the following criteria[2]:

1. The emission unit is subject to an emission limitation or standard[3] (often found in permit conditions);
2. The emission unit uses a control device to achieve compliance with the emission limitation or standard; and,
3. The emission unit has a potential to emit (PTE)[4], either pre-control or post-control depending on the type of Title V application[5], that exceeds or is equivalent to any of Title V major source thresholds shown in the following table:

CAM Potential to Emit (PTE) Emission Threshold[6] For Individual Emission Units at a Title V Facility (tons per year)			
Pollutant	South Coast Air Basin (SOCAB)	Riverside County Portion of Salton Sea Air Basin (SSAB) and Los Angeles County Portion of Mojave Desert Air Basin (MDAB)	Riverside County Portion of Mojave Desert Air Basin (MDAB)
VOC	10	25	100
NOx	10	25	100
SOx	100	100	100
CO	50	100	100
PM-10	70	70	100
1 HAP[7]	10	10	10
2+ HAPs	25	25	25

1 The facility must attach the documentation required by 40 CFR Part 64, Section 64.2 (b)(2) to demonstrate that the backup utility power unit only operates during periods of peak demand or emergency situations; and has actual emissions, averaged over the last three calendar years of operation, less than 50% of the major source emission thresholds.

2 Additional information about the CAM rule can be found on EPA's website at http://www.epa.gov/ttnemc01/cam.html.

3 Only emission limitations and standards from an "applicable requirement" for emission units with control devices are subject to the CAM rule. Applicable requirements are federally-enforceable requirements that are rules adopted by AQMD or the State that are approved by EPA into the State Implementation Plan (SIP) (i.e. "SIP-approved rules"). Refer to Form 500-C1 for the latest versions of SIP-approved and non-SIP approved rules.

For emissions units with control devices that are subject to following federally enforceable requirements, the CAM rule does NOT apply: 1) NSPS (40 CFR Part 60); 2) NESHAP (40 CFR Parts 61 and 63); 3) Title VI of the Federal Clean Air Act (CAA) for Stratospheric Ozone Protection; 4) Title IV of the CAA and SCAQMD Regulation XXXI for Acid Rain facilities; 5) SCAQMD Regulation XX – RECLAIM; 6) Any emission cap that is federally enforceable, quantifiable, and meets the requirements in 40 CFR Part 70, Section 70.4 (b)(12); and 6) Emission limitation or standards for which a continuous compliance determination method is required.

4 To calculate the pre-control device and post-control device PTE for emission units at the facility, refer to the Title V Technical Guidance Document Version 4 .0, Appendix A (pages A-12 through A-23). The calculations are used to determine the CAM applicability according to 40 CFR Part 64, Section 64.5 of the CAM rule.

5 For initial Title V or significant permit revision applications submitted after April 20, 1998, use the post-control device PTE emissions to determine CAM applicability. For Title V permit renewal applications (submittals will begin in 2002), the CAM applicability will be based on the pre-control device PTE.

6 The following table is based on Rule 3001 (Amended November 14, 1997) and Rule 3008 (Amended March 16, 2001). Please be advised that the threshold values are subject to change based on rule amendments.

7 Hazardous Air Pollutant

June 5, 2015

TO: **Burns & McDonnell**
9400 Ward Parkway
Kansas City, MO 64114

Attention: **Mr. Justin Schnegelberger**

SUBJECT: **AES Southland – Emissions Guarantee**

Dear Sir,

Nooter/Eriksen is pleased to provide the following HRSG stack emissions guarantees to support the facility air permit application process. This will serve to document the stack guarantee values, the applicable ranges and operating conditions, and the basis for the guarantees.

Please do not hesitate to contact us with any questions or concerns.

NOOTER/ERIKSEN, INC.

Julie Lux

Name: Julie Lux

Title: Regional Sales Manager

Cc: Hallie Shin- N/E
Steve Meierotto- N/E
Mark French- N/E
Steve Furman- N/E
Todd Sundbom- BMcD
Bradley Deer- BMcD
Jeff Yakle- BMcD

Emissions Guarantees

1.1 SCR System

The SCR vendor guarantees the following emission levels at the HRSG outlet:

The SCR Catalyst System will reduce the NOx content of the exhaust gas to a maximum of 2.0 ppmvd at 15% O2 at the HRSG stack for Natural Gas operation, at the SCR design conditions specified in section 1.6 Stack Emissions of the specification 74473.HB.5.1215 AES Southland.

NH3 concentration at stack sampling ports shall not exceed 5.0 ppmvd @ 15% O2.

The SCR catalyst guarantee life is the earlier of 36 months from first gas in or 39 months from contracted delivery.

1.2 CO System

The CO vendor guarantees the following emission levels at the HRSG outlet:

The CO catalyst system will oxidize the CO content of the exhaust gas to a maximum of 2.0 ppmvd at 15% O2 at the HRSG stack for the design conditions specified in 74473.HB.5.1215 AES Southland.

The CO catalyst system will oxidize the VOC content of the exhaust gas to a maximum of 1.0 ppmvd at 15% O2 at the HRSG stack for the design conditions specified in 74473.HB.5.1215 AES Southland.

The CO catalyst guarantee life is the earlier of 36 months from first gas in or 39 months from contracted delivery.

1.3 Stack Particulate Guarantee

The HRSG will limit the contribution of PM-10 (total) emissions of the exhaust gas to a maximum of 10.2 lb/hr at the HRSG stack for the design conditions specified in 74473.HB.5.1215 AES Southland.

1.4 Basis of Emissions Guarantee

1.4.1 The emissions guarantees are met for the combustion turbine conditions as defined in Heat Balance file provided with the following GT emissions:

Gas Turbine Emissions		
NOx @ 15% O2	ppmvd	9.0
CO @ 15% O2	ppmvd	9.0
VOC @ 15% O2	ppmvd	1.2
PM 10 (total)	lb/hr	6.7
PM 2.5 (total)	lb/hr	6.7
Note: It is assumed that PM2.5 (total) and PM10 are mutually exclusive and not additive.		

1.4.2 If the PM 10 (total) emissions are not met it is the client/owner's responsibility to prove the GT emissions contributions are correct.

1.4.3 All emission level guarantees are at steady state operation.

1.4.4 The SCR catalyst design assumes the NO2 content of the total combustion turbine outlet NOX does not exceed 20%.

1.4.5 Emissions testing will be in accordance with a mutually agreed test procedure that is in general accordance with standard EPA test methods.

1.4.6 Any emissions measurement uncertainty will be to the Customer's account.

1.4.7 VOC's are defined as non-methane, non-ethane unburned hydrocarbons and are assumed to be less than 50% saturated.

1.4.8 Total Sulfur Maximum provided in the fuel flow is 0.25 grains/100 SCF.

1.4.9 Fuel flow estimate for particulate guarantee is based on the provided Total CTG Heat Input (LHV) on a per case basis and a fuel LHV of 19,715 Btu/lb.

1.4.10 PM10 emissions shall be the sum of non-condensable emissions determined using Method 201 or 201A and condensable emissions determined using Method 202

1.4.11 These guarantees are provided on a no-harm, no-foul basis. If the air permit requirements are met, then N/E's guarantees will be deemed to have been met.

1.4.12 N/E is not subject to any delay damages for failure to meet these guarantees.

GUARANTEE
PROJECT: AES SOUTHLAND
LOCATION: USA

KW AT GEN TERMS	99016
BTU/KW-HR, LHV	8196

Vu, Christopher
Performance Engineer
Date: 06/16/2015

Start Up Time to Base Load, 10 Minutes
(See conditions for 10-minute start)

EMISSIONS GUARANTEED W/ GE SUPPLIED SCR AND COR
EMISSIONS ARE VALID FOR T2 WITHIN 20F-110F AND A GTG LOAD DOWN TO 50% AS DEFINED IN STEADY STATE CONDITIONS FOR EMISSIONS GUARANTEE.

NOX: 2.5 PPMVD AT 15% O2
(5 mg/Nm3)
CO: 4.0 PPMVD AT 15% O2
(5 mg/Nm3)
VOC: 2 PPMVD AT 15% O2
(1 mg/Nm3)
NH3: 5.0 PPMVD AT 15% O2

EMISSIONS GUARANTEED W/ GE SUPPLIED SCR/CO CATALYST
EMISSIONS ARE VALID FOR T2 WITHIN 20F-110F AND A GTG LOAD DOWN TO 50% AS DEFINED IN STEADY STATE CONDITIONS AND PER THE CONDITIONS FOR A PM10 EMISSIONS GUARANTEE.

PM10: 5.0 LB/HR

NOT VALID WITHOUT SIGNATURE

VALID UNTIL 09/16/2015

BASIS OF GUARANTEE:	BASE LOAD, GAS FUEL NOZZLE SYSTEM NO BLEED OR EXTRACTED POWER
ENGINE:	(1) GE LMS100PB DRY FIN FAN COOLING DLE GAS TURBINE
FUEL:	20,674 Btu/lb LHV, GAS FUEL (#900-4519)
FUEL SPEC:	MID-TD-0000-1 LATEST REVISION
FUEL TEMP:	SITE FUEL TEMPERATURE OF 76.9°F
FUEL PRESS:	900 PSIG
GENERATOR:	BDAX 82-445ER
GENERATOR OUTPUT	13.8kV, 60 Hz
POWER FACTOR:	0.9
AMBIENT TEMP:	65.8°F
AMBIENT RH:	58.3%
INLET CONDITIONING:	NONE
ALTITUDE:	14.0 feet
INLET FILTER LOSS:	5.00 inH_2O
EXHAUST LOSS:	10.00 inH_2O
NOX CONTROL:	DLE
INTERCOOLER:	COOLING WATER SUPPLY TEMP AT 80°F / 100% WATER
ENGINE CONDITION:	NEW AND CLEAN ≤ 200 SITE FIRED HOURS
FIELD TEST METHODS	
PERFORMANCE:	GE POWER & WATER SGTGPTM
NOX:	EPA METHOD 20
CO:	EPA METHOD 10
VOC:	EPA METHOD 25A/18
PM10:	EPA METHOD 5 / 202
NH3:	EPA METHOD CTM 027

BASIS OF GUARANTEE IS NOT FOR DESIGN, REFER TO PROJECT DRAWINGS FOR DESIGN REQUIREMENTS.
SI VALUES ARE FOR REFERENCE PURPOSES ONLY.

THIS GUARANTEE SUPERSEDES ANY PREVIOUS GUARANTEES PRESENTED

GUARANTEE
PROJECT: AES SOUTHLAND
LOCATION: USA

NEAR FIELD NOISE:
85 DB(A) ARITHMETIC AVERAGE SOUND PRESSURE LEVEL (dB REF 20 MICROPASCALS, RMS) OF LOCATIONS AROUND THE PACKAGE (VERTICAL DISTANCE OF 5FT. (1.5M) ABOVE PACKAGE BASE AT A HORIZONTAL DISTANCE OF 3FT. (1M) FROM THE EXTERIOR PLANE OF EQUIPMENT AS TESTED IN A FREE-FIELD CONDITION OVER A HARD REFLECTING GROUND PLANE, OPERATING AT BASE LOAD)

Christopher H. Vu
Vu, Christopher
Performance Engineer
Date: 06/16/2015

NOT VALID WITHOUT SIGNATURE — VALID UNTIL 09/16/2015

BASIS OF GUARANTEE:	BASE LOAD, GAS FUEL NOZZLE SYSTEM NO BLEED OR EXTRACTED POWER
ENGINE:	(1) GE LMS100PB DRY FIN FAN COOLING DLE GAS TURBINE
FUEL:	20,674 Btu/lb LHV, GAS FUEL (#900-4519)
FUEL SPEC:	MID-TD-0000-1 LATEST REVISION
FUEL TEMP:	SITE FUEL TEMPERATURE OF 76.9°F
FUEL PRESS:	900 PSIG
GENERATOR:	BDAX 82-445ER
GENERATOR OUTPUT	13.8kV, 60 Hz
POWER FACTOR:	0.9
AMBIENT TEMP:	65.8°F
AMBIENT RH:	58.3%
INLET CONDITIONING:	NONE
ALTITUDE:	14.0 feet
INLET FILTER LOSS:	5.00 inH_2O
EXHAUST LOSS:	10.00 inH_2O
NOX CONTROL:	DLE
INTERCOOLER:	COOLING WATER SUPPLY TEMP AT 80°F / 100% WATER
ENGINE CONDITION:	NEW AND CLEAN ≤ 200 SITE FIRED HOURS
NEAR FIELD NOISE:	GE POWER & WATER SGTGPTM EPA METHOD 20 EPA METHOD 10 EPA METHOD 25A/18 EPA METHOD 5 / 202 EPA METHOD CTM 027

BASIS OF GUARANTEE IS NOT FOR DESIGN, REFER TO PROJECT DRAWINGS FOR DESIGN REQUIREMENTS.
SI VALUES ARE FOR REFERENCE PURPOSES ONLY.

THIS GUARANTEE SUPERSEDES ANY PREVIOUS GUARANTEES PRESENTED

Estimated Average Engine Performance NOT FOR GUARANTEE, REFER TO PROJECT F&ID FOR DESIGN
Predicted Intercooler Performance not to be utilized for Balance of Plant design. Please contact GE.

GE Power & Water

Performance By: **Vu, Christopher**
Project Info: **AES Southland**

Engine: **LMS100 PB DLE**
Deck Info: **G0179E - 8jy.scp**
Generator: **BDAX 82-445ER 60Hz, 13.8kV, 0.9PF (EffCurve#: 32398; CapCurve#: 32396)**
Fuel: **Site Gas Fuel#900-4519, 20674 Btu/lb,LHV**

Date: **6/16/2015**
Time: **2:33:25 PM**
Version: **4.0.1**

Case #	**100**
Ambient Conditions	
Dry Bulb, °F	65.8
Wet Bulb, °F	57.0
RH, %	58.3
Altitude, ft	14.0
Ambient Pressure, psia	14.689
Engine Inlet	
Comp Inlet Temp, °F	65.8
RH, %	58.3
Conditioning	NONE
Tons(Chilling) or kBtu/hr(Heating)	0
Pressure Losses	
Inlet Loss, inH2O	5.00
Exhaust Loss, inH2O	10.00
Partload %	**100**
kW, Gen Terms	**98827**
Est. Btu/kW-hr, LHV	**7955**
Guar. Btu/kW-hr, LHV	**8196**
Fuel Flow	
MMBtu/hr, LHV	786.2
lb/hr	38026
NOx Control	**DLE**
Intercooler	**Dry Fin Fan Cooling**
Humidification	OFF
IC Heat Extraction, btu/s	30216
Exhaust Parameters	
Temperature, °F	797.7
lb/sec	478.8
lb/hr	1723559

Emissions (ESTIMATED, NOT FOR GUARANTEE)

NOx ppmvd Ref 15% O2	25
NOx as NO2, lb/hr	79

Exh Wght % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)

AR	1.2498
N2	73.3042
O2	14.0480
CO2	5.8982
H20	5.4689
SO2	0.0000
CO	0.0208
HC	0.0069
NOX	0.0032

Exh Mole % Dry (NOT FOR USE IN ENVIRONMENTAL PERMITS)

AR	0.9709
N2	81.2057
O2	13.6247
CO2	4.1592
H20	0.0000
SO2	0.0000
CO	0.0230
HC	0.0134
NOX	0.0031

Exh Mole % Wet (NOT FOR USE IN ENVIRONMENTAL PERMITS)

AR	0.8873
N2	74.2140
O2	12.4516
CO2	3.8011
H20	8.6099
SO2	0.0000
CO	0.0211
HC	0.0123
NOX	0.0028

Aero Energy Fuel Number **900-4519 (AES Southland LMS100PB (New Fuel))**

	Volume %	**Weight %**
Hydrogen	0.0000	0.0000
Methane	95.8300	91.6635
Ethane	2.4400	4.3745
Ethylene	0.0000	0.0000
Propane	0.0300	0.0789
Propylene	0.0000	0.0000
Butane	0.0300	0.1040
Butylene	0.0000	0.0000
Butadiene	0.0000	0.0000
Pentane	0.0100	0.0430
Cyclopentane	0.0000	0.0000
Hexane	0.0000	0.0000
Heptane	0.0000	0.0000
Carbon Monoxide	0.0000	0.0000
Carbon Dioxide	1.0100	2.6504
Nitrogen	0.6500	1.0857
Water Vapor	0.0000	0.0000
Oxygen	0.0000	0.0000
Hydrogen Sulfide	0.0000	0.0000
Ammonia	0.0000	0.0000

Btu/lb, LHV	20674
Btu/scf, LHV	916.0
Btu/scf, HHV	1015.7
Btu/lb, HHV	22923
Fuel Temp, °F	76.9
NOx Scalar	0.984
Specific Gravity	0.58
Wobbe	51.973

GE POWER & WATER

Conditions for Near-field Noise Guarantee

1. Based on arithmetic average of sound pressure levels at locations around the package.
2. The following areas are excluded from the noise measurements: between (a) VBV valves and silencer, and the main unit; (b) intercooler heat exchanger and the main unit, which includes intercooler ducting and water pump skid.
3. BRUSH 82-445 Generator must be enclosed with a full-weather enclosure, or it must be supplied with the Brush low-noise option.
4. Gas Filter (Coalescer) / Metering Skid must be at least 25-ft away from the main unit and other ancillary skids.
5. Generator/Clutch Lube Oil Skid must be enclosed.
6. Other Ancillary skids must be at least 10-ft away from any fin-fan lube oil cooler, measuring nearest edge-to-edge.
7. Fin Fan Coolers must be located at least 75-ft away from the main unit and ancillary skids of the package, measuring nearest edge-to-edge.
8. Per unit basis.
9. Baseload operation only .
10. GE Power & Water GTG package scope of supply only, customer supplied equipment is not included.
11. GE Power & Water GTG package scope of supply only, GE Power & Water supplied BOP equipment is not included.
12. If GE Power & Water supplies BOP equipment, then GE Power & Water is to advise best location.

Steady State Conditions for Emissions Guarantee

1.	Power Output (electrical)	±10.0% / Min
2.	T2 Compressor Inlet air temperature	± 2.5°F / 5.0 Min
3.	Heat Value - gaseous fuel per unit volume	±0.25% / Min
4.	Pressure - gaseous fuel as supplied to engine	± 10 PSIG / 5.0 Min

GE POWER & WATER

*Conditions for 10-minute Start Up Guarantee

1. The engine/stack purge times in the 10-minute start apply to exhaust systems that terminate with a (SCR) Selective Catalytic Reduction Unit that is purged by a forced air purging system or has been pre-purged in accordance to NFPA and GE position papers pp#19-LMS100 Turbine Purge Requirements and pp# 22 LMS100 10-minute start.
2. If SCR is not purged per item 1 above, then proper purging of SCR will be required prior to the beginning of Startup Test. **SCR purge time is to be excluded from 10-minute Start.**
3. 10-Minute Start is for Simple Cycle Operation only.
4. Lube oil heaters and heat tracing are required to be energized during offline periods
5. Intercooler water flow initiation requires 45 seconds. The turbine warm up cycle is controlling when they occur together.
6. Lube oil initiation and pressure checks performed during enclosure purge cycle
7. Start sequence is for 60 or 50 Hz applications.
8. Per unit basis.
9. Emission guarantees are not in effect during Startup.
10. Valid over ambient temperature range of 30°F to 90°F . However, the unit must be out of an icing condition as defined by PP17 before ramping to full load. This "warm up period" is to be excluded from the 10-minute start.

GE POWER & WATER

Conditions for PM10 Emissions Guarantee

PM10 emissions include filterable (front half) and condensable (back half) emissions. The following additional criteria and precautions are required for this particulate emissions guarantee level:

1. Fuel must meet GE specification MID-TD-000-01 and satisfy "pipeline quality natural gas" requirements as defined by EPA 40CFR72.2 with the added requirement that the total sulfur must be below 0.75 grains / 100 scf.
2. The timing of test to should not occur when ambient particulate levels are higher than normal. A site particulate evaluation and conditions at the stack must be reported, including any activities in the surrounding area that might impact PM levels (e.g. high winds, high pollen count, wildfires, road grading, etc.). Any unusual conditions may require postponement, additional test runs, or an allowance for background PM.
3. Gas turbine must run for a minimum of 300 total fired hours prior to particulate testing.
4. Gas turbine must be operating for a minimum of 2 hours at base load prior to initiating the test.
5. Gas turbine inlet, exhaust, and emissions catalyst system (if applicable) must be free of any dirt, sand, mud, rust, oil, or other contaminates.
6. Multiple re-testing must be allowed if required. Re-testing shall be at Purchaser's cost.
7. An off-line compressor water wash must be executed prior to starting with particulate test.
8. The area around the turbine is to be treated (e.g. sprayed down with water) to minimize airborne dust.
9. Evaporative coolers and/or chiller systems shall not be used during the time of testing.
10. If a SCR/COR is supplied and includes the use of dilution air fans, the dilution air system must utilize highly efficient HEPA filtration with 2 micron or better rating.
11. If a SCR is supplied, the ammonium slip must be less than 5 ppmvd @ 15%O2.
12. GE/Customer must mutually agree on a PM/PM10 testing firm that
    Test Firm:
    - A) Must have 10 years particulate testing experience
    - B) Must have experience on Natural Gas Power Plants
    - C) Must have 2 Customer references
    - D) Must be ASTM Certified or equivalent
    - E) Must submit an example test report for review

    Individual Tester:
    - A) Must have 5 years particulate testing experience
    - B) Must have experience on Natural Gas Power Plants
    - C) Must be SES Certified
    - D) Must submit an example test report for review

Continued … Conditions for PM10 Emissions Guarantee

Laboratory:

A) Must be State Certified
B) Must use 6 Place Balance
C) Must have experience with optional procedures
D) Must have 10 years particulate testing experience
E) Must have experience with low level ion chromatography
F) Must submit an example report with detail for review

Laboratory Technician:

A) Must have 1 years particulate testing experience

13. The following test process adjustments must be followed:

A) At least 4 test runs must be performed and averaged to produce the final result.
B) Each baseload test run duration shall be at least 240 minutes (continuous). If partload testing is applicable, each run's duration shall be at least 360 minutes (continuous).
C) At least three fuel analyses are required per test run and shall include total sulfur per method ASTM D5504 (report as total sulfur in grains per one hundred standard cubic feet).
D) If SCR is provided, ammonium slip shall be measured for each test run per CTM 027 or equivalent.
E) Measurement of oxygen and carbon dioxide shall be done per EPA Method 3A (not Method 3).
F) Mass emission rates of particulate matter shall be calculated using fuel flow and exhaust flow determined by the EPA Method 19, F-factor method (40CFR60 Appendix A).
G) For condensable PM measurements, the sample train must be purged with N2 gas at the end of each test run.
H) For condensable PM measurements, NH4OH titration shall be used to neutralize acid in the sample.

GE POWER & WATER

Conditions for VOC Emissions Guarantee

1. Fuel must meet GE specification MID-TD-000-01.
2. The timing of test to coincide with lowest site ambient VOCs levels.
3. Gas turbine must run for a minimum of 300 total fired hours at base load prior to testing.
4. Gas turbine inlet and exhaust system must be free of any dirt,sand,mud,rust,oil or any other contaminates.
5. Re-testing (at purchaser's expense) must be allowed, if required.
6. GE receives a copy of the final test results.
7. An off-line compressor water wash must be executed prior to starting with particulate test.

CleaverBrooks®

6940 Cornhusker Highway
Lincoln, Nebraska 68507
(402) 434-2000 Phone
(402)434-2064 Fax

June 10, 2015

Burns & McDonnell
9400 Ward Parkway
Kansas City, MO 64114

Re: Your Project Contract No. 5.2910, AES Southland Gas Fired Auxiliary Boiler

Dear Mr. Schnegelberger:

As per your request for the above referenced project, we confirm that we can design for the following emissions using a combination of flue gas recirculation and an SCR system:

Guaranteed Stack Emissions		**Natural Gas**		
NOx (post-SCR)	ppmv	5		
CO	ppmv	50		
VOC	lb/MMBtu	0.003		
PM10	lb/MMBtu	0.0043		
Ammonial Slip	ppmv	5		

Based on:
From 25% to 100% MCR corrected to 3% O_2 on a dry basis.
NATCOM technician is required for start-up and adjustments.
PM is exclusive of any particulates in combustion air or other sources of residual particulates from material.

Natural gas analysis shall be as per the attached *GNN36157.pdf*. Burner emissions for this application are based on a firing natural gas at a maximum rate of 71 MMBtu/hr with emissions guaranteed between 25% to 100% MCR corrected to 3% O2 dry basis.

Sincerely yours,

David Obrecht
Application Sales Engineer
Cleaver-Brooks, Inc.
402-434-2045

Enclosure:
GNN36157.pdf dated 5/20/2014

AQMD

Fee Calculation

Below are the permit fees we have calculated based on the information you have entered. To complete the permit process, please click the print button to print the Fee Sheet and submit a signed check for the Total amount due along with your application package.

Thank you for using AQMD's online Fee Calculator!

Fee Sheet

RESTART PRINT

Facility Information EDIT

Name:	AES Alamitos, LLC	ID: 115394
Address:	690 N. Studebaker Road Long Beach, CA 90803	
Operation Type:		Non-Manufacturing Facility
Number of Employees:		N/A
Annual Revenue:		$ N/A
Prior Permit?:		Yes

Add Applications ADD

Permit Unit	
Gas Turbine, 50 MW, other fuel	$18,050.38
Gas Turbine, 50 MW, other fuel (1 Identical)	$9,025.19
Expedited Processing Fee	$13,537.79
Permit Unit	
Selective Catalytic Reduction (SCR)	$3,835.06
Selective Catalytic Reduction (SCR) (1 Identical)	$1,917.53
Expedited Processing Fee	$2,876.30
Permit Unit	
Oil/Water Separator (>= 10,000 GPD)	$3,835.06
Oil/Water Separator (>= 10,000 GPD) (1 Identical)	$1,917.53
Expedited Processing Fee	$2,876.30
Permit Unit	

Boiler, Other Fuel (> 50 MMBTU/hr)	$6,085.38
Expedited Processing Fee	$3,042.69
Permit Unit	
Storage Tank, Other	$1,521.32
Storage Tank, Other (2 Identical)	$1,521.32
Expedited Processing Fee	$1,521.32
Permit Unit	
Gas Turbine, 50 MW, other fuel	$18,050.38
Gas Turbine, 50 MW, other fuel (3 Identical)	$27,075.57
Expedited Processing Fee	$22,562.99
Permit Unit	
Selective Catalytic Reduction (SCR)	$3,835.06
Selective Catalytic Reduction (SCR) (3 Identical)	$5,752.59
Expedited Processing Fee	$4,793.84
Permit Unit	
Selective Catalytic Reduction (SCR)	$3,835.06
Expedited Processing Fee	$1,917.53
Facility Permit Revision Fee	
Administrative Permit Revision Fee	$1,994.55

Summary of Subtotals

Permit Fees	$106,257.40
Expedited Processing Fees	$53,128.76
Higher Fees	$0.00
Small Business Discount	$0.00

Fees are calculated based on current fiscal year (July 1st - June 30th).
Fee calculation date: September 23, 2015.

Grand Total: **$161,380.74**

BACK PRINT

Appendix 5.1F
Dispersion Modeling Protocols

APPENDIX 5.1F

Dispersion Modeling Protocols

This Appendix contains the air dispersion modeling protocols used to assess air quality impacts near the Alamitos Energy Center. The files contained within this Appendix are as follows:

Protocol	Dispersion Modeling Protocol for the Alamitos Energy Center
Protocol	Dispersion Modeling Protocol for Air Quality Related Values at Class I Areas Near the Alamitos Energy Center

MODELING PROTOCOL

Dispersion Modeling Protocol for the Alamitos Energy Center

Prepared for

AES Southland Development, LLC

690 N. Studebaker Road
Long Beach, CA 90803

September 2015

Submitted to

The California Energy Commission

Prepared by

ch2m

2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833

Contents

Acronyms and Abbreviations

°F	degrees Fahrenheit
ΔE	color difference
µg/m^3	microgram(s) per cubic meter
AEC	Alamitos Energy Center
AES	AES Southland Development, LLC
AFC	Application for Certification
AQRV	air quality-related value
ARB	California Air Resources Board
CAAQS	California Ambient Air Quality Standards
CalEEMod	California Emissions Estimator Model
CEC	California Energy Commission
CFR	*Code of Federal Regulations*
CO	carbon monoxide
DPM	diesel particulate matter
EPA	U.S. Environmental Protection Agency
FLM	Federal Land Manager
GE	General Electric
GHG	greenhouse gas
GRP	General Reporting Protocol
H_2S	hydrogen sulfide
H_2SO_4	sulfuric acid
HARP 2	Hotspots Analysis Reporting Program Version 2
HI	hazard index
HRA	health risk assessment
IMPROVE	Interagency Monitoring of Protected Visual Environments
INC	Incomplete
ISC	Industrial Source Complex
K	degrees Kelvin
km	kilometer
lb	pound(s)
LBWD	City of Long Beach Water Department
MPRM	Meteorological Processor for Regulatory Modeling Applications
N/A	Not Applicable
NAAQS	National Ambient Air Quality Standards
NAD83	North American Datum 1983
NO_2	nitrogen dioxide

NO_x	oxides of nitrogen
NSR	New Source Review
OEHHA	Office of Environmental Health Hazard Assessment
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
ppm	part(s) per million
ppmv	part(s) per million by volume
PSD	Prevention of Significant Deterioration
PTE	potential to emit
PVMRM	plume volume molar ratio method
Q/D	emissions/distance
RECLAIM	Regional Clean Air Incentives Market
RELs	Reference Exposure Levels
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SCR	selective catalytic reduction
SIL	significant impact level
SF_6	sulfur hexafluoride
SO_2	sulfur dioxide
T-BACT	Best Available Control Technology for Toxics
TAC	toxic air contaminants
TCR	The Climate Registry
tpy	ton(s) per year
UTM	Universal Transverse Mercator
VOC	volatile organic compound(s)

SECTION 1.0

Introduction

AES Southland Development, LLC (AES) proposes to construct the Alamitos Energy Center (AEC or Project) at the existing AES Alamitos Generating Station site, located at 690 N. Studebaker Road, Long Beach, California 90803 (see Figure 1-1). AES submitted an Application for Certification (AFC) to the California Energy Commission (CEC) in December 2013, which was deemed data adequate by the CEC in March 2014. In November 2014, AES received notice from Southern California Edison (SCE) that it was shortlisted for a power purchase agreement (PPA). The power plant configuration selected by SCE for a PPA was different from the Project configuration in the AFC filed with the CEC. Therefore, AES is required to supplement the AEC AFC to be consistent with the SCE PPA.

The AEC will consist of one two-on-one combined-cycle power block and one simple-cycle power block with a combined net capacity of 1,040 megawatts. The combined-cycle power block will consist of two General Electric (GE) Frame 7FA.05 natural-gas-fired combustion turbines, one steam turbine, and an air-cooled condenser. Each combustion turbine will be equipped with a heat recovery steam generator without supplemental natural gas firing (duct firing). The turbines will use advanced combustion controls, dry low oxides of nitrogen (NO_x) burners, and selective catalytic reduction (SCR) to limit NO_x emissions to 2 parts per million by volume (ppmv). Emissions of carbon monoxide (CO) and volatile organic compounds (VOCs) will be limited to 2 ppmv and 2 ppmv, respectively, through the use of advanced combustion controls combined with the use of an oxidation catalyst. The AEC will also include a natural-gas-fired auxiliary boiler, used to decrease the startup duration and air emissions of the combined-cycle turbines. The auxiliary boiler will include ultra-low-NO_x burners, SCR to control NO_x emissions to 5 ppmv, or both.

The AEC simple-cycle power block will consist of four GE LMS100PB natural-gas-fired combustion turbines and four closed-loop cooling fin fan coolers. The turbines will use advanced combustion controls, dry low NO_x burners, and SCR to limit NO_x emissions to 2.5 ppmv. Emissions of CO and VOC will be limited to 4 ppmv and 2 ppmv, respectively, through the use of advanced combustion controls combined with the use of an oxidation catalyst. Good combustion practices and burning pipeline-quality natural gas will minimize emissions of the remaining criteria pollutants for both the combined-cycle and simple-cycle power blocks.

The AEC will use closed-loop cooling fin-fan coolers and an air-cooled condenser for cooling, completely eliminating the existing ocean water once-through-cooling system. The AEC will use potable water provided by the City of Long Beach Water Department (LBWD) for construction, operational process, and sanitary uses but at substantially lower volumes than the existing Alamitos Generating Station has historically used. This water will be supplied through existing onsite potable water lines.

The AEC will interconnect to the existing SCE 230-kilovolt switchyard adjacent to the north side of the property. Natural gas will be supplied to the AEC via the existing offsite 30-inch-diameter pipeline owned and operated by Southern California Gas Company that currently serves the Alamitos Generating Station. Existing water treatment facilities, emergency services, and administration and maintenance buildings will be reused for the AEC. The AEC will require relocation of the natural gas metering facilities and construction of a new natural gas compressor building within the existing Alamitos Generating Station site footprint. Stormwater will be discharged to two retention basins and then ultimately to the San Gabriel River via existing stormwater outfalls.

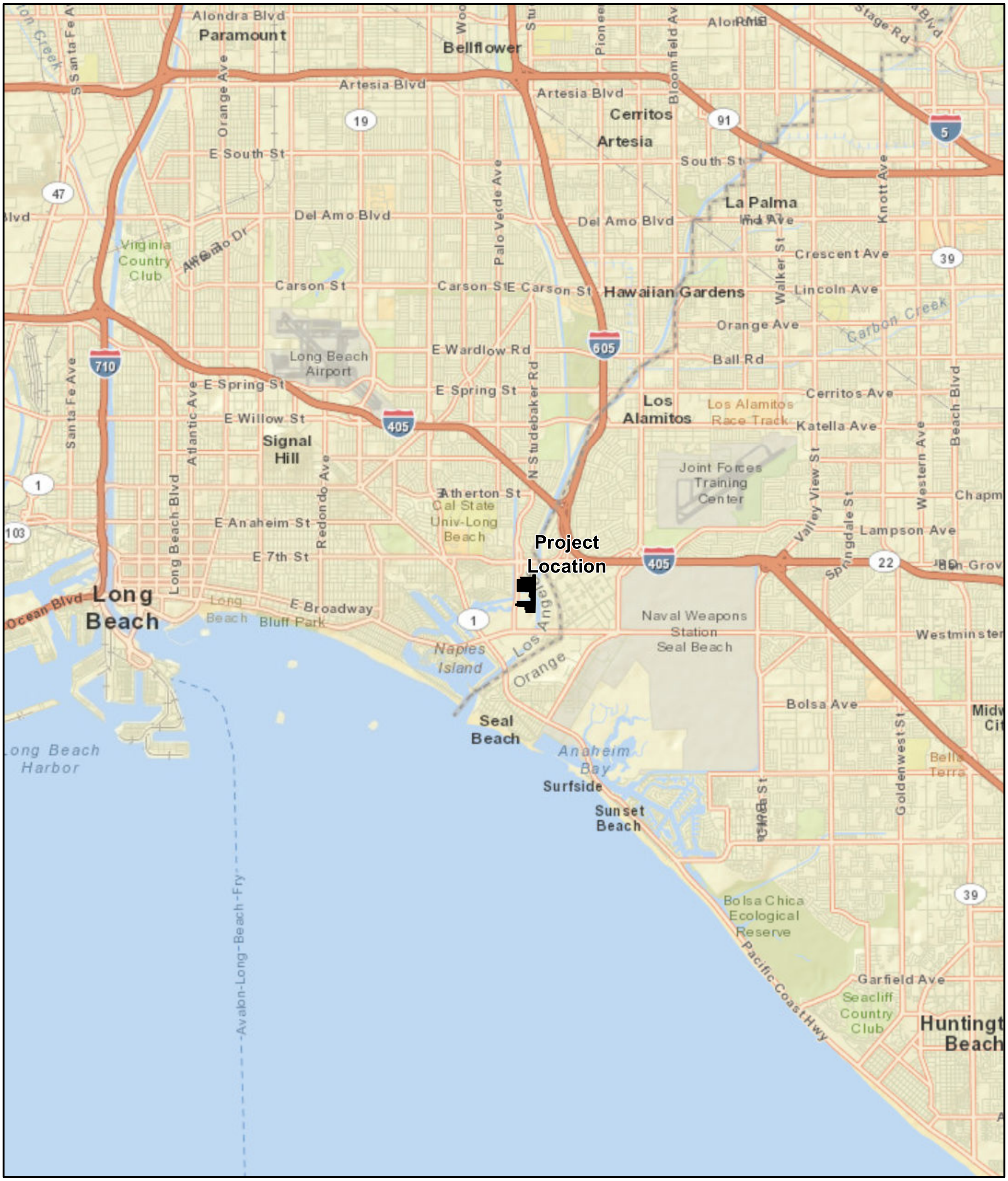
The AEC will include a new 1,000-foot process/sanitary wastewater pipeline to the first point of interconnection with the existing LBWD sewer system and will eliminate the current practice of treatment and discharge of process/sanitary wastewater to the San Gabriel River. The Project may also require upgrading approximately 4,000 feet of the existing offsite LBWD sewer line downstream of the first point of interconnection; therefore, this possible offsite improvement to the LBWD system will also be analyzed in the supplemental AFC. The total length of the new pipeline (1,000 feet) and the upgraded pipeline (4,000 feet) is approximately 5,000 feet.

The AEC will be permitted through the CEC AFC licensing process and the South Coast Air Quality Management District (SCAQMD) New Source Review (NSR) permitting process. Because the AEC includes the use of steam to generate electricity, the Project is also categorized as one of the 28 Prevention of Significant Deterioration (PSD) major source categories (40 *Code of Federal Regulations* [CFR] 52.21(b)(1)(i)). Therefore, the Project is considered a new major source subject to PSD permitting requirements. The existing Alamitos Generating Station units will be retired as part of the Project.

The Project's potential to emit (PTE) is expected to exceed the 100 tons per year (tpy) threshold for two PSD-regulated pollutants (see Section 3.3, Operation). Therefore, the Project will be considered a major stationary source in accordance with PSD regulations. The SCAQMD has also been delegated partial PSD permitting authority. Therefore, the PSD modeling results will be submitted to the SCAQMD as part of the permitting process.

Dispersion modeling will be conducted to demonstrate that the Project will neither cause a new violation of a state or federal ambient air quality standard nor make an existing violation significantly worse for nitrogen dioxide (NO_2), CO, particulate matter less than 10 microns in aerodynamic diameter (PM_{10}), particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$), and sulfur dioxide (SO_2). AES intends to submit an air quality impacts analysis to both the SCAQMD and CEC that evaluates the impacts from AEC commissioning, startup/shutdown, and normal facility operations. AES will also evaluate the demolition and construction-based air quality impacts per the CEC regulations. In addition, an assessment of the cumulative air quality impacts analysis and the potential human health risks associated with the Project will be performed. Although VOC emissions are included in the following discussion, there are no regulatory-approved models available for assessing VOC impacts on ambient ozone levels. As such, VOC emissions will not be modeled as part of the air quality impacts analysis. Similarly, although greenhouse gas (GHG) emissions are also included in the following discussion, they will not be modeled as part of the air quality impacts analysis.

The following discussion presents the protocol proposed for evaluating the potential air quality and public health impacts associated with demolition and construction, commissioning, and operation of the AEC.



Legend

Project Boundary

0 1 2 Miles

N

FIGURE 1-1
Regional Location Map
Alamitos Energy Center
Long Beach, California

CH2MHILL

SECTION 2.0

Existing Setting

This section describes the area designations and background concentrations associated with the Project.

2.1 Area Designations

The AEC will be located in Los Angeles County, California. Los Angeles County is in attainment for all federal National Ambient Air Quality Standards (NAAQS) with the exception of ozone, $PM_{2.5}$, and lead. Los Angeles County is in attainment for all California Ambient Air Quality Standards (CAAQS) with the exception of ozone, PM_{10}, $PM_{2.5}$, and lead. The area designations for each of the pollutants are included in Table 2-1.

Table 2-1. State and Federal Air Quality Designations for Los Angeles County (South Coast Air Basin), California

Pollutant	State Designation	Federal Designation
Ozone	1-Hour: Nonattainment (Extreme) 8-Hour: Nonattainment	1-Hour: N/A 8-Hour: Nonattainment (Extreme)
CO	1-Hour: Attainment 8-Hour: Attainment	1-Hour: Attainment 8-Hour: Attainment
NO_2	1-Hour: Attainment Annual: Attainment	1-Hour: Attainment Annual: Attainment
SO_2	1-Hour: Attainment 24-Hour: Attainment	1-Hour: Attainment 24-Hour: N/A
PM_{10}	24-Hour: Nonattainment Annual: Nonattainment	24-Hour: Attainment[a] Annual: N/A
$PM_{2.5}$	24-Hour: N/A Annual: Nonattainment	24-Hour: Nonattainment Annual: Nonattainment
Lead	Attainment	Nonattainment
H_2S and Sulfates	Unclassified, Attainment	N/A, N/A

[a] Effective July 26, 2013, the South Coast Air Basin was reclassified by the U.S. Environmental Protection Agency (EPA) from nonattainment to attainment with an approved maintenance plan for PM_{10} (78 Federal Register 38223; EPA-R09-OAR-2013-0007-0021).

Notes:

H_2S = hydrogen sulfide

N/A = Not applicable (i.e., no standard)

Sources: California Air Resources Board (ARB), 2013; EPA, 2015b

2.2 Background Concentrations

The four California Air Resources Board (ARB)-certified monitoring stations closest to the AEC site with three or more years of data available are located approximately 4.6 miles northwest of the site in (South) Long Beach, California (South Coastal Los Angeles County 2); 6.4 miles northwest of the site in (North) Long Beach, California (South Coastal Los Angeles County 1); 7.2 miles to the northwest of the site in (Hudson) Long Beach, California (South Coastal Los Angeles County 3, EPA ID 06-037-4006); and 10.1 miles to the east-northeast of the site in Anaheim, California (Central Orange County). One other ARB-certified monitoring station is located in Compton, California (South Central Los Angeles County). However, this monitoring station was relocated from Lynwood, California, in 2008 and is approximately

10.9 miles to the north-northwest of the site, which is farther from the site than the other monitoring stations identified. These ARB-certified monitoring stations will continue to be used for the AEC, as appropriate based on the following discussion.

Table 2-2 lists the pollutants monitored at each of the monitoring stations.

Table 2-2. Summary of the Closest Monitoring Stations and the Pollutants Monitored at Each Station

Monitoring Location (closest to farthest)	Ozone	CO	NO_2	SO_2	PM_{10}	$PM_{2.5}$	Lead
South Coastal Los Angeles County 2 (South Long Beach)	N/A	N/A	N/A	N/A	X	X	X
South Coastal Los Angeles County 1 (North Long Beach)	X	X	X	X	X	X	X
South Coastal Los Angeles County 3, EPA ID 06-037-4006 (Hudson Long Beach) [a]	X	X	X	X	N/A	N/A	N/A
Central Orange County (Anaheim)	X	X	X	N/A	X	X	N/A
South Central Los Angeles County (Compton) [b]	X	X	X	N/A	N/A	X	X

[a] Station, referred to as the Hudson site by the SCAQMD, was commissioned in 2010 and, at the request of the SCAQMD, is used to represent 1-hour NO_2 background concentrations because EPA Region 9 believes that it captures the large NO_x sources in the Ports area that are upwind of the AEC.

[b] Station is near the AEC, but not one of the three closest stations. The station has been presented for informational purposes.

Notes:

N/A = Not applicable (i.e., pollutant was not monitored at this location).

X = Pollutant monitored at this location.

As outlined in 40 CFR 51, Appendix W, Section 9.2, the background data used to evaluate the potential air quality impacts need not be collected on a project site, as long as the data are representative of the air quality in the subject area. The following three criteria were used for determining whether the background data are representative of the Project site: (1) location, (2) data quality, and (3) data currentness. These criteria are defined and apply to the Project as follows:

- **Location:** The measured data must be representative of the areas where the maximum concentration occurs for the proposed stationary source, existing sources, and a combination of the proposed and existing sources.

  The monitoring station nearest to the Project site is the South Long Beach monitoring station (South Coastal Los Angeles County 2). This monitoring station is located approximately 4.6 miles from the Project site. The proximity to the ocean is similar at both locations, and no significant terrain features are in the vicinity of either the Project site or monitoring station that would significantly affect the representativeness of the winds or monitored background concentrations. For the reasons noted previously, the South Long Beach monitoring station is considered the most representative location. However, because the South Long Beach monitoring station only measures PM_{10}, $PM_{2.5}$, and lead, the nearest representative location for the remaining pollutants was selected based on the surrounding features, as discussed below.

  The North Long Beach monitoring station (South Coastal Los Angeles County 1) is close to the AEC site (approximately 6.4 miles to the northwest), is located in an urban area near two large industrial sources (the Port of Long Beach and the Long Beach airport), and collects monitored background concentrations comparable to the other monitoring station options located in Long Beach. In addition, the North Long Beach monitoring station measures each of the pollutants required in the air quality impact analysis. The Anaheim monitoring station (Central Orange County) is directly downwind from the Project site, but is farther from the Project site (approximately 10.1 miles to the east-northeast), farther inland than the Project site, and collects monitored background concentrations lower than those collected at the North Long Beach monitoring station (i.e., the North Long Beach monitoring station represents a more conservative analysis).

Based on the information above, the ambient data collected at the North Long Beach monitoring station are considered representative of the Project site for the pollutants not monitored at the South Long Beach monitoring station, unless otherwise noted below. Additionally, a meteorological dataset has also been collected at the North Long Beach monitoring station and is considered representative of the Project site using the criteria above (see Section 4.0, Topography and Meteorology).

At the request of SCAQMD, NO_2 data collected at the Hudson Long Beach monitoring station (South Coastal Los Angeles County 3, EPA ID 06-037-4006) are considered representative of the Project site. This monitoring station is located approximately 7.2 miles to the northwest of the Project site and is considered representative because it captures the large NO_x-emitting sources in the Ports area that are upwind of the Project.

- **Data quality:** Data must be collected and equipment must be operated in accordance with the requirements of 40 CFR 58, Appendixes A and B, and PSD monitoring guidance.

  The SCAQMD, ARB, and EPA ambient air quality data summaries will be used as the primary sources of data. Therefore, the data at all five monitoring stations listed in Table 2-2 will meet the data quality requirements of 40 CFR 58, Appendixes A and B, and PSD monitoring guidance.

- **Data currentness:** The data are current if they have been collected within the preceding 3 years and are representative of existing conditions.

  The ambient background concentrations from the most recent 3-year period will be combined with the modeled concentrations and used for comparison to the ambient air quality standards. Therefore, the data at all five monitoring stations listed in Table 2-2 represent the three most recent years of available data.[1]

Based on the criteria presented previously, the three most recent years of background hourly NO_2 data from the Hudson Long Beach monitoring station, the three most recent years of background annual NO_2, ozone, SO_2, and CO data from the North Long Beach monitoring station, and the three most recent years of background PM_{10}, $PM_{2.5}$, and lead data from the South Long Beach monitoring station will be combined with the modeled concentrations and used for comparison to the ambient air quality standards. A summary of the background concentrations for 2009 through 2013 is presented in Table 2-3.

[1] It should be noted that the recently established site in Long Beach (South Coastal Los Angeles County 3, EPA ID 06-037-4006) does not have three complete years of data available. In 2012, NO_2 was only monitored during peak conditions; therefore, the collected data do not meet the completeness criteria for an annual averaging time.

Table 2-3. Background Air Concentrations (2009-2013) [a]

Pollutant	Averaging Time	2009		2010		2011		2012		2013		Maximum	Average
		ppm	µg/m³	ppm	µg/m³	ppm	µg/m³	ppm	µg/m³	ppm	µg/m³	µg/m³	µg/m³
Ozone [b]	1-hour	0.089	175	0.101	198	0.073	143	0.084	165	INC	INC	198	--
	8-hour	0.068	133	0.084	165	0.061	120	0.067	132	INC	INC	165	--
CO [b]	1-hour	3.0	3,437	3.0	3,437	3.2	3,666	2.6	2,979	INC	INC	3,666	--
	8-hour	2.6	2,520	2.1	2,406	2.6	2,979	2.2	2,520	INC	INC	2,979	--
NO_2	1-hour (maximum) [c]	--	--	0.1180	222	0.0900	169	0.0905	170	0.0813	153	170	--
	1-hour (98th percentile) [c]	--	--	0.0710	134	0.0740	139	0.0774	146	0.0713	134	--	140
	Annual [b,d]	0.0212	39.9	0.0198	37.3	0.0177	33.3	INC	INC	INC	INC	39.9	--
SO_2 [b]	1-hour (maximum)	0.0200	52.4	0.0400	105	0.0148	38.8	INC	INC	INC	INC	105	--
	1-hour (99th percentile)	0.0120	31.4	0.0160	41.9	0.0107	28.0	INC	INC	INC	INC	--	33.8
	3-hour [e]	0.0200	52.4	0.0400	105	0.0148	38.8	INC	INC	INC	INC	105	--
	24-hour	0.005	13.1	0.006	15.7	0.004	10.5	INC	INC	INC	INC	15.7	--
PM_{10} [f]	24-hour	--	83	--	76	--	50	--	54	--	54	54	--
	Annual	--	33.2	--	27.3	--	28.7	--	25.5	--	27.3	28.7	--
$PM_{2.5}$ [f]	24-hour (98th percentile)	--	30.5	--	26.5	--	26.6	--	25.1	--	24.6	--	25.4
	Annual	--	12.5	--	10.4	--	10.7	--	10.6	--	10.97	10.97	--
Lead [d]	Monthly (max.)	--	0.010	--	0.010	--	0.013	--	NA	--	0.012	0.013	--
	Quarterly (Max.)	--	0.010	--	0.010	--	0.009	--	NA	--	0.009	0.010	--

[a] The SCAQMD, ARB, and EPA ambient air quality data summaries were used as reference.

[b] Data from the North Long Beach monitoring station.

[c] Data from the Hudson Long Beach monitoring station.

[d] Annual Arithmetic Mean.

[e] Background concentrations for the 3-hour EPA Secondary Standard for SO_2 were not available for the three most recent years. Therefore, the maximum 1-hour background concentrations were conservatively used.

[f] Data from the South Long Beach monitoring station.

Notes:

INC = The data collection was incomplete for these years.
µg/m³ = microgram(s) per cubic meter
NA = Background data were not available for these years.
ppm = parts per million

Sources: SCAQMD, 2015b; ARB, 2015; EPA, 2015a

SECTION 3.0

Methodology for Estimating Project-Related Emissions

This section presents the methodology for estimating Project-related emissions from demolition and construction, commissioning, and operation.

3.1 Demolition and Construction

Approximately 39 acres will be disturbed at the AEC site during demolition and construction activities. Onsite demolition activities will include removal of existing Alamitos Generating Station Units 1 through 7, the Unit 7 fuel tank, and the northeast warehouse. Demolition of the existing units will include an organized, top-down dismantling of the existing boiler units, generators, and stacks. The existing foundations will remain largely intact at the conclusion of the demolition activities, and most of the demolition debris will be transported to an offsite location for recycling. No overlap in demolition and construction activities is expected. Onsite construction activities will consist of installing two new combined-cycle gas turbines, four simple-cycle gas turbines, various auxiliary equipment, and administrative structures. To the maximum extent possible, the AEC will reuse existing onsite potable water, natural gas, and stormwater pipelines, as well as electrical transmission facilities; however, some modification and interconnection of the AEC into these systems will require construction activity. Additionally, the Project will include construction of a new 1,000-foot offsite wastewater pipeline and the potential need to upgrade up to 4,000 feet of an existing offsite sanitary pipeline.

Onsite and offsite Project emissions will be divided into three categories: (1) vehicle and construction equipment exhaust; (2) fugitive dust from vehicle and construction equipment, including grading and bulldozing during construction; and (3) fugitive dust from demolition activities such as the top-down removal of the boiler stack and loading waste haul trucks with the generated debris.

The following criteria pollutant emissions will be calculated: NO_x, sulfur oxides (SO_x), VOCs, CO, PM_{10}, and $PM_{2.5}$. Fugitive dust and construction equipment exhaust emissions will be estimated using methodology and emission factors consistent with the California Emissions Estimator Model (CalEEMod; Version 2013.2.2), which incorporates OFFROAD2011 and portions of EPA's *AP-42* (ENVIRON, 2013; SCAQMD et al., 2011). Vehicle exhaust emissions for travel on both paved and unpaved roads will be estimated using EMFAC2014 (Version 1.0.1) emission factors, as consistent with the CalEEMod methodology.[2]

GHG emissions from construction equipment exhaust will be estimated using emission factors from The Climate Registry (TCR) General Reporting Protocol (GRP, Version 2.0) (TCR, 2014) and fuel consumption rates from OFFROAD2011. GHG emissions from vehicle exhaust for truck trips and worker commutes will be estimated using emission factors from TCR GRP (Version 2.0) (TCR, 2014) and fuel economy values from EMFAC2014 (Version 1.0.1). No significant emissions of hydrofluorocarbons, perfluorocarbons, or sulfur hexafluoride (SF_6) are expected during construction and demolition.

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[2] CalEEMod is a statewide computer model created by ENVIRON and the SCAQMD to quantify criteria pollutant and GHG emissions associated with the construction activities from a variety of land use projects (ENVIRON, 2013). Developed in cooperation with air districts throughout the state, CalEEMod is intended to standardize air quality analyses while allowing air districts to provide specific defaults reflecting regional conditions, regulations, and policies (SCAQMD et al., 2011). CalEEMod is generally viewed as an improvement and replacement of URBEMIS2007 by providing updated factors, methodologies, and defaults that are robustly documented.

3.2 Commissioning

During the commissioning phase of the AEC, the GE 7FA.05s and the GE LMS100PBs initially will be operated at various load rates without the benefit of the emission control systems to facilitate proper operation of the equipment. However, maximum hourly emission rates for SO_2, PM_{10}, and $PM_{2.5}$ are expected to be equal to or lower than normal operating rates owing to reduced loads during commissioning. Therefore, emission calculations for commissioning activities will be limited to NO_x, CO, and VOC. The NO_x, CO, and VOC emissions will be estimated based on turbine performance data provided by the vendor, estimated durations and control efficiencies of each commissioning event, and turbine operating rates.

3.3 Operation

Emissions of NO_2, SO_2, CO, VOC, PM_{10}, and $PM_{2.5}$ to the atmosphere from the AEC will occur from combustion of natural gas in the combustion turbines. Emission rates will be calculated based on vendor data and additional conservative assumptions of turbine performance. Turbine emissions and stack parameters, such as flow rate and exit temperature, will exhibit some variation with ambient temperature and operating load. Therefore, to evaluate the worst-case air quality impacts during normal operation, dispersion modeling for each combustion turbine will be conducted at a minimum, intermediate, and 100 percent load at 28, 65.3, and 107 degrees Fahrenheit (°F), representing minimum, average, and maximum temperatures at the Project site. In addition to the normal operating load/temperature scenarios, emission estimates and an air quality impacts analysis will also be conducted for startup and shutdown events.

The preliminary annual AEC PTE of criteria pollutants are presented in Table 3-1. The combined-cycle PTE is based on 5,000 hours of base load operation per turbine per year and the simple-cycle PTE is based on 1,250 hours of base load operation per turbine per year. Startup and shutdown emission rates are not available at this time, but will be incorporated into the dispersion modeling analysis.

Table 3-1. Preliminary Annual Facility Emission Estimates

	Facility Emission Totals – Tons Per Year (Estimate)					
Facility	**NO_x**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**CO**
AEC (PTE) [a]	131	11.3 [b]	68.7	68.7	46.7	243

[a] Assumes the combined-cycle turbines are operated 5,000 hours per year and the simple-cycle turbines are operated 1,250 hours per year, excluding startup and shutdown emissions.

[b] Assumes an annual average fuel sulfur content of 0.25 grains per 100 standard cubic feet.

Combustion of natural gas in the turbines will also result in emissions of the following GHGs: carbon dioxide, methane, and nitrous oxide. Therefore, GHG emissions for normal facility operations will be calculated based on the maximum fuel usage predicted for the AEC and emission factors contained in TCR GRP (Version 2.0) (TCR, 2014). GHGs may also be emitted as SF_6 from annual leakage of SF_6-containing circuit breakers; these emissions are expected to be negligible compared to combustion emissions.

Criteria pollutant and GHG emissions from AEC operational worker commutes and material deliveries will also be calculated. Criteria pollutant emissions will be estimated using emission factors from EMFAC2014 (Version 1.0.1). GHG emissions will be estimated using emission factors from TCR GRP (Version 2.0) (TCR, 2014) and fuel economy values from EMFAC2014 (Version 1.0.1). Criteria pollutant and GHG emissions from AEC operational worker commutes and material deliveries will be calculated for CEC informational purposes, but will not be included in the air quality impacts analysis.

Topography and Meteorology

This section provides a summary-level description of the topography and meteorology associated with the Project.

4.1 Topography

The AEC site is located near sea level, approximately 2 miles from the California coast, and is bounded to the north by a switchyard; to the east by the San Gabriel River and, beyond that, a power generating facility; to the south by a petroleum storage facility and undeveloped property; and to the west by the Los Cerritos Channel, Alamitos Generating Station inlets, and city of Long Beach residences.

The AEC site is located on a gently sloping coastal terrace above the Alamitos Bay marina, and the topography of the site ranges from approximately 7 to 20 feet above mean sea level. The nearest complex terrain (terrain exceeding stack height) in relation to the AEC is located in the city of Signal Hill, approximately 3.5 miles northwest of the AEC site. Although Signal Hill is the highest area within 6 miles of the AEC site, it is not a significant terrain feature, with gradual rising terrain less than 0.5 mile in width. The nearest Class I area is the San Gabriel Wilderness, which is approximately 33 miles (approximately 53 kilometers [km]) northeast of the AEC site.

4.2 Meteorology

4.2.1 Meteorology for Dispersion Modeling

According to EPA's *Guideline on Air Quality Models* (EPA, 2005), representativeness of meteorological data used in dispersion modeling depends on (1) the proximity of the meteorological monitoring site to the area under consideration; (2) the complexity of the terrain; (3) the exposure of the meteorological monitoring site; and (4) the period of time during which data are collected.

Two SCAQMD meteorological data collection sites were identified in proximity to the Project: Long Beach, which is collocated with the North Long Beach ambient monitoring station, and Anaheim. Of the two locations, the Long Beach site was selected as the most representative based on the following factors:

- The monitoring site is the closer of the two to the Project (approximately 6.4 miles to the northwest of the AEC site, versus 10.1 miles to the east-northeast for the Anaheim monitoring station).
- There are no complex terrain features between the two locations.
- The land uses surrounding the monitoring site and the AEC site are similar (both are surrounded by a blend of low-, medium-, and high-intensity land uses with open water less than 10 miles to the south-southwest).

Therefore, the Long Beach station is considered representative of the AEC site, and the meteorological data collected at the Long Beach station will be used to model the ambient air quality impacts. The meteorological data used for this analysis have been compiled by SCAQMD specifically for use in dispersion modeling analyses and include the periods of January 1, 2007, through December 31, 2012.[3] A wind rose for the Long Beach monitoring station is presented in Figure 4-1.

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[3] At the direction of the SCAQMD, 2010 meteorological data were not recommended for use because the data do not meet the 90 percent completeness requirements. Similarly, 2012 meteorological data were not recommended for use because the collected wind speeds are suspect.

4.2.2 Upper Air Data

Twice-daily National Climatic Data Center soundings from the National Weather Service San Diego Miramar station (Station #03190) will be coupled with the Long Beach surface data provided by SCAQMD to create the AERMET meteorological dataset.

4.2.3 AERMET Preprocessing

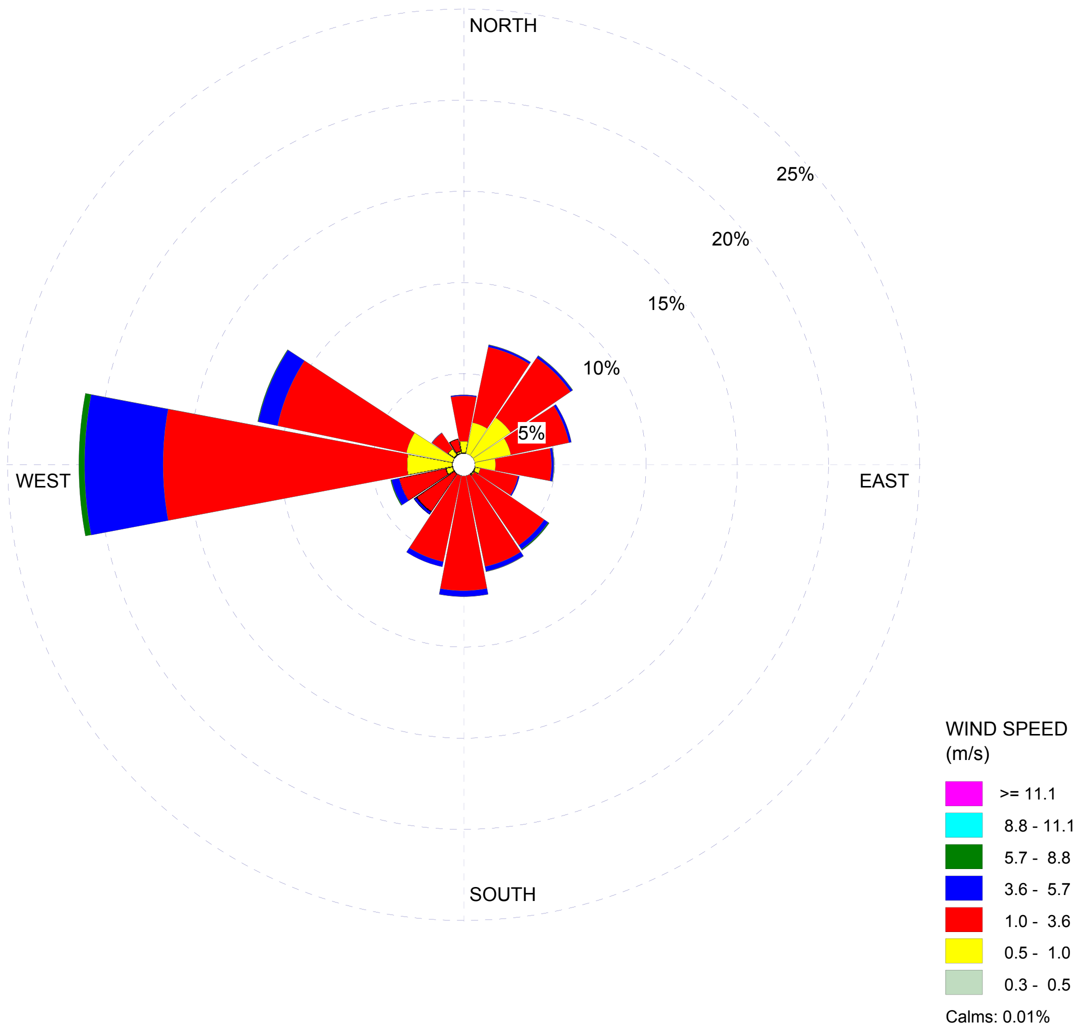
Processing of the meteorological data will be performed using the latest version of AERMET (currently Version 15181). These data will be obtained directly from SCAQMD, if available. If these data are not available, raw surface data files will be requested from SCAQMD and the data will be processed using the latest version of AERMET according to the procedures outlined in EPA's *Guideline on Air Quality Models* (EPA, 2005).

WIND ROSE PLOT:

AERMET Meteorological Data
SCAQMD Long Beach Station

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 1/1/2006 - 00:00 **End Date: 12/31/2011 - 23:00**	MODELER:	
	CALM WINDS: **0.01%**	TOTAL COUNT: **43378 hrs.**	
	AVG. WIND SPEED: **1.88 m/s**	DATE: **12/6/2013**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

FIGURE 4-1
SCAQMD Long Beach
Meteorological Station Wind Rose
Alamitos Energy Center
Long Beach, California

CH2MHILL.

Dispersion Modeling Approach

This section describes the proposed approach to dispersion modeling. Model selection, input defaults/options, land use/designation, the receptor network, source characterization, and building wake downwash and good engineering practice are summarized.

5.1 Model Selection

The EPA-approved AERMOD (Version 15181 or most recent version) dispersion model will be used to evaluate the air quality emissions from the AEC. AERMOD is the latest generation of EPA's short-term model recommended for predicting impacts from industrial-point sources, as well as area and volume sources.

5.2 Model Input Defaults/Options

AERMOD will be used with regulatory default options, as recommended in EPA's *Guideline on Air Quality Models* (EPA, 2005). The following supporting preprocessing programs for AERMOD will also be used:

- BPIP-Prime (Version 04274)
- AERMAP (Version 11103)

The technical options to be selected for AERMOD include the following:

- Regulatory default control options
- Receptor elevations and controlling hill heights obtained from AERMAP output

The emission units will be modeled as point sources within AERMOD. Emission rates and other source parameters will be determined from the manufacturer's data or EPA-established emission factors.

Initially, a complete conversion of NO_x emissions to NO_2 will be assumed. If this assumption leads to predicted exceedances of the NAAQS, CAAQS, or significance criteria for NO_2 identified in Section 6.0, Air Quality Impacts Analysis, the default ambient ratios of 0.75 NO_2/NO_x (i.e., 75 percent of NO_x emissions are converted to NO_2) and 0.80 will be applied to annual and 1-hour predicted impacts, respectively, to determine NO_2 concentrations (EPA, 2005; EPA, 2011). If 1-hour predicted NO_2 impacts still exceed the NAAQS after application of the ambient ratio, the predicted impacts will instead be estimated by pairing the maximum modeled concentration with the 98th percentile seasonal, hour-of-day NO_2 background concentrations. The 98th percentile seasonal, hour-of-day NO_2 background concentrations for 2011 through 2013 or 2014, depending on EPA Air Quality System data availability for the Hudson Long Beach ambient monitor, will be processed following applicable EPA guidance (EPA, 2011).

If predicted 1-hour NO_2 impacts require further refinement, the plume volume molar ratio method (PVMRM) will be used. PVMRM options will assume an initial in-stack NO_2/NO_x ratio of 0.5 and an out-of-stack NO_2/NO_x ratio of 0.9 (EPA, 2011; California Air Pollution Control Officers Association, 2011). Corresponding hourly ozone data from the North Long Beach monitoring station will be provided via e-mail by the SCAQMD.

5.3 Land Use/Designation

AERMOD will be run in urban dispersion mode because land use within 3 km of the AEC site is primarily classified as urban (Auer Method). A population of 9,862,049 will be used in AERMOD, as recommended by SCAQMD for projects in Los Angeles County (SCAQMD, 2015a).

5.4 Receptor Network

The base receptor grid for the AERMOD modeling will consist of receptors that are placed at the ambient air boundary and Cartesian-grid receptors that are placed beyond the Project's property boundary, at spacing that increases with distance from the origin. The Project's property boundary will be used as the ambient air boundary. Property boundary receptors will be placed at 30-meter intervals. Beyond the Project's property boundary, receptor spacing will be as follows:

- 50-meter spacing from property boundary to 500 meters from the origin
- 100-meter spacing from beyond 500 meters to 3 km from the origin
- 500-meter spacing from beyond 3 km to 10 km from the origin
- 1,000-meter spacing from beyond 10 km to 25 km from the origin
- 5,000-meter spacing from beyond 25 km to 50 km from the origin

All receptors and source locations will be expressed in the Universal Transverse Mercator (UTM) North American Datum 1983 (NAD83), Zone 11 coordinate system.

The base receptor grid will be extended if predicted concentration gradients increase at the edge of the grid. The base (coarse) receptor grid will be supplemented with receptors at closer (tighter) receptor spacing, where appropriate, so that the maximum points of impact have been identified.

AERMAP (Version 11103) will be used to calculate the receptor elevations and the controlling hill heights. Terrain in the vicinity of the Project will be accounted for by assigning base elevations to each receptor. National Elevation Dataset files from the U.S. Geological Survey will be obtained in one-third arc-second resolution for the 50-km grid. The AERMAP domain will be large enough to encompass the 10 percent slope factor required for calculating the controlling hill height.

5.5 Source Characterization

5.5.1 Demolition and Construction

The AEC construction site will be represented as a set of point sources and area sources in the modeling analysis. The exhaust emissions will be modeled as a set of point sources spaced approximately 25 meters (82 feet) apart over the construction areas with a horizontal stack release. The horizontal release type is an AERMOD beta option (i.e., nonregulatory default option), which negates mechanical plume rise. This conservative approach is proposed because it is unknown whether the construction equipment will have vertically oriented exhaust stacks. Stack release parameters will consist of a stack release temperature of 533 degrees Kelvin (K; 500°F), a stack diameter of 0.127 meter (5 inches), and a release height of 4.6 meters (15 feet) based on data for typical construction equipment. The wind-blown and fugitive dust emissions will be modeled as area sources assuming a ground-level release height with an initial vertical dimension of 1 meter.

As discussed in Section 6.0, Air Quality Impacts Analysis, predicted concentrations of NO_x, CO, PM_{10}, $PM_{2.5}$, and SO_2 from onsite construction-related activities will be combined with the ambient background concentrations and compared to the ambient air quality standards. Note that if the predicted concentrations initially exceed the ambient air quality standards, the model will be refined to limit the hours in which concentrations are predicted to align with the expected hours of construction activities.

5.5.2 Commissioning

Each of the combustion turbine exhaust stacks will be modeled as point sources within AERMOD. Exhaust parameters will be based on information provided by the vendor for each combustion turbine type and commissioning phase. Only maximum hourly impacts for NO_x and CO will be modeled for each commissioning phase. Emission rates of PM_{10}, $PM_{2.5}$, and SO_x are expected to be equal to or lower than normal operating rates as a result of reduced loads during commissioning.

Although commissioning is expected to be completed in less than 1 year, annual impacts for the combined commissioning and operation for a rolling 12-month period will also be evaluated because annual emissions during the commissioning year could be higher than those during a noncommissioning year. As a result, annual NO_x, PM_{10}, and $PM_{2.5}$ impacts from commissioning with operation will also be modeled.

5.5.3 Operation

The proposed combustion turbines will be modeled as point sources within AERMOD. Exhaust parameters will be based on information provided by the vendor. The modeling analysis will include a load screening to determine which operating conditions, including startup and shutdown of the combustion turbines, will yield the highest ground-level concentrations. Owing to the timing of the construction of the combined- and simple-cycle turbines, a number of operational scenarios will be modeled to reflect expected operating conditions. Where necessary, modeling will include both construction/demolition emission sources and commissioning emissions for the simple-cycle turbines while the combined-cycle turbines are in commercial operation.

5.6 Building Wake Downwash and Good Engineering Practice

AERMOD can account for building downwash and cavity zone effects. Existing Alamitos Generating Station and the AEC stack locations, heights, building locations, and dimensions will be input to BPIP-PRIME (Version 04274). The first step of BPIP-PRIME determines and reports on whether a stack follows good engineering practice or is being subjected to wake effects from a structure or structures. The second step calculates direction-dependent equivalent building dimensions if a stack is being influenced by structure wake effects. The BPIP-PRIME output will be used in the AERMOD modeling.

SECTION 6.0

Air Quality Impacts Analysis

The AEC will require an ambient air quality impacts analysis for emissions of CO, NO_X, SO_2, and $PM_{10/2.5}$. This section summarizes the approach used to address the requirements applicable to each reviewing agency and highlights the criteria required for each analysis.

6.1 SCAQMD New Source Review

6.1.1 Rule 1303 and Rule 1304

SCAQMD Rule 1303 requires an ambient air quality impacts analysis for each new emission source to demonstrate that a proposed project will not cause a violation or make significantly worse an existing violation of the CAAQS or NAAQS. However, under SCAQMD Rule 1304(a)(2), the AEC is exempt from this rule because it is a replacement of existing electric utility steam boilers with combined-cycle and advanced simple-cycle gas turbines with no increase in basin-wide energy capacity. Therefore, a comparison of potential impacts to the significant change in air quality thresholds of SCAQMD Rule 1303, Table A-2, is not required as part of this air quality impacts analysis.

Per SCAQMD Rule 1303(b)(5)(C), a modeling analysis is required to evaluate impacts on plume visibility if the net emission increase from the new or modified source exceeds 15 tpy of PM_{10} or 40 tpy of NO_x, and the location of the source, relative to the closest boundary of a specified Federal Class I area, is within 28 km. Net emissions of NO_x will exceed the emissions threshold, but the distance to the nearest Class I area is approximately 53 km, as presented in Figure 6-1. Therefore, a visibility analysis is not required for Class I areas under SCAQMD Rule 1303.

Although not required by its rules, SCAQMD requested an analysis of the Project's impacts on visibility for nearby State Parks and National Wilderness Areas designated as Class II areas. As such, a visibility analysis for Class II areas will be performed using the EPA-recommended VISCREEN model. The general procedures to determine visibility impacts will follow the approach outlined in the *Workbook for Plume Visual Impact Screening and Analysis (Revised)* (EPA, 1992), with clarification of the following particular inputs:

- Background visual ranges for the Class II areas will be determined using maps supplied by the Interagency Monitoring of Protected Visual Environments (IMPROVE). The average of the annual upper and lower bounds will be used.
- If a Tier 1 approach exceeds the Class I criterion for color difference (ΔE) and contrast, a Tier II assessment will be conducted. The Tier II assessment will use the SCAQMD Long Beach meteorological station data described previously. These data will be preprocessed with the EPA Meteorological Processor for Regulatory Modeling Applications (MPRM, Version 99349) for the Industrial Source Complex (ISC) modeling system.[4]

Based on a survey of State Parks and National Wilderness Areas designated as Class II areas within 50 km of the AEC, AES proposes to include the following Class II areas in the visibility assessment, as presented in Figure 6-2:

- Crystal Cove State Park
- Water Canyon National Park

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[4] ISC-ready data, preprocessed with MPRM, contain the wind speed, wind direction, and stability class for each hour of the year. These data are required to create the Joint Frequency Distribution tables used to calculate the Tier II wind speed and stability class for each area analyzed.

- Chino Hills State Park
- Kenneth Hahn State Park

6.1.2 Rule 1401

SCAQMD Rule 1401 specifies limits for maximum individual cancer risk, cancer burden, and noncancer acute and chronic hazard index (HI) from new permit units, relocations, or modifications to existing permit units that emit toxic air contaminants (TAC) listed in SCAQMD Rule 1401, Table I. The AEC will be subject to the SCAQMD Rule 1401 NSR requirements. Therefore, a health risk assessment (HRA) will be completed as part of the air quality impacts analysis for the AEC. The procedure for evaluating the potential impacts is discussed in Section 7.0, Human Health Risk Assessment.

6.1.3 Rule 2005

SCAQMD Rule 2005 sets forth preconstruction review requirements for new facilities subject to the requirements of the Regional Clean Air Incentives Market (RECLAIM) program, for modifications to RECLAIM facilities, and for facilities that increase their allocation to a level greater than their starting allocation plus nontradable credits. The existing AES Alamitos Generating Station facility is currently subject to RECLAIM requirements, and, as shown in Table 6-1, the Project will also exceed the major NO_X modification threshold of 1 pound (lb) per day. Therefore, SCAQMD Rule 2005 requires an ambient air quality impacts analysis to demonstrate the AEC will not cause a significant increase in the air quality concentration of NO_X, as specified in SCAQMD Rule 2005, Appendix A.

Table 6-1. Rule 2005 Emissions Levels That Trigger Dispersion Modeling Requirements

Pollutant	Estimated PTE (tpy)	Major Source Threshold	Major Modification Threshold	Exceeds Threshold? (Yes/No)
NO_x	131	10	1 lb/day	Yes
SO_2	11.3 [a]	100	40 tpy	No

[a] Assumes an annual average fuel sulfur content of 0.25 grains per 100 standard cubic feet.

Note:

lb/day = pounds per day

The significance thresholds and the most stringent air quality standards for NO_2 are presented in Table 6-2. The maximum modeled NO_2 concentrations from the refined dispersion modeling analysis for each turbine will be compared to the significance values identified in Table 6-2. The maximum modeled NO_2 concentrations will also be added to representative background concentrations, and the results compared to the state and federal ambient air quality standards for NO_2. The highest ambient concentration from the most recent three years of ambient monitoring data will be used as the background concentration.

Table 6-2. Rule 2005 Air Quality Thresholds and Standards Applicable to the Project (Per Emission Unit)

Averaging Period/ Pollutant	Significant Change in Air Quality Concentration [a] ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)	CAAQS ($\mu g/m^3$)
NO_2 (1-hour)	20	188 [b]	339
NO_2 (Annual)	1	100	57

[a] Allowable change in air quality concentration per emission unit.

[b] National 1-hour standard represents the 3-year average of the 98^{th} percentile of the daily maximum 1-hour average.

Note:

$\mu g/m^3$ = micrograms per cubic meter

6.2 Prevention of Significant Deterioration

SCAQMD Regulation XVII sets forth preconstruction review requirements for stationary sources to ensure that air quality in clean air areas does not significantly deteriorate, while maintaining a margin for future industrial growth. This requirement applies to preconstruction review of new or modified stationary sources that emit more than 100 tpy of federal attainment air contaminants. As discussed in Section 2.0, Existing Setting, CO, NO_2, PM_{10}, and SO_2 are designated as federal attainment pollutants. Therefore, the estimated AEC emissions were compared to the major source thresholds of 100 tpy and the significant emissions increase threshold of 40 tpy (Table 6-3) to determine which pollutants are subject to dispersion modeling requirements as outlined in SCAQMD Rule 1703. Note that although the AEC is not expected to emit more than 100 tpy of PM_{10}, PM_{10} impacts were also evaluated against the significant emissions increase threshold of 15 tpy because of Los Angeles County's new designation as an attainment area for PM_{10}. Based on the estimated emissions and attainment designations, NO_x, CO, and PM_{10} are the only attainment pollutants from the AEC that will exceed the significant emissions increase thresholds and be subject to dispersion modeling requirements.

Low-sulfur natural gas will be the only fuel allowed for the AEC. Therefore, emissions of asbestos, beryllium, mercury, sulfur compounds, vinyl chloride, fluoride, lead, and sulfur compounds are expected to be negligible.

Table 6-3. Preliminary PSD Emissions Levels That Trigger Dispersion Modeling Requirements

Pollutant	Estimated PTE (tpy)	Significant Emission Increase Threshold [a] (tpy)	Exceeds Threshold? (Yes/No)
CO	243	100	Yes
NO_x	131	40	Yes
SO_2	11.3 [b]	40	No
PM_{10}	68.7	15	Yes
VOC [c]	46.7	40	Yes
Asbestos	Negligible	0.007	No
Beryllium	Negligible	0.0004	No
Mercury	Negligible	0.1	No
Vinyl Chloride	Negligible	1.0	No
Fluorides	Negligible	3	No
Lead	Negligible	0.6	No
Sulfuric Acid Mist	Negligible	7	No
Hydrogen Sulfide	Negligible	10	No
Total Reduced Sulfur (including H_2S)	Negligible	10	No

[a] The PSD significance level is listed here for reference.

[b] Assumes an annual average fuel sulfur content of 0.25 grains per 100 standard cubic feet.

[c] Modeling is not required for VOCs.

6.3 Class II Area Analysis

Based on the emissions presented in Table 6-3, a dispersion modeling analysis will be conducted to demonstrate that the AEC will not cause or contribute to a violation of the NAAQS or CAAQS and will not exceed the federal PSD Class II Increment Standards for NO_2, CO, and PM_{10}. To demonstrate compliance with the standards, the AEC will be modeled in two tiers. A description of each tier is presented below. Modeling for either tier will be performed per the methodology described in Section 5.0, Dispersion Modeling Approach, unless otherwise noted below.

6.3.1 Tier 1 Analysis

Using the worst-case load identified as part of the operations modeling, the preliminary Tier 1 analysis for each pollutant will be conducted as follows:

- If the predicted impacts are less than the significant impact levels (SIL) presented in Table 6-4 for each criteria pollutant, the modeling is complete for that pollutant and averaging period.
- If the predicted impacts are significant, a Tier 2 refined analysis will be conducted.

Table 6-4 summarizes the Class II SILs, PSD Class II Increment Standards, and the significant monitoring concentration levels. Currently, no ambient air quality data are collected at the existing Alamitos Generating Station. If modeling results for the AEC are greater than the significant monitoring concentrations listed in Table 6-4, onsite ambient air quality data collection may be required. If such monitoring is required, AES requests that the monitoring be conducted in parallel with construction of the AEC and that alternate background concentrations listed in Table 2-3 be used for permit modeling.

Table 6-4. PSD Air Quality Impact Standards Applicable to the Project

Averaging Period/ Pollutant	Significant Impact Level ($\mu g/m^3$)	PSD Class II Increment Standard ($\mu g/m^3$)	Significant Monitoring Concentrations ($\mu g/m^3$)
NO_2 (1-hour)	7.52[a]	N/A	N/A
NO_2 (Annual)	1.0	25	14
CO (1-hour)	2,000	N/A	N/A
CO (8-hour)	500	N/A	575
PM_{10} (24-hour)	5.0	30	10
PM_{10} (Annual)	1.0	17	N/A

[a] The SIL for 1-hour NO_2 is based on SCAQMD correspondence.

N/A = Not applicable (i.e., no standard)

6.3.2 Tier 2 Analysis

The refined Tier 2 analysis will include a comparison to the ambient air quality standards and PSD Class II Increment Standards, as follows:

- For pollutants with concentrations greater than the respective SIL, a significant impact radius will be defined.
- The maximum modeled concentrations will be determined and compared to the NAAQS, CAAQS, and PSD Class II Increment Standards, as appropriate. These concentrations will include contributions from the facility, competing nearby sources, and ambient background concentrations.
- SCAQMD will be consulted to identify competing nearby sources and exhaust characteristics, if available, for inclusion in the refined analysis. Section 6.3.2.1, Competing Source Inventory, summarizes the approach to develop the competing source inventory.
- Only receptors identified above the SIL in the Tier 1 analysis will be included in the Tier 2 analysis.

- Background concentrations described in Section 6.3.2.2, 1-hour NO_2 Refined Analysis, will be included in the Tier 2 analysis.

6.3.2.1 Competing Source Inventory

It is anticipated that the 1-hour NO_2 SIL will be exceeded by operation of the AEC. At the request of SCAQMD, the Hudson Long Beach monitoring station (South Coastal Los Angeles County 3, EPA ID 06-037-4006) will be used as the ambient monitor because it captures the large NO_x-emitting sources in the Ports area that are upwind of the Project. Based on the to-be-determined significant impact radius and the location of the representative ambient monitor, AES proposes to include competing sources within a distance of 10 km of the significant impact radius in the analysis. AES proposes to use the competing source inventory of NO_x-emitting sources that was provided by SCAQMD in October 2013, which is included as Attachment 1. AES still considers this inventory representative of emission sources within 10 km of the AEC site and requests that SCAQMD again approve this inventory for use in this competing source analysis.

6.3.2.2 1-hour NO_2 Refined Analysis

Emergency equipment will not be included in the 1-hour NO_2 competing source analysis. Consistent with recent EPA guidance addressing intermittent emissions for the 1-hour NO_2 analysis (EPA, 2011), exclusion of emergency equipment is appropriate. Startup emissions from the AEC turbines will be included in the 1-hour NO_2 competing source analysis because startups of the units are expected to occur frequently.

Further refinements of the 1-hour NO_2 modeling include the incorporation of seasonal, hour-of-day NO_2 background concentrations and the use of an ambient NO_2 equilibrium ratio and PVMRM in AERMOD, if necessary, described as follows:

- Seasonal, hour-of-day NO_2 background concentrations will be determined by following the most recent EPA NO_2 modeling guidance (EPA, 2011). This includes using the third-highest concentration for each hour-of-day, by season, at the NO_2 monitor. AERMOD will automatically pair the modeled NO_2 concentration to the appropriate background concentration for each hour to determine the model design concentration for comparison to the NAAQS. The 98th percentile seasonal, hour-of-day NO_2 background concentrations for 2011 through 2013 or 2014, depending on EPA Air Quality System data availability for the Hudson Long Beach ambient monitor, will be processed following applicable EPA guidance (EPA, 2011).
- The Ambient Ratio Method uses 0.80 as a default ambient ratio for the 1-hour NO_2 standard.
- PVMRM options, if needed, will initially conservatively assume an in-stack NO_2/NO_x ratio of 0.5 and an ambient NO_2 ratio of 0.9 (EPA, 2011). If additional analysis is required, AES will consult with the SCAQMD to define alternative appropriate in-stack and ambient NO_2 ratios consistent with EPA guidance. Corresponding hourly ozone data from a representative background monitoring station will be provided via e-mail by the SCAQMD.

To complete the refined 1-hour NO_2 competing source analysis, hourly emissions from the competing sources approved by SCAQMD will be modeled by apportioning each source's permitted emissions (tpy) evenly throughout the year, unless otherwise noted. The model design concentration of the 5-year average of the 98th percentile hourly impact at each receptor will be compared to the NAAQS of 188 micrograms per cubic meter ($\mu g/m^3$).

If the model design concentration at any receptor exceeds the NAAQS, the Project's impacts during the NAAQS exceedances will be evaluated and compared to the SIL. If the Project's impacts are below the SIL during all modeled exceedances of the NAAQS, then the Project will be assumed to not significantly contribute to the modeled exceedances.

6.4 Class I Area Increment Analysis

In addition to addressing the AEC's impacts within the near field (i.e., Class II impacts), a Class I impact analysis will be conducted to demonstrate that the AEC will not cause or contribute to an exceedance of the Class I SIL or PSD Class I Increment Standards (Table 6-5) and will not adversely affect air quality-related values (AQRV).[5] To evaluate the potential impacts on Class I areas near the AEC site, all Class I areas within 300 km of the AEC were identified. Based on this survey, the San Gabriel Wilderness, which is approximately 53 km from the AEC site, was identified as the nearest Class I area. Figure 6-1 shows the locations and distances to the Class I areas within 300 km of AEC.

Federal Class I area air quality guidance (Federal Land Managers [FLM], 2010) allows an emissions/ distance (Q/D) factor of 10 to be used as a screening criterion for sources located more than 50 km from a Class I area. This screening criterion includes all AQRVs. Emissions are calculated as the total SO_2, NO_x, PM_{10}, and sulfuric acid (H_2SO_4) annual emissions (in tpy, based on 24-hour maximum allowable emissions). These emissions are divided by the distance (in km) from the Class I area.

Based on the combined annual emissions of NO_x, SO_2, H_2SO_4, and PM_{10}, calculated using the 24-hour maximum allowable emissions, the maximum Q/D for the Project will be greater than the FLM Q/D ratio of 10. Therefore, an additional protocol will be submitted to the National Park Service and the U.S. Forest Service to address AQRVs for all Class I areas that exceed the screening criterion and any additional Class I areas requested by the FLM.

To address PSD Class I Increment Standards, AERMOD will be used with a receptor ring at 50 km from the facility. The ring will be spaced in 5-degree increments centered on the AEC site. AERMOD maximum modeled impacts of NO_x and PM_{10} will be compared to the applicable SILs. If modeled impacts are below the SILs, then the Project would be considered to have negligible impact at the more distant Class I areas. If impacts are above the SILs in the direction of the Class I areas, SCAQMD would be contacted to determine a refined approach to quantify criteria pollutant impacts at the Class I areas.

Table 6-5. Class I SIL and PSD Class I Increment Standards Applicable to the Project

Averaging Period/ Pollutant	Significant Impact Level (µg/m³)	PSD Class I Increment Standard (µg/m³)
NO_2 (Annual)	0.1	2.5
PM_{10} (24-hour)	0.3	2.0
PM_{10} (Annual)	0.2	1.0

6.5 California Energy Commission Air Dispersion Analysis

The sections below summarize the requirements and modeling assessment to be submitted to the CEC.

6.5.1 Demolition and Construction Emissions Impact Assessment

The AEC construction site will be represented as a set of point sources and area sources in the modeling analysis. The exhaust emissions will be modeled as a set of point sources spaced approximately 25 meters (82 feet) apart over the construction areas with a horizontal stack release. Stack release parameters will consist of a stack release temperature of 533 K (500°F), a stack diameter of 0.127 meters (5 inches), and a release height of 4.6 meters (15 feet) based on data for typical construction equipment. The wind-blown and fugitive dust emissions will be modeled as area sources assuming a ground-level release height with an initial vertical dimension of 1 meter. Modeled concentrations of

[5] A separate protocol will be submitted to the National Park Service and U.S. Forest Service to address AQRVs at the nearby Class I areas.

NO_x, CO, PM_{10}, $PM_{2.5}$, and SO_2 from construction activities related to the AEC will be combined with the ambient background concentrations and compared to the ambient air quality standards.

6.5.2 Commissioning Emissions Impact Assessment

The short-term concentrations of NO_2 and CO (i.e., the 1- and 8-hour impacts) from the commissioning phase of the AEC will be combined with the ambient background concentrations and compared to the short-term ambient air quality standards. Although commissioning is expected to be completed in less than 1 year, annual impacts for the combined commissioning and operation for a rolling 12-month period will also be evaluated because annual emissions during the commissioning year could be higher than those during a noncommissioning year. As a result, annual concentrations of NO_x, PM_{10}, and $PM_{2.5}$ from commissioning with operation will be combined with the ambient background concentrations and compared to the annual ambient air quality standards. Furthermore, because commissioning activities only occur once in the life of the Project and are expected to be less than 1 year in duration, the impacts will not be compared to the 1-hour federal NO_2 NAAQS, which is a 3-year average of a 98th percentile daily maxima concentration standard.

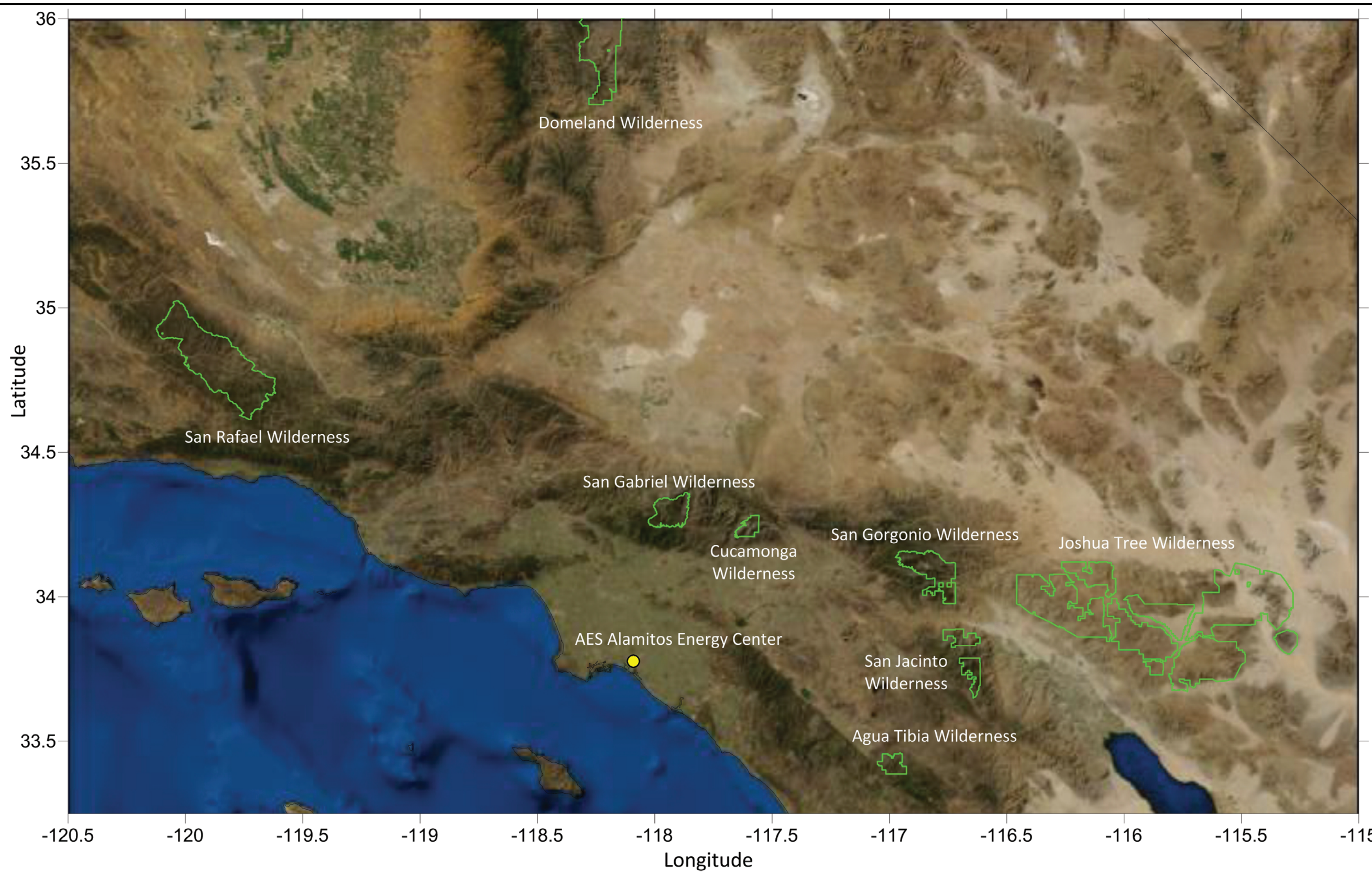
6.5.3 Operational Emissions Impact Assessment

The maximum modeled concentrations will be added to representative background concentrations and the results compared to the state and federal ambient air quality standards for SO_2, NO_2, CO, PM_{10}, and $PM_{2.5}$. The ambient concentrations from the three most recent years of ambient monitoring data identified in Section 2.0, Existing Setting, will be used as the background concentration.

6.5.4 Fumigation Impact Assessment

Fumigation can occur during the breakup of the nocturnal radiation inversion by solar warming of the ground surface. Shoreline fumigation occurs when a plume is emitted into a stable layer of air and is then mixed to the surface as a result of advection of the air mass to less stable surroundings. Under these conditions, an exhaust plume may be drawn to the ground with little diffusion, causing high ground-level pollutant concentrations, although typically for periods less than 1 hour.

SCREEN3 will be used to determine the predicted impacts associated with these fumigation scenarios. The maximum modeled concentrations from the fumigation impact assessment will then be added to representative background concentrations, and the results compared to the state and federal ambient air quality standards. The condition would be short-lived; therefore, impacts will only be compared to the 1-, 3-, 8-, and 24-hour standards.

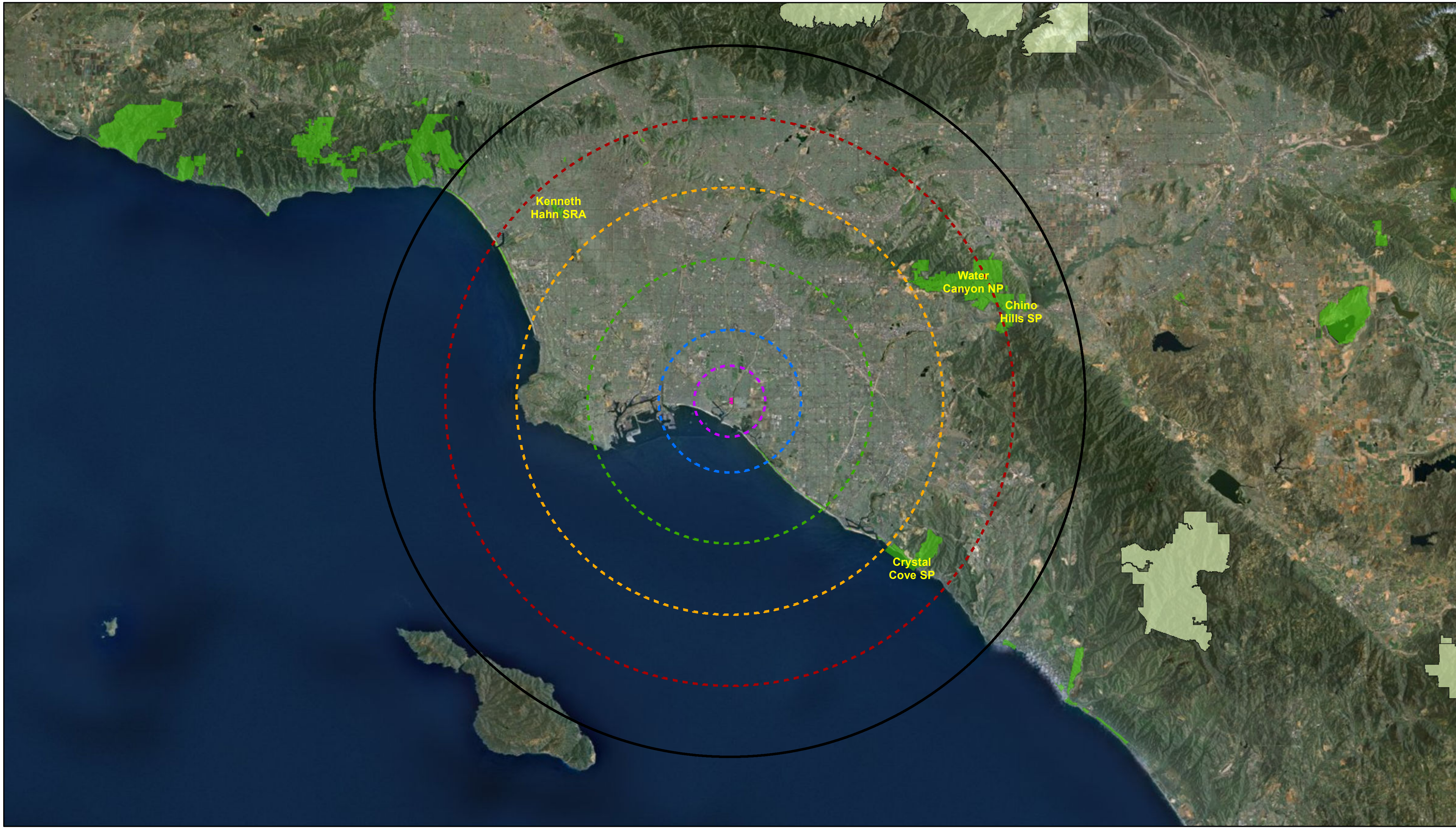


Distance to Nearby Class I Areas (km)

Agua Tibia Wilderness	Cucamonga Wilderness	Domeland Wilderness	Joshua Tree Wilderness	San Gabriel Wilderness	San Gorgonio Wilderness	San Jacinto Wilderness	San Rafael Wilderness
104.5	63.6	214.8	153.7	53.5	111.8	123.5	175.1

FIGURE 6-1
Distance to Nearby Class I Areas
Alamitos Energy Center
Long Beach, California

CH2MHILL.



Legend

- Alamitos Energy Center
- 50-km Buffer
- NLCS Wilderness [1]
- California State Parks [2]

Project Buffers

- 5 km
- 10 km
- 20 km
- 30 km
- 40 km

Sources:
1. Bureau of Land Management (http://www.blm.gov/ca/gis/)
2. Cal-Atlas Geospatial Clearninghouse (https://projects.atlas.ca.gov/)

0 8 16 Miles

0 25 Kilometers

N

FIGURE 6-2
Class II Areas within 50 km of AEC
Alamitos Energy Center
Long Beach, California

CH2MHILL

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SECTION 7.0

Human Health Risk Assessment

A human HRA will be performed to evaluate the potential cancer, chronic, and acute health impacts related to the AEC. This section describes the methodology proposed for conducting the HRA.

7.1 Approach

The HRA will follow the latest version of the *Air Toxics Hot Spot Program Risk Assessment Guidelines* (Office of Environmental Health Hazard Assessment [OEHHA], 2015), EPA's *Guideline on Air Quality Models* (EPA, 2005), and, where applicable based on revised OEHHA guidance, the SCAQMD guidance documents.

TAC emissions from the combustion turbines will be included in the HRA. Combustion turbine TAC emissions will be estimated assuming that all combustion turbines operate simultaneously under normal load conditions. For maximum hourly emissions, the maximum natural gas consumption rate per turbine will be used. For annual emissions, the annual average natural gas consumption rate per turbine will be used, assuming that the turbines will operate the allowable annual operating hours at the base load rate. Ammonia emissions associated with potential ammonia slip from the SCR system will be calculated based on a permit limit maximum of 5 ppmv, dry at 15 percent oxygen.

Owing to the length of the proposed construction and demolition period, TACs associated with construction of the AEC and demolition of the existing Alamitos Generating Station units, which consist of combustion byproducts generated during movement of onsite construction/demolition equipment and onsite and offsite movement of vehicles, will also be included in the HRA. The primary exhaust TAC associated with construction and demolition activities is diesel particulate matter (DPM). Total DPM exhaust emissions from construction and demolition activities will be averaged over the construction period and spatially distributed over the areas in which activities are expected to occur.

7.2 Model Selection

The HRA modeling for the normal AEC operations will be conducted using the ARB's *Hotspots Analysis Reporting Program Version 2* (HARP 2). The AERMOD modeling approach, such as default options, source parameters, meteorological data, receptor spacing, and terrain data, will be similar to the criteria pollutant modeling analysis. The receptor grid will also include sensitive receptors as defined by SCAQMD and CEC siting regulation Appendix B (g)(9)(E)(i). The sensitive receptors included in the analysis will be based on a search conducted by Environmental Data Resources. Additionally, census block receptors will be included in the analysis in order to calculate the increased cancer burden.

7.3 Evaluation of Impacts

Cancer risks will be evaluated for each source and the AEC based on the annual TAC ground-level concentrations, inhalation cancer potency, oral slope factor, frequency and duration of exposure at the receptor, and breathing rate of the exposed persons. Cancer risks from operation of the AEC will be estimated using a conservative assumption of a 30-year continuous exposure duration for residential receptors, and a 25-year, 5-day week, 8-hours-per-day exposure duration for commercial/industrial receptors. To assess chronic and acute noncancer exposures, annual and 1-hour TAC ground-level concentrations, respectively, will be compared with the Reference Exposure Levels (RELs) developed by OEHHA to obtain a chronic or acute HI.

The HRA for construction of the AEC and demolition of the existing Alamitos Generating Station units will be performed for a shorter exposure duration, based on the OEHHA guidance (OEHHA, 2015).

Because the primary TAC for construction and demolition activities is DPM, the cancer risks will be evaluated based on annual average TAC ground-level concentrations and inhalation cancer potency assuming initial exposure during the 3rd trimester and continuing through the duration of construction activities. Chronic toxicity will also be considered using the average annual emissions, calculated as previously described.

In addition to inhalation exposure, the HRA will assess potential health impacts related to exposure from homegrown produce, dermal absorption, soil ingestion, and mother's milk, as required by SCAQMD guidelines (SCAQMD, 2015c). The inhalation cancer potency, oral slope factor values, and RELs used to characterize health risks associated with the modeled impacts will be obtained from the most recent version of the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (OEHHA, 2014).

Consistent with SCAQMD Rule 1401, the modeled health risk values for each permitted unit will be compared to the following de minimus thresholds:

- Incremental increase in cancer risk of 10 in 1 million individuals (if the permitted unit is constructed with Best Available Control Technology for Toxics [T-BACT])
- Incremental increase in cancer risk of 1 in 1 million individuals (if the permitted unit is constructed without T-BACT)
- Cancer burden greater than 0.5
- Chronic HI of 1.0
- Acute HI of 1.0

Predicted cancer risk and HIs less than the thresholds will be considered an acceptable increase in risk associated with the AEC.

SECTION 8.0

Cumulative Impacts Analysis

Per CEC requirements, a cumulative air quality impacts analysis for the AEC's typical operating mode will be conducted. Impacts from the Project will be combined with other stationary emission sources within a 6-mile radius that have received construction permits but are not yet operational or are in the permitting process (such as the NSR or California Environmental Quality Act permitting process). The stationary emission sources included in the cumulative impacts assessment will be limited to new or modified sources (individual emission units) that would cause a net increase of 5 tons or more per modeled criteria pollutant. Therefore, VOC sources, equipment shutdowns, permit-exempt equipment registrations, rule compliance, permit renewals, or replacement/upgrading of existing systems will not be included in the cumulative impacts analysis. TAC emissions will also be excluded from the cumulative impacts analysis.

The sources to be included in the cumulative air quality impacts analysis will be those identified in the October 22, 2014 filing (TN# 203233). Table 8-1 is a summary of the cumulative impact sources.

Table 8-1 Facilities Included in the AEC Cumulative Air Quality Impact Analysis

Facility ID	Facility Name	Number of Sources	Permit Application Number(s)	Description
13990	U.S. Government, Veteran Affairs Medical Center	6	503082, 516319, 516320, 560589, 560591, 560592	Addition of six emergency diesel-powered generators.
53729	Trend Offset Printing Services, Inc.	2	547744, 547749	Modification of two VOC control afterburners.
800074	Los Angeles City, DWP Haynes Generating Station	8	554366, 554367, 559600, 559601, 559602, 559603, 559604, 559605	Addition of six LMS100 simple-cycle gas turbines and two emergency diesel-powered generators.

The cumulative air quality impacts analysis will be performed using the model settings and refined receptor grid outlined in Section 4.0, Topography and Meteorology, and Section 5.0, Dispersion Modeling Approach. The fence lines for the cumulative sources will not be included in the modeling analysis.

The maximum predicted cumulative impacts will represent the impact at the receptor location identified as the maximum receptor for each pollutant in the ambient air quality impacts assessment. The maximum modeled concentrations from the analysis will then be added to representative background concentrations, and the results compared to the state and federal ambient air quality standards for SO_2, NO_2, CO, PM_{10}, and $PM_{2.5}$.

SECTION 9.0

Presentation of Results

The results of the air dispersion modeling analyses for the AEC will be presented to each reviewing agency as follows:

- Description of modeling methodologies and input data
- Summary of the results in tabular form
- Compact disc of modeling files used by AERMOD provided with the supplemental AFC
- Description of any significant deviations from the methodology proposed in this protocol

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Attachment 1
Competing Source Inventory of NO_X-emitting Sources

Alamitos Energy Center Modeling Protocol
Attachment 1-1
PSD Competing Sources - Stack Parameters
August 2015

Point Sources

Facility	Source ID	Easting (X) (m)	Northing (Y) (m)	Base Elevation (m)	Stack Height (m)	Temperature (K)	Exit Velocity (m/s)	Stack Diameter (m)
Haynes Generating Station	80007401	398554	3736805	2.74	45.7	627	21.6	4.11
	80007402	398554	3736811	2.67	45.7	627	21.6	4.11
	80007403	398554	3736912	2.60	45.7	627	21.6	4.11
	80007404	398554	3736919	2.61	45.7	627	21.6	4.11
	80007405	398554	3737019	2.60	45.7	627	21.6	4.11
	80007406	398554	3737025	2.60	45.7	627	21.6	4.11
	80007407	398601	3736258	3.20	73.2	386	17.1	5.33
	80007408	398601	3736293	3.20	73.2	384	15.7	5.33
	80007409	398652	3736693	3.54	42.7	368	19.1	5.79
	80007410	398652	3736739	3.54	42.7	368	19.1	5.79
Beta Offshore	16607301	395222	3716431	0.00	18.3	661	31.1	0.30
	16607302	395222	3716431	0.00	18.3	641	30.0	0.30
	16607303	395222	3716431	0.00	18.3	585	24.2	0.30
	16607304	394082	3717932	0.00	18.3	663	28.7	0.30
	16607305	394082	3717932	0.00	18.3	684	34.7	0.30
	16607306	394082	3717932	0.00	18.3	583	21.1	0.30
	16607307	395265	3716554	0.00	18.3	671	39.4	0.61
	16607308	395265	3716554	0.00	18.3	671	38.1	0.61
	16607309	395265	3716554	0.00	18.3	677	37.5	0.61
	16607310	395265	3716554	0.00	18.3	671	81.2	0.76
	16607311	395265	3716554	0.00	18.3	669	81.1	0.76
	16607312	395265	3716554	0.00	18.3	668	81.4	0.76
	16607313	395265	3716554	0.00	22.9	464	8.35	0.51

Volume Sources

Facility	Source ID	Base Elevation (m)	Release Height (m)	Initial Horizontal Dimension (m)	Initial Vertical Dimension (m)
Shipping Lanes (800 sources)	764601-704625	0.00	50.0	186	23.3

Competing source data provided by SCAQMD.

Emission Rates for PSD 1-hour NO_2 Competing Sources

Facility	Source ID	1-hour NO_2 (g/s)	(lb/hr)
Haynes Generating Station	80007401	3.12	24.7
	80007402	3.12	24.7
	80007403	3.12	24.7
	80007404	3.12	24.7
	80007405	3.12	24.7
	80007406	3.12	24.7
	80007407	1.69	13.4
	80007408	1.69	13.4
	80007409	2.17	17.2
	80007410	2.17	17.2
Beta Offshore	16607301	1.90	15.0
	16607302	1.90	15.0
	16607303	1.90	15.0
	16607304	1.90	15.0
	16607305	1.90	15.0
	16607306	1.90	15.0
	16607307	0.37	2.90
	16607308	0.31	2.50
	16607309	0.35	2.80
	16607310	2.52	20.0
	16607311	2.48	19.7
	16607312	2.48	19.7
	16607313	10.3	81.6
Shipping Lanes (Total for 800 sources)	764601-704625	171	1,357

Competing source data provided by SCAQMD.

Dispersion Modeling Protocol for Air Quality Related Values at Class I Areas Near the Alamitos Energy Center

Prepared for

AES Alamitos Energy, LLC

690 N. Studebaker Road
Long Beach, CA 90803

October 2015

Submitted to

South Coast Air Quality Management District

Prepared by

CH2MHILL®

2485 Natomas Park Drive, Suite 600
Sacramento, CA 95833

Contents

Abbreviations and Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
$\mu g/m^3$	microgram per cubic meter
AEC	Alamitos Energy Center
AES	AES Alamitos Energy, LLC
AFC	Application for Certification
AQRV	Air Quality Related Values
BPIP	Building Profile Input Program
CEC	California Energy Commission
CFR	Code of Federal Regulations
CO	carbon monoxide
f(RH)	relative humidity adjustment factor
FLAG	Federal Land Managers’ Air Quality Related Values Work Group
FLM	Federal Land Managers
GE	General Electric
GHG	greenhouse gas
H_2SO_4	sulfuric acid
IWAQM	Interagency Workgroup on Air Quality Modeling
kg/ha/yr	kilogram(s) per hectare per year
km	kilometer(s)
lb/day	pound(s) per day
lb/hr	pound(s) per hour
lb/yr	pound(s) per year
Mm^{-1}	inverse megameters
MW	megawatt(s)
NAAQS	National Ambient Air Quality Standards
NOx	nitrogen oxides
NPS	National Park Service
NSR	New Source Review
PM	particulate matter
PM_{10}	particulate matter with a diameter less than 10 microns
$PM_{2.5}$	particulate matter with a diameter less than 2.5 microns
PPA	power purchase agreement

ppb	parts per billion
PSD	Prevention of Significant Deterioration
PTE	potential to emit
Q/D	emissions/distance factor
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SO_2	sulfur dioxide
tpy	ton(s) per year
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Department of Agriculture Forest Service
VOC	volatile organic compound

SECTION 1

Introduction

1.1 Project Background

AES Alamitos Energy, LLC (AES) proposes to construct the Alamitos Energy Center (AEC) at the existing AES Alamitos Generating Station site, located at 690 N. Studebaker Road, Long Beach, California 90803. AES submitted an Application for Certification (AFC) to the California Energy Commission (CEC) in December 2013, which was deemed data adequate by the CEC in March 2014. In November 2014, AES received notice from Southern California Edison (SCE) that it was shortlisted for a power purchase agreement (PPA). The power plant configuration selected by SCE for a PPA was different from the project configuration in the AFC filed with the CEC. Therefore, AES is required to supplement the AEC AFC to be consistent with the SCE PPA.

The AEC will consist of one two-on-one combined-cycle power block and one simple-cycle power block with a combined net generating capacity of 1,044 megawatts (MW). The combined-cycle power block will consist of two General Electric (GE) Frame 7FA.05 natural-gas-fired combustion turbines, one steam turbine, and an air-cooled condenser. Each combustion turbine will be equipped with a heat-recovery steam generator without supplemental natural gas firing (duct firing). The combined-cycle power block will also include a natural-gas-fired auxiliary boiler, used to decrease the startup duration and air emissions of the combined-cycle turbines. The simple-cycle power block will consist of four GE LMS-100PB natural-gas-fired combustion turbines and four closed-loop cooling fin fan coolers.

The AEC will be located in the city of Long Beach, Los Angeles County, California. Los Angeles County is in attainment for all federal National Ambient Air Quality Standards (NAAQS) with the exception of ozone, particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and lead. Effective July 26, 2013, Los Angeles County was reclassified by the U.S. Environmental Protection Agency (USEPA) from nonattainment to maintenance for particulate matter less than 10 microns in diameter (PM_{10}) (78 *Federal Register* 38223).

The AEC will be permitted through the South Coast Air Quality Management District (SCAQMD) New Source Review (NSR) permitting process. Because the AEC is also categorized as one of the 28 Prevention of Significant Deterioration (PSD) major source categories (40 Code of Federal Regulations [CFR] 52.21(b)(1)(i)), the project is subject to PSD permitting requirements if the net emission increase from the project exceeds 100 tons per year (tpy) for any regulated pollutant for which the area is designated as attainment, maintenance, or unclassified, with the exception of greenhouse gases (GHGs). The threshold for GHGs is a net increase of 100,000 tpy.

The AEC's potential to emit (PTE) is expected to exceed PSD significant emission increases for nitrogen oxides (NO_x), which is an attainment pollutant; carbon monoxide (CO), which is an attainment pollutant; volatile organic compounds (VOCs); and PM_{10}, for which the area is designated as maintenance. Therefore, the AEC will be required to conduct an analysis at Class I areas for which NO_x and PM_{10} could affect Air Quality Related Values (AQRV) (40 CFR 51.166(p)(2)).[1] Class I AQRVs affected by significant increases in NO_x and PM_{10} are visibility and total nitrogen deposition.

This air dispersion modeling protocol summarizes the modeling methodology that will be used to evaluate the AEC's impacts on air quality with respect to AQRVs at the federally-designated Class I areas within 300 kilometers (km) of the AEC site. This protocol has been prepared based on the USEPA *Guideline on Air Quality Models* (USEPA, 2005), Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 report (USEPA, 1998), and the Federal Land Managers' (FLM) Air Quality Related Values Work Group (FLAG)

[1] No air dispersion modeling demonstration is required for CO and VOC.

guidance document (FLM, 2010). These guidance documents provide modeling approaches suggested by USEPA and the FLM.

A separate protocol was previously submitted to the CEC and SCAQMD for the criteria pollutant air quality analysis for NAAQS and PSD Increment Standards. This air dispersion modeling protocol is consistent with the previous Class I area protocol submitted to SCAQMD and the FLM in 2013 (CH2M HILL Engineers, Inc. [CH2M], 2013). However, updates to the facility description and PTE, and comments from the FLM on the previous modeling protocol have been incorporated where appropriate.

1.2 Project Description

The AEC will have a net generating capacity of 1,044 MW. The AEC location is presented in Figure 1-1. Estimates of the annual AEC PTE criteria pollutant emissions are presented in Table 1-1. The PTE estimates are based on the following:

- GE 7FA.05s: 24 cold startups, 100 warm startups, 376 hot startups, 500 shutdowns, and 4,100 hours of steady-state operation at 100 percent load and 65.3 degrees Fahrenheit (°F) per turbine per year
- GE LMS-100PBs: 500 hot startups, 500 shutdowns, and 2,000 hours of steady-state operation at 100 percent load and 65.3°F per turbine per year
- Auxiliary boiler: 120 startups and 365 days of operation at 100 percent load per year

TABLE 1-1
AEC Annual Criteria Pollutant Emission Estimates (tpy)

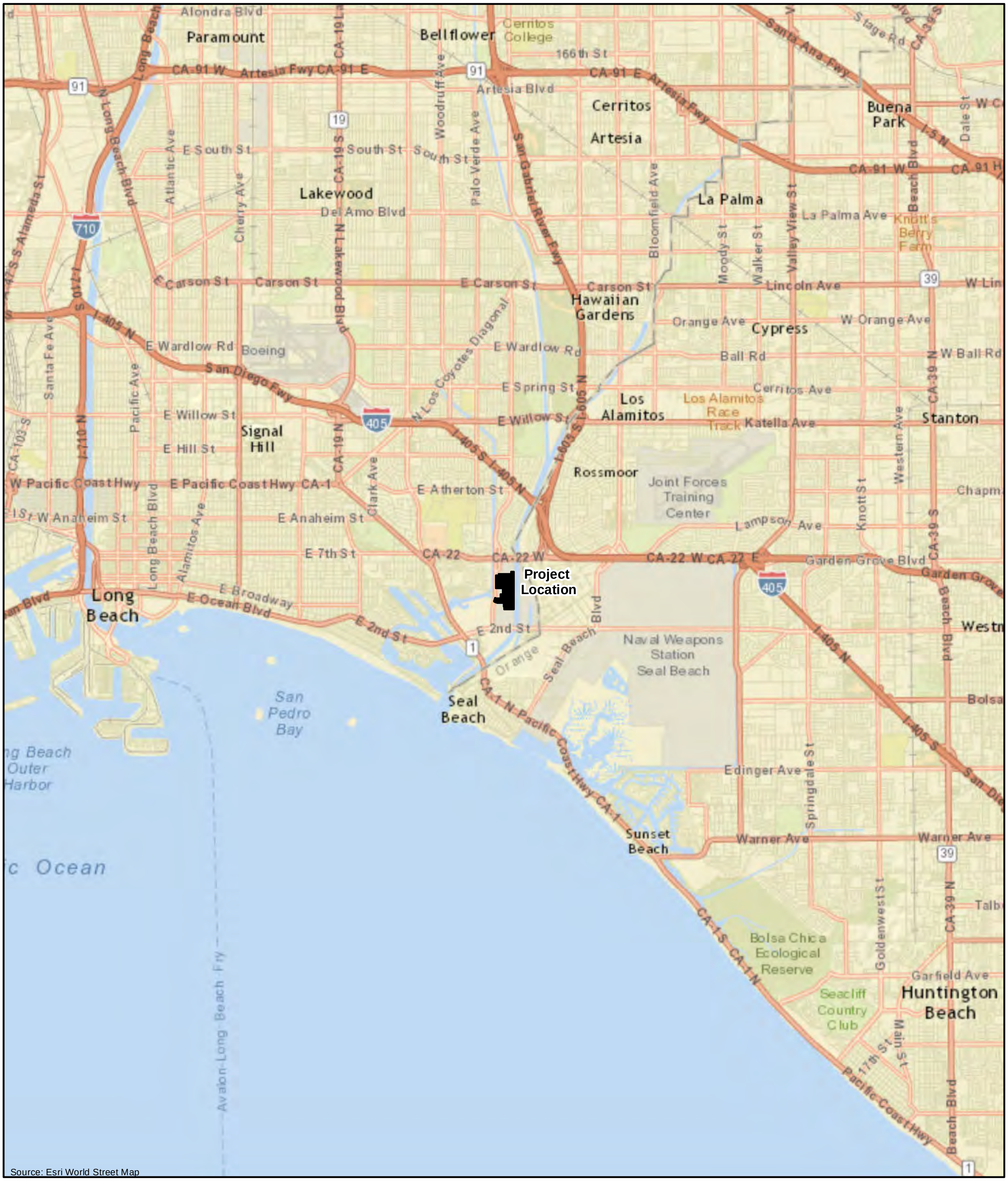
NO_x	SO_2	PM_{10}	$PM_{2.5}$	VOC	CO	H_2SO_4
134	11.3	69.3	69.3	49.3	246	0.5

Notes:
SO_2 = sulfur dioxide
H_2SO_4 = sulfuric acid

In order to evaluate the potential impacts on Class I areas near the AEC site, all Class I areas within 300 km of the AEC were identified. The identified Class I areas are presented, relative to the AEC site, in Figure 1-2. Based on this survey, the San Gabriel Wilderness, which is approximately 54 km from the AEC site, was identified as the nearest Class I area.

1.3 AQRV Analysis Requirements

As described above, the AEC will be a federal major source subject to major PSD NSR requirements for NO_x and PM_{10}. As such, AES must perform an AQRV modeling analysis evaluating the AEC's impacts from the visibility-impairing pollutants PM_{10}, NO_x, sulfuric acid (H_2SO_4), and sulfur dioxide (SO_2). AES will conduct an AQRV analysis at each of the Class I areas within 300 km of the AEC site. This analysis consists of an initial screening step to identify Class I areas subject to further evaluation (discussed in Section 2.1). For the Class I areas that exceed the screening criterion, a far-field AQRV analysis will be performed. The far-field AQRV analysis will address the potential AEC impacts on visibility. In addition to visibility, total nitrogen deposition will be assessed at each Class I area that exceeds the screening criterion. A total sulfur deposition analysis is not required because the AEC's increases in SO_2 emissions would not trigger PSD review.



Legend

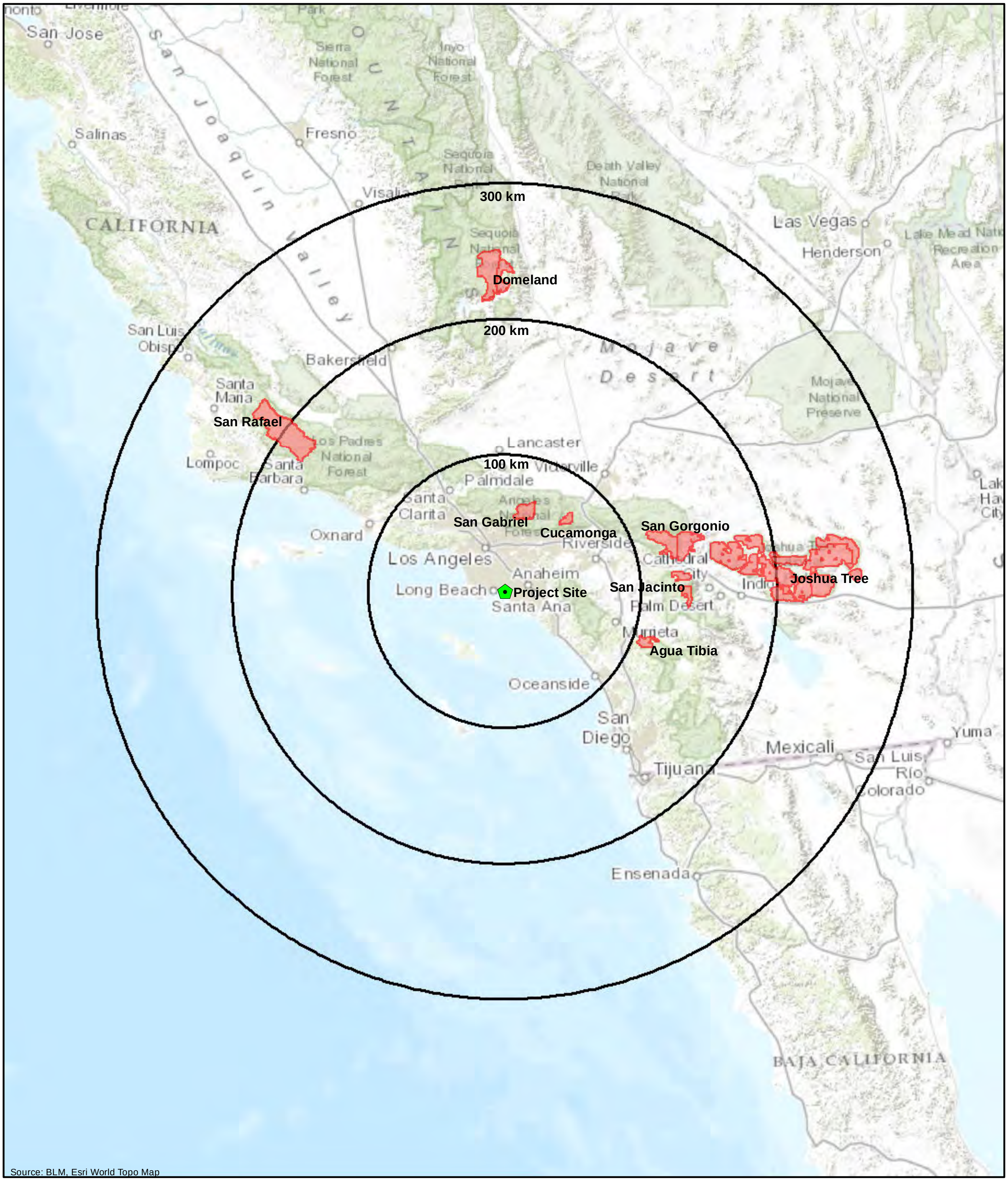
Project Boundary

0 1 2 Miles

N

FIGURE 1-1
Project Location
Alamitos Energy Center
Long Beach, California
October 2015

CH2MHILL



Legend

Project Buffer (100 km intervals)

Wilderness Areas

0 75 150 Kilometers

N

FIGURE 1-2
Class I Area Map

Alamitos Energy Center
Long Beach, California
October 2015

CH2MHILL

Y:\AESCORP\491232DISCPHASEREP\AFC_ARCHIVE\AEC\GIS\ALAMITOS\MAPFILES\AQ\FIG1-2_AQ_CLASS_I_AREAMAP_20151019.MXD MD013761 10/20/2015 10:11:40 AM

SECTION 2

Modeling Methodology

2.1 Screening Methodology for AQRVs

For far-field AQRV analysis, the FLM guidance document (FLM, 2010) allows an emissions/distance (Q/D) factor of 10 to be used to screen out sources located more than 50 km from a Class I area. This screening criterion applies to all AQRVs such that, where Q/D is 10 or less for a given Class I area, no further AQRV review is required for that area. For purposes of applying the Q/D screening criterion, emissions are conservatively calculated as the total SO_2, NO_x, PM_{10}, and H_2SO_4 annual emissions (in tpy, based on the 24-hour maximum allowable emissions). These emissions are divided by the distance (in km) from the Class I area. The emission rates used for screening are extremely conservative and exceed the annual emission limits being requested in the permit application. This is because the FLM guidance document specifies that the emission rates used in the screening analysis must reflect the annual emissions that would occur if the 24-hour maximum emission rate occurred every day, regardless of whether the applicant is seeking to operate in that manner (FLM, 2010).

Table 2-1 summarizes the potential maximum allowable emissions of each of the pollutants used to calculate Q.

TABLE 2-1
Maximum Facility Calculated Q

	Pollutant				
Units	**NO_x**	**SO_2**	**PM_{10}**	**H_2SO_4**	**Total**
Maximum lb/hr (Facility)	66	16	42	1	
lb/day (Facility)	1,595	391	1,014	16	
lb/yr (Facility)	582,024	142,769	370,003	5,989	
Facility Total tpy (Q)	291	71	185	3	**550**

Notes:
Q is a theoretical value based on the maximum daily 24-hour emission rate assuming all proposed units at the AEC would be operating at maximum capacity every day of the year.
lb/hr = pound(s) per hour
lb/day = pound(s) per day
lb/yr = pound(s) per year

Using the emissions in Table 2-1, the Q/D for each Class I area is presented in Table 2-2. Based on the screening analysis above, a far-field AQRV analysis is required for the San Gabriel Wilderness area. All other Class I areas are below the FLM screening criterion; therefore, the AEC will not adversely affect AQRVs at these areas. However, consistent with the agreed-upon Class I areas discussed during the November 1, 2013, conference call with CH2M and the U.S. Department of Agriculture Forest Service (USFS), the Cucamonga, Agua Tibia, and San Gorgonio Wilderness areas will also be evaluated in the AQRV analysis for project impacts on visibility and total nitrogen deposition. These additional Class I areas were agreed upon based on a higher potential Q/D value for each Class I area. Since the AFC was submitted, the calculated Q/D value has decreased for all Class I areas within 300 km from the AEC; however, all four areas will still be evaluated as consistent with the previous analysis.

TABLE 2-2
Screening for Class I Areas within 300 km of AEC

Class I Areas	Distance to AEC (km)	Class I AQRV Q/D (24-hour Max)[a]
San Gabriel Wilderness	53.5	**10.3**
Cucamonga Wilderness	63.6	8.7
Agua Tibia Wilderness	104.5	5.3
San Gorgonio Wilderness	111.8	4.9
San Jacinto Wilderness	123.5	4.5
Joshua Tree Wilderness	153.7	3.6
San Rafael Wilderness	175.1	3.1
Domeland Wilderness	214.8	2.6

Note: **Bold** values indicate an exceedance of the screening criterion (10).

[a] Class I AQRV Q/D calculated as total tpy identified in Table 2-1, divided by the distance to the nearest Class I area.

2.2 AQRV Far-Field Dispersion Modeling

The FLM guidance document recommends that a far-field AQRV analysis be performed using the CALPUFF modeling system (FLM, 2010). As described above, a far-field AQRV analysis is required to assess a project's effect on AQRVs if the project is located more than 50 km from Class I areas that do not screen out in the Q/D calculation. The CALPUFF modeling system includes a Gaussian puff dispersion model (CALPUFF) with algorithms for chemical transformation and deposition, and a post-processor (CALPOST) capable of calculating concentrations, visibility impacts, and total deposition.

SECTION 3

Meteorological Data Processing

The previous Class I area AQRV modeling used CALMET windfields for 2006 through 2008, which were processed with the guidance of, and then approved by, the FLM on December 6, 2013. Since that submittal, the model versions of CALMET and USEPA and IWAQM guidance for processing meteorological data have remained unchanged. Therefore, the previous windfields processed by CALMET for the PSD Class I AQRV modeling will be used for this Class I analysis. Appendix A contains a sample CALMET input file. Appendix B contains the approval letter from the National Park Service (NPS) FLM of the previously provided windfields.

SECTION 4

Modeling Steps

The most recent USEPA-approved version of CALPOST will be used to process CALPUFF binary output data files and produce summary results files. These results will then be used to analyze total nitrogen deposition and visibility impacts.

4.1 CALPUFF Modeling

The following subsections provide a summary of the CALPUFF modeling procedures that will be used to model Class I AQRVs.

4.1.1 Model Version

The most recent USEPA-approved version of the CALPUFF modeling system (Version 5.8) will be used in a full, refined mode using MM5 meteorological data. The following CALPUFF pre- and post-processors will be used:

- SMERGE: Version 5.57, Level 070627
- PMERGE: Version 5.32, Level 070627
- MAKEGEO: Version 2.29, Level 070327
- CALMET: Version 5.8.4, Level 130731
- CALPUFF: Version 5.8.4, Level 130731
- CALPOST: Version 6.221, Level 080724 (for Method 8, mode 5[2] processing option)

4.1.2 Technical Options for Modeling

FLM and USEPA guidance on the CALPUFF model technical options, inputs, and processing steps will be followed.

The CALPUFF model will be run with USEPA-recommended technical option values, including the selection of the MESOPUFF II chemical transformation. The sections below summarize the source characterization, building downwash, receptor grids for each Class I area modeled, and background ozone and ammonia concentrations used for the CALPUFF modeling.

4.1.3 Source Characterization

All sources will be modeled in CALPUFF as point sources. Particulate matter (PM) emissions will be speciated into filterable PM (PM_{10}, $PM_{2.5}$, and elemental carbon) and condensable PM (organic carbon and sulfates). Guidance on the FLM Web site[3] will be used to speciate the emissions from the AEC's emission sources.

4.1.4 Building Downwash

Building influences on stacks are calculated by incorporating the updated USEPA Building Profile Input Program (BPIP). Output from the BPIP program will be included in the CALPUFF modeling file.

4.1.5 Receptors

The TRC COORDS program will be used to convert the latitude/longitude coordinates to Lambert Conformal Conic coordinates for the meteorological stations and source locations. The U.S. Geological Survey conversion program, PROJ (Version 4.4.6), will be used to convert the NPS receptor location data from

[2] Method 8 allows for the use of different relative humidity adjustment factor (f[RH]) values for large hydroscopic particles, small hydroscopic particles, and sea salt.

[3] Speciation information is available at http://www.nature.nps.gov/air/permits/ect/index.cfm.

latitude/longitude to Lambert Conformal Conic. Discrete receptors within the Class I areas that exceeded the screening criterion were taken from the NPS database for Class I area modeling receptors.

4.1.6 Ozone and Ammonia

The CALPUFF modeling will be conducted with hourly background ozone data from the closest monitors and monthly average ammonia background values. In the absence of hourly ozone data for a particular hour, the monthly average of all hourly data from all stations will be used. The background ammonia concentration will initially be taken from the IWAQM Phase 2 report (USEPA, 1998), which suggests values based on the predominant land use throughout the modeling domain. Refinements will be made to the IWAQM ammonia background concentration based on observed seasonal variations in the background ammonia levels.

4.1.6.1 Ozone

The transformation rates of gaseous SO_2 and NO_x are dependent on the ambient concentrations of ozone. Temporally varying ozone values from a number of monitoring stations within the domain can be used within the model to estimate the transformation rates of SO_2 and NO_x.

Southern California has many ozone monitors that collect hourly concentrations. Monitoring stations within the modeling domain will be included in the CALPUFF modeling analysis. A final list of the stations utilized will be included in the permit application.

4.1.6.2 Ammonia

Ammonia is not simulated by CALPUFF, but a background value is required to characterize the conversion of NO_x and SO_2 to ammonium nitrate and ammonium sulfate, respectively.

There are few (if any) monitored ammonia concentration data in the South Coast Air Basin and Los Angeles region. The IWAQM Phase 2 report recommends background concentrations of ammonia of 10 parts per billion (ppb) for grasslands, 1 ppb for arid lands at 20 degrees Celsius (°C), and 0.5 ppb for forested land. The California Regional Haze Rule modeling analysis conservatively used a 10-ppb statewide ambient ammonia background concentration. The 10-ppb background ammonia concentration used for the California Regional Haze Rule modeling would be appropriate for many sources and Class I areas in California due to the amount of agriculture in the central San Joaquin and Sacramento Valleys. However, since the AEC is located in the Los Angeles metropolitan area and the surrounding land use is neither predominantly agriculture nor grassland, a conservative year-round background ammonia concentration of 2 ppb is proposed for the AEC. This is consistent with the land-use types surrounding the emission source and sources of ammonia near the project area.

If better ammonia data are available for the South Coast Air Basin and Los Angeles region, the SCAQMD and FLM will be contacted to determine the appropriateness of such data. If the background ammonia concentration differs from the initially proposed 2 ppb, an analysis of the updated ammonia data will be supplied in the permit application.

4.2 Total Nitrogen Deposition

CALPUFF and CALPOST will be applied to obtain upper limit estimates of annual wet and dry deposition of nitrogen compounds associated with emissions from the AEC. Specifically, CALPUFF will be used to model both wet and dry deposition of ammonia and nitric acid, as well as dry deposition of NO_x, to estimate the maximum annual wet and dry deposition of nitrogen at the Class I areas. The deposition results will be documented for evaluation.

POSTUTIL (Version 1.56) will be used to calculate total nitrogen deposition for each receptor. POSTUTIL will also be used to reapportion nitrate concentrations using monthly ambient ammonia data, if available.

The FLM have developed a deposition analysis threshold of 0.005 kg/ha/yr (FLM, 2008) to be used as a threshold for Class I areas in the western U.S., classified as west of the Mississippi River. Since all Class I areas to be assessed in this analysis are west of the Mississippi River, the selected deposition analysis threshold for total nitrogen deposition is 0.005 kg/ha/yr (FLM, 2008).

4.3 Regional Haze

CALPUFF and CALPOST processing will be used for the regional haze analysis to compute the maximum 24-hour average light extinction due to NO_x, PM_{10}, SO_2, and H_2SO_4 emissions from the AEC. As mentioned above, all emissions which could contribute to visibility impacts are modeled. For both ambient background and emissions, the relative humidity adjustment factor (f[RH]) will calculate the sulfate and nitrate components of the visibility extinction coefficient. For this factor, monthly average f(RH) values for large hygroscopic particles, small hygroscopic particles, and sea salt will be used (Method 8).

Ambient background concentrations of light-attenuating pollutants are based on the 20 percent best day visibility conditions for the Class I areas included in this analysis. The proposed background values, taken from Table 5 of the FLM guidance document (FLM, 2010), are presented in Table 4-1. Table 4-2 presents the f(RH) values used for each Class I area modeled.

TABLE 4-1
20 Percent Best Natural Conditions

Aerosol Component	San Gabriel Wilderness	Cucamonga Wilderness	Agua Tibia Wilderness Area	San Gorgonio Wilderness Area
Ammonium Sulfate ($\mu g/m^3$)	0.03	0.03	0.03	0.03
Ammonium Nitrate ($\mu g/m^3$)	0.03	0.03	0.04	0.02
Organic Matter ($\mu g/m^3$)	0.15	0.15	0.26	0.15
Elemental Carbon ($\mu g/m^3$)	0.01	0.01	0.01	0.01
Soil ($\mu g/m^3$)	0.14	0.14	0.26	0.10
Coarse Mass ($\mu g/m^3$)	0.67	0.67	1.20	0.62
Sea Salt ($\mu g/m^3$)	0.01	0.01	0.04	0.02
Rayleigh (Mm^{-1})	9	9	11	10

Notes:
$\mu g/m^3$ = microgram(s) per cubic meter
Mm^{-1} = inverse megameters

Source: Table 5 of the FLM guidance document (FLM, 2010).

TABLE 4-2
CALPOST Method 8 f(RH) Values

f(RH) Fraction	f(RH) by Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
San Gabriel Wilderness												
f(RH) Small	2.94	2.78	2.72	2.41	2.37	2.29	2.32	2.39	2.44	2.44	2.36	2.58
f(RH) Large	2.25	2.17	2.14	1.96	1.95	1.90	1.91	1.95	1.98	1.97	1.91	2.04
f(RH) Sea Salt	3.12	3.04	3.04	2.77	2.78	2.69	2.69	2.77	2.79	2.74	2.59	2.79
Cucamonga Wilderness												
f(RH) Small	2.87	2.73	2.68	2.40	2.37	2.29	2.31	2.38	2.43	2.42	2.34	2.54
f(RH) Large	2.21	2.14	2.13	1.96	1.95	1.90	1.91	1.96	1.98	1.96	1.90	2.02
f(RH) Sea Salt	3.07	3.01	3.03	2.79	2.80	2.72	2.72	2.80	2.81	2.76	2.58	2.77
Agua Tibia Wilderness Area												
f(RH) Small	2.68	2.61	2.63	2.42	2.40	2.33	2.33	2.45	2.49	2.46	2.29	2.42
f(RH) Large	2.10	2.08	2.11	1.98	1.98	1.93	1.93	2.01	2.02	1.99	1.87	1.95
f(RH) Sea Salt	2.94	2.95	3.02	2.85	2.88	2.81	2.78	2.90	2.90	2.83	2.56	2.69
San Gorgonio Wilderness Area												
f(RH) Small	2.94	2.94	2.74	2.36	2.34	2.00	1.88	2.02	2.05	2.04	2.10	2.43
f(RH) Large	2.21	2.23	2.13	1.90	1.90	1.69	1.62	1.71	1.72	1.70	1.73	1.92
f(RH) Sea Salt	2.97	3.06	2.93	2.60	2.63	2.28	2.13	2.30	2.31	2.24	2.25	2.55

Visibility impacts estimated with the CALPUFF model will be reported for each Class I area analyzed. Modeled potential visibility impacts will then be compared to the applicable background concentrations. For each Class I area, the 3-year average of the 98th percentile change in background light extinction, along with the total number of days exceeding a change greater than 5 and 10 percent, if any, will be reported. If the 3-year average of the 98th percentile change in background light extinction exceeds the recommended screening value of 5 percent in one or more Class I areas, alternative analytical options will be investigated in conjunction with the FLM and SCAQMD.

SECTION 5

Output and Presentation of Results

The Supplemental AFC presents the results of the air dispersion modeling analysis as follows:

- The application will describe modeling methodologies and input data.
- The results will be summarized in tabular and, where appropriate, graphical and narrative form.
- Modeling files used for analysis will be provided with the application on an external hard drive.
- Any significant deviations from the methodology proposed in this protocol will be presented in the application.

SECTION 6

References

CH2M HILL Engineers, Inc. (CH2M). 2013. *Air Quality Related Values at Class I Areas Near the Alamitos Energy Center*. November.

Federal Land Managers (FLM). 2008. *Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report* (Revised 2008). June.

Federal Land Managers (FLM). 2010. *Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report* (Revised 2010). November.

U.S. Environmental Protection Agency (USEPA). 1998. *Interagency Workgroup on Air Quality Modeling (IWAQM) Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts*. December.

U.S. Environmental Protection Agency (USEPA). 2005. Guideline On Air Quality Models, 40 CFR 51, Appendix W. November.

Appendix A
Sample CALMET Input

```
--------------- Run title (3 lines) ------------------------------------------

                    CALMET MODEL CONTROL FILE
                    --------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names


Subgroup (a)
------------
Default Name  Type          File Name
------------  ----          ---------
GEO.DAT       input    ! GEODAT=..\..\MakeGeo\GEO4KM.DAT       !
SURF.DAT      input    ! SRFDAT=..\..\surface\surf06_fill.DAT      !
CLOUD.DAT     input    * CLDDAT=            *
PRECIP.DAT    input    ! PRCDAT=..\..\precip\PMERGE06.dat    !
WT.DAT        input    * WTDAT=             *

CALMET.LST    output   ! METLST=jan06.LST     !
CALMET.DAT    output   ! METDAT=jan06.DAT    !
PACOUT.DAT    output   * PACDAT=            *

All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

    Number of upper air stations (NUSTA)  No default     ! NUSTA =  1  !
    Number of overwater met stations
                                 (NOWSTA) No default     ! NOWSTA =  2  !

NUMBER OF PROGNOSTIC and IGF-CALMET FILEs:

    Number of MM4/MM5/3D.DAT files
                                 (NM3D) No default       ! NM3D =  1 !

    Number of IGF-CALMET.DAT files
                                 (NIGF)   No default     ! NIGF =  0  !

                        !END!
--------------------------------------------------------------------------------
Subgroup (b)
---------------------------------
Upper air files (one per station)
---------------------------------
Default Name  Type       File Name
------------  ----       ---------
UP1.DAT       input     1  ! UPDAT=..\..\UA\up_mir2.DAT!    !END!

--------------------------------------------------------------------------------
Subgroup (c)
-----------------------------------------
Overwater station files (one per station)
-----------------------------------------
Default Name  Type       File Name
------------  ----       ---------
SEA1.DAT       input     1  ! SEADAT=..\..\buoy\2006\46053\46053-06Fill.DAT!   !END!
SEA1.DAT       input     2  ! SEADAT=..\..\buoy\2006\46025\46025-06Fill.DAT!   !END!
```

```
--------------------------------------------------------------------------------
Subgroup (d)
------------------------------------------------
MM4/MM5/3D.DAT files (consecutive or overlapping)
------------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
MM51.DAT       input     1  ! M3DDAT=..\..\mm5\2006_update\JAN06.MM5 !    !END!

--------------------------------------------------------------------------------
Subgroup (e)
-------------------------------------------------
IGF-CALMET.DAT files (consecutive or overlapping)
------------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
IGFn.DAT       input     1  * IGFDAT=CALMET0.DAT *    *END*
--------------------------------------------------------------------------------
Subgroup (f)
----------------
Other file names
----------------

Default Name  Type       File Name
------------  ----       ---------
DIAG.DAT      input      * DIADAT=                  *
PROG.DAT      input      * PRGDAT=                  *

TEST.PRT      output     * TSTPRT=                  *
TEST.OUT      output     * TSTOUT=                  *
TEST.KIN      output     * TSTKIN=                  *
TEST.FRD      output     * TSTFRD=                  *
TEST.SLP      output     * TSTSLP=                  *
DCST.GRD      output     * DCSTGD=                  *

--------------------------------------------------------------------------------
NOTES: (1) File/path names can be up to 70 characters in length
       (2) Subgroups (a) and (f) must have ONE 'END' (surrounded by
           delimiters) at the end of the group
       (3) Subgroups (b) through (e) are included ONLY if the corresponding
           number of files (NUSTA, NOWSTA, NM3D, NIGF) is not 0, and each must have
           an 'END' (surround by delimiters) at the end of EACH LINE

                         !END!


-------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------


     Starting date:   Year (IBYR) -- No default       ! IBYR=  2006  !
                     Month (IBMO) -- No default       ! IBMO=  1  !
                       Day (IBDY) -- No default       ! IBDY=  1  !
                      Hour (IBHR) -- No default       ! IBHR=  1  !

     Note: IBHR is the time at the END of the first hour of the simulation
           (IBHR=1, the first hour of a day, runs from 00:00 to 01:00)

     Base time zone        (IBTZ) -- No default       ! IBTZ=  8  !
        PST = 08, MST = 07
        CST = 06, EST = 05
```

```
     Length of run (hours) (IRLG) -- No default       ! IRLG=  744  !

     Run type            (IRTYPE) -- Default: 1       ! IRTYPE=  1  !

        0 = Computes wind fields only
        1 = Computes wind fields and micrometeorological variables
            (u*, w*, L, zi, etc.)
        (IRTYPE must be 1 to run CALPUFF or CALGRID)

     Compute special data fields required
     by CALGRID (i.e., 3-D fields of W wind
     components and temperature)
     in additional to regular            Default: T    ! LCALGRD = T !
     fields ? (LCALGRD)
     (LCALGRD must be T to run CALGRID)

      Flag to stop run after
      SETUP phase (ITEST)             Default: 2       ! ITEST=  2   !
      (Used to allow checking
      of the model inputs, files, etc.)
      ITEST = 1 - STOPS program after SETUP phase
      ITEST = 2 - Continues with execution of
                  COMPUTATIONAL phase after SETUP


     Test options specified to see if
     they conform to regulatory
     values? (MREG)                   No Default       ! MREG =  1   !

        0 = NO checks are made
        1 = Technical options must conform to USEPA guidance
                  IMIXH    -1       Maul-Carson convective mixing height
                                    over land; OCD mixing height overwater
                  ICOARE   0        OCD deltaT method for overwater fluxes
                  THRESHL  0.0      Threshold buoyancy flux over land needed
                                    to sustain convective mixing height growth

!END!

--------------------------------------------------------------------------------

INPUT GROUP: 2 -- Map Projection and Grid control parameter
--------------

     Projection
     ----------

     Map projection for all X,Y (km)
     (PMAP)                     Default: UTM    ! PMAP = LCC !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
         PS  :  Polar Stereographic
         EM  :  Equatorial Mercator
         LAZA:  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                    Default=0.0     ! FEAST  = 0.0 !
     (FNORTH)                   Default=0.0     ! FNORTH = 0.0 !
```

```
UTM zone (1 to 60)
(Used only if PMAP=UTM)
(IUTMZN)                    No Default      ! IUTMZN = 11 !

Hemisphere for UTM projection?
(Used only if PMAP=UTM)
(UTMHEM)                    Default: N      ! UTMHEM = N !
    N   :  Northern hemisphere projection
    S   :  Southern hemisphere projection

Latitude and Longitude (decimal degrees) of projection origin
(Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
(RLAT0)                     No Default      ! RLAT0 = 33.80534N !
(RLON0)                     No Default      ! RLON0 = 117.36072W !

    TTM :  RLON0 identifies central (true N/S) meridian of projection
           RLAT0 selected for convenience
    LCC :  RLON0 identifies central (true N/S) meridian of projection
           RLAT0 selected for convenience
    PS  :  RLON0 identifies central (grid N/S) meridian of projection
           RLAT0 selected for convenience
    EM  :  RLON0 identifies central meridian of projection
           RLAT0 is REPLACED by 0.0N (Equator)
    LAZA:  RLON0 identifies longitude of tangent-point of mapping plane
           RLAT0 identifies latitude of tangent-point of mapping plane

Matching parallel(s) of latitude (decimal degrees) for projection
(Used only if PMAP= LCC or PS)
(XLAT1)                     No Default      ! XLAT1 = 33.0N !
(XLAT2)                     No Default      ! XLAT2 = 35.0N !
    LCC :  Projection cone slices through Earth's surface at XLAT1 and XLAT2
    PS  :  Projection plane slices through Earth at XLAT1
           (XLAT2 is not used)

----------
Note:  Latitudes and longitudes should be positive, and include a
       letter N,S,E, or W indicating north or south latitude, and
       east or west longitude.  For example,
       35.9  N Latitude  =  35.9N
       118.7 E Longitude = 118.7E


Output Datum-Region
-------------------

The Datum-Region for the output coordinates is identified by a character
string.  Many mapping products currently available use the model of the
Earth known as the World Geodetic System 1984 (WGS-84).  Other local
models may be in use, and their selection in CALMET will make its output
consistent with local mapping products.  The list of Datum-Regions with
official transformation parameters is provided by the National Imagery and
and Mapping Agency (NIMA).

Datum-region for output coordinates
(DATUM)                     Default: WGS-84    ! DATUM = WGS-84 !



Grid
----

Reference coordinates X,Y (km) assigned to the southwest corner
of grid cell (1,1)  (lower left corner of grid)
```

```
     (XORIGKM)                  No Default      ! XORIGKM = -108  !
     (YORIGM)                   No Default      ! YORIGKM = -90 !

     Cartesian grid definition
     No. X grid cells (NX)      No default      ! NX =   54  !
     No. Y grid cells (NY)      No default      ! NY =   45  !
     Grid Spacing (DGRIDKM)     No default      ! DGRIDKM = 4 !
     in kilometers

     Vertical grid definition:
     -------------------------

        No. of vertical layers (NZ)    No default     ! NZ =  10  !

        Cell face heights in arbitrary
        vertical grid (ZFACE(NZ+1))    No defaults
                                       Units: m
        ! ZFACE = 0.,20.,40.,80.,160.,320.,640.,1200.,2000.,3000, 4000. !

!END!

--------------------------------------------------------------------------------
INPUT GROUP: 3 -- Output Options
--------------

    DISK OUTPUT OPTION

       Save met. fields in an unformatted
       output file ?            (LSAVE)  Default: T     ! LSAVE = T !
       (F = Do not save, T = Save)

       Type of unformatted output file:
       (IFORMO)                          Default: 1    ! IFORMO =  1  !

            1 = CALPUFF/CALGRID type file (CALMET.DAT)
            2 = MESOPUFF-II type file     (PACOUT.DAT)

    LINE PRINTER OUTPUT OPTIONS:

       Print met. fields ?  (LPRINT)       Default: F     ! LPRINT = F !
       (F = Do not print, T = Print)
       (NOTE: parameters below control which
              met. variables are printed)

       Print interval
       (IPRINF) in hours                   Default: 1     ! IPRINF =  1  !
       (Meteorological fields are printed
        every  1  hours)

       Specify which layers of U, V wind component
       to print (IUVOUT(NZ)) -- NOTE: NZ values must be entered
       (0=Do not print, 1=Print)
```

```
(used only if LPRINT=T)         Defaults: NZ*0
! IUVOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !
-----------------------


Specify which levels of the W wind component to print
(NOTE: W defined at TOP cell face --  10  values)
(IWOUT(NZ)) -- NOTE: NZ values must be entered
(0=Do not print, 1=Print)
(used only if LPRINT=T & LCALGRD=T)
-----------------------------------
                                     Defaults: NZ*0
 ! IWOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !


Specify which levels of the 3-D temperature field to print
(ITOUT(NZ)) -- NOTE: NZ values must be entered
(0=Do not print, 1=Print)
(used only if LPRINT=T & LCALGRD=T)
-----------------------------------
                                     Defaults: NZ*0
 ! ITOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !

Specify which meteorological fields
to print
(used only if LPRINT=T)             Defaults: 0 (all variables)
-----------------------


  Variable            Print ?
                  (0 = do not print,
                   1 = print)
  --------        ------------------

!  STABILITY  =           0           ! - PGT stability class
!  USTAR      =           0           ! - Friction velocity
!  MONIN      =           0           ! - Monin-Obukhov length
!  MIXHT      =           0           ! - Mixing height
!  WSTAR      =           0           ! - Convective velocity scale
!  PRECIP     =           0           ! - Precipitation rate
!  SENSHEAT   =           0           ! - Sensible heat flux
!  CONVZI     =           0           ! - Convective mixing ht.


Testing and debug print options for micrometeorological module

   Print input meteorological data and
   internal variables (LDB)         Default: F       ! LDB = F !
   (F = Do not print, T = print)
   (NOTE: this option produces large amounts of output)

   First time step for which debug data
   are printed (NN1)                Default: 1       ! NN1 =  1  !

   Last time step for which debug data
   are printed (NN2)                Default: 1       ! NN2 =  1  !

   Print distance to land
   internal variables (LDBCST)      Default: F       ! LDBCST = F !
   (F = Do not print, T = print)
   (Output in .GRD file DCST.GRD, defined in input group 0)

Testing and debug print options for wind field module
```

```
       (all of the following print options control output to
        wind field module's output files: TEST.PRT, TEST.OUT,
        TEST.KIN, TEST.FRD, and TEST.SLP)

          Control variable for writing the test/debug
          wind fields to disk files (IOUTD)
          (0=Do not write, 1=write)        Default: 0       ! IOUTD =  0  !

          Number of levels, starting at the surface,
          to print (NZPRN2)                Default: 1       ! NZPRN2 =  0  !

          Print the INTERPOLATED wind components ?
          (IPR0) (0=no, 1=yes)             Default: 0       !  IPR0 =  0  !

          Print the TERRAIN ADJUSTED surface wind
          components ?
          (IPR1) (0=no, 1=yes)             Default: 0       !  IPR1 =  0  !

          Print the SMOOTHED wind components and
          the INITIAL DIVERGENCE fields ?
          (IPR2) (0=no, 1=yes)             Default: 0       !  IPR2 =  0  !

          Print the FINAL wind speed and direction
          fields ?
          (IPR3) (0=no, 1=yes)             Default: 0       !  IPR3 =  0  !

          Print the FINAL DIVERGENCE fields ?
          (IPR4) (0=no, 1=yes)             Default: 0       !  IPR4 =  0  !

          Print the winds after KINEMATIC effects
          are added ?
          (IPR5) (0=no, 1=yes)             Default: 0       !  IPR5 =  0  !

          Print the winds after the FROUDE NUMBER
          adjustment is made ?
          (IPR6) (0=no, 1=yes)             Default: 0       !  IPR6 =  0  !

          Print the winds after SLOPE FLOWS
          are added ?
          (IPR7) (0=no, 1=yes)             Default: 0       !  IPR7 =  0  !

          Print the FINAL wind field components ?
          (IPR8) (0=no, 1=yes)             Default: 0       !  IPR8 =  0  !

!END!


-------------------------------------------------------------------------------

INPUT GROUP: 4 -- Meteorological data options
--------------

    NO OBSERVATION MODE             (NOOBS)  Default: 0     ! NOOBS =  0   !
          0 = Use surface, overwater, and upper air stations
          1 = Use surface and overwater stations (no upper air observations)
              Use MM4/MM5/3D for upper air data
          2 = No surface, overwater, or upper air observations
              Use MM4/MM5/3D for surface, overwater, and upper air data

    NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS

       Number of surface stations   (NSSTA)  No default     ! NSSTA =  43  !
```

```
       Number of precipitation stations
       (NPSTA=-1: flag for use of MM5/3D precip data)
                                (NPSTA)  No default     ! NPSTA =  45  !

    CLOUD DATA OPTIONS
       Gridded cloud fields:
                               (ICLOUD)  Default: 0     ! ICLOUD =  0  !
       ICLOUD = 0 - Gridded clouds not used
       ICLOUD = 1 - Gridded CLOUD.DAT generated as OUTPUT
       ICLOUD = 2 - Gridded CLOUD.DAT read as INPUT
       ICLOUD = 3 - Gridded cloud cover computed from prognostic fields

    FILE FORMATS

       Surface meteorological data file format
                               (IFORMS)  Default: 2     ! IFORMS =  2  !
       (1 = unformatted (e.g., SMERGE output))
       (2 = formatted   (free-formatted user input))

       Precipitation data file format
                               (IFORMP)  Default: 2     ! IFORMP =  2  !
       (1 = unformatted (e.g., PMERGE output))
       (2 = formatted   (free-formatted user input))

       Cloud data file format
                               (IFORMC)  Default: 2     ! IFORMC =  2  !
       (1 = unformatted - CALMET unformatted output)
       (2 = formatted   - free-formatted CALMET output or user input)

!END!


--------------------------------------------------------------------------------

INPUT GROUP: 5 -- Wind Field Options and Parameters
--------------


    WIND FIELD MODEL OPTIONS
       Model selection variable (IWFCOD)     Default: 1      ! IWFCOD =  1  !
          0 = Objective analysis only
          1 = Diagnostic wind module

       Compute Froude number adjustment
       effects ? (IFRADJ)                    Default: 1      ! IFRADJ =  1  !
       (0 = NO, 1 = YES)

       Compute kinematic effects ? (IKINE)   Default: 0      ! IKINE  =  0  !
       (0 = NO, 1 = YES)

       Use O'Brien procedure for adjustment
       of the vertical velocity ? (IOBR)     Default: 0      ! IOBR =  0  !
       (0 = NO, 1 = YES)

       Compute slope flow effects ? (ISLOPE) Default: 1      ! ISLOPE  =  1  !
       (0 = NO, 1 = YES)

       Extrapolate surface wind observations
       to upper layers ? (IEXTRP)            Default: -4     ! IEXTRP = -4  !
       (1 = no extrapolation is done,
        2 = power law extrapolation used,
        3 = user input multiplicative factors
            for layers 2 - NZ used (see FEXTRP array)
```

```
       4 = similarity theory used
       -1, -2, -3, -4 = same as above except layer 1 data
           at upper air stations are ignored

      Extrapolate surface winds even
      if calm? (ICALM)                      Default: 0      ! ICALM  =  0  !
      (0 = NO, 1 = YES)

      Layer-dependent biases modifying the weights of
      surface and upper air stations (BIAS(NZ))
        -1<=BIAS<=1
      Negative BIAS reduces the weight of upper air stations
        (e.g. BIAS=-0.1 reduces the weight of upper air stations
      by 10%; BIAS= -1, reduces their weight by 100 %)
      Positive BIAS reduces the weight of surface stations
        (e.g. BIAS= 0.2 reduces the weight of surface stations
      by 20%; BIAS=1 reduces their weight by 100%)
      Zero BIAS leaves weights unchanged (1/R**2 interpolation)
      Default: NZ*0
                                ! BIAS =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,
0  !

      Minimum distance from nearest upper air station
      to surface station for which extrapolation
      of surface winds at surface station will be allowed
      (RMIN2: Set to -1 for IEXTRP = 4 or other situations
       where all surface stations should be extrapolated)
                                            Default: 4.     ! RMIN2 = -1.0 !

      Use gridded prognostic wind field model
      output fields as input to the diagnostic
      wind field model (IPROG)              Default: 0      ! IPROG =  14  !
      (0 = No, [IWFCOD = 0 or 1]
       1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]
       2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD = 1]
       3 = Yes, use winds from MM4.DAT file as Step 1 field [IWFCOD = 0]
       4 = Yes, use winds from MM4.DAT file as initial guess field [IWFCOD = 1]
       5 = Yes, use winds from MM4.DAT file as observations [IWFCOD = 1]
       13 = Yes, use winds from MM5/3D.DAT file as Step 1 field [IWFCOD = 0]
       14 = Yes, use winds from MM5/3D.DAT file as initial guess field [IWFCOD = 1]
       15 = Yes, use winds from MM5/3D.DAT file as observations [IWFCOD = 1]

      Timestep (hours) of the prognostic
      model input data   (ISTEPPG)          Default: 1      ! ISTEPPG =  1   !

      Use coarse CALMET fields as initial guess fields (IGFMET)
      (overwrites IGF based on prognostic wind fields if any)
                                            Default: 0      ! IGFMET =  0  !

   RADIUS OF INFLUENCE PARAMETERS

      Use varying radius of influence       Default: F      ! LVARY =  F!
      (if no stations are found within RMAX1,RMAX2,
       or RMAX3, then the closest station will be used)

      Maximum radius of influence over land
      in the surface layer (RMAX1)          No default      ! RMAX1 = 100. !
                                            Units: km
      Maximum radius of influence over land
      aloft (RMAX2)                         No default      ! RMAX2 = 200. !
                                            Units: km
      Maximum radius of influence over water
      (RMAX3)                               No default      ! RMAX3 = 200. !
```

```
                                          Units: km


   OTHER WIND FIELD INPUT PARAMETERS

      Minimum radius of influence used in
      the wind field interpolation (RMIN)   Default: 0.1    ! RMIN = 0.1 !
                                            Units: km
      Radius of influence of terrain
      features (TERRAD)                     No default      ! TERRAD = 15. !

                                            Units: km
      Relative weighting of the first
      guess field and observations in the
      SURFACE layer (R1)                    No default      ! R1 = 50. !
      (R1 is the distance from an           Units: km
      observational station at which the
      observation and first guess field are
      equally weighted)

      Relative weighting of the first
      guess field and observations in the
      layers ALOFT (R2)                     No default      ! R2 = 100. !
      (R2 is applied in the upper layers    Units: km
      in the same manner as R1 is used in
      the surface layer).

      Relative weighting parameter of the
      prognostic wind field data (RPROG)    No default      ! RPROG = 0. !
      (Used only if IPROG = 1)              Units: km
      ------------------------

      Maximum acceptable divergence in the
      divergence minimization procedure
      (DIVLIM)                              Default: 5.E-6  ! DIVLIM= 5.0E-06 !

      Maximum number of iterations in the
      divergence min. procedure (NITER)     Default: 50     ! NITER =  50  !

      Number of passes in the smoothing
      procedure (NSMTH(NZ))
      NOTE: NZ values must be entered
           Default: 2,(mxnz-1)*4 ! NSMTH =
2 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4  !

      Maximum number of stations used in
      each layer for the interpolation of
      data to a grid point (NINTR2(NZ))
      NOTE: NZ values must be entered       Default: 99.    ! NINTR2 =
99 ,  99,  99 ,  99 ,  99,  99 ,  99 ,  99 , 99 ,  99 !

      Critical Froude number (CRITFN)       Default: 1.0    ! CRITFN = 1. !

      Empirical factor controlling the
      influence of kinematic effects
      (ALPHA)                               Default: 0.1    ! ALPHA = 0.1 !

      Multiplicative scaling factor for
      extrapolation of surface observations
      to upper layers (FEXTR2(NZ))          Default: NZ*0.0
      ! FEXTR2 = 0., 0., 0., 0., 0., 0., 0., 0., 0., 0. !
      (Used only if IEXTRP = 3 or -3)
```

```
BARRIER INFORMATION

   Number of barriers to interpolation
   of the wind fields (NBAR)              Default: 0       ! NBAR =  0  !

   Level (1 to NZ) up to which barriers
   apply (KBAR)                           Default: NZ      ! KBAR =  10  !

   THE FOLLOWING 4 VARIABLES ARE INCLUDED
   ONLY IF NBAR > 0
   NOTE: NBAR values must be entered      No defaults
         for each variable                Units: km

      X coordinate of BEGINNING
      of each barrier (XBBAR(NBAR))       ! XBBAR = 0. !
      Y coordinate of BEGINNING
      of each barrier (YBBAR(NBAR))       ! YBBAR = 0. !

      X coordinate of ENDING
      of each barrier (XEBAR(NBAR))       ! XEBAR = 0. !
      Y coordinate of ENDING
      of each barrier (YEBAR(NBAR))       ! YEBAR = 0. !


DIAGNOSTIC MODULE DATA INPUT OPTIONS

   Surface temperature (IDIOPT1)          Default: 0       ! IDIOPT1 =  0  !
      0 = Compute internally from
          hourly surface observations
      1 = Read preprocessed values from
          a data file (DIAG.DAT)

      Surface met. station to use for
      the surface temperature (ISURFT)    No default      ! ISURFT =  3  !
      (Must be a value from 1 to NSSTA)
      (Used only if IDIOPT1 = 0)
      --------------------------

   Domain-averaged temperature lapse
   rate (IDIOPT2)                         Default: 0      ! IDIOPT2 =  0  !
      0 = Compute internally from
          twice-daily upper air observations
      1 = Read hourly preprocessed values
          from a data file (DIAG.DAT)

      Upper air station to use for
      the domain-scale lapse rate (IUPT) No default      ! IUPT   =  1  !
      (Must be a value from 1 to NUSTA)
      (Used only if IDIOPT2 = 0)
      --------------------------

      Depth through which the domain-scale
      lapse rate is computed (ZUPT)       Default: 200.  ! ZUPT = 200. !
      (Used only if IDIOPT2 = 0)          Units: meters
      --------------------------

   Domain-averaged wind components
   (IDIOPT3)                              Default: 0      ! IDIOPT3 =  0  !
      0 = Compute internally from
          twice-daily upper air observations
      1 = Read hourly preprocessed values
          a data file (DIAG.DAT)
```

```
   Upper air station to use for
   the domain-scale winds (IUPWND)    Default: -1    ! IUPWND = -1  !
   (Must be a value from -1 to NUSTA)
   (Used only if IDIOPT3 = 0)
   --------------------------

   Bottom and top of layer through
   which the domain-scale winds
   are computed
   (ZUPWND(1), ZUPWND(2))        Defaults: 1., 1000. ! ZUPWND= 1., 1000. !
   (Used only if IDIOPT3 = 0)    Units: meters
   --------------------------

Observed surface wind components
for wind field module (IDIOPT4)  Default: 0     ! IDIOPT4 =  0  !
   0 = Read WS, WD from a surface
       data file (SURF.DAT)
   1 = Read hourly preprocessed U, V from
       a data file (DIAG.DAT)

Observed upper air wind components
for wind field module (IDIOPT5)  Default: 0     ! IDIOPT5 =  0  !
   0 = Read WS, WD from an upper
       air data file (UP1.DAT, UP2.DAT, etc.)
   1 = Read hourly preprocessed U, V from
       a data file (DIAG.DAT)

LAKE BREEZE INFORMATION

   Use Lake Breeze Module  (LLBREZE)
                                    Default: F      ! LLBREZE = F !

    Number of lake breeze regions (NBOX)            ! NBOX =  0  !

 X Grid line 1 defining the region of interest
                                                ! XG1 = 0. !
 X Grid line 2 defining the region of interest
                                                ! XG2 = 0. !
 Y Grid line 1 defining the region of interest
                                                ! YG1 = 0. !
 Y Grid line 2 defining the region of interest
                                                ! YG2 = 0. !

  X Point defining the coastline (Straight line)
            (XBCST)  (KM)   Default: none    ! XBCST = 0. !

  Y Point defining the coastline (Straight line)
            (YBCST)  (KM)   Default: none    ! YBCST = 0. !

  X Point defining the coastline (Straight line)
            (XECST)  (KM)   Default: none    ! XECST = 0. !

  Y Point defining the coastline (Straight line)
            (YECST)  (KM)   Default: none    ! YECST = 0. !


Number of stations in the region     Default: none ! NLB =  0 !
(Surface stations + upper air stations)

Station ID's  in the region   (METBXID(NLB))
(Surface stations first, then upper air stations)
  ! METBXID =  0 !
```

```
!END!


-------------------------------------------------------------------------------

INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation Parameters
--------------

    EMPIRICAL MIXING HEIGHT CONSTANTS

       Neutral, mechanical equation
       (CONSTB)                           Default: 1.41   ! CONSTB = 1.41 !
       Convective mixing ht. equation
       (CONSTE)                           Default: 0.15   ! CONSTE = 0.15 !
       Stable mixing ht. equation
       (CONSTN)                           Default: 2400.  ! CONSTN = 2400.!
       Overwater mixing ht. equation
       (CONSTW)                           Default: 0.16   ! CONSTW = 0.16 !
       Absolute value of Coriolis
       parameter (FCORIOL)                Default: 1.E-4  ! FCORIOL = 1.0E-04!
                                          Units: (1/s)

    SPATIAL AVERAGING OF MIXING HEIGHTS

       Conduct spatial averaging
       (IAVEZI)  (0=no, 1=yes)            Default: 1      ! IAVEZI =  1  !

       Max. search radius in averaging
       process (MNMDAV)                   Default: 1      ! MNMDAV =  1  !
                                          Units: Grid
                                                 cells
       Half-angle of upwind looking cone
       for averaging (HAFANG)             Default: 30.    ! HAFANG = 30. !
                                          Units: deg.
       Layer of winds used in upwind
       averaging (ILEVZI)                 Default: 1      ! ILEVZI =  1  !
       (must be between 1 and NZ)


    CONVECTIVE MIXING HEIGHT OPTIONS:
       Method to compute the convective
       mixing height(IMIHXH)              Default: 1      ! IMIXH =  -1  !
           1: Maul-Carson for land and water cells
          -1: Maul-Carson for land cells only -
              OCD mixing height overwater
           2: Batchvarova and Gryning for land and water cells
          -2: Batchvarova and Gryning for land cells only
              OCD mixing height overwater

       Threshold buoyancy flux required to
       sustain convective mixing height growth
       overland (THRESHL)                 Default: 0.05   ! THRESHL = 0.0 !
       (expressed as a heat flux          units: W/m3
        per meter of boundary layer)


       Threshold buoyancy flux required to
       sustain convective mixing height growth
       overwater (THRESHW)                Default: 0.05   ! THRESHW = 0.05 !
       (expressed as a heat flux          units: W/m3
        per meter of boundary layer)
```

```
   Option for overwater lapse rates used
   in convective mixing height growth
   (ITWPROG)                              Default: 0      ! ITWPROG =  0  !
   0 : use SEA.DAT lapse rates and deltaT (or assume neutral
       conditions if missing)
   1 : use prognostic lapse rates (only if IPROG>2)
       and SEA.DAT deltaT (or neutral if missing)
   2 : use prognostic lapse rates and prognostic delta T
       (only if iprog>12 and 3D.DAT version# 2.0 or higher)

   Land Use category ocean in 3D.DAT datasets
   (ILUOC3D)                              Default: 16     ! ILUOC3D =  16  !
   Note: if 3D.DAT from MM5 version 3.0, iluoc3d = 16
         if MM4.DAT,           typically iluoc3d = 7


OTHER MIXING HEIGHT VARIABLES

   Minimum potential temperature lapse
   rate in the stable layer above the
   current convective mixing ht.          Default: 0.001  ! DPTMIN = 0.001 !
   (DPTMIN)                               Units: deg. K/m
   Depth of layer above current conv.
   mixing height through which lapse      Default: 200.   ! DZZI = 200. !
   rate is computed (DZZI)                Units: meters

   Minimum overland mixing height         Default:  50.   ! ZIMIN = 50. !
   (ZIMIN)                                Units: meters
   Maximum overland mixing height         Default: 3000.  ! ZIMAX = 3000. !
   (ZIMAX)                                Units: meters
   Minimum overwater mixing height        Default:   50.  ! ZIMINW = 50. !
   (ZIMINW) -- (Not used if observed      Units: meters
   overwater mixing hts. are used)
   Maximum overwater mixing height        Default: 3000.  ! ZIMAXW = 3000. !
   (ZIMAXW) -- (Not used if observed      Units: meters
   overwater mixing hts. are used)


OVERWATER SURFACE FLUXES METHOD and PARAMETERS
      (ICOARE)                            Default: 10      ! ICOARE =  0   !
       0: original deltaT method (OCD)
      10: COARE with no wave parameterization (jwave=0, Charnock)
      11: COARE with wave option jwave=1 (Oost et al.)
          and default wave properties
     -11: COARE with wave option jwave=1 (Oost et al.)
          and observed wave properties (must be in SEA.DAT files)
      12: COARE with wave option 2 (Taylor and Yelland)
           and default wave properties
     -12: COARE with wave option 2 (Taylor and Yelland)
          and observed wave properties (must be in SEA.DAT files)

      Coastal/Shallow water length scale (DSHELF)
      (for modified z0 in shallow water)
      ( COARE fluxes only)
                                       Default : 0.        ! DSHELF = 0. !
                                       units: km

       COARE warm layer computation (IWARM)                ! IWARM =  0   !
       1: on - 0: off (must be off if SST measured with
       IR radiometer)                  Default: 0

       COARE cool skin layer computation (ICOOL)           ! ICOOL =  0   !
```

```
        1: on - 0: off (must be off if SST measured with
        IR radiometer)                   Default: 0


     TEMPERATURE PARAMETERS

        3D temperature from observations or
        from prognostic data? (ITPROG)        Default:0        ! ITPROG =  0   !

           0 = Use Surface and upper air stations
               (only if NOOBS = 0)
           1 = Use Surface stations (no upper air observations)
               Use MM5/3D for upper air data
               (only if NOOBS = 0,1)
           2 = No surface or upper air observations
               Use MM5/3D for surface and upper air data
               (only if NOOBS = 0,1,2)

        Interpolation type
        (1 = 1/R ; 2 = 1/R**2)                Default:1         ! IRAD =  1  !

        Radius of influence for temperature
        interpolation (TRADKM)                Default: 500.     ! TRADKM = 500. !
                                              Units: km

        Maximum Number of stations to include
        in temperature interpolation (NUMTS)  Default: 5        ! NUMTS = 5  !

        Conduct spatial averaging of temp-
        eratures (IAVET)  (0=no, 1=yes)       Default: 1        ! IAVET =  1  !
        (will use mixing ht MNMDAV,HAFANG
         so make sure they are correct)

        Default temperature gradient          Default: -.0098   ! TGDEFB = -0.0098 !
        below the mixing height over          Units: K/m
        water (TGDEFB)

        Default temperature gradient          Default: -.0045   ! TGDEFA = -0.0045 !
        above the mixing height over          Units: K/m
        water (TGDEFA)

        Beginning (JWAT1) and ending (JWAT2)
        land use categories for temperature                    ! JWAT1 =  55  !
        interpolation over water -- Make                       ! JWAT2 =  55  !
        bigger than largest land use to disable

    PRECIP INTERPOLATION PARAMETERS

        Method of interpolation (NFLAGP)      Default: 2       ! NFLAGP =  2  !
         (1=1/R,2=1/R**2,3=EXP/R**2)
        Radius of Influence  (SIGMAP)         Default: 100.0   ! SIGMAP = 100. !
         (0.0 => use half dist. btwn          Units: km
          nearest stns w & w/out
          precip when NFLAGP = 3)
        Minimum Precip. Rate Cutoff (CUTP)    Default: 0.01    ! CUTP = 0.01 !
         (values < CUTP = 0.0 mm/hr)          Units: mm/hr
!END!


-------------------------------------------------------------------------------

INPUT GROUP: 7 -- Surface meteorological station parameters
--------------
```

```
     SURFACE STATION VARIABLES
     (One record per station --  TBD  records in all)


             1     2
         Name   ID            X coord.   Y coord.   Time   Anem.
                               (km)       (km)      zone   Ht.(m)
        ----------------------------------------------------------
! SS1=  'TWEN'  690150    109.875   55.506   8   10 !
! SS2=  'NEWH'  720046   -110.943   62.950   8   10 !
! SS3=  'CORO'  720333    -22.129   10.528   8   10 !
! SS4=  'PALM'  722868     79.660    3.406   8   10 !
! SS5=  'RIVE'  722869     -6.681   16.050   8   10 !
! SS6=  'LAU '  722874    -85.906   24.645   8   10 !
! SS7=  'BURB'  722880    -91.901   44.333   8   10 !
! SS8=  'SAN1'  722885   -100.596   24.013   8   10 !
! SS9=  'VAN '  722886   -103.962   45.456   8   10 !
! SS10= 'BRAC'  722887    -38.969   30.878   8   10 !
! SS11= 'CHIN'  722899    -25.161   17.966   8   10 !
! SS12= 'BROW'  722904     36.979 -137.262   8   10 !
! SS13= 'NORT'  722906     15.072 -122.570   8   10 !
! SS14= 'GILL'  722907     36.865 -107.760   8   10 !
! SS15= 'AVAL'  722920    -98.155  -43.889   8   10 !
! SS16= 'SAN2'  722925   -114.660  -86.072   8   10 !
! SS17= 'MCC '  722927      7.532  -75.111   8   10 !
! SS18= 'OCEA'  722934      0.999  -65.243   8   10 !
! SS19= 'LOS1'  722950    -95.051   15.194   8   10 !
! SS20= 'ZAMP'  722955    -90.020   -0.161   8   10 !
! SS21= 'JACK'  722956    -89.897   12.814   8   10 !
! SS22= 'LONG'  722970    -72.696    1.022   8   10 !
! SS23= 'LOS2'  722975    -63.831   -2.259   8   10 !
! SS24= 'FULL'  722976    -57.570    7.017   8   10 !
! SS25= 'JOHN'  722977    -46.848  -13.781   8   10 !
! SS26= 'EDW1'  723171    -46.227  130.741   8   10 !
! SS27= 'PALM'  723820    -66.317   91.592   8   10 !
! SS28= 'SAND'  723830   -124.826  104.944   8   10 !
! SS29= 'SAN3'  723925   -228.123   71.604   8   10 !
! SS30= 'OXNA'  723927   -170.040   45.417   8   10 !
! SS31= 'RAM2'  745056     41.542  -85.005   8   10 !
! SS32= 'WHIT'  745057    -97.263   51.707   8   10 !
! SS33= 'ELM '  747043    -62.221   31.336   8   10 !
! SS34= 'CAM2'  747186     83.875 -129.647   8   10 !
! SS35= 'SAN4'  994027     18.163 -120.679   8   10 !
! SS36= 'SAN5'  994028   -105.224   23.065   8   10 !
! SS37= 'LOS3'  994035    -83.991   -9.421   8   10 !
! SS38= 'ANAH'  099901    -53.522    3.001   8   10 !
! SS39= 'CELA'  099905    -79.956   29.252   8   10 !
! SS40= 'LGBH'  099912    -76.666    2.384   8   10 !
! SS41= 'LYNN'  099913    -78.606   14.045   8   10 !
! SS42= 'SCLR'  099921   -107.337   64.683   8   10 !
! SS43= 'WSLA'  099922   -101.202   27.791   8   10 !

-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit integer for station ID

!END!
```

```
--------------------------------------------------------------------------------

INPUT GROUP: 8 -- Upper air meteorological station parameters
--------------

     UPPER AIR STATION VARIABLES
     (One record per station --  TBD  records in all)

             1      2
         Name    ID      X coord.   Y coord.  Time zone
                           (km)       (km)
        --------------------------------------------------
! US1  ='MIRA'  03190     19.72189     -103.70682     8     !

-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Five digit integer for station ID

!END!


--------------------------------------------------------------------------------

INPUT GROUP: 9 -- Precipitation station parameters
--------------

     PRECIPITATION STATION VARIABLES
     (One record per station --  TBD  records in all)
     (NOT INCLUDED IF NPSTA = 0)

            1          2
         Name   Station    X coord.  Y coord.
                  Code       (km)      (km)
         ------------------------------------
! PS1  ='PR02'     040014      -83.508       76.310   !
! PS2  ='PR07'     041057      -49.878        9.525   !
! PS3  ='PR08'     041194      -90.265       41.988   !
! PS4  ='PR09'     041272        0.066       47.102   !
! PS5  ='PR15'     041518      -10.148      -28.308   !
! PS6  ='PR17'     041540     -194.828       67.972   !
! PS7  ='PR18'     041682     -115.097       46.694   !
! PS8  ='PR21'     042164       16.666       37.134   !
! PS9  ='PR24'     042805       14.950      -44.937   !
! PS10 ='PR28'     043219     -159.277      103.913   !
! PS11 ='PR29'     043285      -48.028        9.515   !
! PS12 ='PR30'     043751      -93.930       44.241   !
! PS13 ='PR31'     044650      -11.105      -52.700   !
! PS14 ='PR32'     044749      -77.768      103.992   !
! PS15 ='PR35'     045085      -72.142        0.795   !
! PS16 ='PR37'     045114      -94.228       14.298   !
! PS17 ='PR38'     045115      -85.817       24.200   !
! PS18 ='PR39'     045212       14.835       28.259   !
! PS19 ='PR40'     045218        7.444       37.123   !
! PS20 ='PR43'     045417     -178.283       67.644   !
! PS21 ='PR45'     045637      -65.217       65.073   !
! PS22 ='PR52'     046162     -107.524       64.352   !
! PS23 ='PR55'     046473      -48.006       13.951   !
! PS24 ='PR56'     046572     -163.020       46.291   !
```

```
! PS25 ='PR57'     046577     -182.276        98.784   !
! PS26 ='PR59'     046624      -66.906        86.160   !
! PS27 ='PR63'     046910     -180.614        89.876   !
! PS28 ='PR65'     046942     -123.142        65.653   !
! PS29 ='PR67'     047123       -1.791       -30.531   !
! PS30 ='PR68'     047473       13.990       -24.976   !
! PS31 ='PR69'     047600       33.273        34.960   !
! PS32 ='PR73'     047762     -103.932        56.547   !
! PS33 ='PR74'     047779      -46.011        43.886   !
! PS34 ='PR75'     047837        4.720       -49.383   !
! PS35 ='PR76'     047891       27.758        28.288   !
! PS36 ='PR77'     047926      -55.284        33.954   !
! PS37 ='PR82'     048092     -102.271        39.892   !
! PS38 ='PR83'     048230      -74.011        -1.408   !
! PS39 ='PR84'     048243       -2.722       -39.403   !
! PS40 ='PR88'     048261     -133.428        53.591   !
! PS41 ='PR91'     048436      -41.476        27.229   !
! PS42 ='PR92'     048992        0.067       -46.058   !
! PS43 ='PR95'     049325       16.630        57.098   !
! PS44 ='PR96'     049345      -71.577        75.102   !
! PS45 ='PR98'     049666      -66.425        24.044   !


-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit station code composed of state
        code (first 2 digits) and station ID (last
        4 digits)

!END!
```

Appendix B
Federal Land Managers Approval Letter and Response to FLM Comments

From: Nick, Andrea -FS [anick@fs.fed.us]
Sent: Friday, December 06, 2013 7:59 AM
To: Salamy, Jerry/SAC
Cc: McCorison, Mike -FS; Anderson, Bret A -FS; Procter, Trent -FS; Uyehara, Julie C -FS; tchico@aqmd.gov; jbaker@aqmd.gov; stephen.okane@AES.com; Holladay.Cleveland@epamail.epa.gov; bohnenkamp.carol@epa.gov; Gbemis@energy.state.ca.us; JYee@aqmd.gov; Chris.Davis@energy.ca.gov
Subject: (Correction) AES Alamitos Energy Center PSD Application

Hello,

I apologize, the email below is in reference to the AES Alamitos Energy Center. The email should have read:

I am contacting you regarding the AES Alamitos Energy Center's Prevention of Significant Deterioration (PSD) permit. The U.S. Forest Service's Air Resources air quality modeling specialist along with other interested parties within the agency have reviewed the air dispersion modelling protocol which was submitted on November 11, 2013 entitled "AES_AEC_1_Protocol_Response_USFS_11-11-13.pdf". We are not anticipating further comment on the air dispersion modelling protocol for the AES Alamitos Energy Center project and you are free to proceed with the agreed protocol.

Andrea Nick, Air Resources Specialist
Forest Service Region 5
www.fs.fed.us/air

p: 626-574-5209 / c: 626-590-4451 / anick@fs.fed.us
701 N. Santa Anita Avenue, Arcadia, CA 91006-2725

From: Nick, Andrea -FS
Sent: Friday, December 06, 2013 7:49 AM
To: 'Jerry.Salamy@CH2M.com'
Cc: McCorison, Mike -FS; Anderson, Bret A -FS; Procter, Trent -FS; Uyehara, Julie C -FS; tchico@aqmd.gov; jbaker@aqmd.gov; stephen.okane@AES.com; Holladay.Cleveland@epamail.epa.gov; bohnenkamp.carol@epa.gov; Gbemis@energy.state.ca.us; JYee@aqmd.gov; Chris.Davis@energy.ca.gov
Subject: RE: AES Alamitos Energy Center PSD Application

Hello,

I am contacting you regarding the AES Huntington Beach Prevention of Significant Deterioration (PSD) permit. The U.S. Forest Service's Air Resources air quality modeling specialist along with other interested parties within the agency have reviewed the air dispersion modelling protocol which was submitted on November 11, 2013 entitled "AES_AEC_1_Protocol_Response_USFS_11-11-13.pdf". We are not anticipating further comment on the air dispersion modelling protocol for the AES Huntington Beach project and you are free to proceed with the agreed protocol.

Please contact me if you have further questions. Thank you.

Andrea Nick, Air Resources Specialist
Forest Service Region 5
www.fs.fed.us/air

p: 626-574-5209 / c: 626-590-4451 / anick@fs.fed.us
701 N. Santa Anita Avenue, Arcadia, CA 91006-2725

From: Jerry.Salamy@CH2M.com [mailto:Jerry.Salamy@CH2M.com]
Sent: Tuesday, November 12, 2013 9:29 AM
To: Nick, Andrea -FS
Cc: McCorison, Mike -FS; Anderson, Bret A -FS; Procter, Trent -FS; Uyehara, Julie C -FS; tchico@aqmd.gov; jbaker@aqmd.gov; stephen.okane@AES.com; Holladay.Cleveland@epamail.epa.gov; bohnenkamp.carol@epa.gov; Gbemis@energy.state.ca.us; JYee@aqmd.gov; Chris.Davis@energy.ca.gov
Subject: RE: AES Alamitos Energy Center PSD Application

Hi Andrea,

Based on your feedback during our November 1 conference call, we have prepared the attached responses to the United States Forest Service's comments on the Alamitos Energy Center's Class I air dispersion modeling protocol. Please let us know if you have any additional questions.

Thanks,

Jerry Salamy
Principal Project Manager
CH2M HILL/Sacramento
Phone 916-286-0207
Fax 916-614-3407
Cell Phone 916-769-8919

From: Nick, Andrea -FS [mailto:anick@fs.fed.us]
Sent: Wednesday, September 11, 2013 9:06 AM
To: Salamy, Jerry/SAC
Cc: McCorison, Mike -FS; Anderson, Bret A -FS; Procter, Trent -FS; Uyehara, Julie C -FS
Subject: AES Alamitos Energy Center PSD Application

Good Morning,

Our modeling specialist (Bret Anderson) has looked over the modeling protocols supplied for the AES Alamitos Energy Center PSD application. Additional information on the following subjects is requested:

1. MM5 Data documentation: source of data, horizontal/vertical resolution, physics options, performance evaluation, etc.

2. List of all surface and upper air meteorological stations.

3. Procedures for filling in missing meteorological data.

4. List of Proposed CALPUFF control options.

5. List of POSTUTIL and CALPOST options.

6. Discussion on CALMET control options as proposal does not comport with August 31, 2009 EPA Model Clearinghouse memorandum.

Our modeling specialist has recommended that we schedule a conference call to discuss these issues. Would any of the afternoons on Monday, Tuesday, or Thursday work for you?

****

Andrea Nick
Air Resources Specialist
701 N. Santa Anita Ave.
Arcadia, Ca. 91006
Office (626) 574-5209
Cell (626) 590-4451
anick@fs.fed.us
www.fs.fed.us/air

Alamitos Energy Center - Response to USFS FLM Comments on the AQRV Protocol

PREPARED FOR: USFS Federal Land Managers

COPY TO: Tom Chico/SCAQMD
Jillian Baker/SCAQMD
Cleveland Holladay/EPA
Stephen O'Kane/AES
CH2M HILL/Project Folder

PREPARED BY: CH2M HILL

DATE: November 11, 2013

AES Alamitos, LLC (AES) proposes to construct the Alamitos Energy Center (AEC or project) at the existing AES Alamitos Generating Station site in Los Angeles County. Emission estimates indicate that the project will exceed Prevention of Significant Deterioration (PSD) significant emission increases for nitrogen oxides (NOx), which is an attainment pollutant, volatile organic compounds (VOC), and particulate matter with a diameter of 10 microns or less (PM_{10}), for which the area is designated as maintenance. Therefore, the project will be required to conduct an analysis at Class I areas for which NOx and PM_{10} could affect Air Quality Related Values (AQRVs) (40 Code of Federal Regulations [CFR] 51.166(p)(2)).[1] Class I AQRVs affected by significant increases in NOx and PM_{10} are visibility and total nitrogen deposition.

An AQRV modeling protocol[2] was submitted to the U.S. Forest Service (USFS) on September 4, 2013. The USFS supplied comments to the modeling protocol on September 27, 2013. Subsequently, a conference call to discuss the USFS comments was conducted on November 1, 2013. The purpose of the meeting was to receive further input and clarification from the USFS regarding comments on the AQRV modeling protocol.

This technical memorandum summarizes the USFS comments on the AQRV modeling protocol and each comment is followed by a detailed response. Supporting documentation for the responses is attached to this memorandum.

In addition to the written comments below, during the November 1, 2013 conference call, the Federal Land Managers (FLMs) identified two additional Class I areas to include in the visibility and total nitrogen deposition analysis, even though the Q/d screening analysis was below the threshold of 10 for each of these areas. These two additional Class I areas are Agua Tibia Wilderness Area and San Gorgonio Wilderness Area. The two additional areas will be included in the visibility and total nitrogen deposition analysis for the Class I area analysis.

Comment 1: [Please provide] MM5 data documentation [including]: source of data, horizontal/vertical resolution, physics options, and performance evaluation.

Response: As described in the AQRV modeling protocol, MM5 data for years 2006, 2007, and 2008 are proposed for this analysis. The MM5 data is of 36-kilometer (km) horizontal resolution and developed by Alpine Geophysics, LLC.

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[1] No air dispersion modeling demonstration is required for VOC.

[2] CH2M HILL, 2013. *Dispersion Modeling Protocol for Air Quality Related Values at Class I Areas Near the Alamitos Energy Center*. Sacramento, CA. September.

Alpine Geophysics, LLC has provided a performance evaluation of the year 2006 for the continental and western United States, which is included in Attachment A. Model performance is evaluated based on state-wide statistics of temperature bias, temperature error, mixing ratio bias, mixing ratio error, and wind speed index agreement (refer to Tables 3-1, 3-4, 3-7, 3-10, and 3-14, respectively, of Attachment A) as well as numerous snapshots of MM5 predicted parameters with comparisons to contemporaneous observations.

For the 12-km and 36-km domains, the statistical values were compared with similar model performance evaluation statistics from MM5 simulations performed in previous studies upon the same or very similar grid domains. Based on this comparison, the current simulation has performance characteristics that are similar to prior studies. Of the simulations examined, no one simulation exhibits consistently superior performance. Therefore, the current MM5 simulation is performing at par with other simulations that are currently being used for air quality planning so the overall performance of the model is judged to be adequate (Alpine Geophysics, LLC, 2008. *Evaluation of 36/12/4 km MM5 for Calendar Year 2006 over the Continental and Western United States with Emphasis in Southwestern Wyoming*. December).

Comment 2: [Please provide the] procedures for filling in missing meteorological data [and a] list of surface and upper air meteorological stations.

Response: Missing meteorological data will be filled in using different approaches depending on whether it is surface station data or Miramar upper air station data.

If required, surface station data will be filled in following the procedures outlined in the *Meteorological Monitoring Guidance for Regulatory Modeling Applications*[3] guidance document.

Upper air sounding data will be filled in using the TRC UAMAKE pre-processor. If sounding data are missing, the UAMAKE pre-processor will extract sounding data from the prognostic data set for substitution for the missing sounding period. These data will be compared to upper air weather maps from the National Oceanic and Atmospheric Administration (NOAA) Central Library U.S. Daily Weather Maps Project[4] for accuracy and appropriateness.

Attachment B contains a list of the surface and upper air monitoring stations to be included in the CALMET processing.

Comment 3: [Please supply the] list of proposed CALPUFF control options.

Response: As described in the modeling protocol, the MESOPUFF II chemistry scheme will be used for the analysis. A sample CALPUFF input file is supplied in Attachment C, which contains the model triggers required to accurately characterize the emissions from the proposed source to evaluate potential impacts to visibility and total nitrogen deposition at the Class I areas analyzed.

Comment 4: [Please supply the] list of POSTUTIL and CALPOST [control] options.

Response: As recommended by the FLMs' AQRV Work Group (FLAG) guidance document[5], the method 8, mode 5 option in CALPOST will be used to determine the change in background light extinction for each Class I area being evaluated. Attachment D contains the sample CALPOST output file, which identifies the control options utilized for the analysis. As agreed upon during the November 1, 2013 conference call, the Agua Tibia and San Gorgonio Wilderness areas will also be evaluated in the AQRV analysis for project

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[3] U.S. Environmental Protection Agency (EPA), 2000. *Meteorological Monitoring Guidance for Regulatory Modeling Applications.* Office of Air Quality Planning and Standards. Research Triangle Park, NC. February. EPA-454/R-99-005.

[4] http://docs.lib.noaa.gov/rescue/dwm/ data_rescue_daily_weather_maps.html

[5] U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service, 2010. *Federal Land Managers' Air Quality Related Values Work group (FLAG) Phase I Report (Revised 2010)*. Natural Resource Report NPS/NRPC/NRR—2010/232. National Park Service. Denver, Colorado. November.

impacts on visibility and total nitrogen deposition. Ambient background concentrations of light attenuating pollutants are based on the 20 percent best day visibility conditions for these Class I areas. To augment the 20 percent best natural conditions presented in Table 4-1 of the modeling protocol, the proposed background values (taken from Table 5 of the FLAG guidance document) for Agua Tibia and San Gorgonio Wilderness Areas are presented in Table 1. Table 2 presents the f(RH) values used for these additional Class I areas modeled to augment the modeling protocol Table 4-2.

TABLE 1

20 Percent Best Natural Conditions

Aerosol Component	Agua Tibia Wilderness Area	San Gorgonio Wilderness Area
Ammonium Sulfate ($\mu g/m^3$)	0.03	0.03
Ammonium Nitrate ($\mu g/m^3$)	0.04	0.02
Organic Matter ($\mu g/m^3$)	0.26	0.15
Elemental Carbon ($\mu g/m^3$)	0.01	0.01
Soil ($\mu g/m^3$)	0.26	0.10
Coarse Mass ($\mu g/m^3$)	1.20	0.62
Sea Salt ($\mu g/m^3$)	0.04	0.02
Rayleigh (Mm^{-1})	11	10

*Data taken from Table 5 of the FLAG guidance document.
$\mu g/m^3$ = microgram per cubic meter
Mm^{-1} = inverse megameters

TABLE 2

CALPOST Method 8 f(RH) values

f(RH) Fraction	f(RH) by Month											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Agua Tibia Wilderness Area												
f(RH) Small	2.68	2.61	2.63	2.42	2.40	2.33	2.33	2.45	2.49	2.46	2.29	2.42
f(RH) Large	2.10	2.08	2.11	1.98	1.98	1.93	1.93	2.01	2.02	1.99	1.87	1.95
f(RH) Sea Salt	2.94	2.95	3.02	2.85	2.88	2.81	2.78	2.90	2.90	2.83	2.56	2.69
San Gorgonio Wilderness Area												
f(RH) Small	2.94	2.94	2.74	2.36	2.34	2.00	1.88	2.02	2.05	2.04	2.10	2.43
f(RH) Large	2.21	2.23	2.13	1.90	1.90	1.69	1.62	1.71	1.72	1.70	1.73	1.92
f(RH) Sea Salt	2.97	3.06	2.93	2.60	2.63	2.28	2.13	2.30	2.31	2.24	2.25	2.55

As described in the protocol, POSTUTIL will be used to reapportion the nitrate concentrations using monthly ambient ammonia data. Attachment D contains a sample POSTUTIL input file which details the control options.

Comment 5: Discussion on CALMET control options as proposal does not comport with August 31, 2009 EPA Model Clearinghouse memorandum.

Response: Based on the USFS comment and the November 1, 2013 conference call, the control options for CALMET have been updated to reflect the recommendations in the August 31, 2009 clarification memorandum[6]. The revised sample CALMET input file for the proposed project is included in Attachment E.

[6] EPA, 2009. *Clarification on EPA FLM Recommended Settings for CALMET.* Research Triangle Park, NC. August 31.

Attachment A

MM5 Performance Evaluation Support Documentation

Evaluation of 36/12/4 km MM5 for Calendar Year 2006 over the Continental and Western United States with Emphasis in Southwestern Wyoming

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5 December 2008

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1 INTRODUCTION

Over the past decade, emergent requirements for direct numerical simulation of urban and regional scale photochemical and secondary aerosol air quality—spawned largely by the new particulate matter ($PM_{2.5}$) and regional haze regulations—have led to intensified efforts to construct high-resolution emissions, meteorological and air quality data sets. The concomitant increase in computational throughput of low-cost modern scientific workstations has ushered in a new era of regional air quality modeling. It is now possible, for example, to exercise sophisticated mesoscale prognostic meteorological models and Eulerian and Lagrangian photochemical/aerosol models for the full annual period, simulating ozone, sulfate and nitrate deposition, and secondary organic aerosols (SOA) across the entire United States (U.S.) or over discrete subregions.

One such model is the Pennsylvania State University/National Center for Atmospheric Research (PSU/NCAR) Mesoscale Model (MM5) (Dudhia, 1993; Grell et al., 1994: www.mmm.ucar.edu/mm5). MM5 is a limited-area, non-hydrostatic, terrain-following model designed to simulate mesoscale atmospheric circulation. The model is supported by several pre- and post-processing programs which are referred to collectively as the MM5 modeling system.

This report describes an application and performance evaluation of MM5 for an atmospheric simulation for calendar 2006 over a modeling domain that covers the continental United States at 36km grid spacing, much of the Intermountain Western United States at 12km grid spacing and a 4km grid over western Wyoming, Northern Utah and Eastern Idaho.

2 METHODOLOGY

The methodology for this approach is very straightforward. The basic methodology was to apply the MM5 model for the 2006 annual period, and the model results (e.g., wind speeds, wind directions, temperatures) were compared with available surface meteorological observations.

2.1 Model Selection and Application

A brief summary of the MM5 input data preparation procedure used for this annual modeling exercise is provided in the following text.

Model Selection: The publicly available non-hydrostatic version of MM5 (version 3.7.4) was used for this modeling study. Preprocessor programs of the MM5 modeling system including TERRAIN, REGRID, LITTLE_R, and INTERPF (UCAR, 2003b) were used to develop model inputs.

Horizontal Domain Definition: The computational grid is presented in Figure 2-1. The outer 36km domain (D01) has 165 x 129 grid cells, selected to maximize the coverage of the National Center for Environmental Prediction (NCEP) ETA analysis region. The projection is Lambert Conformal with the "national RPO" grid projection pole of 40^o, -97^o with true latitudes of 33^o and 45^o. The 12km domain (D02) has 103 x 100 grid cells with offsets from the 36km grid of 41 columns and 58 rows. The 04km domain (D03) has 163x166 grid cells with offsets from the 12km grid of 13 columns and 30 rows.

Vertical Domain Definition: The MM5 modeling is based on 34 vertical layers with an approximately 38 meter deep surface layer. The MM5 vertical domain is presented in both sigma and height coordinates in Table 2-1.

Topographic Inputs: Topographic information for the MM5 was developed using the NCAR and the United States Geological Survey (USGS) terrain databases (UCAR, 2002). The 36km grid was based on the 5 min (~9 km) Geophysical Data Center global data. The 12km grid was based on the 2 min (~4 km) Geophysical Data Center Global data and the 4km grid on the 30 sec (~1 km) data. Terrain data was interpolated to the model grid using a Cressman-type objective analysis scheme (Cressman, 1959). To avoid interpolating elevated terrain over water bodies, after the terrain databases were interpolated onto the MM5 grid, the NCAR graphic water body database was used to correct elevations over water bodies.

Vegetation Type and Land Use Inputs: Vegetation type and land use information were developed using the most recently released PSU/NCAR databases provided with the MM5 distribution (UCAR, 2002). Standard MM5 surface characteristics that correspond to each land use category were employed.

Atmospheric Data Inputs: The first guess fields were taken from the NCAR ETA archives (UCAR, 2008a). Available surface and upper-air observations were used in the objective analyses. These data were incorporated into the analyses datasets following the procedures outlined by Stauffer and Seaman (1990) and were quality-inspected by MM5 pre-processors using automated gross-error checks and "buddy" checks. In addition, radiosonde soundings were subjected to vertical consistency checks. The synoptic-scale data used for the initialization (and in the analysis nudging discussed later) were obtained from the conventional National Weather Service (NWS) twice-daily radiosondes (UCAR, 2008a) and 3-hr NWS surface observations (UCAR, 2008b).

Water Temperature Inputs: The ETA database contains a “skin temperature” field. This can be and was used as the water temperature input to these MM5 simulations. Past studies have shown that these skin temperatures, the water temperature surrogates, can lead to temperature errors along coastlines. However, for this analysis which focuses on bulk continental scale transport with more resolved flows the intermountain west, this issue is likely not important and the skin temperatures were used.

FDDA Data Assimilation: This simulation used a combination of analysis observation based nudging. Analysis nudging coefficients of $2.5x10^{-4}$ on the 36km grid domain and $1.0x10^{-4}$ on the 12km grid domain were used for winds and temperature. For mixing ratio, analysis nudging coefficients of $1.0x10^{-5}$ were used for both the 36km and 12km grids. On the 36km and 12km grids, nudging was done at both the surface and aloft layers though nudging of temperatures and mixing ratios were excluded in the boundary layer. For the 4km grid, observation nudging to NOAA Techniques Development Lab (TDL) surface observation database (NCAR DS472.0) was used for winds with a nudging coefficient of $4x10^{-4}$

Physics Options: The MM5 physics options employed in this analysis were as follows:

- Betts-Miller Cumulus Parameterization;
- Pleim-Xiu PBL and Land Surface Schemes;
- Reisner 1 Mixed Phase Moisture Scheme; and
- RRTM Atmospheric Radiation Scheme.

Application Methodology: The MM5 model was executed in 5-day blocks initialized at 12Z every 5 days with a 90 second time step. Model results were output every 60 minutes and output files were split at 24 hour intervals. Twelve (12) hours of spin-up was included in each 5-day block before the data were used in the subsequent evaluation. The model was run for all of calendar year 2006.

2.2 Evaluation Approach

The model evaluation approach was based on a combination of qualitative and quantitative analyses. The qualitative approach was to compare the model estimated monthly total precipitation with the monthly Center for Prediction of Climate (CPC) precipitation analysis using graphical outputs (CPC, 2008; Higgins et al., 1996). For the quantitative model performance evaluation, tabulations of (1) the model bias and error for temperature and mixing ratio and (2) the index of agreement for the wind fields were analyzed for each of the grid domains (i.e., 36km, 12km, and 4km). The observed database for winds, temperature, and water mixing ratio used in this analysis was the NOAA Technique Development Lab (TDL) DS472 dataset (UCAR, 2008b; Vincent et al., 2007). Further, the 36km and 12km statistical results were compared to similar 36km and 12km simulations performed in other studies.

Interpretation of bulk statistics over a continental or regional scale domain is problematic. To detect if the model is missing important sub-regional features is difficult. For this analysis, the statistics were performed on a state-by-state basis, a Regional Planning Organization (RPO) basis, and on a domain-wide for the continental 36km domain and the regional 12km domain.

Table 2-1. MM5 vertical domain specification.

k (MM5)	sigma level	pressure (Pa)	height (m)	depth (m)
34	0.000	10000	15674	2004
33	0.050	14500	13670	1585
32	0.100	19000	12085	1321
31	0.150	23500	10764	1139
30	0.200	28000	9625	1004
29	0.250	32500	8621	900
28	0.300	37000	7720	817
27	0.350	41500	6903	750
26	0.400	46000	6153	693
25	0.450	50500	5461	645
24	0.500	55000	4816	604
23	0.550	59500	4212	568
22	0.600	64000	3644	536
21	0.650	68500	3108	508
20	0.700	73000	2600	388
19	0.740	76600	2212	282
18	0.770	79300	1930	274
17	0.800	82000	1657	178
16	0.820	83800	1478	175
15	0.840	85600	1303	172
14	0.860	87400	1130	169
13	0.880	89200	961	167
12	0.900	91000	794	82
11	0.910	91900	712	82
10	0.920	92800	631	81
9	0.930	93700	550	80
8	0.940	94600	469	80
7	0.950	95500	389	79
6	0.960	96400	310	78
5	0.970	97300	232	78
4	0.980	98200	154	39
3	0.985	98650	115	39
2	0.990	99100	77	38
1	0.995	99550	38	38
0	1.000	100000	0	0

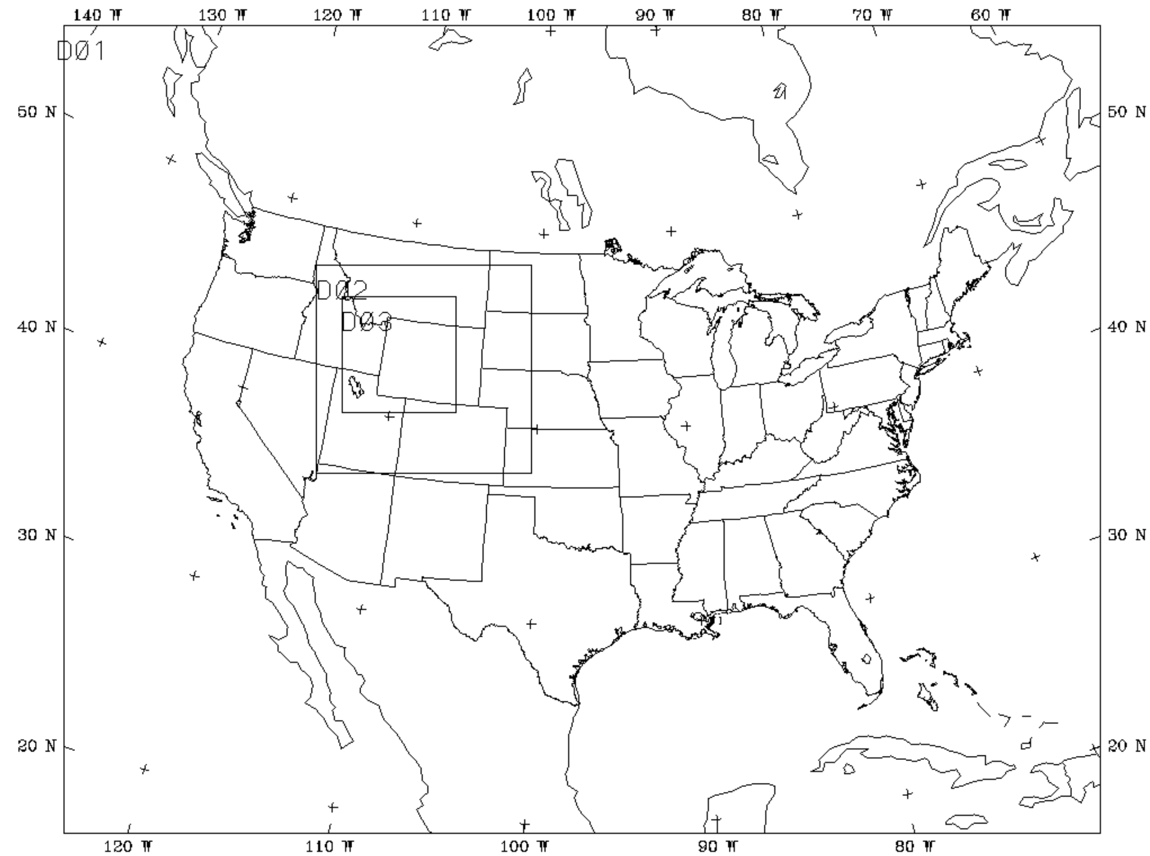

Figure 2-1. 36km (D01), 12km (D02) and 4km (D03) MM5 Domain.

3 MM5 PERFORMANCE EVALUATION RESULTS

3.1 Introduction

Quantitative and qualitative model performance evaluation results for surface winds, temperature, mixing ratio and episode total precipitation are presented and discussed. A full annual model evaluation is very difficult to summarize in a single document. With this in mind, this section presents results so potential users of the MM5 predictions can independently judge the adequacy of the model simulation. Overall comparisons are offered herein to judge the model efficacy, but this review does not necessarily cover all potential user needs and applications.

The statistics that were estimated include the mean bias (or simply bias) and mean absolute gross error (or simply error) for temperature and mixing ratio as well as the wind speed index of agreement (Willmott, 1982; Willmott et al., 1985). Bias quantifies the difference between the average of a predicted value and the average of an observed value. If the bias is negative, the model is said to underpredict the mean observed value. Error quantifies the average of the absolute differences between the predictions and observations. Thus, even if a simulation exhibits no bias, it can still exhibit large error as the simulation results have offsetting under- and overpredictions. Index of agreement quantifies the relative average error between the predictions and observations. ***Please note*** that in the comparisons, vertical level one model estimates that are predicted at approximately nineteen meters are compared directly with the nominal, observed temperatures and moistures that are measured at about two meters and wind speeds and directions that are measured at about ten meters. As such, model performance must be judged with this caveat taken into context.

Quantitative meteorological model performance benchmarks have been developed to help assess the ability of a model to reproduce observed conditions (Emery et al., 2001). The benchmarks are based upon the evaluation of about thirty MM5 and RAMS meteorological simulations of *multi-day episodes* in support of air quality modeling study applications performed over several years. In turn, these benchmarks have been adopted for use in *annual* meteorological modeling studies. The purpose of these benchmarks is not to give a pass or fail grade to any one particular meteorological model application, but rather to put the model results into the proper context of other model simulations and meteorological data sets. That is, the benchmarks provide a contextual understanding as to how the model results compare to other model applications run over portions of the continental United States. Therefore, the benchmarks must be viewed as being *guideline* and not *bright-line* numbers. These benchmarks include bias and error in temperature and mixing ratio as well as the wind speed index of agreement (IA) between the model predictions and observational data bases. The benchmarks for each variable to judge whether predictions from a meteorological model are on par with previous meteorological modeling studies are as follows:

- Temperature bias: less than or equal to ±0.5 K;

- Temperature error: less than or equal to 2.0 K
- Mixing ratio bias: less than or equal to ±1.0 g/kg
- Mixing ratio error: less than or equal to 2.0 g/kg
- Wind speed index of agreement: 0 = worst, 1 = best, 0.6 = acceptable

3.2 Quantitative Model Evaluation Results

Tables 3-1 through 3-15 summarize the statistical metrics by month, season, and year for each state and Regional Planning Organization (RPO). The statistical metrics are presented in individual tables for the 36km, 12km, and 4km modeling domains. Model performance results of the MM5 simulation are presented for the metrics temporally by year, season, and month and spatially by the domain as a whole, by RPO subdomain, and by state. For reference, a graphic of the RPO boundaries is presented in Figure 3-1.

3.2.1 Temperature Bias and Error

Temperature bias statistics are presented in Tables 3-1, 3-2, and 3-3 for the 36km, 12km and 04km domains, respectively. When the temperature biases are averaged over the entire 2006 period for the entire modeling domain (ALL), the model has a bias of 0.46 K for the 36km domain, 0.27 K for the 12km domain, and 0.97 K for the 04km domain. That is, MM5 overestimates mean annual observed temperatures in all three modeling domains, with the model falling within the ±0.5 K benchmark for the 36km and 12km domains.

Over the 36km domain, in general, MM5 tends to overpredict temperatures both seasonally and monthly with the exception of the WRAP states in spring and summer where there is a mix of positive and negative biases. Over the 12km domain, there is a general positive temperature bias seasonally and monthly with the exception of the spring months. And over the 04km domain, MM5 tends to overpredict temperatures, though March and April have distinct underpredictions.

Tables 3-4, 3-5, and 3-6 show the temperature error statistics for the 36km, 12km and 04km modeling domains, respectively. When the temperature errors are averaged over the entire 2006 period for the entire modeling domain (ALL), the model has a temperature error of 2.23 K for the 36km domain, 2.92 K for the 12km domain, and 2.89 K for the 04km domain all which miss the 2.0 K benchmark for temperature error.

Over the 36km domain on a month and seasonal basis by state and RPO subdomain, MM5 generally does not meet the 2.0 K benchmark for temperature error with the exception of the summer months for all but the WRAP states. Over the 12km and 04km domains, MM5 does not meet the benchmark for any period.

3.2.2 Mixing Ratio Bias and Error

Mixing ratio bias statistics are presented in Tables 3-7, 3-8, and 3-9 for the 36km, 12km, and 04km modeling domains, respectively. When the mixing ratio biases are averaged over the entire 2006 period for the entire modeling domain (ALL), the model has a bias of 0.20 g/kg for the 36km domain, -0.04 g/kg for the 12km domain, and -0.51 g/kg for the 04km domain with all within the mixing ratio bias benchmark of ±1.0 g/kg.

Over the 36km domain, in general, MM5 tends to overpredict mixing ratio both seasonally and monthly with the exception of the summer months most notably in the VISTAS, CENRAP and WRAP states. Over the 12km domain, there is a general negative mixing ratio bias seasonally and monthly with the exception of the winter months. And over the 04km domain, MM5 tends to underpredict mixing ratio with the exception, again, of the winter months.

Tables 3-10, 3-11, and 3-12 show the mixing ratio error statistics for the 36km, 12km and 04km modeling domains, respectively. When the mixing ratio errors are averaged over the entire 2006 period for the entire modeling domain (ALL), the model has a mixing ratio error of 1.04 g/kg for the 36km domain, 0.81 g/kg for the 12km domain, and 0.94 g/kg for the 04km domain all which meet the 2.0 g/kg benchmark for mixing ratio error.

Over the 36km domain on a month and seasonal basis by state and RPO subdomain, MM5 almost exclusively meets the 2.0 g/kg benchmark for mixing ratio error with the exceptions of Oklahoma in July and Arizona in May. Over the 12km and 04km domains, MM5 meets the benchmark for all periods.

3.2.3 Wind Speed Index of Agreement

The wind speed index of agreement (IA) model performance results are presented in Tables 3-13, 3-14, and 3-15 for the 36km, 12km, and 04km domains, respectively. The 36 km domain-wide 2006 annual average IA is 0.87, which is well above the benchmark of 0.6. Seasonal and month-to-month IA values for the entire domain are also well above the 0.6 benchmark with IA values no less than 0.85. Over the entire 12km and 04km domains, the IA is 0.84 and 0.80, respectively, which are well above the benchmark. Further for the 12km and 04km domains, MM5 meets the IA benchmark for all areas both monthly and seasonally.

3.3 Qualitative Monthly Precipitation Analysis

This section presents qualitative comparisons of MM5 estimated precipitation with the CPC retrospective analysis data. When comparing the CPC and MM5 precipitation data, note should be taken that the CPC analysis covers only the Continental U.S. and does not extend offshore or into Canada or Mexico. The MM5 fields, on the other hand, cover the entire 36km domain. Also note that the CPC analysis is based on a 0.25 x 0.25 degree (~40 x 40 km) grid and the MM5 is based on a 36 x 36 km grid. Neither grid will effectively capture small precipitation features.

Monthly total precipitation comparisons for the 36km domain are presented in Figures 3-2 through 3-13. For each month, the first plot (e.g., Figure 3-2a) represents the CPC analyzed precipitation data, and the second plot (e.g., Figure 3-2b) represents the MM5 total precipitation for the month (e.g., Figure 3-2 is for January 2006 over the 36km domain). If the CPC analysis data are considered to be the observational standard for precipitation, MM5 provides an overall, reasonable representation of the spatial distribution and rate of precipitation over the contiguous U.S. for all months of 2006.

Over the 36km domain during the winter months (i.e., December, January, and February [Figures 3-13, 3-2, and 3-3]), MM5 does reasonably well at predicting the spatial extent of rainfall and the magnitude of the precipitation rates, though there is a noticeable overprediction of the rate over the Ohio River Valley and underprediction over northern Florida in February. During the spring months (i.e., March, April, and May [Figures 3-4 through 3-6]), MM5 tends to predict a greater spatial extent of rainfall with slightly higher rates over much of the domain. During the summer months (i.e., June, July, and August [Figures 3-7 through 3-9]), MM5 generally has good spatially agreement with noted additional rainfall over southern Oregon, parts of Nevada and Arizona, and much of New Mexico in June and misses precipitation over Oregon, Washington, and parts of Idaho, Nevada, Montana, and Wyoming in August. Further, MM5 has relatively high overpredictions of the precipitation rates during the summer months. During the autumn months (i.e., September, October, and November [Figures 3-10 through 3-12]), MM5 has relatively good spatial agreement though it does miss some rainfall in various parts of the 36km domain. Also, MM5 does reasonably well at predicting the rate of rainfall with various slight over- and underpredictions throughout the domain.

Over the 12km domain during the winter months (Figures 3-25, 3-14, and 3-15), MM5 does reasonably well at predicting the spatial extent of rainfall and the magnitude of the precipitation rates. During the spring months (Figures 3-16 through 3-18), MM5 tends to predict a greater spatial extent of rainfall with slightly higher rates over localized portions of the domain. During the summer months (Figures 3-19 through 3-21), MM5 generally has fair spatial agreement though misses rainfall throughout small parts of the domain and has slight overpredictions of precipitation rates. During the autumn months (Figures 3-22 through 3-24), MM5 has relatively good spatial agreement though it does miss some rainfall in the Colorado, Nebraska, Wyoming border area in September and has slight overpredictions of precipitation rates over the mountains.

Over the 04km domain during the winter months (Figures 3-37, 3-26, and 3-27), MM5 has fair spatial representation though in January, MM5 predicts rain over much of the north-south extent just east of the central portion of the domain where the CPC data indicate no rainfall. Also during the winter, MM5 has large overpredictions of rainfall rates over the mountains. During the spring months (Figures 3-28 through 3-30), MM5 tends to predict a greater spatial extent of rainfall with slightly higher rates over localized portions of the domain, especially the mountains. During the summer months (Figures 3-31 through 3-33), MM5 generally has fair spatial agreement though misses rainfall throughout small parts of the domain and has generally good agreement with precipitation rates though the peak rate tends to be displaced. During the autumn months (Figures 3-34 through 3-36), MM5 has relatively good spatial agreement and predicts reasonably well the precipitation rates with some slight displacement of the peak rate.

Of note, over mountainous terrain during some months, MM5 modeling tends to intensify precipitation and have higher amounts with less spatial coverage. This appears to be a function of the difference in grid spacing as the CPC data tends to smear precipitation over the larger 40km grid cells than the 12km or 04km grid cells used in the current MM5 simulation. Through the use of the coarse resolution CPC data, it is not possible to determine if this is a real feature or an artifact of the resolution.

3.4 Summary of Model Performance Evaluation

Temperature bias and error statistics, mixing ratio bias and error statistics, and wind speed index of agreement statistics were estimated for the model predictions for the 36km, 12km and 4km modeling grids. Further, a qualitative examination of model predicted rainfall versus observed precipitation was performed.

Temperature bias performance for all three domains indicated that MM5 consistently had difficulty reproducing temperature (i.e., the ±0.5 K benchmark was not consistently met at the spatial levels and time scales examined). This was further confirmed by the temperature error statistic with, again, MM5 failing to consistently meet the 2.0 K benchmark.

Though this may appear to be problematic, it is not outside the realm of MM5 performance as demonstrated in other studies. This is issue is covered in more detail in Section 4 of this report.

Mixing ratio bias performance is good at all spatial levels and time scales that were examined over all three domains. Indeed, the model predicted mixing ratios so well that the benchmark of ±1.0 g/kg was met in virtually all instances.

As with mixing ratio bias performance, mixing ratio error performance is good at all levels that were examined over the three domains. The model was unable to meet the benchmark of 2.0 g/kg in only two instances both of which occurred over the 36km domain.

The model also did well in regards to the wind speed index of agreement performance over the three domains. In only a handful of instances did MM5 fail to meet the benchmark of 0.6 most of which occurred over the 36km domain.

Finally, from a qualitative perspective, the model does a reasonable job of replicating rainfall. Though as noted previously, the model does tend to overpredict the magnitude of the rainfall, especially in the summer months, and overpredict the spatial extent where rainfall occurs.

Table 3-1. Temperature bias (K) for 2006 MM5 by month, state and region in the 36km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
Mid-Atlantic/Northeast Visibility Union (MANE-VU)																	
CT	0.32	-0.12	-0.38	-0.06	-0.31	0.42	0.63	0.25	0.65	0.56	0.68	0.63	0.76	0.48	0.61	0.62	0.36
DE	1.01	-0.43	-0.40	0.06	-0.50	0.00	-0.09	-0.20	0.26	0.15	0.02	0.14	0.30	0.52	0.48	0.43	0.11
MA	0.31	-0.35	-0.33	-0.12	-0.15	0.41	0.44	0.23	0.47	0.07	0.58	0.37	0.78	0.47	0.57	0.61	0.27
MD	0.96	0.65	0.30	0.64	0.58	0.83	0.41	0.61	0.48	0.70	0.32	0.50	0.67	0.57	0.69	0.64	0.60
ME	0.63	0.10	-0.27	0.15	-1.37	0.29	1.15	0.02	0.94	0.44	0.93	0.77	0.80	0.72	0.79	0.77	0.43
NH	0.76	0.11	-0.09	0.26	-0.37	0.70	1.30	0.54	1.34	0.86	1.15	1.12	1.16	0.89	0.94	1.00	0.73
NJ	0.29	0.14	-0.30	0.04	-0.08	0.29	0.34	0.18	0.47	0.58	0.42	0.49	0.74	0.48	0.26	0.49	0.30
NY	0.11	-0.31	-0.56	-0.25	-0.75	0.11	0.48	-0.05	0.39	0.05	0.32	0.25	0.53	0.38	0.47	0.46	0.10
PA	0.34	0.20	-0.21	0.11	0.21	0.67	0.85	0.58	0.89	0.73	0.42	0.68	0.95	0.64	0.43	0.67	0.51
RI	0.17	-0.29	-0.43	-0.18	0.04	0.55	0.50	0.36	0.53	0.33	1.15	0.67	0.63	0.40	0.52	0.52	0.34
VT	-0.06	-0.94	-1.34	-0.78	-1.57	-0.46	0.63	-0.47	0.90	0.19	0.41	0.50	0.39	0.38	0.36	0.38	-0.09
MANE_VU	0.37	-0.07	-0.34	-0.01	-0.36	0.38	0.66	0.23	0.67	0.41	0.55	0.54	0.74	0.54	0.54	0.61	0.34
Visibility Improvement State and Tribal Association of the Southeast (VISTAS)																	
AL	1.39	0.66	1.14	1.06	0.62	0.73	1.11	0.82	0.81	0.64	0.31	0.59	0.35	1.24	1.07	0.89	0.84
FL	0.53	0.62	1.02	0.72	-0.03	-0.38	0.02	-0.13	0.01	0.14	0.43	0.19	0.49	0.56	0.82	0.62	0.35
GA	1.66	0.89	1.23	1.26	0.79	0.72	1.12	0.88	0.71	0.55	0.39	0.55	0.57	1.08	0.98	0.88	0.89
KY	0.65	-0.01	0.11	0.25	0.86	1.05	1.28	1.06	1.18	1.01	0.71	0.97	1.07	0.83	0.92	0.94	0.81
MS	1.34	1.16	1.55	1.35	0.95	0.83	1.15	0.98	1.07	1.19	0.68	0.98	0.66	1.32	1.55	1.18	1.12
NC	1.68	0.84	1.17	1.23	0.92	1.08	1.39	1.13	1.04	0.60	0.37	0.67	0.43	0.78	0.73	0.65	0.92
SC	1.93	1.04	1.45	1.47	0.88	0.51	1.13	0.84	0.59	0.42	0.36	0.46	0.46	0.91	1.00	0.79	0.89
TN	1.33	0.31	0.54	0.73	0.52	0.88	1.45	0.95	1.02	0.98	0.56	0.85	0.49	0.93	1.24	0.89	0.85
VA	1.14	0.22	0.13	0.50	0.41	0.79	0.63	0.61	0.57	0.68	0.19	0.48	0.52	0.50	0.64	0.55	0.53
WV	0.35	-0.38	-1.14	-0.39	0.34	0.47	1.16	0.66	1.11	0.91	0.45	0.82	0.85	0.59	0.59	0.68	0.44
VISTAS	1.22	0.61	0.85	0.89	0.57	0.59	0.91	0.69	0.69	0.59	0.39	0.56	0.53	0.80	0.87	0.73	0.72
Midwest Regional Planning Organization (MRPO)																	
IL	0.49	-0.02	-0.05	0.14	1.12	1.45	1.48	1.35	1.20	1.04	1.05	1.10	0.96	0.58	0.85	0.80	0.85
IN	0.22	0.14	0.16	0.17	1.14	1.47	1.41	1.34	1.15	0.90	1.13	1.06	1.05	0.58	0.92	0.85	0.86
MI	0.25	0.17	-0.09	0.11	-0.14	0.84	0.88	0.53	0.68	0.44	0.91	0.68	1.17	0.94	0.54	0.88	0.55
OH	0.23	0.03	-0.14	0.04	0.97	1.20	1.30	1.16	0.93	0.85	0.84	0.87	0.85	0.54	0.68	0.69	0.69
WI	-0.19	-0.85	-1.67	-0.90	-1.33	0.84	1.31	0.27	1.27	0.80	1.07	1.05	0.89	0.39	0.09	0.46	0.22
MRPO	0.21	-0.13	-0.42	-0.11	0.19	1.10	1.24	0.84	1.03	0.77	0.99	0.93	1.00	0.64	0.57	0.74	0.60

Table 3-1. Temperature bias (K) for 2006 MM5 by month, state and region in the 36km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
Central States Regional Air Partnership (CENRAP)																	
AR	0.68	0.56	1.22	0.82	0.83	0.79	1.25	0.96	1.20	0.70	0.75	0.88	1.21	1.13	0.89	1.08	0.93
IA	0.76	0.08	-0.28	0.19	0.54	1.63	1.58	1.25	1.52	1.35	1.33	1.40	1.10	0.82	0.88	0.93	0.94
KS	1.09	0.64	0.98	0.90	0.92	0.75	1.06	0.91	0.63	0.68	0.67	0.66	1.17	0.98	1.13	1.09	0.89
LA	1.17	0.54	1.27	0.99	0.32	0.17	0.46	0.32	0.83	0.82	0.44	0.70	0.58	1.31	1.25	1.05	0.76
MN	0.28	-0.54	-0.94	-0.40	-2.00	0.54	1.32	-0.05	1.61	0.97	1.33	1.30	0.96	0.60	0.68	0.75	0.40
MO	0.11	0.13	0.46	0.23	1.00	0.94	1.25	1.06	0.91	0.51	0.27	0.56	1.02	0.65	0.49	0.72	0.65
NE	1.88	0.73	0.97	1.19	0.39	1.10	1.06	0.85	0.66	0.74	0.81	0.74	1.30	1.48	2.10	1.63	1.10
OK	0.22	0.53	0.90	0.55	0.66	0.27	0.89	0.61	1.01	0.71	0.79	0.84	0.96	0.72	0.32	0.67	0.67
TX	0.83	0.85	1.46	1.05	0.61	0.26	0.22	0.36	0.30	0.14	0.06	0.17	0.55	0.68	0.61	0.61	0.55
CENRAP	0.73	0.35	0.55	0.54	0.09	0.64	0.91	0.55	0.94	0.67	0.71	0.77	0.91	0.83	0.83	0.86	0.68
Western Regional Air Partnership (WRAP)																	
AZ	1.74	0.80	0.60	1.05	-0.25	-1.14	-1.77	-1.05	-1.38	-0.69	-0.86	-0.98	-0.27	0.05	1.06	0.28	-0.18
CA	2.01	0.82	1.11	1.31	-0.25	-0.92	-1.41	-0.86	-1.47	-1.12	-0.74	-1.11	0.06	0.31	0.96	0.44	-0.05
CO	0.96	-0.56	-0.35	0.02	-1.54	-1.57	-0.78	-1.30	-0.77	0.02	0.08	-0.22	0.16	0.01	-0.04	0.04	-0.37
ID	1.07	-0.27	-0.49	0.10	-1.55	-0.98	0.25	-0.76	0.29	0.42	0.60	0.44	1.44	1.02	-0.02	0.81	0.15
MT	0.72	-0.77	-0.95	-0.33	-1.28	-0.94	0.20	-0.67	0.09	-0.37	-0.09	-0.12	0.46	0.47	-0.25	0.23	-0.23
ND	1.32	0.41	0.27	0.67	-0.62	1.10	1.73	0.74	1.54	1.48	1.50	1.51	1.21	1.17	1.67	1.35	1.07
NM	1.03	0.20	0.59	0.61	-0.27	-0.65	-0.84	-0.59	-0.52	-0.06	0.06	-0.17	0.46	0.61	1.10	0.72	0.14
NV	1.65	-0.98	-0.90	-0.08	-1.87	-2.06	-1.70	-1.88	-2.07	-1.90	-2.18	-2.05	-0.69	-0.25	0.94	0.00	-1.00
OR	1.03	-0.26	-0.06	0.24	-1.05	-0.83	-0.54	-0.81	-0.97	-1.13	-0.81	-0.97	0.44	1.04	0.17	0.55	-0.25
SD	1.69	0.44	0.26	0.80	-0.25	1.41	1.71	0.96	1.30	1.18	1.35	1.28	1.66	1.59	1.90	1.72	1.19
UT	2.41	0.82	-0.04	1.06	-1.03	-1.69	-0.77	-1.16	-0.82	-0.83	-0.57	-0.74	0.65	0.99	1.62	1.09	0.06
WA	0.68	0.03	-0.06	0.22	-0.20	0.04	0.40	0.08	-0.13	-0.16	0.07	-0.07	1.02	0.98	0.31	0.77	0.25
WY	0.85	-1.30	-1.03	-0.49	-1.81	-2.04	-0.56	-1.47	-0.92	-0.71	-0.41	-0.68	0.19	-0.15	-0.73	-0.23	-0.72
WRAP	1.36	0.17	0.23	0.59	-0.69	-0.77	-0.55	-0.67	-0.66	-0.43	-0.19	-0.43	0.45	0.57	0.62	0.55	0.01
ALL	0.87	0.23	0.28	0.46	-0.06	0.31	0.56	0.27	0.46	0.35	0.42	0.41	0.70	0.69	0.72	0.70	0.46

(a) ALL in this case refers to those states within the area covered by the 36km modeling domain.

Table 3-2. Temperature bias (K) for 2006 MM5 by month and state in the 12km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
CO	1.19	0.26	0.24	0.56	-1.20	-1.38	-0.43	-1.00	-0.26	0.52	0.53	0.26	0.44	0.00	0.13	0.19	0.00
UT	2.28	0.89	0.06	1.08	-0.99	-1.32	-0.54	-0.95	-0.42	-0.44	-0.18	-0.35	0.85	0.94	1.68	1.16	0.23
WY	1.76	0.07	-0.05	0.59	-1.01	-1.09	0.17	-0.64	-0.07	0.18	0.42	0.18	0.84	0.30	0.05	0.40	0.13
ALL	1.55	0.36	0.12	0.68	-1.06	-0.88	0.10	-0.61	0.05	0.36	0.47	0.29	0.89	0.63	0.59	0.70	0.27

(a) ALL in this case refers to those states within the area covered by the 12km modeling domain.

Table 3-3. Temperature Bias (K) for 2006 MM5 by Month in the 4km Domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
ALL	2.24	1.04	0.68	1.32	-0.94	-1.52	0.96	-0.50	1.60	1.89	1.97	1.82	2.11	1.17	0.47	1.25	0.97

Table 3-4. Temperature error (K) for 2006 MM5 by month, state and region in the 36km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
Mid-Atlantic/Northeast Visibility Union (MANE-VU)																	
CT	1.75	1.87	1.97	1.86	1.88	1.98	1.73	1.86	1.61	1.62	1.81	1.68	1.87	1.90	2.02	1.93	1.83
DE	2.18	2.08	2.19	2.15	2.36	2.25	1.84	2.15	1.61	1.75	1.73	1.70	1.59	1.60	1.55	1.58	1.89
MA	1.71	1.96	2.03	1.90	2.03	2.05	1.94	2.01	1.84	1.63	2.00	1.82	1.97	1.87	1.98	1.94	1.92
MD	2.58	1.85	2.04	2.16	2.11	2.15	1.90	2.05	1.67	1.68	1.85	1.73	1.80	2.11	2.26	2.06	2.00
ME	1.75	2.42	1.93	2.03	2.50	2.29	1.97	2.25	1.67	1.73	1.87	1.76	1.92	1.94	1.85	1.90	1.99
NH	2.48	2.56	2.74	2.59	3.04	2.96	2.60	2.87	2.40	2.57	2.70	2.56	2.60	2.65	2.56	2.60	2.65
NJ	1.89	1.74	1.93	1.85	1.84	2.10	1.63	1.86	1.51	1.68	1.81	1.67	1.80	1.95	1.89	1.88	1.81
NY	1.67	1.86	2.00	1.84	2.11	2.06	1.89	2.02	1.72	1.66	1.87	1.75	1.81	1.94	1.90	1.88	1.87
PA	1.75	1.70	1.67	1.71	1.77	1.94	1.84	1.85	1.72	1.58	1.70	1.67	1.71	1.78	1.87	1.79	1.75
RI	1.54	1.63	1.79	1.65	1.58	1.83	1.83	1.75	1.78	1.74	2.29	1.94	1.79	1.62	1.58	1.66	1.75
VT	1.79	2.28	2.31	2.13	2.60	2.38	2.00	2.33	1.92	1.92	2.00	1.95	1.99	2.11	2.18	2.09	2.12
MANE_VU	1.85	1.95	1.99	1.93	2.11	2.13	1.91	2.05	1.76	1.73	1.92	1.80	1.88	1.94	1.96	1.93	1.93
Visibility Improvement State and Tribal Association of the Southeast (VISTAS)																	
AL	2.47	2.09	2.22	2.26	2.14	2.14	2.13	2.14	2.25	2.05	1.90	2.07	1.95	2.39	2.38	2.24	2.18
FL	1.86	1.98	2.33	2.06	2.08	1.92	1.90	1.97	1.82	1.76	1.85	1.81	1.88	2.09	2.10	2.02	1.96
GA	2.74	2.18	2.39	2.44	2.23	2.23	2.31	2.26	2.25	2.01	1.80	2.02	1.88	2.41	2.40	2.23	2.24
KY	1.70	1.77	1.62	1.70	1.86	2.03	1.83	1.91	1.86	1.65	1.51	1.67	1.78	1.95	2.07	1.93	1.80
MS	2.27	2.28	2.38	2.31	2.21	2.05	2.09	2.12	2.39	2.15	2.09	2.21	2.07	2.37	2.67	2.37	2.25
NC	3.07	2.18	2.31	2.52	2.22	2.32	2.27	2.27	2.10	1.84	1.81	1.92	1.75	2.33	2.50	2.19	2.22
SC	2.94	2.23	2.30	2.49	2.20	2.14	2.17	2.17	1.87	1.66	1.66	1.73	1.62	2.18	2.40	2.07	2.11
TN	2.28	1.96	1.92	2.05	2.02	2.09	2.06	2.06	2.07	1.98	1.80	1.95	1.86	2.14	2.43	2.14	2.05
VA	2.83	1.93	2.15	2.30	2.14	2.32	2.10	2.19	1.92	1.77	1.83	1.84	1.86	2.20	2.40	2.15	2.12
WV	2.34	2.07	2.34	2.25	2.05	2.11	2.14	2.10	2.05	1.85	1.80	1.90	1.82	2.03	2.24	2.03	2.07
VISTAS	2.53	2.08	2.25	2.29	2.14	2.16	2.12	2.14	2.04	1.86	1.82	1.91	1.84	2.23	2.35	2.14	2.12
Midwest Regional Planning Organization (MRPO)																	
IL	1.65	1.68	1.70	1.68	1.84	2.18	2.02	2.01	1.95	1.86	1.84	1.88	2.00	1.94	1.84	1.93	1.88
IN	1.49	1.48	1.45	1.47	1.76	2.14	1.95	1.95	1.89	1.64	1.74	1.76	1.80	1.82	1.84	1.82	1.75
MI	1.31	1.33	1.55	1.40	1.98	2.20	2.06	2.08	2.15	2.01	2.04	2.07	2.00	1.86	1.67	1.84	1.85
OH	1.60	1.44	1.53	1.52	1.78	1.94	1.97	1.90	1.94	1.78	1.76	1.83	1.63	1.78	1.98	1.80	1.76
WI	1.57	1.88	2.35	1.93	2.35	2.33	2.19	2.29	2.27	2.23	2.11	2.20	2.01	1.94	1.69	1.88	2.08
MRPO	1.52	1.57	1.76	1.62	1.98	2.18	2.06	2.07	2.07	1.96	1.94	1.99	1.93	1.89	1.78	1.87	1.89

Table 3-4. Temperature error (K) for 2006 MM5 by month, state and region in the 36km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
Central States Regional Air Partnership (CENRAP)																	
AR	1.94	2.12	2.24	2.10	1.98	1.98	1.87	1.94	2.07	1.94	1.87	1.96	2.13	2.16	2.23	2.17	2.04
IA	2.02	1.73	1.95	1.90	2.14	2.40	2.22	2.25	2.33	2.00	1.91	2.08	2.16	2.07	2.12	2.12	2.09
KS	2.40	2.36	2.41	2.39	2.16	2.19	2.19	2.18	1.92	1.86	1.81	1.86	2.15	2.18	2.39	2.24	2.17
LA	2.37	2.40	2.53	2.43	2.18	1.94	1.97	2.03	2.20	2.06	2.05	2.10	2.14	2.40	2.60	2.38	2.24
MN	1.74	2.00	2.57	2.10	2.78	2.51	2.21	2.50	2.36	2.17	2.15	2.23	2.10	2.04	2.00	2.05	2.22
MO	1.96	1.93	1.82	1.90	2.03	2.02	1.86	1.97	1.88	1.76	1.73	1.79	2.01	1.98	1.97	1.99	1.91
NE	2.82	2.39	2.42	2.54	2.53	2.38	2.52	2.48	2.16	2.03	1.94	2.04	2.32	2.57	3.07	2.65	2.43
OK	2.50	2.55	2.41	2.49	2.05	2.04	1.97	2.02	1.97	1.82	1.90	1.90	2.20	2.14	2.14	2.16	2.14
TX	2.18	2.53	2.67	2.46	1.96	1.74	1.77	1.82	1.65	1.51	1.68	1.61	1.93	1.92	2.16	2.00	1.98
CENRAP	2.15	2.24	2.43	2.27	2.23	2.12	2.04	2.13	2.03	1.86	1.88	1.92	2.09	2.09	2.22	2.13	2.12
Western Regional Air Partnership (WRAP)																	
AZ	3.16	2.94	2.83	2.98	2.34	2.70	3.29	2.78	3.00	2.69	2.70	2.80	2.71	2.77	3.27	2.92	2.87
CA	3.47	2.60	3.08	3.05	2.18	2.37	2.84	2.46	2.98	3.10	2.77	2.95	2.96	2.92	2.78	2.89	2.84
CO	3.37	3.65	3.71	3.58	3.47	3.84	3.27	3.53	3.22	2.91	2.75	2.96	2.80	2.76	3.32	2.96	3.26
ID	2.68	2.44	3.06	2.73	2.93	3.16	3.10	3.06	2.80	3.35	3.31	3.15	3.25	2.89	2.56	2.90	2.96
MT	3.52	3.14	3.41	3.36	2.85	3.34	2.84	3.01	2.57	3.09	2.91	2.86	2.75	2.63	3.34	2.91	3.03
ND	2.34	1.96	2.49	2.26	2.01	2.65	2.54	2.40	2.35	2.57	2.48	2.47	2.18	2.12	2.68	2.33	2.36
NM	2.98	2.84	2.93	2.92	2.40	2.48	2.59	2.49	2.42	2.23	1.99	2.21	2.31	2.54	3.09	2.65	2.57
NV	3.71	2.74	3.10	3.18	2.96	3.15	3.52	3.21	3.74	3.69	4.24	3.89	3.92	3.48	3.47	3.62	3.48
OR	2.78	2.00	2.61	2.46	2.25	2.27	2.49	2.34	2.56	2.96	2.95	2.82	3.08	2.96	2.33	2.79	2.60
SD	2.64	1.93	2.09	2.22	2.35	2.60	2.64	2.53	2.50	2.48	2.32	2.43	2.31	2.48	2.71	2.50	2.42
UT	3.54	2.64	3.07	3.08	2.63	3.21	2.96	2.93	3.17	3.04	3.01	3.07	3.01	2.63	3.07	2.90	3.00
WA	1.99	1.49	2.11	1.86	1.85	1.93	2.25	2.01	2.18	2.58	2.56	2.44	2.66	2.42	1.76	2.28	2.15
WY	3.78	3.39	3.69	3.62	3.15	3.46	3.06	3.22	2.99	3.23	3.03	3.08	2.73	2.58	3.10	2.80	3.18
WRAP	3.06	2.58	2.93	2.86	2.45	2.69	2.80	2.65	2.76	2.87	2.69	2.77	2.76	2.70	2.77	2.74	2.76
ALL	2.33	2.16	2.37	2.29	2.22	2.28	2.24	2.25	2.20	2.12	2.10	2.14	2.18	2.23	2.30	2.24	2.23

(a) ALL in this case refers to those states within the area covered by the 36km modeling domain.

Table 3-5. Temperature error (K) for 2006 MM5 by month and state in the 12km domain.																	
Region	**Dec**	**Jan**	**Feb**	**Win**	**Mar**	**Apr**	**May**	**Spr**	**Jun**	**Jul**	**Aug**	**Sum**	**Sep**	**Oct**	**Nov**	**Aut**	**Mean**
CO	3.44	3.49	3.47	3.47	3.04	3.60	3.04	3.23	2.94	2.67	2.56	2.72	2.75	2.79	3.44	2.99	3.10
UT	3.39	2.72	3.22	3.11	2.56	3.08	3.01	2.88	3.25	3.02	3.10	3.12	3.14	2.76	3.22	3.04	3.04
WY	3.82	3.02	3.14	3.33	2.69	2.88	2.77	2.78	2.68	2.92	2.75	2.78	2.62	2.42	2.91	2.65	2.89
ALL	3.36	2.89	3.11	3.12	2.75	3.11	2.90	2.92	2.77	2.84	2.72	2.78	2.78	2.67	3.11	2.85	2.92

(a) ALL in this case refers to those states within the area covered by the 12km modeling domain.

Table 3-6. Temperature error (K) for 2006 MM5 by month in the 4km domain.																	
Region	**Dec**	**Jan**	**Feb**	**Win**	**Mar**	**Apr**	**May**	**Spr**	**Jun**	**Jul**	**Aug**	**Sum**	**Sep**	**Oct**	**Nov**	**Aut**	**Mean**
ALL	3.47	2.75	3.14	3.12	2.55	3.05	2.64	2.75	2.71	2.97	2.98	2.89	2.96	2.69	2.81	2.82	2.89

Table 3-7. Mixing ratio bias (g/kg) for 2006 MM5 by month, state, and region in the 36km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
Mid-Atlantic/Northeast Visibility Union (MANE-VU)																	
CT	0.85	0.62	0.49	0.65	0.98	0.58	0.67	0.74	0.68	0.26	0.53	0.49	0.48	0.72	0.93	0.71	0.65
DE	0.40	0.49	0.18	0.36	0.17	0.36	0.23	0.25	-0.10	-0.39	0.10	-0.13	0.28	0.22	0.57	0.36	0.21
MA	0.81	0.43	0.41	0.55	0.88	0.55	0.65	0.69	0.75	0.49	0.88	0.71	0.63	0.75	0.87	0.75	0.68
MD	0.38	0.73	0.24	0.45	0.35	0.33	0.11	0.26	-0.10	-0.72	-0.34	-0.39	0.23	-0.09	0.64	0.26	0.15
ME	0.65	0.36	0.31	0.44	0.56	0.82	0.64	0.67	0.80	0.54	0.71	0.68	0.58	0.62	0.70	0.63	0.61
NH	0.83	0.44	0.43	0.57	0.85	0.82	0.78	0.82	0.93	0.59	0.75	0.76	0.45	0.69	0.87	0.67	0.70
NJ	0.87	0.88	0.43	0.73	0.69	0.64	0.52	0.62	0.61	0.36	0.93	0.63	0.79	0.70	1.04	0.84	0.70
NY	0.75	0.58	0.36	0.56	0.65	0.53	0.43	0.54	0.55	0.39	0.62	0.52	0.51	0.69	0.84	0.68	0.57
PA	0.69	0.91	0.38	0.66	0.63	0.58	0.51	0.57	0.57	0.14	0.63	0.45	0.42	0.48	0.85	0.58	0.57
RI	0.69	0.56	0.39	0.55	0.81	0.60	0.74	0.72	0.73	0.45	0.95	0.71	0.46	0.58	0.71	0.58	0.64
VT	0.74	0.31	0.31	0.45	0.63	0.88	0.53	0.68	0.84	0.48	0.55	0.62	0.43	0.62	0.84	0.63	0.60
MANE_VU	0.72	0.61	0.37	0.57	0.67	0.60	0.53	0.60	0.60	0.28	0.62	0.50	0.50	0.58	0.83	0.64	0.58
Visibility Improvement State and Tribal Association of the Southeast (VISTAS)																	
AL	0.82	1.19	0.86	0.96	0.88	0.92	0.43	0.74	0.53	0.20	0.40	0.38	0.18	-0.02	0.30	0.15	0.56
FL	0.80	1.15	1.02	0.99	1.02	0.70	0.52	0.75	0.36	-0.31	-0.27	-0.07	0.07	0.53	0.59	0.40	0.52
GA	0.77	1.03	0.63	0.81	0.78	1.04	0.58	0.80	0.53	-0.07	0.16	0.21	0.23	0.06	0.37	0.22	0.51
KY	0.72	0.67	0.23	0.54	0.42	0.97	0.32	0.57	0.15	-0.60	-0.40	-0.28	0.21	0.20	0.61	0.34	0.29
MS	0.50	1.09	1.00	0.86	1.02	0.89	0.39	0.77	0.51	-0.34	0.34	0.17	0.12	0.15	0.26	0.18	0.49
NC	0.88	1.05	0.41	0.78	0.64	1.23	0.87	0.91	0.69	0.15	0.37	0.40	0.26	0.16	0.71	0.38	0.62
SC	1.04	1.19	0.60	0.94	0.98	1.58	1.24	1.27	0.85	0.41	0.59	0.62	0.34	0.24	0.59	0.39	0.80
TN	0.72	0.92	0.41	0.68	0.61	1.04	0.64	0.76	0.32	-0.20	-0.21	-0.03	0.32	0.01	0.46	0.26	0.42
VA	0.43	0.72	0.19	0.45	0.38	0.64	0.05	0.36	-0.23	-0.82	-0.50	-0.52	-0.11	-0.15	0.52	0.09	0.09
WV	0.49	0.84	0.25	0.53	0.58	1.06	0.52	0.72	0.28	-0.36	-0.01	-0.03	0.31	0.15	0.51	0.32	0.38
VISTAS	0.74	1.01	0.58	0.78	0.74	0.96	0.55	0.75	0.40	-0.20	0.02	0.07	0.16	0.16	0.53	0.28	0.47
Midwest Regional Planning Organization (MRPO)																	
IL	0.47	0.29	0.10	0.29	0.38	0.40	0.04	0.27	0.17	-0.19	-0.25	-0.09	0.11	0.06	0.23	0.13	0.15
IN	0.66	0.44	0.15	0.42	0.47	0.45	-0.03	0.30	0.10	-0.24	-0.25	-0.13	0.23	0.29	0.50	0.34	0.23
MI	0.41	0.37	0.26	0.35	0.46	0.35	0.29	0.37	0.36	0.44	0.40	0.40	0.39	0.33	0.30	0.34	0.36
OH	0.60	0.64	0.19	0.48	0.42	0.33	0.18	0.31	0.31	-0.08	-0.09	0.05	0.36	0.40	0.50	0.42	0.31
WI	0.34	0.23	0.15	0.24	0.36	0.43	0.21	0.33	0.55	0.62	0.26	0.48	0.38	0.06	0.17	0.20	0.31
MRPO	0.45	0.36	0.18	0.33	0.41	0.39	0.16	0.32	0.32	0.19	0.08	0.20	0.30	0.20	0.30	0.27	0.28

Table 3-7. Mixing ratio bias (g/kg) for 2006 MM5 by month, state, and region in the 36km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
Central States Regional Air Partnership (CENRAP)																	
AR	0.49	0.59	0.16	0.41	0.74	0.92	0.50	0.72	-0.15	-0.23	-0.13	-0.17	-0.01	0.00	0.17	0.05	0.25
IA	0.06	0.33	0.06	0.15	0.33	0.03	-0.58	-0.07	-0.01	-0.69	-0.37	-0.36	0.35	-0.18	-0.24	-0.02	-0.08
KS	0.14	0.23	0.15	0.17	0.28	0.68	0.53	0.50	0.29	-0.47	-0.09	-0.09	-0.07	-0.14	-0.06	-0.09	0.12
LA	0.43	0.99	1.14	0.85	1.03	1.11	0.68	0.94	0.47	0.03	0.57	0.36	0.18	0.55	0.28	0.34	0.62
MN	0.13	0.21	0.12	0.15	0.13	0.41	-0.23	0.10	-0.16	-0.14	-0.13	-0.14	0.20	-0.10	-0.09	0.00	0.03
MO	0.40	0.47	0.11	0.33	0.50	0.93	0.58	0.67	0.24	0.11	0.47	0.27	0.06	0.10	0.11	0.09	0.34
NE	0.30	0.28	0.14	0.24	0.09	0.24	0.29	0.21	0.66	-0.19	0.04	0.17	0.27	-0.07	-0.02	0.06	0.17
OK	-0.06	0.09	-0.07	-0.01	0.10	-0.07	-0.45	-0.14	-1.16	-1.73	-1.08	-1.32	-1.01	-0.55	-0.39	-0.65	-0.53
TX	-0.15	0.37	0.55	0.26	0.29	-0.12	0.06	0.08	-0.39	-0.79	-0.61	-0.60	-0.51	-0.44	-0.21	-0.39	-0.16
CENRAP	0.09	0.34	0.26	0.23	0.30	0.26	0.01	0.19	-0.16	-0.54	-0.30	-0.33	-0.12	-0.19	-0.12	-0.14	-0.01
Western Regional Air Partnership (WRAP)																	
AZ	0.20	0.38	0.51	0.36	0.47	1.09	1.93	1.16	1.49	0.14	0.09	0.57	-0.36	0.31	0.64	0.20	0.57
CA	0.10	0.01	-0.30	-0.06	0.19	0.00	-0.17	0.01	-0.33	-0.58	-0.83	-0.58	-0.82	-0.48	-0.14	-0.48	-0.28
CO	0.19	0.15	0.23	0.19	0.17	0.18	-0.12	0.08	0.00	-0.79	-0.90	-0.56	-0.76	-0.42	-0.11	-0.43	-0.18
ID	0.29	0.30	0.17	0.25	0.12	-0.03	-0.12	-0.01	-0.29	-0.15	-0.32	-0.25	-0.44	-0.33	0.19	-0.19	-0.05
MT	0.49	0.58	0.37	0.48	0.20	-0.19	-0.18	-0.06	-0.40	0.12	-0.10	-0.13	-0.15	-0.06	0.49	0.09	0.10
ND	0.28	0.42	0.28	0.33	0.20	0.10	-0.21	0.03	-0.14	-0.16	-0.12	-0.14	0.04	-0.11	0.24	0.06	0.07
NM	0.00	0.24	0.31	0.18	0.56	0.62	0.62	0.60	0.43	-0.64	-1.02	-0.41	-0.88	-0.59	0.00	-0.49	-0.03
NV	0.55	0.30	0.23	0.36	0.20	0.31	0.38	0.30	0.74	-0.08	0.62	0.43	0.44	0.16	0.73	0.44	0.38
OR	0.33	0.45	0.33	0.37	0.33	0.09	-0.09	0.11	0.08	0.61	0.18	0.29	-0.04	-0.01	0.47	0.14	0.23
SD	0.35	0.34	0.28	0.32	0.31	0.13	-0.16	0.09	0.68	0.02	-0.12	0.19	0.12	-0.09	0.06	0.03	0.16
UT	0.27	0.11	0.05	0.14	-0.01	-0.09	-0.05	-0.05	0.20	0.12	-0.49	-0.06	-0.16	-0.38	0.00	-0.18	-0.04
WA	0.18	0.43	0.23	0.28	0.19	-0.04	-0.10	0.02	-0.16	0.46	0.12	0.14	-0.08	-0.16	0.48	0.08	0.13
WY	0.40	0.30	0.24	0.31	0.07	-0.17	-0.55	-0.22	-0.30	0.20	-0.50	-0.20	-0.27	-0.04	0.17	-0.05	-0.04
WRAP	0.21	0.25	0.12	0.19	0.23	0.14	0.05	0.14	0.03	-0.15	-0.41	-0.18	-0.43	-0.25	0.15	-0.18	-0.01
ALL	0.38	0.48	0.29	0.38	0.43	0.43	0.21	0.36	0.17	-0.18	-0.09	-0.03	0.00	0.01	0.25	0.09	0.20

(a) ALL in this case refers to those states within the area covered by the 36km modeling domain.

Table 3-8. Mixing ratio bias (g/kg) for 2006 MM5 by month and state in the 12km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
CO	0.14	0.13	0.18	0.15	0.09	0.18	-0.15	0.04	0.10	-0.84	-0.94	-0.56	-0.65	-0.38	-0.09	-0.37	-0.19
UT	0.17	0.01	-0.03	0.05	-0.05	-0.02	0.07	0.00	0.29	-0.07	-0.42	-0.07	-0.14	-0.27	0.02	-0.13	-0.04
WY	0.31	0.19	0.16	0.22	-0.01	-0.16	-0.45	-0.21	-0.12	0.15	-0.44	-0.14	-0.17	0.00	0.11	-0.02	-0.04
ALL	0.27	0.20	0.17	0.21	0.05	0.02	-0.14	-0.02	0.03	-0.21	-0.51	-0.23	-0.30	-0.21	0.09	-0.14	-0.04

(a) ALL in this case refers to those states within the area covered by the 12km modeling domain.

Table 3-9. Mixing ratio bias (g/kg) for 2006 MM5 by month in the 4km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
ALL	0.24	0.14	0.12	0.17	-0.18	-0.5	-0.99	-0.56	-1.23	-1.16	-1.14	-1.18	-0.82	-0.47	-0.12	-0.47	-0.51

Table 3-10. Mixing ratio error (g/kg) for 2006 MM5 by month, state, and region in the 36km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
Mid-Atlantic/Northeast Visibility Union (MANE-VU)																	
CT	0.89	0.73	0.61	0.74	1.00	0.80	0.94	0.91	1.05	1.26	1.26	1.19	0.97	0.90	1.01	0.96	0.95
DE	0.63	0.66	0.41	0.57	0.62	0.84	0.87	0.78	0.95	1.31	1.12	1.13	0.82	0.73	0.71	0.75	0.81
MA	0.87	0.61	0.55	0.68	0.92	0.78	0.95	0.88	1.12	1.14	1.30	1.19	1.00	0.92	0.97	0.96	0.93
MD	0.70	0.84	0.51	0.68	0.73	1.00	1.00	0.91	1.08	1.63	1.54	1.42	1.03	0.92	0.90	0.95	0.99
ME	0.71	0.56	0.43	0.57	0.67	0.95	0.93	0.85	1.19	1.15	1.05	1.13	0.86	0.77	0.80	0.81	0.84
NH	0.91	0.62	0.52	0.68	0.91	0.99	1.03	0.98	1.29	1.27	1.16	1.24	0.88	0.86	0.95	0.90	0.95
NJ	0.96	0.92	0.56	0.81	0.78	0.88	0.99	0.88	1.15	1.37	1.50	1.34	1.22	0.99	1.12	1.11	1.04
NY	0.79	0.67	0.48	0.65	0.73	0.80	0.92	0.82	1.04	1.19	1.19	1.14	0.90	0.87	0.90	0.89	0.87
PA	0.81	0.96	0.51	0.76	0.75	0.99	1.02	0.92	1.16	1.35	1.35	1.29	0.94	0.84	0.98	0.92	0.97
RI	0.77	0.66	0.54	0.66	0.85	0.88	1.10	0.94	1.10	1.25	1.46	1.27	0.98	0.89	0.86	0.91	0.94
VT	0.78	0.51	0.44	0.58	0.76	1.04	0.96	0.92	1.29	1.29	1.07	1.22	0.84	0.81	0.89	0.85	0.89
MANE_VU	0.81	0.73	0.51	0.68	0.79	0.89	0.97	0.88	1.13	1.28	1.28	1.23	0.95	0.87	0.94	0.92	0.93
Visibility Improvement State and Tribal Association of the Southeast (VISTAS)																	
AL	1.11	1.32	1.01	1.15	1.19	1.43	1.33	1.32	1.41	1.59	1.42	1.47	1.17	1.12	0.82	1.04	1.24
FL	1.21	1.45	1.31	1.32	1.39	1.47	1.50	1.45	1.58	1.57	1.46	1.54	1.41	1.35	1.16	1.31	1.41
GA	1.19	1.27	0.99	1.15	1.26	1.67	1.62	1.52	1.84	1.79	1.64	1.76	1.44	1.26	0.94	1.21	1.41
KY	0.85	0.85	0.45	0.72	0.80	1.49	1.15	1.15	1.34	1.47	1.44	1.42	0.96	0.98	0.92	0.95	1.06
MS	0.92	1.31	1.21	1.15	1.32	1.43	1.45	1.40	1.54	1.72	1.54	1.60	1.16	1.20	0.94	1.10	1.31
NC	1.10	1.17	0.73	1.00	1.06	1.68	1.44	1.39	1.53	1.52	1.60	1.55	1.09	1.03	1.05	1.06	1.25
SC	1.31	1.30	0.86	1.16	1.23	1.78	1.57	1.53	1.53	1.31	1.43	1.42	1.02	1.02	0.92	0.99	1.27
TN	0.91	1.06	0.63	0.87	0.90	1.45	1.27	1.21	1.32	1.40	1.39	1.37	0.99	1.03	0.88	0.97	1.10
VA	0.82	0.88	0.52	0.74	0.83	1.31	1.17	1.10	1.38	1.77	1.69	1.61	1.12	1.05	0.98	1.05	1.13
WV	0.69	0.92	0.46	0.69	0.81	1.41	1.14	1.12	1.09	1.24	1.21	1.18	0.93	0.95	0.91	0.93	0.98
VISTAS	1.06	1.19	0.87	1.04	1.12	1.52	1.40	1.35	1.51	1.59	1.53	1.54	1.19	1.13	1.00	1.11	1.26
Midwest Regional Planning Organization (MRPO)																	
IL	0.63	0.55	0.42	0.53	0.71	1.22	1.15	1.03	1.31	1.54	1.40	1.42	1.03	0.92	0.70	0.88	0.96
IN	0.76	0.59	0.42	0.59	0.73	1.24	1.09	1.02	1.24	1.33	1.33	1.30	0.98	0.85	0.77	0.87	0.94
MI	0.49	0.45	0.36	0.43	0.56	0.80	0.99	0.78	1.06	1.25	1.30	1.20	0.92	0.64	0.55	0.70	0.78
OH	0.69	0.70	0.40	0.60	0.69	1.07	1.05	0.94	1.12	1.24	1.24	1.20	0.93	0.83	0.76	0.84	0.89
WI	0.45	0.42	0.31	0.39	0.52	0.96	1.01	0.83	1.25	1.47	1.22	1.31	0.92	0.65	0.46	0.68	0.80
MRPO	0.57	0.52	0.37	0.49	0.62	1.02	1.05	0.90	1.19	1.38	1.30	1.29	0.96	0.76	0.62	0.78	0.86

Table 3-10. Mixing ratio error (g/kg) for 2006 MM5 by month, state, and region in the 36km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
Central States Regional Air Partnership (CENRAP)																	
AR	0.80	0.85	0.69	0.78	1.10	1.36	1.37	1.28	1.38	1.68	1.63	1.56	1.11	1.17	0.90	1.06	1.17
IA	0.56	0.51	0.36	0.48	0.72	1.15	1.43	1.10	1.54	1.91	1.57	1.67	1.10	0.94	0.64	0.89	1.04
KS	0.49	0.51	0.39	0.46	0.74	1.13	1.28	1.05	1.34	1.57	1.46	1.46	0.90	0.80	0.70	0.80	0.94
LA	0.92	1.25	1.33	1.17	1.31	1.52	1.47	1.43	1.64	1.58	1.51	1.58	1.12	1.28	0.98	1.13	1.33
MN	0.36	0.40	0.28	0.35	0.43	1.10	1.19	0.91	1.36	1.72	1.41	1.50	0.99	0.77	0.45	0.74	0.87
MO	0.64	0.61	0.40	0.55	0.85	1.36	1.29	1.17	1.32	1.46	1.35	1.38	0.86	0.91	0.73	0.83	0.98
NE	0.53	0.52	0.46	0.50	0.72	1.00	1.32	1.01	1.52	1.48	1.46	1.49	0.98	0.82	0.55	0.78	0.95
OK	0.64	0.58	0.52	0.58	0.95	1.17	1.42	1.18	1.85	2.16	1.81	1.94	1.39	1.06	0.91	1.12	1.21
TX	0.91	0.91	1.02	0.95	1.30	1.51	1.54	1.45	1.58	1.67	1.66	1.64	1.41	1.38	1.04	1.28	1.33
CENRAP	0.65	0.66	0.62	0.64	0.90	1.27	1.38	1.18	1.51	1.72	1.56	1.60	1.16	1.05	0.77	0.99	1.10
Western Regional Air Partnership (WRAP)																	
AZ	0.66	0.67	0.74	0.69	1.05	1.26	2.04	1.45	1.96	1.66	1.90	1.84	1.40	1.33	0.86	1.20	1.29
CA	0.95	0.95	1.12	1.01	0.78	0.82	1.03	0.88	1.32	1.64	1.61	1.52	1.52	1.22	1.12	1.29	1.17
CO	0.49	0.49	0.47	0.48	0.70	0.78	0.99	0.82	1.28	1.54	1.51	1.44	1.18	0.88	0.58	0.88	0.91
ID	0.54	0.53	0.46	0.51	0.56	0.82	1.01	0.80	1.18	1.47	1.05	1.23	0.96	0.82	0.69	0.82	0.84
MT	0.59	0.68	0.50	0.59	0.46	0.80	1.05	0.77	1.16	1.20	0.97	1.11	0.78	0.66	0.66	0.70	0.79
ND	0.41	0.52	0.38	0.44	0.38	0.89	1.14	0.80	1.25	1.38	1.27	1.30	0.85	0.62	0.53	0.67	0.80
NM	0.54	0.54	0.61	0.56	0.92	1.07	1.23	1.07	1.46	1.51	1.66	1.54	1.43	1.17	0.59	1.06	1.06
NV	0.70	0.62	0.52	0.61	0.65	0.91	1.25	0.94	1.30	1.42	1.30	1.34	0.95	0.84	0.90	0.90	0.95
OR	0.62	0.62	0.58	0.61	0.61	0.68	0.88	0.72	0.97	1.29	1.09	1.12	0.97	0.87	0.74	0.86	0.83
SD	0.47	0.48	0.39	0.45	0.57	0.99	1.26	0.94	1.47	1.43	1.44	1.45	0.91	0.76	0.45	0.71	0.88
UT	0.47	0.49	0.44	0.47	0.62	0.74	1.05	0.80	1.25	1.47	1.33	1.35	0.93	0.97	0.56	0.82	0.86
WA	0.63	0.57	0.53	0.58	0.59	0.66	0.86	0.70	0.96	1.20	0.97	1.04	1.02	0.77	0.72	0.84	0.79
WY	0.54	0.47	0.43	0.48	0.47	0.73	1.05	0.75	1.10	1.27	1.13	1.17	0.90	0.69	0.50	0.70	0.77
WRAP	0.66	0.66	0.68	0.67	0.69	0.83	1.10	0.87	1.27	1.45	1.39	1.37	1.18	0.97	0.76	0.97	0.97
ALL	0.74	0.75	0.63	0.71	0.84	1.13	1.22	1.06	1.36	1.53	1.44	1.44	1.11	0.98	0.81	0.97	1.04

(a) ALL in this case refers to those states within the area covered by the 36km modeling domain.

Table 3-11. Mixing ratio error (g/kg) for 2006 MM5 by month and state in the 12km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
CO	0.47	0.46	0.43	0.45	0.62	0.73	0.96	0.77	1.17	1.46	1.49	1.37	1.08	0.82	0.55	0.82	0.85
UT	0.42	0.45	0.43	0.43	0.6	0.74	1.04	0.79	1.26	1.41	1.33	1.33	0.88	0.92	0.57	0.79	0.84
WY	0.47	0.42	0.36	0.42	0.44	0.69	0.98	0.70	1.07	1.19	1.07	1.11	0.83	0.65	0.47	0.65	0.72
ALL	0.48	0.47	0.42	0.46	0.53	0.76	1.03	0.77	1.19	1.34	1.29	1.27	0.91	0.74	0.53	0.73	0.81

(a) ALL in this case refers to those states within the area covered by the 12km modeling domain.

Table 3-12. Mixing ratio error (g/kg) for 2006 MM5 by month in the 4km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
ALL	0.45	0.47	0.42	0.45	0.52	0.85	1.32	0.90	1.61	1.63	1.48	1.57	1.1	0.89	0.56	0.85	0.94

Table 3-13. Wind speed index of agreement for 2006 MM5 by month, state, and region in the 36km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
Mid-Atlantic/Northeast Visibility Union (MANE-VU)																	
CT	0.53	0.52	0.55	0.53	0.53	0.53	0.52	0.53	0.57	0.53	0.55	0.55	0.56	0.56	0.51	0.54	0.54
DE	0.72	0.69	0.75	0.72	0.73	0.77	0.80	0.77	0.79	0.74	0.81	0.78	0.74	0.71	0.72	0.72	0.75
MA	0.55	0.61	0.58	0.58	0.59	0.64	0.65	0.63	0.57	0.64	0.57	0.59	0.63	0.59	0.57	0.60	0.60
MD	0.51	0.57	0.57	0.55	0.57	0.61	0.60	0.59	0.50	0.55	0.60	0.55	0.53	0.54	0.55	0.54	0.56
ME	0.52	0.56	0.56	0.55	0.55	0.58	0.54	0.56	0.54	0.51	0.59	0.55	0.55	0.59	0.51	0.55	0.55
NH	0.27	0.41	0.43	0.37	0.39	0.44	0.33	0.39	0.45	0.35	0.32	0.37	0.24	0.36	0.33	0.31	0.36
NJ	0.48	0.56	0.58	0.54	0.55	0.59	0.53	0.56	0.59	0.52	0.52	0.54	0.60	0.54	0.53	0.56	0.55
NY	0.68	0.71	0.68	0.69	0.71	0.68	0.71	0.70	0.71	0.72	0.67	0.70	0.72	0.68	0.66	0.69	0.69
PA	0.61	0.63	0.64	0.63	0.64	0.63	0.66	0.64	0.65	0.69	0.64	0.66	0.65	0.67	0.63	0.65	0.65
RI	0.68	0.66	0.67	0.67	0.69	0.71	0.70	0.70	0.72	0.72	0.72	0.72	0.76	0.72	0.72	0.73	0.71
VT	0.52	0.50	0.50	0.51	0.49	0.49	0.51	0.50	0.50	0.54	0.51	0.52	0.51	0.48	0.50	0.50	0.50
MANE_VU	0.64	0.70	0.68	0.67	0.69	0.72	0.69	0.70	0.73	0.69	0.72	0.71	0.65	0.70	0.65	0.67	0.69
Visibility Improvement State and Tribal Association of the Southeast (VISTAS)																	
AL	0.66	0.65	0.68	0.66	0.65	0.64	0.65	0.65	0.65	0.64	0.61	0.63	0.65	0.69	0.63	0.66	0.65
FL	0.68	0.74	0.68	0.70	0.73	0.75	0.73	0.74	0.73	0.73	0.74	0.73	0.71	0.65	0.70	0.69	0.71
GA	0.56	0.65	0.65	0.62	0.60	0.65	0.58	0.61	0.55	0.60	0.58	0.58	0.55	0.60	0.59	0.58	0.60
KY	0.56	0.56	0.58	0.57	0.53	0.55	0.55	0.54	0.57	0.54	0.58	0.56	0.59	0.57	0.59	0.58	0.56
MS	0.61	0.61	0.63	0.62	0.62	0.61	0.61	0.61	0.61	0.57	0.62	0.60	0.59	0.61	0.62	0.61	0.61
NC	0.57	0.60	0.58	0.58	0.64	0.60	0.53	0.59	0.56	0.62	0.56	0.58	0.63	0.57	0.59	0.60	0.59
SC	0.59	0.64	0.61	0.61	0.66	0.55	0.66	0.62	0.56	0.57	0.59	0.57	0.59	0.55	0.60	0.58	0.60
TN	0.62	0.59	0.60	0.60	0.56	0.67	0.60	0.61	0.64	0.63	0.64	0.64	0.63	0.64	0.66	0.64	0.62
VA	0.63	0.63	0.62	0.63	0.61	0.64	0.59	0.61	0.64	0.62	0.61	0.62	0.66	0.61	0.66	0.64	0.63
WV	0.55	0.54	0.57	0.55	0.55	0.54	0.55	0.55	0.56	0.59	0.53	0.56	0.53	0.60	0.56	0.56	0.56
VISTAS	0.76	0.76	0.78	0.77	0.76	0.73	0.76	0.75	0.75	0.76	0.78	0.76	0.74	0.77	0.76	0.76	0.76
Midwest Regional Planning Organization (MRPO)																	
IL	0.67	0.65	0.67	0.66	0.66	0.62	0.66	0.65	0.64	0.64	0.66	0.65	0.68	0.65	0.70	0.68	0.66
IN	0.61	0.60	0.61	0.61	0.62	0.58	0.58	0.59	0.61	0.58	0.62	0.60	0.62	0.63	0.62	0.62	0.61
MI	0.64	0.64	0.66	0.65	0.65	0.62	0.63	0.63	0.66	0.63	0.63	0.64	0.66	0.65	0.64	0.65	0.64
OH	0.64	0.62	0.63	0.63	0.62	0.65	0.62	0.63	0.64	0.65	0.65	0.65	0.62	0.65	0.64	0.64	0.64
WI	0.62	0.63	0.63	0.63	0.61	0.58	0.61	0.60	0.62	0.59	0.59	0.60	0.60	0.59	0.62	0.60	0.61
MRPO	0.73	0.72	0.71	0.72	0.73	0.69	0.75	0.72	0.73	0.76	0.72	0.74	0.76	0.74	0.77	0.76	0.73

Table 3-13. Wind speed index of agreement for 2006 MM5 by month, state, and region in the 36km domain.

Central States Regional Air Partnership (CENRAP)																	
AR	0.72	0.69	0.68	0.70	0.66	0.66	0.71	0.68	0.71	0.66	0.71	0.69	0.70	0.70	0.71	0.70	0.69
IA	0.68	0.63	0.65	0.65	0.69	0.64	0.70	0.68	0.65	0.66	0.66	0.66	0.69	0.67	0.71	0.69	0.67
KS	0.75	0.74	0.74	0.74	0.73	0.73	0.72	0.73	0.75	0.74	0.71	0.73	0.73	0.69	0.78	0.73	0.73
LA	0.65	0.68	0.67	0.67	0.62	0.68	0.66	0.65	0.65	0.68	0.65	0.66	0.65	0.65	0.67	0.66	0.66
MN	0.64	0.67	0.67	0.66	0.66	0.67	0.68	0.67	0.69	0.70	0.68	0.69	0.70	0.70	0.65	0.68	0.68
MO	0.68	0.69	0.70	0.69	0.68	0.64	0.67	0.66	0.69	0.67	0.66	0.67	0.66	0.72	0.66	0.68	0.68
NE	0.77	0.78	0.76	0.77	0.78	0.78	0.75	0.77	0.73	0.73	0.72	0.73	0.76	0.72	0.80	0.76	0.76
OK	0.71	0.68	0.70	0.70	0.70	0.66	0.70	0.69	0.68	0.69	0.68	0.68	0.67	0.64	0.69	0.67	0.68
TX	0.77	0.76	0.77	0.77	0.75	0.77	0.77	0.76	0.75	0.73	0.78	0.75	0.74	0.75	0.78	0.76	0.76
CENRAP	0.85	0.83	0.83	0.84	0.82	0.82	0.85	0.83	0.86	0.85	0.84	0.85	0.88	0.85	0.83	0.85	0.84
Western Regional Air Partnership (WRAP)																	
AZ	0.74	0.75	0.72	0.74	0.65	0.72	0.75	0.71	0.71	0.69	0.73	0.71	0.72	0.71	0.75	0.73	0.72
CA	0.79	0.73	0.74	0.75	0.74	0.74	0.74	0.74	0.75	0.75	0.76	0.75	0.78	0.78	0.78	0.78	0.76
CO	0.72	0.79	0.79	0.77	0.78	0.76	0.77	0.77	0.78	0.75	0.76	0.76	0.76	0.72	0.74	0.74	0.76
ID	0.72	0.77	0.77	0.75	0.74	0.73	0.71	0.73	0.77	0.75	0.69	0.74	0.74	0.74	0.69	0.72	0.73
MT	0.68	0.78	0.78	0.75	0.76	0.78	0.77	0.77	0.76	0.76	0.78	0.77	0.73	0.73	0.74	0.73	0.75
ND	0.71	0.74	0.73	0.73	0.68	0.73	0.73	0.71	0.76	0.72	0.69	0.72	0.77	0.74	0.69	0.73	0.72
NM	0.73	0.77	0.77	0.76	0.78	0.80	0.79	0.79	0.79	0.77	0.77	0.78	0.78	0.77	0.75	0.77	0.77
NV	0.76	0.74	0.74	0.75	0.73	0.75	0.74	0.74	0.72	0.73	0.76	0.74	0.75	0.74	0.74	0.74	0.74
OR	0.72	0.72	0.73	0.72	0.76	0.72	0.75	0.74	0.76	0.77	0.76	0.76	0.74	0.73	0.72	0.73	0.74
SD	0.80	0.79	0.80	0.80	0.79	0.78	0.72	0.76	0.74	0.77	0.80	0.77	0.74	0.72	0.75	0.74	0.77
UT	0.72	0.68	0.72	0.71	0.71	0.73	0.72	0.72	0.72	0.72	0.75	0.73	0.74	0.74	0.71	0.73	0.72
WA	0.72	0.77	0.74	0.74	0.81	0.78	0.81	0.80	0.71	0.76	0.77	0.75	0.75	0.71	0.71	0.72	0.75
WY	0.65	0.76	0.78	0.73	0.76	0.76	0.74	0.75	0.68	0.69	0.73	0.70	0.67	0.66	0.73	0.69	0.72
WRAP	0.86	0.86	0.86	0.86	0.85	0.84	0.87	0.85	0.84	0.84	0.84	0.84	0.83	0.86	0.85	0.85	0.85
ALL	0.87	0.86	0.88	0.87	0.87	0.85	0.85	0.86	0.90	0.88	0.87	0.88	0.87	0.89	0.88	0.88	0.87

(a) ALL in this case refers to those states within the area covered by the 36km modeling domain.

Table 3-14. Wind speed index of agreement for 2006 MM5 by month and state in the 12km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
CO	0.75	0.80	0.80	0.78	0.81	0.77	0.79	0.79	0.78	0.80	0.78	0.79	0.79	0.76	0.77	0.77	0.78
UT	0.75	0.70	0.74	0.73	0.72	0.76	0.74	0.74	0.74	0.72	0.77	0.74	0.76	0.76	0.73	0.75	0.74
WY	0.81	0.79	0.80	0.80	0.79	0.81	0.78	0.79	0.80	0.78	0.81	0.80	0.79	0.80	0.79	0.79	0.80
ALL	0.83	0.85	0.85	0.84	0.86	0.85	0.84	0.85	0.83	0.83	0.82	0.83	0.83	0.83	0.80	0.82	0.84

(a) ALL in this case refers to those states within the area covered by the 12km modeling domain.

Table 3-15. Wind speed index of agreement for 2006 MM5 by month in the 4km domain.

Region	Dec	Jan	Feb	Win	Mar	Apr	May	Spr	Jun	Jul	Aug	Sum	Sep	Oct	Nov	Aut	Mean
ALL	0.76	0.80	0.81	0.79	0.81	0.81	0.81	0.81	0.81	0.77	0.78	0.79	0.80	0.79	0.81	0.80	0.80

Figure 3-1. Regional Planning Organization (RPO) Boundaries.

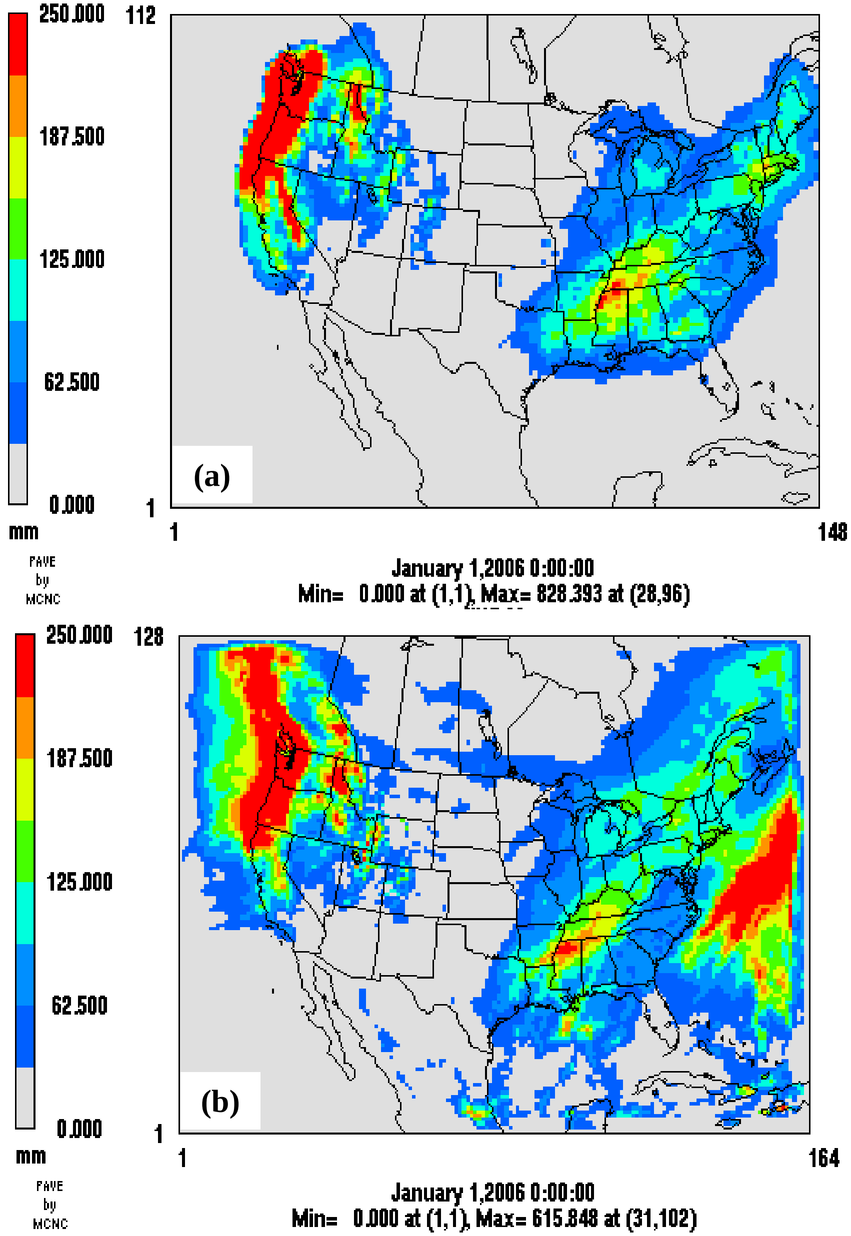

Figure 3-2. Precipitation for January 2006 over the 36km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

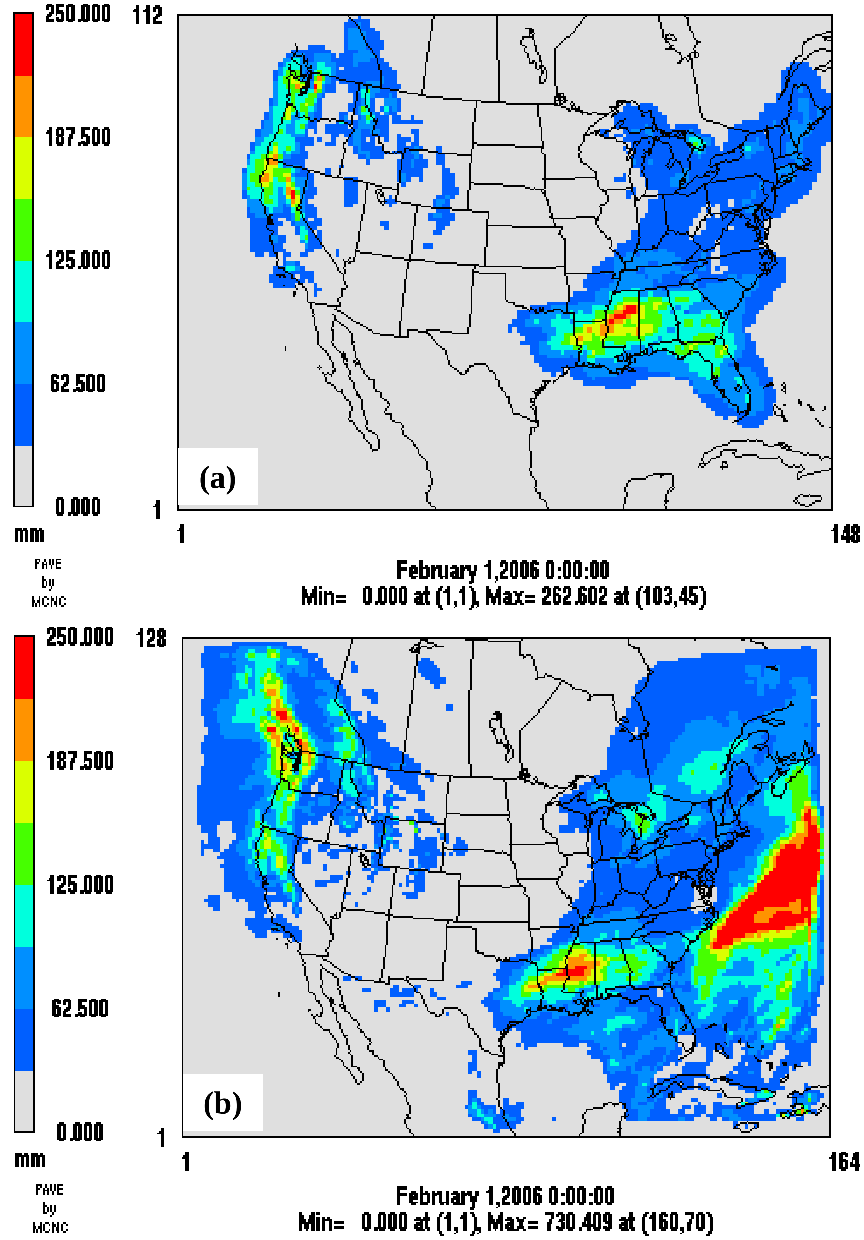

Figure 3-3. Precipitation for February 2006 over the 36km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

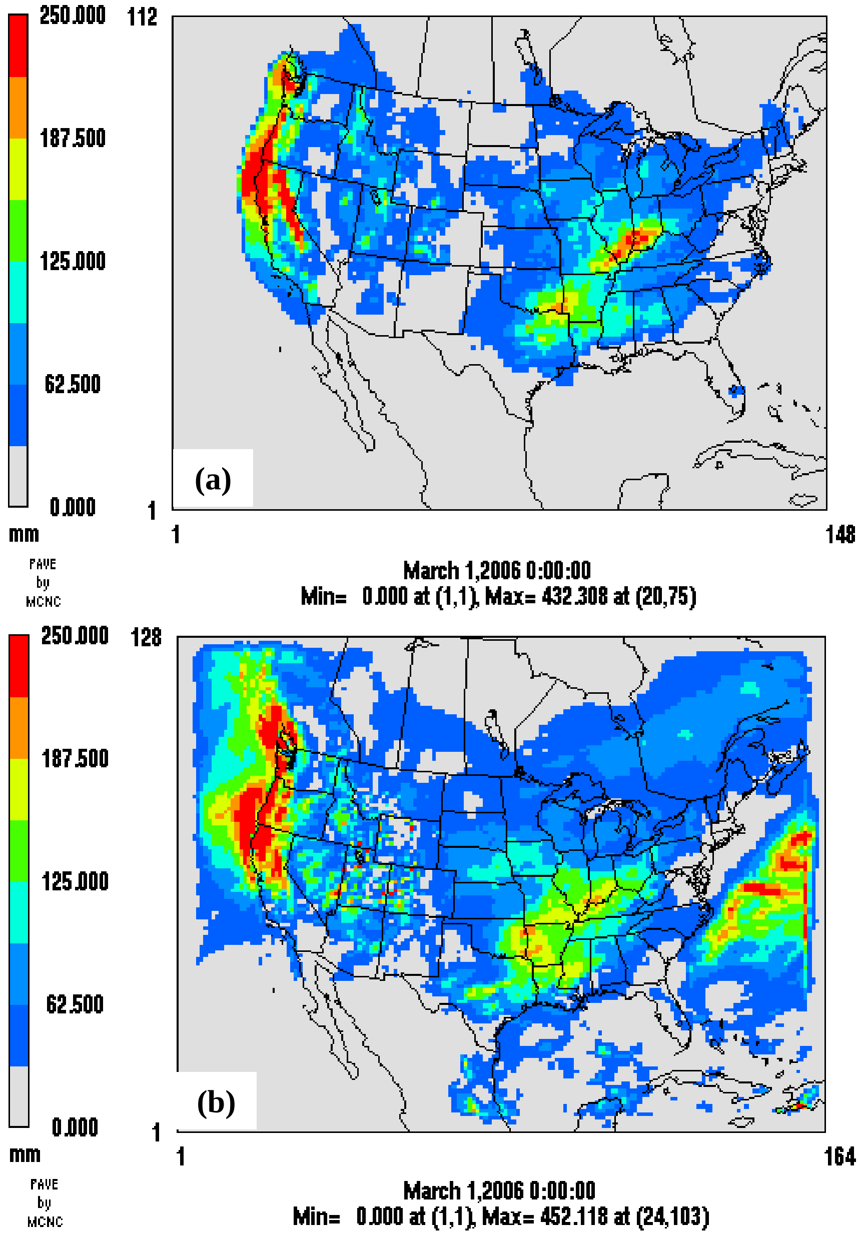

Figure 3-4. Precipitation for March 2006 over the 36km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

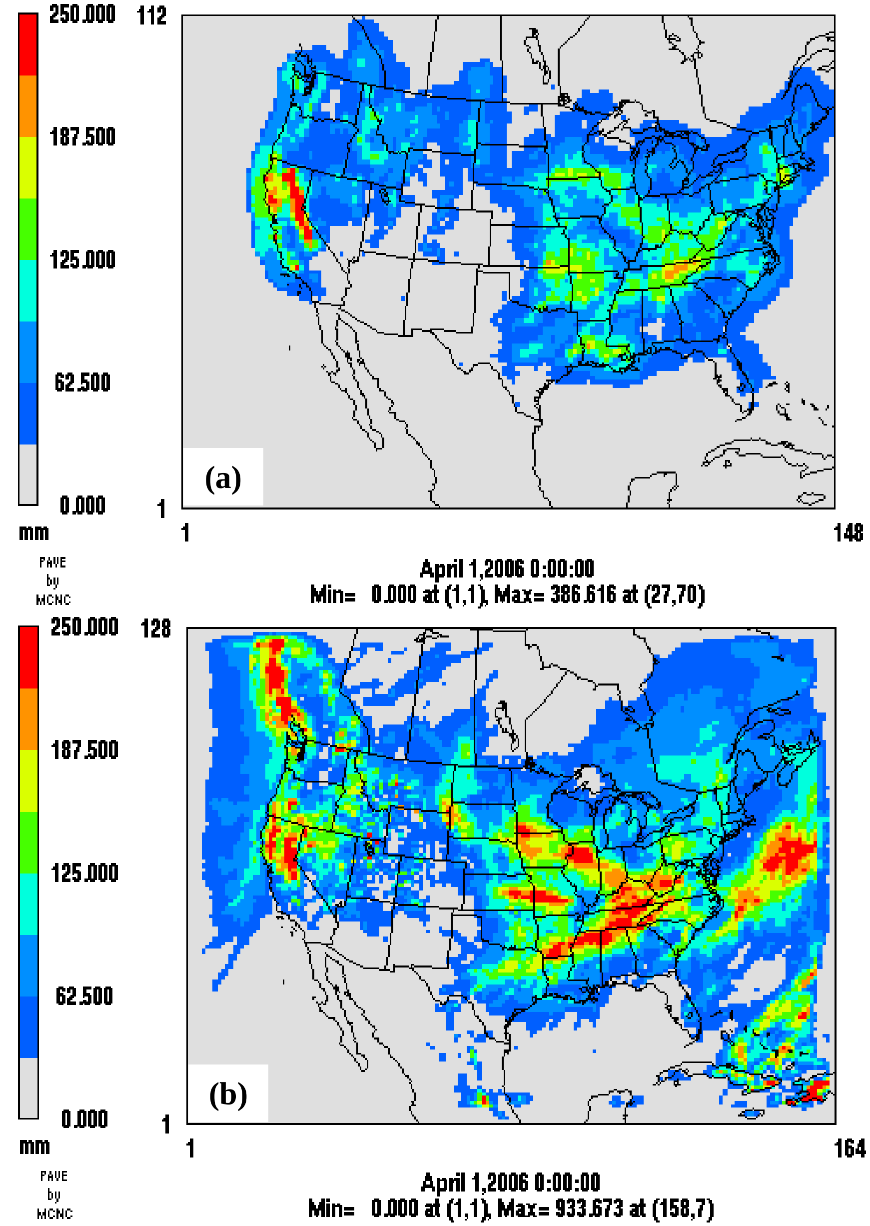

Figure 3-5. Precipitation for April 2006 over the 36km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

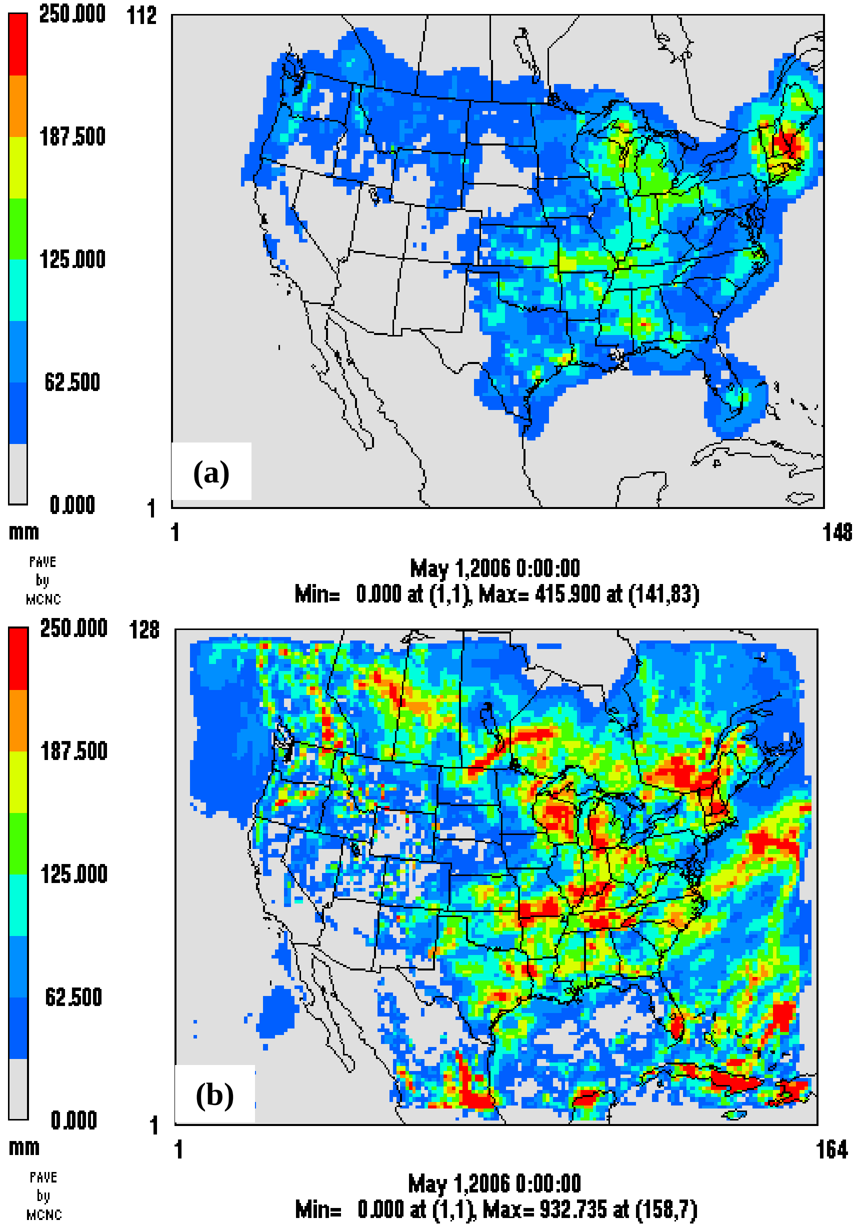

Figure 3-6. Precipitation for May 2006 over the 36km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

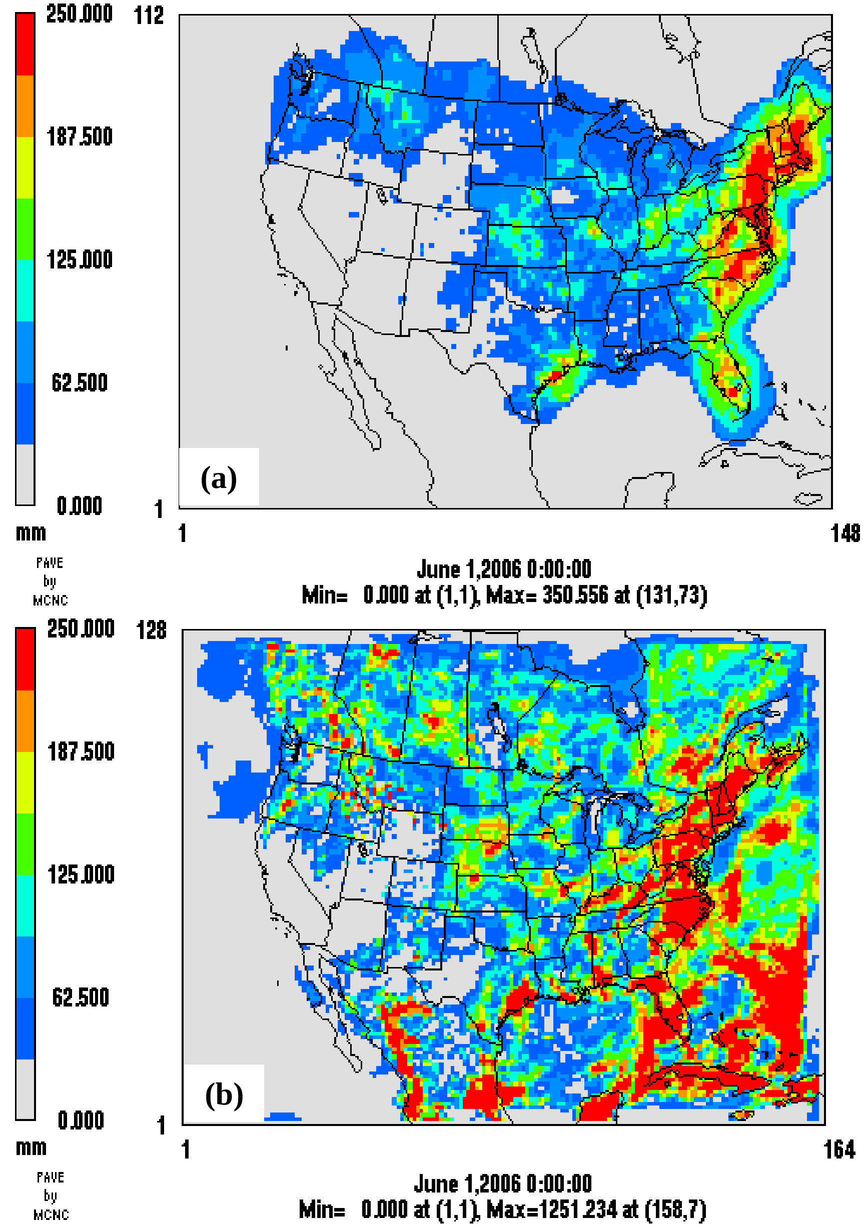

Figure 3-7. Precipitation for June 2006 over the 36km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

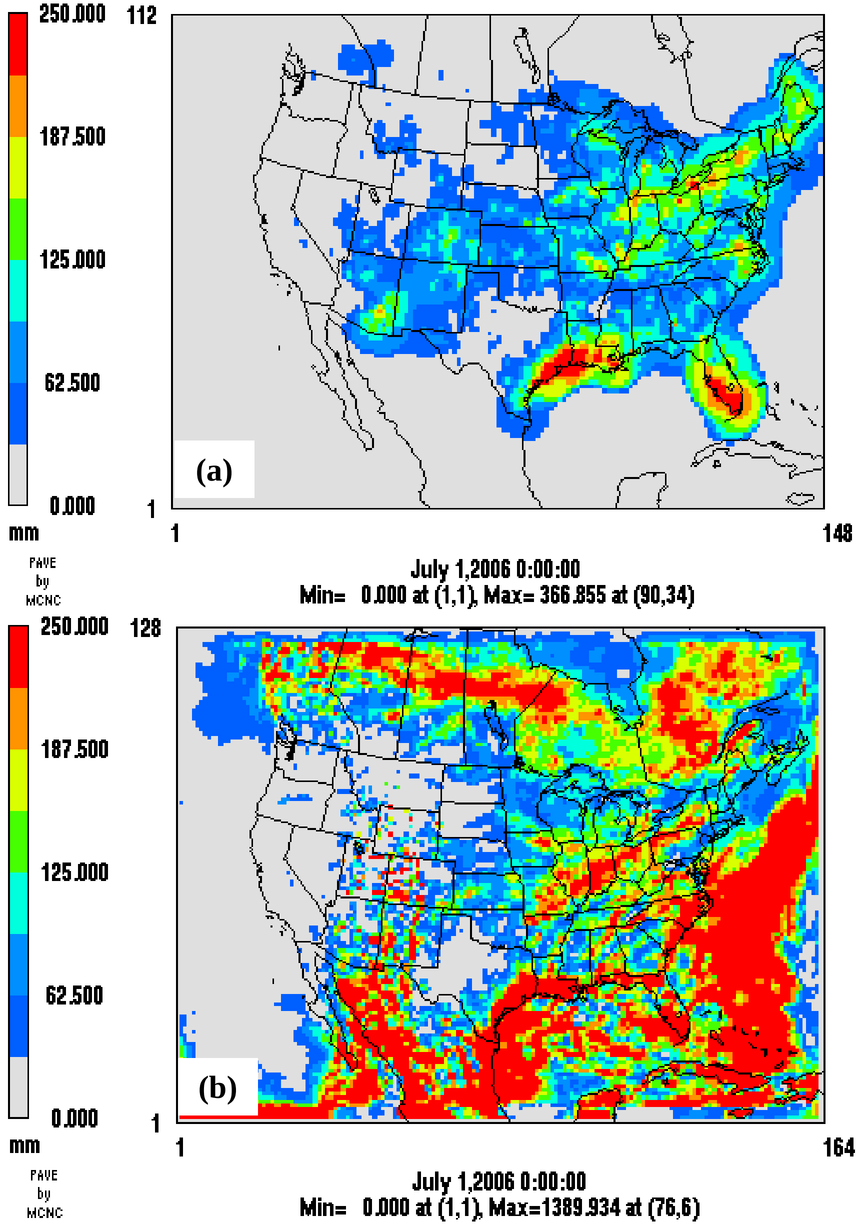

Figure 3-8. Precipitation for July 2006 over the 36km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

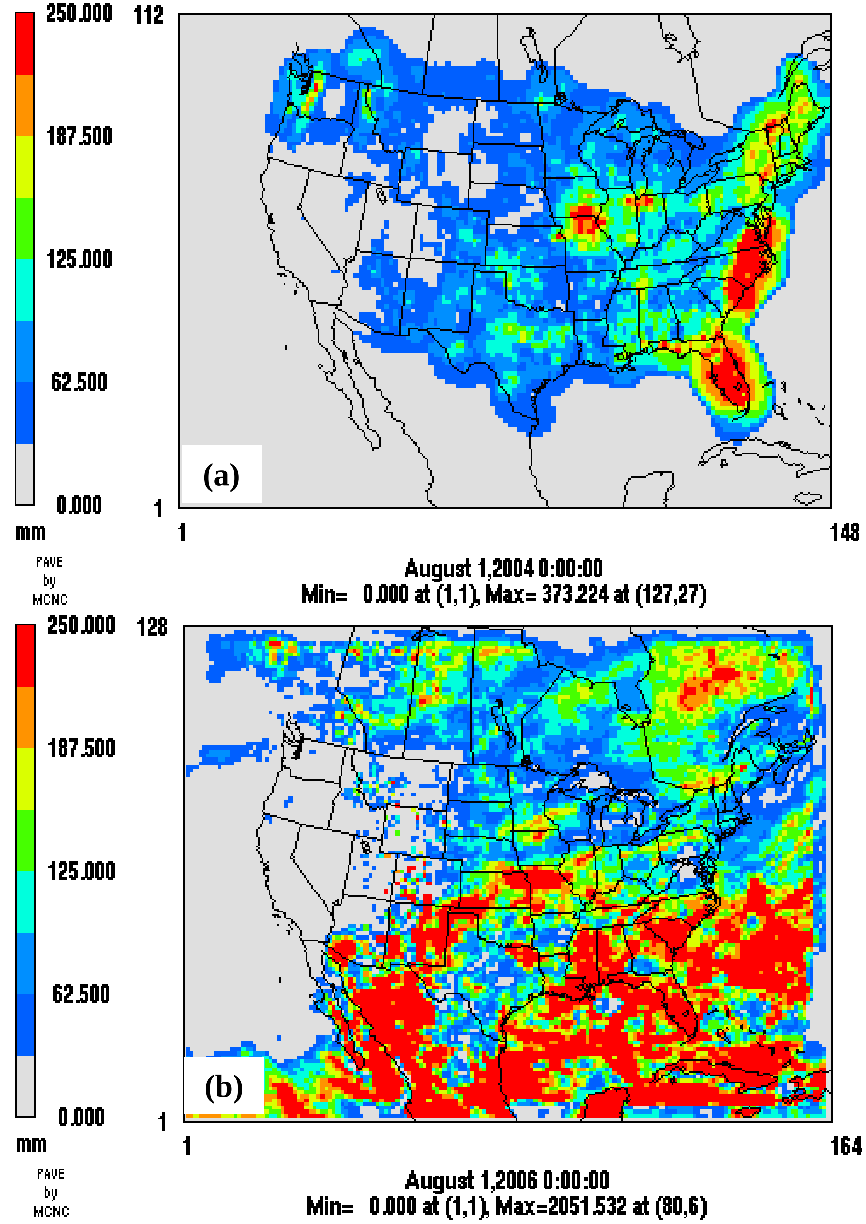

Figure 3-9. Precipitation for August 2006 over the 36km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

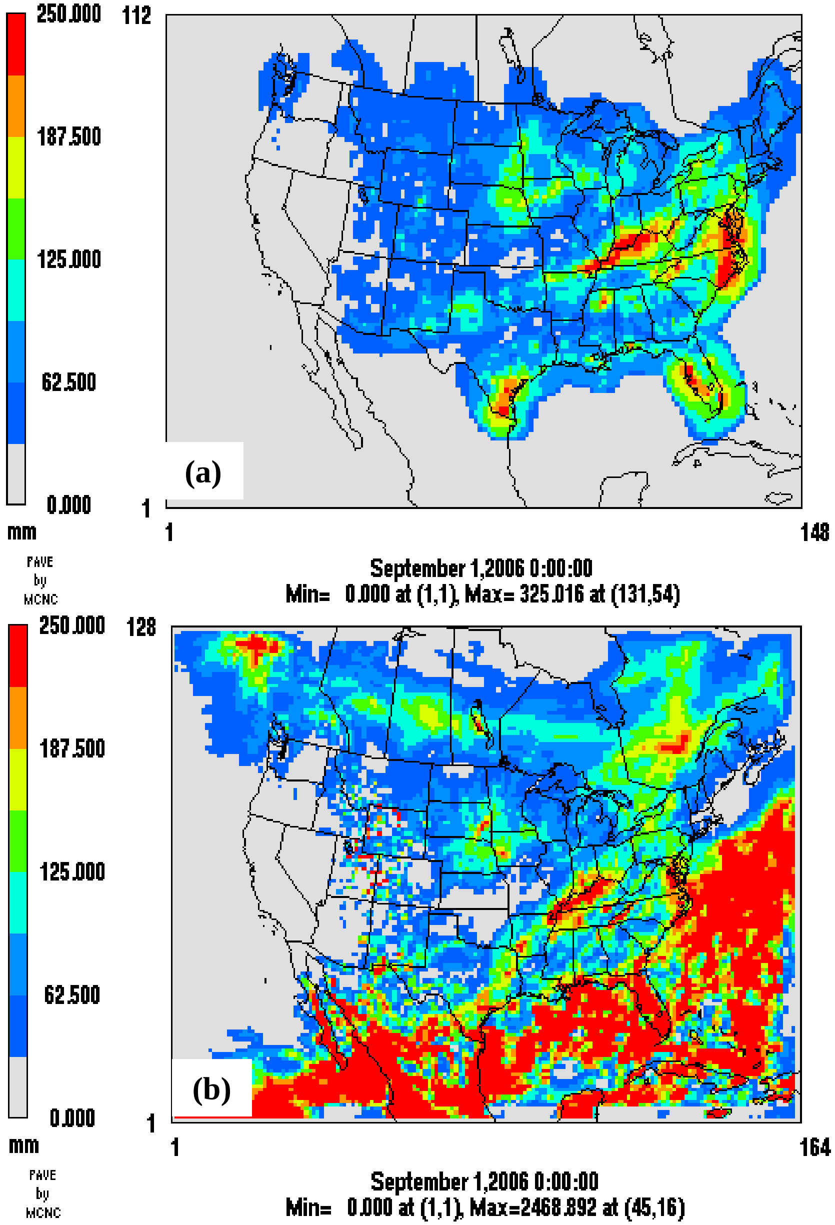

Figure 3-10. Precipitation for September 2006 over the 36km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

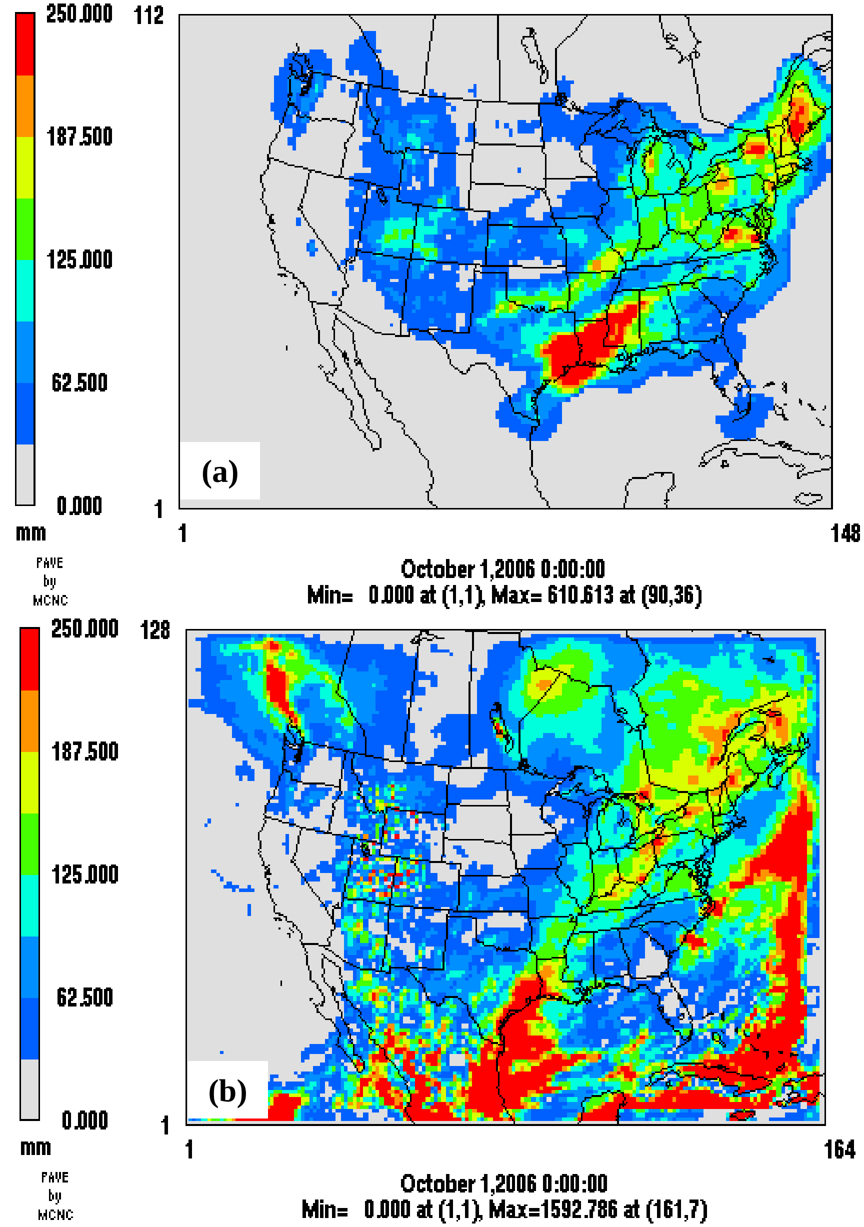

Figure 3-11. Precipitation for October 2006 over the 36km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

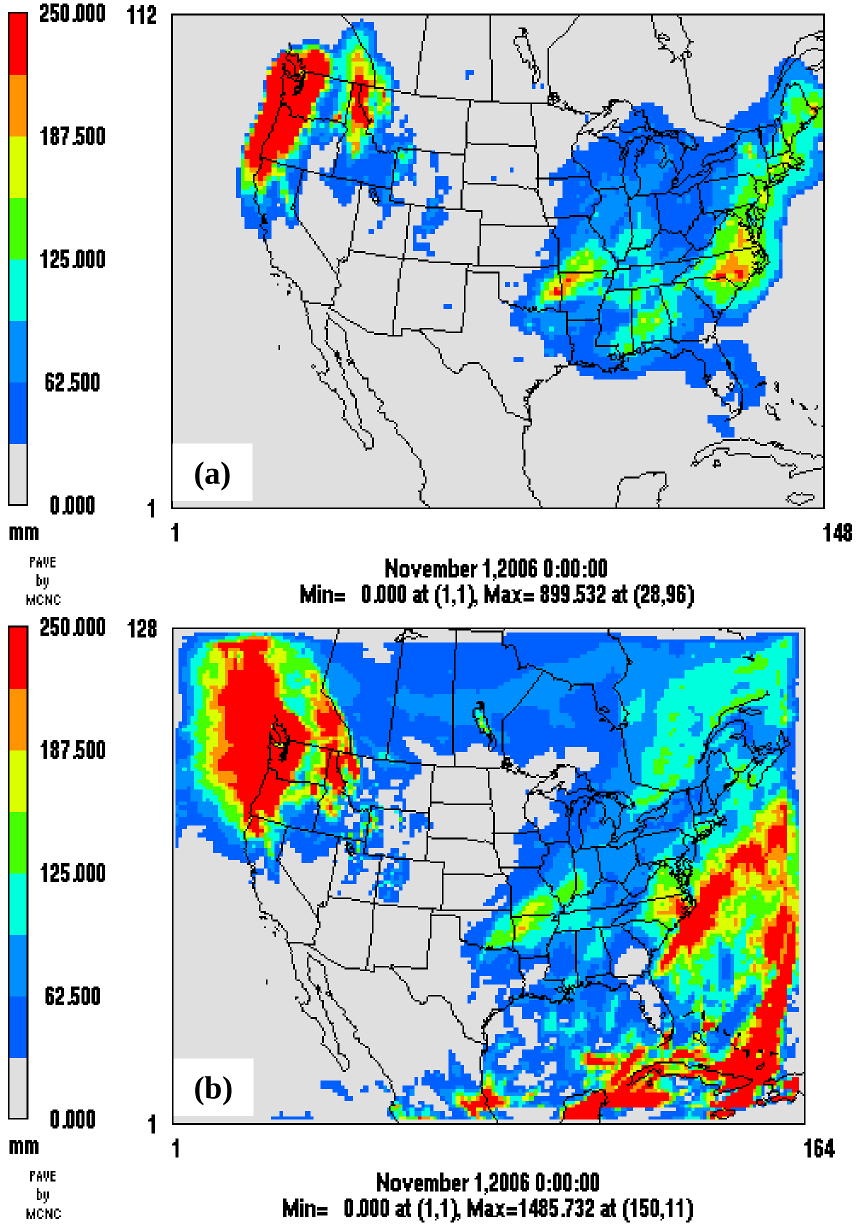

Figure 3-12. Precipitation for November 2006 over the 36km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

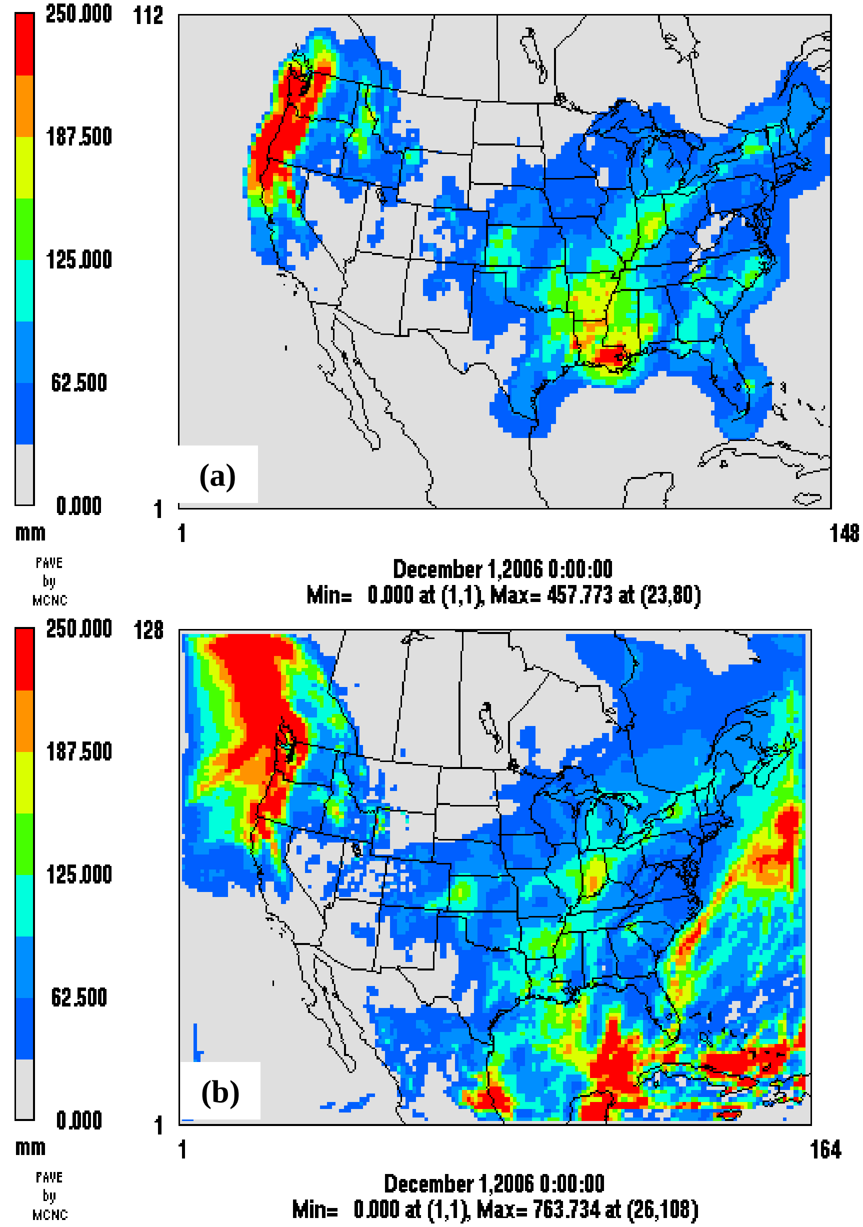

Figure 3-13. Precipitation for December 2006 over the 36km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

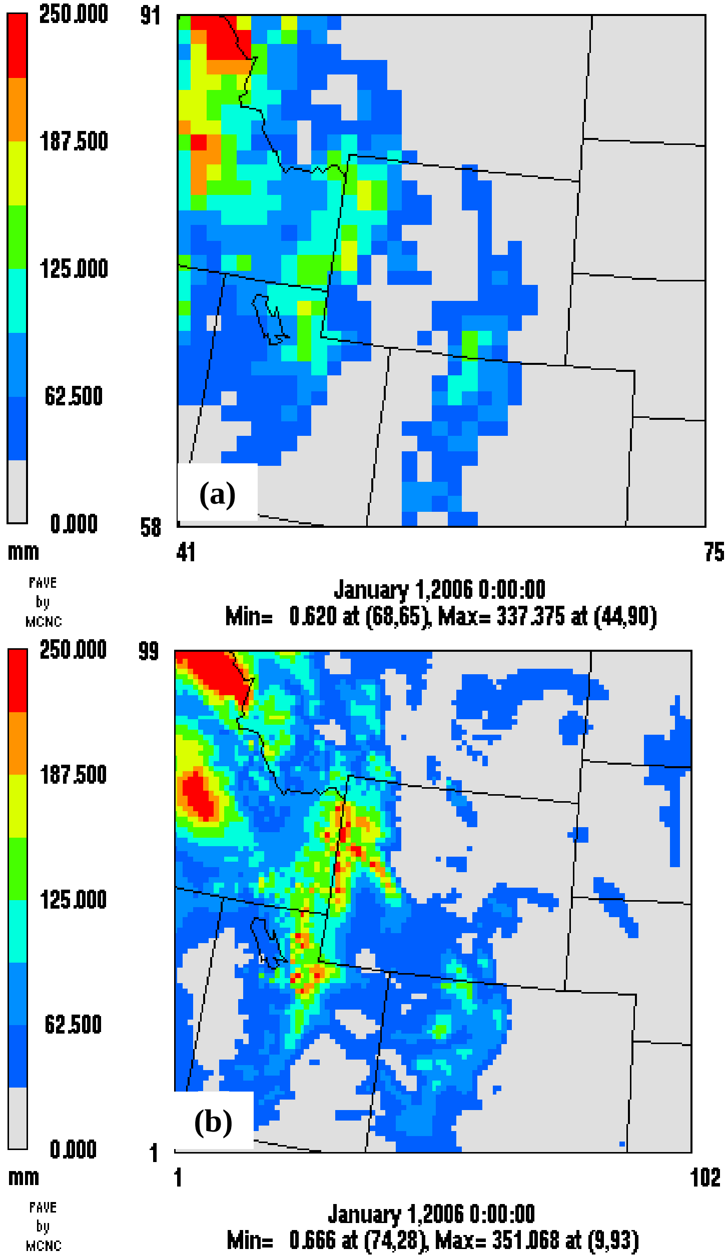

Figure 3-14. Precipitation for January 2006 over the 12km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

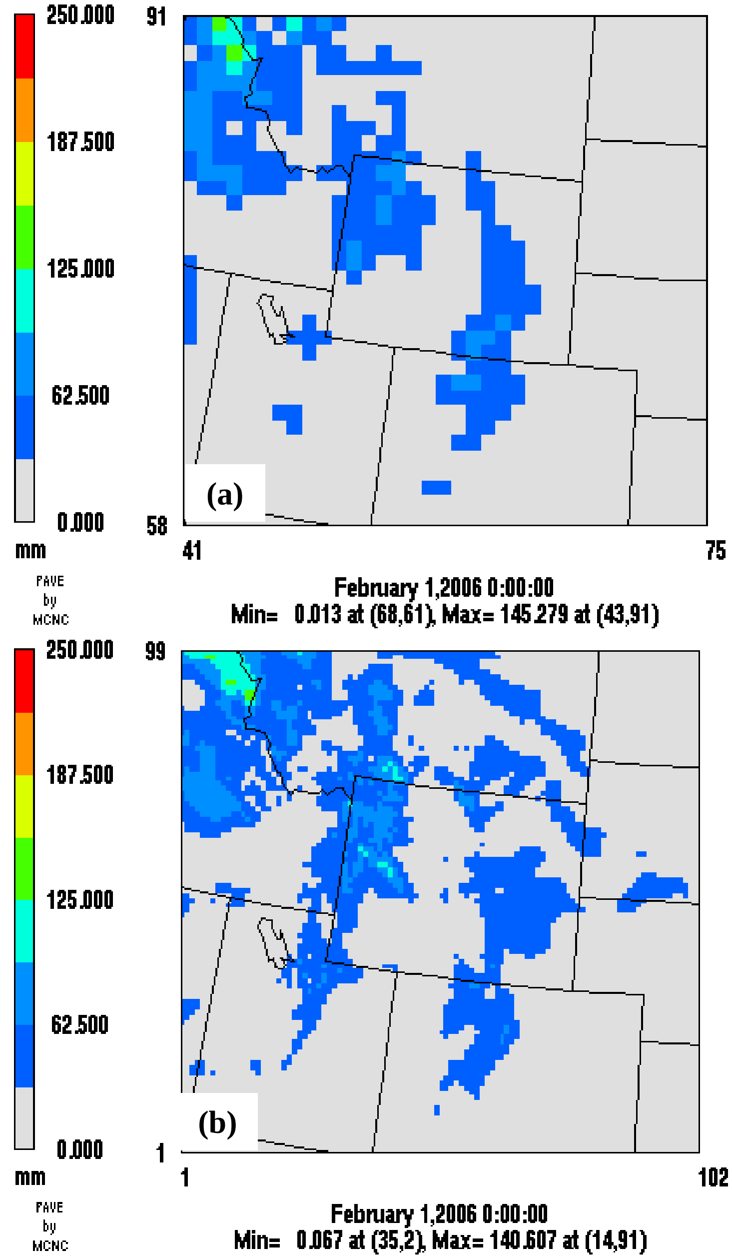

Figure 3-15. Precipitation for February 2006 over the 12km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

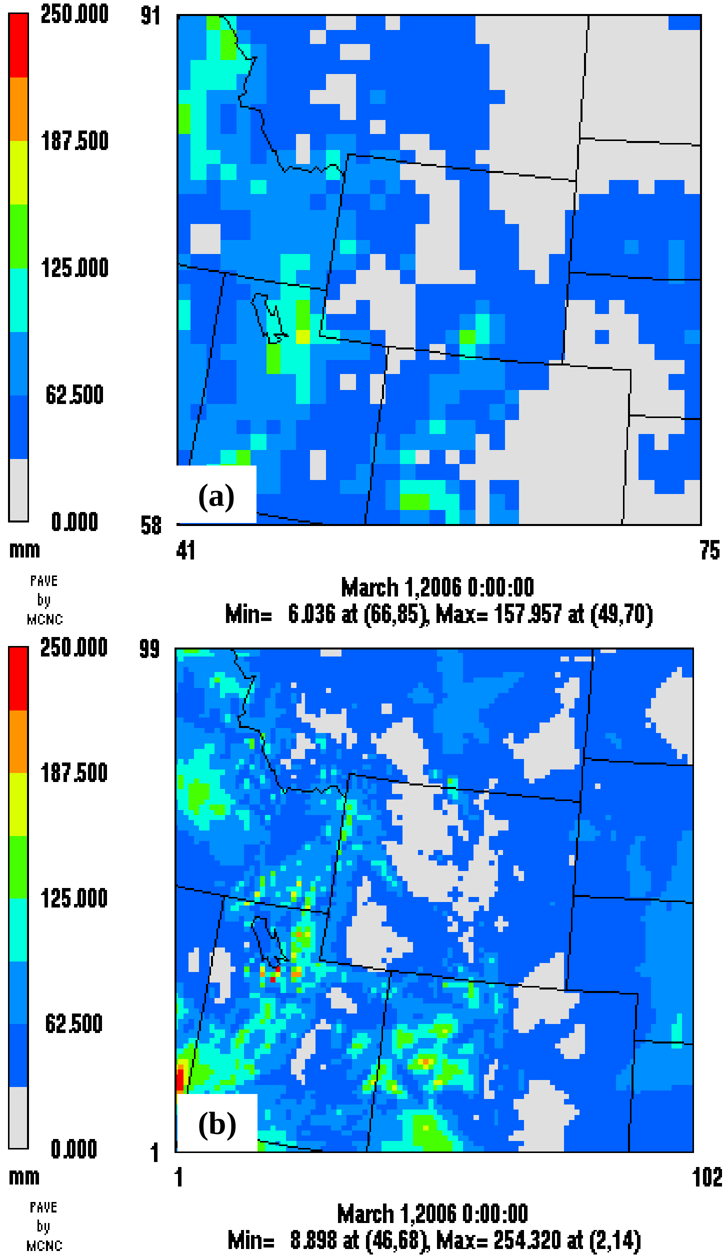

Figure 3-16. Precipitation for March 2006 over the 12km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

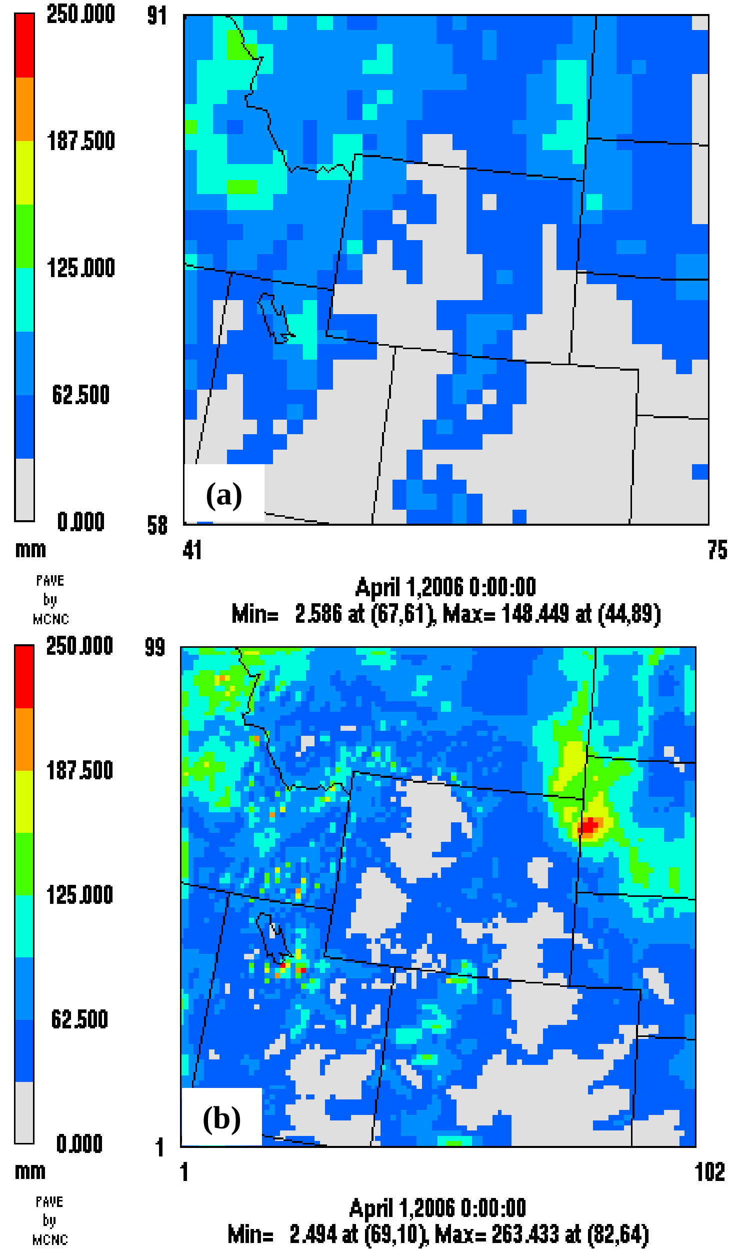

Figure 3-17. Precipitation for April 2006 over the 12km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

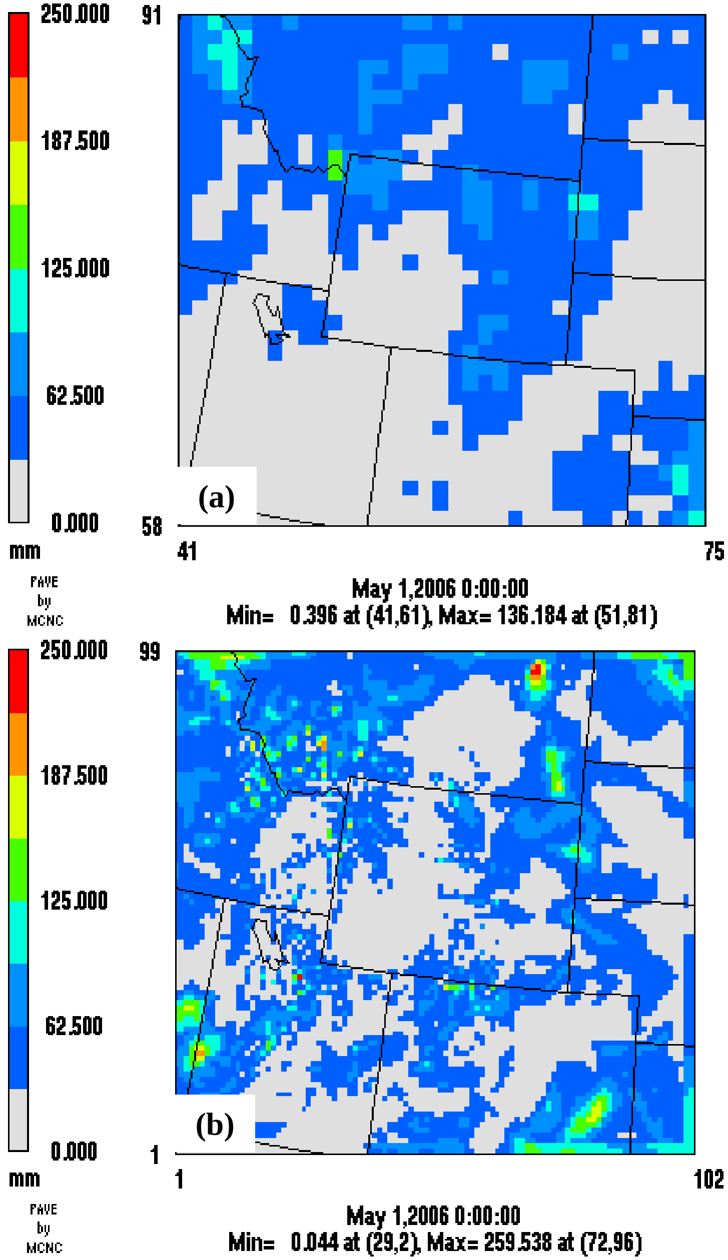

Figure 3-18. Precipitation for May 2006 over the 12km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

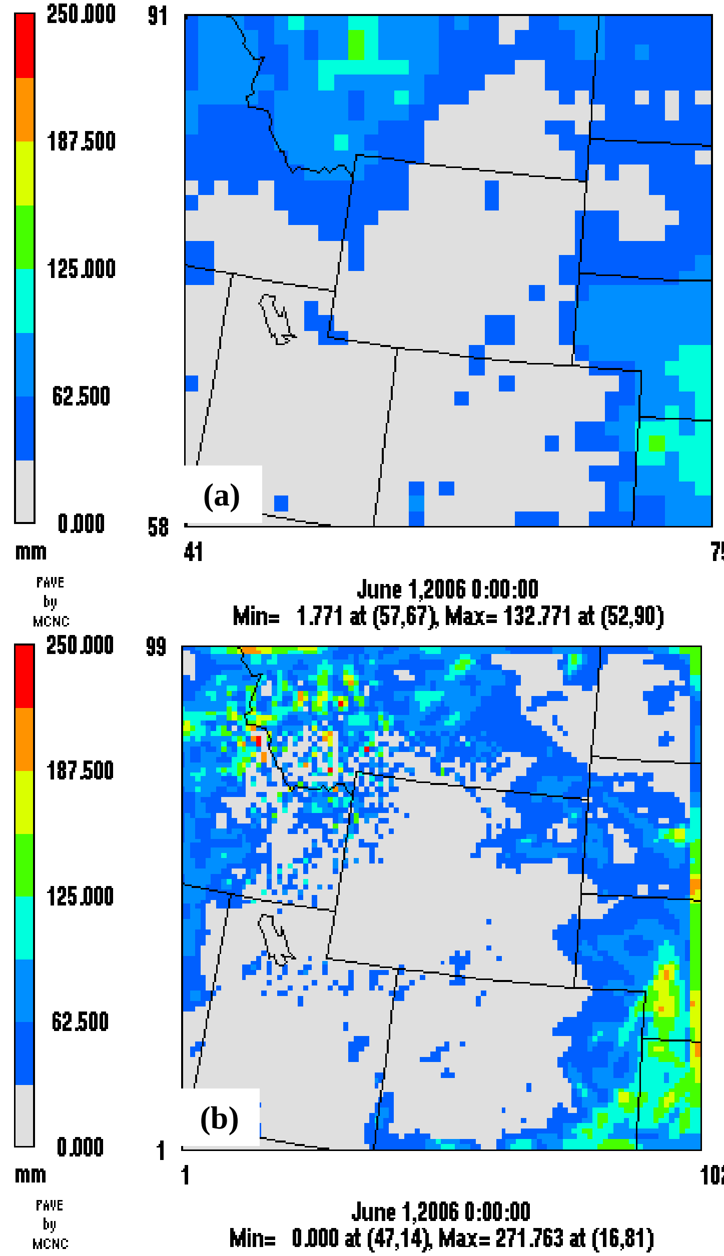

Figure 3-19. Precipitation for June 2006 over the 12km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

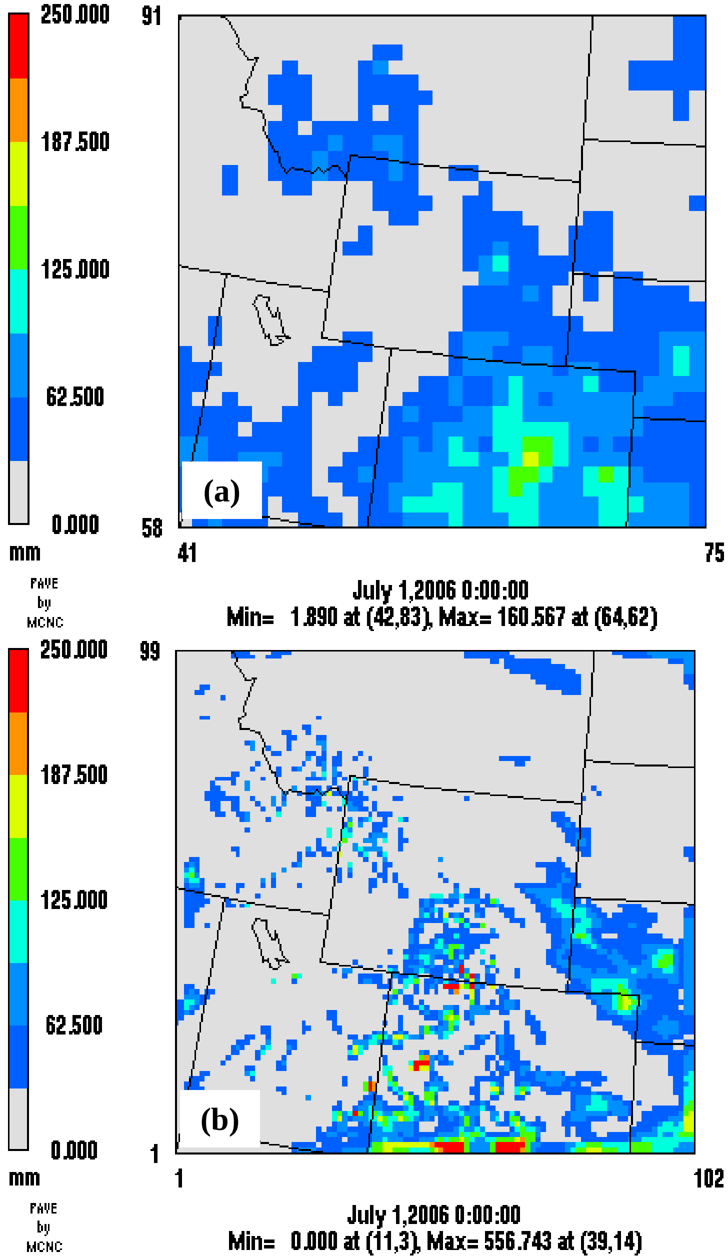

Figure 3-20. Precipitation for July 2006 over the 12km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

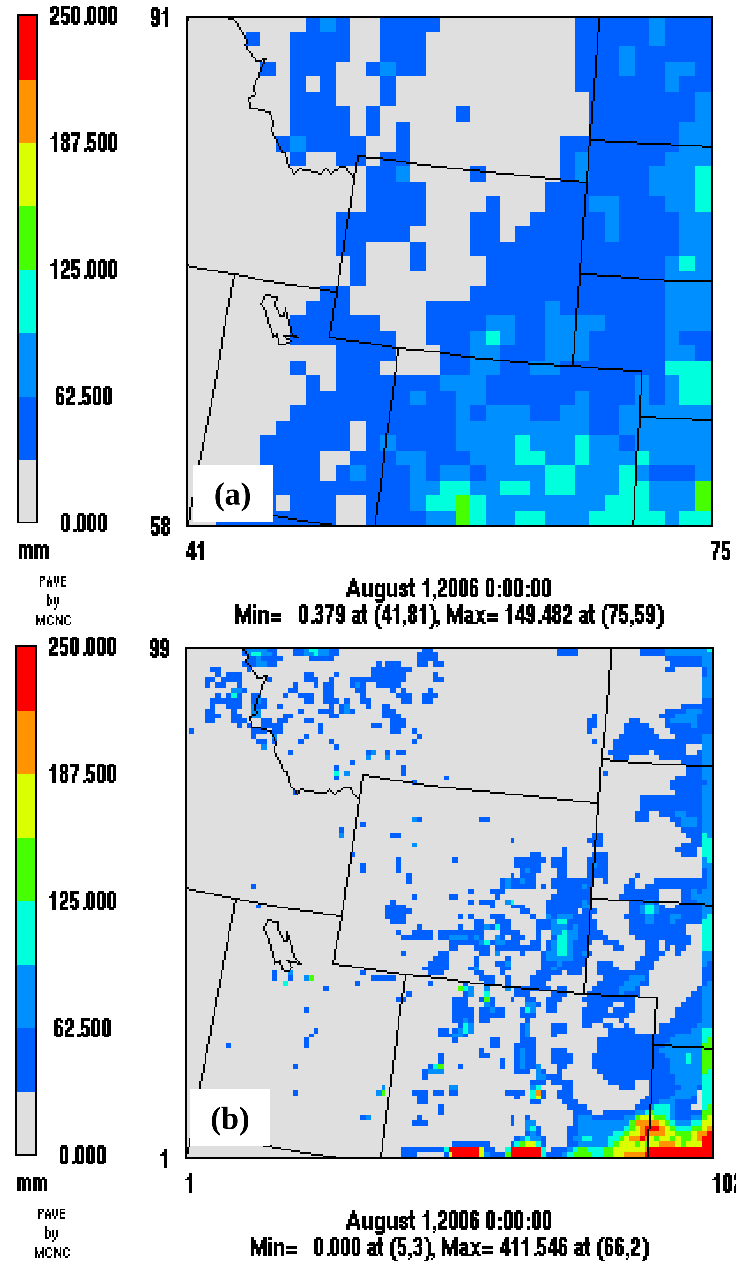

Figure 3-21. Precipitation for August 2006 over the 12km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

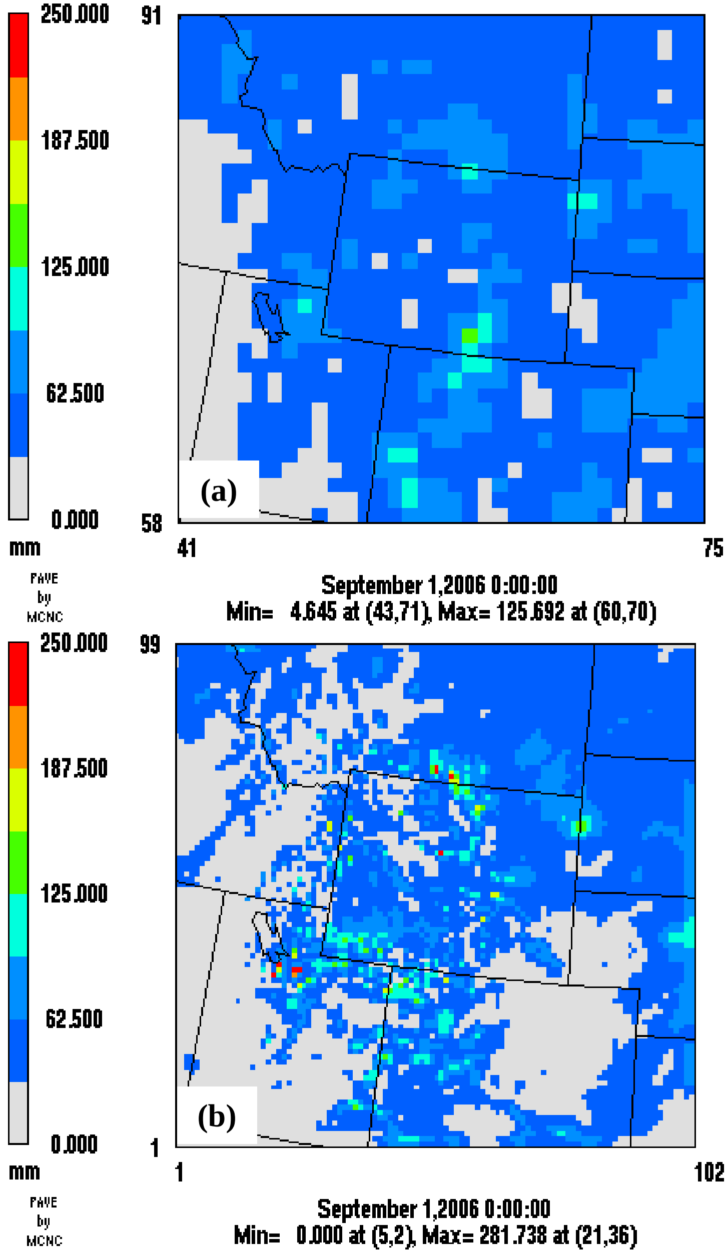

Figure 3-22. Precipitation for September 2006 over the 12km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

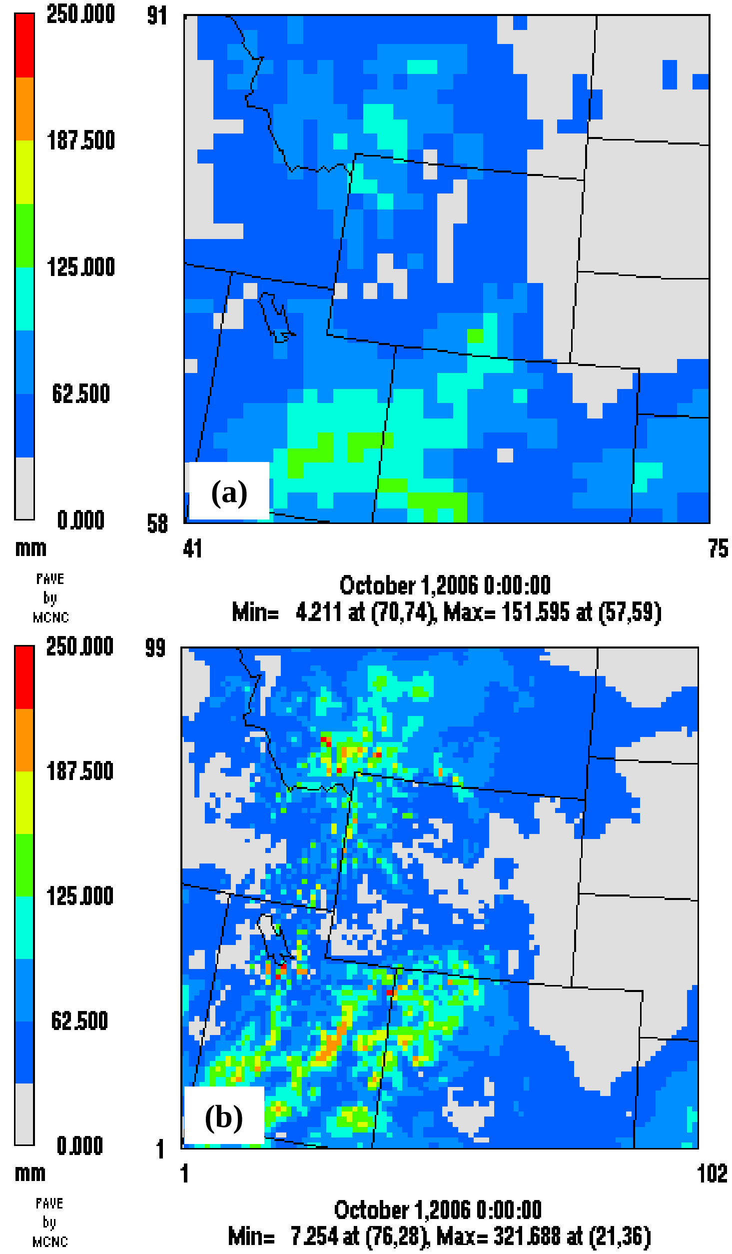

Figure 3-23. Precipitation for October 2006 over the 12km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

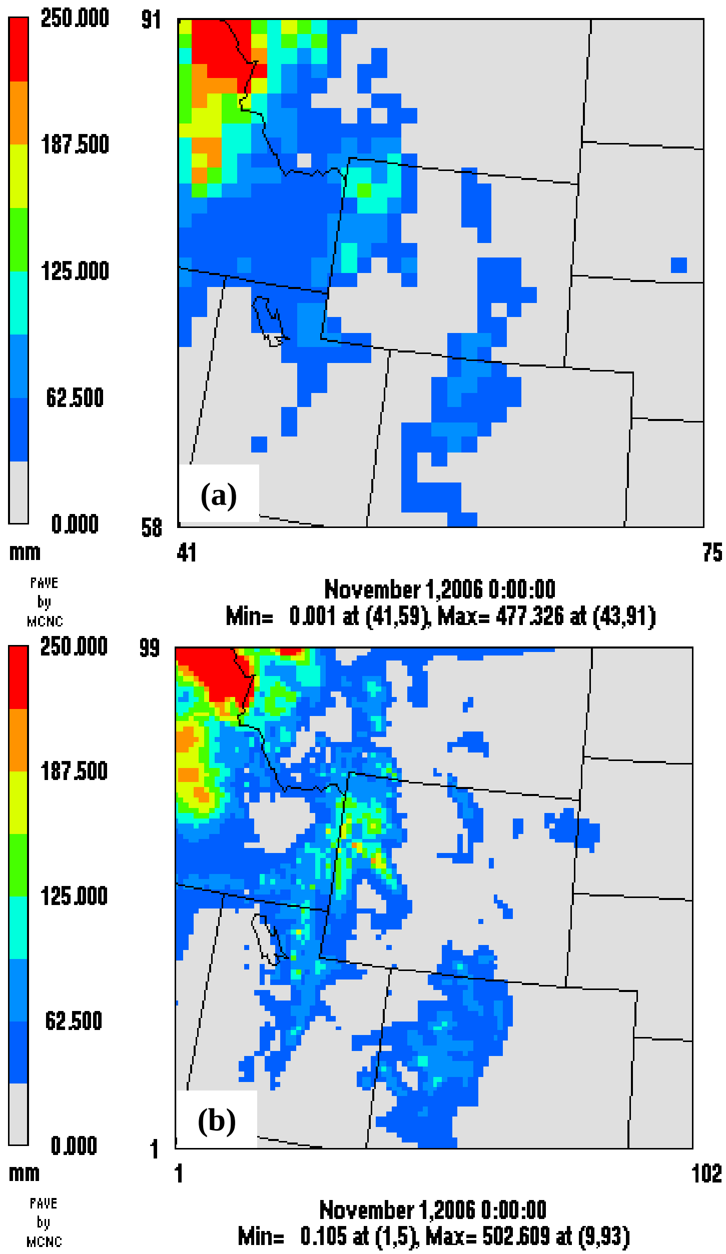

Figure 3-24. Precipitation for November 2006 over the 12km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

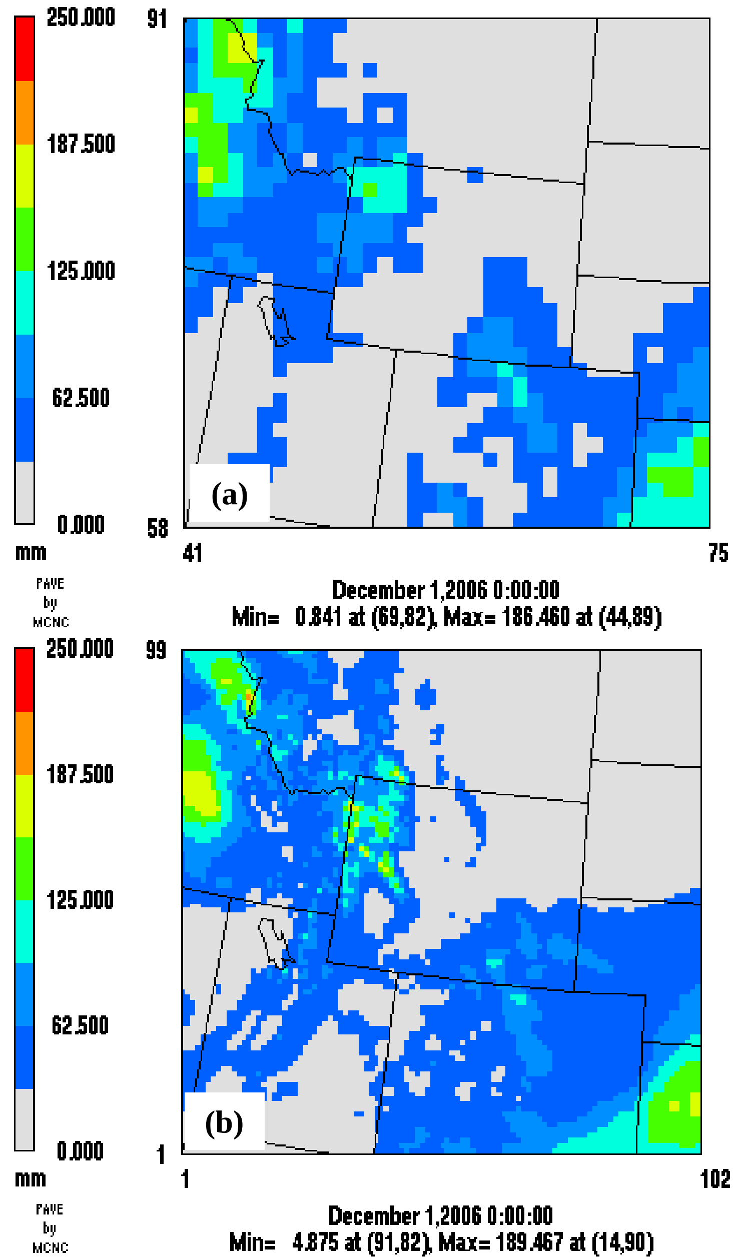

Figure 3-25. Precipitation for December 2006 over the 12km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

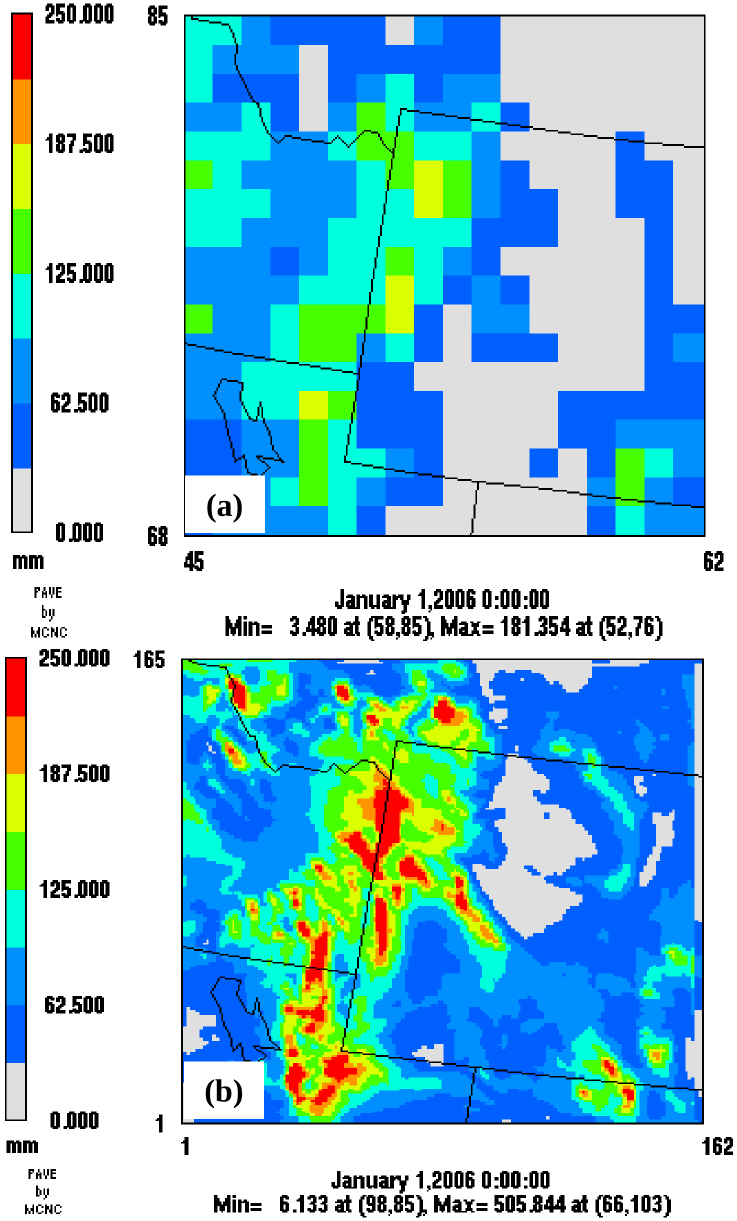

Figure 3-26. Precipitation for January 2006 over the 4km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

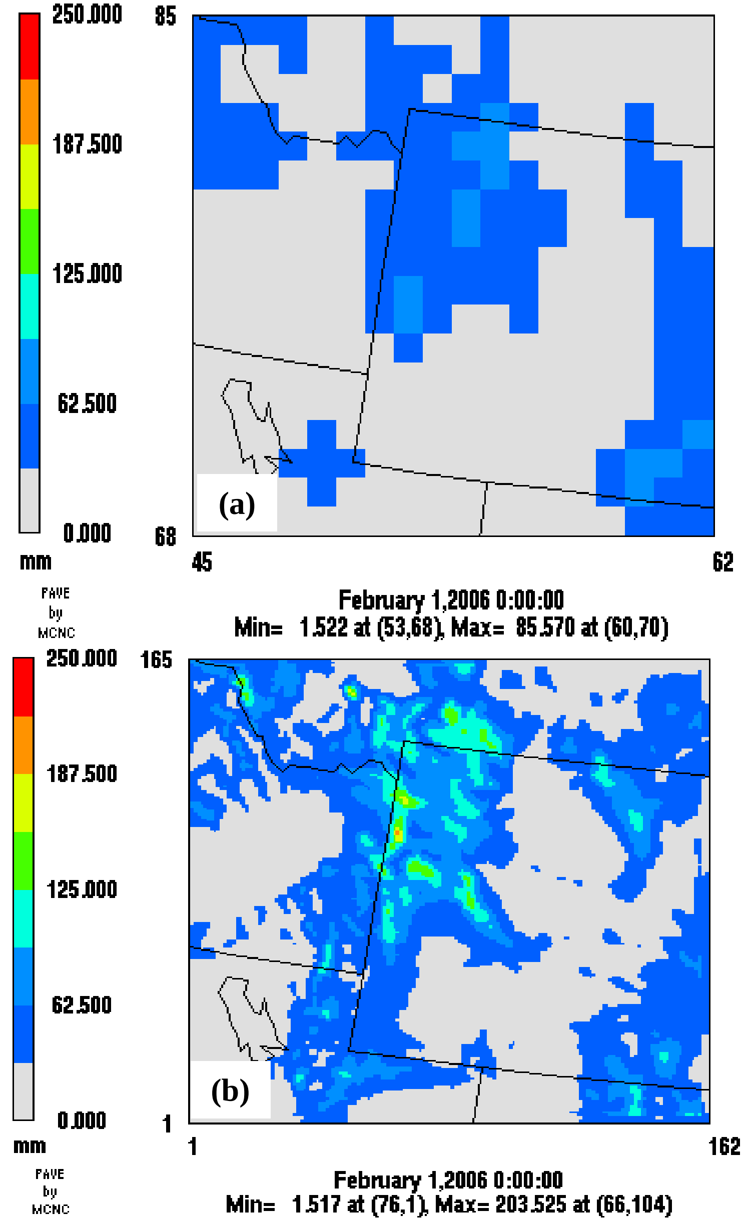

Figure 3-27. Precipitation for February 2006 over the 4km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

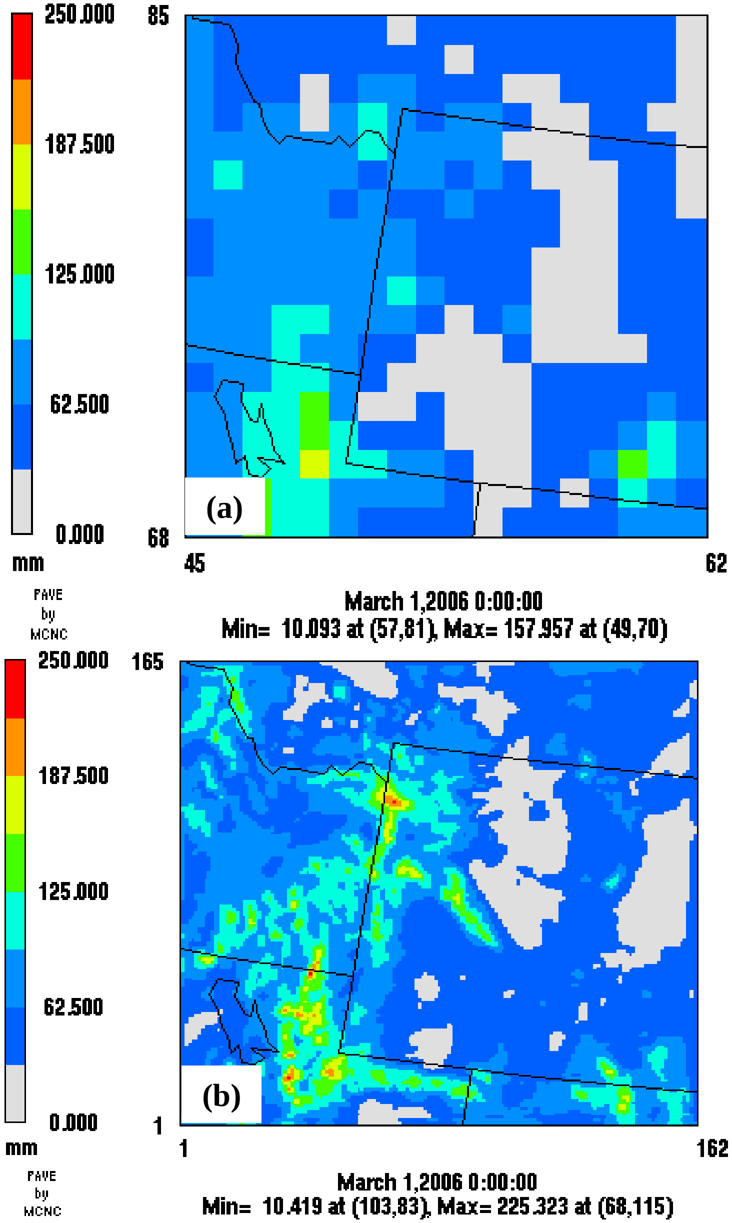

Figure 3-28. Precipitation for March 2006 over the 4km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

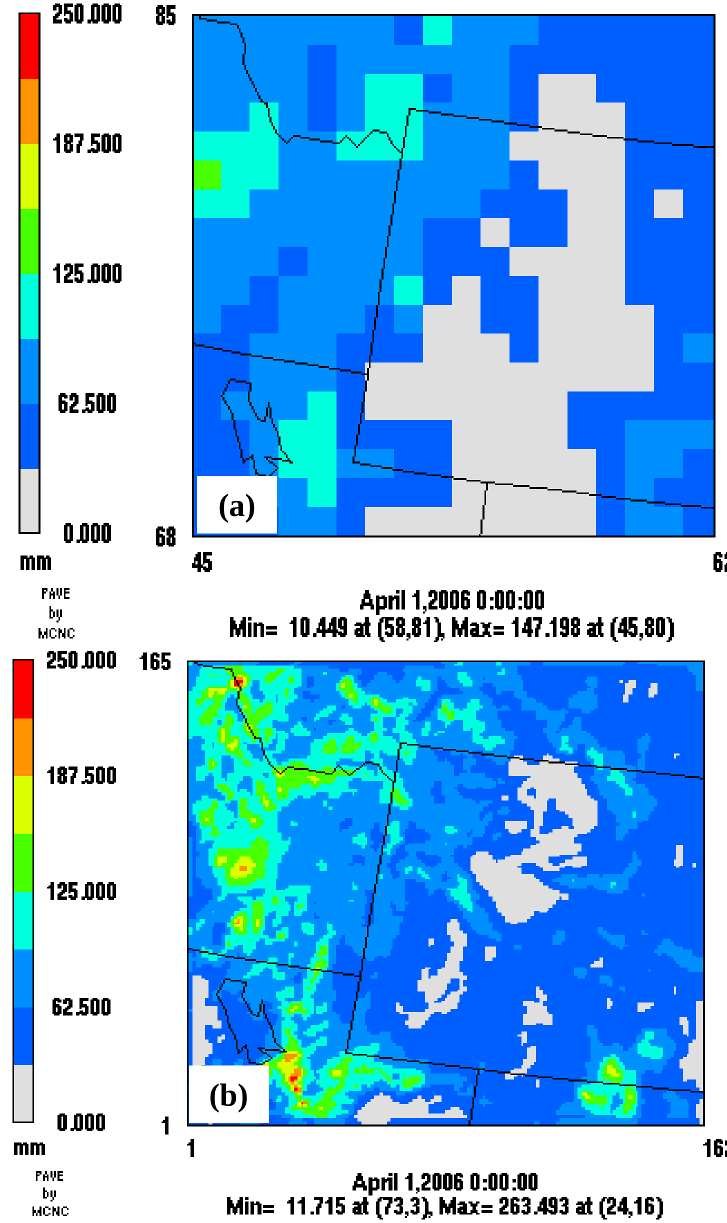

Figure 3-29. Precipitation for April 2006 over the 4km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

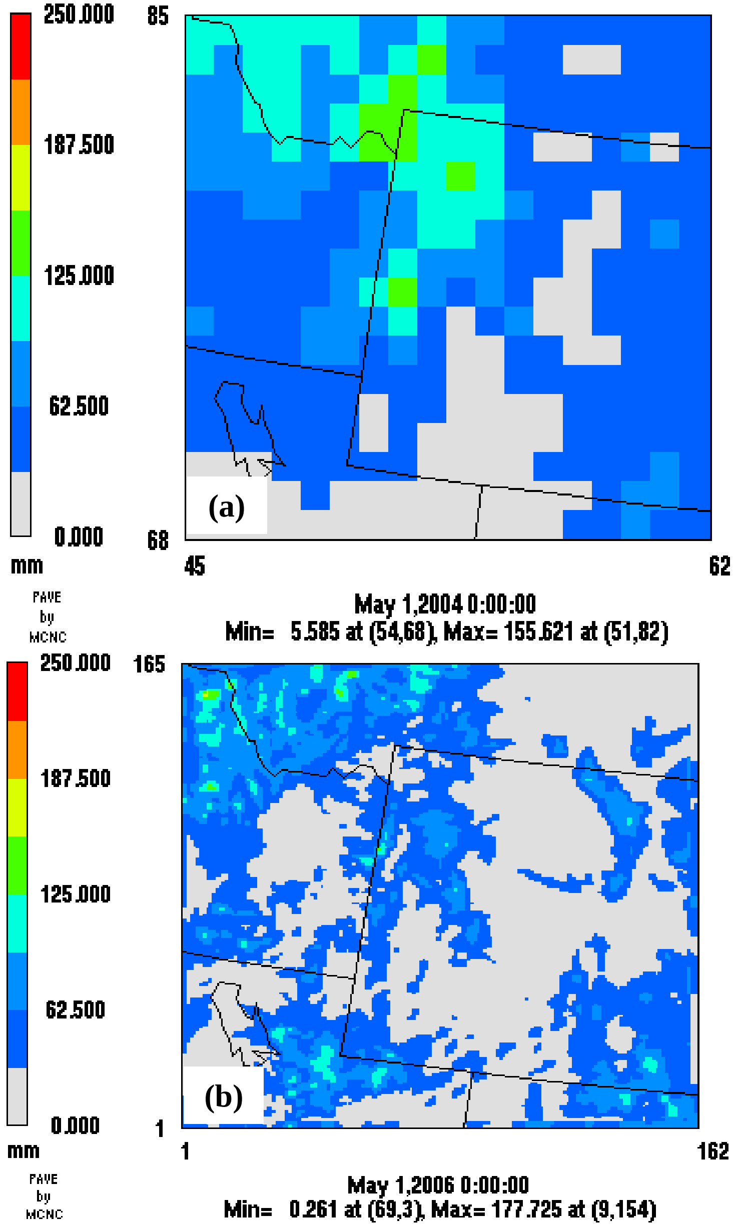

Figure 3-30. Precipitation for May 2006 over the 4km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

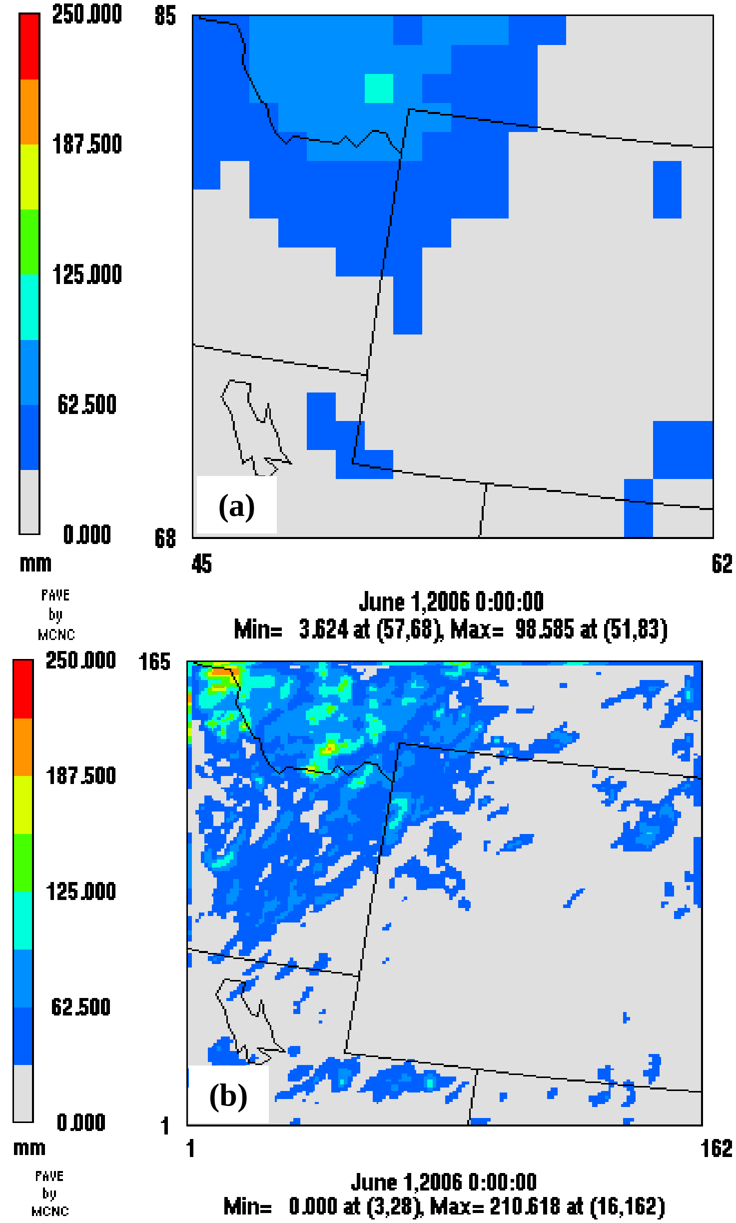

Figure 3-31. Precipitation for June 2006 over the 4km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

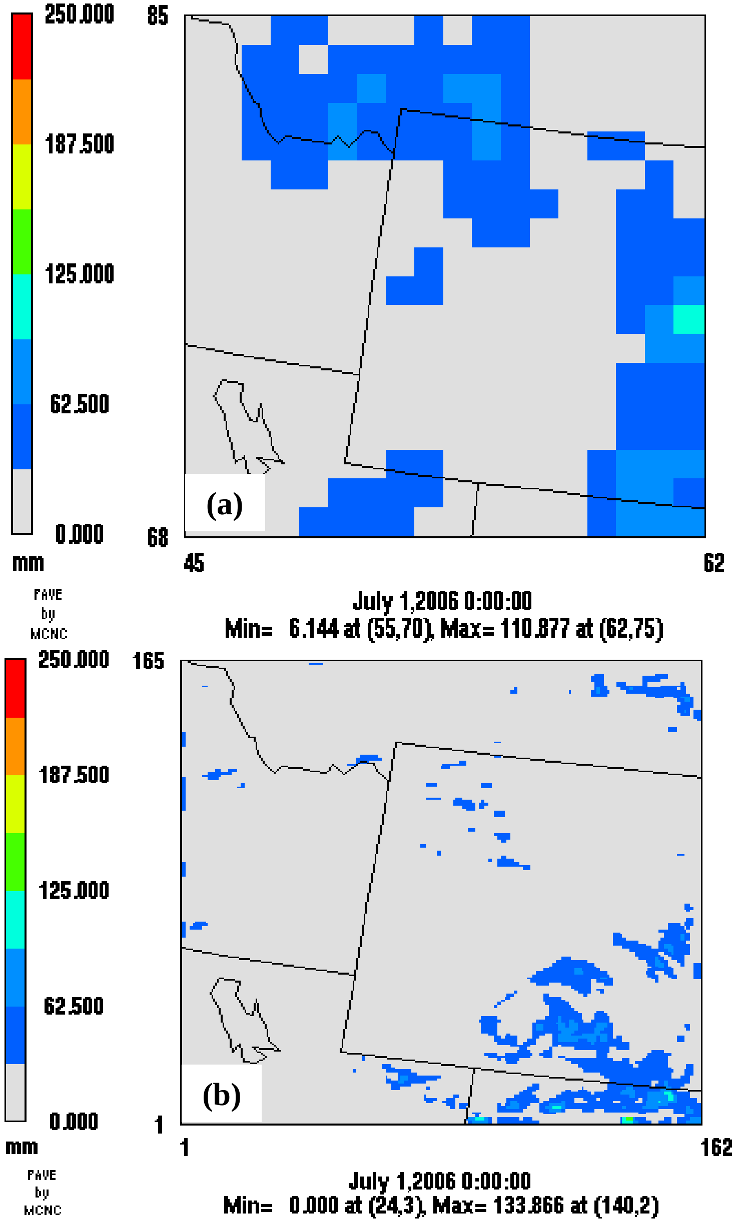

Figure 3-32. Precipitation for July 2006 over the 4km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

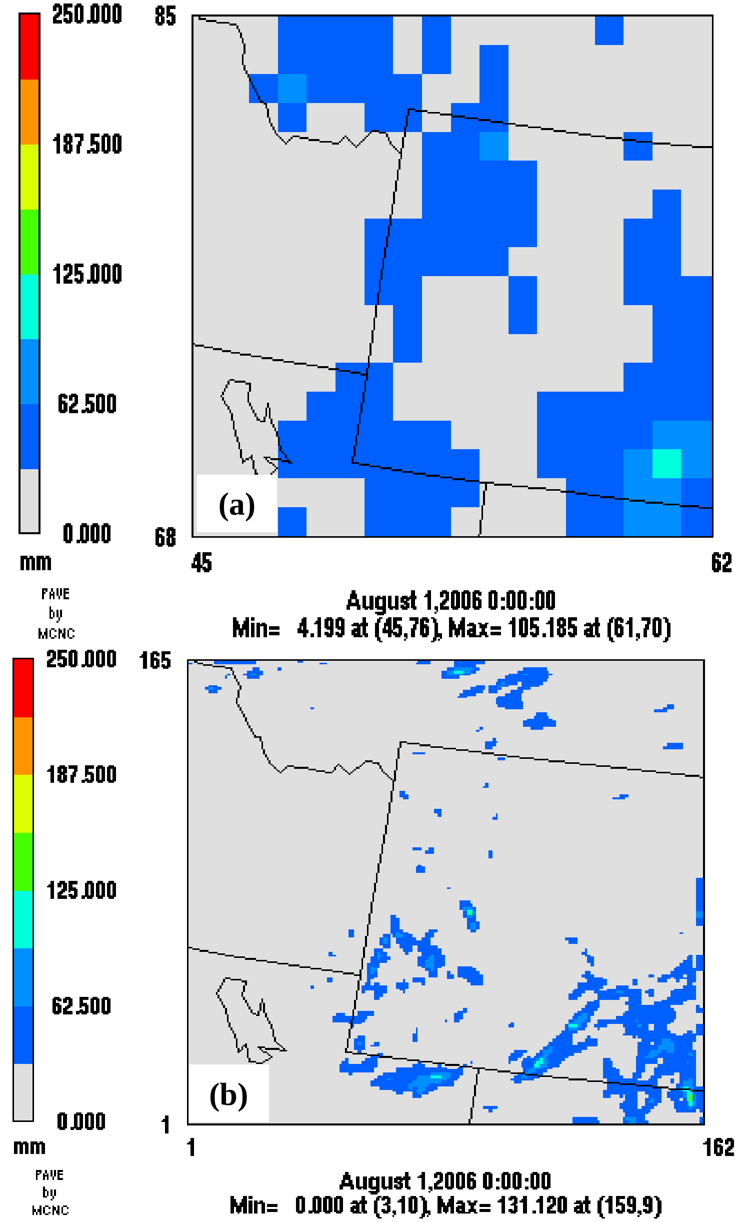

Figure 3-33. Precipitation for August 2006 over the 4km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

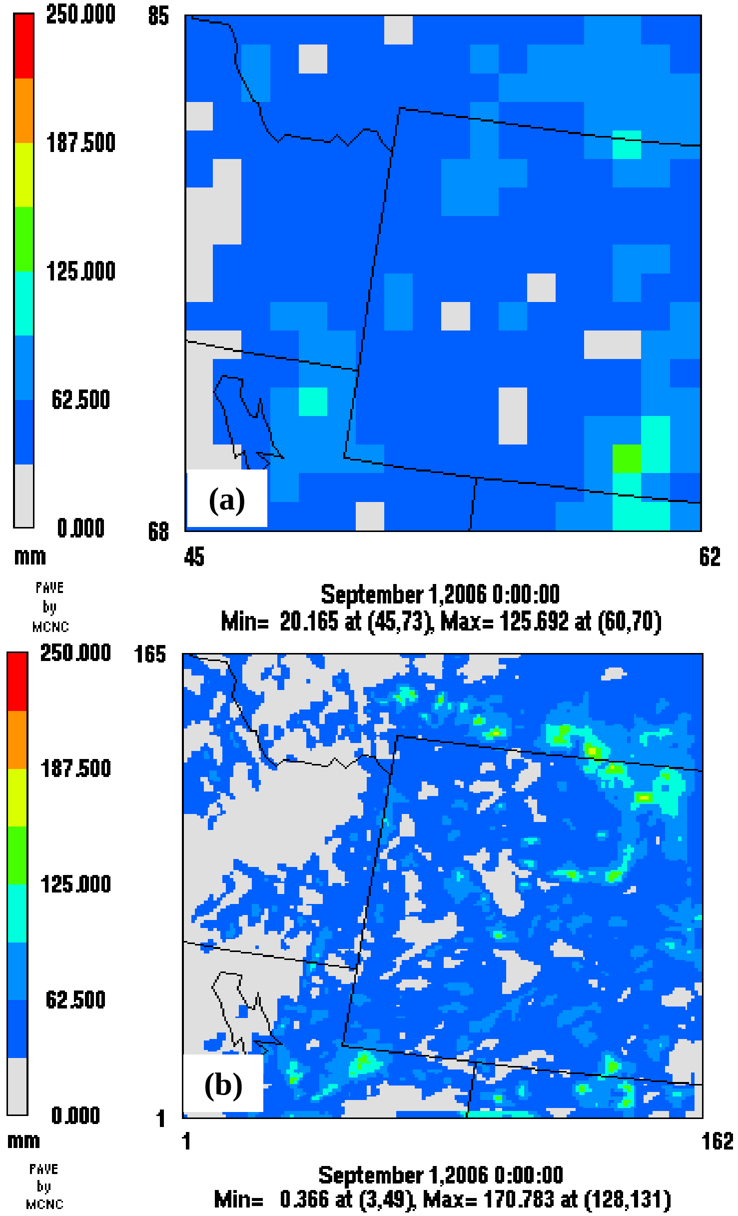

Figure 3-34. Precipitation for September 2006 over the 4km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

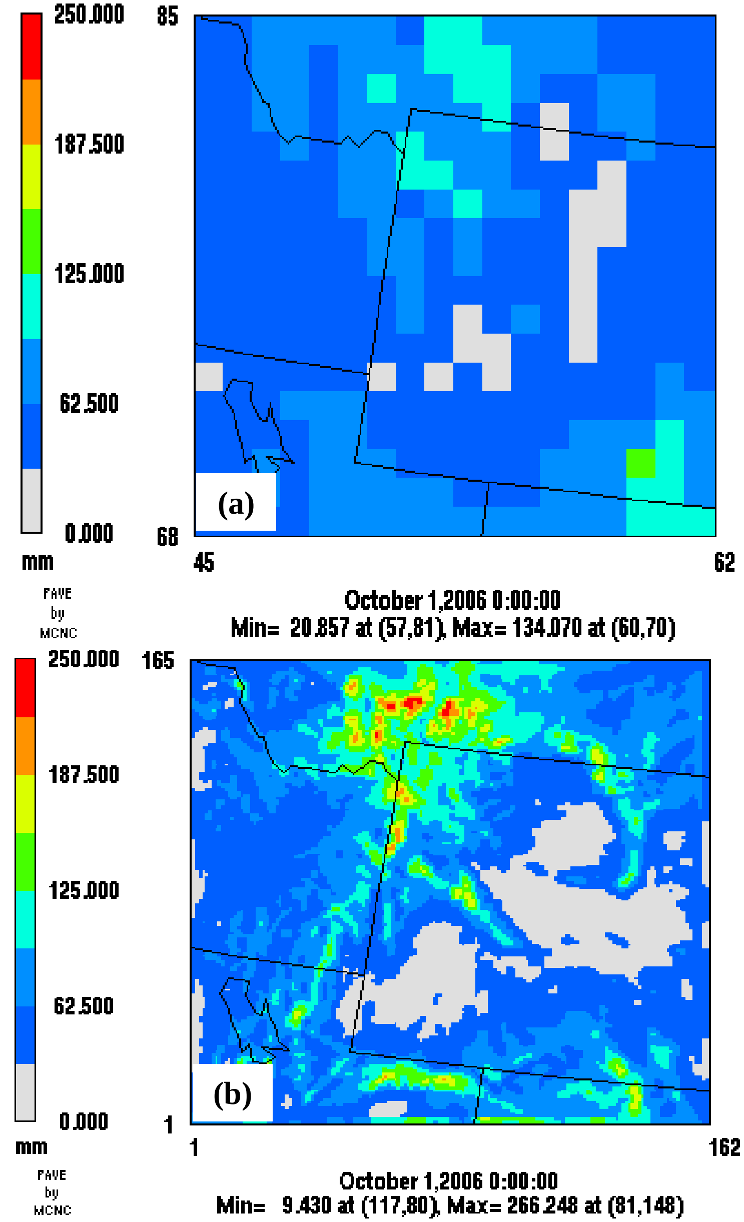

Figure 3-35. Precipitation for October 2006 over the 4km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

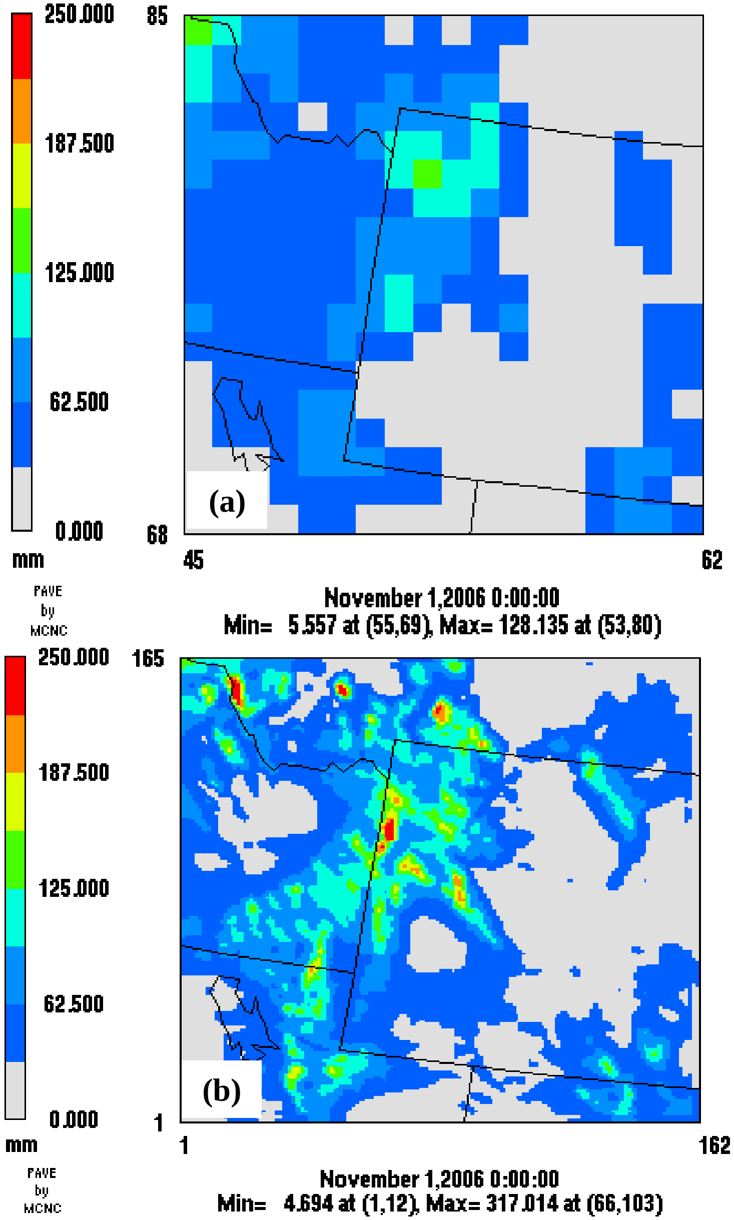

Figure 3-36. Precipitation for November 2006 over the 4km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

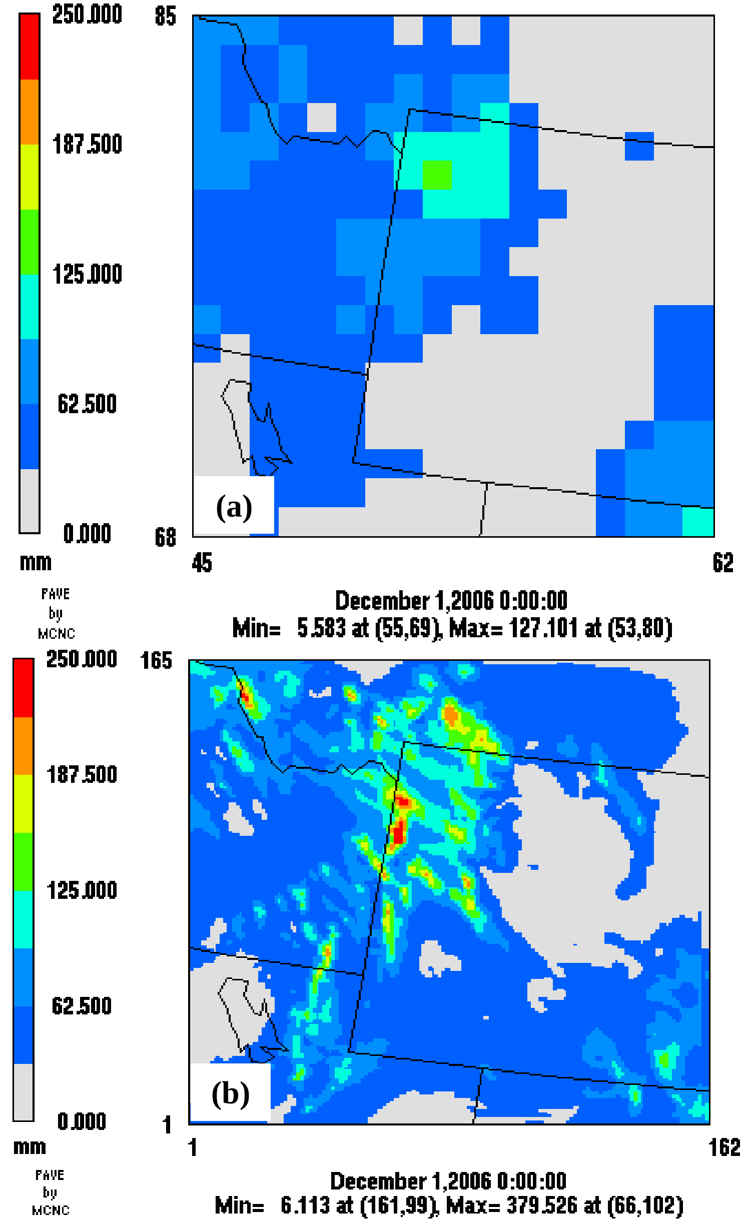

Figure 3-37. Precipitation for December 2006 over the 4km domain. (a) CPC analyzed precipitation. (b) MM5 predicted precipitation.

4 COMPARISON WITH OTHER ANNUAL MM5 SIMULATIONS

This section presents a comparison of the current 36km and 12km MM5 simulations with past 36km and 12km annual meteorological simulations that have been completed during the past several years by Alpine Geophysics and other researchers. Tables 4-1 through 4-5 present the temperature bias, temperature error, mixing ratio bias, mixing ratio error, and wind speed index of agreement comparisons, respectively, for the 36km simulations. Tables 4-6 through 4-10 present the temperature bias, temperature error, mixing ratio bias, mixing ratio error, and wind speed index of agreement comparisons, respectively, for the 12km simulations.

4.1 Comparison to Other Annual 36km Simulations

Comparisons between the performance of the current 2006 MM5 36km simulation and the performance of those atmospheric simulations of contemporaneous researchers were conducted. All Alpine MM5 simulations as well as those of the other researchers were performed at a 36km grid resolution using the same horizontal and vertical grid definitions as the 36km grid simulations presented in this report. The simulations that were compared include the following:

- EPA 2001 (McNally and Tesche, 2003);
- WRAP 2002 (Kemball-Cook, Jia, et. al., 2005);
- VISTAS 2002 (Olerud and Sims, 2004);
- MRPO 2003 (Baker and Johnson, 2005);
- NMED 2003, NMED 2004, and NMED 2005 (McNally, 2006);
- ENSR 2006 (McNally and Schewe, 2007);
- MOG 2005 (McNally and Schewe, 2007);
- RAQC 2006 (McNally and Schewe, 2008);
- EPA 2005 (McNally and Wilkinson, 2008a; Wilkinson and McNally, 2008);
- ARWY 2005, ARWY 2004 (McNally and Wilkinson, 2008b,c); and
- ARCO 2006, ARCO 2005, and ARCO 2004 (McNally and Wilkinson, 2008d,e,f).

For purposes of model comparisons, the current study will be referred herein as the ARWY 2006. The analysis of these simulations was subdivided by region (CENRAP, MANE_VU, MRPO, VISTAS, and WRAP) and used the Alpine Geophysics MAPS analysis package (McNally and Tesche, 1994).

The performance benchmarks for typical meteorological model performance that were used in this comparison were based on the same measures as in Section 3 of this report. As stated before, the purpose of these benchmarks was not to give a passing or failing grade to any one particular meteorological model application, but rather to put its results into the proper context of other derived meteorological data sets. As a reference, the performance benchmarks are repeated here:

- Temperature bias - +/- 0.5 K

- Temperature error - 2.0 K
- Mixing ratio bias - +/- 1.0 g/kg
- Mixing ratio error - 2.0 g/kg
- Wind Speed Index of Agreement – 0 = worst, 0.6=acceptable, 1 = best

Temperature bias model performance statistics for the entire domain and each RPO for the sixteen studies and for the current study (i.e., ARWY 2006) are presented in Table 4-1. The ARWY 2006 MM5 application is within the temperature bias benchmark of +/- 0.5 K with a 0.46 K average over the whole U.S. (ALL in Table 4-1). When comparing ARWY 2006 performance across the RPOs, the simulation has a slightly high temperature bias for the CENRAP, MRPO, and VISTAS subdomains (0.68 K, 0.60 K and 0.72 K respectively) while the MANE-VU and WRAP regions (0.34 K and 0.01 K, respectively) are well within the benchmark range. The ARWY 2006 simulation performs similarly to other researchers' simulations in terms of the temperature bias.

Temperature error is presented in Table 4-2. For the ARWY 2006 application of MM5, the temperature error is comparable to annual simulations conducted by other researchers. As with the other simulations, the MM5 results for ARWY 2006 is somewhat greater than the benchmark of 2.0 K over the entire U.S (i.e., 2.23 K for ALL). On a RPO subdomain basis, only the MANE-VU (1.93 K) and MRPO (1.89 K) subdomains meet the benchmark. The temperature error in the ARWY 2006 study is consistent across all regions with those as derived from other simulations.

Mixing ratio bias is presented in Table 4-3. The domain-wide bias for the ARWY 2006 MM5 simulation is 0.20 g/kg (ALL in Table 4-3) which is well within the benchmark of +/- 1.0 g/kg. Further, the ARWY 2006 simulation meets the performance benchmark in all subdomains. The ARWY 2006 mixing ratio bias is comparable to the overall performance of the other studies and other years across each RPO.

Table 4-4 presents the mixing ratio error comparisons between the sixteen studies and the ARWY 2006 simulation across the U.S. and the five RPO regions. The domain-wide mixing ratio error of 1.04 g/kg and the range of mixing ratio errors across the RPOs from 0.86 g/kg to 1.26 g/kg for the ARWY 2006 simulation are well under the benchmark error of 2.0 g/kg. The ARWY 2006 MM5 simulation has mixing ratio errors that are comparable with the other annual MM5 applications by other researchers.

Wind speed index of agreement (IA) is presented in Table 4-5. The domain-wide Wind IA for the ARWY 2006 simulation is 0.87 (ALL in Table 4-5) which exceeds the benchmark of 0.6 and is close to the best performing IA statistic of 1.0. Indeed, the IA benchmark for the ARWY 2006 simulation is exceeded in each of the RPO subdomains. The ARWY 2006 simulation is comparable to all other annual simulations.

4.2 Comparison to Other 12km Annual Simulations

Over the past several years, Alpine Geophysics has been involved with a number of 12km Western United States MM5 applications. These studies have simulated 2003 through 2006 for a 12km grid that is comparable to the 12km grid that was used in the current study with the notable exception of EPA 2005, which was a much larger 12km grid. However, these studies have evaluated the MM5 12km simulations on a state-by-state basis for states that were wholly contained in the modeling domain. Thus, a direct comparison between the current study and the previous studies can be performed for the states of Colorado, Utah and Wyoming.

These studies used the most recent versions of MM5 at the time of the study, starting with version 3.7.2. While changes to the MM5 model have occurred since v.3.7.2, these have been only minor model changes.

Tables 4-6 through 4-10 present the model performance evaluation results at 12km from previous studies and the current study. The entries in the "State/Simulation" columns of Tables 4-6 through 4-10 are coded as "SS-Simulation" where "SS" is CO (Colorado), UT (Utah), or WY (Wyoming) and "Simulation" is as follows:

- 2003-NM, 2004-NM, and 2005-NM – 2003, 2004, and 2005 MM5 simulations sponsored by New Mexico Environment Department (McNally, 2006);
- 2006-CO – 2006 RAQC MM5 simulation sponsored by the State of Colorado (McNally and Schewe, 2008);
- 2005-EPA – 2005 MM5 simulation sponsored by the U.S. EPA (McNally and Wilkinson, 2008a; Wilkinson and McNally, 2008);
- 2004-ARWY, 2005-ARWY – 2004 and 2005 MM5 simulations sponsored by Arcadis Environmental (McNally and Wilkinson, 2008b,c); and
- 2004-ARCO, 2005-ARCO, and 2006-ARCO – 2004, 2005, and 2006 MM5 simulations sponsored by Arcadis Environmental (McNally and Wilkinson, 2008d,e,f).

Table 4-6 shows the temperature bias model performance evaluation results for the 12km grid. Examination of Table 4-6 reveals the current simulation has temperature bias performance characteristics that are similar to previous simulations. The current simulation compared to previous simulations appear to have equal mixes of positive and negative biases, and the simulations appear to perform similarly on an annual basis, seasonal basis, and month-by-month basis.

Table 4-7 shows the temperature error model performance evaluation results for the 12km grid. Examination of Table 4-7 reveals that all model simulations had difficulty replicating observed temperatures. No single simulation routinely meets the temperature error benchmark of 2.0 K. Further, the temperature error model performance results are similar across the simulations.

Table 4-8 shows the mixing ratio bias model performance evaluation results for the 12km grid. Examination of Table 4-8 reveals the current simulation has mixing ratio bias performance characteristics that are similar to previous. Monthly, seasonally and annually, all simulations perform similarly.

Table 4-9 shows the mixing ratio error model performance evaluation results for the 12km grid. Examination of Table 4-9 reveals the current simulation has mixing ratio error performance characteristics that are similar to previous simulations. Monthly, seasonally and annually, all simulations perform similarly.

Table 4-10 shows the wind speed index of agreement model performance evaluation results for the 12km grid. Examination of Table 4-10 reveals that all simulations perform similarly. All simulations meet the 0.6 benchmark for this statistic. No single simulation has superior index of agreement performance characteristics.

4.3 Summary of Intercomparison of Model Performance Evaluation Results

Temperature bias and error statistics, mixing ratio bias and error statistics, and wind speed index of agreement statistics were estimated for the model predictions on 04km, 12km and 36km modeling grids for the current simulation. For the 12km and 36km domains, the statistical values were compared with similar model performance evaluation statistics from previous MM5 simulations performed in previous studies upon the same or very similar grid domains.

In regards to the 12km and 36km domains, the current simulation has performance characteristics that are similar to prior studies. Of the simulations examined, no one simulation exhibits consistently superior performance. Therefore, the current MM5 simulation is performing at par with other simulations that are currently being used for air quality planning so the overall performance of the model is judged to be adequate.

Table 4-1. Temperature Bias (K) for 36km Annual MM5 Simulations. Current simulation results are highlighted in blue.

Simulation	ALL	CENRAP	MANE_VU	MRPO	VISTAS	WRAP
EPA 2001	-0.51	-0.26	-0.40	-0.31	-0.25	-1.10
WRAP 2002	-0.12	0.14	-0.15	-0.11	0.05	-0.49
VISTAS 2002	-0.05	0.14	0.00	0.05	0.24	-0.55
MRPO 2003	-0.15	0.11	-0.17	-0.10	0.18	-0.67
NMED 2005	0.52	0.86	0.15	0.58	0.75	0.13
NMED 2004	0.49	0.79	0.27	0.55	0.73	0.07
NMED 2003	0.27	0.54	0.21	0.28	0.65	-0.26
MOG 2005	0.38	0.75	0.05	0.49	0.61	-0.12
ENSR 2006	0.44	0.68	0.37	0.59	0.72	-0.10
RAQC 2006	0.51	0.72	0.40	0.63	0.75	0.04
EPA 2005	-0.33	-0.05	-0.82	-0.44	-0.09	-0.52
ARWY 2005	0.49	0.81	0.11	0.51	0.76	0.11
ARWY 2004	0.45	0.76	0.24	0.51	0.70	-0.03
ARCO 2006	0.46	0.68	0.33	0.60	0.73	0.00
ARCO 2005	0.50	0.81	0.11	0.51	0.76	0.12
ARCO 2004	0.45	0.76	0.24	0.52	0.70	-0.02
ARWY 2006	0.46	0.68	0.34	0.60	0.72	0.01

Table 4-2. Temperature Error (K) for 36km Annual MM5 Simulations. Current simulation results are highlighted in blue.

Simulation	ALL	CENRAP	MANE_VU	MRPO	VISTAS	WRAP
EPA 2001	2.04	1.77	1.85	1.63	1.92	2.70
WRAP 2002	2.10	1.85	1.80	1.74	1.93	2.79
VISTAS 2002	2.02	1.76	1.80	1.72	1.84	2.67
MRPO 2003	2.17	1.94	1.86	1.92	1.98	2.82
NMED 2005	2.28	2.20	2.05	2.05	2.10	2.74
NMED 2004	2.26	2.13	1.99	2.01	2.11	2.75
NMED 2003	2.23	2.07	1.97	1.97	2.06	2.73
MOG 2005	2.26	2.16	2.05	2.03	2.07	2.74
ENSR 2006	2.24	2.15	1.95	1.90	2.13	2.75
RAQC 2006	2.25	2.16	1.96	1.92	2.15	2.76
EPA 2005	2.22	2.08	2.11	1.98	2.01	2.72
ARWY 2005	2.28	2.21	2.04	2.01	2.10	2.74
ARWY 2004	2.24	2.12	1.98	1.99	2.08	2.73
ARCO 2006	2.24	2.12	1.94	1.89	2.13	2.77
ARCO 2005	2.28	2.21	2.04	2.01	2.10	2.75
ARCO 2004	2.24	2.11	1.98	1.99	2.09	2.74
ARWY 2006	2.23	2.12	1.93	1.89	2.12	2.76

Table 4-3. Mixing Ratio Bias (g/kg) for 36km Annual MM5 Simulations. Current simulation results are highlighted in blue.

Simulation	ALL	CENRAP	MANE_VU	MRPO	VISTAS	WRAP
EPA 2001	-0.11	-0.24	-0.06	-0.22	0.06	-0.08
WRAP 2002	-0.09	-0.34	0.08	-0.11	0.20	-0.09
VISTAS 2002	0.01	-0.07	0.19	0.13	0.02	-0.04
MRPO 2003	0.22	0.11	0.30	0.29	0.49	0.05
NMED 2005	0.17	-0.02	0.54	0.24	0.47	-0.08
NMED 2004	0.07	-0.09	0.36	0.19	0.38	-0.20
NMED 2003	0.05	-0.18	0.35	0.17	0.35	-0.13
MOG 2005	0.29	0.11	0.59	0.30	0.67	0.03
ENSR 2006	0.17	-0.04	0.57	0.27	0.46	-0.05
RAQC 2006	0.13	-0.07	0.53	0.23	0.42	-0.09
EPA 2005	0.33	0.13	0.54	0.31	0.75	0.15
ARWY 2005	0.19	-0.01	0.53	0.24	0.48	-0.03
ARWY 2004	0.08	-0.09	0.35	0.18	0.38	-0.17
ARCO 2006	0.20	-0.01	0.59	0.29	0.49	-0.02
ARCO 2005	0.18	-0.01	0.53	0.24	0.48	-0.04
ARCO 2004	0.08	-0.09	0.36	0.19	0.38	-0.18
ARWY 2006	0.20	-0.01	0.58	0.28	0.47	-0.01

Table 4-4. Mixing Ratio Error (g/kg) for 36km Annual MM5 Simulations. Current simulation results are highlighted in blue.

Simulation	ALL	CENRAP	MANE_VU	MRPO	VISTAS	WRAP
EPA 2001	1.02	1.09	0.80	0.85	1.13	1.04
WRAP 2002	1.03	1.17	0.82	0.93	1.16	0.94
VISTAS 2002	0.94	0.98	0.78	0.82	1.13	0.90
MRPO 2003	0.96	0.98	0.78	0.82	1.14	0.97
NMED 2005	1.12	1.20	0.96	0.97	1.32	1.03
NMED 2004	1.05	1.11	0.89	0.85	1.29	0.99
NMED 2003	1.03	1.09	0.86	0.85	1.22	1.00
MOG 2005	1.16	1.23	0.98	1.00	1.38	1.07
ENSR 2006	1.04	1.10	0.92	0.86	1.24	0.97
RAQC 2006	1.03	1.10	0.91	0.85	1.23	0.97
EPA 2005	1.04	1.10	0.86	0.89	1.31	0.93
ARWY 2005	1.08	1.14	0.92	0.92	1.28	1.00
ARWY 2004	1.06	1.11	0.88	0.85	1.29	1.00
ARCO 2006	1.05	1.11	0.93	0.86	1.26	0.97
ARCO 2005	1.08	1.14	0.92	0.92	1.28	1.00
ARCO 2004	1.06	1.11	0.89	0.86	1.30	0.99
ARWY 2006	1.04	1.10	0.93	0.86	1.26	0.97

Table 4-5. Wind Index of Agreement for 36km Annual MM5 Simulation. Current simulation results are highlighted in blue.

Simulation	ALL	CENRAP	MANE_VU	MRPO	VISTAS	WRAP
EPA 2001	0.88	0.85	0.69	0.75	0.77	0.86
WRAP 2002	0.93	0.92	0.81	0.84	0.84	0.92
VISTAS 2002	0.90	0.88	0.71	0.78	0.79	0.89
MRPO 2003	0.90	0.88	0.72	0.78	0.80	0.88
NMED 2005	0.87	0.84	0.71	0.73	0.75	0.86
NMED 2004	0.90	0.88	0.76	0.77	0.79	0.88
NMED 2003	0.90	0.88	0.76	0.77	0.79	0.88
MOG 2005	0.87	0.84	0.71	0.73	0.75	0.86
ENSR 2006	0.87	0.85	0.69	0.73	0.75	0.85
RAQC 2006	0.89	0.87	0.74	0.76	0.78	0.87
EPA 2005	0.88	0.85	0.72	0.75	0.77	0.87
ARWY 2005	0.87	0.84	0.71	0.73	0.75	0.85
ARWY 2004	0.88	0.85	0.70	0.74	0.76	0.86
ARCO 2006	0.87	0.84	0.69	0.73	0.76	0.85
ARCO 2005	0.87	0.84	0.71	0.73	0.75	0.85
ARCO 2004	0.88	0.85	0.70	0.74	0.76	0.85
ARWY 2006	0.87	0.84	0.69	0.73	0.76	0.85

Table 4-6. Temperature bias (K) model performance evaluation (MPE) results by state for 12km annual MM5 simulations. MPE results from prior studies that are within the benchmark of $\pm$0.5 K are shaded yellow. Current study MPE results are shaded blue with those MPE results shaded green that are within the benchmark.

State/Simulation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
CO-2003-NM	0.55	-0.68	-2.11	-2.20	-0.75	-0.59	-0.75	-0.63	0.33	0.80	-0.14	0.99	-0.43
CO-2004-NM	1.47	-0.04	-1.04	-1.08	-0.17	0.00	0.25	0.22	0.07	-0.17	0.26	0.58	0.03
CO-2005-NM	0.68	-0.06	-1.42	-0.94	-0.30	-0.01	-0.14	0.45	0.38	0.32	0.46		-0.05
CO-2006-CO	-0.46	-0.24	-1.34	-1.39	-0.43	-0.33	0.47	0.56	0.32	-0.04	0.06	0.85	-0.16
CO-2005-EPA	0.27	-0.31	-1.16	-0.99	-0.41	-0.16	-0.39	0.27	0.24	0.12	0.02	0.11	-0.20
CO-2005-ARWY	0.69	0.08	-1.40	-0.97	-0.26	0.00	-0.07	0.53	0.41	0.40	0.44	0.43	0.02
CO-2004-ARWY	1.42	-0.13	-1.20	-1.25	-0.33	-0.11	0.22	0.15	0.05	-0.21	0.20	0.56	-0.05
CO-2006-ARCO	0.57	0.62	-1.01	-1.08	-0.33	-0.22	0.52	0.50	0.55	0.36	0.72	1.76	0.25
CO-2005-ARCO	1.15	0.37	-1.11	-0.71	-0.18	0.08	0.03	0.55	0.49	0.57	0.93	0.98	0.26
CO-2004-ARCO	2.03	0.04	-0.71	-0.96	-0.16	0.09	0.31	0.28	0.14	-0.01	0.66	1.20	0.27
CO-2006-ARWY	0.26	0.24	-1.20	-1.38	-0.43	-0.26	0.52	0.53	0.44	0.00	0.13	1.19	0.00
UT-2003-NM	0.91	-1.04	-1.78	-1.35	-0.61	-1.20	-1.27	-0.70	0.54	1.51	-0.02	0.93	-0.34
UT-2004-NM	1.90	0.14	-0.72	-0.45	-0.53	-0.45	-0.44	-0.16	0.18	0.33	1.03	1.09	0.16
UT-2005-NM	0.76	0.34	-0.63	-0.97	-0.25	-0.32	0.07	0.45	0.87	1.00	1.40		0.25
UT-2006-CO	0.59	-0.14	-1.03	-1.46	-0.37	-0.50	-0.31	-0.11	0.70	0.83	1.57	2.06	0.15
UT-2005-EPA	0.64	0.37	-0.57	-0.92	-0.36	-0.43	-0.32	0.28	0.56	0.74	1.06	0.89	0.16
UT-2005-ARWY	0.97	0.56	-0.58	-0.92	-0.28	-0.37	0.06	0.46	0.78	1.02	1.44	1.29	0.37
UT-2004-ARWY	2.22	0.48	-0.55	-0.52	-0.65	-0.50	-0.48	-0.18	0.07	0.27	1.09	1.27	0.21
UT-2006-ARCO	0.86	0.29	-0.90	-1.22	-0.46	-0.36	-0.38	-0.11	0.93	1.08	1.85	2.56	0.35
UT-2005-ARCO	1.15	0.73	-0.44	-0.83	-0.21	-0.31	0.11	0.47	0.89	1.19	1.63	1.54	0.49
UT-2004-ARCO	2.53	0.62	-0.39	-0.45	-0.57	-0.44	-0.44	-0.17	0.20	0.36	1.28	1.55	0.34
UT-2006-ARWY	0.89	0.06	-0.99	-1.32	-0.54	-0.42	-0.44	-0.18	0.85	0.94	1.68	2.28	0.23
WY-2003-NM	-0.01	-0.08	-1.38	-1.62	-0.64	-0.43	-0.51	-0.61	0.26	0.57	-0.08	0.95	-0.30
WY-2004-NM	1.43	0.56	-0.63	-0.26	-0.34	-0.25	0.20	-0.01	0.14	0.64	1.00	-0.68	0.15
WY-2005-NM	0.73	1.56	-0.80	-0.93	0.09	0.45	0.17	1.05	0.68	0.78	0.20		0.36
WY-2006-CO	-0.49	-0.40	-1.18	-1.35	0.12	-0.14	0.14	0.34	0.61	0.02	-0.22	1.28	-0.11
WY-2005-EPA	0.50	1.42	-0.68	-0.86	-0.05	0.28	-0.12	0.83	0.62	0.54	-0.22	-0.14	0.18
WY-2005-ARWY	1.18	1.98	-0.58	-0.73	0.20	0.55	0.22	1.12	0.84	0.98	0.54	0.62	0.58
WY-2004-ARWY	1.97	1.07	-0.35	-0.17	-0.28	-0.19	0.25	0.06	0.25	0.76	1.33	-0.18	0.38
WY-2006-ARCO	-0.93	-0.66	-1.49	-1.46	-0.01	-0.37	-0.10	0.13	0.59	0.02	-0.34	1.16	-0.29
WY-2005-ARCO	0.83	1.31	-0.96	0.98	0.01	0.35	-0.09	0.90	0.49	0.65	-0.03	0.00	0.21
WY-2004-ARCO	1.42	0.42	-0.76	-0.33	-0.30	-0.42	-0.07	-0.30	-0.04	0.48	0.84	-0.81	0.01
WY-2006-ARWY	0.07	-0.05	-1.01	-1.09	0.17	-0.07	0.18	0.42	0.84	0.30	0.05	1.76	0.13

Table 4-7. Temperature error (K) MPE results by state for 12km annual MM5 simulations. MPE results from prior studies that meet the benchmark of 2.0 K are shaded yellow. Current study MPE results are shaded blue with those MPE results shaded green that meet the benchmark.

State/Simulation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
CO-2003-NM	3.69	2.79	3.50	3.64	2.82	2.73	3.23	2.62	2.86	3.50	2.94	3.53	3.15
CO-2004-NM	3.71	2.92	3.33	2.91	3.04	2.88	2.85	2.78	2.75	2.82	2.73	3.48	3.02
CO-2005-NM	3.26	3.06	3.29	3.17	2.93	2.80	3.11	2.69	2.93	2.90	3.32		3.04
CO-2006-CO	3.19	3.49	3.11	3.56	3.02	2.97	2.66	2.61	2.75	2.77	3.33	3.30	3.06
CO-2005-EPA	2.98	3.00	3.09	3.06	2.79	2.70	3.00	2.56	2.76	2.67	3.09	3.08	2.90
CO-2005-ARWY	3.28	3.09	3.29	3.22	2.95	2.78	3.13	2.72	2.99	2.90	3.23	3.29	3.07
CO-2004-ARWY	3.78	2.88	3.38	2.99	3.02	2.82	2.84	2.80	2.75	2.81	2.75	3.44	3.02
CO-2006-ARCO	3.75	3.60	3.02	3.56	3.07	3.02	2.69	2.56	2.76	2.77	3.44	3.58	3.15
CO-2005-ARCO	3.39	3.13	3.23	3.16	2.96	2.83	3.18	2.75	3.00	2.98	3.42	3.49	3.13
CO-2004-ARCO	3.88	2.92	3.27	2.89	3.04	2.92	2.90	2.82	2.78	2.80	2.77	3.61	3.05
CO-2006-ARWY	3.49	3.47	3.04	3.60	3.04	2.94	2.67	2.56	2.75	2.79	3.44	3.44	3.10
UT-2003-NM	2.93	2.46	2.87	2.85	2.81	3.06	3.52	2.85	3.31	3.62	2.17	2.79	2.94
UT-2004-NM	3.67	2.58	3.42	2.42	2.78	3.02	3.05	2.95	3.04	2.55	2.53	3.04	2.92
UT-2005-NM	2.74	2.70	2.88	2.75	2.46	2.68	3.15	2.90	3.19	2.96	3.11		2.87
UT-2006-CO	2.59	3.21	2.59	3.16	3.03	3.13	2.96	2.95	2.96	2.66	3.15	3.29	2.97
UT-2005-EPA	2.55	2.58	2.63	2.54	2.30	2.61	2.94	2.80	2.96	2.73	2.92	2.81	2.70
UT-2005-ARWY	2.84	2.84	2.99	2.80	2.55	2.82	3.28	3.05	3.34	3.12	3.23	3.13	3.00
UT-2004-ARWY	3.86	2.72	3.48	2.50	2.91	3.11	3.16	3.04	3.17	2.61	2.68	3.14	3.03
UT-2006-ARCO	2.90	3.22	2.52	3.02	2.96	3.22	2.99	3.05	3.12	2.78	3.30	3.54	3.05
UT-2005-ARCO	2.88	2.86	2.96	2.79	2.52	2.77	3.29	3.00	3.33	3.14	3.30	3.23	3.01
UT-2004-ARCO	3.95	2.68	3.46	2.48	2.86	3.10	3.11	3.07	3.14	2.60	2.69	3.23	3.03
UT-2006-ARWY	2.72	3.22	2.56	3.08	3.01	3.25	3.02	3.10	3.14	2.76	3.22	3.39	3.04
WY-2003-NM	3.37	2.87	2.92	3.00	2.50	2.38	3.09	2.74	2.65	3.33	3.07	3.26	2.93
WY-2004-NM	4.36	3.00	3.22	2.53	2.54	2.45	2.70	2.61	2.60	2.46	2.95	3.02	2.87
WY-2005-NM	3.30	3.57	2.81	2.75	2.17	2.36	2.86	2.92	2.90	2.72	2.72		2.83
WY-2006-CO	2.90	3.14	2.73	2.99	2.90	2.78	3.03	2.87	2.66	2.49	2.94	3.65	2.92
WY-2005-EPA	3.04	3.41	2.66	2.58	2.05	2.22	2.71	2.75	2.74	2.56	2.64	3.16	2.71
WY-2005-ARWY	3.34	3.74	2.74	2.70	2.13	2.34	2.89	2.93	2.90	2.78	2.80	3.46	2.90
WY-2004-ARWY	4.48	3.15	3.17	2.51	2.47	2.39	2.66	2.58	2.55	2.46	3.04	2.97	2.87
WY-2006-ARCO	3.23	3.20	2.82	3.13	2.79	2.66	2.91	2.73	2.58	2.47	3.07	3.66	2.94
WY-2005-ARCO	3.36	3.52	2.86	2.85	2.20	2.37	2.82	2.83	2.86	2.69	2.72	3.41	2.87
WY-2004-ARCO	4.34	2.95	3.26	2.57	2.51	2.44	2.64	2.58	2.57	2.40	2.92	3.00	2.85
WY-2006-ARWY	3.02	3.14	2.69	2.88	2.77	2.68	2.92	2.75	2.62	2.42	2.91	3.82	2.92

Table 4-8. Mixing ratio bias (g/kg) MPE results by state for 12km annual MM5 simulations. MPE results from prior studies that meet the benchmark of ±1.0 g/kg are shaded yellow. Current study MPE results are shaded blue with those MPE results shaded green that meet the benchmark.

State/Simulation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
CO-2003-NM	0.26	0.04	0.10	0.15	-0.09	-0.14	0.63	-0.05	-0.36	0.04	-0.15	0.01	0.04
CO-2004-NM	-0.09	-0.09	0.26	-0.05	-0.42	-0.13	-0.54	-0.76	-0.60	-0.20	-0.10	0.01	-0.23
CO-2005-NM	0.15	0.08	0.10	0.23	-0.12	-0.46	0.24	-0.57	-0.10	-0.37	-0.08		-0.08
CO-2006-CO	0.14	0.21	0.15	0.27	-0.01	0.22	-0.65	-0.82	-0.54	-0.36	-0.06	0.12	-0.11
CO-2005-EPA	0.21	0.08	0.12	0.34	0.16	0.05	1.08	0.17	0.32	-0.14	0.01	0.15	0.21
CO-2005-ARWY	0.13	0.09	0.06	0.18	-0.21	-0.54	0.14	-0.68	-0.23	-0.41	-0.13	0.12	-0.12
CO-2004-ARWY	-0.10	-0.13	0.19	-0.07	-0.48	-0.17	-0.67	-0.88	-0.67	-0.25	-0.13	0.02	-0.28
CO-2006-ARCO	0.09	0.14	0.07	0.16	-0.15	0.02	-0.89	-0.98	-0.68	-0.43	-0.14	0.10	-0.22
CO-2005-ARCO	0.09	0.00	0.00	0.09	-0.27	-0.71	-0.03	-0.83	-0.37	-0.44	-0.15	0.10	-0.21
CO-2004-ARCO	-0.14	-0.14	0.10	-0.13	-0.55	-0.32	-0.77	-0.99	-0.73	-0.30	-0.17	-0.05	-0.35
CO-2006-ARWY	0.13	0.18	0.09	0.18	-0.15	0.10	-0.84	-0.94	-0.65	-0.38	-0.09	0.14	-0.19
UT-2003-NM	0.15	0.04	0.27	0.25	0.06	0.47	1.24	0.46	0.46	0.42	-0.06	0.13	0.32
UT-2004-NM	0.24	0.10	0.77	0.27	-0.05	0.48	0.84	0.50	0.47	0.26	-0.13	0.08	0.32
UT-2005-NM	0.10	0.04	0.37	0.11	-0.35	-0.13	0.68	0.25	0.22	-0.07	-0.14		0.10
UT-2006-CO	0.02	-0.03	-0.03	0.01	0.11	0.47	0.09	-0.13	0.03	-0.22	0.02	0.16	0.04
UT-2005-EPA	0.27	0.13	0.41	0.27	-0.12	0.21	1.30	0.96	0.55	0.15	0.04	0.23	0.37
UT-2005-ARWY	0.06	-0.04	0.28	0.05	-0.45	-0.21	0.44	-0.07	0.14	-0.11	-0.15	0.09	0.00
UT-2004-ARWY	0.21	0.07	0.60	0.17	-0.14	0.33	0.58	0.27	0.39	0.20	-0.16	0.05	0.21
UT-2006-ARCO	-0.02	-0.04	-0.04	-0.03	0.07	0.30	-0.01	-0.39	-0.11	-0.29	-0.01	0.15	-0.03
UT-2005-ARCO	0.04	-0.04	0.27	0.04	-0.43	-0.23	0.54	0.08	0.11	-0.09	-0.17	0.10	0.02
UT-2004-ARCO	0.20	0.06	0.57	0.18	-0.16	0.34	0.65	0.32	0.36	0.19	-0.17	0.03	0.21
UT-2006-ARWY	0.01	-0.03	-0.05	-0.02	0.07	0.29	-0.07	-0.42	-0.14	-0.27	0.02	0.17	-0.04
WY-2003-NM	0.33	0.09	0.23	0.37	-0.01	-0.33	0.23	0.29	-0.31	0.29	0.11	0.17	0.12
WY-2004-NM	0.22	0.12	0.40	0.16	-0.28	-0.35	-0.41	-0.25	-0.25	-0.08	0.04	0.13	-0.05
WY-2005-NM	0.23	0.22	0.19	0.13	-0.59	-0.89	-0.10	0.00	0.11	-0.23	0.06		-0.08
WY-2006-CO	0.20	0.18	0.00	-0.11	-0.33	-0.06	0.31	-0.21	-0.10	0.05	0.13	0.31	0.03
WY-2005-EPA	0.27	0.28	0.16	0.27	-0.34	-0.42	0.46	0.61	0.35	-0.02	0.09	0.22	0.16
WY-2005-ARWY	0.19	0.16	0.10	0.04	-0.67	-1.04	-0.29	-0.15	-0.07	-0.29	-0.01	0.22	-0.15
WY-2004-ARWY	0.19	0.09	0.23	0.08	-0.37	-0.46	-0.54	-0.37	-0.39	-0.14	-0.03	0.07	-0.14
WY-2006-ARCO	0.19	0.17	-0.01	-0.14	-0.51	-0.11	0.20	-0.41	-0.20	0.02	0.17	0.35	-0.02
WY-2005-ARCO	0.22	0.20	0.13	0.07	-0.64	-1.13	-0.25	-0.15	-0.07	-0.30	0.02	0.25	-0.14
WY-2004-ARCO	0.21	0.11	0.29	0.07	-0.40	-0.37	-0.51	-0.36	-0.36	-0.15	-0.01	0.10	-0.12
WY-2006-ARWY	0.19	0.16	-0.01	-0.16	-0.45	-0.12	0.15	-0.44	-0.17	0.00	0.11	0.31	-0.04

Table 4-9. Mixing ratio error (g/kg) MPE results by state for 12km annual MM5 simulations. MPE results from prior studies that meet the benchmark of 2.0 g/kg are shaded yellow. Current study MPE results are shaded blue with those MPE results shaded green that meet the benchmark.

State/Simulation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
CO-2003-NM	0.55	0.47	0.61	0.85	1.14	1.23	1.73	1.46	1.05	0.79	0.56	0.46	0.91
CO-2004-NM	0.46	0.48	0.77	0.78	1.05	1.27	1.64	1.47	1.15	0.79	0.56	0.45	0.91
CO-2005-NM	0.51	0.58	0.56	0.80	0.95	1.39	1.57	1.46	1.19	0.88	0.62		0.96
CO-2006-CO	0.47	0.45	0.64	0.77	0.99	1.29	1.48	1.46	1.05	0.81	0.55	0.46	0.87
CO-2005-EPA	0.55	0.60	0.59	0.82	1.01	1.47	2.02	1.56	1.27	0.79	0.61	0.43	0.98
CO-2005-ARWY	0.51	0.56	0.54	0.80	0.97	1.43	1.52	1.45	1.19	0.90	0.64	0.43	0.91
CO-2004-ARWY	0.47	0.49	0.76	0.79	1.09	1.26	1.63	1.48	1.21	0.82	0.56	0.44	0.92
CO-2006-ARCO	0.47	0.42	0.63	0.74	0.97	1.20	1.47	1.44	1.06	0.84	0.56	0.45	0.85
CO-2005-ARCO	0.50	0.57	0.54	0.77	0.97	1.46	1.53	1.52	1.20	0.91	0.62	0.41	0.92
CO-2004-ARCO	0.47	0.49	0.72	0.78	1.07	1.27	1.67	1.54	1.20	0.81	0.56	0.45	0.92
CO-2006-ARWY	0.46	0.43	0.62	0.73	0.96	1.17	1.46	1.49	1.08	0.82	0.55	0.47	0.85
UT-2003-NM	0.57	0.51	0.62	0.66	0.99	1.25	2.13	1.64	1.16	0.93	0.61	0.50	0.96
UT-2004-NM	0.45	0.40	1.11	0.78	0.92	1.44	1.74	1.42	1.20	0.77	0.59	0.46	0.94
UT-2005-NM	0.55	0.52	0.71	0.72	1.12	1.38	1.74	1.54	1.16	0.87	0.69		1.00
UT-2006-CO	0.43	0.43	0.60	0.74	1.02	1.29	1.43	1.25	0.91	0.94	0.58	0.43	0.84
UT-2005-EPA	0.60	0.58	0.75	0.78	1.11	1.44	2.12	1.87	1.27	0.86	0.65	0.53	1.05
UT-2005-ARWY	0.55	0.52	0.68	0.71	1.16	1.41	1.63	1.48	1.12	0.86	0.69	0.47	0.94
UT-2004-ARWY	0.45	0.40	0.99	0.75	0.90	1.41	1.63	1.35	1.17	0.78	0.59	0.46	0.91
UT-2006-ARCO	0.47	0.43	0.59	0.74	1.02	1.24	1.39	1.30	0.88	0.92	0.57	0.42	0.83
UT-2005-ARCO	0.54	0.52	0.66	0.69	1.11	1.37	1.66	1.46	1.13	0.85	0.70	0.47	0.93
UT-2004-ARCO	0.44	0.40	0.97	0.75	0.89	1.42	1.65	1.40	1.16	0.77	0.59	0.45	0.91
UT-2006-ARWY	0.45	0.43	0.60	0.74	1.04	1.26	1.41	1.33	0.88	0.92	0.57	0.42	0.84
WY-2003-NM	0.52	0.37	0.50	0.76	0.90	1.20	1.61	1.41	1.01	0.77	0.43	0.43	0.83
WY-2004-NM	0.47	0.43	0.72	0.71	0.90	1.06	1.46	1.08	0.97	0.75	0.53	0.40	0.79
WY-2005-NM	0.46	0.51	0.55	0.73	1.01	1.52	1.39	1.28	1.03	0.75	0.55		0.89
WY-2006-CO	0.43	0.38	0.44	0.69	0.98	1.11	1.25	1.07	0.85	0.67	0.48	0.48	0.74
WY-2005-EPA	0.47	0.53	0.54	0.74	0.86	1.44	1.60	1.57	1.14	0.68	0.51	0.42	0.88
WY-2005-ARWY	0.45	0.47	0.51	0.68	1.03	1.58	1.37	1.24	0.97	0.74	0.54	0.41	0.83
WY-2004-ARWY	0.45	0.42	0.63	0.69	0.90	1.05	1.43	1.09	0.97	0.75	0.52	0.38	0.77
WY-2006-ARCO	0.45	0.38	0.46	0.72	1.02	1.10	1.24	1.09	0.86	0.68	0.49	0.49	0.75
WY-2005-ARCO	0.49	0.50	0.54	0.72	1.06	1.67	1.41	1.27	1.01	0.77	0.57	0.44	0.87
WY-2004-ARCO	0.46	0.42	0.66	0.73	0.94	1.07	1.50	1.13	1.00	0.78	0.52	0.39	0.80
WY-2006-ARWY	0.42	0.36	0.44	0.69	0.98	1.07	1.19	1.07	0.83	0.65	0.47	0.47	0.72

Table 4-10. Wind speed Index of Agreement MPE results by state for 12km annual MM5 simulations. All areas meet the 0.6 benchmark for the statistic monthly and annually. Current study MPE results are shaded blue.

State/Simulation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Mean
CO-2003-NM	0.84	0.83	0.83	0.80	0.83	0.84	0.85	0.84	0.85	0.87	0.84	0.85	0.84
CO-2004-NM	0.84	0.84	0.82	0.8	0.84	0.85	0.83	0.82	0.82	0.82	0.84	0.85	0.83
CO-2005-NM	0.82	0.81	0.79	0.79	0.80	0.81	0.83	0.83	0.81	0.81	0.79		0.81
CO-2006-CO	0.80	0.82	0.81	0.78	0.81	0.83	0.83	0.83	0.83	0.83	0.82	0.82	0.82
CO-2005-EPA	0.82	0.82	0.81	0.82	0.81	0.81	0.80	0.81	0.80	0.80	0.80	0.80	0.81
CO-2005-ARWY	0.82	0.79	0.78	0.82	0.80	0.80	0.79	0.80	0.80	0.78	0.78	0.79	0.80
CO-2004-ARWY	0.81	0.80	0.81	0.80	0.79	0.80	0.79	0.82	0.77	0.78	0.81	0.77	0.80
CO-2006-ARCO	0.81	0.81	0.81	0.77	0.80	0.81	0.77	0.79	0.77	0.75	0.78	0.76	0.79
CO-2005-ARCO	0.83	0.82	0.81	0.83	0.81	0.80	0.77	0.81	0.81	0.79	0.78	0.80	0.81
CO-2004-ARCO	0.81	0.80	0.80	0.80	0.81	0.81	0.80	0.82	0.80	0.78	0.78	0.82	0.80
CO-2006-ARWY	0.80	0.80	0.81	0.77	0.79	0.78	0.80	0.78	0.79	0.76	0.77	0.75	0.78
UT-2003-NM	0.79	0.76	0.77	0.80	0.79	0.81	0.78	0.80	0.81	0.81	0.78	0.80	0.79
UT-2004-NM	0.72	0.78	0.78	0.81	0.81	0.79	0.77	0.79	0.79	0.79	0.78	0.77	0.78
UT-2005-NM	0.72	0.71	0.74	0.76	0.76	0.78	0.77	0.74	0.78	0.77	0.76		0.75
UT-2006-CO	0.77	0.75	0.76	0.77	0.78	0.78	0.76	0.79	0.78	0.77	0.76	0.73	0.77
UT-2005-EPA	0.70	0.74	0.71	0.77	0.76	0.73	0.75	0.78	0.75	0.74	0.76	0.78	0.75
UT-2005-ARWY	0.70	0.72	0.69	0.76	0.76	0.75	0.73	0.78	0.76	0.73	0.75	0.78	0.74
UT-2004-ARWY	0.67	0.74	0.72	0.72	0.75	0.76	0.77	0.75	0.78	0.76	0.78	0.78	0.75
UT-2006-ARCO	0.71	0.74	0.76	0.72	0.75	0.73	0.73	0.76	0.75	0.75	0.74	0.75	0.74
UT-2005-ARCO	0.71	0.73	0.70	0.77	0.76	0.73	0.74	0.77	0.75	0.74	0.76	0.78	0.75
UT-2004-ARCO	0.67	0.74	0.74	0.73	0.76	0.75	0.76	0.76	0.76	0.76	0.77	0.78	0.75
UT-2006-ARWY	0.70	0.74	0.72	0.76	0.74	0.74	0.72	0.77	0.76	0.76	0.73	0.75	0.74
WY-2003-NM	0.82	0.82	0.80	0.82	0.82	0.82	0.84	0.83	0.82	0.81	0.82	0.84	0.82
WY-2004-NM	0.82	0.84	0.81	0.82	0.82	0.81	0.81	0.81	0.82	0.83	0.84	0.82	0.82
WY-2005-NM	0.78	0.79	0.75	0.77	0.80	0.78	0.79	0.78	0.78	0.79	0.80		0.78
WY-2006-CO	0.84	0.84	0.82	0.81	0.80	0.82	0.82	0.84	0.83	0.83	0.82	0.83	0.83
WY-2005-EPA	0.79	0.80	0.78	0.78	0.81	0.80	0.80	0.78	0.81	0.79	0.79	0.81	0.80
WY-2005-ARWY	0.79	0.80	0.79	0.78	0.81	0.80	0.80	0.79	0.80	0.78	0.79	0.81	0.80
WY-2004-ARWY	0.79	0.78	0.81	0.81	0.79	0.81	0.80	0.79	0.80	0.79	0.80	0.78	0.80
WY-2006-ARCO	0.78	0.79	0.77	0.78	0.76	0.77	0.75	0.78	0.75	0.76	0.76	0.76	0.77
WY-2005-ARCO	0.77	0.76	0.78	0.76	0.77	0.77	0.78	0.78	0.75	0.76	0.77	0.78	0.77
WY-2004-ARCO	0.77	0.76	0.78	0.78	0.77	0.78	0.77	0.75	0.78	0.78	0.75	0.76	0.77
WY-2006-ARWY	0.79	0.80	0.79	0.81	0.78	0.80	0.78	0.81	0.79	0.80	0.79	0.81	0.80

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Attachment B

List of Surface and Upper Air Monitoring Stations used for CALMET

Table B-1. List of Surface Meteorological Stations in CALPUFF Domain

Station Name	USAF (ISH/NWS) or AIRS (SCAQMD)	WBAN (ISH/NWS) or ARB (SCAQMD)	Latitude	Longitude	Station ID (USAF-WBAN for ISH/NWS and AIRS-ARB for SCAQMD data)	Data Source	Years Available
TWENTYNINE PALMS	690150	93121	34.3	-116.167	690150-93121	ISH/NWS	2006-2008
NEWHALL	720046	99999	34.367	-118.567	720046-99999	ISH/NWS	2006-2008
BIG BEAR CITY	720165	99999	34.264	-116.854	720165-99999	ISH/NWS	2007-2008
CORONA MUNI	720333	99999	33.9	-117.6	720333-99999	ISH/NWS	2006-2008
PALM SPRINGS INTL	722868	93138	33.833	-116.5	722868-93138	ISH/NWS	2006- 2008
RIVERSIDE MUNI	722869	99999	33.95	-117.433	722869-99999	ISH/NWS	2006-2008
LA USC DOWNTOWN CAM	722874	99999	34.024	-118.291	722874-99999	ISH/NWS	2006-2008
BURBANK/GLENDALE	722880	03171	34.201	-118.358	722880-03171	ISH/NWS	2006-2008
SANTA MONICA MUNI	722885	93134	34.017	-118.45	722885-93134	ISH/NWS	2006-2008
VAN NUYS	722886	23152	34.21	-118.489	722886-23152	ISH/NWS	2006-2008
BRACKETT FLD	722887	93197	34.083	-117.783	722887-93197	ISH/NWS	2006-2008
MOUNT WILSON	722890	99999	34.226	118.066	722890-99999	ISH/NWS	2006
CHINO	722899	23130	33.967	-117.633	722899-23130	ISH/NWS	2006-2008
BROWN FLD MUNI	722904	99999	32.567	-116.967	722904-99999	ISH/NWS	2006-2008
NORTH ISLAND NAS	722906	03180	32.7	-117.2	722906-03180	ISH/NWS	2006-2008
GILLESPIE FLD	722907	93136	32.833	-116.967	722907-93136	ISH/NWS	2006-2008
AVALON/CATALINA	722920	99999	33.405	-118.416	722920-99999	ISH/NWS	2006-2008
SAN CLEMENTE ISLAND	722925	03179	33.023	-118.588	722925-03179	ISH/NWS	2006-2008
CAMP PENDLETON MCAS	722926	99999	33.3	-117.35	722926-99999	ISH/NWS	2006, 2007
MC CLELLAN PALOMAR	722927	93112	33.128	-117.28	722927-93112	ISH/NWS	2006-2008
OCEANSIDE MUNI	722934	53143	33.217	-117.35	722934-53143	ISH/NWS	2006-2008
LOS ANGELES INTL	722950	99999	33.938	-118.389	722950-99999	ISH/NWS	2006-2008
ZAMPERINI FLD	722955	23191	33.8	-118.333	722955-23191	ISH/NWS	2006-2008
JACK NORTHROP FLD H	722956	93117	33.917	-118.333	722956-93117	ISH/NWS	2006-2008
LONG BEACH/LB AIRP.	722970	03154	33.812	-118.146	722970-03154	ISH/NWS	2006-2008
LOS ALAMITOS AAF	722975	99999	33.783	-118.05	722975-99999	ISH/NWS	2006-2008
FULLERTON MUNICIPAL	722976	03177	33.867	117.983	722976-03177	ISH/NWS	2006-2008

Station Name	USAF (ISH/NWS) or AIRS (SCAQMD)	WBAN (ISH/NWS) or ARB (SCAQMD)	Latitude	Longitude	Station ID (USAF-WBAN for ISH/NWS and AIRS-ARB for SCAQMD data)	Data Source	Years Available
JOHN WAYNE ARPT ORA	722977	99999	33.68	-117.866	722977-99999	ISH/NWS	2006-2008
EDWARDS AF AUX NORTH	723171	99999	34.983	-117.867	723171-99999	ISH/NWS	2006-2008
PALMDALE PRODUCTION	723820	03174	34.629	-118.084	723820-03174	ISH/NWS	2006-2008
SANDBURG (AUT)	723830	99999	34.744	-118.724	723830-99999	ISH/NWS	2006-2008
SANTA BARBARA MUNI	723925	03167	34.426	119.843	723925-03167	ISH/NWS	2006-2008
OXNARD AIRPORT	723927	23129	34.201	119.206	723927-23129	ISH/NWS	2006-2008
RAMONA	745056	99999	33.038	-116.916	745056-99999	ISH/NWS	2008
RAMONA	745056	53141	33.039	-116.915	745056-53141	ISH/NWS	2006-2007
WHITEMAN	745057	99999	34.267	-118.417	745057-99999	ISH/NWS	2006-2008
EL MONTE	747043	93184	34.086	-118.035	747043-93184	ISH/NWS	2006-2008
CAMPO	747186	99999	32.633	-116.467	747186-99999	ISH/NWS	2006-2008
SAN DIEGO	994027	53144	32.717	-117.167	994027-53144	ISH/NWS	2006-2008
SANTA MONICA	994028	99999	34.008	-118.5	994028-99999	ISH/NWS	2006-2008
LOS ANGELES	994035	03159	33.717	-118.267	994035-03159	ISH/NWS	2006-2008
TIJUANA RIVER RESERV	998013	23182	32.573	-117.127	998013-23182	ISH/NWS	2008
ANAHEIM	60590007	30178	33.829	-117.939	60590007-30178	SCAQMD	2006-2008
AZUSA	60370002	70060	34.135	-117.924	60370002-70060	SCAQMD	2008
BANNING AIRPORT	60650012	33164	33.919	-116.858	60650012-33164	SCAQMD	2008
BURBANK	60371002	70069	34.174	-118.317	60371002-70069	SCAQMD	2008
CENTRAL LA	60710025	70087	34.065	-118.227	60710025-70087	SCAQMD	2006-2007
COSTA MESA	60591003	30195	33.672	-117.926	60591003-30195	SCAQMD	2007-2008
CRESTLINE	60710005	36181	34.240	-117.276	60710005-36181	SCAQMD	2006-2008
FONTANA	60712002	36197	34.099	-117.492	60712002-36197	SCAQMD	2008
INDIO	60652002	33157	33.707	-116.216	60652002-33157	SCAQMD	2007-2008
LA HABRA	60595001	30177	33.923	-117.952	60595001-30177	SCAQMD	2008
LAKE ELSINORE	60659001	33158	33.675	-117.331	60659001-33158	SCAQMD	2008
LAX	60375005	70111	33.952	-118.430	60375005-70111	SCAQMD	2007-2008
LONG BEACH	60374002	70072	33.822	-118.189	60374002-70072	SCAQMD	2007-2008
MISSION VIEJO	60592022	30002	33.628	-117.675	60592022-30002	SCAQMD	2007-2008

Station Name	USAF (ISH/NWS) or AIRS (SCAQMD)	WBAN (ISH/NWS) or ARB (SCAQMD)	Latitude	Longitude	Station ID (USAF-WBAN for ISH/NWS and AIRS-ARB for SCAQMD data)	Data Source	Years Available
PALM SPRINGS	60655001	33137	33.851	-116.541	60655001-33137	SCAQMD	2008
PERRIS	60656001	33149	33.787	-117.228	60656001-33149	SCAQMD	2007-2008
PICO RIVERA	60371602	70185	34.008	-118.069	60371602-70185	SCAQMD	2008
POMONA	60371701	70075	34.065	-117.750	60371701-70075	SCAQMD	2008
REDLANDS	60714003	36204	34.057	-117.148	60714003-36204	SCAQMD	2007-2008
RESEDA	60371201	70074	34.197	-118.533	60371201-70074	SCAQMD	2008
RIVERSIDE	60658001	33144	33.999	-117.415	60658001-33144	SCAQMD	2007-2008
SAB BERNADINO	60719004	36203	34.105	-117.274	60719004-36203	SCAQMD	2007-2008
SANTA CLARA	60376012	70090	34.382	-118.528	60376012-70090	SCAQMD	2006-2008
UPLAND	60711004	36175	34.102	-117.629	60711004-36175	SCAQMD	2008
WEST LA	60370113	70091	34.049	-118.457	60370113-70091	SCAQMD	2006, 2008

Table B-2. Upper Air Meteorological Station in CALPUFF Domain

Station Name	USAF	WBAN	Lat	Long	Station ID (USAF-WBAN)	Data Source	Years Available
MIRMAR	722930	03190	32.87	117.15	722930-03190	**NOAA/ESRL**	2005-2008

Attachment C

Sample CALPUFF Input File

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CALPUFF Demonstration Run


---------------- Run title (3 lines) ------------------------------------------

                    CALPUFF MODEL CONTROL FILE
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-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names

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Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    ! METDAT =CMET.DAT   !
    or
ISCMET.DAT    input    * ISCDAT =             *
    or
PLMMET.DAT    input    * PLMDAT =             *
    or
PROFILE.DAT   input    * PRFDAT =             *
SURFACE.DAT   input    * SFCDAT =             *
RESTARTB.DAT  input    ! RSTARTB=CPUF.out!
--------------------------------------------------------------------------------
CALPUFF.LST   output   ! PUFLST =CPUF.LST  !
CONC.DAT      output   ! CONDAT =CPUF.CON     !
DFLX.DAT      output   ! DFDAT  =CPUF.DRY     !
WFLX.DAT      output   ! WFDAT  =CPUF.WET     !

VISB.DAT      output   ! VISDAT =CPUF.VIS     !
TK2D.DAT      output   * T2DDAT =             *
RHO2D.DAT     output   * RHODAT =             *
RESTARTE.DAT  output  ! RSTARTE= CPUF.rst    !
--------------------------------------------------------------------------------
Emission Files
--------------
PTEMARB.DAT   input    * PTDAT  =             *
VOLEMARB.DAT  input    * VOLDAT =             *
BAEMARB.DAT   input    * ARDAT  =             *
LNEMARB.DAT   input    * LNDAT  =             *
--------------------------------------------------------------------------------
Other Files
-----------
OZONE.DAT     input    ! OZDAT  =OZONE.DAT    !
VD.DAT        input    * VDDAT  =             *
CHEM.DAT      input    * CHEMDAT=             *
H2O2.DAT      input    * H2O2DAT=             *
HILL.DAT      input    * HILDAT=             *
HILLRCT.DAT   input    * RCTDAT=             *
COASTLN.DAT   input    * CSTDAT=             *
FLUXBDY.DAT   input    * BDYDAT=             *
BCON.DAT      input    * BCNDAT=             *
DEBUG.DAT     output   * DEBUG =             *
MASSFLX.DAT   output   * FLXDAT=             *
MASSBAL.DAT   output   * BALDAT=             *
FOG.DAT       output   * FOGDAT=             *
--------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = F !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 70 characters in length
```

```
Provision for multiple input files
----------------------------------

     Number of CALMET.DAT files for run (NMETDAT)
                                Default: 1       ! NMETDAT =   12   !

     Number of PTEMARB.DAT files for run (NPTDAT)
                                Default: 0       ! NPTDAT =  0  !

     Number of BAEMARB.DAT files for run (NARDAT)
                                Default: 0       ! NARDAT =  0  !

     Number of VOLEMARB.DAT files for run (NVOLDAT)
                                Default: 0       ! NVOLDAT =  0  !

!END!

-------------
Subgroup (0a)
-------------

  The following CALMET.DAT filenames are processed in sequence if NMETDAT>1

Default Name  Type          File Name
------------  ----          ---------
 none         input    ! METDAT=   ~\CALMET\calpuff_jan08.met  !   !END!
 none         input    ! METDAT=   ~\CALMET\calpuff_feb08.met  !   !END!
 none         input    ! METDAT=   ~\CALMET\calpuff_mar08.met  !   !END!
 none         input    ! METDAT=   ~\CALMET\calpuff_apr08.met  !   !END!
 none         input    ! METDAT=   ~\CALMET\calpuff_may08.met  !   !END!
 none         input    ! METDAT=   ~\CALMET\calpuff_jun08.met  !   !END!
 none         input    ! METDAT=   ~\CALMET\calpuff_jul08.met  !   !END!
 none         input    ! METDAT=   ~\CALMET\calpuff_aug08.met  !   !END!
 none         input    ! METDAT=   ~\CALMET\calpuff_sep08.met  !   !END!
 none         input    ! METDAT=   ~\CALMET\calpuff_oct08.met  !   !END!
 none         input    ! METDAT=   ~\CALMET\calpuff_nov08.met  !   !END!
 none         input    ! METDAT=   ~\CALMET\calpuff_dec08.met  !   !END!


--------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

    Option to run all periods found
    in the met. file     (METRUN)   Default: 0       ! METRUN =   0  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in met. file

     Starting date:   Year (IBYR) -- No default       ! IBYR =  2008  !
     (used only if   Month (IBMO) -- No default       ! IBMO =  1  !
      METRUN = 0)      Day (IBDY) -- No default       ! IBDY =  1  !
                      Hour (IBHR) -- No default       ! IBHR =  0  !

     Note: IBHR is the time at the END of the first hour of the simulation
           (IBHR=1, the first hour of a day, runs from 00:00 to 01:00)

     Base time zone        (XBTZ) -- No default       ! XBTZ = 8.0  !
     The zone is the number of hours that must be
     ADDED to the time to obtain UTC (or GMT)
```

```
Examples: PST = 8., MST = 7.
          CST = 6., EST = 5.

Length of run (hours) (IRLG) -- No default       ! IRLG =  8784  !

Number of chemical species (NSPEC)
                                Default: 5       ! NSPEC =  9   !

Number of chemical species
to be emitted  (NSE)            Default: 3       ! NSE =  7   !

Flag to stop run after
SETUP phase (ITEST)             Default: 2       ! ITEST =  2   !
(Used to allow checking
of the model inputs, files, etc.)
      ITEST = 1 - STOPS program after SETUP phase
      ITEST = 2 - Continues with execution of program
                  after SETUP

Restart Configuration:

   Control flag (MRESTART)      Default: 0       ! MRESTART =  0   !

      0 = Do not read or write a restart file
      1 = Read a restart file at the beginning of
          the run
      2 = Write a restart file during run
      3 = Read a restart file at beginning of run
          and write a restart file during run

   Number of periods in Restart
   output cycle (NRESPD)        Default: 0       ! NRESPD =  0   !

      0 = File written only at last period
     >0 = File updated every NRESPD periods

Meteorological Data Format (METFM)
                                Default: 1       ! METFM =  1   !

      METFM = 1 - CALMET binary file (CALMET.MET)
      METFM = 2 - ISC ASCII file (ISCMET.MET)
      METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)
      METFM = 4 - CTDM plus tower file (PROFILE.DAT) and
                  surface parameters file (SURFACE.DAT)
      METFM = 5 - AERMET tower file (PROFILE.DAT) and
                  surface parameters file (SURFACE.DAT)

Meteorological Profile Data Format (MPRFFM)
       (used only for METFM = 1, 2, 3)
                                Default: 1       ! MPRFFM =  1   !

      MPRFFM = 1 - CTDM plus tower file (PROFILE.DAT)
      MPRFFM = 2 - AERMET tower file (PROFILE.DAT)

PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2
Averaging Time (minutes) (AVET)
                                Default: 60.0    ! AVET = 60. !
PG Averaging Time (minutes) (PGTIME)
                                Default: 60.0    ! PGTIME = 60. !


!END!
```

```
--------------------------------------------------------------------------------

INPUT GROUP: 2 -- Technical options
--------------


     Vertical distribution used in the
     near field (MGAUSS)                   Default: 1     ! MGAUSS =  1   !
        0 = uniform
        1 = Gaussian

     Terrain adjustment method
     (MCTADJ)                              Default: 3     ! MCTADJ =  3   !
        0 = no adjustment
        1 = ISC-type of terrain adjustment
        2 = simple, CALPUFF-type of terrain
            adjustment
        3 = partial plume path adjustment

     Subgrid-scale complex terrain
     flag (MCTSG)                          Default: 0     ! MCTSG =  0   !
        0 = not modeled
        1 = modeled

     Near-field puffs modeled as
     elongated slugs? (MSLUG)              Default: 0     ! MSLUG =  0   !
        0 = no
        1 = yes (slug model used)

     Transitional plume rise modeled?
     (MTRANS)                              Default: 1     ! MTRANS =  1   !
        0 = no  (i.e., final rise only)
        1 = yes (i.e., transitional rise computed)

     Stack tip downwash? (MTIP)            Default: 1     ! MTIP =  1  !
        0 = no  (i.e., no stack tip downwash)
        1 = yes (i.e., use stack tip downwash)

     Method used to simulate building
     downwash? (MBDW)                      Default: 1     ! MBDW =   1  !
        1 = ISC method
        2 = PRIME method

     Vertical wind shear modeled above
     stack top? (MSHEAR)                   Default: 0     ! MSHEAR =  0  !
        0 = no  (i.e., vertical wind shear not modeled)
        1 = yes (i.e., vertical wind shear modeled)

     Puff splitting allowed? (MSPLIT)      Default: 0     ! MSPLIT =  0  !
        0 = no (i.e., puffs not split)
        1 = yes (i.e., puffs are split)

     Chemical mechanism flag (MCHEM)       Default: 1     ! MCHEM =  1   !
        0 = chemical transformation not
            modeled
        1 = transformation rates computed
            internally (MESOPUFF II scheme)
        2 = user-specified transformation
            rates used
        3 = transformation rates computed
            internally (RIVAD/ARM3 scheme)
        4 = secondary organic aerosol formation
```

```
        computed (MESOPUFF II scheme for OH)

Aqueous phase transformation flag (MAQCHEM)
(Used only if MCHEM = 1, or 3)        Default: 0     ! MAQCHEM =  0   !
   0 = aqueous phase transformation
        not modeled
   1 = transformation rates adjusted
        for aqueous phase reactions

Wet removal modeled ? (MWET)          Default: 1     ! MWET =  1   !
   0 = no
   1 = yes

Dry deposition modeled ? (MDRY)       Default: 1     ! MDRY =  1   !
   0 = no
   1 = yes
   (dry deposition method specified
    for each species in Input Group 3)


Gravitational settling (plume tilt)
modeled ? (MTILT)                     Default: 0     ! MTILT =  0   !
   0 = no
   1 = yes
   (puff center falls at the gravitational
    settling velocity for 1 particle species)

Restrictions:
    - MDRY  = 1
    - NSPEC = 1  (must be particle species as well)
    - sg    = 0  GEOMETRIC STANDARD DEVIATION in Group 8 is
                 set to zero for a single particle diameter

Method used to compute dispersion
coefficients (MDISP)                  Default: 3     ! MDISP =  3   !

   1 = dispersion coefficients computed from measured values
        of turbulence, sigma v, sigma w
   2 = dispersion coefficients from internally calculated
        sigma v, sigma w using micrometeorological variables
        (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
        the ISCST multi-segment approximation) and MP coefficients in
        urban areas
   4 = same as 3 except PG coefficients computed using
        the MESOPUFF II eqns.
   5 = CTDM sigmas used for stable and neutral conditions.
        For unstable conditions, sigmas are computed as in
        MDISP = 3, described above.  MDISP = 5 assumes that
        measured values are read

Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)
(Used only if MDISP = 1 or 5)         Default: 3     ! MTURBVW =  3  !
   1 = use sigma-v or sigma-theta measurements
        from PROFILE.DAT to compute sigma-y
        (valid for METFM = 1, 2, 3, 4, 5)
   2 = use sigma-w measurements
        from PROFILE.DAT to compute sigma-z
        (valid for METFM = 1, 2, 3, 4, 5)
   3 = use both sigma-(v/theta) and sigma-w
        from PROFILE.DAT to compute sigma-y and sigma-z
        (valid for METFM = 1, 2, 3, 4, 5)
   4 = use sigma-theta measurements
```

```
        from PLMMET.DAT to compute sigma-y
        (valid only if METFM = 3)

Back-up method used to compute dispersion
when measured turbulence data are
missing (MDISP2)                      Default: 3     ! MDISP2 =  3  !
(used only if MDISP = 1 or 5)
   2 = dispersion coefficients from internally calculated
       sigma v, sigma w using micrometeorological variables
       (u*, w*, L, etc.)
   3 = PG dispersion coefficients for RURAL areas (computed using
       the ISCST multi-segment approximation) and MP coefficients in
       urban areas
   4 = same as 3 except PG coefficients computed using
       the MESOPUFF II eqns.

[DIAGNOSTIC FEATURE]
Method used for Lagrangian timescale for Sigma-y
(used only if MDISP=1,2 or MDISP2=1,2)
(MTAULY)                              Default: 0     ! MTAULY =  0  !
   0 = Draxler default 617.284 (s)
   1 = Computed as Lag. Length / (.75 q) -- after SCIPUFF
  10 < Direct user input (s)             -- e.g., 306.9


[DIAGNOSTIC FEATURE]
Method used for Advective-Decay timescale for Turbulence
(used only if MDISP=2 or MDISP2=2)
(MTAUADV)                             Default: 0     ! MTAUADV =  0  !
   0 = No turbulence advection
   1 = Computed (OPTION NOT IMPLEMENTED)
  10 < Direct user input (s)   -- e.g., 300


Method used to compute turbulence sigma-v &
sigma-w using micrometeorological variables
(Used only if MDISP = 2 or MDISP2 = 2)
(MCTURB)                              Default: 1     ! MCTURB =  1  !
   1 = Standard CALPUFF subroutines
   2 = AERMOD subroutines

PG sigma-y,z adj. for roughness?      Default: 0     ! MROUGH =  0  !
(MROUGH)
   0 = no
   1 = yes

Partial plume penetration of          Default: 1     ! MPARTL =  1  !
elevated inversion?
(MPARTL)
   0 = no
   1 = yes

Strength of temperature inversion     Default: 0     ! MTINV =  0  !
provided in PROFILE.DAT extended records?
(MTINV)
   0 = no (computed from measured/default gradients)
   1 = yes

PDF used for dispersion under convective conditions?
                                      Default: 0     ! MPDF =  0  !
(MPDF)
   0 = no
   1 = yes
```

```
Sub-Grid TIBL module used for shore line?
                                       Default: 0     ! MSGTIBL = 0  !
(MSGTIBL)
   0 = no
   1 = yes

Boundary conditions (concentration) modeled?
                                       Default: 0     ! MBCON = 0  !
(MBCON)
   0 = no
   1 = yes, using formatted BCON.DAT file
   2 = yes, using unformatted CONC.DAT file

Note:  MBCON > 0 requires that the last species modeled
       be 'BCON'.  Mass is placed in species BCON when
       generating boundary condition puffs so that clean
       air entering the modeling domain can be simulated
       in the same way as polluted air.  Specify zero
       emission of species BCON for all regular sources.

Individual source contributions saved?
                                       Default: 0     ! MSOURCE = 0  !
(MSOURCE)
   0 = no
   1 = yes


Analyses of fogging and icing impacts due to emissions from
arrays of mechanically-forced cooling towers can be performed
using CALPUFF in conjunction with a cooling tower emissions
processor (CTEMISS) and its associated postprocessors.  Hourly
emissions of water vapor and temperature from each cooling tower
cell are computed for the current cell configuration and ambient
conditions by CTEMISS. CALPUFF models the dispersion of these
emissions and provides cloud information in a specialized format
for further analysis. Output to FOG.DAT is provided in either
'plume mode' or 'receptor mode' format.

Configure for FOG Model output?
                                       Default: 0     ! MFOG =  0   !
(MFOG)
   0 = no
   1 = yes  - report results in PLUME Mode format
   2 = yes  - report results in RECEPTOR Mode format


Test options specified to see if
they conform to regulatory
values? (MREG)                         Default: 1     ! MREG =  1   !

   0 = NO checks are made
   1 = Technical options must conform to USEPA
       Long Range Transport (LRT) guidance
                  METFM    1 or 2
                  AVET     60. (min)
                  PGTIME   60. (min)
                  MGAUSS   1
                  MCTADJ   3
                  MTRANS   1
                  MTIP     1
                  MCHEM    1 or 3 (if modeling SOx, NOx)
                  MWET     1
```

```
MDRY      1
MDISP     2 or 3
MPDF      0 if MDISP=3
          1 if MDISP=2
MROUGH    0
MPARTL    1
SYTDEP    550. (m)
MHFTSZ    0
SVMIN     0.5 (m/s)


!END!


-------------------------------------------------------------------------------

INPUT GROUP: 3a, 3b -- Species list
-------------------

------------
Subgroup (3a)
------------

  The following species are modeled:

! CSPEC =          SO2 !         !END!
! CSPEC =          SO4 !         !END!
! CSPEC =          NOX !         !END!
! CSPEC =          HNO3!         !END!
! CSPEC =          NO3 !         !END!
! CSPEC =          PMC !         !END!
! CSPEC =          SOA !         !END!
! CSPEC =          PMF !         !END!
! CSPEC =          EC  !         !END!
                                                                Dry                 OUTPUT
GROUP
    SPECIES          MODELED          EMITTED       DEPOSITED                 NUMBER
     NAME         (0=NO, 1=YES)    (0=NO, 1=YES)    (0=NO,                  (0=NONE,
   (Limit: 12                                        1=COMPUTED-GAS          1=1st
CGRUP,
    Characters                                       2=COMPUTED-PARTICLE     2=2nd
CGRUP,
    in length)                                       3=USER-SPECIFIED)       3= etc.)

!          SO2  =         1,               1,           1,                 0   !
!          SO4  =         1,               1,           2,                 0   !
!          NOX  =         1,               1,           1,                 0   !
!          HNO3 =         1,               0,           1,                 0   !
!          NO3  =         1,               0,           2,                 0   !
!          PMC  =         1,               1,           2,                 0   !
!          SOA  =         1,               1,           2,                 0   !
!          PMF  =         1,               1,           2,                 0   !

!          EC   =         1,               1,           2,                 0   !

!END!

  Note:  The last species in (3a) must be 'BCON' when using the
         boundary condition option (MBCON > 0).  Species BCON should
         typically be modeled as inert (no chem transformation or
         removal).
```

```
-------------
Subgroup (3b)
-------------
  The following names are used for Species-Groups in which results
  for certain species are combined (added) prior to output.  The
  CGRUP name will be used as the species name in output files.
  Use this feature to model specific particle-size distributions
  by treating each size-range as a separate species.
  Order must be consistent with 3(a) above.



--------------------------------------------------------------------------------


INPUT GROUP: 4 -- Map Projection and Grid control parameters
--------------

     Projection
     ----------

     Map projection for all X,Y (km)
     (PMAP)                     Default: UTM    ! PMAP = LCC !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
         PS  :  Polar Stereographic
         EM  :  Equatorial Mercator
         LAZA:  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                    Default=0.0     ! FEAST  = 0.0 !
     (FNORTH)                   Default=0.0     ! FNORTH = 0.0 !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                   No Default      ! IUTMZN = 11 !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                   Default: N      ! UTMHEM = N !
         N   :  Northern hemisphere projection
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)                    No Default      ! RLAT0 = 34.06179N !
     (RLON0)                    No Default      ! RLON0 = 117.8192W !

         TTM :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping plane
                RLAT0 identifies latitude of tangent-point of mapping plane

     Matching parallel(s) of latitude (decimal degrees) for projection
```

```
     (Used only if PMAP= LCC or PS)
     (RLAT1)                    No Default      ! RLAT1 = 33.0N !
     (RLAT2)                    No Default      ! RLAT2 = 35.0N !

         LCC :  Projection cone slices through Earth's surface at RLAT1 and RLAT2
         PS  :  Projection plane slices through Earth at RLAT1
                (RLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E


     Output Datum-Region
     -------------------

     The Datum-Region for the output coordinates is identified by a character
     string.  Many mapping products currently available use the model of the
     Earth known as the World Geodetic System 1984 (WGS-84).  Other local
     models may be in use, and their selection in TERREL will make its output
     consistent with local mapping products.  The list of Datum-Regions with
     official transformation parameters is provided by the National Imagery and
     and Mapping Agency (NIMA).

     Datum-region for output coordinates
     (DATUM)                    Default: WGS-84    ! DATUM = WGS-84 !



     Grid
     ----

     Reference coordinates X,Y (km) assigned to the southwest corner
     of grid cell (1,1)  (lower left corner of grid)
     (XREFKM)                   No Default      ! XREFKM = -78  !
     (YREFKM)                   No Default      ! YREFKM = -84 !

     Cartesian grid definition
     No. X grid cells (NX)      No default      ! NX =   39  !
     No. Y grid cells (NY)      No default      ! NY =   42  !
     Grid Spacing (DGRIDKM)     No default      ! DGRIDKM = 4 !
     in kilometers

!END!

--------------------------------------------------------------------------------

--------------------------------------------------------------------------------


INPUT GROUP: 5 -- Output Options
--------------
                                             *                          *
     FILE                       DEFAULT VALUE             VALUE THIS RUN
     ----                       -------------             --------------

   Concentrations (ICON)              1                   !  ICON =  1   !
   Dry Fluxes (IDRY)                  1                   !  IDRY =  1   !
   Wet Fluxes (IWET)                  1                   !  IWET =  1   !
```

```
2D Temperature (IT2D)             0                    !  IT2D =  0   !
2D Density (IRHO)                 0                    !  IRHO =  0   !
Relative Humidity (IVIS)          1                    !  IVIS =  1   !
 (relative humidity file is
  required for visibility
  analysis)
Use data compression option in output file?
(LCOMPRS)                          Default: T          ! LCOMPRS = T !

*
 0 = Do not create file, 1 = create file


 QA PLOT FILE OUTPUT OPTION:

    Create a standard series of output files (e.g.
    locations of sources, receptors, grids ...)
    suitable for plotting?
    (IQAPLOT)                      Default: 1          !  IQAPLOT =  1   !
      0 = no
      1 = yes

 DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

    Mass flux across specified boundaries
    for selected species reported?
    (IMFLX)                        Default: 0          ! IMFLX =  0  !
      0 = no
      1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames
               are specified in Input Group 0)

    Mass balance for each species
    reported?
    (IMBAL)                        Default: 0          ! IMBAL =  0  !
      0 = no
      1 = yes (MASSBAL.DAT filename is
           specified in Input Group 0)


 LINE PRINTER OUTPUT OPTIONS:

    Print concentrations (ICPRT)   Default: 0          ! ICPRT =  1   !
    Print dry fluxes (IDPRT)       Default: 0          ! IDPRT =  0   !
    Print wet fluxes (IWPRT)       Default: 0          ! IWPRT =  0   !
    (0 = Do not print, 1 = Print)

    Concentration print interval
    (ICFRQ) in timesteps           Default: 1          ! ICFRQ =  1   !
    Dry flux print interval
    (IDFRQ) in timesteps           Default: 1          ! IDFRQ =  1   !
    Wet flux print interval
    (IWFRQ) in timesteps           Default: 1          ! IWFRQ =  1   !

    Units for Line Printer Output
    (IPRTU)                        Default: 1          ! IPRTU =  3   !
                    for             for
               Concentration    Deposition
        1 =       g/m**3         g/m**2/s
        2 =      mg/m**3        mg/m**2/s
        3 =      ug/m**3        ug/m**2/s
        4 =      ng/m**3        ng/m**2/s
        5 =     Odour Units
```

```
       Messages tracking progress of run
       written to the screen ?
       (IMESG)                         Default: 2         ! IMESG =  2   !
         0 = no
         1 = yes (advection step, puff ID)
         2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)


     SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

                 ---- CONCENTRATIONS ----   ------ DRY FLUXES ------   ------ WET
FLUXES ------   -- MASS FLUX --
   SPECIES
   /GROUP        PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?   PRINTED?
SAVED ON DISK?   SAVED ON DISK?
   -------       ------------------------   ------------------------
------------------------   ---------------
!          SO2 =     0,           1,           0,           1,           0,
 1,          0   !
!          SO4 =     0,           1,           0,           1,           0,
 1,          0   !
!          NOX =     0,           1,           0,           1,           0,
 1,          0   !
!          HNO3=     0,           1,           0,           1,           0,
 1,          0   !
!          NO3 =     0,           1,           0,           1,           0,
 1,          0   !
!          PMC =     0,           1,           0,           1,           0,
 1,          0   !
!          SOA =     0,           1,           0,           1,           0,
 1,          0   !
!          PMF  =    0,           1,           0,           1,           0,
 1,          0   !
!          EC   =    0,           1,           0,           1,           0,
 1,          0   !

  Note:  Species BCON (for MBCON > 0) does not need to be saved on disk.


     OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)

       Logical for debug output
       (LDEBUG)                                 Default: F     ! LDEBUG = F !

       First puff to track
       (IPFDEB)                                 Default: 1     ! IPFDEB =  1  !

       Number of puffs to track
       (NPFDEB)                                 Default: 1     ! NPFDEB =  1  !

       Met. period to start output
       (NN1)                                    Default: 1     ! NN1 =  1   !

       Met. period to end output
       (NN2)                                    Default: 10    ! NN2 =  10  !

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs
```

```
------------------------

---------------
Subgroup (6a)
---------------
       Number of terrain features (NHILL)       Default: 0     ! NHILL =  0   !

       Number of special complex terrain
       receptors  (NCTREC)                      Default: 0     ! NCTREC =  0   !

       Terrain and CTSG Receptor data for
       CTSG hills input in CTDM format ?
       (MHILL)                                  No Default     ! MHILL =  2   !
       1 = Hill and Receptor data created
           by CTDM processors & read from
           HILL.DAT and HILLRCT.DAT files
       2 = Hill data created by OPTHILL &
           input below in Subgroup (6b);
           Receptor data in Subgroup (6c)

       Factor to convert horizontal dimensions  Default: 1.0   ! XHILL2M = 1.0 !
       to meters (MHILL=1)

       Factor to convert vertical dimensions    Default: 1.0   ! ZHILL2M = 1.0 !
       to meters (MHILL=1)

       X-origin of CTDM system relative to      No Default     ! XCTDMKM = 0 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

       Y-origin of CTDM system relative to      No Default     ! YCTDMKM = 0 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

---------------
Subgroup (6b)
---------------

                      1 **
     HILL information


HILL           XC        YC       THETAH  ZGRID  RELIEF    EXPO 1    EXPO 2   SCALE
1    SCALE 2    AMAX1     AMAX2
 NO.          (km)      (km)      (deg.)   (m)     (m)      (m)       (m)       (m)
      (m)       (m)       (m)
----          ----      ----      ------  -----  ------    ------    ------
-------    -------    -----     -----

---------------
Subgroup (6c)
---------------

    COMPLEX TERRAIN RECEPTOR INFORMATION

                      XRCT         YRCT         ZRCT          XHH
                      (km)         (km)          (m)
                     ------        -----       ------         ----


-------------------
1
     Description of Complex Terrain Variables:
```

```
XC, YC  = Coordinates of center of hill
THETAH  = Orientation of major axis of hill (clockwise from
          North)
ZGRID   = Height of the  0  of the grid above mean sea
          level
RELIEF  = Height of the crest of the hill above the grid elevation
EXPO 1  = Hill-shape exponent for the major axis
EXPO 2  = Hill-shape exponent for the major axis
SCALE 1 = Horizontal length scale along the major axis
SCALE 2 = Horizontal length scale along the minor axis
AMAX    = Maximum allowed axis length for the major axis
BMAX    = Maximum allowed axis length for the major axis

XRCT, YRCT = Coordinates of the complex terrain receptors
ZRCT    = Height of the ground (MSL) at the complex terrain
          Receptor
XHH     = Hill number associated with each complex terrain receptor
          (NOTE: MUST BE ENTERED AS A REAL NUMBER)
```

```
   **
     NOTE: DATA for each hill and CTSG receptor are treated as a separate
           input subgroup and therefore must end with an input group terminator.

-------------------------------------------------------------------------------


INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases
--------------

      SPECIES     DIFFUSIVITY      ALPHA STAR      REACTIVITY    MESOPHYLL
RESISTANCE     HENRY'S LAW COEFFICIENT
       NAME        (cm**2/s)                                        (s/cm)
         (dimensionless)
      -------     -----------      ----------      ----------
--------------------     -----------------------

!          SO2 =      .1509,        1000.0,           8.0,                .0,
          .04 !
!           NO =      .1345,           1.0,           2.0,              25.0,
         18.0 !
!          NO2 =      .1656,           1.0,           8.0,               5.0,
          3.5 !
!         HNO3 =      .1628,           1.0,          18.0,                .0,
      .0000001 !

!END!


-------------------------------------------------------------------------------


INPUT GROUP: 8 -- Size parameters for dry deposition of particles
--------------

     For SINGLE SPECIES, the mean and standard deviation are used to
     compute a deposition velocity for NINT (see group 9) size-ranges,
     and these are then averaged to obtain a mean deposition velocity.

     For GROUPED SPECIES, the size distribution should be explicitly
     specified (by the 'species' in the group), and the standard deviation
     for each should be entered as 0.  The model will then use the
     deposition velocity for the stated mean diameter.
```

```
      SPECIES      GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
       NAME             DIAMETER                   DEVIATION
                        (microns)                  (microns)
      -------      -------------------        ------------------
!          SO4 =          0.48,                      2.   !
!          NO3 =          0.48,                      2.   !
!          PMC  =         6.0 ,                      6.   !
!          SOA =          0.48,                      2.   !
!          PMF =          1.0 ,                      1.5  !
!          EC  =          1.0 ,                      1.5  !

!END!

-------------------------------------------------------------------------------


INPUT GROUP: 9 -- Miscellaneous dry deposition parameters
--------------

     Reference cuticle resistance (s/cm)
     (RCUTR)                          Default: 30    !  RCUTR = 30.0 !
     Reference ground resistance  (s/cm)
     (RGR)                            Default: 10    !    RGR = 10.0 !
     Reference pollutant reactivity
     (REACTR)                         Default: 8     ! REACTR = 8.0 !

     Number of particle-size intervals used to
     evaluate effective particle deposition velocity
     (NINT)                           Default: 9     !   NINT =  9  !

     Vegetation state in unirrigated areas
     (IVEG)                           Default: 1     !   IVEG =  1   !
        IVEG=1 for active and unstressed vegetation
        IVEG=2 for active and stressed vegetation
        IVEG=3 for inactive vegetation

!END!

-------------------------------------------------------------------------------


INPUT GROUP: 10 -- Wet Deposition Parameters
---------------


                      Scavenging Coefficient -- Units: (sec)**(-1)

       Pollutant      Liquid Precip.       Frozen Precip.
       ---------      --------------       --------------
!          SO2 =         3.0E-05,              0.0E00 !
!          SO4 =         1.0E-04,             3.0E-05 !
!         HNO3 =         6.0E-05,              0.0E00 !
!          NO3 =         1.0E-04,             3.0E-05 !
!         PMC  =         1.0E-04,             3.0E-05 !
!          SOA =         1.0E-04,             3.0E-05 !
!          PMF =         1.0E-04,             3.0E-05 !
!          EC   =         1.0E-04,             3.0E-05 !

!END!
```

```
--------------------------------------------------------------------------------


INPUT GROUP: 11 -- Chemistry Parameters
---------------

     Ozone data input option (MOZ)     Default: 1            ! MOZ =  1   !
     (Used only if MCHEM = 1, 3, or 4)
        0 = use a monthly background ozone value
        1 = read hourly ozone concentrations from
            the OZONE.DAT data file

     Monthly ozone concentrations
     (Used only if MCHEM = 1, 3, or 4 and
      MOZ = 0 or MOZ = 1 and all hourly O3 data missing)
     (BCKO3) in ppb                    Default: 12*80.
     !  BCKO3 = 40.00, 40.00, 40.00, 40.00, 40.00, 40.00, 40.00, 40.00, 40.00,
40.00, 40.00, 40.00 !

     Monthly ammonia concentrations
     (Used only if MCHEM = 1, or 3)
     (BCKNH3) in ppb                   Default: 12*10.
     !  BCKNH3 = 2.00, 2.00, 2.00, 2.00, 2.00, 2.00, 2.00, 2.00, 2.00, 2.00, 2.00,
2.00 !

     Nighttime SO2 loss rate (RNITE1)
     in percent/hour                   Default: 0.2          ! RNITE1 = .2 !

     Nighttime NOx loss rate (RNITE2)
     in percent/hour                   Default: 2.0          ! RNITE2 = 2.0 !

     Nighttime HNO3 formation rate (RNITE3)
     in percent/hour                   Default: 2.0          ! RNITE3 = 2.0 !

     H2O2 data input option (MH2O2)    Default: 1            ! MH2O2 =  1   !
     (Used only if MAQCHEM = 1)
        0 = use a monthly background H2O2 value
        1 = read hourly H2O2 concentrations from
            the H2O2.DAT data file

     Monthly H2O2 concentrations
     (Used only if MQACHEM = 1 and
      MH2O2 = 0 or MH2O2 = 1 and all hourly H2O2 data missing)
     (BCKH2O2) in ppb                  Default: 12*1.
     !  BCKH2O2 = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00,
1.00 !


 --- Data for SECONDARY ORGANIC AEROSOL (SOA) Option
     (used only if MCHEM = 4)

     The SOA module uses monthly values of:
          Fine particulate concentration in ug/m^3 (BCKPMF)
          Organic fraction of fine particulate     (OFRAC)
          VOC / NOX ratio (after reaction)         (VCNX)
     to characterize the air mass when computing
     the formation of SOA from VOC emissions.
     Typical values for several distinct air mass types are:

        Month    1    2    3    4    5    6    7    8    9   10   11   12
                Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov  Dec

     Clean Continental
```

```
        BCKPMF   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.
        OFRAC  .15  .15  .20  .20  .20  .20  .20  .20  .20  .20  .20  .15
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

     Clean Marine (surface)
        BCKPMF  .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5
        OFRAC  .25  .25  .30  .30  .30  .30  .30  .30  .30  .30  .30  .25
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.

     Urban - low biogenic (controls present)
        BCKPMF  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.
        OFRAC  .20  .20  .25  .25  .25  .25  .25  .25  .20  .20  .20  .20
        VCNX     4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.

     Urban - high biogenic (controls present)
        BCKPMF  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.
        OFRAC  .25  .25  .30  .30  .30  .55  .55  .55  .35  .35  .35  .25
        VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.

     Regional Plume
        BCKPMF  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.
        OFRAC  .20  .20  .25  .35  .25  .40  .40  .40  .30  .30  .30  .20
        VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.

     Urban - no controls present
        BCKPMF 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
        OFRAC  .30  .30  .35  .35  .35  .55  .55  .55  .35  .35  .35  .30
        VCNX     2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.

     Default: Clean Continental
     !  BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00,
1.00 !
     !  OFRAC  = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20,
0.15 !
     !  VCNX   = 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00,
50.00, 50.00, 50.00 !


!END!


-------------------------------------------------------------------------------


INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters
---------------

     Horizontal size of puff (m) beyond which
     time-dependent dispersion equations (Heffter)
     are used to determine sigma-y and
     sigma-z (SYTDEP)                           Default: 550.   ! SYTDEP = 5.5E02 !

     Switch for using Heffter equation for sigma z
     as above (0 = Not use Heffter; 1 = use Heffter
     (MHFTSZ)                                   Default: 0      ! MHFTSZ =  0   !

     Stability class used to determine plume
     growth rates for puffs above the boundary
     layer (JSUP)                               Default: 5      ! JSUP =  5   !

     Vertical dispersion constant for stable
     conditions (k1 in Eqn. 2.7-3)  (CONK1)     Default: 0.01   ! CONK1 = .01 !
```

```
Vertical dispersion constant for neutral/
unstable conditions (k2 in Eqn. 2.7-4)
(CONK2)                                  Default: 0.1    ! CONK2 = .1 !

Factor for determining Transition-point from
Schulman-Scire to Huber-Snyder Building Downwash
scheme (SS used for Hs < Hb + TBD * HL)
(TBD)                                    Default: 0.5    ! TBD = .5 !
   TBD < 0   ==> always use Huber-Snyder
   TBD = 1.5 ==> always use Schulman-Scire
   TBD = 0.5 ==> ISC Transition-point

Range of land use categories for which
urban dispersion is assumed
(IURB1, IURB2)                           Default: 10     ! IURB1 =  10  !
                                                  19     ! IURB2 =  19  !

Site characterization parameters for single-point Met data files ---------
(needed for METFM = 2,3,4,5)

   Land use category for modeling domain
   (ILANDUIN)                            Default: 20     ! ILANDUIN =  20  !

   Roughness length (m) for modeling domain
   (Z0IN)                                Default: 0.25   ! Z0IN = .25 !

   Leaf area index for modeling domain
   (XLAIIN)                              Default: 3.0    ! XLAIIN = 3.0 !

   Elevation above sea level (m)
   (ELEVIN)                              Default: 0.0    ! ELEVIN = .0 !

   Latitude (degrees) for met location
   (XLATIN)                              Default: -999.  ! XLATIN = .0 !

   Longitude (degrees) for met location
   (XLONIN)                              Default: -999.  ! XLONIN = .0 !

Specialized information for interpreting single-point Met data files -----

   Anemometer height (m) (Used only if METFM = 2,3)
   (ANEMHT)                              Default: 10.    ! ANEMHT = 10.0 !

   Form of lateral turbulance data in PROFILE.DAT file
   (Used only if METFM = 4,5 or MTURBVW = 1 or 3)
   (ISIGMAV)                             Default: 1      ! ISIGMAV =  1  !
       0 = read sigma-theta
       1 = read sigma-v

   Choice of mixing heights (Used only if METFM = 4)
   (IMIXCTDM)                            Default: 0      ! IMIXCTDM =  0  !
       0 = read PREDICTED mixing heights
       1 = read OBSERVED mixing heights

Maximum length of a slug (met. grid units)
(XMXLEN)                                 Default: 1.0    ! XMXLEN = 1.0 !

Maximum travel distance of a puff/slug (in
grid units) during one sampling step
(XSAMLEN)                                Default: 1.0    ! XSAMLEN = 1.0 !

Maximum Number of slugs/puffs release from
one source during one time step
```

```
     (MXNEW)                                    Default: 99     ! MXNEW =  99   !

     Maximum Number of sampling steps for
     one puff/slug during one time step
     (MXSAM)                                    Default: 99     ! MXSAM =  99   !

     Number of iterations used when computing
     the transport wind for a sampling step
     that includes gradual rise (for CALMET
     and PROFILE winds)
     (NCOUNT)                                   Default: 2      ! NCOUNT =  2   !

     Minimum sigma y for a new puff/slug (m)
     (SYMIN)                                    Default: 1.0    ! SYMIN = 1.0  !

     Minimum sigma z for a new puff/slug (m)
     (SZMIN)                                    Default: 1.0    ! SZMIN = 1.0  !

     Default minimum turbulence velocities sigma-v and sigma-w
     for each stability class over land and over water (m/s)
     (SVMIN(12) and SWMIN(12))

                     ----------  LAND  ----------       ---------  WATER  ----------
        Stab Class :  A    B    C    D    E    F         A    B    C    D    E    F
                     ---  ---  ---  ---  ---  ---       ---  ---  ---  ---  ---  ---
     Default SVMIN : .50, .50, .50, .50, .50, .50,      .37, .37, .37, .37, .37, .37
     Default SWMIN : .20, .12, .08, .06, .03, .016,     .20, .12, .08, .06, .03,
.016

           ! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.500,
0.500, 0.500, 0.500 !
           ! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200, 0.120, 0.080,
0.060, 0.030, 0.016 !

     Divergence criterion for dw/dz across puff
     used to initiate adjustment for horizontal
     convergence (1/s)
     Partial adjustment starts at CDIV(1), and
     full adjustment is reached at CDIV(2)
     (CDIV(2))                                  Default: 0.0,0.0  ! CDIV = .0, .0 !

     Minimum wind speed (m/s) allowed for
     non-calm conditions. Also used as minimum
     speed returned when using power-law
     extrapolation toward surface
     (WSCALM)                                   Default: 0.5    ! WSCALM = .5 !

     Maximum mixing height (m)
     (XMAXZI)                                   Default: 3000.  ! XMAXZI = 3000.0 !

     Minimum mixing height (m)
     (XMINZI)                                   Default: 50.    ! XMINZI = 50.0 !

     Default wind speed classes --
     5 upper bounds (m/s) are entered;
     the 6th class has no upper limit
     (WSCAT(5))                      Default   :
                                     ISC RURAL : 1.54, 3.09, 5.14, 8.23, 10.8
(10.8+)

                              Wind Speed Class :  1     2     3     4     5
                                                 ---   ---   ---   ---   ---
                                        ! WSCAT = 1.54, 3.09, 5.14, 8.23, 10.80 !
```

```
     Default wind speed profile power-law
     exponents for stabilities 1-6
     (PLX0(6))                        Default   : ISC RURAL values
                                      ISC RURAL : .07, .07, .10, .15, .35, .55
                                      ISC URBAN : .15, .15, .20, .25, .30, .30

                                Stability Class :  A     B     C     D     E     F
                                                  ---   ---   ---   ---   ---   ---
                                         ! PLX0 = 0.07, 0.07, 0.10, 0.15, 0.35, 0.55
!

     Default potential temperature gradient
     for stable classes E, F (degK/m)
     (PTG0(2))                        Default: 0.020, 0.035
                                         ! PTG0 = 0.020,   0.035 !

     Default plume path coefficients for
     each stability class (used when option
     for partial plume height terrain adjustment
     is selected -- MCTADJ=3)
     (PPC(6))                   Stability Class :  A     B     C     D     E     F
                                   Default  PPC : .50,  .50,  .50,  .50,  .35,  .35
                                                  ---   ---   ---   ---   ---   ---
                                         !  PPC = 0.50, 0.50, 0.50, 0.50, 0.35, 0.35
!

     Slug-to-puff transition criterion factor
     equal to sigma-y/length of slug
     (SL2PF)                                Default: 10.        ! SL2PF = 10.0 !

     Puff-splitting control variables ------------------------

       VERTICAL SPLIT
       --------------

       Number of puffs that result every time a puff
       is split - nsplit=2 means that 1 puff splits
       into 2
       (NSPLIT)                             Default:   3        ! NSPLIT =  3  !

       Time(s) of a day when split puffs are eligible to
       be split once again; this is typically set once
       per day, around sunset before nocturnal shear develops.
       24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)
       0=do not re-split    1=eligible for re-split
       (IRESPLIT(24))                       Default:  Hour 17 = 1
       !  IRESPLIT = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0 !

       Split is allowed only if last hour's mixing
       height (m) exceeds a minimum value
       (ZISPLIT)                            Default: 100.       ! ZISPLIT = 100.0 !

       Split is allowed only if ratio of last hour's
       mixing ht to the maximum mixing ht experienced
       by the puff is less than a maximum value (this
       postpones a split until a nocturnal layer develops)
       (ROLDMAX)                            Default: 0.25       ! ROLDMAX = 0.25 !


       HORIZONTAL SPLIT
       ----------------
```

```
        Number of puffs that result every time a puff
        is split - nsplith=5 means that 1 puff splits
        into 5
        (NSPLITH)                          Default:   5        ! NSPLITH =  5  !

        Minimum sigma-y (Grid Cells Units) of puff
        before it may be split
        (SYSPLITH)                         Default:  1.0       ! SYSPLITH = 1.0 !

        Minimum puff elongation rate (SYSPLITH/hr) due to
        wind shear, before it may be split
        (SHSPLITH)                         Default:  2.        ! SHSPLITH = 2.0 !

        Minimum concentration (g/m^3) of each
        species in puff before it may be split
        Enter array of NSPEC values; if a single value is
        entered, it will be used for ALL species
        (CNSPLITH)                         Default:  1.0E-07   ! CNSPLITH = 1.0E-07
!

      Integration control variables ------------------------

        Fractional convergence criterion for numerical SLUG
        sampling integration
        (EPSSLUG)                          Default:   1.0e-04  ! EPSSLUG = 1.0E-04 !

        Fractional convergence criterion for numerical AREA
        source integration
        (EPSAREA)                          Default:   1.0e-06  ! EPSAREA = 1.0E-06 !

        Trajectory step-length (m) used for numerical rise
        integration
        (DSRISE)                           Default:   1.0      ! DSRISE = 1.0 !

        Boundary Condition (BC) Puff control variables ------------------------

        Minimum height (m) to which BC puffs are mixed as they are emitted
        (MBCON=2 ONLY).  Actual height is reset to the current mixing height
        at the release point if greater than this minimum.
        (HTMINBC)                          Default:   500.     ! HTMINBC = 500.0 !

        Search radius (km) about a receptor for sampling nearest BC puff.
        BC puffs are typically emitted with a spacing of one grid cell
        length, so the search radius should be greater than DGRIDKM.
        (RSAMPBC)                          Default:   10.      ! RSAMPBC = 10.0 !

        Near-Surface depletion adjustment to concentration profile used when
        sampling BC puffs?
        (MDEPBC)                           Default:   1        ! MDEPBC =  1  !
           0 = Concentration is NOT adjusted for depletion
           1 = Adjust Concentration for depletion

!END!


-------------------------------------------------------------------------------


INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters
--------------------------------

---------------
Subgroup (13a)
```

```
---------------

     Number of point sources with
     parameters provided below      (NPT1)  No default  !  NPT1 =  TBD  !

     Units used for point source
     emissions below                (IPTU)  Default: 1  !  IPTU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (13d)        (NSPT1) Default: 0  !  NSPT1 =  0  !

     Number of point sources with
     variable emission parameters
     provided in external file      (NPT2)  No default  !  NPT2 =  0  !

     (If NPT2 > 0, these point
     source emissions are read from
     the file: PTEMARB.DAT)

!END!

---------------
Subgroup (13b)
---------------
                                            a
          POINT SOURCE: CONSTANT DATA
          -----------------------------
                                                                                 b
    c
  Source       X          Y       Stack    Base     Stack    Exit  Exit    Bldg.
Emission
   No.     Coordinate Coordinate Height Elevation Diameter  Vel.  Temp.   Dwash
Rates
              (km)      (km)       (m)      (m)       (m)  (m/s) (deg. K)
  ------   ---------- ---------- ------  ------   -------- ----- -------- -----
--------
   1 ! SRCNAM = TBD !
   1 ! X =    TBD !
   1 ! ZPLTFM  =       .0 !
   1 ! FMFAC  =      1.0 !   !END!

--------

    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

     SRCNAM  is a 12-character name for a source
             (No default)
     X       is an array holding the source data listed by the column headings
             (No default)
     SIGYZI  is an array holding the initial sigma-y and sigma-z (m)
             (Default: 0.,0.)
     FMFAC   is a vertical momentum flux factor (0. or 1.0) used to represent
```

```
           the effect of rain-caps or other physical configurations that
           reduce momentum rise associated with the actual exit velocity.
           (Default: 1.0  -- full momentum used)
   ZPLTFM  is the platform height (m) for sources influenced by an isolated
           structure that has a significant open area between the surface
           and the bulk of the structure, such as an offshore oil platform.
           The Base Elevation is that of the surface (ground or ocean),
           and the Stack Height is the release height above the Base (not
           above the platform).  Building heights entered in Subgroup 13c
           must be those of the buildings on the platform, measured from
           the platform deck.  ZPLTFM is used only with MBDW=1 (ISC
           downwash method) for sources with building downwash.
           (Default: 0.0)

  b
   0. = No building downwash modeled
   1. = Downwash modeled for buildings resting on the surface
   2. = Downwash modeled for buildings raised above the surface (ZPLTFM > 0.)
   NOTE: must be entered as a REAL number (i.e., with decimal point)

  c
   An emission rate must be entered for every pollutant modeled.
   Enter emission rate of zero for secondary pollutants that are
   modeled, but not emitted.  Units are specified by IPTU
   (e.g. 1 for g/s).

---------------
Subgroup (13c)
---------------

          BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH
          -------------------------------------------------------
Source                                                                 a
 No.      Effective building height, width, length and X/Y offset (in meters)
          every 10 degrees.  LENGTH, XBADJ, and YBADJ are only needed for
          MBDW=2 (PRIME downwash option)
------    --------------------------------------------------------------------
1 ! SRCNAM =    TDB  !
1 ! HEIGHT =      TBD !
1 ! WIDTH =       TBD!
!END!

--------

  a
   Building height, width, length, and X/Y offset from the source are treated
   as a separate input subgroup for each source and therefore must end with
   an input group terminator.  The X/Y offset is the position, relative to the
   stack, of the center of the upwind face of the projected building, with the
   x-axis pointing along the flow direction.

---------------
Subgroup (13d)
---------------
                                              a
         POINT SOURCE: VARIABLE EMISSIONS DATA
         ---------------------------------------

   Use this subgroup to describe temporal variations in the emission
   rates given in 13b.  Factors entered multiply the rates in 13b.
   Skip sources here that have constant emissions.  For more elaborate
   variation in source parameters, use PTEMARB.DAT and NPT2 > 0.
```

```
     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)



--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


-------------------------------------------------------------------------------


INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters
--------------------------------

---------------
Subgroup (14a)
---------------

     Number of polygon area sources with
     parameters specified below (NAR1)       No default  !  NAR1 =  0   !

     Units used for area source
     emissions below           (IARU)       Default: 1  !  IARU =   1  !
           1 =        g/m**2/s
           2 =       kg/m**2/hr
           3 =       lb/m**2/hr
           4 =     tons/m**2/yr
           5 =     Odour Unit * m/s  (vol. flux/m**2 of odour compound)
           6 =     Odour Unit * m/min
           7 =     metric tons/m**2/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (14d)        (NSAR1) Default: 0  !  NSAR1 =  0  !

     Number of buoyant polygon area sources
     with variable location and emission
     parameters (NAR2)                      No default  !  NAR2 =  0   !
     (If NAR2 > 0, ALL parameter data for
     these sources are read from the file: BAEMARB.DAT)

!END!

---------------
Subgroup (14b)
---------------
```

```
                                           a
          AREA SOURCE: CONSTANT DATA
          ---------------------------
                                                                  b
Source            Effect.    Base      Initial    Emission
 No.              Height   Elevation   Sigma z     Rates
                    (m)       (m)        (m)
-------           ------    ------     --------   ---------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.
    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IARU
     (e.g. 1 for g/m**2/s).

---------------
Subgroup (14c)
---------------

           COORDINATES (km) FOR EACH VERTEX(4) OF EACH POLYGON
           --------------------------------------------------------
Source                                                                    a
 No.       Ordered list of X followed by list of Y, grouped by source
------     ------------------------------------------------------------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.


---------------
Subgroup (14d)
---------------
                                                     a
          AREA SOURCE: VARIABLE EMISSIONS DATA
          --------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 14b.  Factors entered multiply the rates in 14b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                 Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
```

```
--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


-------------------------------------------------------------------------------

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters
---------------------------

---------------
Subgroup (15a)
---------------

     Number of buoyant line sources
     with variable location and emission
     parameters (NLN2)                              No default  !  NLN2 =  0   !

     (If NLN2 > 0, ALL parameter data for
      these sources are read from the file: LNEMARB.DAT)

     Number of buoyant line sources (NLINES)        No default   ! NLINES =  0  !

     Units used for line source
     emissions below               (ILNU)           Default: 1  !  ILNU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (15c)       (NSLN1) Default: 0  !  NSLN1 =  0  !

     Maximum number of segments used to model
     each line (MXNSEG)                             Default: 7   ! MXNSEG =  7  !

     The following variables are required only if NLINES > 0.  They are
     used in the buoyant line source plume rise calculations.

        Number of distances at which                Default: 6   ! NLRISE =  6  !
        transitional rise is computed

        Average building length (XL)                No default   ! XL = .0 !
                                                    (in meters)

        Average building height (HBL)               No default   ! HBL = .0 !
                                                    (in meters)

        Average building width (WBL)                No default   ! WBL = .0 !
                                                    (in meters)

        Average line source width (WML)             No default   ! WML = .0 !
                                                    (in meters)
```

```
        Average separation between buildings (DXL)  No default   ! DXL = .0 !
                                                    (in meters)

        Average buoyancy parameter (FPRIMEL)        No default   ! FPRIMEL = .0 !
                                                    (in m**4/s**3)

!END!

---------------
Subgroup (15b)
---------------

          BUOYANT LINE SOURCE: CONSTANT DATA
          ----------------------------------

     a
Source     Beg. X      Beg. Y      End. X    End. Y     Release    Base
Emission
 No.     Coordinate  Coordinate  Coordinate Coordinate  Height    Elevation
Rates
           (km)        (km)        (km)      (km)        (m)       (m)
------   ----------  ----------  ---------  ----------  -------   ---------
---------

--------

    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by ILNTU
     (e.g. 1 for g/s).

---------------
Subgroup (15c)
---------------
                                                              a
          BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA
          ----------------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 15b.  Factors entered multiply the rates in 15b.
     Skip sources here that have constant emissions.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                 Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)
```

```
--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


-------------------------------------------------------------------------------


INPUT GROUPS: 16a, 16b, 16c -- Volume source parameters
---------------------------

---------------
Subgroup (16a)
---------------

     Number of volume sources with
     parameters provided in 16b,c (NVL1)     No default  !  NVL1 =  0   !

     Units used for volume source
     emissions below in 16b       (IVLU)     Default: 1  !  IVLU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (16c)      (NSVL1)    Default: 0  !  NSVL1 =  0  !

     Number of volume sources with
     variable location and emission
     parameters                   (NVL2)     No default  !  NVL2 =   0   !

     (If NVL2 > 0, ALL parameter data for
      these sources are read from the VOLEMARB.DAT file(s) )

!END!

---------------
Subgroup (16b)
---------------
                                            a
           VOLUME SOURCE: CONSTANT DATA
           ------------------------------
                                                                               b
         X           Y        Effect.    Base     Initial    Initial    Emission
     Coordinate  Coordinate   Height   Elevation  Sigma y    Sigma z     Rates
        (km)        (km)        (m)       (m)       (m)        (m)
     ----------  ----------   ------    ------    --------   --------   --------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.
```

```
    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IVLU
     (e.g. 1 for g/s).

---------------
Subgroup (16c)
---------------
                                                     a
          VOLUME SOURCE: VARIABLE EMISSIONS DATA
          ---------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 16b.  Factors entered multiply the rates in 16b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                               Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)



--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


-------------------------------------------------------------------------------

INPUT GROUPS: 17a & 17b -- Non-gridded (discrete) receptor information
-----------------------

---------------
Subgroup (17a)
---------------

     Number of non-gridded receptors (NREC)  No default  !  NREC =  0   !

!END!

---------------
Subgroup (17b)
---------------
                                                   a
           NON-GRIDDED (DISCRETE) RECEPTOR DATA
           ------------------------------------
```

Receptor No.	X Coordinate (km)	Y Coordinate (km)	Ground Elevation (m)	Height Above Ground (m) [b]

1! X = TDB,   TBD,   TBD,   TBD!   !END!   name

----

[a] Data for each receptor are treated as a separate input subgroup and therefore must end with an input group terminator.

[b] Receptor height above ground is optional. If no value is entered, the receptor is placed on the ground.

Attachment D

Sample CALPOST and POSTUTIL Input Files

```
CALPUFF Demonstration


---------------- Run title (3 lines) ------------------------------------------

                    CALPOST MODEL CONTROL FILE
                    --------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

Input Files
-----------

File                       Default File Name
----                       -----------------
Conc/Dep Flux File         MODEL.DAT          ! MODDAT =CALPUFF.CON   !
Relative Humidity File     VISB.DAT           ! VISDAT =  ..\..CPUF.VIS! *
Background Data File       BACK.DAT           * BACKDAT =   *
Transmissometer or         VSRN.DAT           * VSRDAT =   *
Nephelometer Data File      or
DATSAV Weather Data File    or
Prognostic Weather  File

Single-point Met File      SURFACE.DAT        * MET1DAT =   *
 (Used ONLY to identify CALM hours for plume model
  output averaging when MCALMPRO option is used)


Output Files
------------

File                       Default File Name
----                       -----------------
List File                  CALPOST.LST        ! PSTLST =CALPOST.LST   !

Pathname for Timeseries Files   (blank)       * TSPATH =   *
(activate with exclamation points only if
providing NON-BLANK character string)

Pathname for Plot Files   (blank)             * PLPATH =   *
(activate with exclamation points only if
 providing NON-BLANK character string)

User Character String (U) to augment default filenames
(activate with exclamation points only if
 providing NON-BLANK character string)

Timeseries          TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT
Peak Value          PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT

                                              * TSUNAM =   *

Top Nth Rank Plot   RANK(ALL)_ASPEC_ttHR_CONC_TUNAM.DAT
                or  RANK(ii)_ASPEC_ttHR_CONC_TUNAM.GRD

                                              * TUNAM =   *

Exceedance Plot      EXCEED_ASPEC_ttHR_CONC_XUNAM.DAT
                 or  EXCEED_ASPEC_ttHR_CONC_XUNAM.GRD
```

```
                                                   * XUNAM =   *

Echo Plot
(Specific Days)
           yyyy_Mmm_Ddd_hhmm(UTCszzzz)_L00_ASPEC_ttHR_CONC.DAT
     or    yyyy_Mmm_Ddd_hhmm(UTCszzzz)_L00_ASPEC_ttHR_CONC.GRD


Visibility Plot      DAILY_VISIB_VUNAM.DAT   ! VUNAM =VTEST   !
(Daily Peak Summary)


Auxiliary Output Files
----------------------

File                      Default File Name
----                      -----------------
Visibility Change         DELVIS.DAT         * DVISDAT =   *

--------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case               ! LCFILES = T !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 132 characters in length
NOTE: (2) Filenames for ALL PLOT and TIMESERIES FILES are constructed
          using a template that includes a pathname, user-supplied
          character(s), and context-specific strings, where
             ASPEC = Species Name
              CONC = CONC Or WFLX Or DFLX Or TFLX
                tt = Averaging Period (e.g. 03)
                ii = Rank (e.g. 02)
                hh = Hour(ending) in LST
             szzzz = LST time zone shift (EST is -0500)
              yyyy = Year(LST)
                mm = Month(LST)
                dd = day of month (LST)
          are determined internally based on selections made below.
          If a path or user-supplied character(s) are supplied, each
          must contain at least 1 non-blank character.

!END!
--------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Option to run all periods found
     in the met. file(s)  (METRUN)       Default: 0   ! METRUN =   1  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in CALPUFF data file(s)

     Starting date:    Year   (ISYR)  --    No default   ! ISYR  =  2008  !
                       Month  (ISMO)  --    No default   ! ISMO  =  1  !
                       Day    (ISDY)  --    No default   ! ISDY  =  1  !
     Starting time:    Hour   (ISHR)  --    No default   ! ISHR  =  0  !
                       Minute (ISMIN) --    No default   ! ISMIN =  0  !
                       Second (ISSEC) --    No default   ! ISSEC =  0  !

     Ending date:      Year   (IEYR)  --    No default   ! IEYR  =  2008  !
                       Month  (IEMO)  --    No default   ! IEMO  =  12  !
                       Day    (IEDY)  --    No default   ! IEDY  =  31  !
```

```
     Ending time:       Hour   (IEHR)  --    No default   ! IEHR  =  23  !
                        Minute (IEMIN) --    No default   ! IEMIN =  0  !
                        Second (IESEC) --    No default   ! IESEC =  0  !

     (These are only used if METRUN = 0)

     All times are in the base time zone of the CALPUFF simulation.
     CALPUFF Dataset Version 2.1 contains the zone, but earlier versions
     do not, and the zone must be specified here.  The zone is the
     number of hours that must be ADDED to the time to obtain UTC (or GMT).
     Identify the Base Time Zone for the CALPUFF simulation
                             (BTZONE) -- No default   ! BTZONE = 8.0 !

     Process every period of data?
                               (NREP) -- Default: 1   ! NREP  =  1  !
      (1 = every period processed,
       2 = every 2nd period processed,
       5 = every 5th period processed, etc.)

Species & Concentration/Deposition Information
----------------------------------------------

      Species to process (ASPEC)       -- No default   ! ASPEC = VISIB  !
      (ASPEC = VISIB for visibility processing)

      Layer/deposition code (ILAYER)   -- Default: 1   ! ILAYER =  1  !
        '1'  for CALPUFF concentrations,
        '-1' for dry deposition fluxes,
        '-2' for wet deposition fluxes,
        '-3' for wet+dry deposition fluxes.

      Scaling factors of the form:     -- Defaults:    ! A =  0.0    !
            X(new) = X(old) * A + B         A = 0.0    ! B =  0.0    !
        (NOT applied if A = B = 0.0)        B = 0.0

      Add Hourly Background Concentrations/Fluxes?
                             (LBACK)  -- Default: F   ! LBACK =  F !


      Source of NO2 when ASPEC=NO2 (above) or LVNO2=T (Group 2) may be
      from CALPUFF NO2 concentrations OR from a fraction of CALPUFF NOx
      concentrations.  Specify the fraction of NOx that is treated as NO2
      either as a constant or as a table of fractions that depend on the
      magnitude of the NOx concentration:
                            (NO2CALC) -- Default: 1   ! NO2CALC =   1  !
         0 =  Use NO2 directly (NO2 must be in file)
         1 =  Specify a single NO2/NOx ratio (RNO2NOX)
         2 =  Specify a table NO2/NOx ratios (TNO2NOX)
              (NOTE: Scaling Factors must NOT be used with NO2CALC=2)

      Single NO2/NOx ratio (0.0 to 1.0) for treating some
      or all NOx as NO2, where [NO2] = [NOX] * RNO2NOX
      (used only if NO2CALC = 1)
                            (RNO2NOX) -- Default: 1.0 ! RNO2NOX = 1.0 !

      Table of NO2/NOx ratios that vary with NOx concentration.
      Provide 14 NOx concentrations (ug/m**3) and the corresponding
      NO2/NOx ratio, with NOx increasing in magnitude.  The ratio used
      for a particular NOx concentration is interpolated from the values
      provided in the table.  The ratio for the smallest tabulated NOx
      concentration (the first) is used for all NOx concentrations less
      than the smallest tabulated value, and the ratio for the largest
      tabulated NOx concentration (the last) is used for all NOx
```

```
      concentrations greater than the largest tabulated value.
      (used only if NO2CALC = 2)

       NOx concentration(ug / m3)
                              (CNOX)    -- No default
         ! CNOX = 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0,
                  8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0 !

       NO2/NOx ratio for each NOx concentration:
                              (TNO2NOX) -- No default
         ! TNO2NOX = 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
                     1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0 !


Source information
------------------

  Option to process source contributions:
         0 =  Process only total reported contributions
         1 =  Sum all individual source contributions and process
         2 =  Run in TRACEBACK mode to identify source
              contributions at a SINGLE receptor
                              (MSOURCE) -- Default: 0   ! MSOURCE =  0  !


Plume Model Output Processing Options
-------------------------------------

  Output from models other than CALPUFF and CALGRID can be written in
  the CONC.DAT format and processed by CALPOST.  Plume models such as
  AERMOD typically do not treat CALM hours, and do not include such hours
  in multiple-hour averages, with specific rules about how many calm hours
  can be removed from an average.  This treatment is known as CALM
  PROCESSING.  Calm periods are identified from wind speeds in the
  meteorological data file for the application, which must be identified
  in Input Group 0 as the single-point meteorological data file MET1DAT.
         0 =  Option is not used for CALPUFF/CALGRID output files
         1 =  Apply CALM processing procedures to multiple-hour averages
                           (MCALMPRO) -- Default: 0   ! MCALMPRO =  0  !

  Format of Single-point Met File
         1 =  AERMOD/AERMET SURFACE file
                            (MET1FMT) -- Default: 1   ! MET1FMT =  1  !


Receptor information
--------------------

  Gridded receptors processed?    (LG) -- Default: F   ! LG  = F  !
  Discrete receptors processed?   (LD) -- Default: F   ! LD  = T  !
  CTSG Complex terrain receptors processed?
                                  (LCT) -- Default: F   ! LCT = F  !

--Report results by DISCRETE receptor RING?
  (only used when LD = T)     (LDRING) -- Default: F   ! LDRING = F  !

--Select range of DISCRETE receptors (only used when LD = T):

  Select ALL DISCRETE receptors by setting NDRECP flag to -1;
                                OR
  Select SPECIFIC DISCRETE receptors by entering a flag (0,1) for each
     0 = discrete receptor not processed
     1 = discrete receptor processed
```

```
  using repeated value notation to select blocks of receptors:
     23*1, 15*0, 12*1
  Flag for all receptors after the last one assigned is set to 0
  (NDRECP) -- Default: -1
                                                  ! NDRECP =  TBD  !


--Select range of GRIDDED receptors (only used when LG = T):

       X index of LL corner (IBGRID) -- Default: -1     ! IBGRID = -1  !
           (-1 OR 1 <= IBGRID <= NX)

       Y index of LL corner (JBGRID) -- Default: -1     ! JBGRID = -1  !
           (-1 OR 1 <= JBGRID <= NY)

       X index of UR corner (IEGRID) -- Default: -1     ! IEGRID = -1  !
           (-1 OR 1 <= IEGRID <= NX)

       Y index of UR corner (JEGRID) -- Default: -1     ! JEGRID = -1  !
           (-1 OR 1 <= JEGRID <= NY)

  Note: Entire grid is processed if IBGRID=JBGRID=IEGRID=JEGRID=-1


--Specific gridded receptors can also be excluded from CALPOST
  processing by filling a processing grid array with 0s and 1s.  If the
  processing flag for receptor index (i,j) is 1 (ON), that receptor
  will be processed if it lies within the range delineated by IBGRID,
  JBGRID,IEGRID,JEGRID and if LG=T. If it is 0 (OFF), it will not be
  processed in the run.  By default, all array values are set to 1 (ON).

  Number of gridded receptor rows provided in Subgroup (1a) to
  identify specific gridded receptors to process
                         (NGONOFF) -- Default: 0      ! NGONOFF =  0  !

!END!


--------------
Subgroup (1a) -- Specific gridded receptors included/excluded
--------------

    Specific gridded receptors are excluded from CALPOST processing
    by filling a processing grid array with 0s and 1s.  A total of
    NGONOFF lines are read here.  Each line corresponds to one 'row'
    in the sampling grid, starting with the NORTHERNMOST row that
    contains receptors that you wish to exclude, and finishing with
    row 1 to the SOUTH (no intervening rows may be skipped).  Within
    a row, each receptor position is assigned either a 0 or 1,
    starting with the westernmost receptor.
       0 = gridded receptor not processed
       1 = gridded receptor processed

    Repeated value notation may be used to select blocks of receptors:
       23*1, 15*0, 12*1

    Because all values are initially set to 1, any receptors north of
    the first row entered, or east of the last value provided in a row,
    remain ON.

    (NGXRECP) -- Default: 1
```

```
--------------------------------------------------------------------------------

INPUT GROUP: 2 -- Visibility Parameters (ASPEC = VISIB)
--------------

    Test visibility options specified to see
    if they conform to FLAG 2008 configuration?
                           (MVISCHECK) -- Default: 1   ! MVISCHECK =   1  !
         0 =  NO checks are made
         1 =  Technical options must conform to FLAG 2008 visibility guidance
                ASPEC = VISIB
                LVNO2 = T
                NO2CALC = 1
                RNO2NOX = 1.0
                MVISBK = 8
                M8_MODE = 5

    Some of the data entered for use with the FLAG 2008 configuration
    are specific to the Class I area being evaluated. These values can
    be checked within the CALPOST user interface when the name of the
    Class I area is provided.

    Name of Class I Area (used for QA purposes only)
                            (AREANAME) -- Default: User  ! AREANAME =  USER !

    Particle growth curve f(RH) for hygroscopic species
                                (MFRH) -- Default: 4   ! MFRH   =  4  !

         1 =  IWAQM (1998) f(RH) curve (originally used with MVISBK=1)
         2 =  FLAG (2000) f(RH) tabulation
         3 =  EPA (2003) f(RH) tabulation
         4 =  IMPROVE (2006) f(RH) tabulations for sea salt, and for small and
              large SULFATE and NITRATE particles;
              Used in Visibility Method 8 (MVISBK = 8 with M8_MODE = 1, 2, or 3)

    Maximum relative humidity (%) used in particle growth curve
                               (RHMAX) -- Default: 98  ! RHMAX  = 98 !

    Modeled species to be included in computing the light extinction
     Include SULFATE?          (LVSO4) -- Default: T   ! LVSO4  = T  !
     Include NITRATE?          (LVNO3) -- Default: T   ! LVNO3  = T  !
     Include ORGANIC CARBON?   (LVOC)  -- Default: T   ! LVOC   = T  !
     Include COARSE PARTICLES? (LVPMC) -- Default: T   ! LVPMC  = T  !
     Include FINE PARTICLES?   (LVPMF) -- Default: T   ! LVPMF  = T  !
     Include ELEMENTAL CARBON? (LVEC)  -- Default: T   ! LVEC   = T  !
     Include NO2 absorption?   (LVNO2) -- Default: F   ! LVNO2  = T  !
              With Visibility Method 8 -- Default: T
                                          FLAG (2008)

    And, when ranking for TOP-N, TOP-50, and Exceedance tables,
     Include BACKGROUND?       (LVBK)  -- Default: T   ! LVBK   = T  !

    Species name used for particulates in MODEL.DAT file
                  COARSE    (SPECPMC) -- Default: PMC ! SPECPMC = PMC !
                  FINE      (SPECPMF) -- Default: PMF ! SPECPMF = PMF !

Extinction Efficiency (1/Mm per ug/m**3)
----------------------------------------
    MODELED particulate species:
               PM  COARSE      (EEPMC) -- Default: 0.6   ! EEPMC  = 0.6 !
               PM  FINE        (EEPMF) -- Default: 1.0   ! EEPMF  = 1 !
    BACKGROUND particulate species:
               PM  COARSE    (EEPMCBK) -- Default: 0.6   ! EEPMCBK = 0.6 !
```

```
    Other species:
              AMMONIUM SULFATE (EESO4) -- Default: 3.0   ! EESO4  = 3 !
              AMMONIUM NITRATE (EENO3) -- Default: 3.0   ! EENO3  = 3 !
              ORGANIC CARBON   (EEOC)  -- Default: 4.0   ! EEOC   = 4 !
              SOIL             (EESOIL)-- Default: 1.0   ! EESOIL = 1 !
              ELEMENTAL CARBON (EEEC)  -- Default: 10.   ! EEEC   = 10 !
              NO2 GAS          (EENO2) -- Default: .1755 ! EENO2  = 0.17 !
    Visibility Method 8:
              AMMONIUM SULFATE (EESO4S)   Set Internally (small)
              AMMONIUM SULFATE (EESO4L)   Set Internally (large)
              AMMONIUM NITRATE (EENO3S)   Set Internally (small)
              AMMONIUM NITRATE (EENO3L)   Set Internally (large)
              ORGANIC CARBON   (EEOCS)    Set Internally (small)
              ORGANIC CARBON   (EEOCL)    Set Internally (large)
              SEA SALT         (EESALT)   Set Internally

Background Extinction Computation
---------------------------------

    Method used for the 24h-average of percent change of light extinction:
    Hourly ratio of source light extinction / background light extinction
    is averaged?              (LAVER) -- Default: F   ! LAVER = F  !


    Method used for background light extinction
                             (MVISBK) -- Default: 8   ! MVISBK =  8  !
                                         FLAG (2008)

         1 =  Supply single light extinction and hygroscopic fraction
              - Hourly F(RH) adjustment applied to hygroscopic background
                and modeled sulfate and nitrate
         2 =  Background extinction from speciated PM concentrations (A)
              - Hourly F(RH) adjustment applied to observed and modeled sulfate
                and nitrate
              - F(RH) factor is capped at F(RHMAX)
         3 =  Background extinction from speciated PM concentrations (B)
              - Hourly F(RH) adjustment applied to observed and modeled sulfate
                and nitrate
              - Receptor-hour excluded if RH>RHMAX
              - Receptor-day excluded if fewer than 6 valid receptor-hours
         4 =  Read hourly transmissometer background extinction measurements
              - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
              - Hour excluded if measurement invalid (missing, interference,
                or large RH)
              - Receptor-hour excluded if RH>RHMAX
              - Receptor-day excluded if fewer than 6 valid receptor-hours
         5 =  Read hourly nephelometer background extinction measurements
              - Rayleigh extinction value (BEXTRAY) added to measurement
              - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
              - Hour excluded if measurement invalid (missing, interference,
                or large RH)
              - Receptor-hour excluded if RH>RHMAX
              - Receptor-day excluded if fewer than 6 valid receptor-hours
         6 =  Background extinction from speciated PM concentrations
              - FLAG (2000) monthly RH adjustment factor applied to observed and
                and modeled sulfate and nitrate
         7 =  Use observed weather or prognostic weather information for
              background extinction during weather events; otherwise, use Method 2
              - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
              - F(RH) factor is capped at F(RHMAX)
              - During observed weather events, compute Bext from visual range
                if using an observed weather data file, or
              - During prognostic weather events, use Bext from the prognostic
```

```
          weather file
        - Use Method 2 for hours without a weather event
   8 =  Background extinction from speciated PM concentrations using
        the IMPROVE (2006) variable extinction efficiency formulation
        (MFRH must be set to 4)
        - Split between small and large particle concentrations of
          SULFATES, NITRATES, and ORGANICS is a function of concentration
          and different extinction efficiencies are used for each
        - Source-induced change in visibility includes the increase in
          extinction of the background aerosol due to the change in the
          extinction efficiency that now depends on total concentration.
        - Fsmall(RH) and Flarge(RH) adjustments for small and large
          particles are applied to observed and modeled sulfate and
          nitrate concentrations
        - Fsalt(RH) adjustment for sea salt is applied to background
          sea salt concentrations
        - F(RH) factors are capped at F(RHMAX)
        - RH for Fsmall(RH), Flarge(RH), and Fsalt(RH) may be obtained
          from hourly data as in Method 2 or from the FLAG monthly RH
          adjustment factor used for Method 6 where EPA F(RH) tabulation
          is used to infer RH, or monthly Fsmall, Flarge, and Fsalt RH
          adjustment factors can be directly entered.
          Furthermore, a monthly RH factor may be applied to either hourly
          concentrations or daily concentrations to obtain the 24-hour
          extinction.
          These choices are made using the M8_MODE selection.

Additional inputs used for MVISBK = 1:
--------------------------------------
 Background light extinction (1/Mm)
                         (BEXTBK) -- No default   ! BEXTBK = 12 !
 Percentage of particles affected by relative humidity
                         (RHFRAC) -- No default   ! RHFRAC = 10 !

Additional inputs used for MVISBK = 6,8:
----------------------------------------
 Extinction coefficients for hygroscopic species (modeled and
 background) are computed using a monthly RH adjustment factor
 in place of an hourly RH factor (VISB.DAT file is NOT needed).
 Enter the 12 monthly factors here (RHFAC).  Month 1 is January.

 (RHFAC)  -- No default     ! RHFAC = 0, 0, 0, 0,
                                      0, 0, 0, 0,
                                      0, 0, 0, 0 !

Additional inputs used for MVISBK = 7:
--------------------------------------
 The weather data file (DATSAV abbreviated space-delimited) that
 is identified as VSRN.DAT may contain data for more than one
 station.  Identify the stations that are needed in the order in
 which they will be used to obtain valid weather and visual range.
 The first station that contains valid data for an hour will be
 used.  Enter up to MXWSTA (set in PARAMS file) integer station IDs
 of up to 6 digits each as variable IDWSTA, and enter the corresponding
 time zone for each, as variable TZONE (= UTC-LST).

 A prognostic weather data file with Bext for weather events may be used
 in place of the observed weather file.  Identify this as the VSRN.DAT
 file and use a station ID of IDWSTA = 999999, and TZONE = 0.

 NOTE:  TZONE identifies the time zone used in the dataset.  The
        DATSAV abbreviated space-delimited data usually are prepared
        with UTC time rather than local time, so TZONE is typically
```

```
        set to zero.

 (IDWSTA)   -- No default   * IDWSTA = 000000 *
 (TZONE)    -- No default   * TZONE =      0. *

Additional inputs used for MVISBK = 2,3,6,7,8:
----------------------------------------------
 Background extinction coefficients are computed from monthly
 CONCENTRATIONS of ammonium sulfate (BKSO4), ammonium nitrate (BKNO3),
 coarse particulates (BKPMC), organic carbon (BKOC), soil (BKSOIL), and
 elemental carbon (BKEC).  Month 1 is January.
 (ug/m**3)

 (BKSO4)  -- No default     ! BKSO4 = TBD !
 (BKNO3)  -- No default     ! BKNO3 = TBD !
 (BKPMC)  -- No default     ! BKPMC = TBD !
 (BKOC)   -- No default     ! BKOC  = TBD !
 (BKSOIL) -- No default     ! BKSOIL= TBD !
 (BKEC)   -- No default     ! BKEC  = TBD !
Additional inputs used for MVISBK = 8:
--------------------------------------
 Extinction coefficients for hygroscopic species (modeled and
 background) may be computed using hourly RH values and hourly
 modeled concentrations, or using monthly RH values inferred from
 the RHFAC adjustment factors and either hourly or daily modeled
 concentrations, or using monthly RHFSML, RHFLRG, and RHFSEA adjustment
 factors and either hourly or daily modeled concentrations.

 (M8_MODE) -- Default: 5     ! M8_MODE=  5   !
              FLAG (2008)

      1 = Use hourly RH values from VISB.DAT file with hourly
          modeled and monthly background concentrations.
      2 = Use monthly RH from monthly RHFAC and EPA (2003) f(RH) tabulation
          with hourly modeled and monthly background concentrations.
          (VISB.DAT file is NOT needed).
      3 = Use monthly RH from monthly RHFAC with EPA (2003) f(RH) tabulation
          with daily modeled and monthly background concentrations.
          (VISB.DAT file is NOT needed).
      4 = Use monthly RHFSML, RHFLRG, and RHFSEA with hourly modeled
          and monthly background concentrations.
          (VISB.DAT file is NOT needed).
      5 = Use monthly RHFSML, RHFLRG, and RHFSEA with daily modeled
          and monthly background concentrations.
          (VISB.DAT file is NOT needed).

 Background extinction coefficients are computed from monthly
 CONCENTRATIONS of sea salt (BKSALT).  Month 1 is January.
 (ug/m**3)

 (BKSALT) -- No default     ! BKSALT= TBD !

 Extinction coefficients for hygroscopic species (modeled and
 background) can be computed using monthly RH adjustment factors
 in place of an hourly RH factor (VISB.DAT file is NOT needed).
 Enter the 12 monthly factors here (RHFSML,RHFLRG,RHFSEA).
 Month 1 is January.  (Used if M8_MODE = 4 or 5)

 Small ammonium sulfate and ammonium nitrate particle sizes
 (RHFSML) -- No default     ! RHFSML= TBD !

 Large ammonium sulfate and ammonium nitrate particle sizes
 (RHFLRG) -- No default     ! RHFLRG= TBD !
```

```
     Sea salt particles
     (RHFSEA) -- No default     ! RHFSEA= TBD !

    Additional inputs used for MVISBK = 2,3,5,6,7,8:
    ------------------------------------------------
     Extinction due to Rayleigh scattering is added (1/Mm)
                              (BEXTRAY) -- Default: 10.0 ! BEXTRAY = 10 !

!END!
-------------------------------------------------------------------------------

INPUT GROUP: 3 -- Output options
--------------

Documentation
-------------

    Documentation records contained in the header of the
    CALPUFF output file may be written to the list file.
    Print documentation image?
                                 (LDOC) -- Default: F   !  LDOC = F !

Output Units
------------
    Units for All Output       (IPRTU) -- Default: 1   ! IPRTU =  3   !
                     for            for
                Concentration    Deposition
       1 =         g/m**3         g/m**2/s
       2 =        mg/m**3        mg/m**2/s
       3 =        ug/m**3        ug/m**2/s
       4 =        ng/m**3        ng/m**2/s
       5 =      Odour Units

    Visibility: extinction expressed in 1/Mega-meters (IPRTU is ignored)


Averaging time(s) reported
--------------------------

    1-pd averages           (L1PD) -- Default: T   !   L1PD = F  !
    (pd = averaging period of model output)

    1-hr averages           (L1HR) -- Default: T   !   L1HR = F !

    3-hr averages           (L3HR) -- Default: T   !   L3HR = F  !

    24-hr averages         (L24HR) -- Default: T   !  L24HR = T  !

    Run-length averages    (LRUNL) -- Default: T   !  LRUNL = F  !

    User-specified averaging time in hours, minutes, seconds
    - results for this averaging time are reported if it is not zero

                           (NAVGH) -- Default: 0   !   NAVGH =  0  !
                           (NAVGM) -- Default: 0   !   NAVGM =  0  !
                           (NAVGS) -- Default: 0   !   NAVGS =  0  !


Types of tabulations reported
------------------------------

   1) Visibility: daily visibility tabulations are always reported
```

```
               for the selected receptors when ASPEC = VISIB.
               In addition, any of the other tabulations listed
               below may be chosen to characterize the light
               extinction coefficients.
               [List file or Plot/Analysis File]


 2) Top 50 table for each averaging time selected
    [List file only]
                        (LT50) -- Default: T   !   LT50 = F  !

 3) Top 'N' table for each averaging time selected
    [List file or Plot file]
                       (LTOPN) -- Default: F   !  LTOPN = T  !

      -- Number of 'Top-N' values at each receptor
         selected (NTOP must be <= 4)
                        (NTOP) -- Default: 4   ! NTOP =  1   !

      -- Specific ranks of 'Top-N' values reported
         (NTOP values must be entered)
               (ITOP(4) array) -- Default:     ! ITOP =  1   !
                                  1,2,3,4


 4) Threshold exceedance counts for each receptor and each averaging
    time selected
    [List file or Plot file]
                       (LEXCD) -- Default: F   !  LEXCD = F  !

      -- Identify the threshold for each averaging time by assigning a
         non-negative value (output units).

                                   -- Default: -1.0
          Threshold for  1-hr averages   (THRESH1) !  THRESH1 = -1.0 !
         Threshold for  3-hr averages   (THRESH3) !  THRESH3 = -1.0  !
         Threshold for 24-hr averages  (THRESH24) ! THRESH24 = -1.0  !
         Threshold for NAVG-hr averages (THRESHN) !  THRESHN = -1.0  !


      -- Counts for the shortest averaging period selected can be
         tallied daily, and receptors that experience more than NCOUNT
         counts over any NDAY period will be reported.  This type of
         exceedance violation output is triggered only if NDAY > 0.

         Accumulation period(Days)
                        (NDAY) -- Default: 0   !    NDAY =  0  !
         Number of exceedances allowed
                      (NCOUNT) -- Default: 1   !  NCOUNT =  1  !


 5) Selected day table(s)

    Echo Option -- Many records are written each averaging period
    selected and output is grouped by day
    [List file or Plot file]
                       (LECHO) -- Default: F   !  LECHO = F  !

    Timeseries Option -- Averages at all selected receptors for
    each selected averaging period are written to timeseries files.
    Each file contains one averaging period, and all receptors are
    written to a single record each averaging time.
    [TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT files]
```

```
                          (LTIME) -- Default: F   !  LTIME = F  !

      Peak Value Option -- Averages at all selected receptors for
      each selected averaging period are screened and the peak value
      each period is written to timeseries files.
      Each file contains one averaging period.
      [PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT files]
                          (LPEAK) -- Default: F   !  LPEAK = F  !

        -- Days selected for output
                     (IECHO(366)) -- Default: 366*0
           ! IECHO  = 366*0  !
           (366 values must be entered)
```

Plot output options

```
     Plot files can be created for the Top-N, Exceedance, and Echo
     tables selected above.  Two formats for these files are available,
     DATA and GRID.  In the DATA format, results at all receptors are
     listed along with the receptor location [x,y,val1,val2,...].
     In the GRID format, results at only gridded receptors are written,
     using a compact representation.  The gridded values are written in
     rows (x varies), starting with the most southern row of the grid.
     The GRID format is given the .GRD extension, and includes headers
     compatible with the SURFER(R) plotting software.

     A plotting and analysis file can also be created for the daily
     peak visibility summary output, in DATA format only.

     Generate Plot file output in addition to writing tables
     to List file?
                                (LPLT) -- Default: F   ! LPLT  = F !

     Use GRID format rather than DATA format,
     when available?
                                (LGRD) -- Default: F   ! LGRD  = F !
```

Auxiliary Output Files (for subsequent analyses)

```
      Visibility

      A separate output file may be requested that contains the change
      in visibility at each selected receptor when ASPEC = VISIB.  This
      file can be processed to construct visibility measures that are
      not available in CALPOST.

      Output file with the visibility change at each receptor?
                               (MDVIS) -- Default: 0   ! MDVIS  =  0  !

           0 =  Do Not create file
           1 =  Create file of DAILY (24 hour) Delta-Deciview
           2 =  Create file of DAILY (24 hour) Extinction Change (%)
           3 =  Create file of HOURLY Delta-Deciview
           4 =  Create file of HOURLY Extinction Change (%)
```

Additional Debug Output

```
   Output selected information to List file
```

```
     for debugging?
                                   (LDEBUG) -- Default: F  ! LDEBUG  = F !

    Output hourly extinction information to REPORT.HRV?
     (Visibility Method 7)
                                  (LVEXTHR) -- Default: F  ! LVEXTHR = F !

!END!
```

CALPUFF Demonstration

```
---------------- Run title (3 lines) ------------------------------------------

                    CALPOST MODEL CONTROL FILE
                    --------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

Input Files
-----------

File                       Default File Name
----                       -----------------
Conc/Dep Flux File         MODEL.DAT          ! MODDAT =CALPUFF.CON   !
Relative Humidity File     VISB.DAT           ! VISDAT =  ..\..CPUF.VIS! *
Background Data File       BACK.DAT           * BACKDAT =   *
Transmissometer or         VSRN.DAT           * VSRDAT =   *
Nephelometer Data File      or
DATSAV Weather Data File    or
Prognostic Weather  File

Single-point Met File      SURFACE.DAT        * MET1DAT =   *
 (Used ONLY to identify CALM hours for plume model
  output averaging when MCALMPRO option is used)


Output Files
------------

File                       Default File Name
----                       -----------------
List File                  CALPOST.LST        ! PSTLST =CALPOST.LST   !

Pathname for Timeseries Files   (blank)       * TSPATH =   *
(activate with exclamation points only if
providing NON-BLANK character string)

Pathname for Plot Files   (blank)             * PLPATH =   *
(activate with exclamation points only if
 providing NON-BLANK character string)

User Character String (U) to augment default filenames
(activate with exclamation points only if
 providing NON-BLANK character string)

Timeseries          TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT
Peak Value          PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT

                                              * TSUNAM =   *

Top Nth Rank Plot   RANK(ALL)_ASPEC_ttHR_CONC_TUNAM.DAT
                or  RANK(ii)_ASPEC_ttHR_CONC_TUNAM.GRD

                                              * TUNAM =   *

Exceedance Plot      EXCEED_ASPEC_ttHR_CONC_XUNAM.DAT
                 or  EXCEED_ASPEC_ttHR_CONC_XUNAM.GRD
```

```
                                    * XUNAM =   *

Echo Plot
(Specific Days)
           yyyy_Mmm_Ddd_hhmm(UTCszzzz)_L00_ASPEC_ttHR_CONC.DAT
     or    yyyy_Mmm_Ddd_hhmm(UTCszzzz)_L00_ASPEC_ttHR_CONC.GRD


Visibility Plot      DAILY_VISIB_VUNAM.DAT   ! VUNAM =VTEST   !
(Daily Peak Summary)


Auxiliary Output Files
----------------------

File                      Default File Name
----                      -----------------
Visibility Change         DELVIS.DAT         * DVISDAT =   *

--------------------------------------------------------------------------------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case               ! LCFILES = T !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 132 characters in length
NOTE: (2) Filenames for ALL PLOT and TIMESERIES FILES are constructed
          using a template that includes a pathname, user-supplied
          character(s), and context-specific strings, where
             ASPEC = Species Name
              CONC = CONC Or WFLX Or DFLX Or TFLX
                tt = Averaging Period (e.g. 03)
                ii = Rank (e.g. 02)
                hh = Hour(ending) in LST
             szzzz = LST time zone shift (EST is -0500)
              yyyy = Year(LST)
                mm = Month(LST)
                dd = day of month (LST)
          are determined internally based on selections made below.
          If a path or user-supplied character(s) are supplied, each
          must contain at least 1 non-blank character.

!END!
--------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Option to run all periods found
     in the met. file(s)  (METRUN)        Default: 0   ! METRUN =   1  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in CALPUFF data file(s)

     Starting date:    Year   (ISYR)  --    No default   ! ISYR  =  2008  !
                       Month  (ISMO)  --    No default   ! ISMO  =  1  !
                       Day    (ISDY)  --    No default   ! ISDY  =  1  !
     Starting time:    Hour   (ISHR)  --    No default   ! ISHR  =  0  !
                       Minute (ISMIN) --    No default   ! ISMIN =  0  !
                       Second (ISSEC) --    No default   ! ISSEC =  0  !

     Ending date:      Year   (IEYR)  --    No default   ! IEYR  =  2008  !
                       Month  (IEMO)  --    No default   ! IEMO  =  12  !
                       Day    (IEDY)  --    No default   ! IEDY  =  31  !
```

```
Ending time:       Hour   (IEHR)  --    No default   ! IEHR  =  23  !
                   Minute (IEMIN) --    No default   ! IEMIN =  0  !
                   Second (IESEC) --    No default   ! IESEC =  0  !

(These are only used if METRUN = 0)

All times are in the base time zone of the CALPUFF simulation.
CALPUFF Dataset Version 2.1 contains the zone, but earlier versions
do not, and the zone must be specified here.  The zone is the
number of hours that must be ADDED to the time to obtain UTC (or GMT).
Identify the Base Time Zone for the CALPUFF simulation
                         (BTZONE) -- No default   ! BTZONE = 8.0 !

Process every period of data?
                           (NREP) -- Default: 1   ! NREP  =  1  !
 (1 = every period processed,
  2 = every 2nd period processed,
  5 = every 5th period processed, etc.)

Species & Concentration/Deposition Information
----------------------------------------------

 Species to process (ASPEC)       -- No default   ! ASPEC = N  !
 (ASPEC = VISIB for visibility processing)

 Layer/deposition code (ILAYER)   -- Default: 1   ! ILAYER =  -3  !
   '1'  for CALPUFF concentrations,
   '-1' for dry deposition fluxes,
   '-2' for wet deposition fluxes,
   '-3' for wet+dry deposition fluxes.

 Scaling factors of the form:     -- Defaults:    ! A =  0.0    !
       X(new) = X(old) * A + B         A = 0.0    ! B =  0.0    !
   (NOT applied if A = B = 0.0)        B = 0.0

 Add Hourly Background Concentrations/Fluxes?
                         (LBACK)  -- Default: F   ! LBACK =  F !


 Source of NO2 when ASPEC=NO2 (above) or LVNO2=T (Group 2) may be
 from CALPUFF NO2 concentrations OR from a fraction of CALPUFF NOx
 concentrations.  Specify the fraction of NOx that is treated as NO2
 either as a constant or as a table of fractions that depend on the
 magnitude of the NOx concentration:
                       (NO2CALC) -- Default: 1   ! NO2CALC =   1  !
    0 =  Use NO2 directly (NO2 must be in file)
    1 =  Specify a single NO2/NOx ratio (RNO2NOX)
    2 =  Specify a table NO2/NOx ratios (TNO2NOX)
         (NOTE: Scaling Factors must NOT be used with NO2CALC=2)

 Single NO2/NOx ratio (0.0 to 1.0) for treating some
 or all NOx as NO2, where [NO2] = [NOX] * RNO2NOX
 (used only if NO2CALC = 1)
                       (RNO2NOX) -- Default: 1.0 ! RNO2NOX = 0.8 !

 Table of NO2/NOx ratios that vary with NOx concentration.
 Provide 14 NOx concentrations (ug/m**3) and the corresponding
 NO2/NOx ratio, with NOx increasing in magnitude.  The ratio used
 for a particular NOx concentration is interpolated from the values
 provided in the table.  The ratio for the smallest tabulated NOx
 concentration (the first) is used for all NOx concentrations less
 than the smallest tabulated value, and the ratio for the largest
 tabulated NOx concentration (the last) is used for all NOx
```

```
      concentrations greater than the largest tabulated value.
      (used only if NO2CALC = 2)

       NOx concentration(ug / m3)
                              (CNOX)    -- No default
         ! CNOX = 1.0, 2.0, 3.0, 4.0, 5.0, 6.0, 7.0,
                  8.0, 9.0, 10.0, 11.0, 12.0, 13.0, 14.0 !

       NO2/NOx ratio for each NOx concentration:
                              (TNO2NOX) -- No default
         ! TNO2NOX = 1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0,
                     1.0, 1.0, 1.0, 1.0, 1.0, 1.0, 1.0 !


Source information
------------------

  Option to process source contributions:
         0 =  Process only total reported contributions
         1 =  Sum all individual source contributions and process
         2 =  Run in TRACEBACK mode to identify source
              contributions at a SINGLE receptor
                              (MSOURCE) -- Default: 0   ! MSOURCE =  0  !


Plume Model Output Processing Options
-------------------------------------

  Output from models other than CALPUFF and CALGRID can be written in
  the CONC.DAT format and processed by CALPOST.  Plume models such as
  AERMOD typically do not treat CALM hours, and do not include such hours
  in multiple-hour averages, with specific rules about how many calm hours
  can be removed from an average.  This treatment is known as CALM
  PROCESSING.  Calm periods are identified from wind speeds in the
  meteorological data file for the application, which must be identified
  in Input Group 0 as the single-point meteorological data file MET1DAT.
         0 =  Option is not used for CALPUFF/CALGRID output files
         1 =  Apply CALM processing procedures to multiple-hour averages
                           (MCALMPRO) -- Default: 0   ! MCALMPRO =  0  !

  Format of Single-point Met File
         1 =  AERMOD/AERMET SURFACE file
                            (MET1FMT) -- Default: 1   ! MET1FMT =  1  !


Receptor information
--------------------

  Gridded receptors processed?    (LG) -- Default: F   ! LG  = F  !
  Discrete receptors processed?   (LD) -- Default: F   ! LD  = T  !
  CTSG Complex terrain receptors processed?
                                  (LCT) -- Default: F   ! LCT = F  !

--Report results by DISCRETE receptor RING?
  (only used when LD = T)     (LDRING) -- Default: F   ! LDRING = F  !

--Select range of DISCRETE receptors (only used when LD = T):

  Select ALL DISCRETE receptors by setting NDRECP flag to -1;
                               OR
  Select SPECIFIC DISCRETE receptors by entering a flag (0,1) for each
     0 = discrete receptor not processed
     1 = discrete receptor processed
```

```
  using repeated value notation to select blocks of receptors:
     23*1, 15*0, 12*1
  Flag for all receptors after the last one assigned is set to 0
  (NDRECP) -- Default: -1
                                                  ! NDRECP =  TBD  !


--Select range of GRIDDED receptors (only used when LG = T):

       X index of LL corner (IBGRID) -- Default: -1     ! IBGRID = -1  !
           (-1 OR 1 <= IBGRID <= NX)

       Y index of LL corner (JBGRID) -- Default: -1     ! JBGRID = -1  !
           (-1 OR 1 <= JBGRID <= NY)

       X index of UR corner (IEGRID) -- Default: -1     ! IEGRID = -1  !
           (-1 OR 1 <= IEGRID <= NX)

       Y index of UR corner (JEGRID) -- Default: -1     ! JEGRID = -1  !
           (-1 OR 1 <= JEGRID <= NY)

  Note: Entire grid is processed if IBGRID=JBGRID=IEGRID=JEGRID=-1


--Specific gridded receptors can also be excluded from CALPOST
  processing by filling a processing grid array with 0s and 1s.  If the
  processing flag for receptor index (i,j) is 1 (ON), that receptor
  will be processed if it lies within the range delineated by IBGRID,
  JBGRID,IEGRID,JEGRID and if LG=T. If it is 0 (OFF), it will not be
  processed in the run.  By default, all array values are set to 1 (ON).

  Number of gridded receptor rows provided in Subgroup (1a) to
  identify specific gridded receptors to process
                           (NGONOFF) -- Default: 0      ! NGONOFF =  0  !

!END!


--------------
Subgroup (1a) -- Specific gridded receptors included/excluded
--------------

    Specific gridded receptors are excluded from CALPOST processing
    by filling a processing grid array with 0s and 1s.  A total of
    NGONOFF lines are read here.  Each line corresponds to one 'row'
    in the sampling grid, starting with the NORTHERNMOST row that
    contains receptors that you wish to exclude, and finishing with
    row 1 to the SOUTH (no intervening rows may be skipped).  Within
    a row, each receptor position is assigned either a 0 or 1,
    starting with the westernmost receptor.
       0 = gridded receptor not processed
       1 = gridded receptor processed

    Repeated value notation may be used to select blocks of receptors:
       23*1, 15*0, 12*1

    Because all values are initially set to 1, any receptors north of
    the first row entered, or east of the last value provided in a row,
    remain ON.

    (NGXRECP) -- Default: 1
```

```
-------------------------------------------------------------------------------

INPUT GROUP: 2 -- Visibility Parameters (ASPEC = VISIB)
--------------

    Test visibility options specified to see
    if they conform to FLAG 2008 configuration?
                           (MVISCHECK) -- Default: 1   ! MVISCHECK =   0  !
         0 =  NO checks are made
         1 =  Technical options must conform to FLAG 2008 visibility guidance
                ASPEC = VISIB
                LVNO2 = T
                NO2CALC = 1
                RNO2NOX = 1.0
                MVISBK = 8
                M8_MODE = 5

    Some of the data entered for use with the FLAG 2008 configuration
    are specific to the Class I area being evaluated. These values can
    be checked within the CALPOST user interface when the name of the
    Class I area is provided.

    Name of Class I Area (used for QA purposes only)
                            (AREANAME) -- Default: User  ! AREANAME =  USER !

    Particle growth curve f(RH) for hygroscopic species
                                (MFRH) -- Default: 4   ! MFRH   =  4  !

         1 =  IWAQM (1998) f(RH) curve (originally used with MVISBK=1)
         2 =  FLAG (2000) f(RH) tabulation
         3 =  EPA (2003) f(RH) tabulation
         4 =  IMPROVE (2006) f(RH) tabulations for sea salt, and for small and
              large SULFATE and NITRATE particles;
              Used in Visibility Method 8 (MVISBK = 8 with M8_MODE = 1, 2, or 3)

    Maximum relative humidity (%) used in particle growth curve
                               (RHMAX) -- Default: 98  ! RHMAX  = 98 !

    Modeled species to be included in computing the light extinction
     Include SULFATE?          (LVSO4) -- Default: T   ! LVSO4  = T  !
     Include NITRATE?          (LVNO3) -- Default: T   ! LVNO3  = T  !
     Include ORGANIC CARBON?   (LVOC)  -- Default: T   ! LVOC   = T  !
     Include COARSE PARTICLES? (LVPMC) -- Default: T   ! LVPMC  = T  !
     Include FINE PARTICLES?   (LVPMF) -- Default: T   ! LVPMF  = T  !
     Include ELEMENTAL CARBON? (LVEC)  -- Default: T   ! LVEC   = T  !
     Include NO2 absorption?   (LVNO2) -- Default: F   ! LVNO2  = T  !
              With Visibility Method 8 -- Default: T
                                          FLAG (2008)

    And, when ranking for TOP-N, TOP-50, and Exceedance tables,
     Include BACKGROUND?       (LVBK)  -- Default: T   ! LVBK   = T  !

    Species name used for particulates in MODEL.DAT file
                   COARSE    (SPECPMC) -- Default: PMC ! SPECPMC = PMC !
                   FINE      (SPECPMF) -- Default: PMF ! SPECPMF = PMF !

Extinction Efficiency (1/Mm per ug/m**3)
----------------------------------------
    MODELED particulate species:
               PM  COARSE      (EEPMC) -- Default: 0.6   ! EEPMC  = 0.6 !
               PM  FINE        (EEPMF) -- Default: 1.0   ! EEPMF  = 1 !
    BACKGROUND particulate species:
               PM  COARSE    (EEPMCBK) -- Default: 0.6   ! EEPMCBK = 0.6 !
```

```
    Other species:
              AMMONIUM SULFATE (EESO4) -- Default: 3.0   ! EESO4  = 3 !
              AMMONIUM NITRATE (EENO3) -- Default: 3.0   ! EENO3  = 3 !
              ORGANIC CARBON   (EEOC)  -- Default: 4.0   ! EEOC   = 4 !
              SOIL             (EESOIL)-- Default: 1.0   ! EESOIL = 1 !
              ELEMENTAL CARBON (EEEC)  -- Default: 10.   ! EEEC   = 10 !
              NO2 GAS          (EENO2) -- Default: .1755 ! EENO2  = 0.17 !
    Visibility Method 8:
              AMMONIUM SULFATE (EESO4S)   Set Internally (small)
              AMMONIUM SULFATE (EESO4L)   Set Internally (large)
              AMMONIUM NITRATE (EENO3S)   Set Internally (small)
              AMMONIUM NITRATE (EENO3L)   Set Internally (large)
              ORGANIC CARBON   (EEOCS)    Set Internally (small)
              ORGANIC CARBON   (EEOCL)    Set Internally (large)
              SEA SALT         (EESALT)   Set Internally

Background Extinction Computation
---------------------------------

    Method used for the 24h-average of percent change of light extinction:
    Hourly ratio of source light extinction / background light extinction
    is averaged?               (LAVER) -- Default: F   ! LAVER = F  !


    Method used for background light extinction
                              (MVISBK) -- Default: 8   ! MVISBK =  8  !
                                          FLAG (2008)

         1 =  Supply single light extinction and hygroscopic fraction
              - Hourly F(RH) adjustment applied to hygroscopic background
                and modeled sulfate and nitrate
         2 =  Background extinction from speciated PM concentrations (A)
              - Hourly F(RH) adjustment applied to observed and modeled sulfate
                and nitrate
              - F(RH) factor is capped at F(RHMAX)
         3 =  Background extinction from speciated PM concentrations (B)
              - Hourly F(RH) adjustment applied to observed and modeled sulfate
                and nitrate
              - Receptor-hour excluded if RH>RHMAX
              - Receptor-day excluded if fewer than 6 valid receptor-hours
         4 =  Read hourly transmissometer background extinction measurements
              - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
              - Hour excluded if measurement invalid (missing, interference,
                or large RH)
              - Receptor-hour excluded if RH>RHMAX
              - Receptor-day excluded if fewer than 6 valid receptor-hours
         5 =  Read hourly nephelometer background extinction measurements
              - Rayleigh extinction value (BEXTRAY) added to measurement
              - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
              - Hour excluded if measurement invalid (missing, interference,
                or large RH)
              - Receptor-hour excluded if RH>RHMAX
              - Receptor-day excluded if fewer than 6 valid receptor-hours
         6 =  Background extinction from speciated PM concentrations
              - FLAG (2000) monthly RH adjustment factor applied to observed and
                and modeled sulfate and nitrate
         7 =  Use observed weather or prognostic weather information for
              background extinction during weather events; otherwise, use Method 2
              - Hourly F(RH) adjustment applied to modeled sulfate and nitrate
              - F(RH) factor is capped at F(RHMAX)
              - During observed weather events, compute Bext from visual range
                if using an observed weather data file, or
              - During prognostic weather events, use Bext from the prognostic
```

```
            weather file
          - Use Method 2 for hours without a weather event
     8 =  Background extinction from speciated PM concentrations using
          the IMPROVE (2006) variable extinction efficiency formulation
          (MFRH must be set to 4)
          - Split between small and large particle concentrations of
            SULFATES, NITRATES, and ORGANICS is a function of concentration
            and different extinction efficiencies are used for each
          - Source-induced change in visibility includes the increase in
            extinction of the background aerosol due to the change in the
            extinction efficiency that now depends on total concentration.
          - Fsmall(RH) and Flarge(RH) adjustments for small and large
            particles are applied to observed and modeled sulfate and
            nitrate concentrations
          - Fsalt(RH) adjustment for sea salt is applied to background
            sea salt concentrations
          - F(RH) factors are capped at F(RHMAX)
          - RH for Fsmall(RH), Flarge(RH), and Fsalt(RH) may be obtained
            from hourly data as in Method 2 or from the FLAG monthly RH
            adjustment factor used for Method 6 where EPA F(RH) tabulation
            is used to infer RH, or monthly Fsmall, Flarge, and Fsalt RH
            adjustment factors can be directly entered.
            Furthermore, a monthly RH factor may be applied to either hourly
            concentrations or daily concentrations to obtain the 24-hour
            extinction.
            These choices are made using the M8_MODE selection.

Additional inputs used for MVISBK = 1:
--------------------------------------
 Background light extinction (1/Mm)
                          (BEXTBK) -- No default   ! BEXTBK = 12 !
 Percentage of particles affected by relative humidity
                          (RHFRAC) -- No default   ! RHFRAC = 10 !

Additional inputs used for MVISBK = 6,8:
----------------------------------------
 Extinction coefficients for hygroscopic species (modeled and
 background) are computed using a monthly RH adjustment factor
 in place of an hourly RH factor (VISB.DAT file is NOT needed).
 Enter the 12 monthly factors here (RHFAC).  Month 1 is January.

 (RHFAC)  -- No default     ! RHFAC = 0, 0, 0, 0,
                                      0, 0, 0, 0,
                                      0, 0, 0, 0 !

Additional inputs used for MVISBK = 7:
--------------------------------------
 The weather data file (DATSAV abbreviated space-delimited) that
 is identified as VSRN.DAT may contain data for more than one
 station.  Identify the stations that are needed in the order in
 which they will be used to obtain valid weather and visual range.
 The first station that contains valid data for an hour will be
 used.  Enter up to MXWSTA (set in PARAMS file) integer station IDs
 of up to 6 digits each as variable IDWSTA, and enter the corresponding
 time zone for each, as variable TZONE (= UTC-LST).

 A prognostic weather data file with Bext for weather events may be used
 in place of the observed weather file.  Identify this as the VSRN.DAT
 file and use a station ID of IDWSTA = 999999, and TZONE = 0.

 NOTE:  TZONE identifies the time zone used in the dataset.  The
        DATSAV abbreviated space-delimited data usually are prepared
        with UTC time rather than local time, so TZONE is typically
```

```
       set to zero.

 (IDWSTA)   -- No default   * IDWSTA = 000000 *
 (TZONE)    -- No default   * TZONE =      0. *

Additional inputs used for MVISBK = 2,3,6,7,8:
----------------------------------------------
 Background extinction coefficients are computed from monthly
 CONCENTRATIONS of ammonium sulfate (BKSO4), ammonium nitrate (BKNO3),
 coarse particulates (BKPMC), organic carbon (BKOC), soil (BKSOIL), and
 elemental carbon (BKEC).  Month 1 is January.
 (ug/m**3)

 (BKSO4)  -- No default     ! BKSO4 = 0.02,0.02,0.02,0.02,
                                      0.02,0.02,0.02,0.02,
                                      0.02,0.02,0.02,0.02 !
 (BKNO3)  -- No default     ! BKNO3 = 0.01,0.01,0.01,0.01,
                                      0.01,0.01,0.01,0.01,
                                      0.01,0.01,0.01,0.01 !
 (BKPMC)  -- No default     ! BKPMC = 0.21,0.21,0.21,0.21,
                                      0.21,0.21,0.21,0.21,
                                      0.21,0.21,0.21,0.21 !
 (BKOC)   -- No default     ! BKOC  = 0.06,0.06,0.06,0.06,
                                      0.06,0.06,0.06,0.06,
                                      0.06,0.06,0.06,0.06 !
 (BKSOIL) -- No default     ! BKSOIL= 0.04,0.04,0.04,0.04,
                                      0.04,0.04,0.04,0.04,
                                      0.04,0.04,0.04,0.04 !
 (BKEC)   -- No default     ! BKEC  = 0.00,0.00,0.00,0.00,
                                      0.00,0.00,0.00,0.00,
                                      0.00,0.00,0.00,0.00 !
Additional inputs used for MVISBK = 8:
--------------------------------------
 Extinction coefficients for hygroscopic species (modeled and
 background) may be computed using hourly RH values and hourly
 modeled concentrations, or using monthly RH values inferred from
 the RHFAC adjustment factors and either hourly or daily modeled
 concentrations, or using monthly RHFSML, RHFLRG, and RHFSEA adjustment
 factors and either hourly or daily modeled concentrations.

 (M8_MODE) -- Default: 5     ! M8_MODE=  5   !
              FLAG (2008)

      1 = Use hourly RH values from VISB.DAT file with hourly
          modeled and monthly background concentrations.
      2 = Use monthly RH from monthly RHFAC and EPA (2003) f(RH) tabulation
          with hourly modeled and monthly background concentrations.
          (VISB.DAT file is NOT needed).
      3 = Use monthly RH from monthly RHFAC with EPA (2003) f(RH) tabulation
          with daily modeled and monthly background concentrations.
          (VISB.DAT file is NOT needed).
      4 = Use monthly RHFSML, RHFLRG, and RHFSEA with hourly modeled
          and monthly background concentrations.
          (VISB.DAT file is NOT needed).
      5 = Use monthly RHFSML, RHFLRG, and RHFSEA with daily modeled
          and monthly background concentrations.
          (VISB.DAT file is NOT needed).

 Background extinction coefficients are computed from monthly
 CONCENTRATIONS of sea salt (BKSALT).  Month 1 is January.
 (ug/m**3)

 (BKSALT) -- No default     ! BKSALT= 0.01, 0.01, 0.01, 0.01,
```

```
                                           0.01, 0.01, 0.01, 0.01,
                                           0.01, 0.01, 0.01, 0.01 !

     Extinction coefficients for hygroscopic species (modeled and
     background) can be computed using monthly RH adjustment factors
     in place of an hourly RH factor (VISB.DAT file is NOT needed).
     Enter the 12 monthly factors here (RHFSML,RHFLRG,RHFSEA).
     Month 1 is January.  (Used if M8_MODE = 4 or 5)

     Small ammonium sulfate and ammonium nitrate particle sizes
     (RHFSML) -- No default     ! RHFSML= 5.71, 5.00, 4.46, 4.23,
                                           3.89, 3.55, 3.26, 3.41,
                                           4.02, 5.13, 5.89, 5.98 !

     Large ammonium sulfate and ammonium nitrate particle sizes
     (RHFLRG) -- No default     ! RHFLRG= 3.78, 3.40, 3.10, 2.98,
                                           2.78, 2.60, 2.43, 2.52,
                                           2.84, 3.45, 3.87, 3.92 !

     Sea salt particles
     (RHFSEA) -- No default     ! RHFSEA= 5.24, 4.74, 4.34, 4.18,
                                           3.91, 3.66, 3.41, 3.51,
                                           3.93, 4.78, 5.36, 5.44 !

    Additional inputs used for MVISBK = 2,3,5,6,7,8:
    ------------------------------------------------
     Extinction due to Rayleigh scattering is added (1/Mm)
                           (BEXTRAY) -- Default: 10.0 ! BEXTRAY = 10 !

!END!
-------------------------------------------------------------------------------

INPUT GROUP: 3 -- Output options
--------------

Documentation
-------------

    Documentation records contained in the header of the
    CALPUFF output file may be written to the list file.
    Print documentation image?
                                (LDOC) -- Default: F   !  LDOC = F !

Output Units
------------
    Units for All Output       (IPRTU) -- Default: 1   ! IPRTU =  3   !
                     for             for
                Concentration    Deposition
       1 =         g/m**3         g/m**2/s
       2 =        mg/m**3        mg/m**2/s
       3 =        ug/m**3        ug/m**2/s
       4 =        ng/m**3        ng/m**2/s
       5 =      Odour Units

    Visibility: extinction expressed in 1/Mega-meters (IPRTU is ignored)


Averaging time(s) reported
--------------------------

    1-pd averages           (L1PD) -- Default: T   !   L1PD = F  !
    (pd = averaging period of model output)
```

```
    1-hr averages           (L1HR) -- Default: T   !   L1HR = F !

    3-hr averages           (L3HR) -- Default: T   !   L3HR = F  !

    24-hr averages         (L24HR) -- Default: T   !  L24HR = T  !

    Run-length averages    (LRUNL) -- Default: T   !  LRUNL = F  !

    User-specified averaging time in hours, minutes, seconds
    - results for this averaging time are reported if it is not zero

                           (NAVGH) -- Default: 0   !   NAVGH =  0  !
                           (NAVGM) -- Default: 0   !   NAVGM =  0  !
                           (NAVGS) -- Default: 0   !   NAVGS =  0  !


Types of tabulations reported
------------------------------

   1) Visibility: daily visibility tabulations are always reported
                  for the selected receptors when ASPEC = VISIB.
                  In addition, any of the other tabulations listed
                  below may be chosen to characterize the light
                  extinction coefficients.
                  [List file or Plot/Analysis File]


   2) Top 50 table for each averaging time selected
      [List file only]
                            (LT50) -- Default: T   !   LT50 = F  !

   3) Top 'N' table for each averaging time selected
      [List file or Plot file]
                           (LTOPN) -- Default: F   !  LTOPN = T  !

        -- Number of 'Top-N' values at each receptor
           selected (NTOP must be <= 4)
                            (NTOP) -- Default: 4   ! NTOP =  1   !

        -- Specific ranks of 'Top-N' values reported
           (NTOP values must be entered)
                   (ITOP(4) array) -- Default:     ! ITOP =  1   !
                                      1,2,3,4


   4) Threshold exceedance counts for each receptor and each averaging
      time selected
      [List file or Plot file]
                           (LEXCD) -- Default: F   !  LEXCD = F  !

        -- Identify the threshold for each averaging time by assigning a
           non-negative value (output units).

                                   -- Default: -1.0
            Threshold for  1-hr averages   (THRESH1) !  THRESH1 = -1.0 !
           Threshold for  3-hr averages   (THRESH3) !  THRESH3 = -1.0  !
           Threshold for 24-hr averages  (THRESH24) ! THRESH24 = -1.0  !
           Threshold for NAVG-hr averages (THRESHN) !  THRESHN = -1.0  !


        -- Counts for the shortest averaging period selected can be
           tallied daily, and receptors that experience more than NCOUNT
           counts over any NDAY period will be reported.  This type of
```

```
        exceedance violation output is triggered only if NDAY > 0.

        Accumulation period(Days)
                         (NDAY) -- Default: 0   !    NDAY =  0  !
        Number of exceedances allowed
                       (NCOUNT) -- Default: 1   !  NCOUNT =  1  !


   5) Selected day table(s)

      Echo Option -- Many records are written each averaging period
      selected and output is grouped by day
      [List file or Plot file]
                        (LECHO) -- Default: F   !  LECHO = F  !

      Timeseries Option -- Averages at all selected receptors for
      each selected averaging period are written to timeseries files.
      Each file contains one averaging period, and all receptors are
      written to a single record each averaging time.
      [TSERIES_ASPEC_ttHR_CONC_TSUNAM.DAT files]
                        (LTIME) -- Default: F   !  LTIME = F  !

      Peak Value Option -- Averages at all selected receptors for
      each selected averaging period are screened and the peak value
      each period is written to timeseries files.
      Each file contains one averaging period.
      [PEAKVAL_ASPEC_ttHR_CONC_TSUNAM.DAT files]
                        (LPEAK) -- Default: F   !  LPEAK = F  !

        -- Days selected for output
                   (IECHO(366)) -- Default: 366*0
           ! IECHO  = 366*0  !
           (366 values must be entered)

Plot output options
-------------------

     Plot files can be created for the Top-N, Exceedance, and Echo
     tables selected above.  Two formats for these files are available,
     DATA and GRID.  In the DATA format, results at all receptors are
     listed along with the receptor location [x,y,val1,val2,...].
     In the GRID format, results at only gridded receptors are written,
     using a compact representation.  The gridded values are written in
     rows (x varies), starting with the most southern row of the grid.
     The GRID format is given the .GRD extension, and includes headers
     compatible with the SURFER(R) plotting software.

     A plotting and analysis file can also be created for the daily
     peak visibility summary output, in DATA format only.

     Generate Plot file output in addition to writing tables
     to List file?
                              (LPLT) -- Default: F   ! LPLT  = F !

     Use GRID format rather than DATA format,
     when available?
                              (LGRD) -- Default: F   ! LGRD  = F !


Auxiliary Output Files (for subsequent analyses)
------------------------------------------------

      Visibility
```

```
      A separate output file may be requested that contains the change
      in visibility at each selected receptor when ASPEC = VISIB.  This
      file can be processed to construct visibility measures that are
      not available in CALPOST.

      Output file with the visibility change at each receptor?
                                 (MDVIS) -- Default: 0   ! MDVIS  =  0  !

           0 =  Do Not create file
           1 =  Create file of DAILY (24 hour) Delta-Deciview
           2 =  Create file of DAILY (24 hour) Extinction Change (%)
           3 =  Create file of HOURLY Delta-Deciview
           4 =  Create file of HOURLY Extinction Change (%)


Additional Debug Output
-----------------------

   Output selected information to List file
    for debugging?
                                (LDEBUG) -- Default: F  ! LDEBUG  = F !

   Output hourly extinction information to REPORT.HRV?
    (Visibility Method 7)
                               (LVEXTHR) -- Default: F  ! LVEXTHR = F !

!END!
```

```
POSTUTIL Run Deposition Analysis
---------------- Run title (3 lines) ------------------------------------------

                    POSTUTIL MODEL CONTROL FILE
                    ---------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names
--------------

-------------
Subgroup (0a)
-------------

Output Files
------------

 File            Default File Name
 ----            -----------------
 List File       POSTUTIL.LST       ! UTLLST =putildep.lst   !
 Data File       MODEL.DAT          ! UTLDAT =putildep.dat   !


Input Files
-----------

 A time-varying file of "background" concentrations can be included
 when the ammonia-limiting method (ALM) for setting the HNO3/NO3
 concentration partition is accomplished in 1 step.  This option
 is selected by setting MNITRATE=3 in Input Group 1.
 Species required in the "background" concentration file are:
 SO4, NO3, HNO3 and TNH3 (total NH3).

 File            Default File Name
 ----            -----------------
 BCKG File       BCKGALM.DAT         * BCKGALM =BCKGALM.DAT     *


 A number of CALPUFF data files may be processed in this application.
 The files may represent individual CALPUFF simulations that were made
 for a specific set of species and/or sources.  Specify the total number
 of CALPUFF runs you wish to combine, and provide the filename for each
 in subgroup 0b.

     Number of CALPUFF data files (NFILES)
                                     Default: 1       ! NFILES  = 2   !


 Meteorological data files are needed for the HNO3/NO3 partition option.
 Three types of meteorological data files can be used:
       METFM= 0 - CALMET.DAT
       METFM= 1 - 1-D file with RH, Temp and Rhoair timeseries
       METFM= 2 - 2-D files with either Rh, Temp or Rhoair in each
                  (3 2_D files are needed)
      The default is to use CALMET.DAT files.

                                     Default: 0       ! METFM   = 0   !


 Multiple meteorological data files may be used in sequence to span the
 processing period.  Specify the number of time-period files (NMET) that
```

```
 you need to use, and provide a filename for each in subgroup 0b.
 - NMET is 0 if no meteorological files are provided
 - NMET is 1 if METFM=1 (multiple file feature is not available)
 - NMET is 1 or more if METFM=0 or 2 (multiple CALMET files or 2DMET files)

     Number of meteorological data file time-periods (NMET)
                                  Default: 0       ! NMET    = 0   !


 All filenames will be converted to lower case if LCFILES = T
 Otherwise, if LCFILES = F, filenames will be converted to UPPER CASE

     Convert filenames to lower case?  Default: T     ! LCFILES = T !
         T = lower case
         F = UPPER CASE

!END!

-----------------------------------------------------------
 NOTE: file/path names can be up to 70 characters in length
-----------------------------------------------------------

-------------
Subgroup (0b)
-------------

NMET CALMET Data Files (METFM=0):

Input File      Default File Name
----------      -----------------
  1             MET.DAT    * UTLMET =~calpuff_jan08.met  *   *END*


NMET 1-D Data Files (METFM=1):

Input File      Default File Name
----------      -----------------
   1            MET_1D.DAT         * MET1D   = MET_1D.DAT * *END*


NMET 2-D Data Files of Each Type (METFM=2):

Input File      Default File Name
----------      -----------------
   1            RHUMD.DAT          * M2DRHU  = RELHUM.DAT * *END*
   1            TEMP.DAT           * M2DTMP  = TEMP.DAT   * *END*
   1            RHOAIR.DAT         * M2DRHO  = RHOAIR.DAT * *END*


NFILES CALPUFF Data Files:

Input File      Default File Name
----------      -----------------
   1            CALPUFF.DAT        ! MODDAT =cpuf08.dfx! !END!
   2            CALPUFF.DAT        ! MODDAT =cpuf08.wfx! !END!



-------------
Note:  provide NMET lines of the form   * UTLMET = name * *END*

                                   or   * MET1D  = name * *END*
```

```
                                       or    * M2DRHU = name * *END*
                                    (and)    * M2DTMP = name * *END*
                                    (and)    * M2DRHO = name * *END*

       and NFILES lines of the form          * MODDAT = name * *END*

       where the * should be replaced with an exclamation point,
       the special delimiter character.


--------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------

     Starting date:    Year  (ISYR) --    No default   ! ISYR  =  2008 !
                       Month (ISMO) --    No default   ! ISMO  = 1   !
                       Day   (ISDY) --    No default   ! ISDY  = 1   !
                       Hour  (ISHR) --    No default   ! ISHR  = 1   !

     Number of periods to process
                                (NPER) -- No default   ! NPER  = 8784   !

     Number of species to process from CALPUFF runs
                            (NSPECINP) -- No default   ! NSPECINP = 5 !

     Number of species to write to output file
                            (NSPECOUT) -- No default   ! NSPECOUT = 2 !

     Number of species to compute from those modeled
     (must be no greater than NSPECOUT)
                            (NSPECCMP) -- No default   ! NSPECCMP = 2 !


 When multiple files are used, a species name may appear in more than
 one file.  Data for this species will be summed (appropriate if the
 CALPUFF runs use different source groups).  If this summing is not
 appropriate, remove duplicate species from the file(s).

     Stop run if duplicate species names
     are found? (MDUPLCT)           Default: 0       ! MDUPLCT  =  0  !
        0 = no  (i.e., duplicate species are summed)
        1 = yes (i.e., run is halted)

 Data for each species in a CALPUFF data file may also be scaled as
 they are read.  This can be done to alter the emission rate of all
 sources that were modeled in a particular CALPUFF application.
 The scaling factor for each species is entered in Subgroup (2d), for
 each file for which scaling is requested.

     Number of CALPUFF data files that will be scaled
     (must be no greater than NFILES)
     (NSCALED)                      Default: 0       ! NSCALED = 0 !


 Ammonia-Limiting Method Option to recompute the HNO3/NO3 concentration
 partition prior to performing other actions is controlled by MNITRATE.
 This option will NOT alter any deposition fluxes contained in the CALPUFF
 file(s).  Three partition selections are provided.  The first two are
 typically used in sequence (POSTUTIL is run more than once).  The first
 selection (MNITRATE=1) computes the partition for the TOTAL (all sources)
 concentration fields (SO4, NO3, HNO3; NH3), and the second (MNITRATE=2)
```

```
uses this partition (from the previous application of POSTUTIL) to
compute the partition for individual source groups.  The third selection
(MNITRATE=3) can be used instead in a single POSTUTIL application if a
file of background concentrations is provided (BCKGALM in Input Group 0).

Required information for MNITRATE=1 includes:
         species NO3, HNO3, and SO4
         NH3 concentration(s)
         met. data file for RH and T

Required information for MNITRATE=2 includes:
         species NO3 and HNO3 for a source group
         species NO3ALL and HNO3ALL for all source groups, properly
         partitioned

Required information for MNITRATE=3 includes:
         species NO3, HNO3, and SO4 for a source group
         species NO3, HNO3, SO4 and TNH3 from the background BCKGALM file
         If TNH3 is not in the background BCKGALM file, monthly TNH3
         concentrations are used (BCKTNH3)

     Recompute the HNO3/NO3 partition for concentrations?
     (MNITRATE)                     Default: 0       ! MNITRATE  =  0  !
        0 = no
        1 = yes, for all sources combined
        2 = yes, for a source group
        3 = yes, ALM application in one step


SOURCE OF AMMONIA:

Ammonia may be available as a modeled species in the CALPUFF files,
and it may or may not be appropriate to use it for repartitioning NO3/HNO3
(in option MNITRATE=1 or MNITRATE=3).  Its use is contolled by NH3TYP.
When NH3 is listed as a processed species in Subgroup (2a), as one of
the NSPECINP ASPECI entries, and the right option is chosen for NH3TYP,
the NH3 modeled values from the CALPUFF concentration files will be used
in the chemical equilibrium calculation.

NH3TYP also controls when monthly background ammonia values are used.  Both
gaseous (NH3) and total (TNH3) ammonia can be provided monthly as
BCKNH3/BCKTNH3.

     What is the input source of Ammonia?
     (NH3TYP)                       No Default       ! NH3TYP = 3  !
        0 = No background will be used.
            ONLY NH3 from the concentration
            files listed in Subgroup (2a) as
            a processed species will be used.
            (Cannot be used with MNITRATE=3)

        1 = NH3 Monthly averaged background (BCKNH3)
            listed below will be added to NH3 from
            concentration files listed in Subgroup (2a)

        2 = NH3 from background concentration file BCKGALM
            will be added to NH3 from concentration files
            listed in Subgroup (2a)
            (ONLY possible for MNITRATE=3)

        3 = NH3 Monthly averaged background (BCKNH3)
            listed below will be used alone.
```

```
        4 = NH3 from background concentration file BCKGALM
            will be used alone
            (ONLY possible for MNITRATE=3)
```

NH3TYP	NH3 CONC	NH3 FROM BCKNH3	NH3 FROM BCKGALM
0	X	0	0
1	X	X	0
2	X	0	X
3	0	X	0
4	0	0	X

```
     Default monthly (12 values) background ammonia concentration (ppb)
     used for HNO3/NO3 partition:

      Gaseous NH3 (BCKNH3)            Default: -999
      *  BCKNH3 = 12*17 *

      Total TNH3  (BCKTNH3)           Default: -999
      * BCKTNH3 = 1., 1., 1., 1.1, 1.4, 1.3, 1.3, 1.2, 4*1. *

     If a single value is entered, this is used for all 12 months.
     Month 1 is JANUARY, Month 12 is DECEMBER.

!END!
-------------------------------------------------------------------------------

INPUT GROUP: 2 -- Species Processing Information
--------------

-------------
Subgroup (2a)
-------------

  The following NSPECINP species will be processed:

! ASPECI =          SO2 !         !END!
! ASPECI =          SO4 !         !END!
! ASPECI =          NOX !         !END!
! ASPECI =          HNO3!         !END!
! ASPECI =          NO3 !         !END!


-------------
Subgroup (2b)
-------------

  The following NSPECOUT species will be written:

! ASPECO =          S !         !END!
! ASPECO =          N !         !END!

Subgroup (2c)
-------------

  The following NSPECCMP species will be computed by scaling and summing
  one or more of the processed input species.  Identify the name(s) of
```

```
  the computed species and provide the scaling factors for each of the
  NSPECINP input species (NSPECCMP groups of NSPECINP+1 lines each):

! CSPECCMP =        N !
!     SO2  =     0.0 !
!     SO4  =     0.291667 !
!     NOX  =     0.30435 !
!    HNO3  =     0.222222 !
!     NO3  =     0.451613 !
!END!

! CSPECCMP =        S !
!     SO2  =     0.500000 !
!     SO4  =     0.333333 !
!     NOX  =     0.0 !
!    HNO3  =     0.0 !
!     NO3  =     0.0 !
!END!

-------------
Subgroup (2d)
-------------

  Each species in NSCALED CALPUFF data files may be scaled before being
  processed (e.g., to change the emission rate for all sources modeled
  in the run that produced a data file).  For each file, identify the
  file name and then provide the name(s) of the scaled species and the
  corresponding scaling factors (A,B where x' = Ax+B).

               A(Default=1.0)      B(Default=0.0)
               --------------      --------------

* MODDAT =NOFILES.DAT    *
*     SO2  =      1.1,                 0.0   *
*     SO4  =      1.5,                 0.0   *
*    HNO3  =      0.8,                 0.0   *
*     NO3  =      0.1,                 0.0   *
*END*
```

Attachment E

Sample CALMET Input File

```
--------------- Run title (3 lines) ------------------------------------------

                    CALMET MODEL CONTROL FILE
                    --------------------------

-------------------------------------------------------------------------------

INPUT GROUP: 0 -- Input and Output File Names


Subgroup (a)
------------
Default Name  Type          File Name
------------  ----          ---------
GEO.DAT       input    ! GEODAT=GEO4KM.DAT       !
SURF.DAT      input    ! SRFDAT=SURF.DAT      !
CLOUD.DAT     input    * CLDDAT=            *
PRECIP.DAT    input    ! PRCDAT=PRECIP.DAT    !
WT.DAT        input    * WTDAT=             *

CALMET.LST    output   ! METLST=CMET.LST     !
CALMET.DAT    output   ! METDAT=CMET.DAT    !
PACOUT.DAT    output   * PACDAT=            *

All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

    Number of upper air stations (NUSTA)  No default     ! NUSTA =  1  !
    Number of overwater met stations
                                 (NOWSTA) No default     ! NOWSTA =  1  !

NUMBER OF PROGNOSTIC and IGF-CALMET FILEs:

    Number of MM4/MM5/3D.DAT files
                                 (NM3D) No default       ! NM3D =  12  !

    Number of IGF-CALMET.DAT files
                                 (NIGF)   No default     ! NIGF =  0  !

                       !END!
--------------------------------------------------------------------------------
Subgroup (b)
---------------------------------
Upper air files (one per station)
---------------------------------
Default Name  Type       File Name
------------  ----       ---------
UP1.DAT       input     1  ! UPDAT=UPPWM.DAT!    !END!

--------------------------------------------------------------------------------
Subgroup (c)
-----------------------------------------
Overwater station files (one per station)
-----------------------------------------
Default Name  Type       File Name
------------  ----       ---------
SEA1.DAT       input     1  ! SEADAT=SEA.DAT!    !END!
--------------------------------------------------------------------------------
```

```
Subgroup (d)
------------------------------------------------
MM4/MM5/3D.DAT files (consecutive or overlapping)
------------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
MM51.DAT       input     1  * M3DDAT=LSP2003.DAT *    *END*
--------------------------------------------------------------------------------
Subgroup (e)
-------------------------------------------------
IGF-CALMET.DAT files (consecutive or overlapping)
-------------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
IGFn.DAT       input     1  * IGFDAT=CALMET0.DAT *    *END*
--------------------------------------------------------------------------------
Subgroup (f)
----------------
Other file names
----------------

Default Name  Type       File Name
------------  ----       ---------
DIAG.DAT      input      * DIADAT=                  *
PROG.DAT      input      * PRGDAT=                  *

TEST.PRT      output     * TSTPRT=                  *
TEST.OUT      output     * TSTOUT=                  *
TEST.KIN      output     * TSTKIN=                  *
TEST.FRD      output     * TSTFRD=                  *
TEST.SLP      output     * TSTSLP=                  *
DCST.GRD      output     * DCSTGD=                  *

--------------------------------------------------------------------------------
NOTES: (1) File/path names can be up to 70 characters in length
       (2) Subgroups (a) and (f) must have ONE 'END' (surrounded by
           delimiters) at the end of the group
       (3) Subgroups (b) through (e) are included ONLY if the corresponding
           number of files (NUSTA, NOWSTA, NM3D, NIGF) is not 0, and each must have
           an 'END' (surround by delimiters) at the end of EACH LINE

                         !END!


-------------------------------------------------------------------------------

INPUT GROUP: 1 -- General run control parameters
--------------


     Starting date:   Year (IBYR) -- No default       ! IBYR=  2006  !
                     Month (IBMO) -- No default       ! IBMO=  1  !
                       Day (IBDY) -- No default       ! IBDY=  1  !
                      Hour (IBHR) -- No default       ! IBHR=  0  !

     Note: IBHR is the time at the END of the first hour of the simulation
           (IBHR=1, the first hour of a day, runs from 00:00 to 01:00)

     Base time zone        (IBTZ) -- No default       ! IBTZ=  8  !
        PST = 08, MST = 07
        CST = 06, EST = 05

     Length of run (hours) (IRLG) -- No default       ! IRLG=  8760  !
```

```
     Run type            (IRTYPE) -- Default: 1       ! IRTYPE=  1  !

        0 = Computes wind fields only
        1 = Computes wind fields and micrometeorological variables
            (u*, w*, L, zi, etc.)
        (IRTYPE must be 1 to run CALPUFF or CALGRID)

     Compute special data fields required
     by CALGRID (i.e., 3-D fields of W wind
     components and temperature)
     in additional to regular            Default: T    ! LCALGRD = T !
     fields ? (LCALGRD)
     (LCALGRD must be T to run CALGRID)

      Flag to stop run after
      SETUP phase (ITEST)             Default: 2       ! ITEST=  2   !
      (Used to allow checking
      of the model inputs, files, etc.)
      ITEST = 1 - STOPS program after SETUP phase
      ITEST = 2 - Continues with execution of
                  COMPUTATIONAL phase after SETUP


     Test options specified to see if
     they conform to regulatory
     values? (MREG)                   No Default       ! MREG =  1   !

        0 = NO checks are made
        1 = Technical options must conform to USEPA guidance
                  IMIXH    -1       Maul-Carson convective mixing height
                                    over land; OCD mixing height overwater
                  ICOARE   0        OCD deltaT method for overwater fluxes
                  THRESHL  0.0      Threshold buoyancy flux over land needed
                                    to sustain convective mixing height growth

!END!

--------------------------------------------------------------------------------

INPUT GROUP: 2 -- Map Projection and Grid Information for Output
--------------

     Projection
     ----------

     Map projection for all X,Y (km)
     (PMAP)                      Default: UTM    ! PMAP = LCC !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
         PS  :  Polar Stereographic
         EM  :  Equatorial Mercator
         LAZA:  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                     Default=0.0     ! FEAST  = 0.0 !
     (FNORTH)                    Default=0.0     ! FNORTH = 0.0 !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
```

```
      (IUTMZN)                    No Default      ! IUTMZN = -999 !

      Hemisphere for UTM projection?
      (Used only if PMAP=UTM)
      (UTMHEM)                    Default: N      ! UTMHEM = N !
          N   :  Northern hemisphere projection
          S   :  Southern hemisphere projection

      Latitude and Longitude (decimal degrees) of projection origin
      (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
      (RLAT0)                     No Default      ! RLAT0 = 34.06179N !
      (RLON0)                     No Default      ! RLON0 = 117.8192W !

          TTM :  RLON0 identifies central (true N/S) meridian of projection
                 RLAT0 selected for convenience
          LCC :  RLON0 identifies central (true N/S) meridian of projection
                 RLAT0 selected for convenience
          PS  :  RLON0 identifies central (grid N/S) meridian of projection
                 RLAT0 selected for convenience
          EM  :  RLON0 identifies central meridian of projection
                 RLAT0 is REPLACED by 0.0N (Equator)
          LAZA:  RLON0 identifies longitude of tangent-point of mapping plane
                 RLAT0 identifies latitude of tangent-point of mapping plane

      Matching parallel(s) of latitude (decimal degrees) for projection
      (Used only if PMAP= LCC or PS)
      (RLAT1)                     No Default      ! RLAT1 = 33.0N !
      (RLAT2)                     No Default      ! RLAT2 = 35.0N !

          LCC :  Projection cone slices through Earth's surface at RLAT1 and RLAT2
          PS  :  Projection plane slices through Earth at RLAT1
                 (RLAT2 is not used)

      ----------
      Note:  Latitudes and longitudes should be positive, and include a
             letter N,S,E, or W indicating north or south latitude, and
             east or west longitude.  For example,
             35.9  N Latitude  =  35.9N
             118.7 E Longitude = 118.7E


      Output Datum-Region
      -------------------

      The Datum-Region for the output coordinates is identified by a character
      string.  Many mapping products currently available use the model of the
      Earth known as the World Geodetic System 1984 (WGS-84).  Other local
      models may be in use, and their selection in TERREL will make its output
      consistent with local mapping products.  The list of Datum-Regions with
      official transformation parameters is provided by the National Imagery and
      and Mapping Agency (NIMA).

 Datum-region for output coordinates
      (DATUM)                     Default: WGS-84    ! DATUM = WGS-84  !


      Horizontal grid definition:
      ---------------------------

      Rectangular grid defined for projection PMAP,
      with X the Easting and Y the Northing coordinate

             No. X grid cells (NX)      No default     ! NX =     !
```

```
          No. Y grid cells (NY)      No default     ! NY =     !

     Grid spacing (DGRIDKM)          No default     ! DGRIDKM = 4 !
                                     Units: km

     Reference grid coordinate of
     SOUTHWEST corner of grid cell (1,1)

        X coordinate (XORIGKM)       No default     ! XORIGKM =  !
        Y coordinate (YORIGKM)       No default     ! YORIGKM =  !
                                     Units: km


     Vertical grid definition:
     -------------------------

        No. of vertical layers (NZ)  No default     ! NZ =  10  !

        Cell face heights in arbitrary
        vertical grid (ZFACE(NZ+1))  No defaults
                                     Units: m
        ! ZFACE = 0.,20.,40.,80.,160.,320.,640.,1200.,2000.,3000, 4000. !

!END!


--------------------------------------------------------------------------------
INPUT GROUP: 3 -- Output Options
--------------


    DISK OUTPUT OPTION

       Save met. fields in an unformatted
       output file ?            (LSAVE)  Default: T     ! LSAVE = T !
       (F = Do not save, T = Save)

       Type of unformatted output file:
       (IFORMO)                          Default: 1    ! IFORMO =  1  !

            1 = CALPUFF/CALGRID type file (CALMET.DAT)
            2 = MESOPUFF-II type file     (PACOUT.DAT)


    LINE PRINTER OUTPUT OPTIONS:

       Print met. fields ?  (LPRINT)     Default: F     ! LPRINT = F !
       (F = Do not print, T = Print)
       (NOTE: parameters below control which
              met. variables are printed)

       Print interval
       (IPRINF) in hours                 Default: 1     ! IPRINF =  1  !
       (Meteorological fields are printed
        every  1  hours)


       Specify which layers of U, V wind component
       to print (IUVOUT(NZ)) -- NOTE: NZ values must be entered
       (0=Do not print, 1=Print)
       (used only if LPRINT=T)       Defaults: NZ*0
       ! IUVOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !
       -----------------------
```

```
 Specify which levels of the W wind component to print
 (NOTE: W defined at TOP cell face --  10  values)
 (IWOUT(NZ)) -- NOTE: NZ values must be entered
 (0=Do not print, 1=Print)
 (used only if LPRINT=T & LCALGRD=T)
 -----------------------------------
                                     Defaults: NZ*0
  ! IWOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !


 Specify which levels of the 3-D temperature field to print
 (ITOUT(NZ)) -- NOTE: NZ values must be entered
 (0=Do not print, 1=Print)
 (used only if LPRINT=T & LCALGRD=T)
 -----------------------------------
                                     Defaults: NZ*0
  ! ITOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !

 Specify which meteorological fields
 to print
 (used only if LPRINT=T)             Defaults: 0 (all variables)
 -----------------------


   Variable            Print ?
                   (0 = do not print,
                    1 = print)
   --------        ------------------

!  STABILITY  =           0           ! - PGT stability class
!  USTAR      =           0           ! - Friction velocity
!  MONIN      =           0           ! - Monin-Obukhov length
!  MIXHT      =           0           ! - Mixing height
!  WSTAR      =           0           ! - Convective velocity scale
!  PRECIP     =           0           ! - Precipitation rate
!  SENSHEAT   =           0           ! - Sensible heat flux
!  CONVZI     =           0           ! - Convective mixing ht.


 Testing and debug print options for micrometeorological module

    Print input meteorological data and
    internal variables (LDB)         Default: F       ! LDB = F !
    (F = Do not print, T = print)
    (NOTE: this option produces large amounts of output)

    First time step for which debug data
    are printed (NN1)                Default: 1       ! NN1 =  1  !

    Last time step for which debug data
    are printed (NN2)                Default: 1       ! NN2 =  1  !

    Print distance to land
    internal variables (LDBCST)      Default: F       ! LDBCST = F !
    (F = Do not print, T = print)
    (Output in .GRD file DCST.GRD, defined in input group 0)

 Testing and debug print options for wind field module
 (all of the following print options control output to
  wind field module's output files: TEST.PRT, TEST.OUT,
  TEST.KIN, TEST.FRD, and TEST.SLP)
```

```
        Control variable for writing the test/debug
        wind fields to disk files (IOUTD)
        (0=Do not write, 1=write)        Default: 0       ! IOUTD =  0  !

        Number of levels, starting at the surface,
        to print (NZPRN2)                Default: 1       ! NZPRN2 =  0  !

        Print the INTERPOLATED wind components ?
        (IPR0) (0=no, 1=yes)             Default: 0       !  IPR0 =  0  !

        Print the TERRAIN ADJUSTED surface wind
        components ?
        (IPR1) (0=no, 1=yes)             Default: 0       !  IPR1 =  0  !

        Print the SMOOTHED wind components and
        the INITIAL DIVERGENCE fields ?
        (IPR2) (0=no, 1=yes)             Default: 0       !  IPR2 =  0  !

        Print the FINAL wind speed and direction
        fields ?
        (IPR3) (0=no, 1=yes)             Default: 0       !  IPR3 =  0  !

        Print the FINAL DIVERGENCE fields ?
        (IPR4) (0=no, 1=yes)             Default: 0       !  IPR4 =  0  !

        Print the winds after KINEMATIC effects
        are added ?
        (IPR5) (0=no, 1=yes)             Default: 0       !  IPR5 =  0  !

        Print the winds after the FROUDE NUMBER
        adjustment is made ?
        (IPR6) (0=no, 1=yes)             Default: 0       !  IPR6 =  0  !

        Print the winds after SLOPE FLOWS
        are added ?
        (IPR7) (0=no, 1=yes)             Default: 0       !  IPR7 =  0  !

        Print the FINAL wind field components ?
        (IPR8) (0=no, 1=yes)             Default: 0       !  IPR8 =  0  !

!END!


-------------------------------------------------------------------------------

INPUT GROUP: 4 -- Meteorological data options
--------------

    NO OBSERVATION MODE             (NOOBS)  Default: 0     ! NOOBS =  0   !
          0 = Use surface, overwater, and upper air stations
          1 = Use surface and overwater stations (no upper air observations)
              Use MM4/MM5/3D for upper air data
          2 = No surface, overwater, or upper air observations
              Use MM4/MM5/3D for surface, overwater, and upper air data

    NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS

       Number of surface stations   (NSSTA)  No default     ! NSSTA =  TBD  !

       Number of precipitation stations
       (NPSTA=-1: flag for use of MM5/3D precip data)
                                    (NPSTA)  No default     ! NPSTA =  TBD  !
```

```
    CLOUD DATA OPTIONS
       Gridded cloud fields:
                                   (ICLOUD)  Default: 0     ! ICLOUD =  0  !
       ICLOUD = 0 - Gridded clouds not used
       ICLOUD = 1 - Gridded CLOUD.DAT generated as OUTPUT
       ICLOUD = 2 - Gridded CLOUD.DAT read as INPUT
       ICLOUD = 3 - Gridded cloud cover computed from prognostic fields

    FILE FORMATS

       Surface meteorological data file format
                                   (IFORMS)  Default: 2     ! IFORMS =  2  !
       (1 = unformatted (e.g., SMERGE output))
       (2 = formatted   (free-formatted user input))

       Precipitation data file format
                                   (IFORMP)  Default: 2     ! IFORMP =  2  !
       (1 = unformatted (e.g., PMERGE output))
       (2 = formatted   (free-formatted user input))

       Cloud data file format
                                   (IFORMC)  Default: 2     ! IFORMC =  2  !
       (1 = unformatted - CALMET unformatted output)
       (2 = formatted   - free-formatted CALMET output or user input)

!END!


-------------------------------------------------------------------------------

INPUT GROUP: 5 -- Wind Field Options and Parameters
--------------


    WIND FIELD MODEL OPTIONS
       Model selection variable (IWFCOD)     Default: 1      ! IWFCOD =  1  !
          0 = Objective analysis only
          1 = Diagnostic wind module

       Compute Froude number adjustment
       effects ? (IFRADJ)                    Default: 1      ! IFRADJ =  1  !
       (0 = NO, 1 = YES)

       Compute kinematic effects ? (IKINE)   Default: 0      ! IKINE  =  0  !
       (0 = NO, 1 = YES)

       Use O'Brien procedure for adjustment
       of the vertical velocity ? (IOBR)     Default: 0      ! IOBR =  0  !
       (0 = NO, 1 = YES)

       Compute slope flow effects ? (ISLOPE) Default: 1      ! ISLOPE  =  1  !
       (0 = NO, 1 = YES)

       Extrapolate surface wind observations
       to upper layers ? (IEXTRP)            Default: -4     ! IEXTRP = -4  !
       (1 = no extrapolation is done,
        2 = power law extrapolation used,
        3 = user input multiplicative factors
            for layers 2 - NZ used (see FEXTRP array)
        4 = similarity theory used
        -1, -2, -3, -4 = same as above except layer 1 data
            at upper air stations are ignored
```

```
    Extrapolate surface winds even
    if calm? (ICALM)                     Default: 0      ! ICALM  =  0  !
    (0 = NO, 1 = YES)

    Layer-dependent biases modifying the weights of
    surface and upper air stations (BIAS(NZ))
      -1<=BIAS<=1
    Negative BIAS reduces the weight of upper air stations
      (e.g. BIAS=-0.1 reduces the weight of upper air stations
    by 10%; BIAS= -1, reduces their weight by 100 %)
    Positive BIAS reduces the weight of surface stations
      (e.g. BIAS= 0.2 reduces the weight of surface stations
    by 20%; BIAS=1 reduces their weight by 100%)
    Zero BIAS leaves weights unchanged (1/R**2 interpolation)
    Default: NZ*0
                           ! BIAS =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,
0  !

    Minimum distance from nearest upper air station
    to surface station for which extrapolation
    of surface winds at surface station will be allowed
    (RMIN2: Set to -1 for IEXTRP = 4 or other situations
     where all surface stations should be extrapolated)
                                         Default: 4.     ! RMIN2 = -1.0 !

    Use gridded prognostic wind field model
    output fields as input to the diagnostic
    wind field model (IPROG)             Default: 0      ! IPROG =  14  !
    (0 = No, [IWFCOD = 0 or 1]
     1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]
     2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD = 1]
     3 = Yes, use winds from MM4.DAT file as Step 1 field [IWFCOD = 0]
     4 = Yes, use winds from MM4.DAT file as initial guess field [IWFCOD = 1]
     5 = Yes, use winds from MM4.DAT file as observations [IWFCOD = 1]
     13 = Yes, use winds from MM5/3D.DAT file as Step 1 field [IWFCOD = 0]
     14 = Yes, use winds from MM5/3D.DAT file as initial guess field [IWFCOD = 1]
     15 = Yes, use winds from MM5/3D.DAT file as observations [IWFCOD = 1]

    Timestep (hours) of the prognostic
    model input data   (ISTEPPG)         Default: 1      ! ISTEPPG =  1   !

    Use coarse CALMET fields as initial guess fields (IGFMET)
    (overwrites IGF based on prognostic wind fields if any)
                                         Default: 0      ! IGFMET =  0  !

 RADIUS OF INFLUENCE PARAMETERS

    Use varying radius of influence      Default: F      ! LVARY =  F!
    (if no stations are found within RMAX1,RMAX2,
     or RMAX3, then the closest station will be used)

    Maximum radius of influence over land
    in the surface layer (RMAX1)         No default      ! RMAX1 = 100. !
                                         Units: km
    Maximum radius of influence over land
    aloft (RMAX2)                        No default      ! RMAX2 = 200. !
                                         Units: km
    Maximum radius of influence over water
    (RMAX3)                              No default      ! RMAX3 = 200. !
                                         Units: km
```

OTHER WIND FIELD INPUT PARAMETERS

```
    Minimum radius of influence used in
    the wind field interpolation (RMIN)   Default: 0.1     ! RMIN = 0.1 !
                                          Units: km
    Radius of influence of terrain
    features (TERRAD)                     No default       ! TERRAD = 15. !

                                          Units: km
    Relative weighting of the first
    guess field and observations in the
    SURFACE layer (R1)                    No default       ! R1 = 50. !
    (R1 is the distance from an           Units: km
    observational station at which the
    observation and first guess field are
    equally weighted)

    Relative weighting of the first
    guess field and observations in the
    layers ALOFT (R2)                     No default       ! R2 = 100. !
    (R2 is applied in the upper layers    Units: km
    in the same manner as R1 is used in
    the surface layer).

    Relative weighting parameter of the
    prognostic wind field data (RPROG)    No default       ! RPROG = 0. !
    (Used only if IPROG = 1)              Units: km
    ------------------------

    Maximum acceptable divergence in the
    divergence minimization procedure
    (DIVLIM)                              Default: 5.E-6  ! DIVLIM= 5.0E-06 !

    Maximum number of iterations in the
    divergence min. procedure (NITER)     Default: 50      ! NITER =  50  !

    Number of passes in the smoothing
    procedure (NSMTH(NZ))
    NOTE: NZ values must be entered
         Default: 2,(mxnz-1)*4 ! NSMTH =
2 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4  !

    Maximum number of stations used in
    each layer for the interpolation of
    data to a grid point (NINTR2(NZ))
    NOTE: NZ values must be entered       Default: 99.     ! NINTR2 =
99 ,  99,  99 ,  99 ,  99,  99 ,  99 ,  99 , 99 ,  99 !

    Critical Froude number (CRITFN)       Default: 1.0     ! CRITFN = 1. !

    Empirical factor controlling the
    influence of kinematic effects
    (ALPHA)                               Default: 0.1     ! ALPHA = 0.1 !

    Multiplicative scaling factor for
    extrapolation of surface observations
    to upper layers (FEXTR2(NZ))          Default: NZ*0.0
    ! FEXTR2 = 0., 0., 0., 0., 0., 0., 0., 0., 0., 0. !
    (Used only if IEXTRP = 3 or -3)
```

BARRIER INFORMATION

```
   Number of barriers to interpolation
   of the wind fields (NBAR)            Default: 0      ! NBAR =  0  !

   Level (1 to NZ) up to which barriers
   apply (KBAR)                         Default: NZ     ! KBAR =  10  !

   THE FOLLOWING 4 VARIABLES ARE INCLUDED
   ONLY IF NBAR > 0
   NOTE: NBAR values must be entered    No defaults
         for each variable              Units: km

      X coordinate of BEGINNING
      of each barrier (XBBAR(NBAR))     ! XBBAR = 0. !
      Y coordinate of BEGINNING
      of each barrier (YBBAR(NBAR))     ! YBBAR = 0. !

      X coordinate of ENDING
      of each barrier (XEBAR(NBAR))     ! XEBAR = 0. !
      Y coordinate of ENDING
      of each barrier (YEBAR(NBAR))     ! YEBAR = 0. !


DIAGNOSTIC MODULE DATA INPUT OPTIONS

   Surface temperature (IDIOPT1)        Default: 0      ! IDIOPT1 =  0  !
      0 = Compute internally from
          hourly surface observations
      1 = Read preprocessed values from
          a data file (DIAG.DAT)

      Surface met. station to use for
      the surface temperature (ISURFT)  No default     ! ISURFT =  TBD  !
      (Must be a value from 1 to NSSTA)
      (Used only if IDIOPT1 = 0)
      --------------------------

   Domain-averaged temperature lapse
   rate (IDIOPT2)                       Default: 0     ! IDIOPT2 =  0  !
      0 = Compute internally from
          twice-daily upper air observations
      1 = Read hourly preprocessed values
          from a data file (DIAG.DAT)

      Upper air station to use for
      the domain-scale lapse rate (IUPT) No default     ! IUPT   =  TBD  !
      (Must be a value from 1 to NUSTA)
      (Used only if IDIOPT2 = 0)
      --------------------------

      Depth through which the domain-scale
      lapse rate is computed (ZUPT)      Default: 200.  ! ZUPT = 200. !
      (Used only if IDIOPT2 = 0)         Units: meters
      --------------------------

   Domain-averaged wind components
   (IDIOPT3)                            Default: 0     ! IDIOPT3 =  0  !
      0 = Compute internally from
          twice-daily upper air observations
      1 = Read hourly preprocessed values
          a data file (DIAG.DAT)

      Upper air station to use for
      the domain-scale winds (IUPWND)    Default: -1    ! IUPWND = -1  !
```

```
    (Must be a value from -1 to NUSTA)
    (Used only if IDIOPT3 = 0)
    --------------------------

    Bottom and top of layer through
    which the domain-scale winds
    are computed
    (ZUPWND(1), ZUPWND(2))        Defaults: 1., 1000. ! ZUPWND= 1., 1000. !
    (Used only if IDIOPT3 = 0)    Units: meters
    --------------------------

 Observed surface wind components
 for wind field module (IDIOPT4)  Default: 0     ! IDIOPT4 =  0  !
    0 = Read WS, WD from a surface
        data file (SURF.DAT)
    1 = Read hourly preprocessed U, V from
        a data file (DIAG.DAT)

 Observed upper air wind components
 for wind field module (IDIOPT5)  Default: 0     ! IDIOPT5 =  0  !
    0 = Read WS, WD from an upper
        air data file (UP1.DAT, UP2.DAT, etc.)
    1 = Read hourly preprocessed U, V from
        a data file (DIAG.DAT)

 LAKE BREEZE INFORMATION

    Use Lake Breeze Module  (LLBREZE)
                                     Default: F      ! LLBREZE = F !

     Number of lake breeze regions (NBOX)            ! NBOX =  0  !

  X Grid line 1 defining the region of interest
                                                  ! XG1 = 0. !
  X Grid line 2 defining the region of interest
                                                  ! XG2 = 0. !
  Y Grid line 1 defining the region of interest
                                                  ! YG1 = 0. !
  Y Grid line 2 defining the region of interest
                                                  ! YG2 = 0. !

   X Point defining the coastline (Straight line)
             (XBCST)  (KM)   Default: none    ! XBCST = 0. !

   Y Point defining the coastline (Straight line)
             (YBCST)  (KM)   Default: none    ! YBCST = 0. !

   X Point defining the coastline (Straight line)
             (XECST)  (KM)   Default: none    ! XECST = 0. !

   Y Point defining the coastline (Straight line)
             (YECST)  (KM)   Default: none    ! YECST = 0. !


 Number of stations in the region     Default: none ! NLB =  0 !
 (Surface stations + upper air stations)

 Station ID's  in the region   (METBXID(NLB))
 (Surface stations first, then upper air stations)
   ! METBXID =  0 !

!END!
```

```
--------------------------------------------------------------------------------

INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation Parameters
--------------

    EMPIRICAL MIXING HEIGHT CONSTANTS

       Neutral, mechanical equation
       (CONSTB)                            Default: 1.41   ! CONSTB = 1.41 !
       Convective mixing ht. equation
       (CONSTE)                            Default: 0.15   ! CONSTE = 0.15 !
       Stable mixing ht. equation
       (CONSTN)                            Default: 2400.  ! CONSTN = 2400.!
       Overwater mixing ht. equation
       (CONSTW)                            Default: 0.16   ! CONSTW = 0.16 !
       Absolute value of Coriolis
       parameter (FCORIOL)                 Default: 1.E-4  ! FCORIOL = 1.0E-04!
                                           Units: (1/s)

    SPATIAL AVERAGING OF MIXING HEIGHTS

       Conduct spatial averaging
       (IAVEZI)  (0=no, 1=yes)             Default: 1      ! IAVEZI =  1  !

       Max. search radius in averaging
       process (MNMDAV)                    Default: 1      ! MNMDAV =  1  !
                                           Units: Grid
                                                  cells
       Half-angle of upwind looking cone
       for averaging (HAFANG)              Default: 30.    ! HAFANG = 30. !
                                           Units: deg.
       Layer of winds used in upwind
       averaging (ILEVZI)                  Default: 1      ! ILEVZI =  1  !
       (must be between 1 and NZ)


    CONVECTIVE MIXING HEIGHT OPTIONS:
       Method to compute the convective
       mixing height(IMIHXH)               Default: 1      ! IMIXH =  -1  !
           1: Maul-Carson for land and water cells
          -1: Maul-Carson for land cells only -
              OCD mixing height overwater
           2: Batchvarova and Gryning for land and water cells
          -2: Batchvarova and Gryning for land cells only
              OCD mixing height overwater

       Threshold buoyancy flux required to
       sustain convective mixing height growth
       overland (THRESHL)                  Default: 0.05   ! THRESHL = 0.0 !
       (expressed as a heat flux           units: W/m3
        per meter of boundary layer)


       Threshold buoyancy flux required to
       sustain convective mixing height growth
       overwater (THRESHW)                 Default: 0.05   ! THRESHW = 0.05 !
       (expressed as a heat flux           units: W/m3
        per meter of boundary layer)


       Option for overwater lapse rates used
       in convective mixing height growth
```

```
   (ITWPROG)                             Default: 0      ! ITWPROG =  0  !
   0 : use SEA.DAT lapse rates and deltaT (or assume neutral
       conditions if missing)
   1 : use prognostic lapse rates (only if IPROG>2)
       and SEA.DAT deltaT (or neutral if missing)
   2 : use prognostic lapse rates and prognostic delta T
       (only if iprog>12 and 3D.DAT version# 2.0 or higher)

   Land Use category ocean in 3D.DAT datasets
   (ILUOC3D)                             Default: 16     ! ILUOC3D =  16  !
   Note: if 3D.DAT from MM5 version 3.0, iluoc3d = 16
         if MM4.DAT,           typically iluoc3d = 7


OTHER MIXING HEIGHT VARIABLES

   Minimum potential temperature lapse
   rate in the stable layer above the
   current convective mixing ht.         Default: 0.001  ! DPTMIN = 0.001 !
   (DPTMIN)                              Units: deg. K/m
   Depth of layer above current conv.
   mixing height through which lapse     Default: 200.   ! DZZI = 200. !
   rate is computed (DZZI)               Units: meters

   Minimum overland mixing height        Default:  50.   ! ZIMIN = 50. !
   (ZIMIN)                               Units: meters
   Maximum overland mixing height        Default: 3000.  ! ZIMAX = 3000. !
   (ZIMAX)                               Units: meters
   Minimum overwater mixing height       Default:   50.  ! ZIMINW = 50. !
   (ZIMINW) -- (Not used if observed     Units: meters
   overwater mixing hts. are used)
   Maximum overwater mixing height       Default: 3000.  ! ZIMAXW = 3000. !
   (ZIMAXW) -- (Not used if observed     Units: meters
   overwater mixing hts. are used)


OVERWATER SURFACE FLUXES METHOD and PARAMETERS
      (ICOARE)                           Default: 10      ! ICOARE =  0   !
       0: original deltaT method (OCD)
      10: COARE with no wave parameterization (jwave=0, Charnock)
      11: COARE with wave option jwave=1 (Oost et al.)
          and default wave properties
     -11: COARE with wave option jwave=1 (Oost et al.)
          and observed wave properties (must be in SEA.DAT files)
      12: COARE with wave option 2 (Taylor and Yelland)
           and default wave properties
     -12: COARE with wave option 2 (Taylor and Yelland)
          and observed wave properties (must be in SEA.DAT files)

      Coastal/Shallow water length scale (DSHELF)
      (for modified z0 in shallow water)
      ( COARE fluxes only)
                                      Default : 0.        ! DSHELF = 0. !
                                      units: km

       COARE warm layer computation (IWARM)               ! IWARM =  0   !
       1: on - 0: off (must be off if SST measured with
       IR radiometer)                 Default: 0

       COARE cool skin layer computation (ICOOL)          ! ICOOL =  0   !
       1: on - 0: off (must be off if SST measured with
       IR radiometer)                 Default: 0
```

```
    TEMPERATURE PARAMETERS

       3D temperature from observations or
       from prognostic data? (ITPROG)       Default:0        ! ITPROG =  0   !

          0 = Use Surface and upper air stations
              (only if NOOBS = 0)
          1 = Use Surface stations (no upper air observations)
              Use MM5/3D for upper air data
              (only if NOOBS = 0,1)
          2 = No surface or upper air observations
              Use MM5/3D for surface and upper air data
              (only if NOOBS = 0,1,2)

       Interpolation type
       (1 = 1/R ; 2 = 1/R**2)               Default:1         ! IRAD =  1  !

       Radius of influence for temperature
       interpolation (TRADKM)               Default: 500.     ! TRADKM = 500. !
                                            Units: km

       Maximum Number of stations to include
       in temperature interpolation (NUMTS)  Default: 5        ! NUMTS = 5  !

       Conduct spatial averaging of temp-
       eratures (IAVET)  (0=no, 1=yes)      Default: 1        ! IAVET =  1  !
       (will use mixing ht MNMDAV,HAFANG
        so make sure they are correct)

       Default temperature gradient         Default: -.0098   ! TGDEFB = -0.0098 !
       below the mixing height over         Units: K/m
       water (TGDEFB)

       Default temperature gradient         Default: -.0045   ! TGDEFA = -0.0045 !
       above the mixing height over         Units: K/m
       water (TGDEFA)

       Beginning (JWAT1) and ending (JWAT2)
       land use categories for temperature                   ! JWAT1 =  55  !
       interpolation over water -- Make                      ! JWAT2 =  55  !
       bigger than largest land use to disable

   PRECIP INTERPOLATION PARAMETERS

       Method of interpolation (NFLAGP)      Default: 2       ! NFLAGP =  2  !
        (1=1/R,2=1/R**2,3=EXP/R**2)
       Radius of Influence  (SIGMAP)         Default: 100.0   ! SIGMAP = 100. !
        (0.0 => use half dist. btwn          Units: km
         nearest stns w & w/out
         precip when NFLAGP = 3)
       Minimum Precip. Rate Cutoff (CUTP)    Default: 0.01    ! CUTP = 0.01 !
        (values < CUTP = 0.0 mm/hr)          Units: mm/hr
!END!


-------------------------------------------------------------------------------

INPUT GROUP: 7 -- Surface meteorological station parameters
--------------

     SURFACE STATION VARIABLES
     (One record per station --  TBD  records in all)
```

```
             1     2
         Name   ID            X coord.   Y coord.   Time   Anem.
                                (km)       (km)      zone   Ht.(m)
       ----------------------------------------------------------
! SS1  =' '             !
! SS2  =' '             !
! SS3  =' '             !
! SS4  =' '            !
! SS5  =' '             !
-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit integer for station ID

!END!


-------------------------------------------------------------------------------

INPUT GROUP: 8 -- Upper air meteorological station parameters
--------------

     UPPER AIR STATION VARIABLES
     (One record per station --  TBD  records in all)

             1     2
         Name    ID      X coord.   Y coord.  Time zone
                           (km)       (km)
        -----------------------------------------------
! US1  =''    !
! US2  =' '   !
! US3  =' '   !
-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Five digit integer for station ID

!END!


-------------------------------------------------------------------------------

INPUT GROUP: 9 -- Precipitation station parameters
--------------

     PRECIPITATION STATION VARIABLES
     (One record per station --  TBD  records in all)
     (NOT INCLUDED IF NPSTA = 0)

            1          2
         Name   Station    X coord.  Y coord.
                  Code       (km)      (km)
         ------------------------------------

! PS1  =''       !
```

```
! PS2  =''        !
! PS3  =''        !
! PS4  =''        !
! PS5  =''        !
! PS6  =''        !
! PS7  =''        !
! PS8  =''        !
! PS9  =''        !
! PS10 =''        !
! PS11 =''        !
! PS12 =''        !
! PS13 =''        !
! PS14 =''        !
! PS15 =''        !
! PS16 =''        !

-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit station code composed of state
        code (first 2 digits) and station ID (last
        4 digits)

!END!
```