DOCKETED	
Docket Number:	21-AFC-02
Project Title:	Willow Rock Energy Storage Center
TN #:	254897
Document Title:	Eastern Kern Air Pollution Control District (EKAPCD) Application
Description:	Willow Rock Energy Storage Center Rule 210.1 Minor Source Air Quality Permit Application
Filer:	David Stein
Organization:	WSP
Submitter Role:	Applicant Consultant
Submission Date:	3/7/2024 9:33:45 AM
Docketed Date:	3/7/2024

ATMOSPHERIC DYNAMICS, INC
Meteorological & Air Quality Modeling

March 6, 2024

Mr. Glen E. Stephens
Air Pollution Control Officer
Eastern Kern Air Pollution Control District
2700 "M" Street, Suite 302
Bakersfield, CA 93301

Subject: Hydrostor Willow Rock Energy Storage Center Rule 210.1 Minor Source Air Quality Permit Application

Dear Mr. Stephens:

On behalf of GEM A-CAES LLC, please find the enclosed minor source air quality permit application for the Hydrostor Willow Rock Energy Storage Center (WRESC). WRESC will provide 500 megawatts (MW) net of advance compressed air energy storage-based electrical generation which will allow for the additional integration of renewable energy into the electrical grid and will allow for the displacement of older and less efficient generation. The project will be located on approximately 88.6 acres of private land immediately north of Dawn Road and between State Route 14 and Sierra Highway within the unincorporated, southeastern Kern County. The air quality and public health analyses, which are included with the application, identified the following sources of air pollution during construction: combustion of fuel in reciprocating internal combustion engines (off-road and mobile sources), traffic on unpaved roads, bulldozing, wind erosion, grading, and material movement. Similarly, during normal operation, emission of air pollutants will occur from the three (3) 2.5 MW Tier 4 diesel-fueled emergency generators and one 345-kilowatt (kW) Tier 3 emergency diesel-fired engine driven fire pump.

GEM A-CAES-LLC (Applicant) previously submitted applications to the EKAPCD on February 18th, 2022, for emergency engines associated with the project description for the WRESC. The project description for the WRESC has since been revised to reflect an optimized configuration and location, as more fully described in the Supplemental Application for Certification (AFC) filed with the CEC on March 1, 2024. The attached minor source air quality permit application reflects these changes and supersedes the project description in the originally filed AFC and the originally submitted EKAPCD applications for emergency engines.

Pursuant to California Administrative Code Title 20, Section 1744.5, the Eastern Kern Air Pollution Control District (EKAPCD) will have the responsibility to conduct a Determination of Compliance (DOC) review of the application for the CEC's certification process to determine whether the proposed facility meets the requirements of EKAPCD's new source review rule and all other applicable district regulations. To initiate EKAPCD's review, GEM A-CAES LLC is submitting herewith applications for an Authority to Construct (ATC) for the stationary emergency-use diesel engines and fire pump associated with the WRESC. These are the only air pollution sources associated with the operation of the facility. Relevant sections of the Supplemental Application for Certification (AFC) have been included for the EKAPCD review, and includes the project description, the air quality analysis for both construction and operations, the public health analyses for construction and operations, EKAPCD forms, and the support appendices.

This Rule 210.1 minor source permit application contains the following sections from the Supplemental AFC:

- EKAPCD Forms
- Introduction and Project Description (Sections 1 and 2)
- Air Quality Analyses (Section 5.1)
- Public Health (Section 5.9)
- Appendices for Sections 5.1 and 5.9

Other sections of the Supplemental AFC can be provided at your request or can be downloaded directly from the CEC docket for this project (21-AFC-02) at:

https://efiling.energy.ca.gov/Lists/DocketLog.aspx?docketnumber=21-AFC-02)

As noted, the minor source permit application contains the relevant analyses for diesel engines and includes the emissions of criteria pollutants and hazardous air pollutants (HAPs) in the form of diesel particulate matter (DPM). The emergency diesel engines will utilize Tier 4 controls to limit the emissions of nitrogen dioxide (NO_2), carbon monoxide (CO), volatile organic compounds (VOCs) and particulate matter (PM10/PM2.5). Emissions of sulfur will be limited to the use of ultra-low sulfur fuels. The diesel fire pump will utilize Tier 3 controls. Air quality impact analyses and a health risk assessment were prepared for both operation and construction phases. EKAPCD signed forms are also included with this submittal. The EKAPCD application fee of $9,405 will be paid via credit card the day after submitting this application. Also note that in accordance with Rule 402 (large construction activities of 10 acres or more) the Applicant will submit a Fugitive Dust Emission Control Plan prior to the commencement of construction.

We look forward to working with you. If you have any questions, please do not hesitate to call me at (831) 620-0481. Thank you for your attention in this matter.

Sincerely,

Atmospheric Dynamics, Inc.

Gregory S. Darvin
Senior Meteorologist

Attachment

Attachment 1
EKAPCD ATC Application Forms

EASTERN KERN AIR POLLUTION CONTROL DISTRICT
2700 "M" STREET SUITE 302, BAKERSFIELD, CA 93301-2370
PHONE: (661) 862-5250 • FAX: (661) 862-5251 • www.kernair.org

APPLICATION FOR AUTHORITY TO CONSTRUCT, PERMIT TO OPERATE, EXEMPTION, AND BANKING CERTIFICATE

Company/Billing Information

Business Name to Appear on Permit:	Owner's Name:	Phone No:
Willow Rock Energy Storage Center	GEM A CAES LLC	
Mailing Address:	Business E-mail Address:	
333 Bay Street, Suite 520		
City: / State:	Zip:	Fax No:
Toronto, Ontario, Canada		

Equipment Location

Street Address:	City:	Zip
0.4 mi west of SR14 on Dawn Rd	Rosamond, CA.	93501
General Nature of Business:		S.I.C. CODE(S) *If Known*:
Electricity Generation		4911009

Assessors' Parcel No: 431-022-13 OR _____/4 SECTION 33 TOWNSHIP 10N RANGE 12W

Application Type ***See ATC/PTO Instructions for appropriate filing fee***

☒ Authority To Construct (ATC)	☐ Permit To Operate (PTO)	☐ Change of Business Name
☐ ATC – Modification	☐ PTO – Modification	☐ Exemption
☐ ATC – Renewal	☐ PTO – Transfer of Ownership	☐ Exemption Renewal
☐ Transfer of Location	☐ Title V Initial/Renewal/Modification	☐ Banking Certificate

Description of Equipment or Modification for which application is made ***(include Permit #'s if known)***

EGEN #2 - Kohler KD2500-4 diesel engine and 2.5 MW electrical generator set.
This engine and generator will be used for emergency power only.
Engine diesel fuel tank is exempt per Rule 202(G)(4)(a). Use Additional Sheets if Necessary

Check all that apply

Is this Facility within 1,000 feet of the outer boundary of a school? ☐ YES ☒ NO
Have all necessary land-use authorizations been obtained? ☒ YES ☐ NO *(If "NO" attach explanation)*
Is there any other equipment in the EKAPCD jurisdiction operated by the same operator? ☐ YES ☒ NO
Is this application being submitted as the result of a Notice of Violation or Notice to Comply? ☐ YES ☒ NO
If YES, NOV/NTC #: N/A
Is this equipment portable AND will it be operated at different locations within EKAPCD jurisdiction? ☐ YES ☒ NO

Print Contact Name: Curt Hildebrand Consultant? ☐ YES ☒ NO If YES, please attach Assignment of Agent

Title: VP Comm. Affairs Phone: (925) 872-3791 E-Mail Address: curt.hildebrand@hydrostor.ca

Print Signing Authority Name If Different: Patrick Moyer Title: Secretary

Signature: Patrick E. Moyer Date: 02/21/2024

DATE RECEIVED **Validation (for EKAPCD use)**

ATC No: _____ **Filing Fee: $** _____
Equip Dscrpt: _____ **Receipt No:** _____
Equip Code: _____ **Date:** _____

EASTERN KERN AIR POLLUTION CONTROL DISTRICT
2700 "M" STREET SUITE 302, BAKERSFIELD, CA 93301-2370
PHONE: (661) 862-5250 • FAX: (661) 862-5251 • www.kernair.org

SUPPLEMENTAL APPLICATION
PISTON ENGINE DATA FORM

Business Name to Appear on Permit:	Owner's Name:	Phone No:
Willow Rock Energy Storage Center	GEM A CAES LLC	

Engine Information

Engine Manufacturer:	Model:	Model Year:	Serial Number:
EGEN #2 Kohler	KD2500-4	TBD	TBD

EPA Certification: ☐ Tier 0 ☐ Tier 1 ☐ Tier 2 ☐ Tier 3 ☒ Tier 4 ☐ Two Cycle ☒ Four Cycle

Number of Cylinders: 12 | Average Load: 75-100 % | Expected operating schedule: 1 hrs/day 50 hrs/year

Fuel Consumption: 174.5 gl/hr or Cuft/hr | Engine Rating: 3621 BHP @ 1800 RPM

Fuel Type: ☐ Gasoline ☒ Diesel ☐ CNG ☐ LPG ☐ Landfill Gas ☐ Digester Gas ☐ Other (list):

Emissions Controls (check all that apply)

☒ Turbo Charged ☐ Fuel Injected ☒ Lean Burn ☐ Rich Burn ☒ Inter Cooler ☐ After Cooler ☐ Timing Retarded ☐ Naturally Aspired

☒ Oxidation Catalyst (OC) ☒ Diesel Particulate Filter (DPF) ☐ Positive Crankcase Ventilation (PCV) ☐ Exhaust Gas Recirculation ☐ Non-selective Catalytic Reduction

DPF/OC Manufacturer: see attachments | DPF/OC Model: see attachments | DPF/OC Efficiency: see attachments

Emissions data collected from: ☒ Manufacturer Guarantee ☐ Source Test | List any other Emissions Control Device:

PM-10: 0.02 g/bhp-hr | NMHC: 0.14 g/bhp-hr | NOx: 0.50 g/bhp-hr | NMHC+NOx: 0.64 g/bhp-hr | CO: 2.6 g/bhp-hr

Exhaust Information

Stack Diameter: 1.033 in | Height Above Grade or Building: 22.93 ft | Exhaust Temp. @ Rated HP: 914 °F

Does the Stack have a Weather Cap: ☒ Yes ☐ No | Direction of exhaust from engine: ☒ Vertical ☐ Horizontal

Stack Serves: ☒ Only This Equipment ☐ This Engine and Other Equipment | Exhaust Flow Rate: 9734 per stack CFM

*If this stack serves additional equipment please list the type and rating of all other equipment on a separate sheet of paper and submit with this form.

Use (check all that apply)

☐ Pump Driver Rating: gpm | ☒ Electric Generator Rating: 2500 kw | ☐ Compressor Driver Rating: cfm

☐ Full Time ☐ Standby ☒ Emergency ☐ Other (list):

Check one if requesting emission limits exemption: ☒ Emergency Generator ☐ Remote Location (only valid in Indian Wells Valley)

Receptor Data

Is this engine located or to be located within ¼ mile of an off-site residential area (3 or more homes), school, or hospital? ☐ Yes ☒ No

If Yes, check one and complete the following: ☐ Residential ☐ School ☐ Hospital | Distance from Engine: N/A Ft.

Name of School or Hospital:	Address of Receptor:	City:	Compass Direction to Engine:
N/A	N/A	N/A	N/A Deg.

Print Contact Name: Curt Hildebrand Consultant? ☐ YES ☒ NO If YES, please attach Assignment of Agent

Title: VP Comm. Affairs Phone: 925-872-3791 E-Mail Address: curt.hildebrand@hydrostor.ca

Signature: Curt Hildebrand Date: 02/21/2024

EASTERN KERN AIR POLLUTION CONTROL DISTRICT
2700 "M" STREET SUITE 302, BAKERSFIELD, CA 93301-2370
PHONE: (661) 862-5250 • FAX: (661) 862-5251 • www.kernair.org

ENVIRONMENTAL INFORMATION FORM AND INITIAL STUDY EVALUATION

Applicant: Willow rock Energy Storage Center

Contact: Curt Hildebrand

Title: VP Commercial Affairs **Phone:** 925-872-3791

Project Description: CAES Electricity Generation Plant

Environmental Information	**Yes**	**No**	**Maybe**
Will the proposed project with regard to the proposed location:			
1. Conflict with the adopted environmental plans and goals of the community?	[ ]	[✓]	[ ]
2. Have a substantial, demonstrable negative aesthetic effect?	[ ]	[✓]	[ ]
3. Substantially affect a rare or endangered species of animal or plant or the habitat of the species?	[ ]	[✓]	[ ]
4. Interfere substantially with the movement of any resident or migratory fish or wildlife species?	[ ]	[✓]	[ ]
5. Substantially diminish habitat for fish, wildlife or plants?	[ ]	[✓]	[ ]
6. Breach published national, state, or local standards relating to solid waste or litter control?	[ ]	[✓]	[ ]
7. Substantially degrade water quality or contaminate a public water supply?	[ ]	[✓]	[ ]
8. Substantially degrade or deplete ground water resources or interfere substantially with ground water recharge?	[ ]	[✓]	[ ]
9. Disrupt or adversely affect a prehistoric or historic archeological site or a property of historic or cultural significance to a community or ethnic or social group; or a paleontological site except as part of scientific study?	[ ]	[✓]	[ ]
10. Induce substantial growth or concentration of population?	[ ]	[✓]	[ ]
11. Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system?	[ ]	[✓]	[ ]
12. Displace a substantial number of people?	[ ]	[✓]	[ ]

Environmental Information	Yes	No	Maybe
13. Encourage activities which result in the use of large amounts of fuel, water or energy?	[ ]	[✓]	[ ]
14. Use fuel, water or energy inefficiently?	[ ]	[✓]	[ ]
15. Increase substantially the ambient noise level for adjoining areas?	[ ]	[✓]	[ ]
16. Cause substantial flooding, erosion or siltation?	[ ]	[✓]	[ ]
17. Expose people or structures to major geologic hazards?	[ ]	[✓]	[ ]
18. Extend a sewer trunk line with capacity to serve new development?	[ ]	[✓]	[ ]
19. Disrupt or divide the physical arrangement of an established community?	[ ]	[✓]	[ ]
20. Create a potential public health hazard or involve the use, production, or disposal of materials which pose a hazard to people or animal or plant populations in the area affected?	[ ]	[✓]	[ ]
21. Conflict with established recreational, educational, religious or scientific uses?	[ ]	[✓]	[ ]
22. Convert prime agricultural land to non-agricultural use or impair the agricultural productivity of prime agricultural land?	[ ]	[✓]	[ ]
23. Interfere with emergency response or evacuation plans?	[ ]	[✓]	[ ]
24. Violate any ambient air quality standard, contribute substantially to an existing or projected air quality violation, or expose sensitive receptors to substantial pollutant concentrations?	[ ]	[✓]	[ ]
25. Emits Greenhouse Gas (GHG) emissions greater than 25,000 tons?	[ ]	[✓]	[ ]

NOTE: Please attach any pertinent explanatory information.

CERTIFICATION:

I hereby certify the statement furnished above and in attached exhibits present the data and information required for this initial evaluation to the best of my ability, and that the facts, statements, and information presented are true and correct to the best of my knowledge and belief.

Print Signing Authority Name If Different: Patrick Moyer

Signature: Patrick E. Moyer **Date:** 02/21/2024

EASTERN KERN AIR POLLUTION CONTROL DISTRICT
2700 "M" STREET SUITE 302, BAKERSFIELD, CA 93301-2370
PHONE: (661) 862-5250 • FAX: (661) 862-5251 • www.kernair.org

APPLICATION FOR AUTHORITY TO CONSTRUCT, PERMIT TO OPERATE, EXEMPTION, AND BANKING CERTIFICATE

Company/Billing Information

Business Name to Appear on Permit:	Owner's Name:	Phone No:
Willow Rock Energy Storage Center	GEM A CAES LLC	
Mailing Address:	Business E-mail Address:	
333 Bay Street, Suite 520		
City: / State:	Zip:	Fax No:
Toronto, Ontario, Canada		

Equipment Location

Street Address:	City:	Zip:
0.4 mi west of SR14 on Dawn Rd	Rosamond, CA.	93501
General Nature of Business:		S.I.C. CODE(S) *If Known*
Electricity Generation		4911009

Assessors' Parcel No: 431-022-13 OR _____/4 SECTION 33 TOWNSHIP 10N RANGE 12W

Application Type *See ATC/PTO Instructions for appropriate filing fee*

☒ Authority To Construct (ATC)	☐ Permit To Operate (PTO)	☐ Change of Business Name
☐ ATC – Modification	☐ PTO – Modification	☐ Exemption
☐ ATC – Renewal	☐ PTO – Transfer of Ownership	☐ Exemption Renewal
☐ Transfer of Location	☐ Title V Initial/Renewal/Modification	☐ Banking Certificate

Description of Equipment or Modification for which application is made ***(include Permit #'s if known)***

EGEN #1 - Kohler KD2500-4 diesel engine and 2.5 MW electrical generator set.
This engine and generator will be used for emergency power only.
Engine diesel fuel tank is exempt per Rule 202(G)(4)(a). Use Additional Sheets if Necessary

Check all that apply

Is this Facility within 1,000 feet of the outer boundary of a school? ☐ YES ☒ NO
Have all necessary land-use authorizations been obtained? ☒ YES ☐ NO *(If "NO" attach explanation)*
Is there any other equipment in the EKAPCD jurisdiction operated by the same operator? ☐ YES ☒ NO
Is this application being submitted as the result of a Notice of Violation or Notice to Comply? ☐ YES ☒ NO
If YES, NOV/NTC #: N/A
Is this equipment portable AND will it be operated at different locations within EKAPCD jurisdiction? ☐ YES ☒ NO

Print Contact Name: Curt Hildebrand Consultant? ☐ YES ☒ NO If YES, please attach Assignment of Agent

Title: VP Comm. Affairs Phone: (925) 872-3791 E-Mail Address curt.hildebrand@hydrostor.ca

Print Signing Authority Name If Different: Pat rick Moyer Title: Secretary

Signature: Patrick E. Mye Date: 02/21/2024

DATE RECEIVED **Validation (for EKAPCD use)**

ATC No: _____ **Filing Fee: $** _____
Equip Dscrpt: _____ **Receipt No:** _____
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2700 "M" STREET SUITE 302, BAKERSFIELD, CA 93301-2370
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SUPPLEMENTAL APPLICATION
PISTON ENGINE DATA FORM

Business Name to Appear on Permit:	Owner's Name:	Phone No:
Willow Rock Energy Storage Center	GEM A CAES LLC	

Engine Information

Engine Manufacturer:	Model:	Model Year:	Serial Number:
EGEN #1 Kohler	KD2500-4	TBD	TBD

EPA Certification: ☐ Tier 0 ☐ Tier 1 ☐ Tier 2 ☐ Tier 3 ☒ Tier 4 ☐ Two Cycle ☒ Four Cycle

Number of Cylinders: 12 | Average Load: 75-100 % | Expected operating schedule: 1 hrs/day 50 hrs/year

Fuel Consumption: 174.5 gl/hr or Cuft/hr | Engine Rating: 3621 BHP @ 1800 RPM

Fuel Type: ☐ Gasoline ☒ Diesel ☐ CNG ☐ LPG ☐ Landfill Gas ☐ Digester Gas ☐ Other (list):

Emissions Controls (check all that apply)

☒ Turbo Charged ☐ Fuel Injected ☒ Lean Burn ☐ Rich Burn ☒ Inter Cooler ☐ After Cooler ☐ Timing Retarded ☐ Naturally Aspired

☒ Oxidation Catalyst (OC) ☒ Diesel Particulate Filter (DPF) ☐ Positive Crankcase Ventilation (PCV) ☐ Exhaust Gas Recirculation ☐ Non-selective Catalytic Reduction

DPF/OC Manufacturer:	DPF/OC Model:	DPF/OC Efficiency:
see attachments	see attachments	see attachments

Emissions data collected from: ☒ Manufacturer Guarantee ☐ Source Test | List any other Emissions Control Device:

PM-10:	NMHC:	NOx:	NMHC+NOx:	CO:
0.02 g/bhp-hr	0.14 g/bhp-hr	0.50 g/bhp-hr	0.64 g/bhp-hr	2.6 g/bhp-hr

Exhaust Information

Stack Diameter: 1.033 in | Height Above Grade or Building: 22.93 ft | Exhaust Temp. @ Rated HP: 914 °F

Does the Stack have a Weather Cap: ☒ Yes ☐ No | Direction of exhaust from engine: ☒ Vertical ☐ Horizontal

Stack Serves: ☒ Only This Equipment ☐ This Engine and Other Equipment | Exhaust Flow Rate: 9734 per stack CFM

*If this stack serves additional equipment please list the type and rating of all other equipment on a separate sheet of paper and submit with this form.

Use (check all that apply)

☐ Pump Driver Rating: gpm | ☒ Electric Generator Rating: 2500 kw | ☐ Compressor Driver Rating: cfm

☐ Full Time ☐ Standby ☒ Emergency ☐ Other (list):

Check one if requesting emission limits exemption: ☒ Emergency Generator ☐ Remote Location (only valid in Indian Wells Valley)

Receptor Data

Is this engine located or to be located within ¼ mile of an off-site residential area (3 or more homes), school, or hospital? ☐ Yes ☒ No

If Yes, check one and complete the following: ☐ Residential ☐ School ☐ Hospital | Distance from Engine: N/A Ft.

Name of School or Hospital:	Address of Receptor:	City:	Compass Direction to Engine:
N/A	N/A	N/A	N/A Deg.

Print Contact Name: Curt Hildebrand Consultant? ☐ YES ☒ NO If YES, please attach Assignment of Agent

Title: VP Comm. Affairs Phone: 925-872-3791 E-Mail Address: curt.hildebrand@hydrostor.ca

Signature: Curt Hildebrand Date: 02/21/2024

EASTERN KERN AIR POLLUTION CONTROL DISTRICT
2700 "M" STREET SUITE 302, BAKERSFIELD, CA 93301-2370
PHONE: (661) 862-5250 • FAX: (661) 862-5251 • www.kernair.org

ENVIRONMENTAL INFORMATION FORM AND INITIAL STUDY EVALUATION

Applicant: Willow rock Energy Storage Center

Contact: Curt Hildebrand

Title: VP Commercial Affairs **Phone:** 925-872-3791

Project Description: CAES Electricity Generation Plant

Environmental Information	**Yes**	**No**	**Maybe**
Will the proposed project with regard to the proposed location:			
1. Conflict with the adopted environmental plans and goals of the community?	[ ]	[✓]	[ ]
2. Have a substantial, demonstrable negative aesthetic effect?	[ ]	[✓]	[ ]
3. Substantially affect a rare or endangered species of animal or plant or the habitat of the species?	[ ]	[✓]	[ ]
4. Interfere substantially with the movement of any resident or migratory fish or wildlife species?	[ ]	[✓]	[ ]
5. Substantially diminish habitat for fish, wildlife or plants?	[ ]	[✓]	[ ]
6. Breach published national, state, or local standards relating to solid waste or litter control?	[ ]	[✓]	[ ]
7. Substantially degrade water quality or contaminate a public water supply?	[ ]	[✓]	[ ]
8. Substantially degrade or deplete ground water resources or interfere substantially with ground water recharge?	[ ]	[✓]	[ ]
9. Disrupt or adversely affect a prehistoric or historic archeological site or a property of historic or cultural significance to a community or ethnic or social group; or a paleontological site except as part of scientific study?	[ ]	[✓]	[ ]
10. Induce substantial growth or concentration of population?	[ ]	[✓]	[ ]
11. Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system?	[ ]	[✓]	[ ]
12. Displace a substantial number of people?	[ ]	[✓]	[ ]

Environmental Information	Yes	No	Maybe
13. Encourage activities which result in the use of large amounts of fuel, water or energy?	[ ]	[✓]	[ ]
14. Use fuel, water or energy inefficiently?	[ ]	[✓]	[ ]
15. Increase substantially the ambient noise level for adjoining areas?	[ ]	[✓]	[ ]
16. Cause substantial flooding, erosion or siltation?	[ ]	[✓]	[ ]
17. Expose people or structures to major geologic hazards?	[ ]	[✓]	[ ]
18. Extend a sewer trunk line with capacity to serve new development?	[ ]	[✓]	[ ]
19. Disrupt or divide the physical arrangement of an established community?	[ ]	[✓]	[ ]
20. Create a potential public health hazard or involve the use, production, or disposal of materials which pose a hazard to people or animal or plant populations in the area affected?	[ ]	[✓]	[ ]
21. Conflict with established recreational, educational, religious or scientific uses?	[ ]	[✓]	[ ]
22. Convert prime agricultural land to non-agricultural use or impair the agricultural productivity of prime agricultural land?	[ ]	[✓]	[ ]
23. Interfere with emergency response or evacuation plans?	[ ]	[✓]	[ ]
24. Violate any ambient air quality standard, contribute substantially to an existing or projected air quality violation, or expose sensitive receptors to substantial pollutant concentrations?	[ ]	[✓]	[ ]
25. Emits Greenhouse Gas (GHG) emissions greater than 25,000 tons?	[ ]	[✓]	[ ]

NOTE: Please attach any pertinent explanatory information.

CERTIFICATION:

I hereby certify the statement furnished above and in attached exhibits present the data and information required for this initial evaluation to the best of my ability, and that the facts, statements, and information presented are true and correct to the best of my knowledge and belief.

Print Signing Authority Name If Different: Patrick Moyer

Signature: Patrick E. Moyer **Date:** 02/21/2024

EASTERN KERN AIR POLLUTION CONTROL DISTRICT
2700 "M" STREET SUITE 302, BAKERSFIELD, CA 93301-2370
PHONE: (661) 862-5250 • FAX: (661) 862-5251 • www.kernair.org

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Company/Billing Information

Business Name to Appear on Permit	Owner's Name	Phone No:
Willow Rock Energy Storage Center	GEM A CAES LLC	
Mailing Address: 333 Bay Street, Suite 520		**Business E-mail Address:**
City: Toronto, Ontario, Canada	**State:**	**Zip:** / **Fax No:**

Equipment Location

Street Address:	City	Zip
0.4 mi west of SR14 on Dawn Rd	Rosamond, CA.	93501
General Nature of Business: Electricity Generation		**S.I.C. CODE(S) *If Known*:** 4911009

Assessors' Parcel No: 431-022-13 OR _____/4 SECTION 33 TOWNSHIP 10N RANGE 12W

Application Type ***See ATC/PTO Instructions for appropriate filing fee***

☒ Authority To Construct (ATC)	☐ Permit To Operate (PTO)	☐ Change of Business Name
☐ ATC – Modification	☐ PTO – Modification	☐ Exemption
☐ ATC – Renewal	☐ PTO – Transfer of Ownership	☐ Exemption Renewal
☐ Transfer of Location	☐ Title V Initial/Renewal/Modification	☐ Banking Certificate

Description of Equipment or Modification for which application is made *(include Permit #'s if known)*

EGEN #3 - Kohler KD2500-4 diesel engine and 2.5 MW electrical generator set.
This engine and generator will be used for emergency power only.
Engine diesel fuel tank is exempt per Rule 202(G)(4)(a).

Use Additional Sheets if Necessary

Check all that apply

Is this Facility within 1,000 feet of the outer boundary of a school? ☐ YES ☒ NO
Have all necessary land-use authorizations been obtained? ☒ YES ☐ NO *(If "NO" attach explanation)*
Is there any other equipment in the EKAPCD jurisdiction operated by the same operator? ☐ YES ☒ NO
Is this application being submitted as the result of a Notice of Violation or Notice to Comply? ☐ YES ☒ NO
If YES, NOV/NTC #: N/A
Is this equipment portable AND will it be operated at different locations within EKAPCD jurisdiction? ☐ YES ☒ NO

Print Contact Name: Curt Hildebrand Consultant? ☐ YES ☒ NO If YES, please attach Assignment of Agent

Title: VP Comm. Affairs Phone: (925) 872-3791 E-Mail Address: curt.hildebrand@hydrostor.ca

Print Signing Authority Name If Different: Patrick Moyer Title: Secretary

Signature: Patrick E. Moyer Date: 02/21/2024

DATE RECEIVED **Validation (for EKAPCD use)**

ATC No: _____ **Filing Fee: $** _____
Equip Dscrpt: _____ **Receipt No:** _____
Equip Code: _____ **Date:** _____

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SUPPLEMENTAL APPLICATION
PISTON ENGINE DATA FORM

Business Name to Appear on Permit:	Owner's Name:	Phone No:
Willow Rock Energy Storage Center	GEM A CAES LLC	

Engine Information

Engine Manufacturer:	Model:	Model Year:	Serial Number:
EGEN #3 Kohler	KD2500-4	TBD	TBD

EPA Certification: ☐ Tier 0 ☐ Tier 1 ☐ Tier 2 ☐ Tier 3 ☒ Tier 4 ☐ Two Cycle ☒ Four Cycle

Number of Cylinders: 12 | Average Load: 75-100 % | Expected operating schedule: 1 hrs/day 50 hrs/year

Fuel Consumption: 174.5 gl/hr or Cuft/hr | Engine Rating: 3621 BHP @ 1800 RPM

Fuel Type: ☐ Gasoline ☒ Diesel ☐ CNG ☐ LPG ☐ Landfill Gas ☐ Digester Gas ☐ Other (list):

Emissions Controls (check all that apply)

☒ Turbo Charged ☐ Fuel Injected ☒ Lean Burn ☐ Rich Burn ☒ Inter Cooler ☐ After Cooler ☐ Timing Retarded ☐ Naturally Aspired

☒ Oxidation Catalyst (OC) ☒ Diesel Particulate Filter (DPF) ☐ Positive Crankcase Ventilation (PCV) ☐ Exhaust Gas Recirculation ☐ Non-selective Catalytic Reduction

DPF/OC Manufacturer: see attachments | DPF/OC Model: see attachments | DPF/OC Efficiency: see attachments

Emissions data collected from: ☒ Manufacturer Guarantee ☐ Source Test | List any other Emissions Control Device:

PM-10: 0.02 g/bhp-hr | NMHC: 0.14 g/bhp-hr | NOx: 0.50 g/bhp-hr | NMHC+NOx: 0.64 g/bhp-hr | CO: 2.6 g/bhp-hr

Exhaust Information

Stack Diameter: 1.033 in | Height Above Grade or Building: 22.93 ft | Exhaust Temp. @ Rated HP: 914 °F

Does the Stack have a Weather Cap: ☒ Yes ☐ No | Direction of exhaust from engine: ☒ Vertical ☐ Horizontal

Stack Serves: ☒ Only This Equipment ☐ This Engine and Other Equipment | Exhaust Flow Rate: 9734 per stack CFM

*If this stack serves additional equipment please list the type and rating of all other equipment on a separate sheet of paper and submit with this form.

Use (check all that apply)

☐ Pump Driver Rating: gpm | ☒ Electric Generator Rating: 2500 kw | ☐ Compressor Driver Rating: cfm

☐ Full Time ☐ Standby ☒ Emergency ☐ Other (list):

Check one if requesting emission limits exemption: ☒ Emergency Generator ☐ Remote Location (only valid in Indian Wells Valley)

Receptor Data

Is this engine located or to be located within ¼ mile of an off-site residential area (3 or more homes), school, or hospital? ☐ Yes ☒ No

If Yes, check one and complete the following: ☐ Residential ☐ School ☐ Hospital | Distance from Engine: N/A Ft.

Name of School or Hospital:	Address of Receptor:	City:	Compass Direction to Engine:
N/A	N/A	N/A	N/A Deg.

Print Contact Name: Curt Hildebrand Consultant? ☐ YES ☒ NO If YES, please attach Assignment of Agent

Title: VP Comm. Affairs Phone: 925-872-3791 E-Mail Address: curt.hildebrand@hydrostor.ca

Signature: Curt Hildebrand Date: 02/21/2024

EASTERN KERN AIR POLLUTION CONTROL DISTRICT
2700 "M" STREET SUITE 302, BAKERSFIELD, CA 93301-2370
PHONE: (661) 862-5250 • FAX: (661) 862-5251 • www.kernair.org

ENVIRONMENTAL INFORMATION FORM AND INITIAL STUDY EVALUATION

Applicant: Willow rock Energy Storage Center

Contact: Curt Hildebrand

Title: VP Commercial Affairs **Phone:** 925-872-3791

Project Description: CAES Electricity Generation Plant

Environmental Information	**Yes**	**No**	**Maybe**
Will the proposed project with regard to the proposed location:			
1. Conflict with the adopted environmental plans and goals of the community?	[ ]	[✓]	[ ]
2. Have a substantial, demonstrable negative aesthetic effect?	[ ]	[✓]	[ ]
3. Substantially affect a rare or endangered species of animal or plant or the habitat of the species?	[ ]	[✓]	[ ]
4. Interfere substantially with the movement of any resident or migratory fish or wildlife species?	[ ]	[✓]	[ ]
5. Substantially diminish habitat for fish, wildlife or plants?	[ ]	[✓]	[ ]
6. Breach published national, state, or local standards relating to solid waste or litter control?	[ ]	[✓]	[ ]
7. Substantially degrade water quality or contaminate a public water supply?	[ ]	[✓]	[ ]
8. Substantially degrade or deplete ground water resources or interfere substantially with ground water recharge?	[ ]	[✓]	[ ]
9. Disrupt or adversely affect a prehistoric or historic archeological site or a property of historic or cultural significance to a community or ethnic or social group; or a paleontological site except as part of scientific study?	[ ]	[✓]	[ ]
10. Induce substantial growth or concentration of population?	[ ]	[✓]	[ ]
11. Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system?	[ ]	[✓]	[ ]
12. Displace a substantial number of people?	[ ]	[✓]	[ ]

Environmental Information	Yes	No	Maybe
13. Encourage activities which result in the use of large amounts of fuel, water or energy?	[ ]	[✓]	[ ]
14. Use fuel, water or energy inefficiently?	[ ]	[✓]	[ ]
15. Increase substantially the ambient noise level for adjoining areas?	[ ]	[✓]	[ ]
16. Cause substantial flooding, erosion or siltation?	[ ]	[✓]	[ ]
17. Expose people or structures to major geologic hazards?	[ ]	[✓]	[ ]
18. Extend a sewer trunk line with capacity to serve new development?	[ ]	[✓]	[ ]
19. Disrupt or divide the physical arrangement of an established community?	[ ]	[✓]	[ ]
20. Create a potential public health hazard or involve the use, production, or disposal of materials which pose a hazard to people or animal or plant populations in the area affected?	[ ]	[✓]	[ ]
21. Conflict with established recreational, educational, religious or scientific uses?	[ ]	[✓]	[ ]
22. Convert prime agricultural land to non-agricultural use or impair the agricultural productivity of prime agricultural land?	[ ]	[✓]	[ ]
23. Interfere with emergency response or evacuation plans?	[ ]	[✓]	[ ]
24. Violate any ambient air quality standard, contribute substantially to an existing or projected air quality violation, or expose sensitive receptors to substantial pollutant concentrations?	[ ]	[✓]	[ ]
25. Emits Greenhouse Gas (GHG) emissions greater than 25,000 tons?	[ ]	[✓]	[ ]

NOTE: Please attach any pertinent explanatory information.

CERTIFICATION:

I hereby certify the statement furnished above and in attached exhibits present the data and information required for this initial evaluation to the best of my ability, and that the facts, statements, and information presented are true and correct to the best of my knowledge and belief.

Print Signing Authority Name If Different: Patrick Moyer

Signature: Patrick E Moyer **Date:** 02/21/2024

EASTERN KERN AIR POLLUTION CONTROL DISTRICT
2700 "M" STREET SUITE 302, BAKERSFIELD, CA 93301-2370
PHONE: (661) 862-5250 • FAX: (661) 862-5251 • www.kernair.org

APPLICATION FOR AUTHORITY TO CONSTRUCT, PERMIT TO OPERATE, EXEMPTION, AND BANKING CERTIFICATE

Company/Billing Information

Business Name to Appear on Permit:	Owner's Name:	Phone No:
Willow Rock Energy Storage Center	GEM A CAES LLC	
Mailing Address:		Business E-mail Address:
333 Bay Street, Suite 520		
City:	State:	Zip:	Fax No:
Toronto, Ontario, Canada			

Equipment Location

Street Address:	City:	Zip:
0.4 mi west of SR14 on Dawn Rd.	Rosamond, Ca.	93501
General Nature of Business:		S.I.C. CODE(S) *If Known*:
Electricity Generation		4911009

Assessors' Parcel No: 431-022-13 OR _____/4 SECTION 33 TOWNSHIP 10N RANGE 12W

Application Type ***See ATC/PTO Instructions for appropriate filing fee***

☒ Authority To Construct (ATC)	☐ Permit To Operate (PTO)	☐ Change of Business Name
☐ ATC – Modification	☐ PTO – Modification	☐ Exemption
☐ ATC – Renewal	☐ PTO – Transfer of Ownership	☐ Exemption Renewal
☐ Transfer of Location	☐ Title V Initial/Renewal/Modification	☐ Banking Certificate

Description of Equipment or Modification for which application is made ***(include Permit #'s if known)***

Fire Pump - Cummins QST15 diesel engine and water pump drive assembly.
This engine and pump assembly will be used for emergency fire suppression only.
Engine diesel fuel tank is exempt per Rule 202(G)(4)(a).

Use Additional Sheets if Necessary

Check all that apply

Is this Facility within 1,000 feet of the outer boundary of a school? ☐ YES ☒ NO
Have all necessary land-use authorizations been obtained? ☒ YES ☐ NO *(If "NO" attach explanation)*
Is there any other equipment in the EKAPCD jurisdiction operated by the same operator? ☐ YES ☒ NO
Is this application being submitted as the result of a Notice of Violation or Notice to Comply? ☐ YES ☒ NO
If YES, NOV/NTC #: N/A
Is this equipment portable AND will it be operated at different locations within EKAPCD jurisdiction? ☐ YES ☒ NO

Print Contact Name: Curt Hildebrand Consultant? ☐ YES ☒ NO If YES, please attach Assignment of Agent

Title: VP Comm. Affairs Phone: (925) 872-3791 E-Mail Address: curt.hildebrand@hydrostor.ca

Print Signing Authority Name If Different: Patrick Moyer Title: Secretary

Signature: Patrick E. Moyer Date: 02/21/2024

DATE RECEIVED **Validation (for EKAPCD use)**

ATC No: _____ **Filing Fee: $** _____
Equip Dscrpt: _____ **Receipt No:** _____
Equip Code: _____ **Date:** _____

EASTERN KERN AIR POLLUTION CONTROL DISTRICT
2700 "M" STREET SUITE 302, BAKERSFIELD, CA 93301-2370
PHONE: (661) 862-5250 • FAX: (661) 862-5251 • www.kernair.org

SUPPLEMENTAL APPLICATION
PISTON ENGINE DATA FORM

Business Name to Appear on Permit:	Owner's Name:	Phone No:
Willow Rock Energy Storage Center	GEM A CAES LLC	

Engine Information

Engine Manufacturer:	Model:	Model Year:	Serial Number:
Cummins	QST15 CFP15EVS-F10	TBD	TBD

EPA Certification: ☐ Tier 0 ☐ Tier 1 ☐ Tier 2 ☒ Tier 3 ☐ Tier 4 ☐ Two Cycle ☒ Four Cycle

Number of Cylinders: 6 | Average Load: 75-100 % | Expected operating schedule: 1 hrs/day 50 hrs/year

Fuel Consumption: 22.5 gl/hr or Cuft/hr | Engine Rating: 460 BHP @ 1760 RPM

Fuel Type: ☐ Gasoline ☒ Diesel ☐ CNG ☐ LPG ☐ Landfill Gas ☐ Digester Gas ☐ Other (list):

Emissions Controls (check all that apply)

☒ Turbo Charged ☐ Fuel Injected ☒ Lean Burn ☐ Rich Burn ☒ Inter Cooler ☐ After Cooler ☐ Timing Retarded ☐ Naturally Aspired

☐ Oxidation Catalyst (OC) ☒ Diesel Particulate Filter (DPF) ☐ Positive Crankcase Ventilation (PCV) ☐ Exhaust Gas Recirculation ☐ Non-selective Catalytic Reduction

DPF/OC Manufacturer: see attachments | DPF/OC Model: see attachments | DPF/OC Efficiency: see attachments

Emissions data collected from: ☒ Manufacturer Guarantee ☐ Source Test | List any other Emissions Control Device:

PM-10: 0.15 g/bhp-hr | NMHC: 0.15 g/bhp-hr | NOx: 2.85 g/bhp-hr | NMHC+NOx: 3.0 g/bhp-hr | CO: 2.6 g/bhp-hr

Exhaust Information

Stack Diameter: 6 in | Height Above Grade or Building: 15 ft | Exhaust Temp. @ Rated HP: 825 °F

Does the Stack have a Weather Cap: ☒ Yes ☐ No | Direction of exhaust from engine: ☒ Vertical ☐ Horizontal

Stack Serves: ☒ Only This Equipment ☐ This Engine and Other Equipment | Exhaust Flow Rate: 2881 CFM

*If this stack serves additional equipment please list the type and rating of all other equipment on a separate sheet of paper and submit with this form.

Use (check all that apply)

☒ Pump Driver Rating: variable gpm | ☐ Electric Generator Rating: kw | ☐ Compressor Driver Rating: cfm

☐ Full Time ☐ Standby ☒ Emergency ☐ Other (list):

Check one if requesting emission limits exemption: ☐ Emergency Generator ☒ Remote Location (only valid in Indian Wells Valley)

Receptor Data Unable to uncheck Remote Location

Is this engine located or to be located within ¼ mile of an off-site residential area (3 or more homes), school, or hospital? ☐ Yes ☒ No

If Yes, check one and complete the following: ☐ Residential ☐ School ☐ Hospital | Distance from Engine: N/A Ft.

Name of School or Hospital:	Address of Receptor:	City:	Compass Direction to Engine:
N/A	N/A	N/A	N/A Deg.

Print Contact Name: Curt Hildebrand Consultant? ☐ YES ☒ NO If YES, please attach Assignment of Agent

Title: VP Comm. Affairs Phone: (925) 872-3791 E-Mail Address: curt.hildebrand@hydrostor.ca

Signature: Curt Hildebrand Date: 02/21/2024

Attachment 2
AFC Project Description Section

1.0 INTRODUCTION

On December 1, 2021, GEM A-CAES LLC (GEM, or the Applicant) filed this Application for Certification (AFC) with the California Energy Commission (CEC) seeking to construct and operate the Gem Energy Storage Center (21-AFC-02). On August 5, 2022, the Applicant changed the name of the project to the Willow Rock Energy Storage Center (Willow Rock, or WRESC). On June 21, 2023, the Applicant's *Status Report No. 10* stated that efforts to optimize the proposed WRESC were ongoing, including consideration of alternative surface facility configurations, cavern engineering options given the site geotechnical results, and alternate sites that may better support the cavern design. Alternative sites included adjacent and offsite properties in the area with potentially more favorable geologic conditions.

On July 12, 2023, CEC staff filed a motion requesting that the CEC Siting Committee for Willow Rock (Committee) grant an order suspending the AFC proceeding for Willow Rock and requested that the Applicant be directed to submit a supplemental AFC that contains all necessary information for the updated project.

On August 9, 2023, the Committee issued an order indicating that the Applicant may file a single supplemental AFC that updates the project description and all required elements of the application reflecting all project modifications to satisfy the information requirements for an application, as detailed in Appendix B to Article 6 of Title 20 in the California Code of Regulations.

This document is the Supplemental AFC filed in response to the direction set forth in the Committee's August 9, 2023, order (CEC Transaction Numbers (TN#) 251599, 251592).

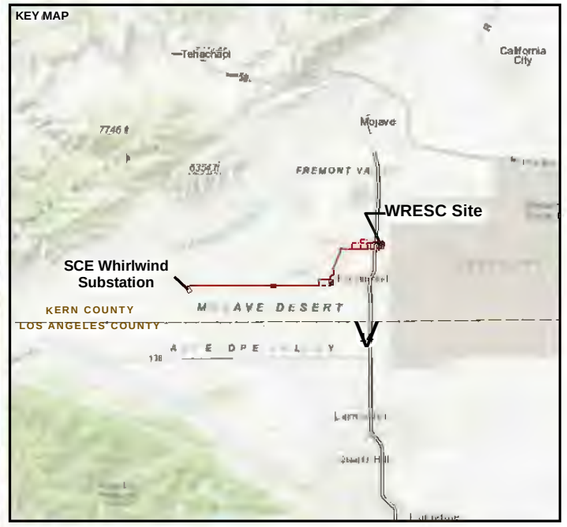
As described further in this Supplemental AFC, the WRESC will be a nominal 520-megawatt (MW) gross (500 MW net) and 4,160 megawatt-hour (MWh) gross (4,000 MWh net) facility using Hydrostor, Inc.'s (Hydrostor's) proprietary, advanced compressed air energy storage (A-CAES) technology. Energy stored at the WRESC will be delivered to Southern California Edison's (SCE's) Whirlwind Substation located southwest of the WRESC at the intersection of 170th Street W and Rosamond Boulevard, via a new approximately 19-mile 230-kilovolt (kV) generation-tie (gen-tie) line. The WRESC will be capable of operating on a 24-hour basis, 365 days a year with an approximately 50-year lifespan.

WRESC will deploy proprietary A-CAES technology consisting of all-electric air compressors and associated power turbine trains, an underground compressed air storage cavern, and miscellaneous aboveground support facilities. Willow Rock will provide unique operation and reliability characteristics that neither conventional nor renewable power plant technologies or batteries can provide on their own. The main elements of Willow Rock, including an optional architectural berm, are further summarized in Section 1.3, below. A detailed project description is included in Chapter 2 of this Supplemental AFC.

Figure 1-1 shows the existing conditions of the WRESC site, and **Figure 1-2** and **Figure 1-3** provide architectural renderings of the same area after construction of Willow Rock with and without the architectural berm on the west and north sides of the WRESC site.

KEY MAP

KEY MAP



REFERENCE(S)

1. PROJECT AREA AERIAL IMAGE - GOOGLE EARTH PRO, 2024
2. COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET
3. MAP SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
EXISTING SITE CONDITIONS

CONSULTANT
wsp

YYYY-MM-DD	2024-02-15
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VG/LL

PROJECT NO.	CONTROL	REV.	FIGURE
31406639.003	01	0	1-1

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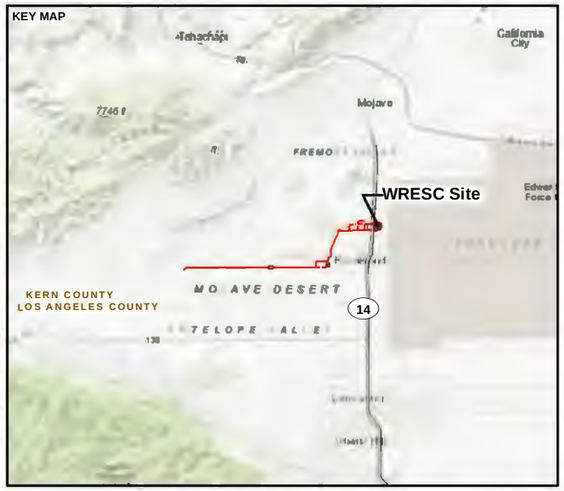
KEY MAP



REFERENCE(S)

1. WRESC SITE RENDERING - KIEWIT 2024
2. COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET
2. MAP SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
RENDERING OF WILLOW ROCK STORAGE CENTER WITH ARCHITECTUAL BERM

CONSULTANT

wsp

YYYY-MM-DD	2024-02-21
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VG/LL

PROJECT NO.	CONTROL	REV.	FIGURE
31406639.003	01	0	1-2

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KEY MAP

REFERENCE(S)

1. WRESC SITE RENDERING - KIEWIT 2024
2. COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET
2. MAP SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
RENDERING OF WILLOW ROCK STORAGE CENTER WITHOUT ARCHITECTUAL BERM

CONSULTANT

wsp

YYYY-MM-DD	2024-02-21
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VG/LL

PROJECT NO.	CONTROL	REV.	FIGURE
31406639.003	01	0	1-3

1.1 Project Objectives

The Willow Rock basic project objectives are the following:

1. Provide 500 MW of quick-starting, flexible, controllable generation with the ability to ramp up and down through a wide range of electrical output to facilitate the integration of renewable energy into the electrical grid in satisfaction of California's Renewable Portfolio Standard and climate objectives, by displacing older and less efficient generation.
2. Interconnect the project to the CAISO-controlled SCE Whirlwind Substation, a major substation in or near the Tehachapi Renewable Wind Resource Area, to facilitate the integration of onshore and offshore renewable energy development.
3. Implement a proven sustainable energy storage technology that provides improved technological diversity, non-combustible energy storage, minimal residual hazardous waste at asset retirement, a long-term commercial lifespan of 30 years or greater, and non-degrading energy storage.
4. Use A-CAES technology to provide dispatchable long-duration storage and energy delivery for a minimum of 8 hours; fossil fuel and greenhouse gas emissions-free operation; flexible capacity with minimal response time; provide long-duration storage to avoid curtailment through energy storage and to facilitate the further integration of renewable resources; peaking energy for local contingencies; voltage support and primary frequency response, including synchronous power output to support grid resiliency without the need for fossil fuel; superior transient response attributes, including synchronous power output; and superior round-trip thermodynamic efficiency.
5. Locate the facility on a site with adequate geologic characteristics for the underground facilities for compressed air storage, including suitable overburden characteristics (limited thickness, constructable soil type); deep subsurface geological formation (2,000 to 2,500 feet below ground surface) of sufficient quality and definition at the required depth for construction of the excavated storage cavern; ultra-low hydraulic conductivity and permeability in deep subsurface geological formation to retain water and air under pressure within the excavated storage cavern; and competent geological structural integrity to sustain an excavated storage cavern at depth intact indefinitely, allowing for repeated compressed air injection and discharge cycles over the life of the project without eroding or collapsing.
6. Site the project on land with acceptable constructability and with adequate access and size for construction of aboveground facilities—at least approximately 80 acres.
7. Site the project near adequate water supply for construction.
8. Locate the project on a site that is available to provide adequate site control, through long-term lease or purchase.
9. Minimize additional supporting infrastructure needs and reduce potential environmental impacts by locating the facility near existing and planned infrastructure, including access to an existing substation with available transmission capacity.
10. Create jobs in Kern County and the state of California through both construction and operation of the facility.
11. Be a good corporate citizen and respected member of the community through the lifecycle of the project.

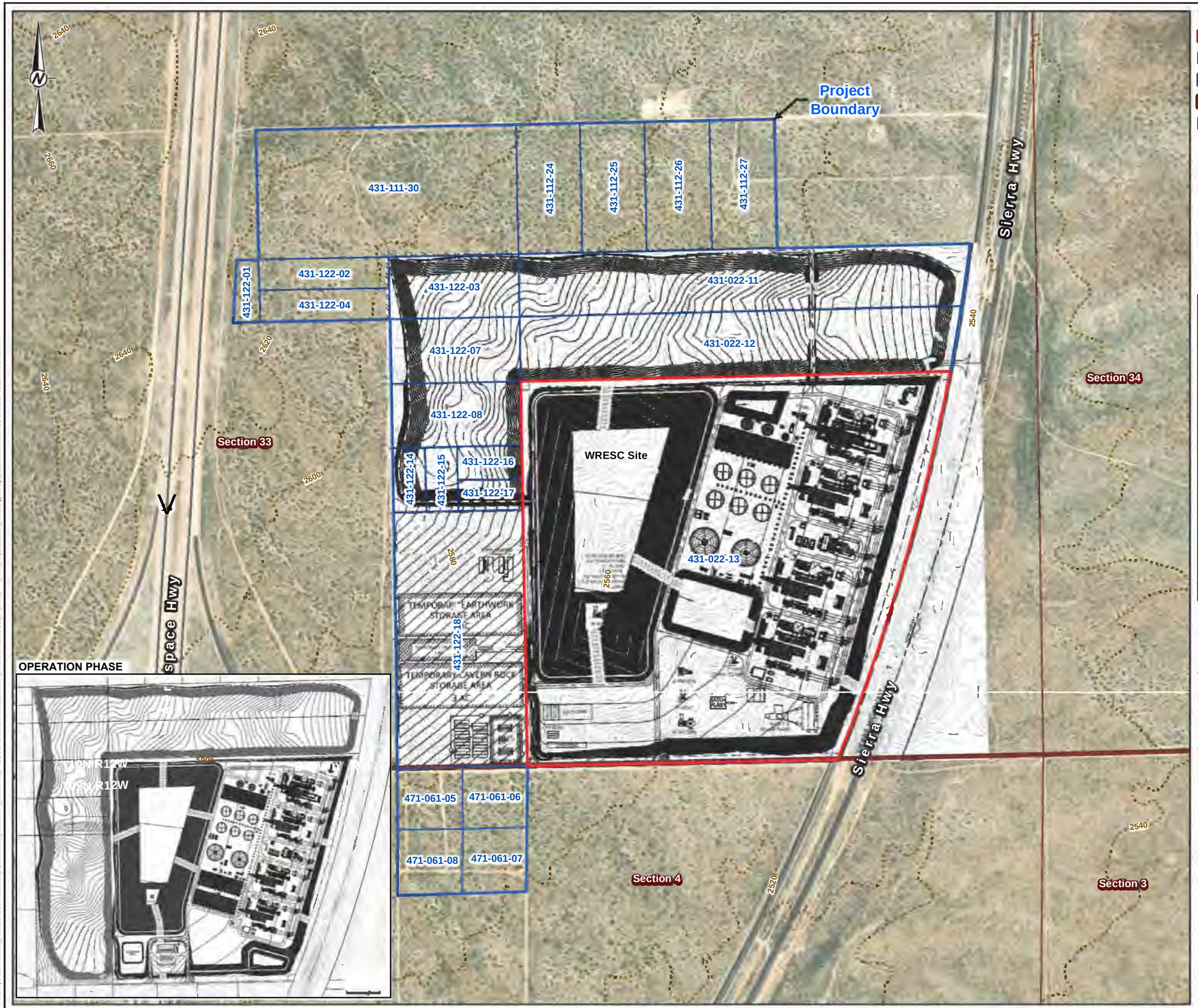
1.2 Project Location

Willow Rock will be located in unincorporated Kern County (County), approximately 4 miles north of Rosamond, California (**Figure 1-4** and **Figure 1-5**). The WRESC site is within the southeast quarter of Section 33 of Township 10 North, Range 12 West.

The WRESC site is located on the western portion of an approximately 112-acre parcel with Assessor's Parcel Number (APN) 431-022-13 that is bisected by Sierra Highway and the Union Pacific Railway. The eastern portion of APN 431-022-13 is not included in the project boundary. The WRESC site is bounded on the north and west by undeveloped property, on the east by Sierra Highway, and on the south by Dawn Road approximately 1,800 feet east of the State Route 14 corridor. Additional parcels adjacent to the WRESC site within the project boundary may be used for temporary parking, construction laydown, or construction of an architectural berm.

The WRESC site is currently proposed on undeveloped land in an area zoned Limited Agriculture (A-1) District. The area surrounding the project boundary is largely undeveloped with very sparse residential development; the nearest residence is approximately 0.8 miles northwest of the northwest corner of the WRESC site. The parcels within the project boundary including the WRESC site are not under a Williamson Act Contract.

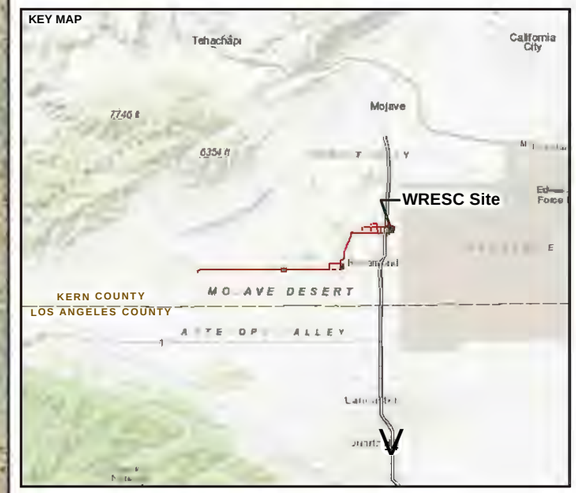
Appendix 1A contains a copy of the Assessor's Parcel Map for the parcels within the project boundary. A list and map of the owners of properties within 1,000 feet of the project boundary and 500 feet of the proposed gen-tie line is provided in Appendix 1B. **Figure 1-6** shows the project boundary and gen-tie line.



LEGEND

- WRESC Site
- Other Project Parcel
- Project Boundary
- PLSS Township and Range
- PLSS Section

KEY MAP



0 500 1,000

1 " = 500 feet FEET

REFERENCE(S)

1. WRESC SITE PLAN - KIEWIT 2024
2. PLSS - CALIFORNIA STATE GEOPORTAL PLSS DB, 2023
3. PARCEL BOUNDARIES - KERN COUNTY, 2023
4. COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET
5. MAP SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY

CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
PROJECT LOCATION MAP OF WILLOW ROCK ENERGY STORAGE CENTER WITH ARCHITECTUAL BERM (CONSTRUCTION PHASE)

CONSULTANT

wsp

YYYY-MM-DD	2024-02-22
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VG/LL

PROJECT NO.	CONTROL	REV.	FIGURE
31406639.003	01	0	1-4

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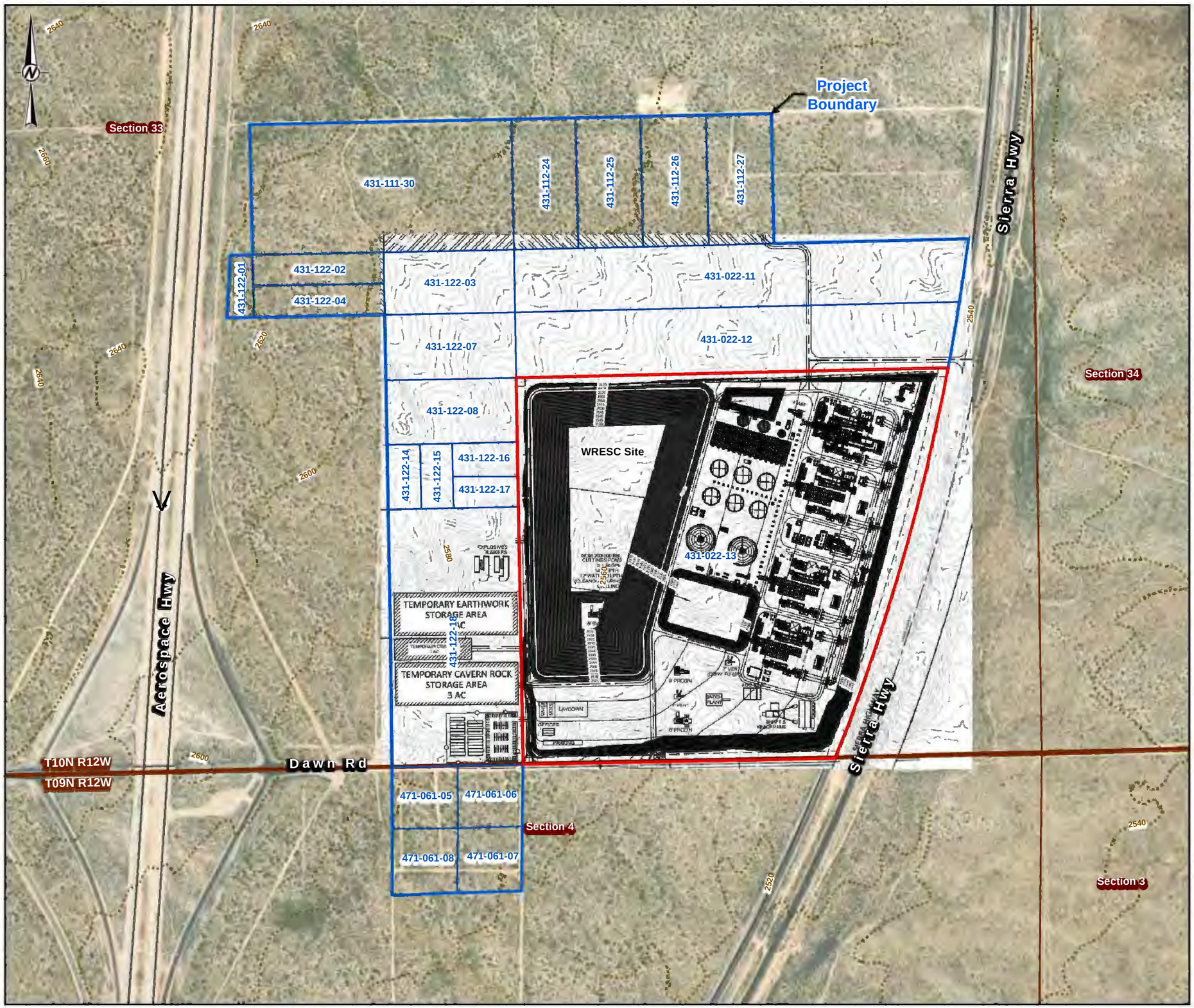
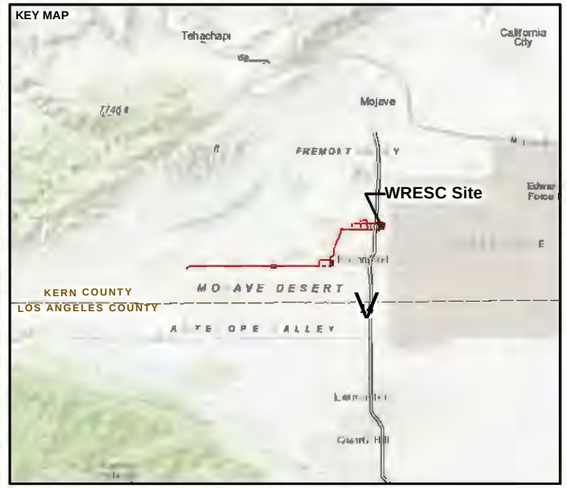


LEGEND

- WRESC Site
- Other Project Parcel
- Project Boundary
- PLSS Township and Range
- PLSS Section

KEY MAP



0 500 1,000

1 " = 500 feet FEET

REFERENCE(S)

1. WRESC SITE PLAN - KIEWIT 2024
2. PLSS - CALIFORNIA STATE GEOPORTAL PLSS DB, 2023
3. PARCEL BOUNDARIES - KERN COUNTY, 2023
4. COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET
5. MAP SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY

CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
PROJECT LOCATION MAP OF WILLOW ROCK ENERGY STORAGE CENTER WITHOUT ARCHITECTUAL BERM

CONSULTANT

wsp

YYYY-MM-DD	2024-02-22
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VG/LL

PROJECT NO.	CONTROL	REV.	FIGURE
31406639.003	01	0	1-5

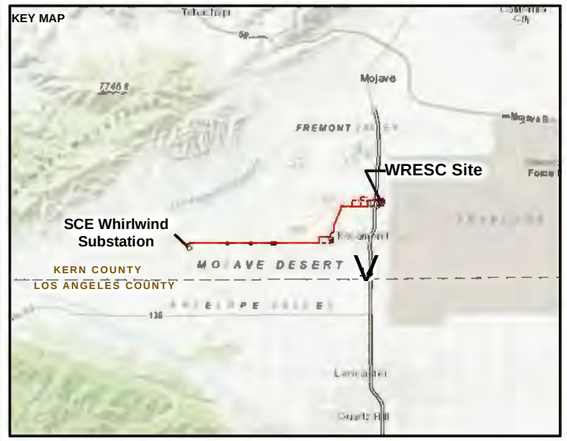
LEGEND

Proposed Transmission Line

- Preferred Route, Aboveground
- Preferred Route, Underground
- Route Options 1-6, Aboveground
- Route Options 1-6, Underground

Project Components

- WRESC Site
- Other Project Parcel
- Project Boundary
- SCE Whirlwind Substation



0 8,000 16,000

1 " = 8,000 feet FEET

REFERENCE(S)

1. TRANSMISSION LINES - GEM A-CAES LLC
2. PARCEL BOUNDARIES - KERN COUNTY GIS DEPT.
3. COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET
4. MAP SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY SOURCE: ESRI, MAXAR, EARTHSTAR GEOGRAPHICS, AND THE GIS USER COMMUNITY

CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
PROJECT SITE AND FACILITIES MAP

CONSULTANT

wsp

YYYY-MM-DD	2024-02-20
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VG/LL

PROJECT NO.	CONTROL	REV.	FIGURE
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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM ANSI B

PATH: G:\Hydrostor\Ansel99_PROJECTS\31406639.003_HydrostorAnsel_Section1\01_Section1\02_PRODUCTION\MXD\FIGURES\Section_1\Rev0\31406639-003_01_0104_F1-4_Rev0_ProjSiteAndFacilities_WRESC.mxd PRINTED ON: 2024-02-20 AT 12:13:02 PM

1.3 Project Elements

WRESC includes the following key features:

- A-CAES Energy Storage Process, Cooling Systems and Electric Transmission
  - All-electric-motor-driven air compressors configured in four trains, totaling nominally 500 MW net
  - Air-powered turbine generators with air discharge stacks
  - Heat extraction and recovery main process heat exchangers
  - Thermal storage system using water
  - Electric, air-cooled heat exchangers
  - Hydrostatically compensating surface reservoir with liner and interlocking shape floating cover
  - Evaporation pond for process water
  - Aboveground piping pipe racks and filter houses
  - Underground compressed air storage cavern
  - Interconnecting shafts for movement of compressed air and water to and from the cavern
  - Optional permanent aboveground architectural berm for onsite re-use of excavated cavern rock[1]
  - Approximately 19-mile long 230 kV single-circuit, double-conductor bundle generation-tie (gen-tie) line interconnecting to the SCE Whirlwind Substation with a preferred gen-tie route and alternate route options
  - Approximately 125 transmission poles
- Operation and Maintenance Facilities, Ancillary Support Systems and Other Features
  - Site stormwater drainage system and stormwater percolation/evaporation pond
  - Water supply from adjacent existing Antelope Valley East Kern Water Agency's supply pipeline
  - Fire detection and fire monitoring system
  - Firewater tank and fire suppression system
  - Diesel-fired emergency fire pump
  - Diesel-fired emergency backup power supply engines to maintain critical loads in the event of a loss of power
  - Combined Office, Control Room, and Maintenance Building
  - Employee and visitor parking area with electric vehicle charging ports and landscaping
  - Primary and secondary entrances with security access gates and site perimeter fencing
  - Permanent plant access roads within the WRESC
  - Extension/upgrades to Dawn Road between the State Route (SR) 14 interchange and Sierra Highway
  - Unpaved access road for portions of the gen-tie line corridor that do not have established access
- Temporary Construction Facilities
  - Temporary laydown and parking areas including cavern construction laydown area, construction phase earthwork areas, cavern rock temporary re-use areas, cavern rock temporary backup re-use areas, and parking areas located on adjacent and nearby parcels
  - Temporary rock crushing facility and portable concrete batch plant to support cavern construction and excavated rock management
  - Temporary entrances for construction
  - Temporary conductor pull and tensioning sites
  - Temporary disturbance for each transmission pole placement

Chapter 2, Project Description, of this Supplemental AFC provides details regarding project elements.

[1] Approximately 1.3 million cubic yards of crushed rock (accounting for swell and void space) would be extracted during construction of the cavern. The WRESC will include options for managing the extracted rock that may be implemented alone or in any combination, including (a) permanent onsite storage in the form of an architectural berm around portions of the WRESC; (b) off-taker transport for commercial use; and (c) off-taker transport for permanent offsite storage. The size of the potential architectural berm will depend on the quantity of rock. The height is expected to not exceed approximately 10 feet. If all the rock were re-used onsite, the total facility size would increase by up to an additional approximately 74.6 acres for a total of approximately 163.2 acres.

1.4 Project Benefits

The WRESC will provide the following key environmental and economic benefits:

- **Strategic location:** The WRESC is located strategically to facilitate the further integration of variable renewable resources located in the Tehachapi Renewable Resource Area, which will help avoid curtailment of variable renewable energy resources through energy storage and to meet California and regional electric grid reliability needs.
- Hydrostor A-CAES technology that provides:
  - Fossil fuel emissions-free spinning reserve.
  - Flexible capacity with minimal start time.
  - Peaking energy for local contingencies.
  - Voltage support and primary frequency response without burning fossil fuel.
  - Superior transient response attributes.
  - Superior round-trip thermodynamic efficiency.
- **Minimized land use impacts:** Willow Rock is sited on compatibly zoned parcels in a sparsely populated area. There are no schools, parks, recreational areas, or other sensitive land uses immediately adjacent to the WRESC Site. The project is consistent with the applicable local land uses and land use plans.
- **Key project for integrating renewables:** Willow Rock will provide rapid-response delivery of energy and synchronous condenser voltage support services that are essential to providing reliability support and stability to the grid and integrating intermittent renewable energy sources into the electrical grid.
- **Substantial construction jobs:** Willow Rock will provide approximately 275 to 750 construction jobs (average to peak) with an expected construction payroll of approximately $400–450 million over the 60-month construction and commissioning period.
- **Permanent local jobs:** Willow Rock will provide approximately 40 full time jobs for operation of the facility.
- **Substantial property tax revenue to Kern County and local schools:** With its sizeable capital cost (estimated at approximately $1.5 billion), Willow Rock will generate significant income in the form of annual property tax payments, and therefore will provide a robust boost to Kern County's economy and local schools.
- **Local economic benefits:** In addition to the direct employment benefit, Willow Rock will require and use the services of local or regional firms for major maintenance and overhauls, plant supplies, and other support services throughout the life of the Willow Rock facility. The project will not significantly impact local housing, educational, or emergency response resources.
- **Supportive community participant:** The Applicant is committed to working collaboratively with the local community and the County to be a beneficial contributor to community programs and supportive community participant.

1.5 Project Operation

Willow Rock will be designed to operate 24 hours per day, 7 days per week and be available to operate at full load at least 95 percent of the time. The facility will typically cycle between Charging Mode (compression/energy storage) lasting approximately 14 hours and Discharging Mode (decompression/power production) lasting 8 hours at nameplate capacity.

During Charging Mode, electric power will be drawn from the grid (typically off-peak) to run the all-electric air compressors. Compressed air will be injected into a water-filled subterranean cavern displacing the cavern water upward into the hydrostatically compensating reservoir. Heat generated during the compression process will be recovered to heat water in a closed loop thermal storage system, with hot water stored in aboveground spherical tanks (spheres). Upon completion of the charging cycle, the system will be available to generate electricity.

During the Discharge Mode, water from the hydrostatically compensating reservoir will be allowed to flow down into the subterranean cavern, displacing the stored compressed air which will be expanded in power turbines to generate electricity for up to 8 or more hours. Hot water recovered and stored in the aboveground spheres during the charging cycle will be used to reheat the expanding air at intermediate turbine stages to facilitate higher

efficiency power generation. During the compression process, water vapor entrained in the compressed air will be condensed and recycled. Dry air exiting the power turbines will be discharged to the atmosphere through five stacks, one serving each power generation train. No fossil fuels will be required to operate the Willow Rock facility.

1.6 Project Ownership

Project Applicant, Owner, and Operator:

GEM A-CAES LLC is the Applicant, owner, and operator of the Willow Rock project, including all aboveground and underground power plant facilities, the onsite substation, and the interconnecting gen-tie line. GEM is a wholly owned subsidiary of Hydrostor Inc.

Hydrostor is a private company based in Toronto, Canada, and is the world's leading developer of utility-scale energy storage facilities deploying its proprietary A-CAES product.

Project Site Owner:

Willow Rock will be located on an approximately 88.6-acre portion of an approximately 112-acre parcel that is currently owned by Zevsar Concepts, LLC, a Nevada limited liability company. GEM has obtained site control of the entire 112-acre parcel by virtue of an optional purchase and sale agreement with the landowner.

Project Construction and Laydown Area Owners:

GEM has entered into, or is in the process of completing, pending purchase and sale agreements with each of the parcel owners that provides the project with full access and site control.

There are no current plans to merge project parcels. Further, merger is not required under the Kern County Code (§ 18.06.030).

A complete listing of properties associated with the project development included in Tables 2-1 and 2-2. Additional information regarding the WRESC and construction laydown area parcels is provided in Appendix 1D.

1.7 Project Schedule

Construction of Willow Rock is expected to begin no later than March 2025. Pre-operational testing of the power plant is expected to begin during 2029, and full-scale operation is expected to begin by September 2029. Additional details of the major milestones are provided in Table 2-8 in Chapter 2, Project Description.

1.8 Persons Who Prepared the Application for Certification

Appendix 1C contains a listing of the persons involved in preparation of the AFC, including their roles and responsibilities.

2.0 Project Description

The Willow Rock Energy Storage Center (WRESC, or Willow Rock) will be located on approximately 88.6 acres of private land immediately north of Dawn Road and between State Route (SR) 14 and Sierra Highway within unincorporated, southeastern Kern County, California. The WRESC will be a nominal 520-megawatt (MW) gross (500 MW net) and 4,160 megawatt-hour (MWh) gross (4,000 MWh net) facility using Hydrostor, Inc.'s (Hydrostor's) proprietary, advanced compressed air energy storage (A-CAES) technology. Energy stored at the WRESC will be delivered to Southern California Edison's (SCE's) Whirlwind Substation located southwest of the WRESC at the intersection of 170th Street W and Rosamond Boulevard, via a new approximately 19-mile 230-kilovolt (kV) generation-tie (gen-tie) line. The WRESC will be capable of operating on a 24-hour basis, 365 days a year with an approximately 50-year lifespan.

The proposed project includes the following key features:

- A-CAES Energy Storage Process, Cooling Systems and Electric Transmission
  - Eight electric-motor-driven air compressors configured in four trains, totaling nominally 500 MW net
  - Four nominally 130 MW air-powered turbine generators with 100-foot-tall air vent stacks
  - Heat extraction and recovery main process heat exchangers
  - Thermal storage system using water, including up to six, 87.5-foot-diameter by 100-foot-tall (maximum) hot-water spherical storage tanks and two 150-foot-diameter, 60-foot-tall cold-water storage tanks
  - Cooling system: three air-cooled heat exchangers with evaporative mist system using excess internally produced process water
  - One approximately 21.5-acre, 577-acre-foot capacity hydrostatically compensating surface reservoir with liner and interlocking shape floating cover
  - One lined evaporation pond for process water
  - Aboveground piping pipe racks and filter houses
  - Underground compressed air storage cavern (approximately 900,000 cubic yards capacity)
  - Interconnecting conduits for movement of compressed air to and from the cavern
  - Potential permanent aboveground architectural berm for onsite re-use of excavated cavern rock[1]
  - Onsite 230 kV substation with oil-filled transformers with 230/13.8 kV rating
  - One approximately 19-mile-long 230 kV single-circuit double-bundle conductor generation-tie (gen-tie) line interconnecting to the SCE Whirlwind Substation with a preferred gen-tie route and route options
  - Approximately 125 transmission poles (approximately 0.1 acres permanent disturbance)
- Operation and Maintenance Facilities, Ancillary Support Systems, and Other Features
  - Site stormwater drainage system and stormwater percolation/evaporation ponds
  - Water supply connection to an existing Antelope Valley East Kern Water Agency's supply pipeline adjacent to Sierra Highway east of the WRESC Site
  - Fire detection and fire monitoring systems
  - Firewater tank and fire suppression system
  - Acoustic enclosures for Turbomachinery
  - Weather Enclosures for Motor Control Center
  - One diesel-fired 345-kilowatt (kW) (460 horsepower) emergency fire pump
  - Three diesel-fired up to 2.5 MW, 4.16 kV emergency backup power supply engines to maintain critical loads in the event of a loss of power
  - One combined office, control room, and maintenance building
  - Employee and visitor parking area with electric vehicle charging ports and landscaping
  - Primary and secondary entrances with security access gates and site perimeter fencing

[1] Approximately 1.3 million cubic yards of crushed rock (accounting for swell and void space) would be extracted during construction of the cavern. The WRESC will include options for managing the extracted rock that may be implemented alone or in any combination, including (a) permanent on-site storage in the form of an architectural berm around portions of the WRESC; (b) off-taker transport for commercial use; and (c) off-taker transport for permanent off-site storage. The size of the potential architectural berm will depend on the quantity of rock. The height is expected to not exceed approximately 10 feet. If all the rock were re-used onsite, the total facility size would increase by up to an additional approximately 74.6 acres for a total of approximately 163.2 acres.

  - Permanent plant access roads within the WRESC Site
  - Extension/upgrades to Dawn Road between the SR 14 interchange and Sierra Highway
  - An estimated up to 1.75 miles of unpaved service access road along the gen-tie line corridor as needed (approximately 4 acres permanent disturbance)
- Temporary Construction Facilities
  - Up to approximately 136.3-acre total laydown areas including cavern construction laydown area, construction phase earthwork areas, cavern rock temporary re-use areas, cavern rock temporary backup re-use areas, and parking areas located on adjacent and nearby parcels
  - Rock crushing facility and concrete batch plant to support cavern construction and excavated rock management (acreage included in 136.3-acre total temporary disturbance)
  - Two temporary entrances for construction; the Dawn Road construction entrance may be converted to permanent
  - Up to five conductor pull and tensioning sites (3.4 acres total)
  - Approximately 75- by 75-foot temporary disturbance for placement of each transmission pole (16.1 acres total)

Willow Rock will not require the combustion of fossil fuel and will not produce combustion-related air emissions during normal operation.[2]

The WRESC Site is located immediately north of Dawn Road and immediately west of Sierra Highway, Rosamond, California, on the 88.6-acre portion of Assessor's Parcel Number 431-022-13, located west of Sierra Highway. The final site boundary and potential construction laydown areas depend on whether the facility will include onsite re-use of excavated cavern rock in an architectural berm on the west and north sides of the facility. **Figure 2-1** and **Figure 2-2** show the WRESC Site and potential construction laydown areas with and without the architectural berm option, respectively. **Table 2-1** summarizes all parcels that will be associated with immediate site development if excavated cavern rock is hauled offsite. **Table 2-2** summarizes all parcels that will be associated with immediate site development if excavated cavern rock is re-used onsite in an architectural berm.

Table 2-1: Main Facility and Associated Parcels with Excavated Cavern Rock Hauled Offsite (No Architectural Berm)

Assessor's Parcel Number	Owner	Parcel Size (acres)	Use
431-022-13	Zevsar Concepts LLC	88.6	Main facility - permanent
431-122-18	Private Owner	20.3	Temporary construction laydown and parking, if needed
431-022-12	Private Owner	17.2	Temporary construction laydown and parking
431-022-11	Private Owner	17	Temporary construction laydown and parking
431-022-08	GEM A-CAES LLC	79.4	Temporary construction laydown and parking and/or Permanent environmental mitigation site

[2] The project will include three emergency diesel-fired engines to maintain critical loads in the event of a loss of power and one diesel-fired fire pump engine. These engines are expected to operate less than 50 hours per year for reliability testing and maintenance and will not operate concurrently during testing. The diesel-fired engines will operate in an emergency for other critical facility loads when electric power is not available. A separate diesel-engine-driven fire pump will provide water in the event of an emergency. This emergency backup equipment does not need to operate for the WRESC to function during normal operation.

Table 2-2: Main Facility and Associated Parcels with Onsite Cavern Rock Re-use (with Architectural Berm)

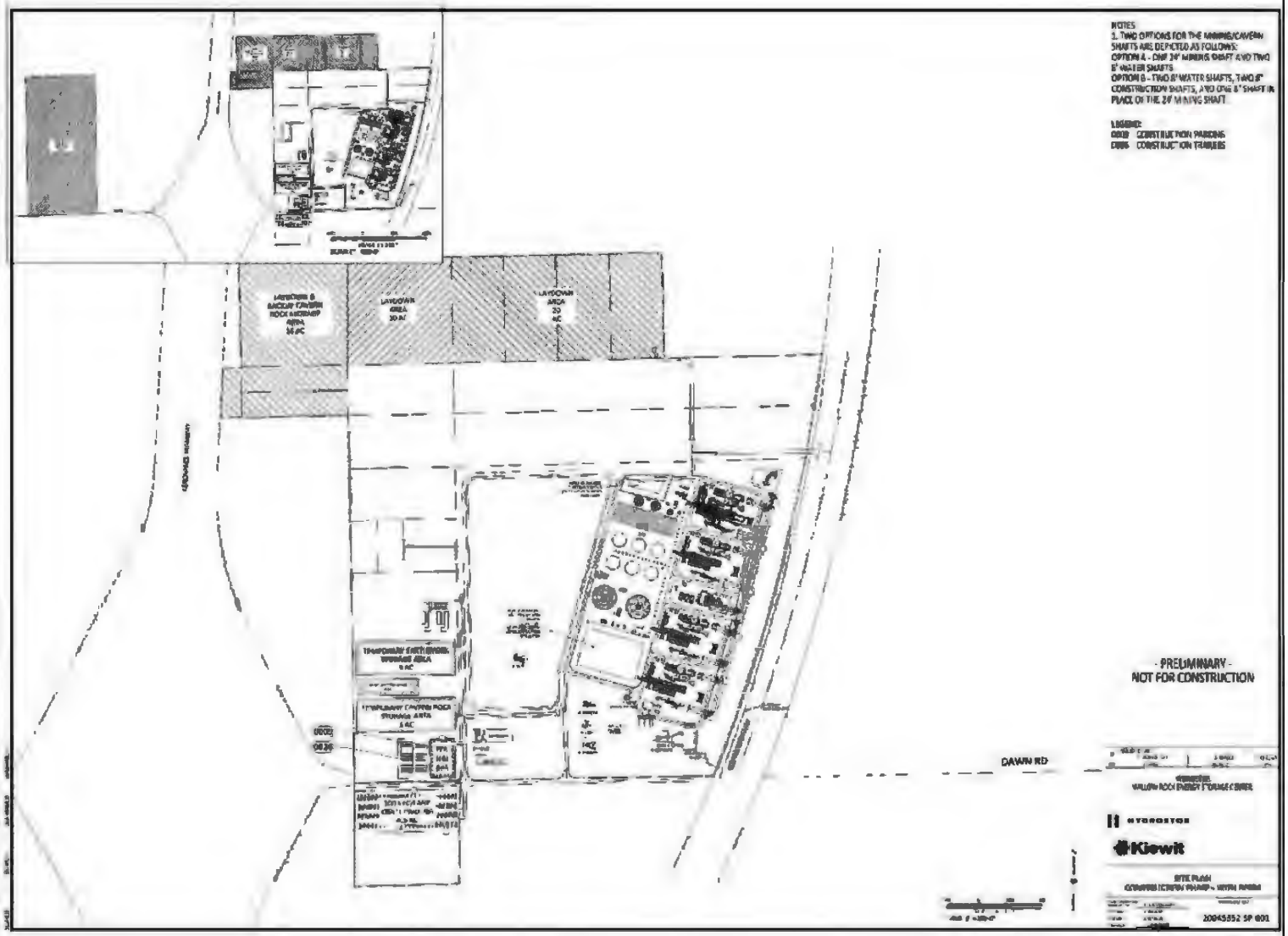
Assessor's Parcel Number	Owner	Parcel Size (acres)	Use
431-022-13	Zevsar Concepts LLC	88.6	Main facility - permanent
431-122-18	Private Owner	20.3	Architectural berm – permanent, if needed
431-022-12	Private Owner	17.2	Architectural berm - permanent
431-022-11	Private Owner	17	Architectural berm - permanent
431-122-01	Private Owner	0.9	Temporary construction and gen-tie line corridor
431-122-02	Private Owner	2.4	Temporary construction and gen-tie line corridor
431-122-03	Private Owner	4.9	Architectural berm - permanent
431-122-04	Private Owner	2.5	Temporary construction and gen-tie line corridor
431-122-07	Private Owner	5.1	Architectural berm - permanent
431-122-08	Private Owner	5.1	Architectural berm - permanent
431-122-14	Private Owner	1.3	Architectural berm – permanent, if needed
431-122-15	Private Owner	1.3	Architectural berm - permanent
431-122-16	Private Owner	1.3	Architectural berm - permanent
431-122-17	Private Owner	1.2	Architectural berm - permanent
431-111-30	Private Owner	20.6	Temporary construction laydown
431-112-24	GEM A-CAES LLC	5.1	Temporary construction laydown
431-112-25	GEM A-CAES LLC	5.1	Temporary construction laydown
431-112-26	GEM A-CAES LLC	5.1	Temporary construction laydown
431-112-27	GEM A-CAES LLC	5.1	Temporary construction laydown
471-061-05	Private Owner	2.5	Temporary construction laydown and parking
471-061-06	Private Owner	2.4	Temporary construction laydown and parking
471-061-07	Private Owner	2.5	Temporary construction laydown and parking
471-061-08	Private Owner	2.6	Temporary construction laydown and parking
431-022-08	GEM A-CAES LLC	79.4	Temporary construction laydown and parking and/or Permanent environmental mitigation site, if needed

A summary of total permanent and temporary disturbances with and without the architectural berm is provided in **Table 2-3.**

Table 2-3: Summary of Estimated Permanent and Temporary Disturbance With and Without Onsite Rock Re-use

Project Element	Disturbed Acreage Without Berm (Rock Hauled Offsite)	Disturbed Acreage With Berm (Onsite Rock Re-use)	Permanent or Temporary?
Main Facility	88.6	88.6	Permanent
Architectural Berm	0	74.6	Permanent
Site Construction Laydown and Parking	133.9	136.3	Temporary
Transmission Poles	0.1	0.1	Permanent
Transmission Pole Construction Sites	16.1	16.1	Temporary
Pull and Tensioning Sites	3.4	3.4	Temporary
New Access Roads	4	4	Permanent
Total Permanent	92.6	167.3	Permanent
Total Temporary	153.5	155.9	Temporary

Project elements are described in the following subsections. The project location, ownership, and benefits are described in detail in Chapter 1, Introduction.



REFERENCE(S)

1. WRESC SITE RENDERING - KIEWIT 2024
2. COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET
3. MAP SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
WRESC SITE AND CONSTRUCTION LAYDOWN/PARKING – WITH ARCHITECTURAL BERM OPTION

CONSULTANT
wsp

YYYY-MM-DD	2024-02-22
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VG/LL

PROJECT NO.	CONTROL	REV.	FIGURE
31406639.003	01	0	2-1

REFERENCE(S)

1. WRESC SITE RENDERING - KIEWIT 2024
2. COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET
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CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
WRESC SITE AND CONSTRUCTION LAYDOWN/PARKING – NO ARCHITECTURAL BERM OPTION

CONSULTANT

YYYY-MM-DD	2024-02-22
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VG/LL

PROJECT NO.	CONTROL	REV.	FIGURE
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2.1 Generating Facility Description, Design, and Operation

The WRESC will be a nominal 4,160 MWh energy storage facility capable of charging and discharging daily. The overall facility will consist of four nominal 130 MW (gross) trains, outputting a total of 500 MW net at the point of interconnection. Each train will contain an electric motor-driven air compressor drivetrain, heat exchangers, an air turbine generator, air exhaust stacks and ancillary equipment. Each train will share a common set of thermal storage tanks (hot and cold water), as well as the air storage cavern.

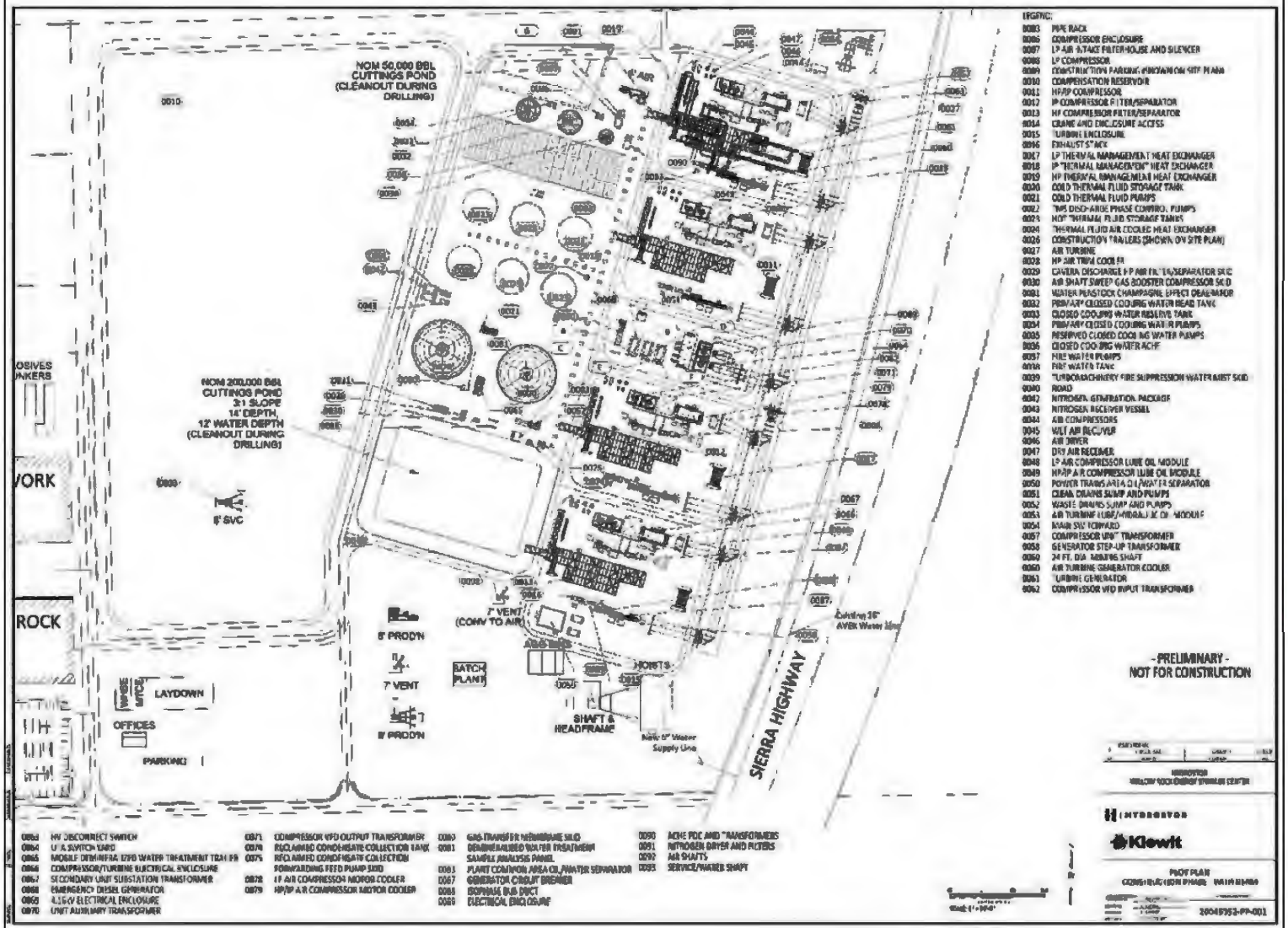
The WRESC will be designed and constructed following the design criteria provided in Appendix 2A, Engineering Design Criteria following applicable laws, ordinances, regulations, and standards (LORS).

2.1.1 General Site Arrangement and Layout

Figure 2-3 and **Figure 2-4** show the plot plan or general arrangement for the WRESC Site during the construction phase and operations phase, respectively. **Figure 2-5** and **Figure 2-6** present elevation drawings showing the project profile with and without the berm option, respectively. The main access to the Willow Rock site will be from Dawn Road. There will be two entry/exit points from Dawn Road for heavy load traffic. Access at the west side will lead to the laydown area, while access at the east side will lead to the east end of the Power Block. Temporary access during construction will be obtained from crushed rock driveways from both Dawn Road and Sierra Highway; the Dawn Road temporary construction access may be converted to permanent. The Sierra Highway access point will enter the WRESC Site at the construction laydown areas to the north. The permanent entrances and main plant roads within WRESC Site will be surfaced to provide internal access to all project facilities and onsite buildings. Personnel parking spaces, electric vehicle charging stations, and parking lot landscaping will be provided and will conform to Kern County requirements. The areas around equipment will have crushed rock surfacing, not paved or concreted. **Table 2-4** summarizes the preliminary square footage for the single onsite building, a combined office, control room, warehouse and maintenance building.

Table 2-4: Approximate Building Square Footage

Building Structure	Area (square feet)
Office and control room	5,000
Warehouse and maintenance area	1,600
Combined building area	6,600



KEY MAP

REFERENCE(S)

1. WRESC SITE RENDERING - KIEWIT 2024
2. COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET
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CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
WRESC PLOT PLAN – CONSTRUCTION PHASE

CONSULTANT

YYYY-MM-DD	2024-02-22
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VGLL

PROJECT NO.	CONTROL	REV.	FIGURE
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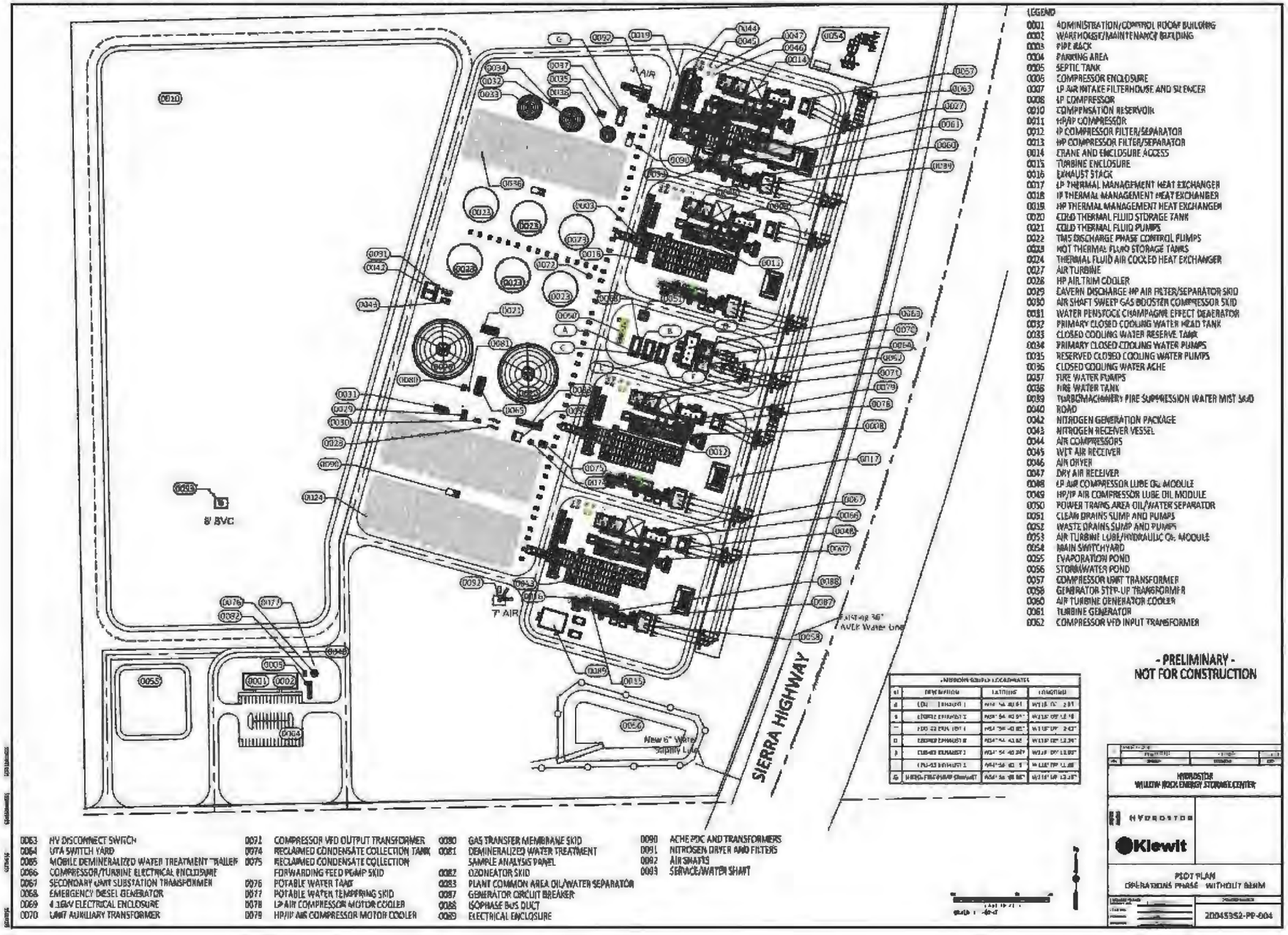

LEGEND

0001 ADMINISTRATION/CONTROL ROOM BUILDING
0002 WAREHOUSE/MAINTENANCE BUILDING
0003 FIRE RACK
0004 PARKING AREA
0005 SEPTIC TANK
0006 COMPRESSOR ENCLOSURE
0007 LP AIR INTAKE FILTERHOUSE AND SILENCER
0008 LP COMPRESSOR
0010 COMPENSATION RESERVOIR
0011 HP/AP COMPRESSOR
0012 IP COMPRESSOR FILTER/SEPARATOR
0013 HP COMPRESSOR FILTER/SEPARATOR
0014 CRANE AND ENCLOSURE ACCESS
0015 TURBINE ENCLOSURE
0016 EXHAUST STACK
0017 LP THERMAL MANAGEMENT HEAT EXCHANGER
0018 IP THERMAL MANAGEMENT HEAT EXCHANGER
0019 HP THERMAL MANAGEMENT HEAT EXCHANGER
0020 COLD THERMAL FLUID STORAGE TANK
0021 COLD THERMAL FLUID PUMPS
0022 TMS DISCHARGE PHASE CONTROL PUMPS
0023 HOT THERMAL FLUID STORAGE TANKS
0024 THERMAL FLUID AIR COOLED HEAT EXCHANGER
0027 AIR TURBINE
0028 HP AIR TRIM COOLER
0029 CAVERN DISCHARGE HP AIR FILTER/SEPARATOR SKID
0030 AIR SHAFT SWEEP GAS BOOSTER COMPRESSOR SKID
0031 WATER PENSTOCK CHAMPAGNE EFFECT DEAERATOR
0032 PRIMARY CLOSED COOLING WATER HEAD TANK
0033 CLOSED COOLING WATER RESERVE TANK
0034 PRIMARY CLOSED COOLING WATER PUMPS
0035 RESERVED CLOSED COOLING WATER PUMPS
0036 CLOSED COOLING WATER ACHE
0037 FIRE WATER PUMPS
0038 FIRE WATER TANK
0039 TURBOMACHINERY FIRE SUPPRESSION WATER MIST SKID
0040 ROAD
0042 NITROGEN GENERATION PACKAGE
0043 NITROGEN RECEIVER VESSEL
0044 AIR COMPRESSORS
0045 WET AIR RECEIVER
0046 AIR DRYER
0047 DRY AIR RECEIVER
0048 LP AIR COMPRESSOR LUBE OIL MODULE
0049 HP/IP AIR COMPRESSOR LUBE OIL MODULE
0050 POWER TRAINS AREA OIL/WATER SEPARATOR
0051 CLEAN DRAINS SUMP AND PUMPS
0052 WASTE DRAINS SUMP AND PUMPS
0053 AIR TURBINE LUBE/HYDRAULIC OIL MODULE
0054 MAIN SWITCHYARD
0055 EVAPORATION POND
0056 STORMWATER POND
0057 COMPRESSOR UNIT TRANSFORMER
0058 GENERATOR STEP-UP TRANSFORMER
0060 AIR TURBINE GENERATOR COOLER
0061 TURBINE GENERATOR
0062 COMPRESSOR VFD INPUT TRANSFORMER
0063 HV DISCONNECT SWITCH
0064 UTA SWITCH YARD
0065 MOBILE DEMINERALIZED WATER TREATMENT TRAILER
0066 COMPRESSOR/TURBINE ELECTRICAL ENCLOSURE
0067 SECONDARY UNIT SUBSTATION TRANSFORMER
0068 EMERGENCY DIESEL GENERATOR
0069 4.16kV ELECTRICAL ENCLOSURE
0070 UNIT AUXILIARY TRANSFORMER
0072 COMPRESSOR VFD OUTPUT TRANSFORMER
0074 RECLAIMED CONDENSATE COLLECTION TANK
0075 RECLAIMED CONDENSATE COLLECTION
FORWARDING FEED PUMP SKID
0076 POTABLE WATER TANK
0077 POTABLE WATER TEMPERING SKID
0078 LP AIR COMPRESSOR MOTOR COOLER
0079 HP/IP AIR COMPRESSOR MOTOR COOLER
0080 GAS TRANSFER MEMBRANE SKID
0081 DEMINERALIZED WATER TREATMENT
SAMPLE ANALYSIS PANEL
0082 OZONEATOR SKID
0083 PLANT COMMON AREA OIL/WATER SEPARATOR
0087 GENERATOR CIRCUIT BREAKER
0088 ISOPHASE BUS DUCT
0089 ELECTRICAL ENCLOSURE
0090 ACHE PDC AND TRANSFORMERS
0091 NITROGEN DRYER AND FILTERS
0092 AIR SHAFTS
0093 SERVICE/WATER SHAFT

- PRELIMINARY -
NOT FOR CONSTRUCTION

HYDROSTOR
WILLOW ROCK ENERGY STORAGE CENTER
HYDROSTOR
Klewit
PLOT PLAN
OPERATIONS PHASE - WITHOUT GRWM
20045352-PP-004

KEY MAP

REFERENCE(S)

1. WRESC SITE RENDERING - KIEWIT 2024
2. COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET
3. MAP SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
WRESC PLOT PLAN – OPERATIONS PHASE

CONSULTANT
wsp

YYYY-MM-DD	2024-02-22
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VG/LL

PROJECT NO.	CONTROL	REV.	FIGURE
31406639.003	01	0	2-4

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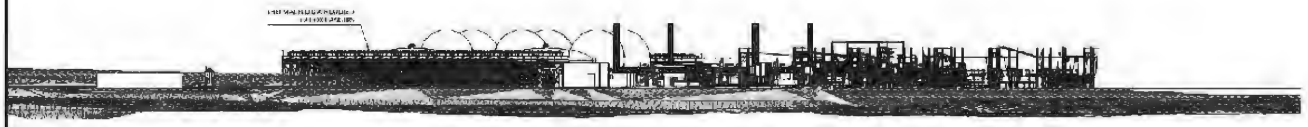
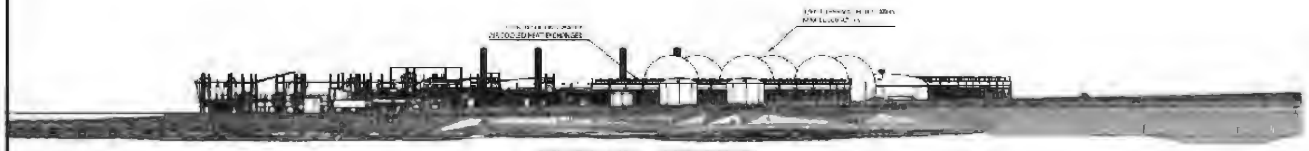


ELEVATION VIEW - LOOKING NORTH



ELEVATION VIEW - LOOKING SOUTH

ELEVATION VIEW - LOOKING WEST

- PRELIMINARY -
NOT FOR CONSTRUCTION

ELEVATION VIEW LOOKING EAST

REFERENCE(S)

1. WRESC SITE RENDERING - KIEWIT 2024
2. COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET
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CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
WRESC SITE ELEVATION PROFILE - WITH ARCHITECTURAL BERM OPTION

CONSULTANT

YYYY-MM-DD	2024-02-22
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VG/LL

PROJECT NO.	CONTROL	REV.	FIGURE
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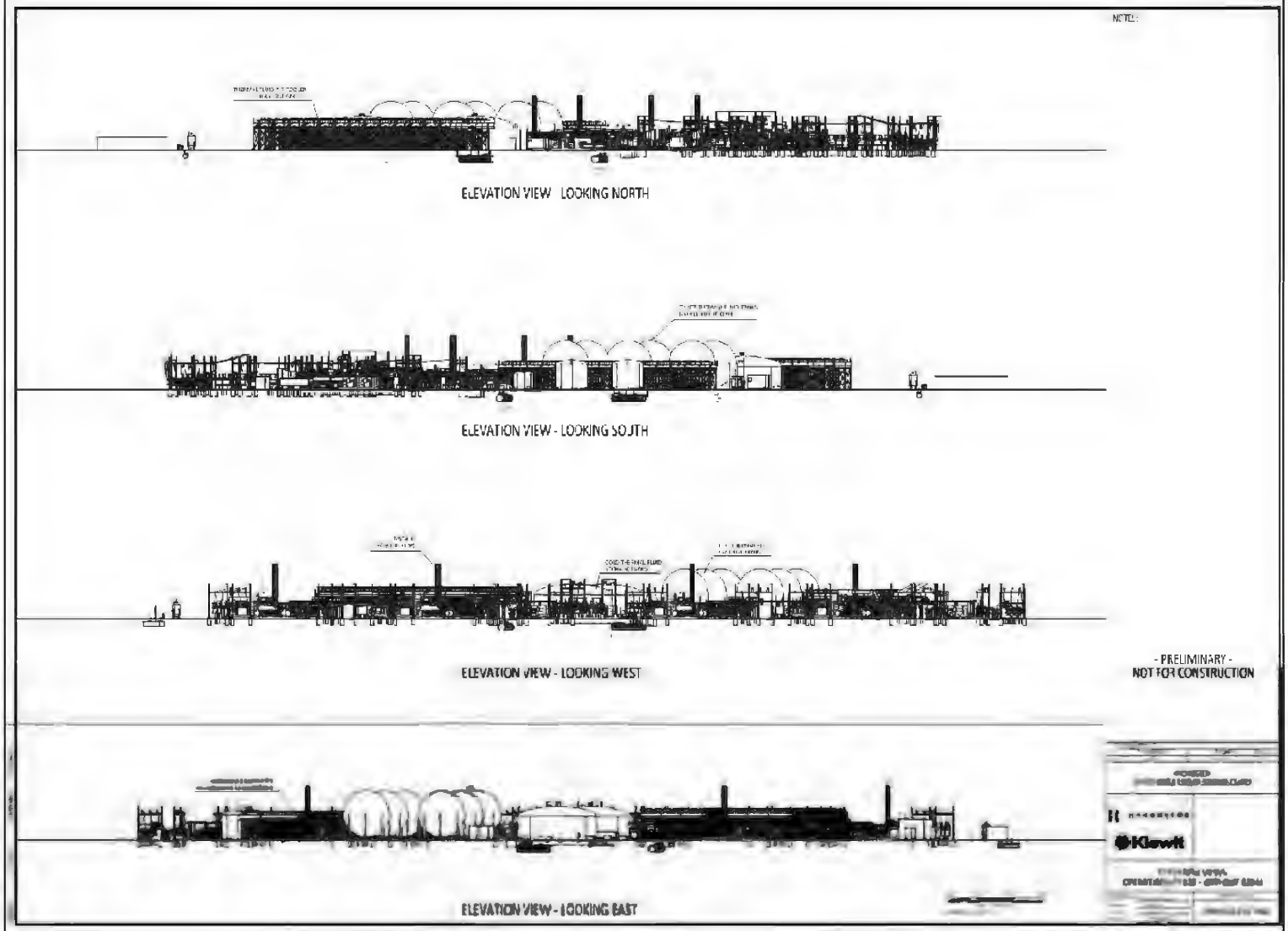


REFERENCE(S)

1. WRESC SITE RENDERING - KIEWIT 2024
2. COORDINATE SYSTEM: NAD 1983 STATEPLANE CALIFORNIA V FIPS 0405 FEET
3. MAP SERVICE LAYER CREDITS: SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
WRESC SITE ELEVATION PROFILE – NO ARCHITECTURAL BERM OPTION

CONSULTANT

wsp

YYYY-MM-DD	2024-02-22
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VG/LL

PROJECT NO.	CONTROL	REV.	FIGURE
31406639.003	01	0	2-6

2.1.2 Process Description

Hydrostor's proprietary A-CAES technology is a low-cost, bulk-scale energy storage solution. It provides long-duration, emission-free storage that can be sited where the electricity grid requires long-duration storage, providing multi-hundred MW of generation capacity and a suite of ancillary services with an estimated 30-year service life for major equipment and an estimated 50-year service life for the cavern. This is enabled by combining industry-proven technologies with two key innovations: the use of hydrostatically compensated air storage caverns and a proprietary water-based thermal management system.

The system stores compressed air in a purpose-built underground storage cavern, analogous to those used worldwide for hydrocarbon storage. The storage cavern is filled with water through a hydraulic conduit from a water storage compensation reservoir at the ground surface level. The weight of the water in this compensation reservoir maintains a near-constant air pressure in the cavern throughout both the charging and discharging cycles, supporting efficient operation, and significantly reducing the cavern volume requirements.

The water-based thermal management system captures the heat developed during air compression, stores it, and re-uses it when generating electricity, making the process nearly adiabatic. This increases the system's efficiency and eliminates the need for burning fossil fuels.

When the Hydrostor A-CAES system is charging (known as the "charge cycle"), off-peak energy or surplus electricity (such as excess solar that might otherwise be curtailed when production exceeds demand) from the grid is used to drive air compressors, converting the electrical energy into potential energy in the compressed air and heat energy stored by the thermal energy management system. At multiple points in the compression process, the heat generated during air compression is transferred to boiler-grade water as the only thermal water by a set of heat exchangers and is stored separately for later use during the discharge cycle.

The air stream exits the compression process at the same pressure as that maintained in the air storage cavern which is governed by the vertical distance between the cavern and the connected hydrostatic compensation reservoir located at the surface. As air is charged into the storage cavern, water is displaced up the hydraulic conduit and into the surface reservoir. This maintains near-constant air pressure within the cavern and stores substantial potential energy in the elevated water. Once in the cavern, the air can be stored until electricity is required.

To generate electricity (known as the "discharge cycle"), compressed air is discharged from the cavern, which allows the compensation water to flow back into the cavern. Similar to the charge cycle, the compensation water from the reservoir maintains near-constant air pressure in the cavern during discharging. The cool high-pressure air exiting the cavern is reheated using the heat stored by the thermal management system and the same set of heat exchangers that were initially used to extract it. The reheated compressed air is then used to drive air-expansion turbine generators, which efficiently convert the stored potential energy back into electricity for the grid.

This energy storage system uses non-toxic materials and does not use fossil fuels as part of the energy storage process. The process combines proven, off-the-shelf technologies (air compressors, water-based thermal storage and turbine generators) and the underground storage cavern design, all with a track record of successful performance in other industries/applications.[3] **Table 2-5** summarizes the main process.

[3] A video summarizing Hydrostor's technology can be found at the following link: https://www.youtube.com/watch?v=cN39gCh9PWg,

Table 2-5: Energy Storage Process Steps

STEP 1 Air Compression Using Electricity	STEP 2 Heat Capture in a Thermal Management System	STEP 3 Compressed Air Storage	STEP 4 Compressed Air Conversion to Electricity
Off-peak or surplus electricity from the grid is used to operate air compressors that produce high-pressure heated compressed air.	Heat is extracted from the compressed air and stored in a proprietary thermal management system. This nearly adiabatic process increases overall cycle efficiency and eliminates the subsequent need for burning fossil fuels.	Air is stored in a purpose-built storage cavern, where hydrostatic compensation is used to maintain the system at near-constant air pressure during operation.	Hydrostatic pressure forces air back to the surface, where it is recombined with the stored heat and expanded through turbine generators to generate electricity on demand.

The WRESC heat and mass balance block flow diagrams are shown in Appendix 2C, Heat and Mass Balance Diagrams (confidential). These balances are based on the mean weather conditions at the nearest ASHRAE weather station (Fox Field, Lancaster) using the 95th percentile dry bulb temperature and associated relative humidity for the charging cycle.

The actual net electrical output of the system will vary in response to ambient air temperature conditions, electrical grid operating requirements such as voltage or volt ampere reactive (VAR) support and other operating factors. Operational modes will be driven by good operating practices, market conditions, and grid dispatch requirements.

As a long-duration energy storage asset, the WRESC will be able to provide power during periods of increased need on the grid such as times of high electrical load, periods when intermittent renewable source generation fluctuates, when baseload plants are not operating or are being brought online, or during grid emergency conditions and/or local reliability needs. To maximize efficiency, the facility is expected to charge during times of low demand on the grid such as times of low electrical load and during periods when renewable source generation is higher than the instantaneous system demand, thus affording the ability to store excess renewable generation that might otherwise be lost.

2.1.3 Facility Operational Modes

Hydrostor's facility is an electrical energy storage technology with unique operating characteristics that must be considered across its operating states (charge, discharge, standby).

Based on 95% availability, the facility will be designed to operate:

- Up to 13.5 hours per day and 4960 hours per year in charging mode at a total capacity of 500 MW (plus 213 hours at 75% or less).
- Up to 8 hours per day and 2976 hours per year in discharging mode at a total capacity of 500 MW (plus 128 hours at 75% or less).
- A minimum of 372 hours in standby mode.

2.1.4 Energy Storage Facility Charge Mode Cycle

The facility is designed for 520 MW gross rated capacity on both charge and discharge with an 8-hour discharge duration at full rated capacity. The facility will be designed to achieve an average round trip efficiency of 55 to 60 percent. This means that the facility will return 55 to 60 percent of the electric energy used to complete the storage cycle as useful power output during the discharge cycle and that a complete charge of the cavern will require about 13.5 hours at full rated capacity (8 hours divided by 60 percent RTE).

The frequency of charging the system is dependent on the electrical grid operator's requirement to discharge the system. The system could be charged, or partially charged, daily. It could feasibly remain charged for long durations before discharging, but the hot water stored in the spherical tanks must be maintained by electrical heaters for very long standby periods (exceeding a few days).

When electricity from the electrical grid is available, the system will enter charge mode. While charging, electricity is drawn from the electrical grid to operate multi-stage, electrically driven air compressors. Air at atmospheric pressure and ambient temperature is compressed to cavern storage pressure. The cavern storage pressure is expected to be 870 to 1,100 pounds per square inch gauge (psig) across three sequential pressure sections of compression, low pressure, intermediate pressure, and high pressure (LP, IP, and HP, respectively), to allow storage in an underground hydrostatically compensated rock cavern with a floor depth of approximately 2,000 to 2,500 feet below ground surface (bgs).

As the compressed air enters the storage cavern, the air pressure will overcome the hydrostatic head of the compensation water system, forcing an equivalent volume of water out of the cavern and up the compensation shaft (water conduit), increasing the water level of the surface reservoir.

The hot air exiting each section of compression is cooled using boiler-grade water in the LP, IP, and HP heat exchangers. The water exits each heat exchanger and combines into a common stream. The heated water (water) flows to the hot-water spherical tanks, where it is stored at its vapor pressure to avoid vaporization. This is achieved through a system of self-pressurization whereby water vapor generated inside the tank acts as the head gas to maintain positive pressure.

2.1.5 Energy Storage Facility Generation/Discharge Mode

When the plant is sufficiently charged and is called to operate as a power generation facility, a discharge cycle will commence. A grid signal will initiate the operation of the appropriate electrical breakers and transformers, heat exchangers, and balance-of-plant equipment and begin operation of the turbine generators. With the air flowing from the storage cavern, the turbine generators will start receiving reheated high-pressure air, which will allow the turbine generators to ramp up to "sync-idle" speed, whereupon they can be electrically synchronized to the grid. Thereafter the turbine generators will begin loading (increasing electrical output) until they reach the required plant electrical output.

While discharging, the high-pressure air from the cavern will pass through three turbine sections (HP, IP, and LP) to expand the gas from cavern pressure down to atmospheric pressure. The power produced by the turbine will drive a synchronous electrical generator. The turbine stages are pressure-grouped into the same number of pressure sections as the compressors, and, just as in the case with the compressor, air will flow though the turbine sections sequentially. As the air exits the cavern, the surface water reservoir level will decrease and the compensation water level will increase in the cavern, maintaining a near-constant cavern pressure throughout discharge.

For the discharge cycle, the same heat exchangers (LP, IP, and HP) that were used to remove heat-of-compression for storage will be used, but in reverse, using the stored hot water to increase the temperature of the air before each expansion through each turbine section. This is necessary to avoid low temperatures and liquid condensation from the air as it is expanded and naturally cooled through the turbine's blade path. As the water passes through the heat exchangers, it will be cooled by the air, but will not reach a low enough temperature for the next charge cycle. Accordingly, a secondary cooling system is used to reduce the water temperature as required.

2.1.6 Energy Storage Facility Standby/Idle Mode

When the plant is not actively charging or discharging, it will be maintained in standby/idle mode. Standby/idle mode may occur either at the end of a charge cycle (e.g., the plant is ready and waiting to be called to operate as a power generator) or can occur at the end of a discharge cycle (e.g., the need for power generation has ceased and there is no immediate need to (re)charge the facility with potential energy (high-pressure air and hot water). The electrical power draw of the facility during standby/idle primarily consists of relatively small pumps, heaters, and coolers in various sections of the plant.

If the standby/idle mode follows a complete charge cycle, the stored air contained in the cavern will be at the maximum level and maintained at a high pressure by the hydrostatic compensation system, and the stored thermal energy (heat) will be maintained in the insulated hot-water spherical tanks, which are full. Both the motor-driven air compressors and the air-expansion turbine generators will be idle, with the lubricating oil systems heated and lubricating oil circulating through them to keep them warm and ready to start, slow-speed turning gears operating if required, and with the generators or motors internally heated to keep them at an optimum temperature.

If the standby/idle mode follows a full discharge cycle the stored air contained in the cavern will be at the minimum level and the cavern will be mostly filled with compensation water, leaving the water level in the surface-level compensation reservoir at its minimum level, while the remaining air in the cavern stays at constant hydrostatic pressure. Very little water will remain in the hot-water spherical tanks, and the cooled water will be held in the cold thermal storage tank. Both the motor-driven air compression equipment and the air-expansion turbine generators will be idle, with heated lubricating oil circulating, and motor and generator heaters maintaining them at optimum temperatures, all to keep them ready to start. With the hot-water storage tanks are holding a low level of liquid, the temperature will reduce quickly due to the small amount of water in the tank.

Therefore, supplementary heating via tank immersion heaters will be initiated to counteract any temperature and pressure drops.

In very exceptional circumstances (e.g., a complete plant shutdown for major maintenance), the complete plant could be in a wholly de-pressurized, and potentially a wholly cooled state, with potentially all piping and tanks in a de-watered state (except for the cavern and the compensation reservoir), and all turbomachines allowed to cool as major work is conducted.

2.1.7 Energy Storage Air Compression Equipment Drivetrain

There WRESC will include four air compression drivetrains in the system, one LP compressor, and one IP/HP compressor for each nominal 130 MW gross train, totaling a nominal 520 MW gross load during charge mode.

The compression/charge portion of the basic facility design will consist of a two-part compression drivetrain, each part using a dedicated electrical motor. The basic framework for the charge/compression equipment consists of:

- **LP compressor:** A dedicated LP compressor drawing filtered ambient air, driven by a synchronous electrical motor, with capacity flow and surge control managed by inlet flow mechanisms combined with discharge piping blow-off valves. Filtration and moisture knockout provisions are fitted as required. A non-return valve will be fitted in the LP compressor discharge to prevent air backflow.

The “low-pressure” air discharge from the LP compressor, after being cooled by the downstream heat exchanger, will then be piped to the inlet of the IP/HP compressor, as described below.

- **IP/HP compressor:** A separate compressor with a combined IP compressor and HP compressor, all driven by a single, separate, synchronous electrical motor. Cooled and filtered inlet air for both pressure groups in this combined compressor will be delivered from the upstream air-to-water heat exchanger.

The high-pressure discharge from the HP compressor section will be directed to a final air-to-water heat exchanger and the resulting cooled air will thereafter be directed to the air storage cavern at near-constant pressure. All compressors will utilize heavy process-industry quality synchronous motors with brushless excitation. Each compressor will be fitted with a dedicated lubricating/control oil system, dedicated synchronous motor controllers, and protective relaying. The compressor surge controller will be integrated to monitor and manage the compressors.

2.1.8 Energy Storage Air-Expansion Turbine Generators

The WRESC system will include four air-expansion turbine generators. There will be one turbine and one generator for each 130 MW (gross) train for a plant-wide total of 520 MW (gross).

All turbine generators will be single-casing axial-bladed machines with multiple air inlets and outlets, driving a synchronous generator, and will be complete with power-generation-industry-quality speed/load controls,

generator-protective relaying, voltage regulators, and synchronizing equipment. Each unit will have a dedicated lubricating/control oil system, a dedicated turbine and generator control, and protection systems.

Each air-expansion turbine will consist of three sections or pressure groups. The high-pressure air (produced from the charge cycle) that has been stored in the underground cavern will be utilized to power the turbine. The discharge air will first be piped to the first HP set of heat exchangers where it will be heated, using the hot water from the hot-water (spherical) tanks. The heated air will be used to power the HP heated turbine sections.

After the HP turbine section, the exiting air will have cooled due to the expansion process and will be routed to the IP heat exchangers, where it will be reheated using the hot water. After the IP turbine section, the cooled air will be routed to the LP heat exchangers. This reheated air will be admitted to the low-pressure expansion section of the turbine machine, after which it will exit to the atmosphere via an exhaust stack.

2.1.9 Thermal Management System

The thermal management system will consist of water, main process heat exchangers, fin fan coolers, and both hot and cold thermal storage tanks. During charging, the system will use water to extract heat from the air in the compression process. This heated water will be stored separately in a dense and insulated environment. During discharging, the heat from the heated water will be re-injected back into the air during the expansion process on discharge. The thermal management system is key to an adiabatic and fuel/emission-free process.

The water management system is a closed system whereby the water will be passed between the hot- and cold-water storage tanks during the charge and discharge cycles (as described above). The stored volume within each of the tanks will fluctuate as part of normal operations. Make-up water for the thermal management system will be taken from the reservoir or the Antelope Valley East Kern (AVEK) water supply line and treated before it is sent to the cold-water tank.

Cold water will be stored outdoors in two cylindrical tanks (approximately 150 feet in diameter by 60 feet high). The cold-water tanks will be fitted with a nitrogen blanketing system, operated at low pressure, to prevent air ingress and oxygenation of the treated water.

Hot water will be stored outdoors in up to six spherical storage tanks, each with a diameter of approximately 87.5 feet and a maximum estimated height of up to 100 feet, including appurtenances. The head gas in the hot-water tanks is steam in liquid-vapor equilibrium with the stored water.

The hot-water tanks will be outfitted with immersion fluid electrical heaters that will counteract any thermal losses. Each tank will be insulated for heat conservation.

The LP, IP, and HP heat exchangers will be designed to both heat the air on discharge and cool the air on charge. They are standard industrial shell and tube heat exchangers and will be insulated to retain heat on standby periods. **Table 2-6** summarizes the number of shells of the heat exchangers per 130 MW gross train.

Table 2-6: Heat Exchangers [a]

Stage	Low Pressure	Intermediate Pressure	High Pressure
Type	Shell and Tube	Shell and Tube	Shell and Tube
Number of Shells	3 per train (12 total)	2 per train (8 total)	2 per train (8 total)

[a] Refer to Appendix 2B, Construction Schedule for the heat balances

2.1.10 Hydrostatically Compensating Surface Reservoir

An approximately 575-acre-foot surface reservoir will be excavated and constructed predominantly in cut (below finished grade) using earthen berms approximately 6 feet high. The reservoir will cover a surface area of approximately 21.5 acres and have an average depth of approximately 45 feet. The berms will be constructed from a combination of excavated soil and excavated rock from underground storage cavern construction. Each berm will have an approximate height of up to 6 feet from the exterior toe to the berm's top. The water level in the

reservoir will fluctuate as to maintain constant underground air storage pressure and be designed to operate with a minimum freeboard of approximately 4 feet at full state of charge. The surface reservoir will be equipped with an engineered liner on the bottom (to prevent percolation and possible comingling with groundwater) and a floating cover consisting of interlocking shapes to minimize evaporative water loss.

Because of the height of the berms and the quantity of water stored between the maximum water elevation and the outside toe of the berm, the reservoir is not expected to be subject to California Division of Safety of Dams jurisdiction.

2.1.11 Underground Storage Infrastructure (Cavern and Shafts)

The A-CAES facility will utilize underground storage infrastructure consisting of one underground manmade cavern for the storage of compressed air and compressed air as well as manmade shafts for conveyance of air and water between the cavern and topside facility.

The storage cavern will be constructed in the bedrock below the WRESC Site targeting a depth of approximately 2,000 to 2,500 feet bgs. Initial access to the cavern depth (“cavern access”) for mobilization of the construction equipment and crews will be accomplished by one of two methods:

1. Construction of a large-diameter conventionally sunk shaft, or
2. Construction of several rotary drilled (blind bore) shafts.

The preferred cavern access approach is still being finalized, so both options have been shown on the plot plan to date. Regardless of the cavern access technique employed, cavern excavation will be accomplished using the same mining approach and techniques. The cavern construction requirements associated with each of these approaches are described below.

Cavern Access

To access the cavern during construction, a combination of conventionally sunk shafts and/or rotary drilled shafts will be constructed on a 24-hour-per-day, 7-day-per-week basis.

Conventionally Sunk Shaft

If a conventionally sunk shaft is used for cavern construction access, a concrete-lined shaft with 24 feet inside diameter will be constructed and equipped with a double-drum hoist, service hoist, dual ventilation ducts, and utilities to support cavern construction. For construction of this shaft, controlled detonations will occur from the top of bedrock surface (approximately 50 to 100 feet bgs) until the cavern construction horizon (2,000 to 2,500 feet bgs) is reached. The controlled detonation associated with shaft construction will increase in depth and decrease in frequency as the shaft is advanced from the surface down to the cavern construction depth. The amount and frequency of controlled detonations will depend on rock properties, but an average of one or two controlled detonations per day are anticipated. Each detonation would last less than a few seconds.

It is expected that the rate of conventional shaft sinking will be around of 5 to 8 feet/day, with an overall shaft construction duration of about 12 to 14 months, including pre-grouting of the overburden. Deeper grouting of the broken bedrock zones will be performed from within the shaft as a step in the sinking cycle if and when necessary.

Once completed, this 24-foot shaft will be sufficient for supporting the hauling, ventilation, and equipment/ personnel all in one shaft.

Rotary Drilled Shafts

If rotary drilled shafts are used for construction access, it is expected that 5- by 8-foot-diameter shafts will be constructed to support the proposed operations. No controlled detonation will be done at the surface or during the drilling phase of the cavern construction if this approach is utilized. Of the five shafts that are constructed, one will be used for equipment and personnel access, two will be used for material movement (rock hauling), and two will be used for ventilation. To construct these shafts, a lined drill cuttings pond will be required that will hold up to approximately three times the shaft volume in water to support the boring operations. Once complete, the pond will be emptied and backfilled. The drilling water will be used for reservoir fill or disposed offsite by a licensed

hauler.Liner material from the drill pond will be removed or perforated, and surplus muck will be spread on top of the settled drill cuttings to completely backfill the pond excavation.

A-CAES Process Shafts

Two types of flow conduits connected to the cavern will be necessary to operate the A-CAES facility: one for the conveyance of air and another for water. It is expected that up to two shafts will be constructed for water conduits, and up to four shafts will be constructed as air conduits. It is possible that fewer shafts will be constructed, but a conservative case is being assumed for this AFC.

If rotary drilled shafts are used for cavern access, two of the cavern access shafts are expected to be repurposed for use as the water shafts for A-CAES operation upon completion of construction. In this case, only the four air wells would need to be constructed. If a conventionally sunk shaft is utilized for cavern construction access, then all six shafts will need to be drilled.

Similar to the rotary drilled cavern access shafts, a drill cuttings pond will be required for the delivery of the A-CAES process shafts. This pond will be sized so that it holds up to approximately three times the shaft volume in water to support the boring operations. Once complete, surplus water will be pumped into the water reservoir, liner material from the drill pond will be removed or perforated, and surplus rock will be spread on top of the settled drill cuttings to completely backfill the pond excavation.

Water Shaft

One large-diameter blind bore or conventionally sunk shaft, approximately 8 feet (blind bore) to 24 feet (conventional) in diameter, will be constructed for use as water conduit during A-CAES operations. Depending on the cavern access used, the shaft either will be a converted construction shaft (for blind bore access) or will be purposely constructed (for conventionally sunk access). The water shaft will be used to convey compensation water between the cavern and topside compensation reservoir during A-CAES operations. The water shaft will be lined and cemented in place to provide formation isolation. The lower end of the water shaft will extend into a sump below the cavern floor to ensure that a water seal will be maintained at all times during operation.

Air Shaft

Up to two blind-bored air shafts, approximately 4 feet in diameter, will be constructed during the cavern construction for use as air shafts during A-CAES operations. The air shaft will be lined and cemented in place for formation isolation. These air shafts will be used to convey compressed air between the cavern and topside process trains during A-CAES operations. The lower end of the air shaft will be located at a high point in the roof of the cavern, such that it is never submerged during operation.

Cavern Excavation

The cavern will be constructed by conventional mining methods including drilling and controlled detonation. The cavern layout will be designed to have a room and pillar or parallel gallery layout. The size and shape of excavated openings will depend on the strength of the host rock and will be finalized during detailed engineering. The size and shape selection of the excavated openings does not materially influence the overall volume of the cavern or rock excavated.

After completion of the cavern access shaft(s), cavern excavation will begin using a combination of conventional controlled detonation methods and physical/mechanical excavation. Cavern excavation will continue on a 24-hour-per-day, 7-day-per-week basis until excavation is complete. The following are the typical steps included in the normal full-scale mining cycle:

1. A jumbo face-drill drills holes into the working face on a predetermined pattern and to a predetermined depth.
2. The drilled holes are loaded with explosives and the charges are set off to break the rock into muck (broken rock).
3. Load-haul-dump vehicles load the muck and haul it from the working face to the production shaft, where it is dumped into the loading pocket and hoisted to the surface.

4. The roof and sidewalls are scaled to remove any loose hanging rock.
5. Rock bolting machines install appropriate ground support (typically rock bolts and wire mesh) for the newly exposed roof and sidewalls.
6. The centerline and drill pattern are marked on the new working face by surveyors and the cycle is repeated.

During underground construction, twice-daily controlled detonation episodes of a few seconds duration each will occur at the beginning of each shift. Controlled detonation is NOT continuous throughout the day and will occur on a regular scheduled approximately 10- to 12-hour intervals. During full-scale cavern excavation, explosives will be placed in closely spaced locations and detonated remotely. Early in the cavern excavation process, personnel will clear the underground area and remain aboveground during the detonation sequence. Once the cavern is large enough, personnel will remain underground during the detonation sequence.

For gallery construction, a top heading will be initially driven, and roof support will be installed as the excavation advances. One or more successive benches will then be excavated to develop the cavern opening to full height. Waste muck will be crushed underground and brought to the surface via a shaft skip. The cavern floors will be graded to drain toward water sump and shaft. Where geology and ground conditions permit, roofs will be sloped up to naturally vent into the air shaft and avoid the possibility of trapped air pockets. Most caverns are completed with unlined, bare rock surfaces, though some are lined with a thin layer of shotcrete for worker safety and geotechnical integrity. Grouting may also be used, if required, to seal large fractures that could permit water inflow. Upon completion of cavern excavation, the cavern will be commissioned into operations which will require the filling and sealing of the construction shafts that are not converted for use in A-CAES operations.

During operations, the cavern will be filled with water through a hydraulic conduit from the surface reservoir. The weight of the water in this surface reservoir will maintain a near-constant air pressure in the cavern throughout both the charging and discharging cycles. This approach supports efficient operations and significantly reduces the cavern volume requirements. The dimensions and design of the cavern are presented in **Table 2-7**.

Table 2-7: Cavern Design

Design Element	Value
Depth	Approximately 2,000 to 2,500 feet bgs
Pressure	870 to 1,100 psig
Volume	Approximately 900,000 cubic yards

bgs = below ground surface; psig = pounds per square inch gauge

2.1.12 Black Start Capability

The facility will not be designed to be black start capable (i.e. capable of starting up without an external utility power feed).

2.1.13 Major Electrical Equipment and Systems

The net electric power generated at the WRESC will be transmitted to the electrical grid at the point of interconnection. Transmission and auxiliary uses are discussed in the following subsections. The electric power required for charging the system will be drawn from the electrical grid with additional power for the auxiliaries. Refer to the preliminary single-line diagram provided in Chapter 3.0, Electric Transmission (Figure 3-3) depicting the onsite Willow Rock main substation, including applicable ratings of key equipment.

For metering of the import and export of power, a power quality meter suitable for revenue metering of MWh and megavolt ampere reactive-hours will be located at the SCE Whirlwind Substation. The power revenue metering will be constructed according to SCE standards.

A power management system will interface with SCE to coordinate power export/import quality and voltage regulation.

2.1.13.1 Generators and Motors

Turbine Generators

Generators will generate at medium voltage (13.8 kV). This power will be transformed via unit transformers to 230 kV for the electrical grid connection.

Generators are preliminarily rated 150 megavolt amperes (MVA) at 0.9 to 0.95 power factor to supply 130 MW gross and 125 MW net to the electrical grid at the point of interconnection. This allows maximum turndown (reduction in total overall output) of plant, whereby a single generator can operate while other generators are offline for maintenance.

Synchronous Motors for Compression Train

Full charging capacity requires eight synchronous motors running to supply the four air compressor trains. The power to the synchronous motors will be supplied via unit transformers.

The synchronous motors will normally run at unity or a slightly leading power factor in order to mitigate the VAR import requirements of induction motors within the auxiliary power system.

The synchronous motors will be started using a variable frequency drive (VFD) soft start system. One soft start unit will be utilized for each of the four sets of motors (one two-motor set per compressor power train) if required.

2.1.13.2 Alternating Current Power—Transmission

Power will be generated by the four generators at 13.8 kV and transformed to 230 kV for the grid interconnection. 230/13.8 kV main transformers in each train support connection to the local 230 kV network at the SCE Whirlwind Substation. For motor operation, four additional 230/13.8 kV unit transformers provide back-feed power to the compressor motors. Surge arrestors at the point of interconnection would protect the system from disturbances in the 230 kV system caused by lightning strikes or other system disruptions.

The transformers will be set on concrete foundations, and the design will include a secondary oil containment reservoir to contain the transformer oil in the event of a leak or spill. There will be differential protection on transformers rated 5 MVA and greater. The 230/13.8 kV transformer will be connected to a single-circuit three-phase 230 kV line, which will be connected to the Whirlwind Substation via an approximately 19-mile predominantly overhead gen-tie line. A detailed discussion of the electric transmission system is provided in Chapter 3, Electric Transmission.

2.1.13.3 Alternating Current Power—Distribution to Auxiliaries

The distribution voltages for plant auxiliary systems and lighting will include: 4.16 kV, 480 V, and 208/120 V.

Auxiliary power supplies for instruments will be 24 volts direct current (VDC); however, in the even that increased power consumption is required, 120 volts alternating current (VAC) will be used.

2.1.13.4 Direct Current Power Supply System

Turbine/generator and compressor/motor auxiliaries will be supplied by 125 VDC.

Process control systems (PCS) will be supplied from 24 VDC power supply modules within system cabinets. Control power for the switchgear will be 12 VDC supplied from a dedicated direct current (DC) battery system.

The 125 VDC battery system will be independent of the 120 VAC uninterruptible power supply (UPS) battery system. All DC systems will have 8-hour battery duration.

The system will be designed to provide continuous rated power in the event of main power failure. The DC systems will be located on the emergency generator bus. The DC systems' health will be monitored by the distributed control systems (DCS).

2.1.13.5 Uninterruptible Power Supply System

An independent UPS system will be dedicated to supply power to the following loads:

- Critical instruments, emergency lighting, and valves
- Control panel fans and other ancillaries
- DCS control racks, including programmable logic controllers (PLCs), flow computers, vibration monitoring system, etc.
- Telecommunications system
- Building cameras and security access system
- Smoke and building heat detector UPS systems include:
  - 20 kVA or less:
    - Input voltage: 208 volts (V)
    - Output voltage: 208 V
  - Greater than 30 kVA:
    - Input voltage: 480 V
    - Output voltage: 480 V

The system will be designed to provide continuous rated power in the event of main power failure. The UPS will be located on the emergency generator bus. The UPS and emergency generators health will be monitored by the DCS.

2.1.13.6 Emergency Power

Three diesel-fired self-contained 4.16 kV generators, up to approximately 2.5 MW each, will supply emergency power for all critical loads via double sided 5 kV emergency switchgear. These units will meet U.S. Environmental Protection Agency (USEPA) Tier 4 emissions standards and will normally operate only to facilitate maintenance and reliability testing for up to 50 hours per year. Only one unit will operate at a time to perform maintenance and reliability testing.

When needed for emergency power due to a loss of utility interconnection, the generators would activate and operate during the emergency period.

2.1.14 Water Supply and Use

The AVEK water agency currently owns and operates a 36-inch-diameter water supply line that is located adjacent to the WRESC Site approximately 300 feet east of the WRESC Site's boundary. AVEK will supply Willow Rock with the required water rates and quantities from a new dedicated tap into its water supply line at a location adjacent to the WRESC Site. A permanent 6-inch-diameter buried water pipeline will be installed onsite to deliver water from the AVEK main supply pipeline to the surface reservoir.

These sources will also provide water for filling the storage tank used for fire protection and service water. Appendix 2D, Water Balance Diagrams and Construction Water Use, provides water balance diagrams showing annual average and high temperature ambient operating conditions.

During plant operation, the expected water consumption from AVEK will be less than 2,000 gallons per day, as shown in the water balance. As the cooling and thermal storage systems operate in a closed loop, losses are minimal, and make-up water demand will be small. The reservoir volume is balanced by controlling evaporation with the floating cover, the inflow of annual precipitation, and condensed water from compressed air.

When the plant is operating in charging mode and the compressors are filling the cavern with compressed air, water is produced at the exit of each compression stage. This is caused by compressed air becoming saturated during compression and moisture in the air condensing in each post-cooling stage. The condensate must be removed from the system to avoid damage to the compressors and sent to the water reservoir and evaporative cooling system.

The water provided by AVEK during operations will mostly be used as a tap water source for offices, maintenance facilities, service water, fire system re-filling, and make-up water for cooling and thermal system water.

During construction and during the initial filling of the surface reservoir the WRESC will require approximately 1,400 acre-feet of water. Construction water requirements are discussed further in Section 5.15, Water Resources. Once the facility commences operation, it is expected to have an annualized surplus of approximately 3.6 acre-feet per year (on average) of non-potable recharge quality water to provide surface reservoir water make-up. Evaporative loss will be reduced by the use of a cover on the reservoir. Since there will be a seasonal variation associated with the production of water as well as evaporation losses, the reservoir will be designed with adequate freeboard to allow for seasonal fluctuations in water inventory.

2.1.14.1 Construction Water

An estimated 1,400 acre-feet of water (incorporating approximate 20 percent contingency) will be needed throughout the construction and startup period. Most of the water will be used for filling the hydrostatically compensating reservoir. Other uses include supporting construction of the cavern works (shaft drilling and cavern excavation), surface works (hydrotesting and general purpose washdown), and fire system testing. These are discussed briefly below. Refer to Appendix 2D, Water Balance Diagrams and Construction Water Use for the estimated water consumption required during construction by month.

Cavern Works

Construction of the cavern is estimated to require an estimated 252 acre-feet of water over the construction period. Uses include site preparation, air and shaft drilling, and excavation of the cavern. Refer to Appendix 2D, Water Balance Diagrams and Construction Water Use for the estimated water consumption required during construction by month. Water remaining in the drilling pond(s) after shaft sinking will be filtered, water quality tested and then either sent to the reservoir, or, if necessary based on test results, hauled offsite by an approved waste hauler.

Surface Works

The surface construction is expected to require approximately 47 acre-feet of water for several purposes over the 24-month period, including the following:

- General purpose (de-dusting roads, daily washdown, etc.)
- Tank and sphere hydrotest
- Piping and vessel hydrotest
- Fire system testing

Water used for hydrotesting will be reused for hydrotesting other systems, including the spheres, pipe circuits, and initial fill. A temporary pumping sub-system with screening and filtering capabilities will be utilized to re-use this water. After all testing, the volume of hydrotest water (losses at flange breaks, nozzle spray tests, etc.) will be screened and filtered to a suitable cleanliness level to supplement the initial fill volume of the cold thermal storage tanks and/or reservoir.

Surface workers are assumed to use 20 gallons of potable water per person per day during all stages of construction, including drinking and wash water.

Refer to Appendix 2D, Water Balance Diagrams and Construction Water Use for the estimated water consumption required for surface construction, by month.

Hydrostatically Compensating Surface Reservoir Fill

The roughly 600-acre-foot surface reservoir will require approximately 868 acre-feet of water for initial fill (accounting for evaporation losses during the filling period). The reservoir fill will require approximately 14 months, with monthly fill requirements as shown in Appendix 2D, Water Balance Diagrams and Construction Water Use. The required fill amount accounts for both precipitation and evaporation. After initial filling, the surface reservoir will be equipped with an interlocking shape floating cover estimated to be 90 percent effective in reducing evaporation. The estimated fill amount conservatively assumes no benefit from the cover.

2.1.14.2 Water and Wastewater Requirements

Demineralized water will be produced onsite and used as make-up water for the water-based thermal storage and closed-cooling medium loops. Appendix 2D includes water balance diagrams for annual average and high temperature conditions, respectively, as well as an estimated month-by-month water balance. Water requirements are further discussed in Section 5.15, Water Resources, subsection 5.15.1.5.

The evaporative cooling water is used intermittently during hot temperatures when the closed-cooling loops cannot meet the cooling objectives of the turbomachinery. The water for the evaporative cooling is expected to be sourced from the produced water at the air compressors such that the evaporative cooling does not require sourcing of additional water.

2.1.14.3 Water Quality

Section 5.15, Water Resources, includes a projection of the water quality based on available testing data.

2.1.14.4 Water Treatment

The AVEK supply water will be used for make-up to the plant water system, fire protection, and general needs such as equipment and surface washdown.

The thermal energy storage system and cooling system will be filled with demineralized water during commissioning. A temporary, portable demineralization system will be used to generate water for the first filling and commissioning. Make-up demineralized water will be produced during operations to cover minor losses in the system. The expected quality of demineralized water used for the first filling will have the following characteristics:

- Appearance: clear and colorless
- Odor: odorless
- Total dissolved solids maximum: < 1 part per million (ppm)
- Hardness: < 0.01 Deutsche Harte
- Oil and grease: none
- Conductivity at 25 degrees Celsius: < 0.5 micro Siemens per centimeter
- Chlorides: <0.5 ppm
- Iron: <0.005 ppm
- Copper: <0.01 ppm

2.1.14.5 Water Availability

AVEK will provide the required quantity and quality of water required by the project. GEM A-CAES LLC (GEM, the Applicant) has filed an application for water service with AVEK and is in the process of securing a water service agreement.

2.1.15 Waste Management

Waste management is the process whereby all wastes produced at Willow Rock will be properly collected, treated if necessary, and disposed of. Wastes include process wastewater, as well as nonhazardous waste (primarily excavated waste rock) and hazardous waste, both liquid and solid. Waste management is discussed below and in more detail in Section 5.14, Waste Management.

2.1.15.1 Wastewater and Stormwater Collection, Treatment, and Disposal

Wastewater and Septic Waste

Project wastewater will be diverted to the zero-discharge evaporation pond. The oil-free evaporation pond will be maintained, and the remaining "sludge" will be hauled offsite by an approved waste disposal company to an approved disposal facility. The water balance diagrams in Appendix 2D show the expected wastewater stream and flow rate under operating conditions.

The septic waste from the administration/control building will be handled by one of the two methods described below:

- Sanitary waste from the administration/control building will be directed to a nearby underground septic storage tank, pumped out periodically by truck, and trucked offsite to an approved disposal facility.
- Alternatively, the sanitary sewer system will consist of a lateral septic system containing a lateral line from the structure to a septic tank. From there, the waste will flow to the lateral system of pipes that allows the waste from the septic system to discharge via perforations in the lateral pipes.

Willow Rock will not have a practice of washing down any equipment with oily residues. Equipment that has oily residues will be cleaned with rags and sorbents, and appropriate cleaning solutions will be applied to the rags and sorbents.

After cleaning, the oily rags and sorbents will be properly stored, manifested, and disposed of by licensed disposal companies in the regulatory-required time frames.

Stormwater

Onsite stormwater flows generated within the WRESC Site boundary will be routed to an unlined stormwater pond and will not be discharged outside the WRESC Site. Plant area drains will be directed to oil-water separators. There will be at least one oil-water separator for the common plant areas, and one oil-water separator for each power block. Water from the oil-water separator sumps will be discharged to the waste drains sump and then to the lined evaporation pond. The separated oil will be periodically pumped out of the oil-water separators by truck and disposed of offsite by a licensed hauler.

A summary of the approach for offsite perimeter stormwater drainage is described below for the "without berm" and "with berm" options.

Option 1 – Without Berm

Offsite flows will be diverted via proposed ditches along the north and west side of the WRESC Site to route them to where they are currently flowing. The flows conveyed by the west ditch will discharge stormwater south and then to the ditch along Dawn Road. The flows conveyed by the north ditch will discharge stormwater to the east to the ditch along the Sierra Highway. These ditches will be sized to carry, at a minimum, the 100-year discharge calculated using TR55 SCS Unit Hydrograph methodology.

Onsite flows generated by the WRESC Site will not be discharged outside the WRESC Site Boundary. All the WRESC Site stormwater will be conveyed via sheet flow and system flow (catch basins, swales, and stormwater conveyance piping) to a proposed, unlined stormwater pond on the southeast corner of the WRESC Site.

Option 2 - With Berm

Offsite flows will be diverted via proposed ditches along the north and west side of the architectural berm and route them to where they are currently flowing. The flows conveyed by the west ditch will discharge stormwater south and then to the ditch along Dawn Road. The flows conveyed by the north ditch will discharge stormwater to the east to the ditch along the Sierra Highway. These ditches will be sized to carry at a minimum the 100-year discharge calculated using TR55 SCS Unit Hydrograph methodology.

Rainwater that falls on the north and west sides of the architectural berm will flow to the proposed ditches along the north and west side of the architectural berm described above. Rainwater that falls on the south and east side

of the architectural berm will be directed south and east via ditches on the north and west boundaries of the WRESC Site and flow towards the Dawn Road and Sierra Highway ditches, respectively.

Onsite flows generated by the WRESC Site will not be discharged outside the WRESC Site. All the WRESC Site stormwater will be conveyed via sheet flow and system flow (catch basins, swales, and stormwater conveyance piping) to a proposed, unlined stormwater pond on the southeast corner of the site.

Excavation Waste

The WRESC will produce excavated material associated with typical mining techniques to create the underground compressed air storage cavern. Excavation waste generally includes soil and rock. The cavern has an equivalent volume of excavated material of approximately 1.3 million cubic yards based on an expected swell by a factor of 1.4. The swell factor accommodates the volumetric expansion from solid rock at depth to crushed rock at the surface. Waste management is discussed further in Section 5.14, Waste Management.

Based on preliminary engineering and environmental planning, the Applicant is considering options for adaptive re-use of the cavern rock onsite within the project boundaries or hauled offsite to up to four independent third parties. To plan conservatively, the project analyses assume that cavern rock will be fully reused in four options: up to 100 percent reused onsite as an architectural berm, up to 100 percent hauled offsite to the Robertson's Ready Mix in Los Angeles County, up to 100 percent hauled offsite to the Holliday Rock facility in Kern County, , and/or up to 100 percent hauled offsite to the Vulcan Materials Inc. processing facility in Los Angeles County. At the time of filing, commercial agreements are underway with the private off-takers, and design of an onsite architectural rock berm is being advanced through engineering.

All of the offsite third-party off-takers have expressed interest in potentially reusing the rock material for commercial purposes. Each potential off-taker has the appropriate permits in place to import material from third parties.

In lieu of hauling the excavated rock offsite, another option is to re-use the material within the project boundaries as an architectural berm. The specific design of the feature is to be determined through final engineering.

2.1.15.2 Solid Nonhazardous Waste

The WRESC will produce nonhazardous waste related to construction, operation, and maintenance that is typical of power generation and energy storage operations. Surface construction wastes will generally include soil, scrap wood, excess concrete, empty containers, scrap metal, insulation, and sanitary waste. Cavern construction wastes will include some of the same materials, as well as explosives packaging.

Facility waste during operation will includes oily rags, scrap metal and plastic, insulation material, defective or broken electrical materials, empty containers, and other solid wastes, including the typical refuse generated by workers. Solid waste will be trucked offsite for recycling or disposal. Waste management is discussed further in Section 5.14, Waste Management.

2.1.15.3 Hazardous Wastes

Several methods will be used to properly manage and dispose of hazardous wastes generated by the project. Waste lubricating oil will be recovered and recycled by a waste oil recycling contractor. Spent lubrication oil filters will either be recycled or disposed of in a Class I landfill. Workers will be trained to handle hazardous wastes generated at the WRESC Site. Chemical cleaning wastes will be temporarily stored onsite in portable tanks or sumps and disposed of offsite by an appropriate contractor in accordance with applicable regulatory requirements.

Hazardous materials management is further discussed in Section 5.5, Hazardous Materials Handling.

2.1.16 Management of Hazardous Materials

A variety of chemicals will be stored, handled, and used during the construction and operation of Willow Rock, following applicable LORS. Chemicals will be stored in appropriate chemical storage facilities. Bulk chemicals will be stored in storage tanks, and most other chemicals will be stored in returnable delivery containers. Chemical

storage and chemical feed areas will be designed to contain leaks and spills. Containment pits and drain piping design will allow a full-tank capacity spill without overflowing the containment area. For multiple tanks located within the same containment area, the capacity of the largest single tank will determine the volume of the containment area and drain piping with an allowance for rainwater. Drain piping for reactive chemicals will be trapped and isolated from other drains to eliminate noxious or toxic vapors.

Safety showers and eyewashes will be provided adjacent to, or in the vicinity of, chemical use and storage areas. Plant personnel will use approved personal protective equipment during chemical spill containment and cleanup activities. Personnel will be properly trained in the handling of these chemicals and will be instructed in the procedures to follow in the event of a chemical spill or accidental release. Adequate supplies of emergency response equipment, including absorbent material, will be stored onsite for spill cleanup.

A list of the chemicals anticipated to be used at Willow Rock, and their storage locations, is provided in Section 5.5, Hazardous Materials Handling.

2.1.17 Fire Protection

The fire protection system will be designed to protect personnel and limit property loss and facility downtime in the event of a fire. The system will include an electric fire pump, a small jockey pump to keep the system under pressure, and a fire protection water network system consisting of hydrants or standpipes and portable fire extinguishers. Where required, automatic or fire sprinkler systems will be provided. A diesel-fired approximately 345 kW (460 horsepower) fire pump will be provided for emergency backup. The fire protection and piping network system will be designed to protect the facility, which will be designed under the following regulations:

- Federal, state, and local fire codes, and occupational health and safety regulations, in concert with the Authority Having Jurisdiction
- California Building Code, where applicable
- Applicable, mandatory National Fire Protection Association standards

The diesel-fired pump engine will meet USEPA Tier 3 emission standards and normally only operate for maintenance and reliability testing for up to 50 hours per year.

Firefighting water will be stored in the service/fire water storage tank. The tank will have an internal service water pump suction standpipe so that the required water volume for a fire event is always available to the fire water pumps. The system can supply maximum water demand for any fire suppression requirements, as well as water for fire hydrants. The total capacity of the tank is estimated at 350,000 gallons, with 300,000 gallons reserved for fire water.

Separation criteria will be evaluated in a fire protection study during further engineering.

Portable and wheeled fire extinguishers will be provided at strategic locations around the facility. Their locations will be determined based on the guidelines of National Fire Protection Association 10 or relevant local requirements.

The following types of portable fire extinguishers can be used as appropriate for the type of risk:

- For areas where there are ordinary combustibles such as wood, cloth, paper, plastic, etc., extinguishers will be suitable for Class A fires. These can be in the form of water, foam, or dry powder.
- For areas where there are flammable liquids, oils, grease, paint etc., extinguishers will be suitable for Class B fires. These can be carbon dioxide (CO_2) dry powder, or foam or any other suitable film forming foams.
- For areas where there is energized electrical equipment, extinguishers will be suitable for Class C fires. These will be CO_2 or other suitable dry chemicals.

Portable fire extinguishers, where applicable, will be installed at a suitable distance above the floor for ease of deployment and to minimize the potential for corrosion. Fire extinguishers will be fixed to walls, columns, or structural supports as appropriate. Weatherproof storage cabinets will be provided for extinguishers located in open areas. Wheeled extinguishers located in external areas will be equipped with a weatherproof cover.

Section 5.5, Hazardous Materials Handling, includes additional information about fire and explosion risk, and Section 5.10, Socioeconomics, provides information about local fire protection capability.

2.1.18 Plant Auxiliaries

The following systems will support, protect, and control the Willow Rock facility.

2.1.18.1 Process Systems

A 5 kV substation will be required in the process area to supply power to the area loads. The 230/5 kV transformers will be distributed at the WRESC Site. Large motors in the process area (above 300 horsepower) will be fed from the 5 kV system with many of the motors on emergency power for operation during a power outage.

Smaller motors will be fed from the 480 V system, and some will be on emergency backup power.

2.1.18.2 Heating, Ventilation, and Air Conditioning Systems

All buildings will be equipped with suitable heating, ventilation, and air conditioning systems and critical systems will operate on emergency power as required.

2.1.18.3 Lighting

Indoor building lighting will be designed consistent with building code requirements to provide adequate indoor illumination with consideration for human factors. Exterior lighting will be hooded and downward facing to provide adequate space lighting while minimizing offsite glare.

The emergency lighting will be sufficient to illuminate the exit path from process areas and inside the buildings and will be supplied from a 120 V UPS located indoors. Exit signs will be self-illuminating. In outdoor areas, emergency light fixtures will be equipped with rechargeable battery packs with minimum 1-hour battery backup. These emergency lighting fixtures will not normally be switched on and will be identical to the fixtures used throughout the facility.

Process plant lighting and convenience outlets will be supplied from a 208 V/120 V, three-phase, four-wire, 60 hertz system.

Section 5.13, Visual Resources provides additional information regarding the potential for offsite lighting impacts. A detailed lighting plan is included in Appendix 5.13B.

2.1.18.4 Grounding

All systems will be grounded and bonded as per the National Electric Code and local municipal codes and standards.

All equipment containing flammable liquids or gases and liable to static discharge ignition will be grounded by having one or more anchor bolts connected to the reinforcing bar of the equipment foundation.

The grounding system design will be as per Institute for Electrical and Electronics Engineers (IEEE)-80 and IEEE-142 guidelines. A detailed step/touch potential, including ground potential rise calculation, will be performed. The substation grounding systems will be designed to limit the overall resistance to earth to safe step and touch voltage conditions.

Prior to detailed design execution, sufficient site soil data will be obtained for performing grounding studies and calculations

All equipment will be connected to the ground through a minimum of two paths, except for small equipment that can be safely connected to a single source.

A dedicated, clean, instrument-grounding system will be provided to connect all PCSs, in addition to a standard equipment grounding system.

The instrumentation grounding system will be bonded to the electrical system ground below grade.

2.1.18.5 Control System

Process Control System

The PCS will provide all monitoring and control of the facility. The PCS configuration will be justified with the plant engineering contractor based on the facility complexity.

The facility will function automatically with minimum operator intervention. Emphasis will be given to automating routine actions so that the operator will have more time to analyze and identify short- and medium-term plant performance, efficiency, and imminent failures.

Adequate instrumentation will be installed to enable operations personnel to monitor facility performance from the central control room with minimum field intervention. Field operators will only assist in visual surveillance and will intervene only when critical equipment and systems warrant immediate attention. All field functions will require a permissive signal from the control system.

For standalone control packages within the facility where operator action will be entirely local, a package common alarm will be connected to the PCS to direct an operator to examine local indicators or panels to determine equipment status.

Operator Interface System

Under normal conditions, the facility will be operated from the central control room with operator displays with mouse and operator keyboards, radio, and telephone panels, monitors for internet protocol camera access.

The PCS operator workstations will provide the following functions at minimum:

- Presentation of process information to the operator
- Facilities to enable the operator to adjust and control the process
- Monitoring and control of packaged equipment
- Monitoring and control of utility systems
- Short-term logging of process conditions and operator actions
- Diagnostic of the PCS and its component parts
- Site security

Monitoring and Controls

The PCS will use solid-state equipment and a PLC or DCS to increase reliability and flexibility.

Electromechanical control relays will not be used, except when required for safety interlocks. The plant DCS will meet cyber-security standards as required by the California Independent System Operator.

If the control system involves electromechanical timing sequences or interlocks, auxiliary dry contacts will be provided for indication of steps or conditions. These contacts will be used to interface with the PCS to monitor the operational status.

All failure and alarm switches will be “fail safe”—i.e., an abnormal condition will cause a loss in output signal. Upon loss of power, control circuits and alarms will go to the “fail safe” condition. Solenoid valves and actuating relays will be normally energized and will de-energize upon protective action or alarm. All alarm contacts shall open to alarm. When contacts are controlled by a pneumatically loaded device, the device will be normally loaded and will vent to create the alarm or shutdown condition.

In general, interlock system circuits will be activated from separate primary instruments. Each interlock signal initiating a shutdown will also activate a separate pre-alarm point to indicate that an abnormal condition exists, and failure to take corrective action will result in a shutdown of the affected equipment. Pre-alarms may be actuated by a “normal” instrumentation system signal.

Communications between the PLC and human-machine interface, and PLC to PCS will be Ethernet transmission control protocol/internet protocol or ProfiNet.

Communications to motor control centers and VFDs will be Ethernet- or fiber-based. Communications to discrete field contacts will be automated with limit switch indications.

Wireless communication devices will be used for communication between control room and operators in the facility.

2.1.18.6 Cathodic Protection

The cathodic protection system will be designed to control corrosion of metallic piping when buried in the soil. Depending on the corrosion potential, type of soils on the WRESC Site, ease of isolation of buried pipe from the aboveground facilities, and proximity to ground grid and foundations, either a passive or impressed current cathodic protection will be provided where required.

2.1.18.7 Freeze Protection System

Freeze protection for above- and below-grade piping and instrumentation lines will be evaluated and installed as necessary, based on the expected minimum ambient temperature at the facility. Given that the record minimum temperature near Willow Rock is 24 degrees Fahrenheit, freeze protection is not expected to be required for large piping but may be required for small piping and air tubing. Below-grade piping will be installed below freezing depth according to site's climate and soil data. Where necessary, the above-grade piping will be protected with an electrical heat tracing system and/or continuous circulation in rare instances of freezing temperatures. The foundation of aboveground pipe support will be rooted below the freezing depth.

2.1.18.8 Service Air

The service air system will supply compressed air to hose connections for general use at the WRESC. Service air headers will be routed to hose connections located at various points throughout the facility.

2.1.18.9 Instrument Air

The instrument air system will provide dry, filtered air to pneumatic operators and devices. Air from the service air system will be dried, filtered, and pressure-regulated before delivery to the instrument air piping network. An instrument air header will be routed to locations within the facility equipment areas.

2.1.19 Interconnect to Electrical Grid

The facility will connect to the SCE electrical grid via a 230 kV overhead (predominantly) single-circuit gen-tie line that will run approximately 19 miles from the SCE Whirlwind Substation to the WRESC Site (see Chapter 3, Electric Transmission). The 230 kV line will terminate at a dead-end tower before the main power transformers, which will step down the voltage to 13.8 V and 5 kV, suitable for distribution within the WRESC. The grid connection will be capable of power import and export, rated to suit all operating scenarios. There are expected to be a small number of short underground gen-tie line segments to allow for crossing of a Los Angeles Department of Water and Power high-voltage transmission corridor and in other locations where the transmission corridor is congested with preexisting facilities (see Figure 1-4 in Chapter 1.0, Introduction). Open trenching or horizontal directional drilling will be used to complete these short underground segments.

A preliminary single-line diagram depicting the onsite Willow Rock main substation, including applicable ratings of key equipment, are included in Chapter 3, Electrical Transmission.

2.1.20 Project Construction

2.1.20.1 Construction Schedule

The construction of the WRESC from site preparation and grading to full-scale operation and construction closure is expected to take roughly 60 months. Major milestones are listed in **Table 2-8**. A more in-depth construction manpower and equipment schedule is provided in in Appendix 2B, Construction Manpower and Equipment

Schedule. The Applicant will assess the prospect of initiating full-scale operations for a portion of the facility's energy capacity in advance of the target date shown below.

Table 2-8: Major Project Milestones

Target Project Milestones	Begin		Complete	
	Month Number	Calendar Date	Month Number	Calendar Date
Mobilization	1	Mar 2025	3	May 2025
Grading	2	Apr 2025	13	Mar 2026
Reservoir Excavation	3	May 2025	13	Mar 2026
Shaft Drilling (Ventilation and Process Connections)	10	Dec 2025	35	Jan 2028
Access Shaft Excavation	11	Jan 2026	23	Jan 2027
Topside Equipment Installation	15	May 2026	45	Nov 2028
Transmission Line Construction	24	Feb 2027	39	May 2028
Cavern Construction (and Cavern Rock Crushing and Hauling)	24	Feb 2027	47	Jan 2029
Topside Equipment Commissioning	40	Jun 2028	52	Jun 2029
Subsurface Commissioning	47	Jan 2029	52	Jun 2029
Full Plant Commissioning	52	Jun 2029	55	Sep 2029
Startup	55	Sep 2029	60	Feb 2030
Construction Demobilization	59	Jan 2030	60	Feb 2030
Commercial Operation	60	Feb 2030	61	Mar 2030

Source: Hydrostor 2024

2.1.20.2 Construction Workforce

During construction, there will be an average and peak workforce of approximately 273 and 749 workers, respectively, including construction craft workers and supervisory, support, and construction management personnel onsite if 100 percent of the waste rock is hauled offsite. The construction average and peak workforce would decrease slightly to 269 and 731, respectively, if all the excavated rock is re-used onsite in the form of an architectural berm (see Section 5.10, Socioeconomics, Table 5.10-8 for a more detailed breakdown of expected labor requirements).

Surface work will normally occur in 8-hour shifts, 5 days a week. Cavern work is planned as follows:

- Mobilization and site preparation (months 1 through 3): 5 days a week, 10-hour shifts
- Grading, excavation, and shaft drilling (months 2 through 26): 12 hours/day, 10 days on, 4 days off
- Cavern construction (months 26 until completion): 24 hours/day, 7 days/week, 12-hour shifts

During cavern construction, trucks will either haul excavated waste rock up to 24 hours per day from the WRESC Site or re-use the material onsite. Excavated rock during construction may be temporarily stored for re-use if necessary. The temporary storage areas will be located as shown in **Figure 2-1** and **Figure 2-2**.

Cavern construction will occur 24 hours per day, 7 days per week. Additional hours may also be necessary for surface construction work to make up schedule deficiencies or to complete critical activities (e.g., pouring concrete at night during hot weather, and working around time-critical shutdowns and constraints).

2.1.20.3 Construction Laydown and Traffic

Construction laydown and parking will be located on property to the west and north of the WRESC Site, as depicted on the WRESC Site plot plans in **Figure 2-1** and **Figure 2-2.** The peak construction site workforce level

is expected to last from month 25 through month 46 of the construction period, with the peak being months 26 and 27.

Table 2-9 provides an estimate of the average and peak construction traffic during the 60-month construction/ commissioning period for Willow Rock based on the worst-case workforce (100 percent excavated rock hauled offsite).

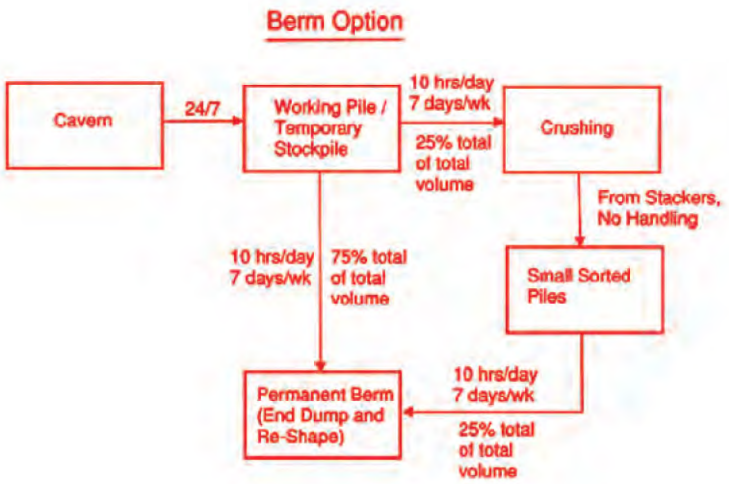
Table 2-9: Estimated Worst-Case Average and Peak Construction Traffic

Vehicle Type	Average Daily Trips	Peak Daily Trips
Construction Workers (one way, no carpooling assumed)	273	749
Deliveries	45	60
Total	318	809

2.1.20.4 Temporary Construction Rock Crushing Facility

A temporary portable rock crushing facility will be located onsite for up to 10 hours per day, 7 days per week for 22 months beginning approximately in month 25. The rock crushing facility will be capable of processing up to 350 tons per hour and is expected to consist of a primary jaw crusher, a secondary cone crusher, screens, three conveyors, and two stackers. The facility will use a combination of water sprays and a baghouse to control fugitive dust and fine particulate matter emissions. The facility will be capable of operating from a locally provided power feed or using two 779-horsepower diesel-fired engine generators meeting USEPA Tier 4 emission standards. The entire facility is expected to be certified under the California Air Resources Board Portable Equipment Registration Program.

The overall quantity of rock to be crushed will depend on whether an architectural berm will be constructed onsite or whether excavated rock will be hauled offsite. If an architectural berm is constructed, only 25 percent of the excavated rock is expected to be crushed to facilitate berm stability. If the excavated rock is hauled offsite, then up to 100 percent of the excavated rock is expected to be crushed to meet off-taker specifications. These options are depicted diagrammatically in **Figure 2-7**.



REFERENCE(S)
1. WRESC SITE RENDERING - KIEWIT 2024

CLIENT
GEM A-CAES LLC

PROJECT
WILLOW ROCK ENERGY STORAGE CENTER
SUPPLEMENTAL AFC

TITLE
ROCK CRUSHING OPERATION PROCESS DIAGRAM WITH AND WITHOUT BERM OPTIONS

CONSULTANT

YYYY-MM-DD	2024-02-22
DESIGNED	MK
PREPARED	MK
REVIEWED	SCH
APPROVED	VG/LL

PROJECT NO.	CONTROL	REV.	FIGURE
31406639.003	01	0	2-7

2.1.20.5 Temporary Concrete Batch Plant

A temporary portable concrete batch plan is also expected to be located onsite to support construction of the shafts and, if necessary, initial cavern construction. The concrete batch plant is expected to operate onsite for approximately 12 to 15 months. Construction is expected to require up to 80 cubic yards per day of finished cement. The facility will be capable of operating from a locally provided power feed or using one 500-horsepower diesel-fired engine generator meeting USEPA Tier 4 emission standards. The entire facility is expected to be certified under the California Air Resources Board Portable Equipment Registration Program.

2.1.21 Willow Rock Facility Operation

The WRESC will be operated and monitored continuously 24 hours per day, 7 days per week by qualified and licensed onsite operations staff and will not be remotely operated (other than potential grid regulation-required operations such as generator transfer trips or special protection schemes).

There will be a total of approximately 40 full-time staff to operate the facility. The operations staff will include control room operators (24 hours per day, 7 days per week) and roving operators in the field conducting general rounds at least twice per 12-hour shift.

Additional field checks will be done as needed for maintenance activity, upsets, or other general operations requirements.

2.2 Engineering

In accordance with California Energy Commission (CEC) regulations, this section together with the engineering appendix (Appendix 2A, Design Criteria) and Chapters 3, Electric Transmission present information concerning the design and engineering of Willow Rock. The LORS applicable to Willow Rock's engineering are provided in Appendix 2A along with a list of agencies that have jurisdiction, the contacts within those agencies, and a list of the permits that will be required.

2.2.1 Facility Design

Summary descriptions of the design criteria for all the major engineering disciplines are included in Appendix 2A, Design Criteria.

Design and engineering information and data for the following systems may be found in the related subsections of this Application for Certification:

- Power Generation: see Section 2.1.8, Energy Storage Air-Expansion Turbine Generators. Also see Appendix 2A and Section 2.1.17 which describe the various plant auxiliaries.
- Power Consumption: see Sections 2.1.7, Energy Storage Air Compression Equipment Drivetrain and 2.1.6, Energy Storage Facility Standby/Idle Mode.
- Water Supply System: see Section 2.1.14, Water Supply and Use. Also see Appendix 2D.
- Waste Disposal System: see Section 2.1.15, Waste Management and Section 5.14, Waste Management.
- Noise Abatement System: see Section 5.7, Noise.
- Switchyards/Transformer Systems: see Section 2.1.13, Major Electrical Equipment and Systems; Section 2.1.18.4, Grounding; Section 2.1.13.2, Alternating Current Power—Transmission; Section 2.1.19, Interconnect to Electrical Grid; and Chapter 3, Electric Transmission. Also see Appendix 2A.

2.2.1.1 Facility Safety Design

Willow Rock will be designed to maximize safe operation. Potential hazards that could affect the facility include earthquake, flood, and fire. Facility operators will be trained in safe operation, maintenance, and emergency response procedures to minimize the risk of personal injury and damage to the facility.

2.2.2 Facility Reliability

This section discusses the expected facility availability, equipment redundancy, fuel availability, water availability, and project quality control (QC) measures.

2.2.2.1 Facility Availability

The WRESC will be designed to be available to operate at its full load at least 95 percent of the time.

Availability is the duration of time that the entire facility will be able to perform its intended task. It is calculated as a ratio expressed in percentage, where the numerator is the number of hours when the system as a whole either (1) is ready to either charge or discharge (during idle/standby periods), or (2) is charging or discharging, all divided by the total number of hours in the period.

Typically, both planned and unplanned outages are subtracted from the availability calculation numerator to calculate actual availability for a period. The availability calculation denominator can be the total amount of time in the day, week, month, or, most commonly, year during which availability is being calculated.

For further clarity, availability is not the same as a typical generating plant's capacity factor, which accounts for annual criteria such as the plant's actual energy MWh output (numerator) versus the plant's nameplate capability to produce MWh over a full year (denominator), and which is usually based on the general assumption that the relevant plant will always operate at baseload.

The WRESC is intended to be operated for approximately 50 years. Reliability and availability projections are based on this operating life. Operation and maintenance procedures will be consistent with industry standard practices to maintain the useful life of plant components.

2.2.3 Redundancy of Critical Components

The following subsections identify equipment redundancy as it applies to project availability. Sparing of equipment must take into consideration the requirement to provide the targeted overall system availability of 95 percent. A Reliability, Availability, and Maintainability (RAM) study will be performed during final engineering design to further refine this preliminary redundancy information.

2.2.3.1 Turbomachinery

As is typical in the industry, there is no redundancy in turbomachinery (spares), given the overall reliability of the component parts and the need to control capital expenditures. Routine minor inspection and maintenance will be performed between charge and discharge cycles during pre-planned outages. Major inspections and overhauls will require shutdowns for removal of the turbomachinery casings, rotors, and other major components.

2.2.3.2 Pumps

All types of pumps are considered susceptible to mechanical breakdown and generally have one installed spare. The decision not to install a spare will depend on the criticality of the service. In general, pumps will be spared in an N +1 arrangement as an early front-end engineering design assumption until either more accurate input is available or the RAM analysis has completed.

2.2.3.3 Heat Exchangers

Shell and tube (S&T) heat exchangers are less susceptible to mechanical breakdown, though appropriate protection will be provided to safeguard equipment against tube failures and cross contamination of fluids. S&T heat exchangers will not be spared; however, the parallel nature of the heat exchanger system will allow the plant to remain available when individual exchanger units are under service. Appropriate filtration will be included to prevent corrosion and increase reliability. Tube inspection and maintenance allowances will be made in the layout design and procurement.

2.2.3.4 Storage Tanks

Multiple spherical tanks are required due to size constraints on the technology at the required operating condition, effectively resulting in sparing. They are not spared beyond the minimum number of spherical tanks required to store the hot water. That is, the WRESC will still be able to operate with a spherical tank rendered unusable, but at a reduced charge/discharge duration.

The low-pressure (atmospheric) tank is not susceptible to mechanical breakdown and, as such, does not require frequent shutdowns for maintenance purposes.

Both types of tanks will be inspected and maintained during pre-planned outages, with major inspections coordinated with major work on the turbomachinery.

Critical sensors and transducers will have triple redundancy.

2.2.4 Fuel Availability

The WRESC will not use fuel for the process. California ultra-low sulfur diesel (15 ppm sulfur by weight) will be used for the emergency backup generators and fire pump and is readily available in the marketplace.

2.2.5 Water Availability

Potable and process water will be provided by interconnection with the AVEK water distribution system. The availability of water to meet the requirements of the facility need is discussed in more detail in Section 5.15, Water Resources.

2.2.6 Project Quality Control

The project will implement a QC program that will ensure the highest level of oversight while meeting the desired project outcomes, as well as the appropriate license and social license for ongoing operations.

2.2.7 Quality Control Records

The following QC records will be maintained for review and reference:

- Project instructions manual
- Design calculations
- Project design manual
- Quality assurance audit reports
- Conformance to construction records drawings
- Procurement specifications (contract issue and change orders)
- Purchase orders and change orders
- Project correspondence
- Any other records as required by LORS

During construction, field QC activities will be performed during the last four stages of the project: receipt inspection, construction/installation, system/component testing, and plant operations. The construction contractor will be contractually responsible for performing the work in accordance with the quality requirements specified by contract.

The subcontractors' quality compliance will be surveyed through inspections, audits, and administration of independent testing contracts.

A plant operation and maintenance program, typical of a project this size, will be implemented at the Willow Rock site to control operation and maintenance quality. A specific program for this project will be defined and implemented prior to initial plant startup.

2.2.8 Facility Closure

Closure of the facility can be temporary or permanent. Temporary closure is defined as a shutdown for a period exceeding the time required for normal maintenance, with an intent to restart in the future. Permanent closure is defined as a cessation in operations with no intent to restart operations. Section 2.3.1 discusses temporary facility closure, and Section 2.3.2 discusses permanent facility closure in relation to the WRESC.

2.2.9 Temporary Closure

For a temporary closure where there is no release of hazardous materials, the Applicant will maintain security of the WRESC facilities and will notify the CEC and other responsible agencies as required by law. If the temporary closure includes damage to the Willow Rock facilities, and if there is a release or threatened release of regulated substances or other hazardous materials into the environment, procedures will be followed as set forth in an Emergency Management Plan in accordance with a Hazardous Materials Plan. Procedures will include methods to control releases, notification of applicable authorities and the public, emergency response, and training for facility personnel in responding to and controlling releases of hazardous materials. Once the immediate problem is solved and the regulated substance/hazardous material release is contained and cleaned up, temporary closure will proceed as described above for a closure where there is no release of hazardous materials.

2.2.10 Permanent Closure

When the facility is permanently closed, the closure procedure will follow a decommissioning plan that will be developed as described below.

The conditions that would affect the decommissioning decision will be presented to the CEC when more information is available and the timing for decommissioning is more imminent.

To ensure that public health and safety and the environment are protected during decommissioning, a decommissioning plan will be submitted to the CEC for approval prior to decommissioning. The plan will discuss the following:

- Proposed decommissioning activities for Willow Rock and all appurtenant facilities constructed as part of Willow Rock
- Conformance of the proposed decommissioning activities to all applicable LORS and local/regional plans
- Associated costs of the proposed decommissioning and the source of funds to pay for the decommissioning

In general, the decommissioning plan for Willow Rock will attempt to maximize the recycling or re-use of all facility components. It is anticipated that the potential cavern rock architectural berm will remain in place to minimize environmental impacts associated with its removal. It will be decommissioned such that no ongoing maintenance is needed for flood control. All nonhazardous wastes will be collected and disposed of in appropriate landfills or waste collection facilities. All hazardous wastes will be disposed of according to all applicable LORS.

Attachment 3
AFC Air Quality Section

5.1 Air Quality

5.1.1 Introduction

GEM A-CAES LLC's (GEM, the Applicant) Willow Rock Energy Storage Center (WRESC, or Willow Rock) will be located on approximately 88.6 acres of private land immediately north of Dawn Road and between State Route (SR) 14 and Sierra Highway within unincorporated, southeastern Kern County, California. The WRESC will be a nominal 520-megawatt (MW) gross (500 MW net) and 4,160 megawatt-hour (MWh) gross (4,000 MWh net) facility using Hydrostor, Inc.'s (Hydrostor's) proprietary, advanced compressed air energy storage (A-CAES) technology. Energy stored at the WRESC will be delivered to Southern California Edison's (SCE's) Whirlwind Substation located southwest of the WRESC at the intersection of 170th Street W and Rosamond Boulevard, via a new approximately 19-mile 230-kilovolt (kV) generation-tie (gen-tie) line. The WRESC will be capable of operating on a 24-hour basis, 365 days a year with an approximately 50-year lifespan.

The Project or Project Area encompasses the WRESC Site, the parcels within the Project Boundary, and the right-of-way associated with the WRESC's gen-tie line. The Project Boundary encompasses the WRESC Site and the parcels of land (an additional 133 acres of private land surrounding the WRESC) that will be allocated for potential temporary staging and laydown area (referred to herein as the Staging Area) during construction, or the construction of a permanent architectural berm constructed from the material excavated during cavern construction. The Staging Area consists of groups of assessor's parcels referred to as P1, P2N, P2S, and VH.

This section presents the methodology and results of an analysis performed to assess the potential impacts of airborne emissions from the construction and operation of the WRESC and the Project's compliance with applicable air quality laws, ordinances, regulations, and standards. The report was prepared following the Kern County Planning Department's Guidelines for Preparing an Air Quality Assessment for Use in Environmental Impact Reports (Kern County 2006), Eastern Kern Air Pollution Control District's (EKAPCD) Guidelines for Implementation of the California Environmental Quality Act (CEQA) (EKAPCD 1999), and Appendix B - Information Requirements for an Application for Certification (AFC) or Small Power Plant Exemption (SPPE) (Title 20, California Code of Regulations, Division 2, Chapter 5, Appendix B).

Section 5.1.1 presents the introduction, Applicant information, and the EKAPCD rules applicable to the WRESC. Section 5.1.2 presents data on the emissions of criteria and air toxic pollutants from the WRESC. Section 5.1.3 presents the Willow Rock Project description, both current and proposed. Section 5.1.4 presents emissions evaluation data. Section 5.1.5 discusses the best available control technology (BACT) evaluations for the WRESC. Section 5.1.6 presents the air quality impact analysis for the WRESC. Section 5.1.7 discusses the meteorological data selection process required to analyze the impacts of the WRESC. Section 5.1.8 presents applicable laws, ordinances, regulations, and standards (LORS). Section 5.1.8.3 presents agency contacts. Section 5.1.8.4 presents permit requirements and schedules. Section 5.1.9 contains references cited or consulted in preparing this section. Appendices 5.1A to 5.1F contain the emissions calculations for operation and construction, air quality impact analysis for construction and operation phases, ambient air quality data, and the modeling and health risk assessment methodology support data.

The WRESC will be a 500-megawatt (MW) (net) A-CAES process that includes aboveground electric air compression and power generation equipment, an underground air storage cavern, heat exchangers, and three diesel fuel-fired internal combustion engines driving 2.5 MW emergency generators, as well as a diesel fuel-fired fire pump engine. A detailed description of the WRESC is presented in Chapter 2, Project Description.

Air will be the dominant pathway for public exposure to chemical substances released by the WRESC. Emissions to the air will consist primarily of combustion by-products produced by testing of the internal combustion engines driving emergency generators. Potential health risks from combustion emissions will occur almost entirely by direct inhalation.

During construction, regulated air emissions will be emitted to the atmosphere due to combustion of fuel in reciprocating internal combustion engines (off-road and on-road mobile sources), traffic on internal site unpaved roads, bulldozing, wind erosion, grading, rock crushing, a cement batch plant, and material movement.

During operations, the WRESC will not routinely operate combustion units or emit regulated pollutants to the atmosphere. Regulated emission of air pollutants will only occur from the stationary internal combustion engines for maintenance and readiness testing or in the emergency event of a fire or power outage. Only two of the 2.5 MW engines are required to support critical loads. The third engine is redundant and only one engine is assumed to operate at any given time for purposes of maintenance and readiness testing.

5.1.2 Regulatory Items Affecting New Source Review

Regulated air emissions from Willow Rock operations will not exceed federal major source thresholds under nonattainment New Source Review (NSR) or Prevention of Significant Deterioration (PSD); therefore, federal NSR will not apply to this project. Because nonattainment NSR does not apply, emission offsets are not required.

The WRESC Site is located in an area that is considered severe nonattainment for 8-hour ozone (2008) and moderate nonattainment for 8-hour ozone (2015) (1987) (EKAPCD 2017). The area is attainment and/maintenance for all other criteria pollutants.

EKAPCD has an NSR process with lower limits than the federal program, which is organized into New Stationary Source Review (NSSR) under APCD Rule 210.1 and Major New Stationary Source Review (MNSSR) under APCD Rule 210.1A.

NSSR identifies a “major” source to have potential emissions at or above 50 tons per year of any affected pollutant. Potential emissions from the WRESC will not exceed this major source level. The NSSR process requires the following considerations:

- Emission units must meet BACT. BACT will be met by purchasing engines that conform to the U.S. Environmental Protection Agency (U.S. EPA) Tier 4 emission standards for the emergency generator engines, and Tier 3 emissions standards for the proposed fire pump engine, and combust diesel fuel that contains no more than 15 parts per million (ppm) sulfur.
- The operation of the WRESC will not require air emission offsets because all proposed emission units are defined as “emergency equipment” and under APCD Rule 210.1(III)(B)(2)(a), emission offsets are not required for emergency equipment not operated more than 200 hours per year.

MNSSR only applies to sources identified as “major,” which is defined as a new source that has potential emissions at or above 100 tons per year of any affected pollutant. Operations at the WRESC will not be a major source and are not subject to the requirements of MNSSR.

The proposed emergency engine emission units will likely use catalytic oxidation and/or selective catalytic reduction, as well as diesel particulate filters to meet Tier 4 standards. These control technologies are not an integral part of the engine and are considered as add-on pollution control equipment. The proposed control systems are positioned between the engines and the exhaust stack and, as such, they cannot be bypassed by the operator. As noted above, the proposed fire pump engine will comply with the Tier 3 standards.

The direct construction and operation emissions impacts associated with the Project are analyzed according to APCD and California Energy Commission (CEC) modeling requirements. An air quality analysis was conducted to demonstrate that impacts from nitrogen oxides (NO_X), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter (PM)10, and PM2.5 will comply with the California and National Ambient Air Quality Standards (CAAQS/NAAQS) for the applicable averaging periods. Impacts from nearby sources are not anticipated to be significant but will be assessed for criteria pollutants under separate cover if requested by EKAPCD or the CEC. The need for a cumulative source analysis will be assessed after the CEC data adequacy review. A search of the California Air Resource Board (CARB) Pollution Mapping Tool shows that there are no significant sources located within a 6-mile radius of the WRESC Site; therefore, no cumulative air quality modeling protocol is provided in this study.

Worst-case annual potential to emit (PTE) emissions for operation are summarized in **Table 5.1-1**.

Table 5.1-1: Facility Potential to Emit Summary and Major Source/Attainment Status for Operation

Pollutant	WRESC PTE (tpy)	Federal Attainment	State Attainment	APCD Rule 210.1A Major Source Threshold (tpy)	Federal NA NSR Major Source Threshold (tpy)	Federal PSD Major Source Threshold (tpy)
NO_X	1.49	Yes	Yes	25 (severe for ozone)	50 (severe for ozone)	250
CO	6.50	Yes	Yes	100	N/A	250
VOC	0.35	N/A	N/A	25 (severe for ozone)	50 (severe for ozone)	250
SO_2	0.013	Yes	Yes	100	N/A	250
PM10	0.063	Yes/Maintenance	No	100	100	250
PM2.5	0.063	Yes	Yes	100	N/A	250
GHG (CO_2e)	1,225	N/A	N/A	N/A	N/A	75,000
Ozone	N/A	N, severe	N	N/A	N/A	N/A

Source: Attainment Status (EKAPCD 2018)
Note: GHG can only be a major source under PSD if another regulated pollutant is major for PSD.
APCD = air pollution control district; CO = carbon monoxide; CO_2e = carbon dioxide equivalent; GHG = greenhouse gas; N/A = not applicable; NSR = new source review; PM10 = particulate matter less than 10 microns; PM2.5 = particulate matter less than 2.5 microns; PSD = prevention of significant deterioration; PTE = potential to emit; NO_X = nitrogen oxides; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compound; WRESC = Willow Rock Energy Storage Center

5.1.3 Project Description

The following sections describe the Project. A detailed project description and location data are presented in Section 2.0.

5.1.3.1 Willow Rock Energy Storage Site Location

The WRESC will be located in Kern County approximately 0.22 miles east of the center of the Highway 14 interchange at Dawn Road. The WRESC Site lies approximately 3.5 miles north of Rosamond, California, within the EKAPCD.

Figures 1-4 and 1-5, in Chapter 1, Introduction, show the Willow Rock site and the immediate vicinity.

5.1.3.2 Project Equipment Specifications

The WRESC will consist of the following major equipment and operations:

- Three 2.5 MW diesel-fired internal combustion engines driving generators for emergency use (only one engine will operate at any given time during maintenance and readiness testing).
- One diesel-fired internal combustion engine driving a 460 brake horsepower (BHP) fire pump.

All power from the facility will be delivered to the SCE's Whirlwind substation.

Equipment specifications are summarized in **Table 5.1-2**.

Table 5.1-2: Equipment Specification

Parameter	Emergency Diesel Generators (each)	Emergency Fire Pump
Manufacturer	Kohler	Cummins
Model	KD2500-4	CFP15EVS-F10
Engine Power	2,500 bkW	343 bkW
Fuel	Ultra-low sulfur diesel	Ultra-low sulfur diesel
Maximum Fuel Consumption	174.6 gallons per hour	22.5 gallons per hour
Annual Limits	200 hours per year	200 hours per year
Exhaust Flow, acfm	9734 (each stack)	2881
Exhaust Temperature	914°F	1,025°F

Source: Kohler KD2500-4 and Cummins CFP15EVS-F10 Specifications
°F= Fahrenheit; acfm = actual cubic feet per minute; bkW = brake kilowatt; G/bkw-hr = grams per brake kilowatt-hour

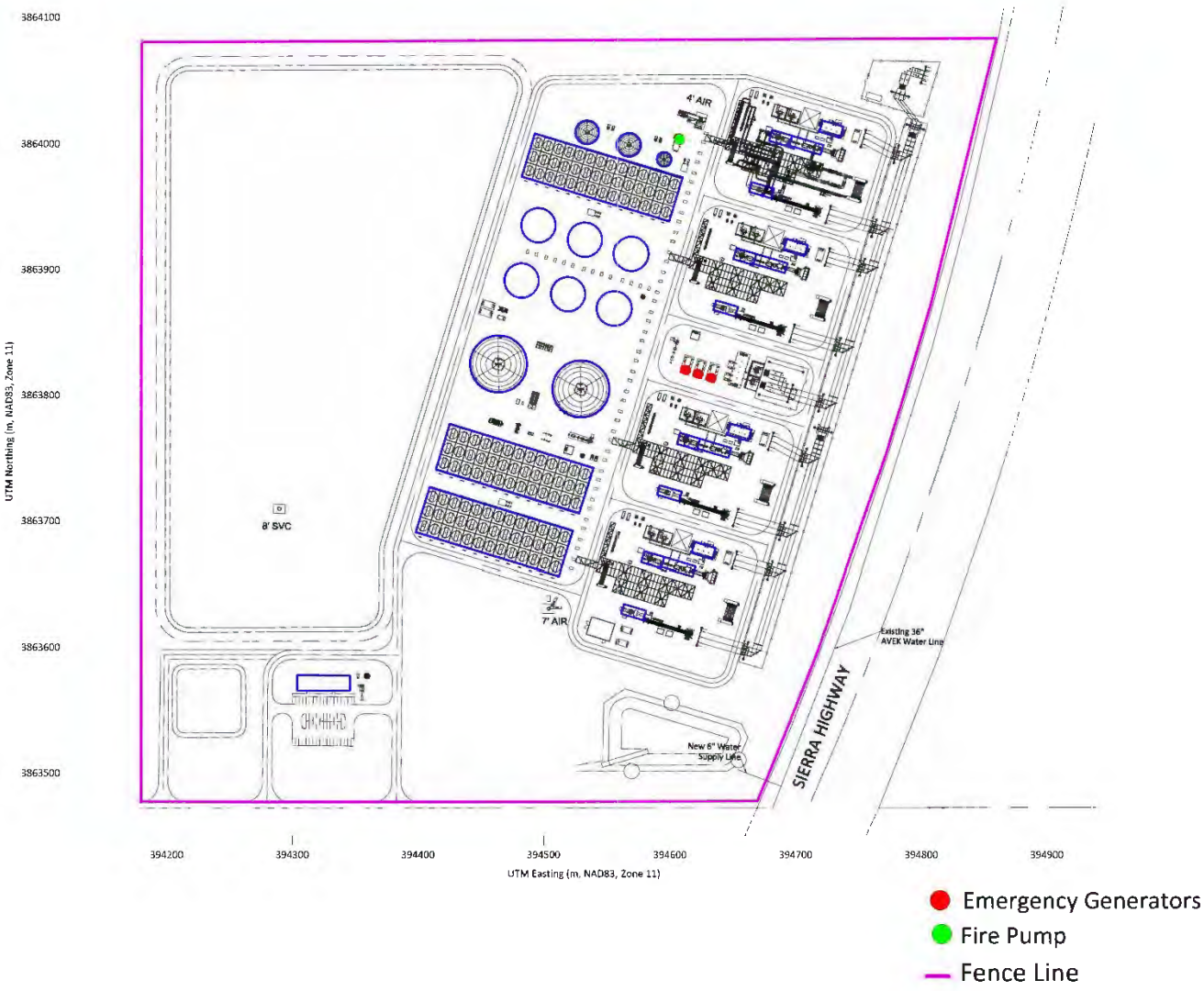
During the operational phase, the diesel generators will supply emergency power for critical loads. These generators are the only stationary sources that will combust fossil fuel and are anticipated to operate for 50 hours (each) per year for readiness testing and maintenance but will be limited to 200 hours per year each in an air permit. This analysis includes emissions from the operation of the three emergency diesel generators and the single fire pump. **Table 5.1-3** provides the location and source characteristics for each generator stack. **Figure 5.1-1** shows the WRESC Site property boundary and location of the four engine emission sources.

Table 5.1-3: Emission Unit Specification

Source ID	Description	UTM Easting Coordinate (meters)	UTM Northing Coordinate (meters)	Stack Height from grade (feet)	Stack Inside Diameter (feet)	Stack Elevation AMSL (feet)	Exhaust Gas Temperature (°F)	Exhaust Gas Flowrate (actual cfm)	Exhaust Velocity (ft/s)
EGEN 1	Emergency Diesel Generator 2.5 MW	394,612.1	3,863,819.9	22.93	1.033	~2,554	914	19,468	193.5
EGEN 2	Emergency Diesel Generator 2.5 MW	3,946,22.3	3,863,816.8	22.93	1.033	~2,554	914	19,468	193.5
EGEN 3	Emergency Diesel Generator 2.5 MW	394,632.4	3,863,813.7	22.93	1.033	~2,554	914	19,468	193.5
FP	Diesel Fire Pump 460 bhp	394,606.4	3,864,004.4	15	0.5	~2,554	1,025	2,881	245

Source: Kohler KD2500-4 and Cummins CFP15EVS-F10 Specifications
Coordinate datum = UTM Zone 11, NAD83 North.
°F = Fahrenheit; AMSL= above mean sea level; bhp = brake horsepower; cfm = cubic feet minute; ft/s = ft per second; MW = megawatts
NAD83 = North American Datum of 1983; UTM = Universal Transverse Mercator

Figure 5.1-1: Location of Willow Rock Energy Storage Center Emission Sources during Operation Phase (No-Architectural Berm Option)



5.1.3.3 Fuels

Fuel use at the WRESC will be limited to ultra-low sulfur diesel fuel. For this application, diesel fuel is assumed to have a heating value of 137,000 British thermal units per gallon (Btu/gallon) as referenced in the calculations (Appendices 5.1A and 5.1C).

5.1.4 Emissions Evaluation

5.1.4.1 Facility Emissions and Permit Limitations

The approximate 88.6-acre proposed Willow Rock site is currently vacant and there are no current air pollution sources located on the WRESC Site.

5.1.4.2 Facility Emissions

Operation of the WRESC will not result in stationary source emissions greater than 250 tons per year (tpy) for any criteria pollutants; as such, the WRESC will be considered a minor NSR source for NO, CO, VOC, and PM10/PM2.5 under the federal regulations. The WRESC will not trigger the requirements of the federal PSD program because the emissions of one or more criteria pollutants will not exceed the 250 tpy major source applicability thresholds. The facility is expected to be a minor source under the APCD NSR rules. Criteria pollutant emissions from the emission units are presented in the following sections, while emissions of hazardous air pollutants are presented in Section 5.9, Public Health. Detailed calculations for criteria air pollutant emission calculations are provided in Appendix 5.1A.

Hourly, daily, and annual emissions for criteria pollutants are based upon the highest emissions for each pollutant considering that the emission units are classified as emergency use and are limited to 200 hours per year of operation.

5.1.4.3 Normal Operations

Operation of the emergency engines at the WRESC will result in emissions to the atmosphere of both criteria and toxic air pollutants. Criteria pollutant emissions will consist primarily of NO_X, CO, VOCs, SO_X, PM10, PM2.5, and CO_2e. Air toxic pollutants will consist of diesel particulate matter, which is the approved surrogate compound for a combination of hazardous air pollutants and other compounds that are commonly generated from the combustion of diesel fuel. **Table 5.1-4** lists the pollutants that may potentially be emitted from the WRESC. Other than the operation of the generators for testing and maintenance, there are no additional significant sources of air emissions from the maintenance or operation of the WRESC. Commissioning of emergency generators is not anticipated to take a significant amount of time and will result in emissions that are characteristically similar to normal operation; no air emission testing is anticipated during commissioning.

Table 5.1-4: Chemical Substances Potentially Emitted to the Air from the Willow Rock Energy Storage Center

Criteria Pollutants	Greenhouse Gases	Other Compounds
Particulate Matter (PM)	Carbon Dioxide (CO_2)	Diesel particulate matter is considered the approved surrogate toxic for all diesel exhaust constituents for purposes of the cancer and chronic health risk assessment analysis.)
PM less than 10 microns (PM10)	Methane (CH_4)	
PM less than 2.5 microns (PM2.5)	Nitrous Oxide (N_2O)	
Carbon Monoxide (CO)		
Nitrogen Oxides (NO_X)		
Volatile Organic Compounds (VOC)		

Source: Appendix 5.1A, and 5.1B, and Section 5.9, Public Health, Appendix 5.9C

5.1.4.4 Operational Criteria Pollutant Emissions

Table 5.1-5 presents a summary of the maximum short-term and annual criteria pollutant emissions for the worst-case operational scenario during operation, i.e., 50 hours per year of readiness testing per engine plus 150 hours per year of emergency operations per engine, for a total of 200 hours per year. The 150 hours of emergency operation is an EKAPCD permitting requirement, but the facility will be limited to only 50 hours per year of maintenance/readiness testing as required by the California Air Toxics Control Measure. Only one engine will be tested during any single hour. The annual emissions in **Table 5.1-5** are based on all three emergency generators and the single fire pump. Detailed calculations for criteria air pollutant emission calculations for operation are provided in Appendix 5.1A.

Table 5.1-5: Facility Maximum Emission Rate and Potential to Emit Summary for Operation of the Proposed Diesel Engines

Pollutant	Maximum Emission Rate (lb/hr) Single Emergency Generator	Maximum Emission Rate (lb/hr) Fire Pump Engine	Potential to Emit (tpy) All Engines	Exceeds EKAPCD CEQA Thresholds?
NO_X	3.991	2.890	1.49	No
CO	20.758	2.637	6.50	No
VOC	1.118	0.152	0.35	No
SO_2	0.040	0.005	0.013	No
PM10	0.160	0.152	0.063	No
PM2.5	0.160	0.152	0.063	No
GHG (CO_2e)	N/A	N/A	1,225	No

Source: Appendix 5.1A.
CO = carbon monoxide; CO_2e = carbon dioxide equivalent; GHG = greenhouse gas; lb/hr = pound per hour; N/A = not applicable; NO_X = nitrogen oxides; PM10/PM2.5 = particulate matter less than 10 or less than 2.5 microns; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compounds

In addition to the combustion-related engine emissions, there will be a very insignificant amount of volatile organic compound (VOC) emissions from the engine fuel tanks. These VOC emissions were calculated to be 0.00103 tpy, or 0.00564 pounds per day. Appendix 5.1A contains the emissions calculation support data for these VOC emissions.

Under EKAPCD's Guidelines for Implementation of CEQA, dated July 1, 1999, the operation of projects meeting the following thresholds are determined not to result in air quality a significant impact as defined by CEQA Section 21068:

Operation of the project will:

Emit (from all project sources subject to KCAPCD (now EKAPCD) Rule 201) less than offsets trigger levels set forth in Subsection III.B.3 of KCAPCD (now EKAPCD) Rule 210.1 (New and Modified Source Review Rule. The applicable offset trigger limits per Rule 210.1 are as follows:

a. *NO_X – 25 tpy*
b. *VOCs – 50 tpy*
c. *PM10 – 70 tpy,*

Emit less than 137 pounds per day of NO_x or reactive organic compounds from motor vehicle trips (indirect sources only),

Not cause or contribute to an exceedance of any CAAQS or NAAQS,

Not exceed the EKAPCD health risk public notification thresholds adopted by the KCAPCD (now EKAPCD) Board (see Section 5.9, Public Health),

Be consistent with adopted federal and state air quality attainment plans.

In addition, since greenhouse gas emissions (GHG) of 1,225 tons per year are less than the EKAPCD guideline significance threshold of 25,000 tons/year, GHG emissions during operation are considered insignificant.

Section 5.10, Socioeconomics lists the number of workers during normal facility operations at 40 full time equivalents. It is expected that all 40 employees will live within Kern County for the assumption of 50 miles per round trip, which corresponds to 2,000 vehicle miles traveled per day. Using 2029 standard vehicle mix, the indirect project emissions would be well below the 137 pounds per day CEQA threshold:

NO_x = 0.283 lbs/day

VOCs = 0.0445 lbs/day

Based on the operational emissions of the Project in Table 5.1-5 to the EKAPCD offset thresholds in Rules 201 and 210.1, the indirect emissions of NO_x and VOCs from worker vehicle trips (commute) and the results of the health risk assessment in Section 5.9, the operation of the Project will not result in significant impacts as defined by the EKAPCD CEQA Guidelines.

5.1.4.4.1 Operational Greenhouse Gas Emissions

Greenhouse gas (GHG) emissions have been estimated for both the construction and operation phases of the WRESC. **Table 5.1-5** of Section 5.1.4.4 presents the GHG emissions for 50 hours of routine operation plus an additional 150 hours of emergency operation, as per the permitting requirements of EKAPCD. Appendix 5.1B shows the GHG emissions for onsite and offsite construction.

5.1.4.5 Operational Hazardous Air Pollutants

See Section 5.9, Public Health, for a detailed discussion and quantification of hazardous air pollutant emissions from the WRESC and the results of the health risk assessment.

5.1.4.6 Construction Emissions

The construction phase of the WRESC is expected to take approximately 60 months (followed by several months of start-up and commissioning). Construction-related emissions are based on the 12-month period during the construction process, which has activities that will produce the highest estimated emissions. Construction emissions at the Willow Rock site are consistent with emissions encountered at most construction sites, including:

- Combustion of fuel in vehicles onsite (direct)
- Fugitive dust from vehicle travel on unpaved roads onsite (direct)
- Fugitive dust from wind erosion, land clearing and material movement onsite (direct)
- Fugitive dust from rock screening and crushing (direct)
- Fugitive dust from concrete batch plant operations (direct)
- Combustion of fuel in vehicles and both onsite and offsite equipment (direct and indirect)
- Fugitive dust from vehicle travel on paved and unpaved roads offsite (indirect)

Detailed construction emissions used to establish construction-related impacts are in Appendix 5.1B. The construction emissions as delineated in Appendix 5.1B are presented for the following two scenarios; with the architectural berm and without the architectural berm. The scenario with the architectural berm assumes that the cavern rock will be used to build an architectural berm. Under this scenario, approximately 25 percent of the cavern rock will be processed through the proposed onsite crushing/screening plant before being delivered to the architectural berm construction area along with the remaining 75 percent of the cavern rock. The no architectural berm scenario conservatively assumes that virtually all the cavern rock will be processed through the crushing/screening plant and subsequently hauled offsite to an existing materials site for future use.

Emissions used in the annual dispersion modeling analysis are based on the estimated highest consecutive 12-month period, which was determined as months 25 through 36 for the" architectural berm" option, and months 30 through 41 for the "no architectural berm" option. These 12-month periods considered manpower values, equipment numbers, and use rates, as well as site activities (both aboveground and belowground). The estimated highest monthly emissions are based on the annual emissions divided by 12, while the highest daily emissions are based on the highest monthly emissions divided by 30 days per month. This procedure is consistent with the evaluation and breakdown of annual emissions data to monthly and daily emissions values from the CalEEMod model (Version 2020.4.0). Additional details are contained in Appendix 5.1B.

The Applicant proposes the incorporation of the following for this site as described in the air pollutant mitigation measures for construction sites by the EKAPCD:

- Land Preparation, Excavation, and/or Demolition Activities
  - All soil excavated or graded should be sufficiently watered to prevent excessive dust. Watering should occur as needed with complete coverage of disturbed soil areas. Watering should be performed at a minimum of twice daily on unpaved/untreated roads and on disturbed soil areas with active operations.
  - All clearing, grading, earth moving, and excavation activities should cease
    - during periods of winds greater than 20 miles per hour (mph) (averaged over 1 hour), if disturbed material is easily windblown, or
    - when dust plumes of 20 percent or greater opacity impact public roads, occupied structures, or neighboring property.
  - All fine material transported offsite should be sufficiently watered or securely covered to prevent excessive dust.
  - If more than 5,000 cubic yards of fill material will be imported or exported from the WRESC Site, all haul trucks should be required to exit the WRESC Site via an access point where a gravel pad or grizzly has been installed.
  - Areas disturbed by clearing, earth moving, or excavation activities should be minimized at all times.
  - Stockpiles of soil or other fine loose material shall be stabilized by watering or other appropriate method to prevent windblown fugitive dust.
- Where acceptable to the fire department, weed control should be accomplished by mowing instead of discing, thereby, leaving the ground undisturbed and with a mulch covering.
- Onsite Rock Crushing and Cement Batch Plant Operations

  Use of dust suppression methods including spay bars for the rock crushing and bag houses for batch cement plant operations.
- Building Construction Activities
  - Once initial leveling has ceased, all inactive soil areas within the construction site should either be seeded and watered until plant growth is evident, treated with a dust palliative, or watered twice daily until soil has sufficiently crusted to prevent fugitive dust emission.
  - All active disturbed soil areas should be sufficiently watered to prevent excessive dust, but no less than twice per day.
- Vehicular Activities
  - Onsite vehicle speed should be limited to 15 mph.
  - All areas with vehicle traffic should be paved, treated with dust palliatives, or watered a minimum of twice daily.
  - Streets adjacent to the WRESC Site should be kept clean and accumulated silt removed.
  - Access to the WRESC Site should be by means of an apron into the Project from adjoining surfaced roadways. The apron should be surfaced or treated with dust palliatives. If operating on soils that cling to the wheels of the vehicles, a grizzly or other such device should be used on the road exiting the Project, immediately prior to the pavement, to remove most of the soil material from the vehicle's tires.
  - Properly maintain and tune all internal combustion engine powered equipment.
  - Require employees and subcontractors to comply with California's idling restrictions for compression ignition engines.
  - Use low sulfur (CARB) diesel fuel.

Based on the nature and the time frame for construction, these measures will reduce construction emissions and impacts to levels that are less than significant. Appendix 5.1B presents the evaluation of construction-related emissions while Appendix 5.1D presents data on the construction-related ambient air quality impacts.

As noted in Section 5.1.4.4, these thresholds do **not** apply to construction emissions. The thresholds noted above only apply to emissions from operation of the facility subsequent to the construction phase. Both the onsite and offsite construction emissions are summarized in **Table 5.1-6** and **Table 5.1-7** below**.**

Table 5.1-6: Onsite and Offsite Construction Emissions Summary for the Architectural Berm Option

Parameter	NO_X	CO	VOC	PM10	PM2.5	SO_2	CO_2e
Onsite, tpy	27.13	32.88	3.37	15.54	3.90	0.08	8060.5
Onsite, lb/day	150.7	182.7	18.7	86.3	21.7	0.4	N/A
Offsite, tpy	1.4	7.4	0.6	2.9	0.5	0.04	3403
Offsite, lb/day	7.6	40.9	3.3	15.9	2.5	0.2	N/A

Note: Emissions are for the maximum 12-month period (months 25 to 36)
CO = carbon monoxide; CO_2e = carbon dioxide equivalent; lb/day = pounds per day; PM10/PM2.5 = particulate matter less than 10 or less than 2.5 microns; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compounds, N/A = not applicable

Table 5.1-7: Onsite and Offsite Construction Emissions Summary for the No-Architectural Berm Option

Parameter	NO_X	CO	VOC	PM10	PM2.5	SO_2	CO_2e
Onsite, tpy	42.70	60.03	6.47	14.60	3.86	0.17	18,246.6
Onsite, lb/day	237.2	333.5	36.0	81.1	21.4	1.0	N/A
Offsite, tpy	9.5	7.7	1.6	7.8	0.9	0.11	11,756
Offsite, lb/day	52.9	42.7	8.7	43.4	4.7	0.6	N/A

Note: Emissions are for the maximum 12-month period (months 30 to 41)
CO = carbon monoxide; CO_2e = carbon dioxide equivalent; lb/day = pounds per day; PM10/PM2.5 = particulate matter less than 10 or less than 2.5 microns; SO_2 = sulfur dioxide; tpy = tons per year; VOC = volatile organic compounds, N/A = not applicable

This Project will not require a federal air permit. The Project may receive federal government financial assistance, in which case, the provisions of general conformity under 40 Code of Federal Regulations (CFR) Part 93 Subpart B and EKAPCD Rule 210.7 may apply to the WRESC. An air quality conformity analysis is provided with this application (see Appendix 5.1D) and demonstrates that the proposed Project will comply with all applicable air quality rules and standards.

5.1.5 Best Available Control Technology Evaluation

5.1.5.1 Current Control Technologies

BACT will be met by purchasing engines (emergency electrical generators) certified to meet U.S. EPA Tier 4 emissions for the applicable size and type of engine. Based on the proposed engines for Willow Rock operation, the following emission limits must be met (EKAPCD 2018):

- NO_X ≤ 0.5 grams per brake horsepower-hour (g/bhp-hr)
- SO_2: combust diesel fuel with a sulfur content no greater than 15 ppm
- CO ≤ 2.6 g/bhp-hr
- PM ≤ 0.02 g/bhp-hr
- Non-methane Hydrocarbons ≤ 0.14 g/bhp-hr

BACT for the proposed fire pump engine will be met by compliance with the Tier 3 emissions standards as follows:

- NO_X ≤ 2.85 g/bhp-hr
- SO_2: combust diesel fuel with a sulfur content no greater than 15 ppm
- CO ≤ 2.6 g/bhp-hr
- PM ≤ 0.15 g/bhp-hr

- Non-methane Hydrocarbons ≤ 0.15 g/bhp-hr

5.1.5.2 Proposed Best Available Control Technology

The emergency generators installed at the WRESC will conform to U.S. EPA and CARB Tier 4 emission standards noted in the previous section, which will satisfy the requirements for BACT, as summarized in the EKAPCD rules. The proposed fire pump engine will meet BACT by complying with the Tier 3 emissions standards. Meeting BACT is considered appropriate mitigation for emissions for emergency generators and fire pump. The EKAPCD permit that will be required for construction and operation of the generator and fire pump engines will include conditions/monitoring requirements, such as logging hours of operation, keeping records of sulfur content of the fuel combusted, and performing manufacturer-recommended maintenance to verify that the emissions are controlled to the levels established by BACT.

5.1.6 Air Quality Impact Analysis for Operations and Construction

This section describes the results, in both magnitude and spatial extent of ground level concentrations resulting from emissions from the WRESC during construction and operations. The maximum modeled concentrations were added to the maximum background concentrations to evaluate the potential total Project impact.

Dispersion modeling methods follow U.S. EPA-approved methods established in 40 CFR Part 51 Appendix W. Descriptions of the air modeling process, model options, and parameters are presented in the following sections. Modeling inputs/outputs will be provided to the CEC and EKAPCD staff in electronic form.

It should be noted that two Project designs were assessed in the dispersion modeling analyses: the Project with an approximate 10-foot-high architectural berm placed in the northern and western portions of the Project and the Project without the architectural berm. The only difference with regards to the modeling assessment will be the use of an expanded Project fence line for the architectural berm and no-architectural berm options.

5.1.6.1 Climate and Meteorology

The climate of the area surrounding the WRESC is influenced by the local terrain and geography. The terrain surrounding the WRESC is relatively flat with some local elevated areas immediately to the south and southeast. The southern end of the Sierra Nevada Mountain Range is located approximately 12 miles to the northwest. Summers are hot, arid, and clear. Winters are cold and partly cloudy. The average high temperatures range from 98 degrees Fahrenheit (°F) in the summer to 56°F in the winter, and average low temperatures range from 69°F in the summer to 33°F in the winter. The area is arid with the wetter season occurring from the end of November to the beginning of April. The dew point generally does not exceed 60°F. Wind is most often out of the west and southwest with an average wind speed of 11.8 mph. Quarterly and annual wind roses, based on the meteorological data obtained from the General William J. Fox Field Airport (Fox Field; Lancaster, California), are presented in Appendix 5.1D. Fox Field is considered representative of the WRESC Site and was used in the air quality modeling analyses (see Appendix 5.1D).

5.1.6.2 Dispersion Modeling

To estimate ambient air concentrations, the latest version (version 23132) of the AERMOD dispersion model was used (U.S. EPA 2021a). AERMOD is appropriate for use in estimating ground-level short-term ambient air concentrations resulting from non-reactive buoyant emissions from sources located in simple, intermediate, and complex terrain. AERMOD is the preferred guideline model recommended by the U.S. EPA for these types of assessments and is based on conservative assumptions (i.e., the model tends to overpredict actual impacts by assuming steady state conditions, no pollutant loss through conservation of mass, no chemical reactions, steady state meteorological conditions, steady state emission rates and instantaneous transport of the plume to the receptors). AERMOD can assess impacts from a variety of source types, such as point, area, line, and volume sources; downwash effects; gradual plume rise as a function of downwind distance; time-dependent exponential decay of pollutants; and can account for settling and dry deposition of particulates (all Project emissions were conservatively modeled as non-reactive gaseous emissions). The model can calculate concentrations for a wide range of averaging times (from 1 hour to the entire period of meteorological data provided).

AERMOD calculates ambient concentrations in areas of simple terrain (receptor base elevations below the stack release heights), intermediate terrain (receptor base elevations between stack release and final plume height), and complex terrain (receptor base elevations above final plume height). AERMOD assesses these impacts for all meteorological conditions, including those that would limit the amount of final plume rise. Plume impaction on elevated terrain, such as on the slope of a nearby hill, can cause high ground level concentrations, especially under stable atmospheric conditions. Due to the relatively flat nature of the Project terrain area, including the surrounding properties, plume impaction effects would not be expected to occur. AERMOD also considers receptors located above the receptor base elevation, called flagpole receptors.

Another dispersion condition that can cause high ground level pollutant concentrations is caused by building downwash. Building downwash can occur during high wind speeds or a building or structure is in close proximity to the emission source. This can result in building wake effects where the plume is drawn down toward the ground by the lower pressure region that exists in the lee side (downwind) of the building or structure. This AERMOD feature was also used in modeling the operational Project emission sources as described later.

5.1.6.2.1 Model Input Options

Model options refer to user selections that account for conditions specific to the area being modeled or to the emissions source that needs to be examined. Examples of model options selected for this analysis include the use of downwash and the rural dispersion option.

Land use in the immediate area surrounding the WRESC Site is characterized as “rural” utilizing the approach by Auer. Here, land uses within the area circumscribed by a 3 km radius around the WRESC Site is greater than 50 percent rural. This is consistent with the current land use and zoning designation for the WRESC Site. Therefore, in the modeling analyses, the rural dispersion option was selected.

AERMOD also supplies recommended defaults for the user for other model options. This analysis was conducted using AERMOD in the regulatory default mode, which includes the following additional modeling control options:

- adjusting stack heights for stack-tip downwash,
- using upper-bound concentration estimates for sources influenced by building downwash from super-squat buildings,
- incorporating the effects of elevated terrain,
- employing the U.S. EPA-recommended calms processing routine, and
- employing the U.S. EPA-recommended missing data processing routine.

Calculation of chemical concentrations for use in the impact and exposure analysis requires the selection of appropriate concentration averaging times. Average pollutant concentrations ranging from 1 hour to annual based on the meteorological data were calculated for each Project source and the facility in total.

All NO_2 concentrations were estimated using the Ambient Ratio Method Version 2, which is a regulatory default option and commonly used in practice. The default minimum NO_2/NO_X conversion ratio of 0.5 and maximum conversion ratio of 0.9 were used for both 1 hour and annual averaging periods.

5.1.6.3 Meteorological Data Selection

AERMOD requires a meteorological input file to characterize the transport and dispersion of pollutants in the atmosphere. Surface and upper air meteorological data inputs, along with surface parameter data describing the land use and surface characteristics near a site, are first processed using AERMET, the meteorological preprocessor to AERMOD. The output files generated by AERMET are the surface and upper air meteorological input files required by AERMOD.

The proposed WRESC Site is in southeastern Kern County in the EKAPCD. The project is about 70 miles from the Pacific Ocean in the northern end of the Antelope Valley in the westernmost part of the Mojave Desert. Terrain surrounding the WRESC is mostly flat or rolling and gradually increases toward the north and west.

Locally there is a series of separated elevated landmasses to the southeast, south, and southwest of the WRESC site. The Sierra Nevada Mountain Range is approximately 17 miles to the northwest of the WRESC site. Land use characteristics along with terrain considerations were considered to determine which meteorological and air quality data set is most representative of the Project area.

AERMOD uses hourly meteorological data to characterize plume dispersion. AERMOD calculates the dispersion conditions for each hour of meteorological data for the emission sources modeled at the user-specific receptor locations. The resulting 1-hour impacts are then averaged by AERMOD for the averaging time(s) specified by the user (accounting for calm winds and missing meteorological data as specified in the model options). Five years of surface meteorological data (2018 to 2022) from the Lancaster/Fox Field Airport (approximately 19 km south of the WRESC Site) were combined with concurrent upper air data from Harry Reid International Airport in Las Vegas, Nevada. While Edwards Air Force Base does collect both surface and upper air data, the data recovery statistics were less than 90 percent on both a quarterly and annual basis. Harry Reid International Airport was the closest and most representative upper air site and was chosen for the Project. The representativeness of the meteorological data is dependent on the proximity of the meteorological monitoring site to the area under consideration; the complexity of the terrain, the exposure of the meteorological monitoring site, and the period of time during which the data are collected. The data was processed with both AERMINUTE (version 15272) and AERMET (version 23132), which are the AERMOD meteorological data preprocessor modules.

Meteorological Data Representativeness: The use of the five (5) years of Lancaster/Fox Field surface and Harry Reid Airport upper air meteorological data would satisfy the definition of onsite data. The U.S. EPA defines the term “onsite data” to mean data that would be representative of atmospheric dispersion conditions at the source and at locations where the source may have a significant impact on air quality. Specifically, the meteorological data requirement originates from the Clean Air Act in Section 165(e)(1), which requires an analysis “of the ambient air quality at the facility and in areas which may be affected by emissions from such facility for each pollutant subject to regulation under [the Act] which will be emitted from such facility.” This requirement and U.S. EPA’s guidance on the use of onsite monitoring data are also outlined in the On-Site Meteorological Program Guidance for Regulatory Modeling Applications (U.S. EPA 1987). The representativeness of meteorological data is dependent upon: (a) the proximity of the meteorological monitoring site to the area under consideration; (b) the complexity of the topography of the area; (c) the exposure of the meteorological sensors; and (d) the period of time during which the data are collected.

First, the Lancaster/Fox Field Airport is near the WRESC Site and has the exact same base elevations and exposures to terrain toward the northwest. Second, both locations are located in the same area of the broad and relatively flat Antelope Valley. Third, the meteorological instrumentation at Lancaster/Fox Field is properly exposed and not adjacent to structures or terrain. Fourth, the period of meteorological data selected at the time of the modeling analyses (2018-2022) would be expected to be the most representative of current conditions, with the same general land uses surrounding the airport location as well as the proposed WRESC Site. In fact, a review of historical and current Google Earth photo aerials shows that nearby land uses now at both locations are similar to the land uses reflected in the 2020 National Land Cover Database.

Representativeness is defined in the document “Workshop on the Representativeness of Meteorological Observations” (Nappo et. al., 1982) as “the extent to which a set of measurements taken in a space-time domain reflects the actual conditions in the same or different space-time domain taken on a scale appropriate for a specific application.” Judgments of representativeness should be made only when sites are climatologically similar, as is the case with the meteorological monitoring site and the proposed Project location. In determining the representativeness of the meteorological data set for use in the dispersion models at the WRESC Site, the consideration of the correlation of terrain features to prevailing meteorological conditions, as discussed earlier, would be nearly identical to both locations since the orientation and aspect of terrain at the proposed project location correlates well with the prevailing wind fields as measured by and contained in the meteorological dataset. In other words, the same mesoscale and localized geographic and topographic features that influence wind flow patterns at the meteorological monitoring site also influence the wind flow patterns at the proposed WRESC Site. Comparisons with the available data collected at Edwards Air Force Base and the 2018-2022 Lancaster Fox Field ASOS derived data show very good correlation between the two data sets. Additionally, runway alignment at Lancaster/Fox Field and Edwards Air Force Base are identical and align with the predominant wind direction.

For these reasons, the Lancaster/Fox Field ASOS data was selected for use in modeling emissions from the proposed project and is expected to satisfy the definition of representative meteorological data and are similar to the dispersion conditions at the WRESC Site and to the regional area. The U.S. EPA-recommended 90 percent completeness criteria are met for all modeled parameters in the surface and upper air meteorological data. Quarterly and annual wind rose plots are presented in Appendix 5.1D as Figures 5.1D-1 through 5.1D-5.

5.1.6.4 Good Engineering Practice Stack Height Analysis

The effects of building downwash on facility operational emissions were included in the modeling assessment. The Plume Rise Model Enhancements to the U.S.EPA Building Profile Input Program (BPIP-PRIME, version 04274) was used to determine the direction-specific building downwash parameters. The BPIP-PRIME enhancements in AERMOD calculate fields of turbulence intensity, wind speed, and slopes of the mean streamlines as a function of projected building shape. Using a numerical plume rise model, the BPIP-PRIME enhancements in AERMOD determine the change in plume centerline location and the rate of plume dispersion with downwind distance. Concentrations are then predicted by AERMOD in both the near and far wake regions, with the plume mass captured by the near wake treated separately from the uncaptured primary plume and re-emitted to the far wake as a volume source.

Good Engineering Practice (GEP) stack height represents the stack height above which the associated building does not influence the plume and is estimated as the greater of 65 meters or the height based on U.S. EPA formulas for the various onsite and offsite structures and their locations and orientations to the WRESC stacks. GEP stack heights were calculated for each proposed stack and were all such that building downwash will be applied to the stacks.

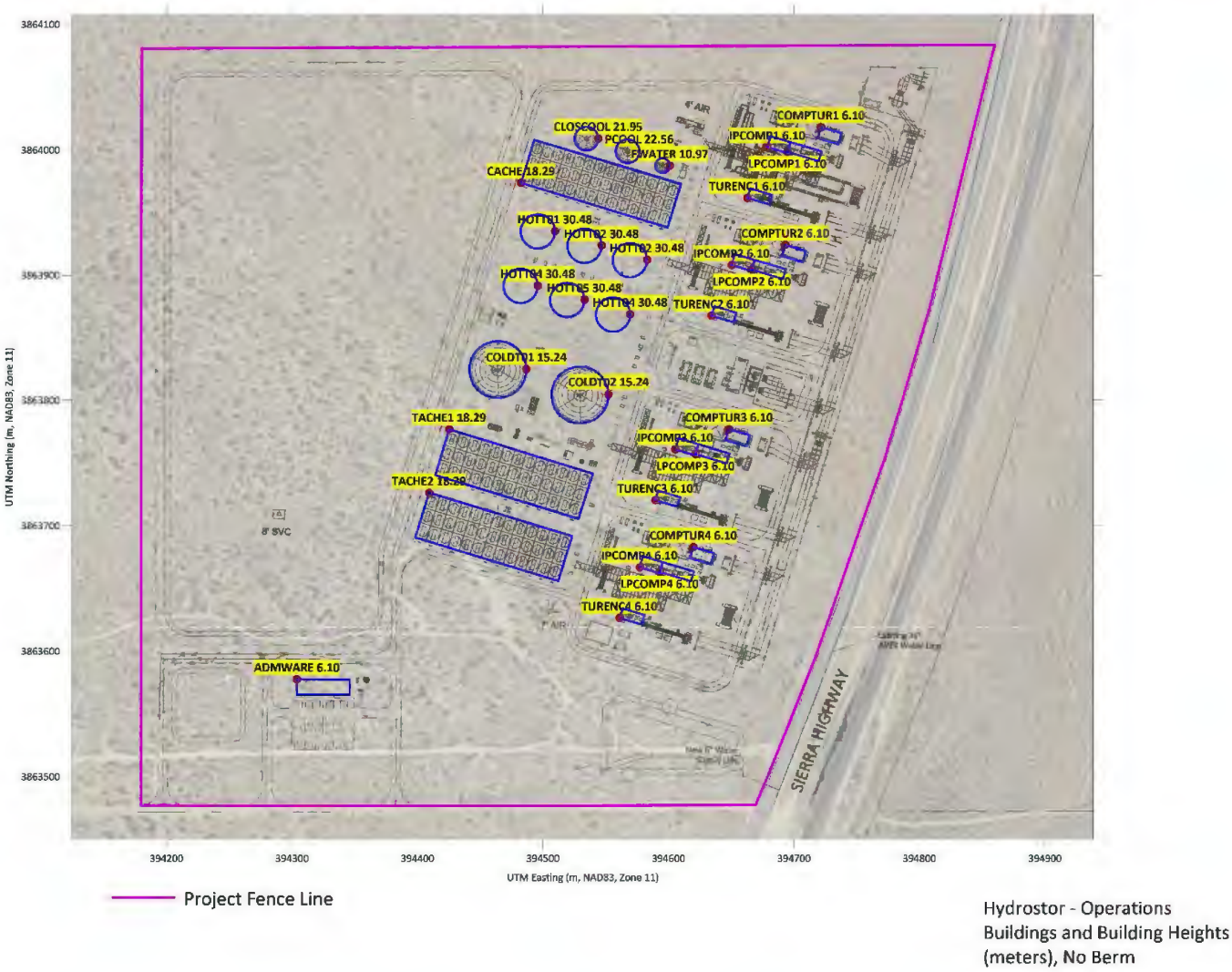
BPIP-PRIME was used to generate wind-direction-specific building dimensions for input into AERMOD. **Figure 5.1-2** shows the structures and source locations included in the BPIP-PRIME downwash analysis. As noted, both architectural berm and no-architectural berm options have the operational sources and structures in the same location, so only the no-architectural berm option is shown in **Figure 5.1-2**.

5.1.6.5 Receptor Grid Selection and Coverage

Receptor and source base elevations were determined from U.S. Geological Survey National Elevation Dataset (NED) data. The NED data was processed with the U.S. EPA model AERMAP for the receptor locations selected. All coordinates (both sources and receptors) are referenced to UTM NAD83, Zone 11. AERMAP (version 18081) can interpolate the elevation data in the NED data for both receptor elevations and hill height scales.

The latest version of AERMAP (version 18081) was used to determine receptor elevations and hill-slope factors utilizing the U.S. Geological Survey's 1-degree square NED (U.S. EPA 2018). NED spacings were 1/3 inch (approximately 10 meters) for the fence line, 20-, 50-, and 100-meter spaced receptor grids and 1 inch (approximately 30 meters) for 200- and 500-meter spaced receptor grids and sensitive receptors. Electronic copies of the BPIP-PRIME and AERMAP input and output files, including the NED data, included with the application will be submitted to staff electronically.

Figure 5.1-2: Structure and Emission Sources Used in Building Profile Input Program (No-Architectural Berm Option)



Hydrostor - Operations Buildings and Building Heights (meters), No Berm

Cartesian coordinate receptor grids were used to provide adequate spatial coverage at the fence line for assessing ground-level pollution concentrations, identifying the extent of significant impacts, and identifying maximum impact locations. For the full impact analyses, a nested grid was developed to fully represent the initial location and extent of significance area(s) and maximum impact area(s). The nested grid was composed of the following:

Receptors were placed along the proposed WRESC ambient boundary fence lines (both the architectural berm and no-architectural berm options) with 20-meter spacing.

- Receptors extending outwards from the ambient boundary in all directions at least 500 meters with 20-meter receptor spacing.
- Receptors extending from 500 meters to 1,000 meters with 50-meter spacing.
- Receptors extending from 1 km to 5 km with 200-meter spacing.
- Receptors extending from 5 km out to 10 km with 500-meter spacing.
- Additional 20-meter resolution receptors were placed if the maximum impact location occurred beyond 20-meter grid locations.

Ambient concentrations within the facility fence lines were not calculated. **Figures 5.1D-6** through **5.1D-9**, which are provided in Appendix 5.1D, depict the receptor grids based on the two different fence line locations (architectural berm and no-architectural berm options) for both construction and operations. While the fence line locations are different for the construction (architectural berm and no architectural berm) and operations (architectural berm and no architectural berm), the receptor grid resolutions are identical for all four scenarios.

5.1.6.6 Background Air Quality

In 1970, the U.S. Congress instructed the U.S. EPA to establish standards for air pollutants, which were of nationwide concern. This directive resulted from the concern of the impacts of air pollutants on the health and welfare of the public. The resulting Clear Air Act set forth air quality standards to protect the health and welfare of the public. Two levels of standards were promulgated, primary standards and secondary standards. Primary NAAQS are “those which, in the judgment of the administrator U.S. EPA, based on air quality criteria and allowing an adequate margin of safety, are requisite to protect the public health (state of general health of community or population).” The secondary NAAQS are “those which in the judgment of the administrator [U.S. EPA], based on air quality criteria, are requisite to protect the public welfare and ecosystems associated with the presence of air pollutants in the ambient air.” To date, the NAAQS have been established for seven criteria pollutants as follows: SO_2, CO, ozone, NO_2, PM10, PM2.5, and lead.

Criteria pollutants are those that have been demonstrated historically to be widespread and have a potential to cause adverse health effects. The U.S. EPA developed comprehensive documents detailing the basis of, or criteria for, the standards that limit the ambient concentrations of these pollutants. The state of California has also established Ambient Air Quality Standards that further limit the allowable concentrations of certain criteria pollutants. Review of the established air quality standards is undertaken by both U.S. EPA and the state of California on a periodic basis. As a result of the periodic reviews, the standards have been updated and amended over the years following adoption.

Each NAAQS or CAAQS is composed of two basic elements: a numerical limit expressed as an allowable concentration and an averaging time that specifies the period over which the concentration value is to be measured. **Table 5.1-8** presents the current standards.

Table 5.1-8: California and National Ambient Air Quality Standards

Pollutant	Averaging Time	CAAQS (form)	NAAQS (form)
Ozone	1 hour	0.09 ppm	N/A
Ozone	8 hours	0.07 ppm	0.07 ppm
PM10	24 hours	50 µg/m^3 (H1H)	150 µg/m^3 (H6H)
PM10	Annual	20 µg/m^3	N/A
PM2.5	24 hours	N/A	35 µg/m^3 (98th percentile)
PM2.5*	Annual	50 µg/m^3	9 µg/m^3 (3-year average)
CO	1 hour	20 ppm (H1H)	35 ppm (H2H)
CO	8 hours	9.0 ppm (H1H)	9 ppm (H2H)
NO_2	1 hour	180 ppb (H1H)	100 ppb (98th percentile)
NO_2	Annual	30 ppb	53 ppb (3-year average)
SO_2	1 hour	250 ppb (H1H)	75 ppb (99th percentile)
SO_2	3 hours	N/A	500 ppb (H2H)
SO_2	24 hours	40 ppb (H1H)	N/A
SO_2	Annual	N/A	0.03 ppm
Lead	30 days	1.5 µg/m^3	N/A
Lead	3 months	N/A	0.15 µg/m^3

Pollutant	Averaging Time	CAAQS (form)	NAAQS (form)
Sulfates	24 hours	25 µg/m^3	N/A
Hydrogen Sulfide	1 hour	0.03 ppm	N/A
Vinyl Chloride	24 hours	0.01 ppm	N/A

Source: Ambient Air Quality Standards (CARB 2016)
CAAQS = California Ambient Air Quality Standards; CO = carbon monoxide; H1H = highest first high; H2H = highest second high; H6H = highest sixth high; N/A = not applicable; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; PM10 = particulate matter less than 10 microns; µg/m^3 = micrograms per cubic meter; PM2.5 = particulate matter less than 2.5 microns; ppb = parts per billion; ppm = parts per million.SO_2 = sulfur dioxide
*The annual PM2.5 standard has been revised to 9.0 µg/m^3 and will be effective 60 days from the February 7, 2024 promulgation date, as published in the Federal Register.

Brief descriptions of health effects for the main criteria pollutants are as follows.

Ozone (O_3): Ozone is a reactive pollutant that is not emitted directly into the atmosphere, but rather is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving VOCs and NO_X. VOC and NO_X are, therefore, known as precursor compounds for ozone. Significant ozone production generally requires ozone precursors to be present in a stable atmosphere with strong sunlight for approximately 3 hours. Ozone is a regional air pollutant because it is not emitted directly by sources but is formed downwind of sources of VOCs and NO_X under the influence of wind and sunlight. Short-term exposure to ozone can irritate the eyes and cause constriction of the airways. In addition to causing shortness of breath, ozone can aggravate existing respiratory diseases, such as asthma, bronchitis, and emphysema.

Carbon Monoxide (CO): CO is a non-reactive pollutant that is a product of incomplete combustion. Ambient CO concentrations generally follow the spatial and temporal distributions of vehicular traffic and are also influenced by meteorological factors, such as wind speed and atmospheric mixing. Under inversion conditions, CO concentrations may be distributed more uniformly over an area out to some distance from vehicular sources. When inhaled at high concentrations, CO combines with hemoglobin in the blood and reduces the oxygen-carrying capacity of the blood. This results in reduced oxygen reaching the brain, heart, and other body tissues. This condition is especially critical for people with cardiovascular diseases, chronic lung disease, or anemia, as well as fetuses.

Particulate Matter (PM10 and PM2.5): Both PM10 and PM2.5 represent fractions of particulate matter, which can be inhaled into the air passages and the lungs and can cause adverse health effects. Particulate matter in the atmosphere results from many kinds of dust- and fume-producing industrial and agricultural operations, combustion, and atmospheric photochemical reactions. Some of these operations, such as demolition and construction activities, contribute to increases in local PM10 concentrations, while others, such as vehicular traffic, affect regional PM10 concentrations.

The U.S. EPA acknowledges that particulate matter can potentially cause the following health effects: premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms.

Nitrogen Dioxide and Sulfur Dioxide (NO_2 and SO_2): NO_2 and SO_2 are two gaseous compounds within a larger group of compounds, NO_X, and SO_X, which are products of the combustion of fuel. NO_X and SO_X emission sources can elevate local NO_2 and SO_2 concentrations, and both are regional precursor compounds to particulate matter. As described above, NO_X is also an ozone precursor compound and can affect regional visibility. (NO_2 is the “whiskey brown-colored” gas readily visible during periods of heavy air pollution.) Elevated concentrations of these compounds are associated with increased risk of acute and chronic respiratory disease.

SO_2 and NO_2 emissions can be oxidized in the atmosphere to eventually form sulfates and nitrates, which contribute to acid rain. Large power facilities with high emissions of these substances from the use of coal or oil are subject to emissions reductions under the Phase I Acid Rain Program of Title IV of the 1990 Clean Air Act Amendments. Power facilities, with individual equipment capacity of 25 MW or greater that use natural gas or other fuels with low sulfur content, are subject to the Phase II Program of Title IV. The WRESC will not require an

acid rain permit because the only power generation units, i.e., the proposed emergency generator engines, that emit regulated air pollutants are less than 25 MW.

Lead: Gasoline-powered automobile engines used to be the major source of airborne lead in urban areas. Excessive exposure to lead concentrations can result in gastrointestinal disturbances, anemia, kidney disease, and, in severe cases, neuromuscular and neurological dysfunction. The use of lead additives in motor vehicle fuel has been eliminated in California and lead concentrations have declined substantially as a result.

CARB has established and maintains a network of sampling stations, called State and Local Air Monitoring Stations (SLAMS) network, that work in conjunction with local air pollution control districts and air quality management districts to monitor ambient pollutant levels. The SLAMS network in Kern County consists of eight stations that monitor various pollutant concentrations. EKAPCD is responsible for monitoring air quality in the Kern County portion of the Mojave Desert Air Basin to determine whether pollutant concentrations meet CAAQS and NAAQS.

Kern Route 58 Business (Kern County), Lancaster (Los Angeles County), and Victorville Park Avenue (San Bernardino County) monitoring stations are the closest stations and have the most representative and complete monitoring data to the WRESC site. Note the three stations belong to the Mojave Desert Air Basin. The identified monitoring stations were used to represent the following background air quality data for use in the modeling analyses:

- Kern Route 58 Business: O_3, PM10, and PM2.5
- Lancaster Division Street: NO_2 and CO
- Victorville Park Avenue: SO_2

Due to its proximity to the WRESC, the Kern Route 58 Business station data was used to summarize ambient concentrations of O_3, PM10, and PM2.5 near the WRESC Site. The Lancaster station was used to summarize CO and NO_2 concentrations, and the Victorville station was used to summarize SO_2 concentrations as the previous two stations do not monitor this pollutant. Appendix 5.1E provides a summary of measured ambient air quality concentrations by year and site for the period 2019 to 2023 (the actual years are dependent upon the monitoring station chosen for this analysis).

Based on the form of the standard, the highest background concentrations for the most recent 3-year period (2019 to 2023) were used to establish background air quality values for modeling. Some of the standards are based on the average across three years (annual PM2.5 and SO_2). These values have been updated and are summarized in **Table 5.1-9** based upon the following caveats:

Data from these sites are a reasonable representation of background air quality for the Project area. The background values represent the highest values reported for the most representative air quality monitoring site during any single year of the most recent 3-year period for the CAAQS assessments. These CAAQS maxima are conservatively used for some of the NAAQS modeling assessments (CO and SO_2), while the appropriate values for the NAAQS, according to the format of the standard, are used for the remainder of the NAAQS modeling assessments (NO_2, PM10, and PM2.5).

Table 5.1-9: Measured Ambient Air Quality (Background)

Pollutant	Basis	Averaging Time	Measured Background (µg/m³)	Site	Data Years
O_3	CAAQS-1st High	1-hr	184.5	Kern 58 Business	2020-2022
	CAAQS-1st High	8-hr	164.9	Kern 58 Business	2020-2022
	NAAQS-4th High	8-hr	155.1	Kern 58 Business	2020-2022
NO_2	CAAQS-1st High	1-hr	97.9	Lancaster Division St	2020-2022
	NAAQS-98th percentile	1-hr	75.91	Lancaster Division St	2020-2022
	CAAQS/NAAQS	Annual	15.7	Lancaster Division St	2020-2022

Pollutant	Basis	Averaging Time	Measured Background (µg/m³)	Site	Data Years
CO	CAAQS/NAAQS -1st High	1-hr	1832	Lancaster Division St	2019-2021
	CAAQS/NAAQS -1st High	8-hr	1260	Lancaster Division St	2019-2021
SO_2	CAAQS/NAAQS -1st High	1-hr	11.2	Victorville Park Ave	2019-2021
	CAAQS/NAAQS -1st High	24-hr	8.9	Victorville Park Ave	2019-2021
	CAAQS/NAAQS	Annual	4.6	Victorville Park Ave	2019-2021
PM10	CAAQS-1st High	24-hr	351	Kern 58 Business	2020-2022
	NAAQS -2nd High	24-hr	112	Kern 58 Business	2020-2022
	CAAQS	Annual	32.7	Kern 58 Business	2020-2022
PM2.5	NAAQS-98th percentile	24-hr	27	Kern 58 Business	2021-2023
	CAAQS/NAAQS	Annual	6.3	Kern 58 Business	2021-2023

µg/m³ = micrograms per cubic meter; O_3 = ozone; CAAQS = California Ambient Air Quality Standards; CO = carbon monoxide; ppm = parts per million; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; PM10 = particulate matter less than 10 microns; PM2.5 = particulate matter less than 2.5 microns ppb = parts per billion; SO_2 = sulfur dioxide

5.1.6.7 Air Quality Analyses

The following sections present the analyses for determining the impacts to ambient air quality concentrations in the Project region. These analyses are composed of an operational modeling assessment and a construction modeling assessment (both operations and construction included the architectural berm and no-architectural berm options, which also affected fence lines as referenced above). Cumulative multisource modeling assessments, which are used to analyze the proposed Project plus nearby existing sources, is not proposed as the only operational air emission sources are emergency engines that are only intended for emergency use.

Operational characteristics of the engines, such as emission rate, exit velocity, and exit temperature were obtained from manufacturer's specifications. The modeling analyses include the assessment of the Project operational emissions and comparing the calculated concentration to the applicable U.S. EPA Significant Impact Levels (SILs) and CAAQS/NAAQS. For purposes of this analysis, if the SILs are not exceeded, then it is concluded that the Project impacts are insignificant and no further analysis is typically required.

The following averaging times and forms were used to compare to the SILs:

- NO_2 1-hour and PM2.5 24-hour: 5-year average of the 100th percentile (H1H)
- NO_2 and PM2.5 annual: 5-year average of the annual maximum
- CO 1-hour and 8-hour, PM10 24-hour, SO_2 1-hour and 3-hour and 24-hour: highest first high

The following averaging times and forms were used to compare to the CAAQS:

- NO_2 1-hour, CO 1-hour and 8-hour, SO_2 1-hour and 24-hour, and PM10 24-hour: highest first high
- NO_2, PM10, and PM2.5 annual: highest annual value in 5 years

The following averaging times and forms were used to compare to the NAAQS:

- NO_2 1-hour and PM2.5 24-hour: 5-year average of the 98th percentile (H8H)
- SO_2 1-hour: 5-year average of the 99th percentile (H4H)
- NO_2 and PM2.5 annual: 5-year average of the annual maximum
- CO 1-hour and 8-hour, SO2 1-hour (99th percentile) and 24-hour: highest second high
- PM10 24-hour: 6th highest across 5 years

5.1.6.8 Operations and Construction Impact Analyses

Table 5.1-10 shows the stack parameters and emission rates for each emergency engine type (diesel generator or diesel-fueled fire pump). The stationary diesel equipment were all modeled as individual point sources. Detailed emission calculations are included in Appendix 5.1A. Other than the emergency diesel generator and emergency diesel-fueled fire pump, no other combustion sources are proposed for this project.

Table 5.1-10: Stack Parameters and Emission Rates for Each Engine Type

Source	Stack Height (feet)	Exhaust Gas Temperature (°F)	Exhaust Velocity (ft/s)	Stack Inside Diameter (feet)	Emission Rates (g/s) Short-term Annual			
					PM10/PM2.5	NO_X	SO_2	CO
Each Emergency Diesel Generator 2.5MW	22.93	914	193.5	1.033	0.0201 4.6E-04 (Annual)	0.503 0.0115 (Annual)	0.005 1.15E-04 (Annual)	2.616
Fire Pump	15	1025	245	0.5	0.019 4.37E-04 (Annual)	0.364 8.31E-03 (Annual)	0.00063 1.4E-05 (Annual)	0.332

Source: Appendices 5.1A and 5.1C.
24-hour PM10/2.5 and SO_2 uses maximum hourly emissions spread over 24 hours (1/24). The 8-hour CO uses maximum hourly emissions spread over 8 hours (1/8). Annual emissions represent 200 hours spread over 8,760 hours.
°F = degrees Fahrenheit; CO = carbon monoxide; ft/s = feet per second; g/s = grams per second; MW = megawatts; NO_x = nitrogen dioxides; PM10 = particulate matter less than 10 microns; PM2.5 = particulate matter less than 2.5 microns; SO_2 = sulfur dioxide

Both the architectural berm and no-architectural berm options were modeled for operational impacts. Because the only difference between the two operational scenarios is the location of the western and northern fence lines, with the no-architectural berm option having the shorter distance to the receptors along the western and northern fence, the no-architectural berm option produced the higher modeled concentrations. For annual averaging periods, each engine was assumed to be capable of operating up to its assumed 200-hour-per-year limit. For shorter averaging periods, i.e., maintenance and readiness testing, only one engine is assumed to be operating in any 1 hour, while up to four engines may be tested in any one day. The use of 200 hours of operation per year results in very conservative criteria pollutant impact assessments since it assumes that up to 150 hours per year will be emergency operation.

Maximum concentrations of pollutants expected to result from the WRESC are compared to the CAAQS and NAAQS in **Table 5.1-11**. Maximum combined concentrations (modeled + background) are less than all the CAAQS and NAAQS except for the PM10 CAAQS (24-hour and annual) and NAAQS (24-hour). For PM10, the background concentrations already exceed the standards. When background exceeds the standards, the Project must demonstrate that it does not contribute to the exceedance of the standard(s). For PM10, the Project's 24-hour and annual modeled concentrations are less than the applicable U.S. EPA SILs of 5 and 1 $\mu g/m^3$ for PM10. Being less than the SIL means that the modeled concentration is not contributing to any violation of the ambient standard as the concentration is considered to be immeasurable; therefore, Project PM10 emissions are less than significant.

The modeling input/output files for both the architectural berm and no-architectural berm options will be provided to the CEC.

Table 5.1-11: Operations Air Quality Impact Results – No-Architectural Berm Option

Pollutant	Averaging Time	Maximum Concentration (µg/m³)	Background (µg/m³)	Total (µg/m³)	U.S. EPA SIL (µg/m³)	Ambient Air Quality Standards (µg/m³)	
						CAAQS	NAAQS
NO_2	1-hour (highest)	121.2	97.9	219.1	NA	339	-
	1-hour (98th percentile) [a]	3.1	75.91	79.0	7.5	-	188
	Annual Maximum	0.3	15.7	16.0	1	57	100
CO	1-hour (highest)	501.6	1,832	2,333.6	2,000	23,000	40,000
	8-hour (highest)	59.3	1,260	1,319.3	500	10,000	10,000
SO_2	1-hour (highest)	1.0	11.2	12.2	NA	655	--
	1-hour (99th percentile)	.04	10.5	10.5	7.5	--	196
	24-hour (highest)	.03	8.9	8.9	5	105	--
	Annual	.003	4.6	4.6	1	105	--
PM10	24-hour (highest)	0.1	351	351.1	5	50	--
	24-hour (6th highest)	0.1	112	112.1	NA	-	150
	Annual maximum	0.02	32.7	32.7	1	20	-
PM2.5	24-hour (98th percentile)	0.08	27.0	27.1	1.2	-	35
	5-year average annual	0.01	6.3	6.3	0.3	9.0*	9.0*

Source: Appendix 5.1E.

[a] Modeling for 1-hour NO_2 NAAQS utilized the annual emissions to assess the 98th percentile concentrations as these units are emergency generators and are, therefore, classified as "intermittent," U.S. EPA Memorandum, March 1, 2011.

µg/m³ = micrograms per cubic meter; CAAQS = California Ambient Air Quality Standards; CO = carbon monoxide; NO_2 = nitrogen dioxide; NAAQS = National Ambient Air Quality Standards; PM10 = particulate matter less than 10 microns; PM2.5 = particulate matter less than 2.5 microns SO_2 = sulfur dioxide, - = not applicable, *U.S. EPA has recently lowered the annual PM2.5 standard from 12 *u*g/m³ down to 9 *u*g/m³: * = the current form of the annual PM2.5 standard is 12.0 *u*g/m³ but is expected to decrease to 9.0 *u*g/m³ within the next 90 days (approximately). To account for this anticipated rulemaking, the new standard was used for this analysis.

Construction equipment and associated heavy-duty truck traffic also generate criteria pollutants through combustion of fuels, as well as the generation of particulate matter through onsite travel and wind erosion of surface and storage piles. As temporary impacts, these construction-related air pollutant emissions would not be considered to contribute substantially to existing or projected air quality violations. However, they were assessed for this project.

For modeling the construction emissions, based upon both the architectural berm and no-architectural berm options, the emission sources for the construction site were grouped into two distinct categories: exhaust emissions and dust emissions. Further, the emissions were, dependent upon the type of activity, modeled as volume line sources (active road sources with a release height of 3.4 meters), as area sources (general site activities related to fugitive dust from equipment usage and wind erosion), and as point sources (stationary diesel combustion sources providing power to the rock crusher and the three cavern vents that expelled emissions from the underground cavern construction). Note that the cement batch was not included in the modeling since operation of this source would occur after the time period of the maximum annual emission scenarios that were assessed. Construction fugitive dust emissions were modeled as area sources covering the 199-acre (with architectural berm) and the 143-acre (no-architectural berm) construction area with a near ground effective

release height of 2 meters. Combustion point, area, and volume source emissions were assumed to occur for 7 days a week, 10 hours per day (7 a.m. to 5 p.m.) while wind-based fugitive dust emissions (wind erosion) were assumed to be continuous (24 hours per day). The construction modeling analysis used the same modeling options, receptor locations, and meteorological data as used for the Project operating impact analysis. In Appendix 5.1D, **Figure 5.1D-10** presents the source type (area, line, and point) and the source location(s) for the no-architectural berm construction option while **Figure 5.1D-11** presents the architectural berm option. The cavern vents were modeled as point sources with a 3-meter release height and with an exit temperature set to ambient. The exit velocity was calculated based on the total incoming air flow rates into the caverns and then adjusted for each cavern vent based on the exit diameter.

To determine the construction impacts on short-term ambient standards (24 hours and less), the calculated worst-case year was used to derive the daily onsite construction emission levels shown in **Table 5.1-6** (architectural berm option) and **Table 5.1-7** (no-architectural berm). The hourly emissions were adjusted to reflect either the 10-hour day operations or were based on a 24-hour day, dependent upon activity and source type. For the pollutants with annual average ambient standards, the annual onsite emission levels shown in **Table 5.1-6** (architectural berm option) or **Table 5.1-7** (no-architectural berm option) were used. Modeled onsite vehicular traffic was based on the CalEEMod default 2025 fleet mix which is composed of Tier 1 through Tier 4 engine categories.

Based on the modeling results in **Table 5.1-12** (architectural berm option), the combined modeled plus background concentrations that are greater than the CAAQS are for the 24-hour and annual PM10 averaging periods, due solely to the monitored background concentrations, which already exceed the CAAQS. The maximum modeled impacts for PM10 are primarily related to the construction fugitive dust emissions. However, reviewing the modeling output identifies that the combustion based construction source concentrations for PM10 are less than the applicable U.S. EPA SILs for both 24-hour and annual averaging periods, the Project modeled impacts are not significant. In addition, application of the CEC construction requirements will further reduce the construction emissions to a level of insignificance.

The modeling results also show the Federal 1-hour NO_2 standard would be exceeded. The Project impacts, by themselves without background, do not exceed any ambient air quality standard. Further, CEC mitigation requiring the application of Tier 4 emission standards and the use of Tier 4 vehicle fleets would also mitigate the 1-hour NO_2 impacts to a level of insignificance. Based on the application of CEC construction requirements, the Project will comply with the ambient air quality standards.

Table 5.1-13 presents the modeling results for the no-architectural berm option. Using the default CalEEMod vehicular fleet mix, exceedances were calculated for the 1-hour NO_2 standard (both California and the Federal Standard). As with the architectural berm option, the total Project impacts (modeled plus background) for 24-hour and annual PM10 exceeded the California and Federal ambient air quality standards, solely due to the background data which already exceeds the applicable standard(s). Modeled impacts without background, with the exception of the 1-hour NO_2 standard are all below the applicable ambient air quality standards. All other modeled impacts are below the applicable ambient air quality standards.

To assess how the application of CEC mitigation measures through the use of Tier 4 engine specifications would reduce the no-architectural berm Project modeled concentrations on 1-hour NO_2 standard the truck fleet used to transport the construction spoils offsite were remodeled as all with Tier 4 emission standards. The dispersion modeling results for 1-hour NO_2 after the application of mitigation are as follows:

- California 1-hour NO_2 modeled + background: 213.57 $u g/m^3$ + 97.9 $u g/m^3$ = 311.5 $u g/m^3$
- Federal 1-hour NO_2 modeled + background: 128.91 $u g/m^3$ + 75.91 $u g/m^3$ = 204.8 $u g/m^3$

Table 5.1-12: Construction Air Quality Impact Results – Architectural Berm Option

Pollutant	Averaging Time	Maximum Concentration (µg/m³)	Background (µg/m³)	Total (µg/m³)	Ambient Air Quality Standards (µg/m³)	
					CAAQS	NAAQS
NO_2	1-hr (highest)	237.51	97.9	335.4	339	-
	1-hr (98_{th} percentile)	131.16	75.91	207.1	-	188
	Annual Maximum	13.77	15.7	29.47	57	100
CO	1-hr (highest)	511.04	1,832	2,343.04	23,000	40,000
	8-hr (highest)	120.22	1,260	1,380.2	10,000	10,000
SO_2	1-hr (highest)	0.94	11.2	12.14	655	--
	1-hr (99_{th} percentile)	0.80	10.5	11.3	--	196
	24-hr (highest)	0.13	8.9	9.03	105	--
	Annual	0.036	4.6	4.64	105	--
PM10	24-hr (highest)	23.94	351	374.9	50	--
	24-hr (6_{th} highest)	19.37	112	131.4	-	150
	Annual maximum	5.99	32.7	38.5	20	-
PM2.5	24-hr (98_{th} percentile)	6.18	27.0	33.2	-	35
	3-year average annual	2.52	6.3	8.82	9*	9*

Source: Appendix 5.1D
µg/m³ = micrograms per cubic meter; CO = carbon monoxide; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; PM10 = particulate matter less than 10 microns; PM2.5 = particulate matter less than 2.5 microns; SO_2 = sulfur dioxide; - = Not Applicable; * = the current form of the annual PM2.5 standard is 12.0 ug/m³ but is expected to decrease to 9.0 ug/m³ within the next 90 days. The new standard was used for this analysis.

Table 5.1-13: Construction Air Quality Impact Results – No-Architectural berm Option

Pollutant	Averaging Time	Maximum Concentration (µg/m³)	Background (µg/m³)	Total (µg/m³)	Ambient Air Quality Standards (µg/m³)	
					CAAQS	NAAQS
NO_2	1-hr (highest)	469.21	97.9	567.1	339	-
	1-hr (98^{th} percentile)	190.38	75.91	266.3	-	188
	Annual Maximum	7.54	15.7	23.2	57	100
CO	1-hr (highest)	1,285.86	1,832	3,117.9	23,000	40,000
	8-hr (highest)	263.74	1,260	1,523.7	10,000	10,000
SO_2	1-hr (highest)	4.32	11.2	15.5	655	--
	1-hr (99^{th} percentile)	2.28	10.5	12.8	--	196
	24-hr (highest)	0.43	8.9	9.3	105	--
	Annual	0.038	4.6	4.6	105	--
PM10	24-hr (highest)	28.97	351	380.0	50	--
	24-hr (6^{th} highest)	20.63	112	132.6	-	150
	Annual maximum	5.21	32.7	37.9	20	-

Pollutant	Averaging Time	Maximum Concentration (µg/m³)	Background (µg/m³)	Total (µg/m³)	Ambient Air Quality Standards (µg/m³)	
					CAAQS	NAAQS
PM2.5	24-hr (98th percentile)	3.77	27.0	30.8	-	35
	3-year average annual	1.44	6.3	7.74	9*	9*

Source: Appendix 5.1D.
µg/m³ = micrograms per cubic meter; CO = carbon monoxide; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; SO_2 = sulfur dioxide; PM10 = particulate matter less than 10 microns; PM2.5 = particulate matter less than 2.5 microns; - = Not Applicable:
* = the current form of the annual PM2.5 standard is 12.0 ug/m³ but is expected to decrease to 9.0 ug/m³ within the next 90 days. The new standard was used for this analysis.

The additional mitigation will show compliance with the California 1-hour standard. While the Federal standard with background still exceeds the ambient air quality standard for the no-architectural berm option, the modeled concentration was below the standard (without background) at 128.91 ug/m3. Application of additional use of Tier 4 equipment in the emission inventory would further reduce the Project impacts for both berm options. Thus, the application of the standard CEC conditions of certification construction mitigation relating to the requirements for an onsite Air Quality Construction Mitigation Manager, preparation of an Air Quality Construction Mitigation Plan, implementation of Construction Fugitive Dust Control, implementation of a Dust Plume Response Requirement, and implementation of Diesel-Fueled Engine Control (see for example, Conditions AQ-SC1 through AQ-SC5 for the Stanton Energy Center decision – 16-AFC-01, docket number TN 225870, pages Appendix A-1 to A-6) would result in the no-architectural berm Project impacts being reduced to a level of insignificance.

The air quality modeling support data, including the input/output and meteorological data sets, will be submitted to staff electronically (Appendix 5.1F).

5.1.6.9 Willow Rock Commissioning Impact Analysis

Commissioning of the engines is not anticipated to have any additional impacts beyond what has been considered for operation, so as U.S. EPA rate commissioning impact analysis is not provided.

5.1.6.10 Fumigation Analysis

Inversion break-up fumigation was not assessed. The U.S. EPA Model AERSCREEN, based upon guidance given in “Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised” (USEPA-454/R-92-019) requires that the point source stack heights would need to exceed 10 meters (33 feet) in order for fumigation impacts to occur (U.S. EPA 2021b). As all the point source emission release heights are less than 10 meters feet above ground level, fumigation was not assessed.

5.1.7 Laws, Ordinances, Regulations, and Statutes

The following presents a listing of local, state, and federal air quality LORS deemed applicable to the proposed Project. Conformance and/or compliance for each identified LORS is noted in the sections below.

5.1.7.1 Specific Laws, Ordinances, Regulations, and Statutes Discussion

5.1.7.1.1 Federal LORS

Federal LORS applicability is discussed in the list below. Parts of Title 40 CFR Subchapter C that have no practical applicability to the WRESC are not discussed.

- 40 CFR Part 50 (NAAQS): All stationary sources of emission are required to meet the NAAQS. WRESC modeling discussed in Section 5.1.6.8 demonstrates compliance with the NAAQS.
- 40 CFR Part 52.21 (PSD): The WRESC will not be considered a major source under Prevention of Significant Deterioration.

- 40 CFR Part 60 (NSPS): The following New Source Performance Standard(s) (NSPS) apply to the WRESC:
  - Subpart A (General Provisions) apply to the WRESC if any of the listed subparts apply. Because NSPS Subpart IIII applies, portions of Subpart A apply, which are listed in NSPS Subpart IIII Table 8.
  - Subpart IIII (Standards for Stationary Compression Ignition Internal Combustion Engines) applies to the four diesel engines proposed that will drive emergency generators and the fire pump. Compliance will be demonstrated by purchasing engines that are certified to applicable emission standards and by following applicable operating and BMPs. Operation will be limited to 200 hours per year for emergency operations and maintenance and readiness testing. Fuel must contain no more than 15 ppm sulfur. The air permitting process described in Section 5.1.2 will document compliance with this rule.
  - No other NSPSs apply.
- 40 CFR Part 61 (NESHAP): No Part 61 National Emission Standards for Hazardous Air Pollutants (NESHAP) apply to the WRESC.
- 40 CFR Part 63 (NESHAP for Source Categories): The following Part 60 NESHAPs apply to the WRESC:
  - Subpart A (General Provisions) apply to the WRESC if any of the listed subparts apply. Because NESHAP Subpart ZZZZ applies, portions of Subpart A apply but due to the limited nature of compliance requirements of Subpart ZZZZ, Subpart A has no practical applicability.
  - Subpart ZZZZ (NESHAP for Stationary Reciprocating Internal Combustion Engines) applies to the four diesel engines proposed that will drive emergency generators and fire pump. The only requirement under Subpart ZZZZ is that the units comply with the requirements of NSPS Subpart IIII. The air permitting process described in Section 5.1.2 will document compliance with this rule.
- 40 CFR Part 63 (CAM): Compliance Assurance Monitoring does not apply because no emission unit has an uncontrolled pollutant specific emission rate above Part 70 major source thresholds and no add-on pollution control equipment is proposed.
- 40 CFR Part 68 (RMP): The WRESC will not require a Risk Management Plan.
- 40 CFR Part 70 (Operating Permits): Because the WRESC will not have permitted emissions from stationary sources that exceed Part 70 major source thresholds, a major source operating permit under Part 70 is not required (sometimes referred to as a Title V permit).
- 40 CFR Part 71 (Federal Operating Permits): The EKAPCD has delegated permitting authority over the geographic region where the WRESC is proposed; therefore, Part 71 does not apply.
- 40 CFR Part 72-75 (Acid Rain): The WRESC will not require an acid rain permit.
- 40 CFR Part 82 (Protection of Stratospheric Ozone): The Applicant anticipates having a licensed third party handle any ozone depleting substances, if applicable. Proper documentation will be kept for such activity.
- 40 CFR Part 93 (General Conformity): As discussed in Section 5.1.4.6, this project is not subject to general conformity.
- 40 CFR Part 98 (Mandatory GHG Reporting): The WRESC is not anticipated to have actual GHG emission from operations that exceed 25,000 metric tons per year; therefore, reporting will not be required under Part 98.

5.1.7.1.2 State Laws, Ordinances, Regulations, and Statutes

- California Health and Safety Code Part 6 Sections 44360 to 44366 [Air Toxics “Hot Spots” Information and Assessment]: The WRESC will be subject to Part 6 because it will release substances listed in the rule from the combustion of diesel fuel from the emergency generators and the fire pump. WRESC will participate in the requirement to prepare an inventory and health risk analysis (as applicable). The analysis presented in Section 5.9, Public Health, shows that emissions from the WRESC will be below the significance levels for operation and that the cancer risk and chronic hazard index values are reasonable for risks due to construction activities.
- California Health and Safety Code 41700 [public nuisance]: Prohibits the discharge from a facility of air pollutants that cause injury, detriment, nuisance, or annoyance to the public, or which endanger the comfort, repose, health, or safety of the public, or that damage business or property. The Applicant will acquire

permits from EKAPCD for emergency generators and fire pump that will not operate for more than 200 hours per year. The operations of these generators are not expected to generate a public nuisance.

- California Code of Regulations Title 17 Section 70200 [California Ambient Air Quality Standards]: Emissions from WRESC operations and construction show compliance with the CAAQS using air dispersion models. WRESC modeling discussed in Section 5.1.6.8 demonstrates compliance with the NAAQS.
- California Health and Safety Code 41753 (https://ww2.arb.ca.gov/our-work/programs/portable-equipment-registration-program-perp): This is a program offered by CARB to register portable equipment as an alternative to securing permits or portable registrations from local air pollution control districts. Equipment registered with the Portable Equipment Registration Program, when used according to the conditions on the registration, may operate throughout the state without obtaining permits to operate or portable registrations from any of California's 35 air quality management or air pollution control districts. Generally, portable engines over 50 horsepower (hp) and portable equipment units that emit particulate matter cannot be operated within the jurisdiction of the EKAPCD without an EKAPCD or State Portable Registration.

5.1.7.1.3 Air Pollution Control District LORS

EKAPCD LORS applicability is discussed in the list below.

- EKAPCD Regulation II Rule 201 [permits required]: The reciprocating engines proposed for the operating phase of the WRESC must obtain an air authority to construct and a permit to operate as described in Section 5.1.2.
- EKAPCD Regulation II Rule 201.1 [Title V]: The WRESC will not be considered a major source under Title V and will not be required to obtain a Title V air permit to operate.
- EKAPCD Regulation II Rules 201.2 and 201.3 [synthetic minor and federally enforceable limits on potential to emit]: The WRESC will accept enforceable limits on annual operation in the air permit such that the facility will be considered a synthetic minor source.
- EKAPCD Regulation II Rule 210.1 [minor new source review]: The WRESC emission units will be subject to new source review for minor sources. The process will require application of BACT. Offsets will not be required because the emission units are for emergency use only and will limit operation to no more than 200 hours per year (excluding maintenance and readiness testing). See Sections 5.1.2 and 5.1.5 for compliance measures.
- EKAPCD Regulation II Rule 210.1A [major new source review]: The WRESC emission units will not be subject to prevention of significant deterioration review due to the potential to emit.
- EKAPCD Regulation II Rule 210.4 [prevention of significant deterioration]: The WRESC emission units will not be subject to major new source review due to the potential to emit.
- EKAPCD Regulation II Rule 210.7 [federal general conformity]: As discussed in Section 5.1.4.6, this action will not be subject to federal general conformity.
- EKAPCD Regulation IV Rule 401 [visible emissions]: The reciprocating engines proposed for the operating phase of the WRESC must obtain an air permit, which will contain conditions that require compliance with the visible emission limits.
- EKAPCD Regulation IV Rule 407 [sulfur compounds]: Reciprocating engines in the operating the WRESC will comply by combusting diesel fuel that contains not more than 15 ppm sulfur.
- EKAPCD Regulation IV Rule 409 [fuel burning equipment]: The engines at the WRESC do not meet the definition of fuel burning equipment; therefore, this rule does not apply.
- EKAPCD Regulation IV Rules 411 and 413 [storage of organic liquids and loading]: The WRESC will include diesel fuel storage tanks; however, Rules 411 and 413 only apply to petroleum distillates that have a true vapor pressure greater than 1.5 pounds per square inch absolute. Diesel fuel has a vapor pressure less than this threshold, so Rules 411 and 413 do not apply.
- EKAPCD Regulation IV Rule 419 [nuisance]: The engines at the WRESC are not anticipated to emit quantities of air contaminants that would qualify as a nuisance.
- EKAPCD Regulation IV Rule 422 [NSPS]: The engines at the operational WRESC will comply with applicable NSPS Subpart IIII.

- EKAPCD Regulation IV Rule 423 [NESHAP]: The only requirement under Subpart ZZZZ will be for the engine to comply with NSPS Subpart IIII.
- EKAPCD Regulation IV Rule 427 [piston engines]: The engines for the WRESC will be for emergency use so this rule does not apply.

5.1.7.2 Agency Jurisdiction and Contacts

Table 5.1-14 presents data on the following:

- Air quality agencies that may or will exercise jurisdiction over air quality issues resulting from the power facility
- The most appropriate agency contacts for Willow Rock
- Contact address and phone information
- The agency involvement in required permits or approvals

Table 5.1-14: Agency, Contacts, Jurisdictional Involvement, Required Permits for Air Quality

Regulatory Agency	Regulatory Contact	Jurisdictional Area	Permit Status
CEC	CEC-Lon Payne 1516 Ninth Street Sacramento, CA 95814	Primary reviewing and certification agency.	Will certify the facility under the energy siting regulations and CEQA. Certification will contain a variety of conditions pertaining to emissions and operation.
EKAPCD	Glen Stephens, PE, Air Pollution Control Officer 2700 M Street, Suite 302 Bakersfield, CA 93301 (661) 862-5250	Prepares DOC for CEC, Issues EKAPCD ATC and Permit to Operate, primary air regulatory and enforcement agency.	DOC will be prepared after AFC submittal.
CARB	Mike Tollstrup Chief, Project Assessment Branch 1001 I Street, 6th Floor Sacramento, CA 95814 (916) 322-6026	Oversight of APCD stationary source permitting and enforcement program.	CARB staff will provide comments on applicable AFC sections affecting air quality and public health. CARB staff will also have opportunity to comment on draft ATC.
U.S. EPA Region 9	La Weeda Ward, Permits Section U.S. EPA Region 9 75 Hawthorne Street San Francisco, CA 94105 (213) 244-1812	Oversight of all APCD programs, including permitting and enforcement programs. PSD permitting authority for EKAPCD.	U.S. EPA Region 9 staff will receive a copy of the DOC. U.S. EPA Region 9 staff will have opportunity to comment on draft ATC.

AFC = Application for Certification; ATC = Authority to Construct; CARB = California Air Resources Board; CEC = California Energy Commission; DOC = Determination of Compliance; CEQA = California Environmental Quality Act; APCD = Air Pollution Control District; EKAPCD = Eastern Kern APCD; CARB = California Air Resources Board; PSD = Prevention of Significant Deterioration; TBD = to be determined; U.S. EPA = U.S. Environmental Protection Agency;

5.1.7.3 Permit Requirements and Schedules

A description of the air permitting process is in Section 5.1.2.

5.1.8 References

Auer, August H. Correlation of Land Use and Cover with meteorological Anomalies, Journal of Applied Meteorology 1978.California Air Resources Board (CARB. 2016. Ambient Air Quality Standards. Updated May 4, 2016. Available at: http://www.arb.ca.gov/research/aaqs/aaqs2.pdf. Accessed in February 2024.

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EKAPCD. 2017 Ozone Attainment Plan. July. Available at: http://kernair.org/Documents/Announcements/Attainment/2017%20Ozone%20Plan_EKAPCD_Adopted_7-27-17.pdf. Accessed in August 2021.

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EKAPCD. 1999. Guidelines for Implementation of the California Environmental Quality Act (CEQA) of 1970, as Amended July 1. Available at: http://kernair.org/Documents/CEQA/CEQA_Guidelines%20&%20Charts.pdf. Accessed online August 2021.

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U.S. EPA. 2021b. AERSCREEN Users Guide, April 2021, United States Environmental Protection Agency.

U.S. EPA. 2018. AERMAP (version 18081). Available at: https://www.USEPA.gov/scram/air-quality-dispersion-modeling-related-model-support-programs. Accessed in August 2021.

U.S. EPA. 1985. Guideline for Determination of Good Engineering Stack Height (Technical Support Document for the Stack Height Regulation) (Revised), USEPA-450/4-80-023R. Office of Air Quality Planning and Standards, Research Triangle Park, NC. June.

Attachment 4
AFC Public Health Section

5.9 Public Health

This section discusses activities that could potentially affect public health as they relate to the construction and operation of the Willow Rock Energy Storage Center (WRESC or Willow Rock). A Health Risk Assessment (HRA) was performed to assess potential effects and public exposure associated with airborne emissions from the WRESC and include the architectural berm and no-architectural berm options for both operations and construction. Section 5.9.1 describes the affected environment. Section 5.9.2 presents an environmental analysis of the operation of the power facility and associated facilities. Section 5.9.3 discusses cumulative effects. Section 5.9.4 discusses mitigation measures. Section 5.9.5 presents applicable laws, ordinances, regulations, and standards (LORS), permit requirements, schedules, and agency contacts. Section 5.9.6 contains references cited or consulted in preparing this section. Appendices 5.9A to 5.9E contain the HRA support data.

the WRESC will be a nominal 520-megawatt (MW) gross (500 MW net) and 4,160 megawatt-hour (MWh) gross (4,000 MWh net) facility using Hydrostor, Inc.'s (Hydrostor's) proprietary, advanced compressed air energy storage (A-CAES) technology. Energy stored at the WRESC will be delivered to Southern California Edison's Whirlwind Substation located southwest of the WRESC at the intersection of 170th Street W and Rosamond Boulevard, via a new approximately 19-mile 230-kilovolt (kV) generation-tie (gen-tie) line. The WRESC will be capable of operating on a 24-hour basis, 365 days a year with an approximately 50-year lifespan. A detailed description of the WRESC is presented in Chapter 2, Project Description.

The Project or Project Area encompasses the WRESC Site, the parcels within the Project Boundary, and the right-of-way (ROW) associated with the WRESC's gen-tie line. The Project Boundary encompasses the WRESC Site and the parcels of land (an additional 133 acres of private land surrounding the WRESC) that will be allocated for potential temporary staging and laydown area (referred to herein as the Staging Area) during construction, or the construction of a permanent architectural berm constructed from the material excavated during cavern construction. The Staging Area consists of groups of assessor's parcels referred to as P1, P2N, P2S, and VH.

Air will be the dominant pathway for public exposure to chemical substances released by the WRESC. Emissions to the air will consist primarily of combustion by-products produced by four internal combustion engines driving emergency generators and a fire pump. Potential health risks from combustion emissions will occur almost entirely by direct inhalation. To be conservative, additional pathways were included in the health risk modeling. The HRA was conducted following the guidelines established by the California Office of Environmental Health Hazard Assessment (OEHHA) and the California Air Resources Board (CARB).

Combustion byproducts with established California Ambient Air Quality Standards (CAAQS) or National Ambient Air Quality Standards (NAAQS), including nitrogen oxides, carbon monoxide (CO), and fine particulate matter (PM) (i.e., PM less than 10 microns [PM_{10}] and PM less than 2.5 microns [$PM_{2.5}$]) are addressed in Section 5.1, Air Quality. However, some discussion of the potential health risks associated with these substances is presented in this section. Human health risks associated with the potential accidental release of stored acutely hazardous materials, if applicable, are discussed in Section 5.5, Hazardous Materials.

5.9.1 Affected Environment

The WRESC will be located in Kern County within the Eastern Kern Air Pollution Control District (EKAPCD). The Willow Rock site is located approximately 0.22 miles due east of the State Route 14 interchange at Dawn Road approximately 3.5 miles north of Rosamond, California.

The Willow Rock site is situated in Kern County census tract 5514, which has a population value of 5964 individuals per the 2020 estimate from the United States Census Bureau. Section 2, Project Description, contains a detailed project description, location maps, and other related technical data.

The Draft 2022 Annual AB 2588 Air Toxics Report for EKAPCD dated September 12, 2022, identifies that there is only one Category 1 (high-level risk) facility in the EKAPCD that has a cancer risk exceeding 10 per million or a total hazard index exceeding 1.0. Twelve facilities are listed as Category 2 (intermediate level risk) and 12 facilities are listed as Category 3 (low-level risk). No facilities pursuant to the 2022 draft report have been required to prepare risk reduction and audit plans.

The EKAPCD 2022-2023 Information Report (EKAPCD) indicates that the number of days above the state 1-hour ozone standard has decreased since the 2001–2003 timeframe. Average concentrations of PM_{10} and $PM_{2.5}$ remain relatively unchanged in recent years, except for those years in which the airshed is impacted by pollutant transport during wildfire events.

The 2018–2019 Kern County Community Health Assessment and Improvement Plan (Kern County Public Health Services Department 2018) was reviewed for public health concerns as they relate to the WRESC Project. Air quality is reported to be a health concern caused by the unique geography of Kern County and is listed as one of the top challenges for the county. The overall trend is reported to be improving, however, and policies including "no burn" days and the promotion of carpooling are cited as contributing to the improving air quality. Asthma is also noted as being a problem in Kern County due to poor air quality.

No additional public health studies related to respiratory illnesses, cancers, or related diseases within a 6-mile radius of the WRESC site were identified within the last 5 years.

5.9.1.1 Receptors

For purposes of the construction and operational HRA evaluations the following four types of receptors were identified:

- Point of maximum impact (PMI). This receptor represents the highest concentration and risk point on the receptor grid for the analysis under consideration.
- Maximum exposed individual resident (MEIR). This receptor represents the maximum impacted actual residential location on the grid for the analysis under consideration.
- Maximum exposed individual worker (MEIW). This receptor represents the maximum impacted actual worker location on the grid for the analysis under consideration.
- Maximum exposed individual sensitive (MEIS). This receptor represents the maximum impacted actual sensitive location on the grid for the analysis under consideration. This location is a non-residential sensitive receptor, i.e., school, hospital, daycare center, or convalescent home.

The nested modeling grids as described in Section 5.1, Air Quality, were used for the HRA modeling. These grids covered the receptor types noted above and was expanded to include sensitive receptors within 5 miles of the WRESC Site.

Table 5.9-1 shows the sensitive receptors within the Project Area.

Table 5.9-1: Nearfield Sensitive Receptors

Receptor ID	UTM East (meters)	UTM North (meters)	Distance from the Project Fence Line (miles)
Nearest Residence	*393,427*	*3,865,201*	*0.80*
Nearest School	*392,025*	*3,858,690*	*3.48*
Nearest Daycare	*391,989*	*3,859,516*	*3.03*
Nearest Airport	*389,771*	*3,859,248*	*4.02*
Nearest Hospital	*None*	*None*	*Not applicable*
Nearest Convalescent Care Facility	*None*	*None*	*Not applicable*

UTM = Universal Transverse Mercator

The nearest residential receptor is located approximately 0.80 miles from the property fence line of the WRESC. The nearest worker receptor is approximately 1.49 miles north-northeast from the property line of the WRESC. The nearest sensitive receptor (residential daycare facility) is approximately 3.03 miles from the WRESC site. It should be noted the nearfield sensitive receptors provided in **Table 5.9-1** may not be the maximum impacted sensitive receptors on the grid, i.e., residential, worker, school, daycare, etc.

5.9.2 Environmental Analysis

The environmental effects on public health from the construction and operation of the WRESC Project Area presented in the following sections.

5.9.2.1 Significant Criteria

Significant criteria for cancer and non-cancer risk are described in the sections below.

5.9.2.1.1 Cancer Risk

Cancer risk is the probability or chance of contracting cancer over a human lifetime. Any exposure to a carcinogen is assumed to have some probability of causing cancer; the lower the exposure, the lower the cancer risk (i.e., a linear, no-threshold model). Under various state and local regulations, an incremental cancer risk greater than 10 per million due to a project's emissions has been established as a threshold for potentially significant effect on public health.

5.9.2.1.2 Non-Cancer Risk

Non-cancer health effects can be classified as either chronic or acute. In determining the potential health risks of non-cancerous air toxics, it is assumed that there is a dose of the chemical of concern below which there would be no effect on human health. The air concentration corresponding to this dose is called the Reference Exposure Level (REL). Non-cancer health risks are measured in terms of a hazard quotient, which is the calculated exposure of each contaminant divided by its REL. Hazard quotients for pollutants affecting the same target organ are typically summed, with the resulting totals expressed as hazard indices for each organ system. A hazard index of less than 1.0 is generally an insignificant health risk. RELs used in the hazard index calculations were those published in the Consolidated Table of OEHHA/CARB Approved Risk Assessment Health Values dated October 16, 2023 (OEHHA/CARB 2023).

Chronic toxicity is defined as adverse health effects from prolonged chemical exposure caused by chemicals accumulating in the body. Because chemical accumulation to toxic levels typically occurs slowly, symptoms of chronic effects usually do not appear until long after exposure commences. The lowest no-effect chronic exposure level for a non-carcinogenic air toxic is the chronic REL. Below this threshold, the body can eliminate or detoxify the chemical rapidly enough to prevent its accumulation. The chronic hazard index was calculated using the hazard quotients calculated with annual concentrations.

Acute toxicity is defined as adverse health effects caused by brief chemical exposure of no more than 24 hours. For most chemicals, the air concentration required to produce acute effects is higher than the level required to produce chronic effects because the exposure duration is shorter. Because acute toxicity is predominantly manifested in the upper respiratory system at threshold exposures, all hazard quotients are typically summed to calculate the acute hazard index. One-hour average concentrations are divided by the acute RELs to obtain a hazard index for health effects caused by relatively high, short-term exposures to air toxics.

5.9.2.2 Construction and Commissioning Phase Effects

The construction phase of the WRESC Project is expected to take approximately 60 months, followed by several months of startup and commissioning. Strict construction practices that incorporate safety and compliance with applicable LORS will be followed (see Section 5.9.5). Additionally, mitigation measures to reduce air emissions from construction effects will be implemented as described in Section 5.1, Air Quality. Temporary emissions from construction-related activities are discussed in Appendix 5.1B. Construction-related emissions are temporary and localized, resulting in no long-term effects to the public.

Small quantities of hazardous waste may be generated during the construction phase of the WRESC. Hazardous waste management plans will be in place so the potential for public exposure will be minimal (see Section 5.14, Waste Management). No acutely hazardous materials will be used or stored onsite during construction (see Section 5.5, Hazardous Materials). To ensure worker safety during construction, safe work practices will be followed (see Section 5.17, Worker Health and Safety).

A screening HRA was conducted for the construction period due to emissions of diesel particulate matter. Diesel engines emit a complex mixture of air pollutants, including both gaseous and solid material. The solid material in diesel exhaust is known as diesel particulate matter (DPM). More than 90% of DPM is less than 1 µm in diameter and, thus, is a subset of both PM10 and PM2.5. Most of the engine emitted PM10 and PM2.5 derive from combustion, such as in diesel fuels by motor vehicles. DPM is considered by CARB as the approved surrogate toxic for all diesel exhaust constituents for purposes of cancer and chronic health risk analyses. By assuming that all combustion based PM10 is in the form of DPM, which has a size of less than 1 µm, using combustion based PM10 to represent DPM would provide overestimates of the emissions of DPM. The analysis indicates that no significant public health effects are expected during the construction phase. The results of this analysis show no significant impact on public health and are presented in Appendix 5.9B.

Commissioning activity will include the operation of the emergency generators and fire pump; however, the effects from commissioning the generators and fire pump are not anticipated to be different than the operational phase effects.

5.9.2.3 Operational Phase Effects

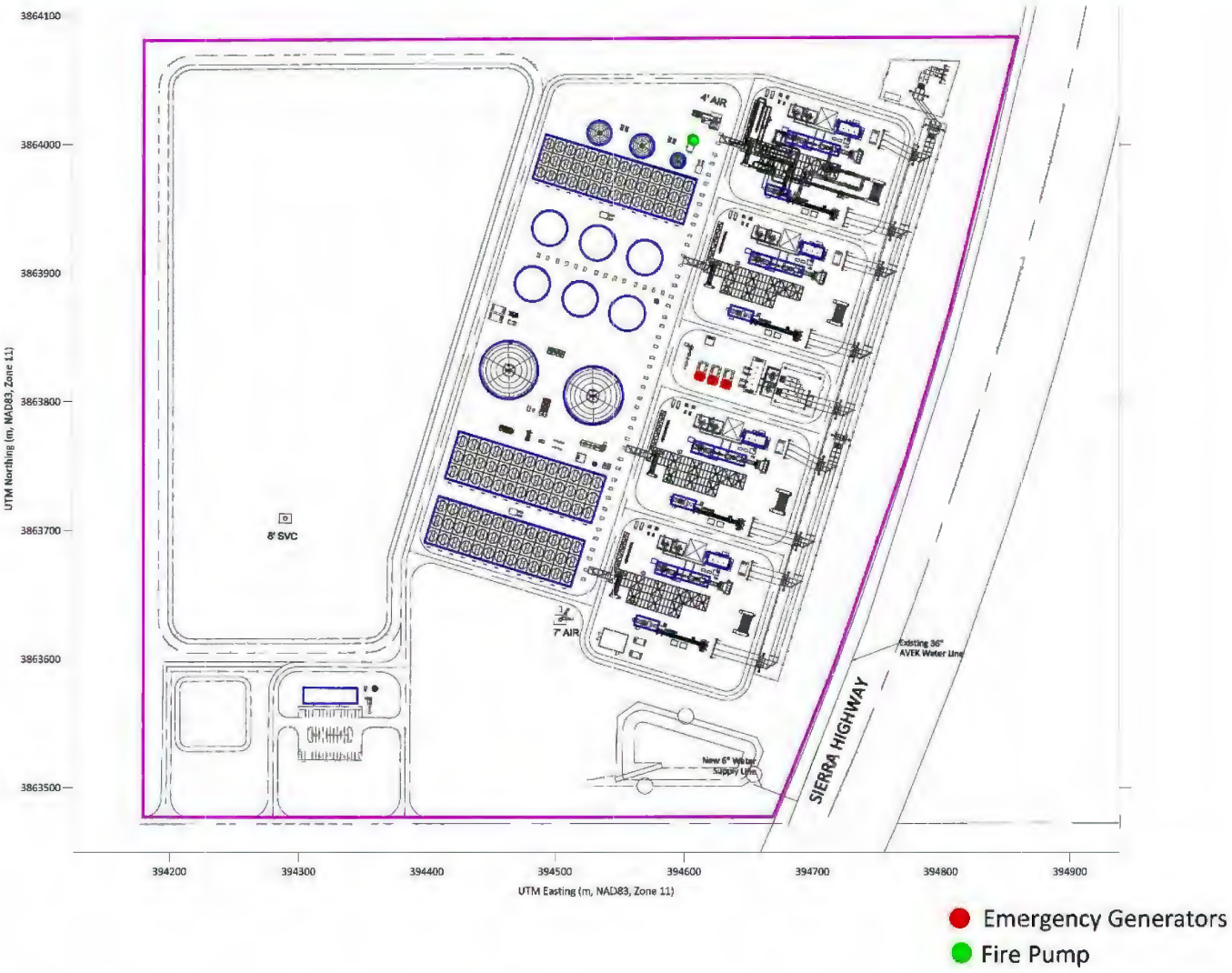
During the operational phase, three diesel generators will supply emergency power for critical loads. The generating capacity for the final design is to be no more than 2.5 MW per generator. Additionally, a single diesel fire pump will be located onsite to provide fire water pumping in critical situations. These engines are the only stationary sources that will combust fossil fuel and are anticipated to operate for up to 50 hours each per year for testing and maintenance. The EKAPCD requires the annual emissions of emergency equipment to be based on 200 hours per year which assumes that each year has up to 150 hours of emergency operation. Since HRA's are based on routine operation and typically do not include emergency operation, basing the health risk on a 30 year exposure values where each year has 150 hours of emergency operation was deemed to be too conservative. Thus, the HRA presented below reflects up to 50 hours per year of operation for each engine. This HRA includes emissions from the operation of the three emergency diesel generators and the fire pump engine. **Table 5.9-2** provides the location and source characteristics for each engine stacks. **Figure 5.9-1** shows the site property boundary (no-architectural berm option) and location of the four emission sources that are evaluated for this HRA. The architectural berm option source locations will be identical to the no-architectural berm option.

Table 5.9-2: Willow Rock Emission Sources for Operation Phase

Source ID	Description	UTM Easting Coordinate (meters)	UTM Northing Coordinate (meters)	Stack Height above grade (feet)	Stack Inside Diameter (feet)	Stack Elevation AMSL (feet)	Exhaust Gas Temperature (°F)	Exhaust Gas Flowrate (actual cfm)	Exhaust Velocity (ft/s)
EGEN 1	*Emergency Diesel Generator 2.5 MW*	*394,612.1*	*3,863,819.9*	*22.93*	*1.033*	*~2,554*	*914*	*19,468*	*193.5*
EGEN 2	*Emergency Diesel Generator 2.5 MW*	*394,622.3*	*3,863,816.8*	*22.93*	*1.033*	*~2,554*	*914*	*19,468*	*193.5*
EGEN 3	*Emergency Diesel Generator 2.5 MW*	*394,632.4*	*386,3813.7*	*22.93*	*1.033*	*~2,554*	*914*	*19,468*	*193.5*
FP	*Diesel Fire Pump 460 bhp*	*394,606.4*	*3,864,004.4*	*15*	*0.5*	*~2,554*	*1025*	*2,881*	*245*

Source: Kohler KD2500-4 and Cummins CFP15EVS-F10 Specifications
Note: Coordinate datum = UTM Zone 11, NAD83 North.
°F = Fahrenheit; AMSL= above mean sea level; bhp = brake horsepower, cfm = cubic feet minute; ft/s = feet per second; MW = megawatts

Figure 5.9-1: Location of Willow Rock Emission Sources during Operation Phase



The human health risks associated with the chemical substances potentially emitted into the air through the operation of the WRESC were evaluated in an HRA. The chemical substances potentially emitted into the air from the WRESC emission units are listed in **Table 5.9-3**.

Table 5.9-3: Chemical Substances Potentially Emitted to the Air from Willow Rock

Criteria Pollutants	Greenhouse Gasses	Toxic Air Pollutants
Particulate Matter (PM)	*Carbon Dioxide (CO2)*	*Diesel Particulate Matter (DPM) is considered the approved surrogate toxic for all diesel exhaust constituents for purposes of the cancer and chronic health risk analysis.*
PM less than 10 microns (PM10)	*Methane (CH4)*	
PM less than 2.5 microns (PM2.5)	*Nitrous Oxide (N2O)*	
Carbon Monoxide (CO)	*Not Applicable*	
Nitrogen Oxides (NOX)	*Not Applicable*	
Volatile Organic Compounds (VOC)	*Not Applicable*	

Source: Appendix 5.9C and Section 5.1, Air Quality

Estimated toxic pollutant emissions from the facility processes are provided in **Table 5.9-4**. Appendix 5.9C shows detailed emission calculations.

Table 5.9-4: Toxic Pollutant Emissions Estimates for Operation Phase

CAS	Pollutant	Each 2.5 MW Generator, lbs/hr	3-2.5 MW Generators, TPY	Fire Pump, lbs/hr	Fire Pump, TPY
9901	*DPM*	*0.16*	*0.012*	*0.152*	*0.0038*

Source: Section 5.9, Public Health, Appendix 5.9C
Notes: Lbs/hr values are for maintenance and readiness testing, no two engines will be tested concurrently.
CAS = Chemical Abstracts Service number
DPM = diesel particulate matter (in the form of PM_{10}.) For purposes of the health risk assessment, diesel particulate matter is assumed to equal PM10.lbs/hr = pounds per hour
MW = megawatts
TPY = tons per year; values are for the 50 hours per year runtime scenario per the CARB Air Toxics Control Measure

Ambient air concentrations due to emissions of criteria pollutants will adhere to NAAQS and CAAQS (see Section 5.1, Air Quality). Offsets will not be required because the WRESC Project will not be a major source under new source review. Air dispersion modeling results (see Section 5.1, Air Quality) show that emissions will not result in ambient concentrations of criteria pollutants that exceed ambient air quality standards (NAAQS or CAAQS). These standards are intended to protect the general public. Therefore, the WRESC Project is not anticipated to have a significant effect on public health from emissions of criteria pollutants.

The HRA was prepared using guidelines developed by OEHHA and CARB, as implemented in the latest version of the Hotspots Analysis and Reporting Program (HARP2) model (ADMRT Ver. 22118). Appendix 5.9D summarizes the HRA methodology followed, HARP2, and American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) model options and parameters.

5.9.2.4 Public Health Effect Study Methods

Emissions of toxic pollutants potentially associated with the WRESC calculated by assuming the PM_{10} emissions were all in the form of diesel particulate matter (DPM). The PM_{10} emission factors were based on the Tier 4 PM_{10} compliance limits. Each source of emissions was modeled with AERMOD using the methods previously described in Section 5.1, Air Quality. AERMOD allows the estimation of both short-term and long-term average concentrations in air for use in an HRA, accounting for site-specific terrain and meteorological conditions. The

emission rates and AERMOD model output were entered into HARP2, which calculates estimated ground level concentration for each pollutant. HARP2 then compares the ground level concentrations to cancer and non-cancer benchmarks to estimate health risk. Health risks potentially associated with the estimated concentrations of pollutants in the air were characterized in terms of excess lifetime cancer risks (for carcinogenic substances), or comparison with RELs for non-cancer health effects (for non-carcinogenic substances). Health risks were evaluated for the PMI, MEIR, MEIW, and MEIS receptor types.

Health risks potentially associated with concentrations of carcinogenic air pollutants were calculated as estimated excess lifetime cancer risks. The excess lifetime cancer risk for a pollutant is estimated as the product of the concentration in the air and a unit risk value. The unit risk value is defined as the estimated probability of a person contracting cancer because of constant exposure to an ambient concentration of 1 microgram per cubic meter over a 30-year lifetime. Evaluation of potential non-cancer health effects from exposure to short-term and long-term concentrations in the air was performed by comparing modeled concentrations in the air with the RELs. A REL is a concentration in the air at or below which no adverse health effects are anticipated. RELs are based on the most sensitive adverse effects reported in medical and toxicological literature. Potential non-cancer effects were evaluated by calculating a ratio of the modeled concentration in the air and the REL. This ratio is referred to as a hazard quotient. The unit risk values and RELs used to characterize health risks associated with modeled concentrations in the air were obtained from the Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values (OEHHA/CARB 2023) and are presented in **Table 5.9-5**.

Table 5.9-5: Toxicity Values Used to Characterize Health Risks (Inhalation)

CAS	Pollutant	Unit Risk Factor ($\mu g/m^3)^{-1}$	Chronic REL ($\mu g/m^3$)	Acute REL ($\mu g/m^3$)	8-hour Chronic REL ($\mu g/m^3$)
9901	*Diesel Particulate Matter*	*3.0E-04*	*5*	*none*	*none-*

Source: CARB/OEHHA 2022.
$\mu g/m^3$ = microgram per cubic meter; CAS=Chemical Abstracts Service number; REL = Reference Exposure Level

5.9.2.5 Characterization of Risks from Toxic Air Pollutants

Based on the HARP2 modeling results for routine operations, the excess lifetime cancer risks and chronic hazard index are all less than the health risk significance thresholds presented in **Table 5.9-6**, with the exception of the PMI, where the cancer risk was exceeded. The PMI is located on the eastern Project fence line boundary and is not a residential receptor. Excess lifetime cancer risks less than 10×10^{-6}, for sources with Best Available Control Technology for Toxics (TBACT) (use of a DPF), are unlikely to represent significant public health impacts that require additional controls of facility emissions. Cancer risks higher than 1×10^{-6} may or may not be of concern, depending upon several factors. These include the conservatism of assumptions used in risk estimation, the size of the potentially exposed population, and the toxicity of the risk-driving chemicals. Cancer risks higher than 10×10^{-6} from sources trigger public notice requirements. Non-cancer risks less than 1.0 are generally not a concern.

Table 5.9-6: Health Effects Significant Threshold Levels for Eastern Kern Air Pollution Control District

	Significance Thresholds	
Risk Category	EKAPCD Net Project Risk	State of California
Cancer Risk	*<=1 in one million without TBACT* *<=10 in one million with TBACT*	*<= 1 in a million without TBACT* *<=10 in a million with TBACT*
Chronic Hazard Index	*1.0* *1.0*	*1.0*
Acute Hazard Index	*1.0* *1.0*	*1.0*
Cancer (TBACT required)	*>1 in a million* *Chronic HI > 1.0*	*See above.*
Cancer Burden	*NA*	*1.0*

Source: EKAPCD 2021
EKAPCD = Eastern Kern Air Pollution Control District; NA = not applicable; TBACT = Best Available Control Technology for Toxics

Facilities with elevated risks are required to provide public notice, and if the risks are considered significant, the facility must work to reduce emissions to acceptable levels within 5 years.

The risks predicted in the HRA are compared to the following EKAPCD levels:

- Public Notification Threshold: Required to notify the public if:
  - The cancer risk is greater than or equal to 10 in 1 million.
  - The non-cancer chronic or acute hazard index is greater than 1.0.
- Significant Risk Threshold: Required to notify the public and prepare a risk reduction audit plan if:
  - The cancer risk is greater than or equal to 100 in 1 million.
  - The non-cancer chronic or acute hazard index is greater than 5.0.

5.9.2.5.1 HRA Results

A summary of the risks associated with operational DPM emitted from the WRESC sources are presented in **Table 5.9-7** and **Table 5.9-8**. The electronic files provided to the California Energy Commission (CEC) present more detailed tables of the HARP2 modeling results for each health risk, at each receptor type, broken down by pollutant and source based on the exposure durations.

Table 5.9-7: Health Risk Assessment Summary for the Operations Phase

Architectural berm Option							
Type of Risk	Receptor Type	Exposure Duration	Risk[a,b]	Above Significance Thresholds?	Receptor ID	UTM E (meters)	UTM N (meters)
Cancer	*PMI*	*30 Years*	*3.16*	*No*	*61*	*394,832.36*	*3,863,973.48*
	MEIR		*0.0177*	*No*	*4,494*	*393,510.00*	*3,865,110.00*
	MEIS		*0.00884*	*No*	*1,911*	*393,160.00*	*3,858,860.00*
	MEIW	*25 Years*	*5.20E-09*	*No*	*4,494*	*393,510.00*	*3,865,110.00*

Architectural berm Option							
Type of Risk	Receptor Type	Exposure Duration	Risk[a,b]	Above Significance Thresholds?	Receptor ID	UTM E (meters)	UTM N (meters)
Chronic HI	*PMI*	*Annual*	*7.14E-04*	*No*	*61*	*394,832.36*	*3,863,973.48*
	MEIR		*4.00E-06*	*No*	*4,494*	*393,510.00*	*3,865,060.00*
	MEIS		*2.00E-06*	*No*	*1,911*	*393,160.00*	*3,858,860.00*
	MEIW		*4.00E-06*	*No*	*4494*	*393,510.00*	*3,865,110.00*

[a] Cancer risk values are expressed in in chances per 1 million to allow direct comparison with EKAPCD public notification and significant risk levels. For example, 3.16 in a 1 million risk at the PMI receptor is less than the public notification threshold of 10 in 1 million and less than the significant risk threshold of 100 in 1 million. Values less than 0.001 in 1 million are expressed in scientific notation. For example, 5.20E-09 is equivalent to 0.0000000052

[b] Chronic HI values are expressed in scientific notation, since all values are less than 0.001 and well below the EKAPCD significance threshold of 1.

MEIR = maximum exposed individual residential; MEIS = maximum exposed individual sensitive; MEIW = maximum exposed individual worker; PMI = point of maximum impact; UTM = Universal Transverse Mercator

Table 5.9-8: Health Risk Assessment Summary for the Operations Phase

No-Architectural berm Option							
Type of Risk	Receptor Type	Exposure Duration	Risk[a,b]	Above Significance Thresholds?	Receptor ID	UTM E (meters)	UTM N (meters)
Cancer	*PMI*	*30 Years*	*3.16*	*No*	*40*	*394,833.27*	*3,863,977.23*
	MEIR		*0.0177*	*No*	*4,388*	*393,480.00*	*3,865,110.00*
	MEIS		*0.00884*	*No*	*1,848*	*393,160.00*	*3,858,860.00*
	MEIW	*25 Years*	*5.20E-09*	*No*	*4,388*	*393,480.00*	*3,865,110.00*
Chronic HI	*PMI*	*Annual*	*7.14E-04*	*No*	*40*	*394,833.27*	*3,863,977.23*
	MEIR		*4.00E-06*	*No*	*4,388*	*393,480.00*	*3,865,110.00*
	MEIS		*2.00E-06*	*No*	*1,848*	*393,160.00*	*3,858,860.00*
	MEIW		*4.00E-06*	*No*	*4,388*	*393,480.00*	*3,865,110.00*

[a] Cancer risk values are expressed in in chances per 1 million to allow direct comparison with EKAPCD public notification and significant risk levels. For example, 3.16 in a 1 million risk at the PMI receptor is less than the public notification threshold of 10 in 1 million and less than the significant risk threshold of 100 in 1 million. Values less than 0.001 in 1 million are expressed in scientific notation. For example, 5.20E-09 is equivalent to 0.0000000052

[b] Chronic HI values are expressed in scientific notation, since all values are less than 0.001 and well below the EKAPCD significance threshold of 1.

Source: HARP2 (ADMRT 22118) model run by ADI, December 2023

The PMI in both scenarios is located on the eastern fence line and is not a residential receptor.

The MEIS in both scenarios is the Rosamond Elementary School.

MEIR = maximum exposed individual residential; MEIS = maximum exposed individual sensitive; MEIW = maximum exposed individual worker; PMI = point of maximum impact; UTM = Universal Transverse Mercator

All calculated health risk impacts to sensitive receptors are far below the significance criteria of one in one million at the residential worker and sensitive receptor locations. A detailed description of the HARP modeling assumptions used to calculate health risks associated with emissions to the air is presented in Appendix 5.9D.

Results of the HRA indicate that cancer and chronic (non-cancer) risk levels associated with emissions from the four sources that will be operated during the operational phase of the WRESC are well below the Assembly Bill

2588 levels that trigger public notice or risk reduction. DPM has no acute REL values; therefore, an acute analysis was not performed.

5.9.2.5.2 Cancer Risk

As noted, the PMI (for both the architectural berm and no-architectural berm scenarios) for cancer risk is predicted to occur on the fence line receptors 61 and 40, at the east side of the property boundary fenceline where no sensitive receptors are located and there is no significant risk of extended exposure by a sensitive receptor and no risk o continuous exposure for 30 years. All of the risk is based on DPM, which is a surrogate toxic for diesel combustion. The pathway for maximum exposure and contribution is inhalation.

The MEIR (for both scenarios) for cancer risk is predicted to occur at receptors 4494 and 4388. This risk assumes 30 years of continuous exposure. The pathway for maximum exposure and contribution is inhalation.

The location of the MEIS receptors (for both scenarios) with maximum cancer risk is predicted to occur at Rosamond Elementary School (1911 and 1848).

The MEIW (for both scenarios) for 25-year cancer risk is predicted to occur at receptors 4494 and 4388.

The Project cancer risk impacts are considered insignificant.

5.9.2.5.3 Chronic Hazard Index

The PMI (for both scenarios) for chronic risk is predicted to occur on the fence line receptors 61 and 40, at the east side of the property boundary. This risk assumes 30 years of continuous exposure. The pathway for maximum exposure and contribution is inhalation.

The MEIR (for both scenarios) for chronic risk is predicted to occur at receptors 4494 and 4388. This risk assumes 30 years of continuous exposure. The pathway for maximum exposure and contribution is inhalation.

The location of the MEIS receptors (for both scenarios) with maximum chronic risk is predicted to occur at Rosamond Elementary School (1911 and 1848).

The MEIW (for both scenarios) for 25-year chronic risk is predicted to occur at receptors 4494 and 4388.

The Project chronic hazard impacts are considered insignificant.

5.9.2.5.4 Acute Hazard Index

DPM is considered by CARB and the U.S. Environmental Protection Agency to be the approved surrogate toxic for whole diesel exhaust. DPM does not, at this time, have an approved acute hazard index (HI) REL value; therefore, an acute HI risk analysis was not performed.

The chronic hazard quotients associated with concentrations in air are shown in **Table 5.9-7**. The chronic hazard quotients for all target organs are below 1.0. As described previously, a hazard quotient less than 1.0 is unlikely to represent a significant effect on public health. Further description of the methodology used to calculate health risks associated with emissions to the air is presented in the HARP2 Users Guides (HARP2 2015) and in the OEHHA 2015 Air Toxics Hot Spots Health Risk Assessment Guidance document (OEHHA/CARB 2015).

Detailed risk and hazard values are provided in the HARP2 output presented in Appendix 5.9E (electronic modeling files on CD-ROM).

The estimates of excess lifetime cancer risks and non-cancer risks associated with chronic exposures are below thresholds used for regulating emissions of toxic pollutants to the air. Historically, exposure to any level of a carcinogen has been considered to have a finite risk of inducing cancer. In other words, there is no threshold for carcinogenicity. Since risks at low levels of exposure cannot be quantified directly by either animal or epidemiological studies, mathematical models have estimated such risks by extrapolation from high to low doses. This modeling procedure is designed to provide a conservative estimate of cancer risks based on the most sensitive species of laboratory animal for extrapolation to humans.

An excess lifetime cancer risk of 1×10^{-6} is typically used as a screening threshold for insignificant risk from potential exposure to carcinogenic substances in the air. The excess cancer risk level of 1×10^{-6}, which has historically been judged to be an acceptable risk, originates from efforts by the Food and Drug Administration to use quantitative HRA for regulating carcinogens in food additives in light of the zero-tolerance provision of the Delany Amendment (Hutt 1985). The associated dose, known as a "virtually safe dose," has become a standard used by many policymakers and the public for evaluating cancer risks. However, a study of regulatory actions about carcinogens found that an acceptable risk level can often be determined on a case-by-case basis. This analysis of 132 regulatory decisions found that regulatory action was not taken to control estimated risks below 1×10^{-6} (one in a million), which are called de minimis risks. De minimis risks are historically considered risks of no regulatory concern. Chemical exposures with risks above 4×10^{-3} (four in 10 thousand), called de manifestis risks, were consistently regulated. De manifestis risks are typical risks of regulatory concern. Risks falling between these two extremes were regulated in some cases, but not in others (Travis et al. 1987). In EKAPCD, an excess cancer risk above 10×10^{-6} requires public notification, and an excess cancer risk above 100×10^{-6} is considered significant and requires risk reduction. The WRESC Project would be below these thresholds.

5.9.2.5.5 Cancer Burden

To evaluate population risk, regulatory agencies have used the cancer burden as a method to account for the number of excess cancer cases that could potentially occur in a population. The cancer burden can be calculated by multiplying the cancer risk at a census block centroid by the number of people who live in the census block, and adding the estimated cancer cases across the zone of impact. A census block is defined as the smallest entity for which the Census Bureau collects and tabulates decennial census information. A centroid is defined as the central location within a specified geographic area.

The cancer burden for an operational site is calculated based on OEHHA (70 years) risk assumptions. It is independent of how many people move in or out of the vicinity of an individual facility. The number of cancer cases is considered independent of the number of people exposed, within some lower limits of exposed population size, and the length of exposure (within reason). For example, if 10,000 people are exposed to a carcinogen at a concentration with a $1x10^{-5}$ cancer risk for a lifetime, the cancer burden is 0.1, and if 100,000 people are exposed to a 1×10^{-5} risk the cancer burden is 1.

Different methods can be used as a measure of population burden. The number of individuals residing within a 1×10^{-6}, 1×10^{-5}, and/or 1×10^{-4} isopleth is another potential measure of population burden.

A cancer burden threshold of significance value could not be identified for the EKAPCD. However, a cancer burden analysis based on a 70-year cancer risk analysis using an isopleth of 1×10^{-6} and the estimated population within this isopleth area (<50 individuals) showed a burden value or 0.00005. In Appendix 5.9D, **Figure 5.9D-1** and **Figure 5.9D-2** show the actual architectural berm and no-architectural berm $1x10^{-6}$ risk isopleths, and **Figure 5.9D-3** shows the extended circular area based on these isopleths, which was used to determine the estimated exposed population.

5.9.2.5.6 Construction HRA Results

Construction health risk was analyzed for DPM onsite emissions only. Health risks were calculated for an exposure period of 5 years. The construction HRAs were run for the architectural berm and no-architectural berm options with identical receptor grids but different fence lines. **Table 5.9-9 and Table 5.9-10** summarize the results of these analyses. The results of the HRA for the architectural berm and no-architectural berm options demonstrate that at all residential and worker receptor locations, the Project will be less than the 10 in one-million risk significance thresholds. It should be noted that the PMI locations were all along the immediate eastern fence line and do not represent either worker or residential receptor locations. All chronic risk exposures are less than the significance criteria of 1.0 at all receptors for both the architectural berm and no-architectural berm options and thus, the Project will not contribute to any type of chronic impact on human health. The electronic input and output files for all of the operations and construction health risk analyses have been provided to the CEC.

Table 5.9-9: Health Risk Assessment Summary for the Construction Phase

Architectural berm Option							
Type of Risk	Receptor Type	Exposure Duration	Risk[a,b]	Above Significance Thresholds?	Receptor ID	UTM E (meters)	UTM N (meters)
Cancer	*PMI*	*5 Years*	*225*	*Yes*	*47*	*394752.77*	*3863698.79*
	MEIR		*1.99*	*No*	*5973*	*393510.00*	*3865110.00*
	MEIS		*0.436*	*No*	*3301*	*393160.00*	*3858860.00*
	MEIW	*5 Years*	*0.235*	*No*	*5973*	*393510.00*	*3865110.00*
Chronic HI	*PMI*	*Annual*	*0.0981*	*No*	*47*	*394752.77*	*3863698.79*
	MEIR		*0.000868*	*No*	*5973*	*393510.00*	*3865110.00*
	MEIS		*0.00019*	*No*	*3301*	*393160.00*	*3858860.00*
	MEIW		*0.000868*	*No*	*5973*	*393510.00*	*3865110.00*

[a] Cancer risk values are expressed in in chances per 1 million to allow direct comparison with EKAPCD public notification and significant risk levels. Although, 225 in a 1 million risk at the PMI receptor is greater than the public notification threshold of 10 in 1 million and the significant risk threshold of 100 in 1 million, the PMI location is along the immediate eastern fence line and does not represent either actual worker or actual residential receptor locations.
[b] Chronic HI values are all less than 0.1 and well below the EKAPCD significance threshold of 1.
MEIR = maximum exposed individual residential; MEIS = maximum exposed individual sensitive; MEIW = maximum exposed individual worker; PMI = point of maximum impact; UTM = Universal Transverse Mercator

Table 5.9-10: Health Risk Assessment Summary for the Construction Phase

No-Architectural berm Option							
Type of Risk	Receptor Type	Exposure Duration	Risk[a,b]	Above Significance Thresholds?	Receptor ID	UTM E (meters)	UTM N (meters)
Cancer	*PMI*	*5 Years*	*273*	*Yes*	*10*	*394735.08*	*3863647.43*
	MEIR		*3.05*	*No*	*5815*	*393510.00*	*3865110.00*
	MEIS		*0.711*	*No*	*3232*	*393,160.00*	*3,858,860.00*
	MEIW	*5 Years*	*0.360*	*No*	*5815*	*393510.00*	*3865110.00*
Chronic HI	*PMI*	*Annual*	*0.1192*	*No*	*10*	*394735.08*	*3863647.43*
	MEIR		*0.00133*	*No*	*5815*	*393510.00*	*3865110.00*
	MEIS		*0.00031*	*No*	*3232*	*393,160.00*	*3,858,860.00*
	MEIW		*0.00133*	*No*	*5815*	*393510.00*	*3865110.00*

Source: HARP2 (ADMRT 22118) model run by ADI, December 2023
[a] Cancer risk values are expressed in in chances per 1 million to allow direct comparison with EKAPCD public notification and significant risk levels. Although, 273 in a 1 million risk at the PMI receptor is greater than the public notification threshold of 10 in 1 million and the significant risk threshold of 100 in 1 million, the PMI location is along the immediate eastern fence line and does not represent either actual worker or actual residential receptor locations.
[b] Chronic HI values are all less than 0.1 and well below the EKAPCD significance threshold of 1.
MEIR = maximum exposed individual residential; MEIS = maximum exposed individual sensitive; MEIW = maximum exposed individual worker; PMI = point of maximum impact; UTM = Universal Transverse Mercator

5.9.2.6 Hazardous Materials

Hazardous materials may be used and stored at the WRESC site. The hazardous materials stored onsite and descriptions of their uses are presented in the Hazardous Materials Handling section. The use of chemicals at the WRESC site will be following standard practices for the storage and management of hazardous materials. The normal use of hazardous materials, therefore, will not pose significant effects on public health. While mitigation measures will be in place to prevent releases, accidental releases that migrate offsite could result in potential effects to the public.

5.9.2.7 Odors

The WRESC is not expected to emit or cause to be emitted any substances that could cause nuisance odors.

5.9.2.8 Electromagnetic Field Exposure

Electromagnetic fields (EMFs) are composed of electric and magnetic fields and occur independently of one another. EMFs will exist at the WRESC created by electric charges at the 60-Hertz frequency used in transmission lines. Electric fields exist when these charges are not moving. Magnetic fields are created when the electric charges are moving. The magnitude of both electric and magnetic fields falls off rapidly as the distance from the source increases (proportional to the inverse of the square of distance).

Because the electric gen-tie lines do not typically travel through residential areas, and based on findings of the National Institute of Environmental Health Sciences (NIEHS) (1999), EMF exposures are not expected to result in a significant effect on public health. The NIEHS report to the U.S. Congress found that “the probability that EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal scientific support that exposure to this agent is causing any degree of harm” (NIEHS 1999).

California does not currently have a regulatory level for magnetic fields. However, the values estimated for transmission lines similar to the gen-tie lines proposed for the WRESC are well below those established by states that do have limits. Other states have established regulations for magnetic field strengths that have limits ranging from 150 milligauss to 250 milligauss at the edge of the ROW, depending on voltage. The CEC does not currently specify limits on magnetic fields for standard types and sizes of transmission lines.

5.9.2.9 Legionella

Legionella is a bacterium that is ubiquitous in natural aquatic environments and is also widely distributed in human-made water systems. It is the principal cause of legionellosis, otherwise known as Legionnaires’ disease, which is similar to pneumonia. Transmission to people results mainly from inhalation or aspiration of aerosolized contaminated water. Untreated or inadequately treated cooling systems, such as industrial cooling tower cells and building heating, ventilating, and air conditioning systems, have been correlated with outbreaks of legionellosis.

The WRESC will not have a cooling tower or wet surface air cooler. As such, there is no requirement to prepare and implement a water treatment program designed to reduce the potential for Legionella.

5.9.2.10 Summary of Effects

Results from the air toxics HRA based on emissions modeling indicate that there will be no significant incremental public health risks from the construction or operation of the WRESC. Results from criteria pollutant modeling for routine operations indicate that potential ambient concentrations of nitrogen dioxide, CO, sulfur dioxide, and PM_{10} will not significantly affect air quality (Section 5.1, Air Quality). Modeled concentrations are below the federal and California standards established to protect public health, including the more sensitive members of the population.

5.9.3 Cumulative Effects

An analysis of the cumulative impacts of the WRESC, per CEC practice, based on modeling studies conducted by staff, is typically only required if the proposed facility is generally within less than 0.5 miles of another existing major or large toxics emissions source. No such sources were identified within the default distance of 0.5 miles. A

search of the CARB Pollution Mapping Tool shows that the closest tracked source is a cement plant (CalPortland) located approximately 12 miles to the north-northwest of the WRESC.

It is not anticipated that a cumulative impact assessment is justified based on the proposed emission units for the operation of the WRESC, and the proximity to the nearest CARB-tracked air emissions source.

Additionally, mapping provided by CalEnviroScreen 4.0 indicated the following for the WRESC Site and surrounding regional area:

- The Rosamond urban area is classified as a 70 to 80 percentile region, and as such is considered an overburdened community area (see Appendix 5.9D, **Figure 5.9D-4**).
- The Rosamond urban area lies within 2010 census tract 6029005802 (2020 census tract numbers are 58.03 and 58.04), which have a population of approximately 9,479 individuals (see Appendix 5.9D, **Figure 5.9D-5** and **Figure 5.9D-6**).
- The WRESC Site lies approximately 1.6 miles (8,400 feet) north of the Rosamond overburdened area northern boundary.
- The WRESC Site lies in 2010 census tract 6029005506 (2020 census tract number is 55.14), which is classified as a 56 percentile area and has a population of approximately 5,964 individuals.

Based on the HRA results presented above, the proposed facility will not significantly impact the Rosamond overburdened designated area.

5.9.4 Best Practices, Design Features, and Mitigation Measures

Any mitigation measures (if applicable) are described in the sections below.

5.9.4.1 Criteria Pollutants

Emissions of criteria pollutants will be minimized by applying Best Available Control Technology (BACT) to the WRESC. BACT for the engines driving the emergency generators (see Section 5.1, Air Quality).

The WRESC is not proposed to be a major source under nonattainment new source review and thus is not expected to trigger the offset requirements of EKAPCD Rule 210.1A IV(A). Therefore, further mitigation of emissions is not required to protect public health.

5.9.4.1.1 Toxic Pollutants

Emissions of toxic pollutants to the air will be minimized using BACT/TBACT at the WRESC, (i.e., the use of best management practices for the control of CO, volatile organic compounds, and gaseous toxic constituents).

5.9.4.1.2 Legionella Mitigation Measure

The WRESC Project will not include cooling towers or wet surface air coolers; therefore, a Legionella mitigation plan is not required.

5.9.4.2 Hazardous Materials

Mitigation measures for hazardous materials are presented below and discussed in more detail in the Hazardous Materials Handling section. Potential public health effects from the use of hazardous materials are only expected to occur because of an accidental release. The facility has many safety features designed to prevent and minimize effects from the use and accidental release of hazardous materials. The WRESC will include the following design features:

Curbs, an architectural berm, and/or secondary containment structures will be provided where the accidental release of chemicals may occur.

- A fire-protection system will be included to detect, alarm, and in some areas suppress a fire, following applicable LORS.
- Construction of all storage systems will be following applicable construction standards, seismic standards, and LORS.

A Risk Management Plan is not required for operations.

A safety program will be implemented and will include safety training programs for contractors and operations personnel, including instructions on the following:

- Proper use of personal protective equipment
- Safety operating procedures
- Fire safety
- Emergency response actions

The safety program will also include programs on safely operating and maintaining systems that use hazardous materials. Emergency procedures for WRESC personnel include power facility evacuation, hazardous material spill cleanup, fire prevention, and emergency response.

Areas subject to potential leaks of hazardous materials will be paved and architectural bermed. Incompatible materials will be stored in separate containment areas. Containment areas will be drained to either a collection sump or to holding or neutralization tanks. Piping and tanks exposed to potential traffic hazards will be additionally protected by traffic barriers.

5.9.5 Laws, Ordinances, Regulations, and Standards

The relevant LORS that affect public health and apply to the WRESC and the conformity of the WRESC to each of the LORS are presented in this section.

5.9.5.1 Federal Laws, Ordinances, Regulations, and Standards

- 40 Code of Federal Regulations (CFR) Part 50 (National Primary and Secondary Ambient Air Quality Standards): WRESC operations will comply with the NAAQS using air dispersion models.
- 40 CFR Part 63 Subpart ZZZZ (National Emission Standards for Hazardous Air Pollutants [NESHAP] – Reciprocating Internal Combustion Engines): The WRESC will comply with this rule by demonstrating compliance with 40 CFR Part 60 Subpart IIII (see Section 5.1, Air Quality).

5.9.5.2 State Laws, Ordinances, Regulations, and Standards

- California Health and Safety Code (CHSC) Part 6 Sections 44360 to 44366 (Air Toxics “Hot Spots” Information and Assessment): The WRESC will be subject to Part 6 because it will release substances listed in the rule from the combustion of diesel fuel from the emergency generators. GEM A-CAES LLC (GEM, the Applicant) will participate in the requirement to prepare an inventory and health risk analysis (if applicable). Analysis shows that emissions from the WRESC will be below the public notification and risk reduction levels of 10×10^{-6} and 100×10^{-6}, respectively, for operation and that the cancer burden is reasonable for risk due to construction activities.
- CHSC Chapter 6.6, Sections 25249.5 to 25249.14 (Safe Drinking Water and Toxic Enforcement Act of 1986): The WRESC is not anticipated to release chemicals known to cause cancer or reproductive toxicity to a source of drinking water. Air emissions will comply with an air permit that must be obtained from EKAPCD. The results of the HRA show that air emissions do not exceed public notice thresholds.
- CHSC Sections 25500 to 25542 (Hazmat Inventory): As applicable, GEM will prepare required hazardous materials plans and inventories and submit them to the proper authorities (see Section 5.5, Hazardous Materials.)
- California Code of Regulations Title 17 Section 70200 (CAAQS): Emissions from Willow Rock operations shows compliance with the CAAQS using air dispersion models.

5.9.5.3 Eastern Kern Air Pollution Control District Laws, Ordinances, Regulations, and Standards

- EKAPCD Regulation II, Rule 201.2 (synthetic minor sources): Emissions of hazardous air pollutants (HAPs) from the operational WRESC will be less than 10 tons per year of an individual HAP and 25 tons per year total HAP and will therefore be classified as a minor source of HAP.

- EKAPCD Regulation II, Rule 208.1 (disclosure of air toxics information): All issued air permits will contain a requirement to comply with CHSC Sections 44300 through 44384, known as the Air Toxics "Hot Spots" Information and Assessment Act. The WRESC will comply with the issued air permit condition.
- EKAPCD Regulation II, Rule 208.2.II.F (finding of no significant impact): This rule establishes that any increase in cancer risk less than one per million and total HI less than 0.2 justifies that the activity is not subject to the California Environmental Quality Act. The HRA shows that risks from WRESC operations will be less than these values.
- EKAPCD Regulation II, Rule 210.9 (construction of major stationary source of HAP): The WRESC will not be a major stationary source of HAP; therefore, this rule will not apply.
- EKAPCD Regulation IV, Rule 423 (NESHAP): This rule incorporates by reference the federal NESHAP under 40 CFR Parts 61 and 63; applicability is discussed under federal LORS.

5.9.5.4 Permits Required and Schedule

Agency-required permits or plans related to public health include a hazardous materials management plan and EKAPCD Permits to Construct/Permits to Operate air emission units. These requirements are discussed in detail in the Hazardous Materials Handling section and Section 5.1, Air Quality, respectively.

5.9.5.5 Agencies Involved and Agency Contacts

Table 5.9-11 provides contact information for agencies involved with Public Health.

Table 5.9-11: Agency Contacts for Public Health

Public Health Concern	Regulatory Agency	Regulatory Contact
Public exposure to air pollutants	*U.S. Environmental Protection Agency Region 9*	*Deborah Jordan, Acting Regional Administrator U.S. EPA Region 9 75 Hawthorne St. San Francisco, CA 94105 (415) 947-8000*
Public exposure to air pollutants	*California Air Resources Board*	*LinYing Li 1001 I Street, 19th Floor Sacramento, CA 95814 (916) 322 1721*
Public exposure to air pollutants	*Eastern Kern Air Pollution Control District*	*Glen Stephens, P.E., Air Pollution Control Officer 2700 M Street, Suite 302 Bakersfield, CA 93301 (661) 862-5250*
Public exposure to chemicals known to cause cancer or reproductive toxicity	*Office of Environmental Health Hazard Assessment*	*Martha Sandy, Ph.D., Branch Chief 1001 I Street, 19th Floor Sacramento, CA 95814 (916) 324-7572*
Public exposure to acutely hazardous materials	*Kern County Public Health Services Department of Toxic Substance Control*	*Brynn Carrigan, Director 2700 M Street, Suite 300 Bakersfield, CA 93301-2370 (661) 862-8740*

5.9.6 References

Eastern Kern Air Pollution Control District (EKAPCD). 2018-2019 Information Report.

Hotspots Analysis and Reporting Program (HARP2). 2015. User Guide, Version 2.0.3. Cal-EPA Air Resources Board, ADMRT Version 21081.

Hutt, P.B. 1985. "Use of Quantitative Risk Assessment in Regulatory Decision Making Under Federal Health and Safety Statutes." Risk Quantitation and Regulatory Policy. Eds. D.G. Hoel, R.A. Merrill and F.P. Perera. Banbury Report 19, Cold Springs Laboratory.

Kern County Public Health Services Department. 2018. Kern County Community Health Assessment and Improvement Plan: 2018-2019. https://kernpublichealth.com/wp-content/uploads/2019/12/KCPHSD-Community-Health-Assessment-and-Improvement-Plan-2018.2019.pdf. Accessed February 19, 2024.

National Institute of Environmental Health Sciences (NIEHS). 1999. Environmental Health Institute report concludes evidence is 'weak' that EMFs cause cancer. Press release. National Institute of Environmental Health Sciences, National Institutes of Health.

California Office of Environmental Health Hazard Assessment and California Air Resources Board (OEHHA/CARB). 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines, Cal-EPA. February 2015.

California Office of Environmental Health Hazard Assessment and California Air Resources Board (OEHHA/CARB). 2023. Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values. October 16, 2023.

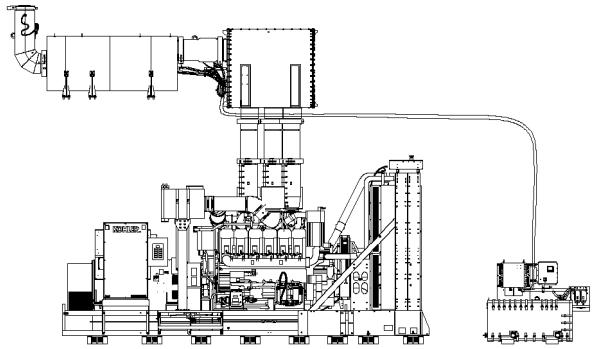
Travis, C. C., E. A. C. Crouch, R. Wilson, and E.D. Klema. 1987. "Cancer Risk Management: A Review of 132 Federal Regulatory Cases." Environ. Sci. Technol. 21: 415-420.

Attachment 5
Engine Brochures and Specifications

KOHLER®

Industrial Diesel Generator Set - KD2500-4

Tier 4 EPA-Certified for Stationary, Prime, Continuous Applications



KDxxxx-4 designates a 60 Hz generator set with a Tier 4 EPA-Certified engine.

Ratings Range

		60 Hz
Standby:	**kW**	2250-2500
	kVA	2812-3125
Prime:	**kW**	2050-2270
	kVA	2562-2838
Continuous:	**kW**	1720-1900
	kVA	2150-2375

Standard Features

- Kohler Co. provides one-source responsibility for the generating system and accessories.
- The generator set and its components are prototype-tested, factory-built, and production-tested.
- The 60 Hz generator set offers a UL 2200 listing.
- The generator set accepts rated load in one step.
- The 60 Hz generator set meets NFPA 110, Level 1, when equipped with the necessary accessories and installed per NFPA standards.
- A standard three-year or 1000-hour limited warranty for standby applications. Five-year basic, five-year comprehensive, and ten-year extended limited warranties are also available.
- A standard two-year or 8700-hour limited warranty for prime power applications. Five-year basic and five-year comprehensive warranties are also available.
- A standard one-year warranty with unlimited hours for continuous power applications.
- Other features:
  - Kohler designed controllers for one-source system integration and remote communication. See Controller on page 4.
  - The low coolant level shutdown prevents overheating (standard on radiator models only).

General Specifications

Orderable Generator Model Number	GMKD2500-4
Manufacturer	Kohler
Engine: model	KD62V12
Alternator Choices	KH06930TO4D KH07000TO4D KH07770TO4D KH08100TO4D KH08430TO4D KH09270TO4D
Performance Class	Per ISO 8528-5
One Step Load Acceptance	100%
Voltage	Wye, 600 V., 4160 V, or 6600-13800 V
Controller	APM603
Fuel Tank Capacity, L (gal.)	16383 (4328)
Fuel Consumption, L/hr (gal./hr) 100% at Standby	661 (174.6)
Fuel Consumption, L/hr (gal./hr) 100% at Prime Power	595 (157.2)
Fuel Consumption, L/hr (gal./hr) 100% at Continuous Power	484 (127.8)
DEF Consumption, L/hr (gal./hr) 100% at Standby	46.2 (12.2)
DEF Consumption, L/hr (gal./hr) 100% at Prime Power	53.5 (14.2)
DEF Consumption, L/hr (gal./hr) 100% at Continuous Power	45.9 (12.1)
Emission Level Compliance (KDxxxx)	Tier 4
Open Unit Noise Level @ 7 m dB(A) at Rated Load	—
Data Center Continuous (DCC) Rating (Refer to TIB-101 for definitions)	Same as the Standby Rating below

Generator Set Ratings

				150°C Rise Standby Rating		130°C Rise Standby Rating		125°C Rise Prime Rating		105°C Rise Prime Rating		80°C Rise Continuous Rating	
Alternator	**Voltage**	**Ph**	**Hz**	**kW/kVA**	**Amps**	**kW/kVA**	**Amps**	**kW/kVA**	**Amps**	**kW/kVA**	**Amps**	**kW/kVA**	**Amps**
KH06930TO4D	277/480	3	60	2500/3125	3759	2500/3125	3759	2270/2838	3414	2270/2838	3414	1890/2362	2842
KH07000TO4D	347/600	3	60	2500/3125	3008	2500/3125	3008	2270/2838	2731	2250/2812	2706	1880/2350	2262
	2400/4160	3	60	2500/3125	434	2500/3125	434	2270/2838	394	2250/2812	391	1880/2350	327
KH07770TO4D	277/480	3	60	2500/3125	3759	2500/3125	3759	2270/2838	3414	2270/2838	3414	1880/2350	2827
	347/600	3	60	2500/3125	3008	2500/3125	3008	2270/2838	2731	2270/2838	2731	1880/2350	2262
	2400/4160	3	60	2500/3125	434	2500/3125	434	2270/2838	394	2270/2838	394	1900/2375	330
KH08430TO4D	240/416	3	60	2500/3125	4338	2500/3125	4338	2270/2838	3939	2270/2838	3939	1880/2350	3262
	277/480	3	60	2500/3125	3759	2500/3125	3759	2270/2838	3414	2270/2838	3414	1880/2350	2827
	347/600	3	60	2500/3125	3008	2500/3125	3008	2270/2838	2731	2270/2838	2731	1890/2362	2273
	2400/4160	3	60	2500/3125	434	2500/3125	434	2270/2838	394	2270/2838	394	1880/2350	327

RATINGS: All three-phase units are rated at 0.8 power factor. *Standby Ratings:* The standby rating is applicable to varying loads for the duration of a power outage. There is no overload capability for this rating. *Prime Power Ratings:* At varying load, the number of generator set operating hours is unlimited. A 10% overload capacity is available for one hour in twelve. Ratings are in accordance with ISO-8528-1 and ISO-3046-1. For limited running time and continuous ratings, consult the factory. Obtain technical information bulletin (TIB-101) for ratings guidelines, complete ratings definitions, and site condition derates. The generator set manufacturer reserves the right to change the design or specifications without notice and without any obligation or liability whatsoever.

Industrial Diesel Generator Set - KD2500-4

Tier 4 EPA-Certified for Stationary, Prime, Continuous Applications

Alternator	Voltage	Ph	Hz	130°C Rise Standby Rating kW/kVA	Amps	105°C Rise Prime Rating kW/kVA	Amps	80°C Rise Continuous Rating kW/kVA	Amps
KH08100TO4D	3810/6600	3	60	2500/3125	274	2270/2838	249	1880/2350	206
	7200/12470	3	60	2250/2812	131	2050/2562	119	1710/2138	100
	7620/13200	3	60	2380/2975	131	2180/2725	120	1820/2275	100
	7970/13800	3	60	2500/3125	131	2270/2838	119	1880/2350	99
KH09270TO4D	3810/6600	3	60	2500/3125	274	2270/2838	249	1890/2362	207
	7200/12470	3	60	2500/3125	145	2270/2838	132	1880/2350	109
	7620/13200	3	60	2500/3125	137	2270/2838	125	1880/2350	103
	7970/13800	3	60	2500/3125	131	2270/2838	119	1880/2350	99

Engine Specifications	60 Hz
Manufacturer	Kohler
Engine: model	KD62V12-6CNS KD62V12-6CNP KD62V12-6CNC
Engine: type	4-Cycle, Turbocharged, Intercooled
Cylinder arrangement	12-V
Displacement, L (cu. in.)	62 (3783)
Bore and stroke, mm (in.)	175 x 215 (6.89 x 8.46)
Compression ratio	16.0:1
Piston speed, m/min. (ft./min.)	774 (2539)
Main bearings: quantity, type	7, Precision Half Shells
Rated rpm	1800
Max. power at rated rpm, kWm (BHP)	2700 (3621)
Cylinder head material	Cast Iron
Crankshaft material	Steel
Valve (exhaust) material	Steel
Governor: type, make/model	KODEC Electronic Control
Frequency regulation, no-load to-full load	Isochronous
Frequency regulation, steady state	±0.25%
Frequency	Fixed
Air cleaner type, all models	Dry

Lubricating System	60 Hz
Type	Full Pressure
Oil pan capacity with filter (initial fill), L (qt.) §	335 (354)
Oil filter: quantity, type §	6, Cartridge
Oil cooler	Water-Cooled

§ Kohler recommends the use of Kohler Genuine oil and filters.

Fuel System	60 Hz
Fuel supply line, min. ID, mm (in.)	25 (1.0)
Fuel return line, min. ID, mm (in.)	19 (0.75)
Max. fuel flow, Lph (gph)	881 (232.7)
Min./max. fuel pressure at engine supply connection, kPa (in. Hg)	-50/50 (-14.8/14.8)
Max. return line restriction, kPa (in. Hg)	30 (8.9)
Fuel filter: quantity, type	2, Primary Engine Filter 2, Fuel/Water Separator
Recommended fuel	#2 Diesel ULSD

	Diesel Fuel Consumption	DEF Consumption
	Standby Rating	**Standby Rating**
% load	**Lph (gph)**	**Lph (gph)**
100%	661 (174.6)	46.2 (12.2)
75%	479 (126.5)	45.5 (12.0)
50%	334 (88.1)	35.0 (9.3)
25%	195 (51.4)	19.5 (5.1)
10%	108 (28.5)	9.7 (2.6)
	Prime Rating	**Prime Rating**
% load	**Lph (gph)**	**Lph (gph)**
100%	595 (157.2)	53.5 (14.2)
75%	440 (116.2)	44.0 (11.6)
50%	310 (82.0)	32.6 (8.6)
25%	184 (48.7)	18.4 (4.9)
10%	107 (28.2)	9.6 (2.5)
	Continuous Rating	**Continuous Rating**
% load	**Lph (gph)**	**Lph (gph)**
100%	484 (127.8)	45.9 (12.1)
75%	372 (98.2)	37.2 (9.8)
50%	265 (69.9)	27.8 (7.3)
25%	159 (42.1)	15.1 (4.0)
10%	95 (25.1)	8.6 (2.3)

Radiator System	60 Hz	
Ambient temperature, °C (°F)*	50 (122)	40 (104)
Engine jacket water capacity, L (gal.)	356 (94)	
Radiator system capacity, including engine, L (gal.)	643 (170)	539 (142)
Engine jacket water flow, Lpm (gpm)	2082 (550)	
Heat rejected to cooling water at rated kW, dry exhaust, kW (Btu/min.)	ESP 920 (52320) PRP 850 (48339) COP 770 (43790)	
Charge cooler water flow, Lpm (gpm)	662 (174)	
Heat rejected to charge cooling water at rated kW, dry exhaust, kW (Btu/min.)	ESP 870 (49476) PRP 750 (42652) COP 530 (30141)	
Water pump type	Centrifugal	
Fan diameter, including blades, mm (in.)	2235 (88)	1901 (75)
Fan, kWm (HP)	90 (120.7)	85 (114)
Max. restriction of cooling air, intake and discharge side of radiator, kPa (in. H_2O)	0.125 (0.5)	

* Enclosure with enclosed silencer reduces ambient temperature capability by 5°C (9°F).

Remote Radiator System†	60 Hz
Exhaust manifold type	Dry
Connection sizes:	Class 150 ANSI Flange
Water inlet/outlet, mm (in.)	216 (8.5) Bolt Circle
Intercooler inlet/outlet, mm (in.)	178 (7.0) Bolt Circle
Static head allowable above engine, kPa (ft. H_2O)	70 (23.5)

† Contact your local distributor for cooling system options and specifications based on your specific requirements.

Exhaust System	60 Hz
Exhaust flow at rated kW, m^3/min. (cfm)	551 (19468)
Exhaust temperature at rated kW at 25°C (77°F) ambient, dry exhaust, °C (°F)	490 (914)
Maximum allowable back pressure, kPa (in. Hg)	See TIB- 119
Exh. outlet size at eng. hookup, mm (in.)	See ADV drawing

Electrical System	60 Hz
Battery charging alternator:	
Ground (negative/positive)	Negative
Volts (DC)	24
Ampere rating	140
Starter motor qty. at starter motor power rating, rated voltage (DC)	Standard: 2 @ 9 kW, 24; Redundant (optional); 2 @ 15 kW, 24
Battery, recommended cold cranking amps (CCA):	
Quantity, CCA rating each, type (with standard starters)	4, 1110, AGM
Quantity, CCA rating each, type (with redundant starters)	8, 1110, AGM
Battery voltage (DC)	12

Air Requirements	60 Hz
Radiator-cooled cooling air, m^3/min. (scfm)‡	50°C 2549 (90000) 40°C 2321 (82000)
Cooling air required for generator set when equipped with city water cooling or remote radiator, based on 14°C (25°F) rise, m^3/min. (scfm)‡	1116 (39398)
Combustion air, m^3/min. (cfm)	ESP 207 (7310) PRP 194.3 (6863) COP 168 (5943)
Heat rejected to ambient air:	
Engine, kW (Btu/min.)	ESP 130 (7393) PRP 120 (6824) COP 100 (5687)
Alternator, kW (Btu/min.)	160 (9099)

‡ Air density = 1.20 kg/m^3 (0.075 lbm/ft^3)

Alternator Specifications		60 Hz
Type		4-Pole, Rotating-Field
Exciter type		Brushless, Permanent-Magnet Pilot Exciter
Voltage regulator		Solid-State, Volts/Hz
Insulation:		NEMA MG1, UL 1446, Vacuum Pressure Impregnated (VPI)
Material		Class H, Synthetic, Nonhygroscopic
Temperature rise		130°C, 150°C Standby
Bearing: quantity, type		1 or 2, Sealed
Coupling type		Flexible Disc or Coupling
Amortisseur windings		Full
Alternator winding type (up to 600 V)		Random Wound
Alternator winding type (above 600 V)		Form Wound
Rotor balancing		125%
Voltage regulation, no-load to full-load		±0.25%
Unbalanced load capability		100% of Rated Standby Current
Peak motor starting kVA:		(35% dip for voltages below)
480 V	KH06930TO4D	5990
480 V	KH07770TO4D	7170
480 V	KH08430TO4D	9908

Alternator Standard Features

- The pilot-excited, permanent magnet (PM) alternator provides superior short-circuit capability.
- All models are brushless, rotating-field alternators.
- NEMA MG1, IEEE, and ANSI standards compliance for temperature rise and motor starting.
- Sustained short-circuit current of up to 300% of the rated current for up to 10 seconds.
- Sustained short-circuit current enabling downstream circuit breakers to trip without collapsing the alternator field.
- Self-ventilated and dripproof construction.
- Superior voltage waveform from two-thirds pitch windings and skewed stator.
- Brushless alternator with brushless pilot exciter for excellent load response.

NOTE: See TIB- 102 Alternator Data Sheets for alternator application data and ratings, efficiency curves, voltage dip with motor starting curves, and short circuit decrement curves.

Controller

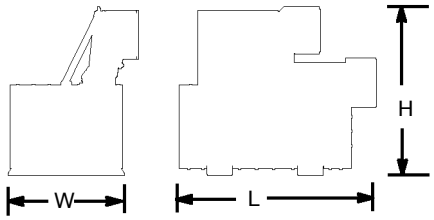
APM603 Controller
Provides advanced control, system monitoring, and system diagnostics for optimum performance and compatibility.

- 7-inch graphic display with touch screen and menu control provides easy local data access
- Measurements are selectable in metric or English units
- Paralleling capability to control up to 8 generators on an isolated bus with first-on logic, synchronizer, kW and kVAR load sharing, and protective relays
  Note: Parallel with other APM603 controllers only
- Generator management to turn paralleled generators off and on as required by load demand
- Load management to connect and disconnect loads as required
- Controller supports Modbus® RTU, Modbus® TCP, SNMP and BACnet®
- Integrated voltage regulator with ±0.25% regulation
- Built-in alternator thermal overload protection
- UL-listed overcurrent protective device
- NFPA 110 Level 1 capability

Refer to G6-162 for additional controller features and accessories.

BACNet® is a registered trademark of ASHRAE.

Diesel Exhaust Fluid (DEF) Tank



Approximate size, L x W x H, mm(in.):	1868 x 1042 x 1479 (73.5 x 41.0 x 58.2)
Tank weight (dry), kg (lb.):	420.6 (927 lb)
Fillable volume:	224 gallons
Consumable volume:	164 gallons
Material:	Stainless steel

Codes and Standards

- Engine- generator set is designed and manufactured in facilities certified to ISO 9001.
- Generator set meets NEMA MG1, BS5000, ISO, DIN EN, and IEC standards, NFPA 110.
- Engine generator set is tested to ISO 8528-5 for transient response.
- The generator set and its components are prototype-tested, factory-built, and production-tested.

Third-Party Compliance

- Tier 4 EPA-Certified for Stationary, Prime, and Continuous Applications

Available Approvals and Listings

- ❑ CSA Certified
- ❑ UL 2200 Listing

Warranty Information

- A standard three-year or 1000-hour limited warranty for standby applications. Five-year basic, five-year comprehensive, and ten-year extended limited warranties are also available.
- A standard two-year or 8700-hour limited warranty for prime power applications. Five-year basic and five-year comprehensive warranties are also available.
- A standard one-year warranty with unlimited hours for continuous power applications.

Available Warranties for Standby Applications

- ❑ 5-Year Basic Limited Warranty
- ❑ 5-Year Comprehensive Limited Warranty
- ❑ 10-Year Major Components Limited Warranty

Available Warranties for Prime Applications

- ❑ 5-Year Basic Limited Warranty
- ❑ 5-Year Comprehensive Limited Warranty

Standard Features

- Closed Crankcase Ventilation (CCV) Filters
- Customer Connection
- Local Emergency Stop Switch
- Oil Drain and Coolant Drain Extension
- Operation and Installation Literature
- Fan Bearing Grease Extension
- Fuel/Water Separator
- Generator Heater
- Spring Isolation Under the Skid
- Battery Rack and Cables

KOHLER®

Industrial Diesel Generator Set - KD2500-4

Tier 4 EPA-Certified for Stationary, Prime, Continuous Applications

Available Options

Circuit Breakers

Type

- ❑ Magnetic Trip
- ❑ Thermal Magnetic Trip
- ❑ Electronic Trip (LI)
- ❑ Electronic Trip with Short Time (LSI)
- ❑ Electronic Trip with Ground Fault (LSIG)

Rating

- ❑ 80%
- ❑ 100%

Operation

- ❑ Manual
- ❑ Electrically Operated (for paralleling)

Circuit Breaker Mounting

- ❑ Generator Mounted
- ❑ Remote Mounted
- ❑ Bus Bar (for remote mounted breakers)

Enclosed Remote Mounted Circuit Breakers

- ❑ NEMA 1 (15- 5000 A)
- ❑ NEMA 3R (15- 1200 A)

Engine Type

- ❑ KDxxxx Tier 4 EPA- Certified Engine

Approvals and Listings

- ❑ CSA Certified
- ❑ IBC Certification Request—Contact Factory
- ❑ UL 2200 Listing
- ❑ cULus Listing (fuel tanks only)
- ❑ Florida Dept. of Environmental Protection (FDEP) Compliance (fuel tanks only)

Enclosed Unit

- ❑ Sound Level 2 Enclosure/Fuel Tank Package

Controller

- ❑ Input/Output, Digital
- ❑ Input/Output, Thermocouple
- ❑ Manual Key Switch
- ❑ Remote Emergency Stop Switch
- ❑ Lockable Emergency Stop Switch
- ❑ Remote Serial Annunciator Panel

Cooling System

- ❑ Block Heater; 9000 W, 208 V, (Select 1 Ph or 3 Ph) *
- ❑ Block Heater; 9000 W, 240 V, (Select 1 Ph or 3 Ph) *
- ❑ Block Heater; 9000 W, 380 V, 3 Ph *
- ❑ Block Heater; 9000 W, 480 V, (Select 1 Ph or 3 Ph) *

* Required for Ambient Temperatures Below 10°C (50°F)

Electrical System

- ❑ Battery, 4/12 V, AGM (kit with qty. 4)
- ❑ Battery Charger
- ❑ Battery Heater; 100 W, 120 V, 1Ph
- ❑ Redundant Starters
- ❑ DEF Tank Heater
- ❑ Load Bank, 300 kW / 350 kW [Recommended for Ambient Temperature > - 5°C (23°F)]
- ❑ Load Bank, 600 kW / 650 kW [Recommended for Ambient Temperature < - 5°C (23°F)]

Fuel System

- ❑ Flexible Fuel Lines
- ❑ Dual Fuel/Water Separator
- ❑ Restriction Gauge (for fuel/water separator)

Literature

- ❑ General Maintenance
- ❑ NFPA 110
- ❑ Overhaul
- ❑ Production

Miscellaneous

- ❑ Air Cleaner, Heavy Duty
- ❑ Air Cleaner Restriction Indicator
- ❑ Automatic Oil Replenishment System
- ❑ Engine Fluids (oil and coolant) Added
- ❑ Rated Power Factor Testing
- ❑ Weld- On Flange, DIN300
- ❑ Weld- On Flange, DEF Tank

Electrical Package (Requires Enclosure selection)

- ❑ Basic Electrical Package (select 1 Ph or 3 Ph)
- ❑ Wire Battery Charger (1 Ph)
- ❑ Wire Block Heater (select 1 Ph or 3 Ph)
- ❑ Wire Power Supply
- ❑ Wire Generator Heater (1 Ph)

Warranty (Standby Applications only)

- ❑ 5-Year Basic Limited Warranty
- ❑ 5-Year Comprehensive Limited Warranty
- ❑ 10-Year Major Components Limited Warranty

Warranty (Prime Applications only)

- ❑ 5-Year Basic Limited Warranty
- ❑ 5-Year Comprehensive Limited Warranty

Other

- ❑

Dimensions and Weights

Generator set size, max., L1 x W x H1, mm (in.):	6958 x 3210 x 3301 (273.9 x 126.4 x 130)
With rear- facing SCR, max., L2 x W x H2, mm (in.):	7696 x 3210 x 6216 (302.9 x 126.4 x 244.7)
Weight, radiator model, max. wet, kg (lb.):	27033 (59598)
Weight, with radiator and SCR, max. wet, kg (lb.):	29185 (64341)

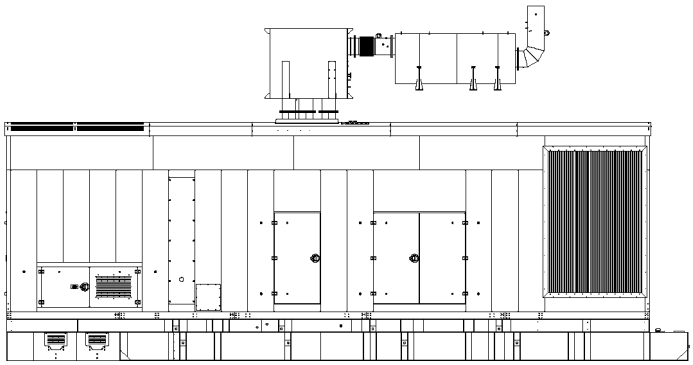
NOTE: This drawing is provided for reference only and should not be used for planning installation. Contact your local distributor for more detailed information.

KOHLER CO., Kohler, Wisconsin 53044 USA
Phone 920-457-4441, Fax 920-459-1646
For the nearest sales and service outlet in the US and Canada, phone 1-800-544-2444
KOHLERPower.com

Sound Enclosures and Subbase Fuel Tank

Sound Level 2 Enclosure Standard Features

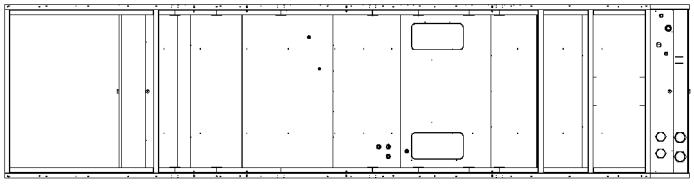
- Lift base or tank-mounted, aluminum construction enclosure with internal-mounted, exhaust silencers.
- Every enclosure has a sloped roof to reduce the buildup of moisture and debris.
- Sound attenuated enclosure that offers noise reduction using up to 51 mm (2 in.) acoustic insulation material, acoustic-lined air inlets, an acoustic-lined air discharge intake sound baffles, vertical air discharge, and secondary silencers.
- Fade-, scratch-, and corrosion-resistant Kohler® Power Armor™ automotive-grade textured finish.
- Acoustic insulation that meets UL 94 HF1 flammability classification.
- Enclosure has large access doors that are hinged and removable which allow for easy maintenance.
- Lockable, flush-mounted door latches.
- Air inlet louvers reduce rain and snow entry.
- High wind bracing, 241 kph (150 mph).
- Louvered air inlet and vertical outlet hood with 90 degree angles to redirect air and reduce noise.



Sound Level 2 Enclosure
(Shown with available spill containment)

Subbase Fuel Tank Features

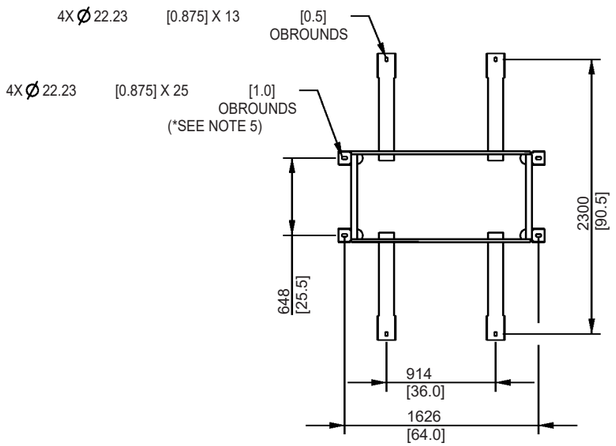
- The fuel tank has a Power Armor Plus™ textured epoxy-based rubberized coating.
- The above-ground rectangular secondary containment tank mounts directly to the generator set, below the generator set skid (subbase).
- Both the inner and outer tanks have UL-listed emergency relief vents.
- Flexible fuel lines are provided with subbase fuel tank selection.
- The containment tank's construction protects against fuel leaks or ruptures. The inner (primary) tank is sealed inside the outer (secondary) tank. The outer tank contains the fuel if the inner tank leaks or ruptures.
- The above ground secondary containment subbase fuel tank meets UL 142 requirements.
- Features include:
  - Additional fittings for optional accessories (qty. 3)
  - Electrical stub-up area open to bottom
  - Emergency inner and outer tank relief vents
  - Fuel fill with lockable cap and 51 mm (2 in.) riser
  - Fuel leak detection switch
  - Fuel level mechanical gauge
  - Fuel level sender
  - Normal vent
  - Removable engine supply and return diptubes



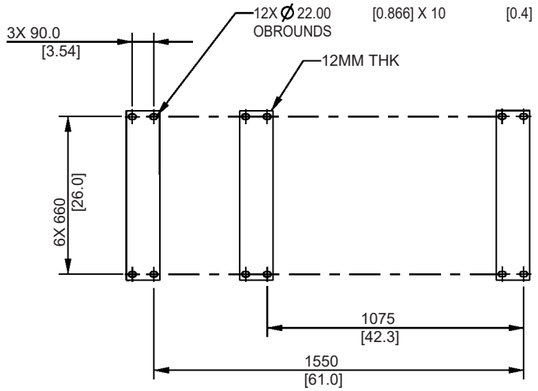
Subbase Fuel Tank (Top View)

DISTRIBUTED BY:

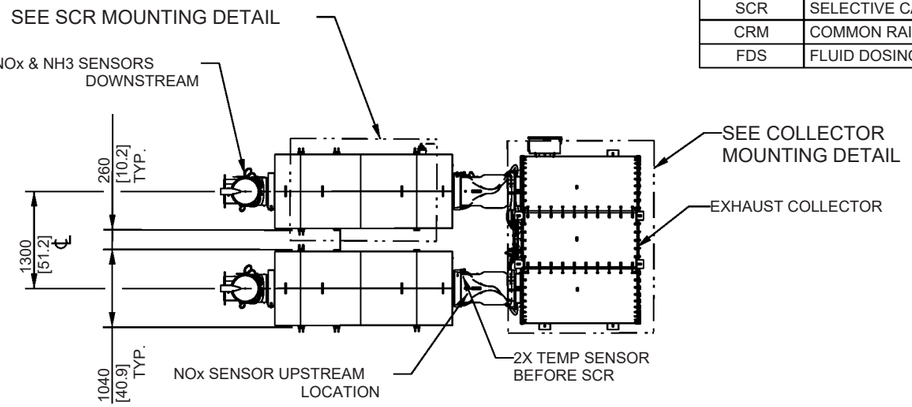
ACRONYM	FULL DESCRIPTION
DEF	DIESEL EXHAUST FLUID
SCR	SELECTIVE CATALYTIC REDUCTION
CRM	COMMON RAIL MANIFOLD
FDS	FLUID DOSING SYSTEM

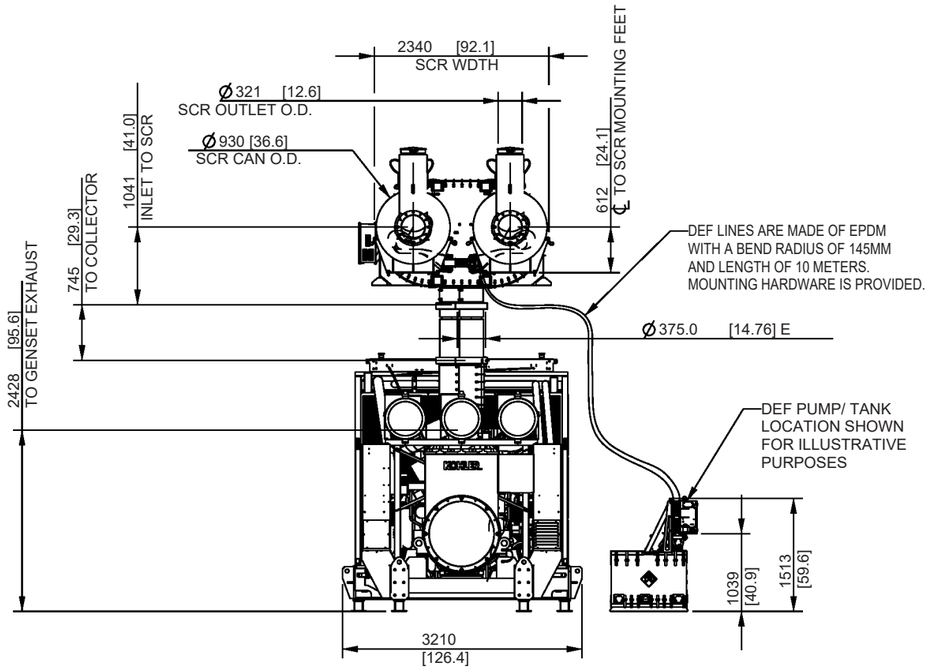


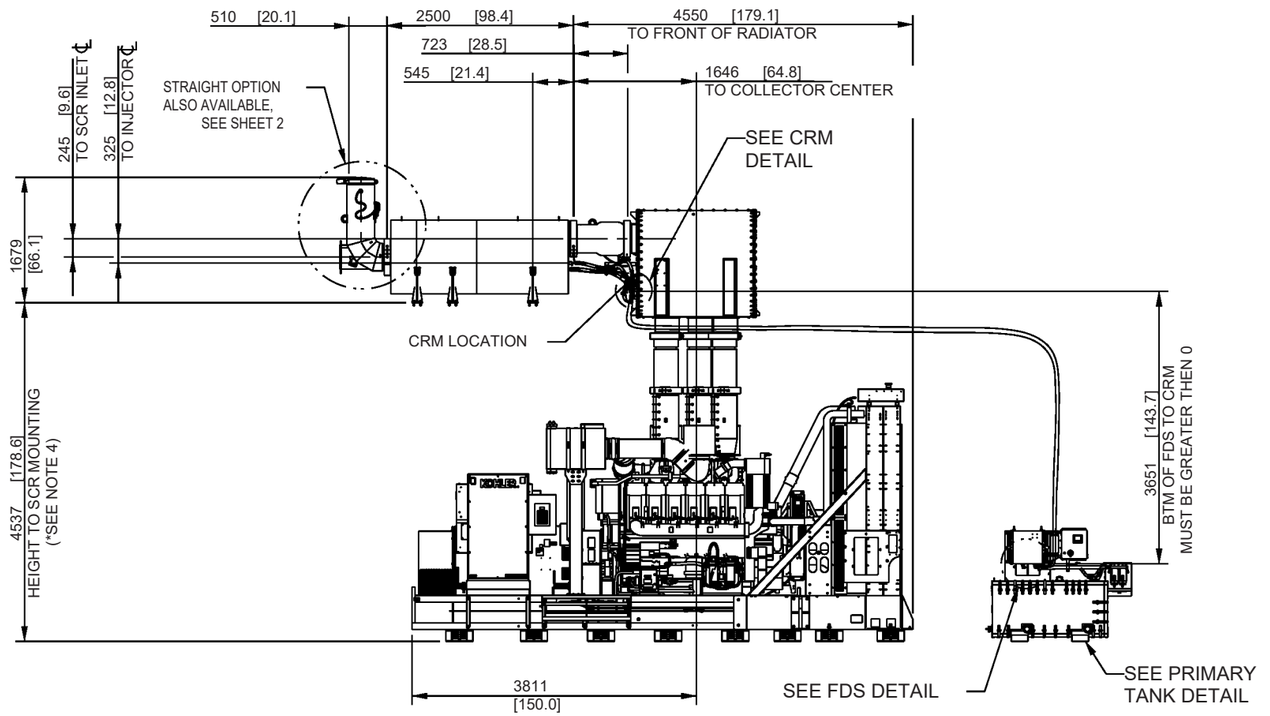
COLLECTOR MOUNTING DETAIL
SCALE 0.04

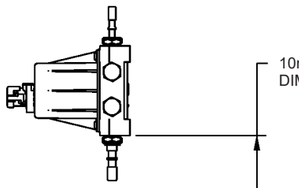


SCR MOUNTING DETAIL (2 PLACES)
SCALE 0.08

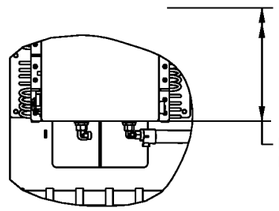








CRM DETAIL
SCALE 0.30



FDS DETAIL
SCALE 0.10

KD2500-4
TIER 4 CERTIFIED

NOTES:
1. SEE BASE GENERATOR ADV-8925 FOR MORE DIMENSIONAL INFORMATION.
2. SEE TP-7153 FOR MORE INFORMATION ON AFTER TREATMENT SYSTEM.
3. COLLECTOR MOUNTING MUST FULLY SUPPORT EXHAUST PIPING SUCH THAT NO WEIGHT IS ON TURBO ELBOWS.
4. IT IS RECOMMENDED THAT THE STRUCTURE MANUFACTURING AND MOUNTING PAD CONSTRUCTION TOLERANCES BE SUBTRACTED FROM THIS DIMENSION AND THE SCR BE SHIMMED DURING INSTALLATION TO ALLOW PROPER ALIGNMENT OF THE SYSTEM COMPONENTS.
5. 4X RECOMMENDED LIFT POINTS.

REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
-	2-14-20	NEW DRAWING [CT201889]	SLR

DO NOT SCALE, REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS IN MILLIMETERS
GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

APPROVALS	DATE
DRAWN SLR	2-14-20
CHECKED BGW	2-14-20
APPROVED BMK	2-14-20

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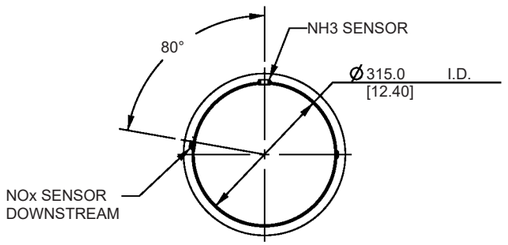
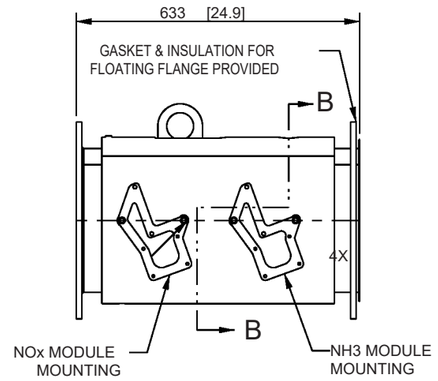
TITLE: DIMENSION PRINT, KD2500-4 (T4 CERTIFIED)

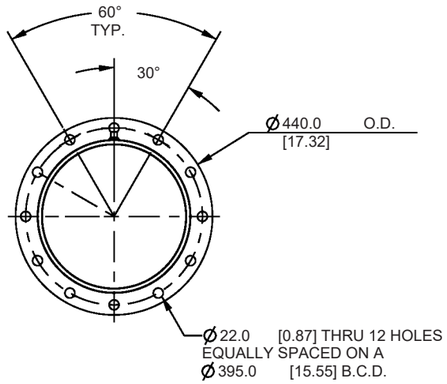
SCALE 0.03 | CAD NO. | SHEET 1 of 3

DWG NO. ADV-9163 | D

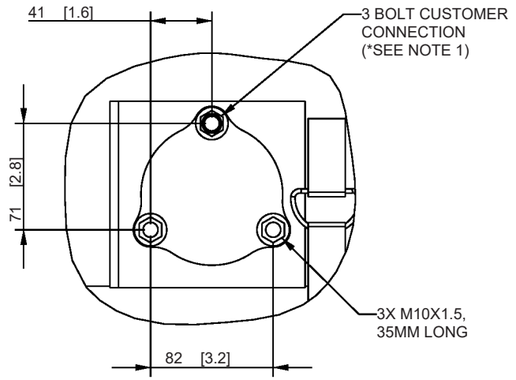


SECTION B-B

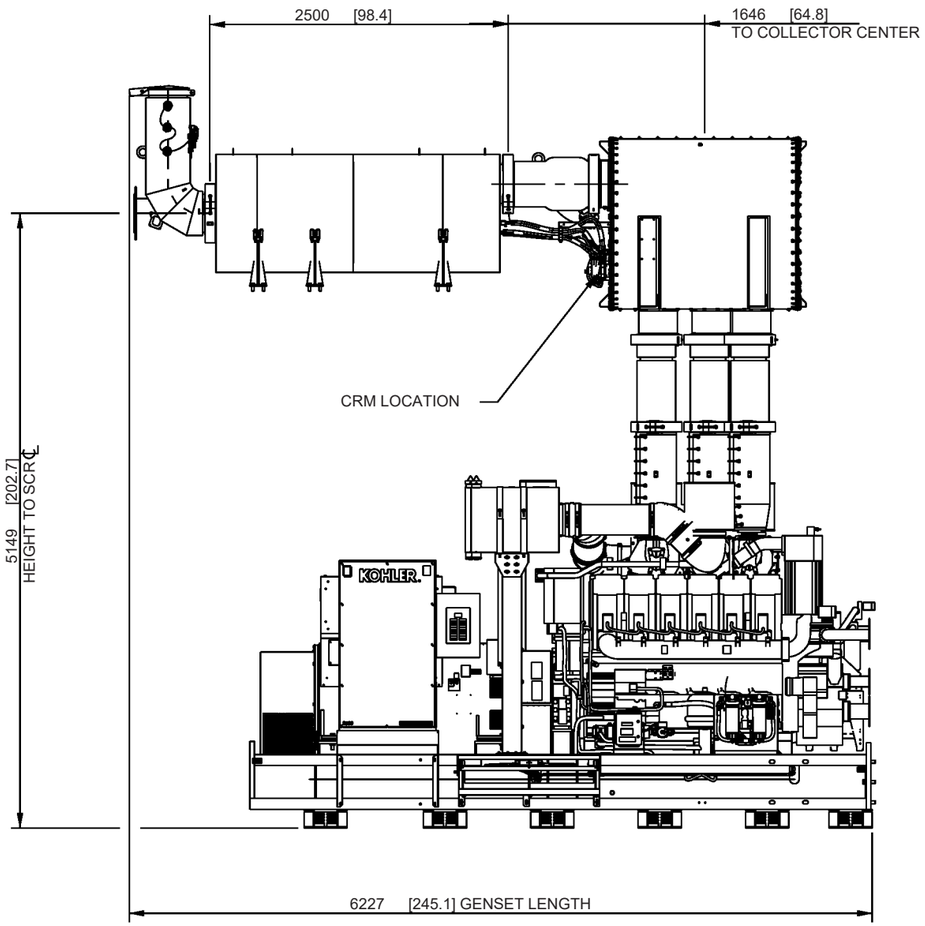




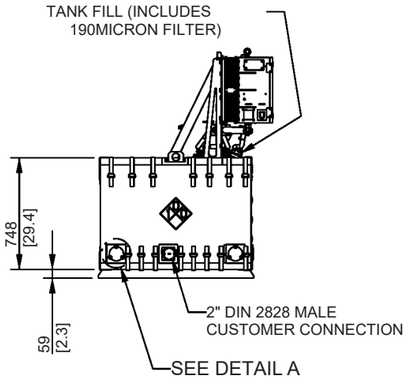
STRAIGHT OUTLET OPTION
SCALE 0.15

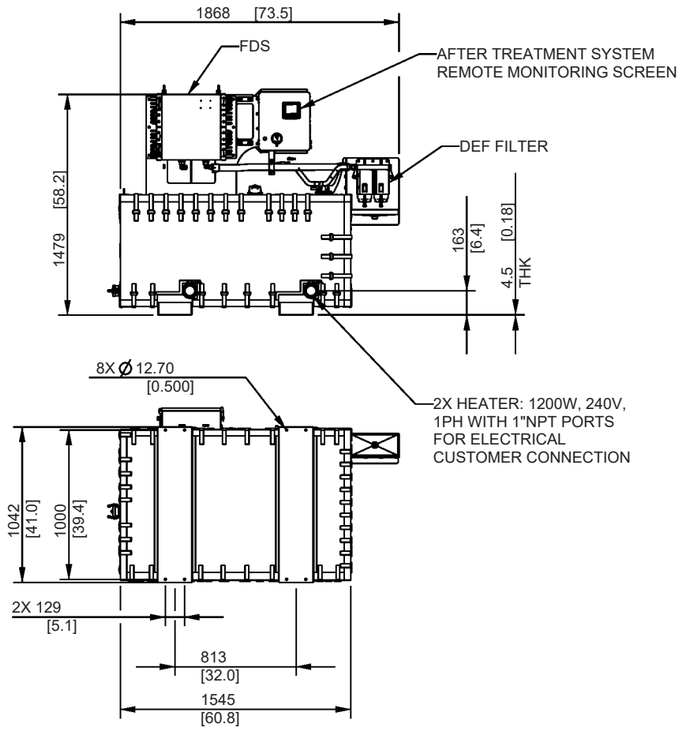


DETAIL A
SCALE 0.50



REMOTE RADIATOR CONFIGURATION SHOWN FOR VISUALIZATION





PRIMARY DEF TANK DETAIL
SCALE 0.05

NOTES:
1. SCR DOSING SYSTEM IS 24V DC PROVIDED BY THE GENERATOR.

KD2500-4
TIER 4 CERTIFIED

REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
-	2-14-20	NEW DRAWING [CT201889]	SLR

DO NOT SCALE. REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS IN MILLIMETERS
GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	SLR	2-14-20
CHECKED	BGW	2-14-20
APPROVED	BMK	2-14-20

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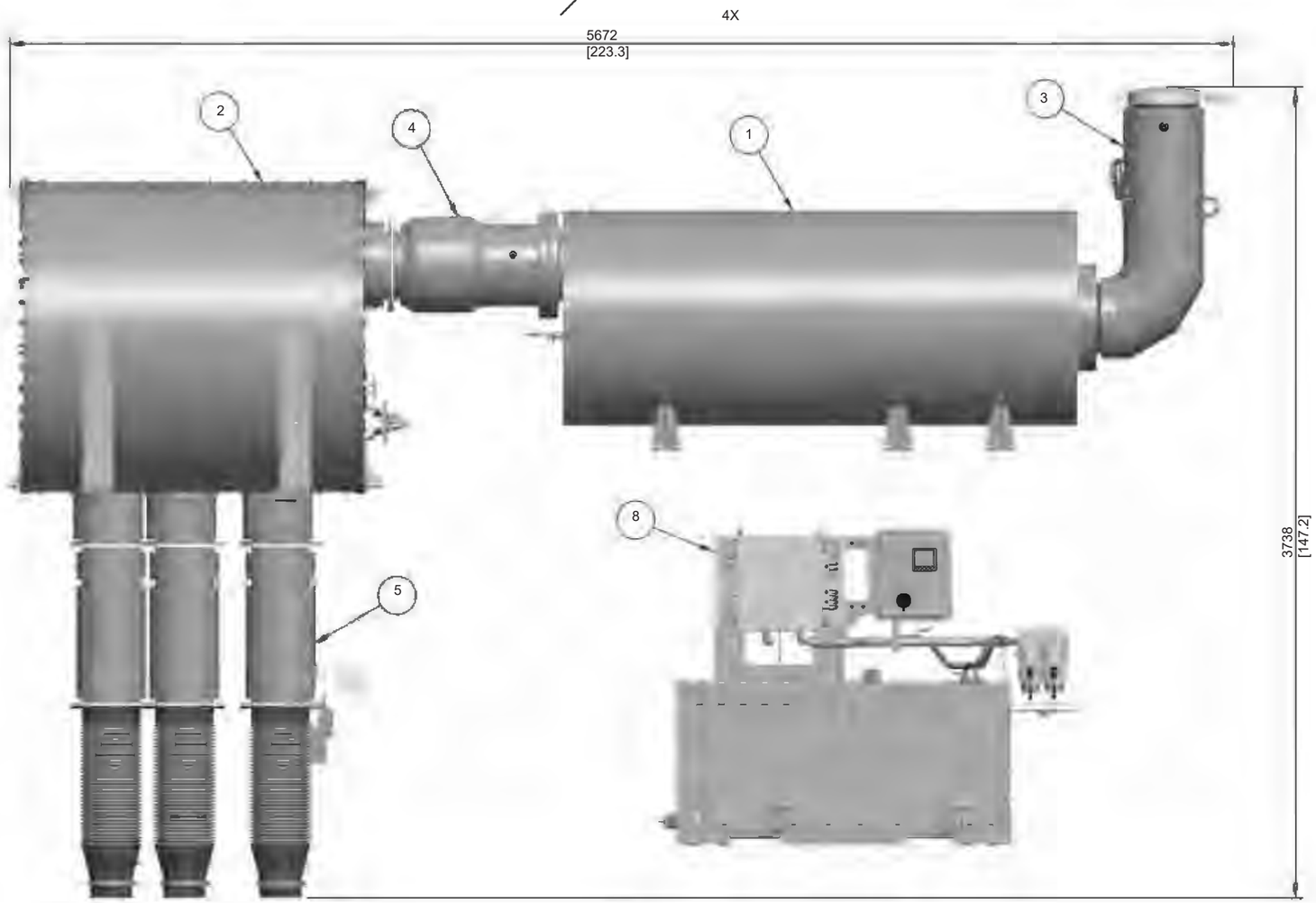
KOHLER, WISCONSIN 53044

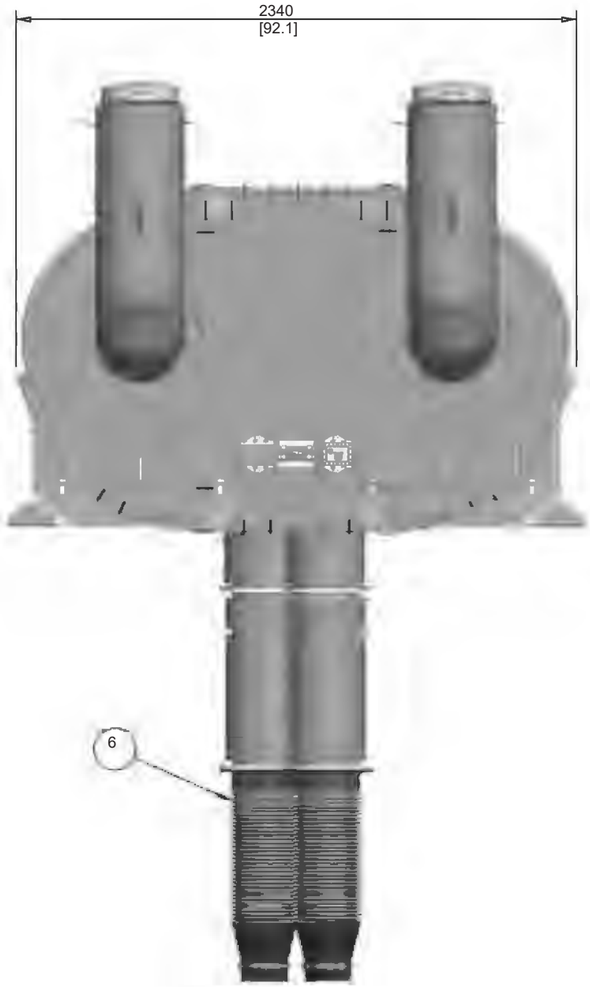
TITLE: DIMENSION PRINT, KD2500-4 (T4 CERTIFIED)

SCALE 0.04 | CAD NO. | SHEET 2 of 3

DWG NO. ADV-9163 | D

ITEM NO	PART NUMBER	DESCRIPTION	MASS [Kg]	QTY	SUBTOTAL OF MASS [Kg]	NOTES
1	10901011701	SCR	550	2	1100	
2	10901016301	COLLECTOR, EXHAUST, K175V16	663	1	663	
3	10901015800	TUBE, OUTLET SCR (DOWNSTREAM)	43	2	86	
4	10901017301	TUBE, INLET SCR, K175	36	2	71	
5	10901027702	PIPE, EXHAUST	8	3	25	
6	10901017401	TUBE, FLEX EXHAUST	19	3	57	
7	-	INSULATION, PIPING	150	1	150	
GRAND TOTAL MASS [Kg]					2152	





DEF TANK (ITEM 8)		
DESCRIPTION	MASS [Kg]	NOTES
DRY TANK	420.6	WITH ALL ACCESSORIES
WET TANK	1375.6	WITH ALL ACCESSORIES

KD2500-4
TIER 4 CERTIFIED

REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
-	2-14-20	NEW DRAWING [CT201889]	SLR

DO NOT SCALE, REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS IN MILLIMETERS
GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

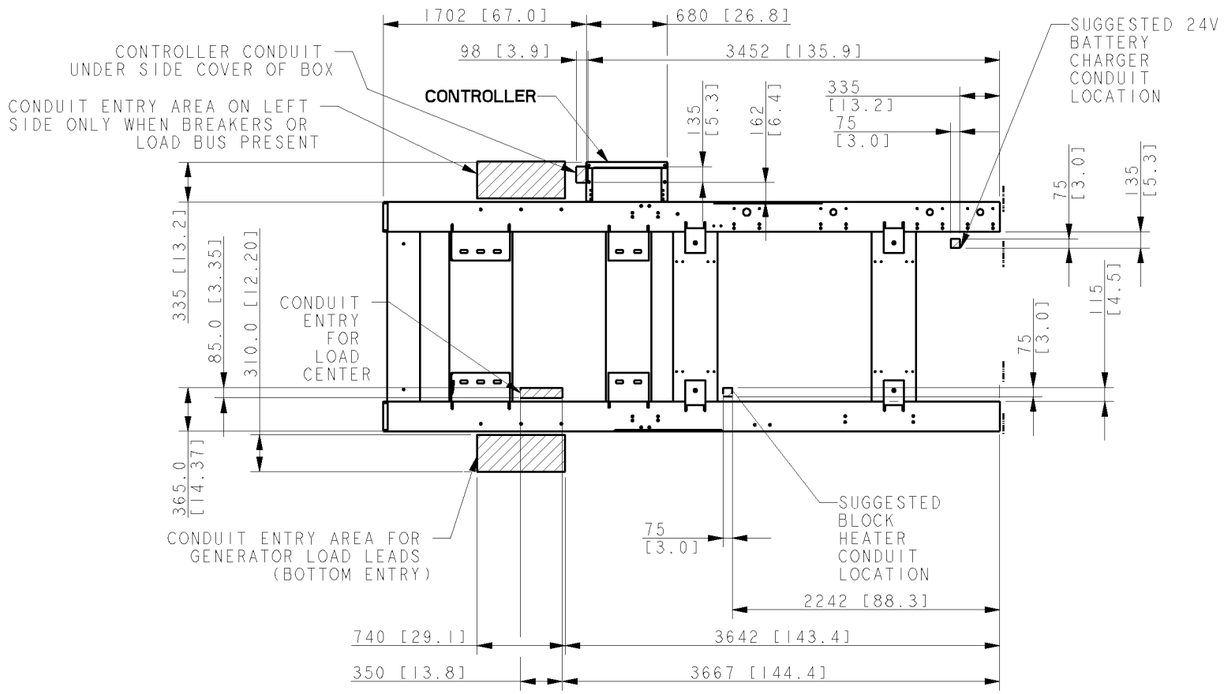
APPROVALS		DATE
DRAWN	SLR	2-14-20
CHECKED	BGW	2-14-20
APPROVED	RMK	2-14-20

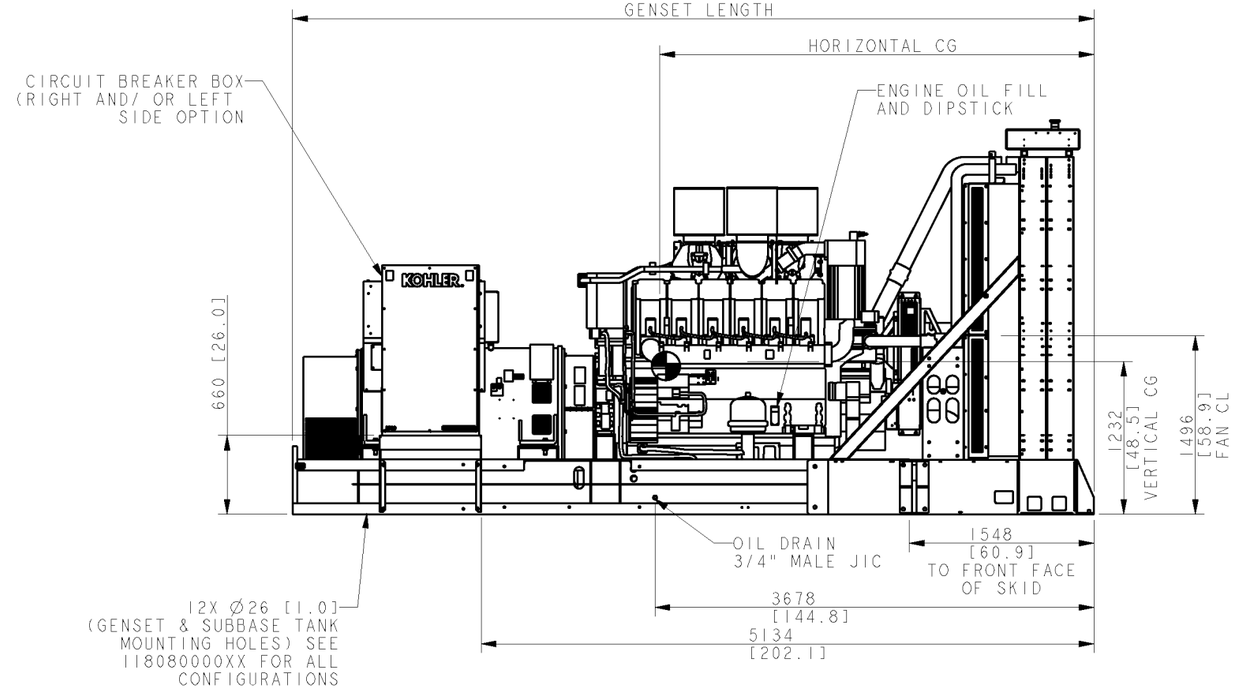
KOHLER
Kohler, Wisconsin 53044

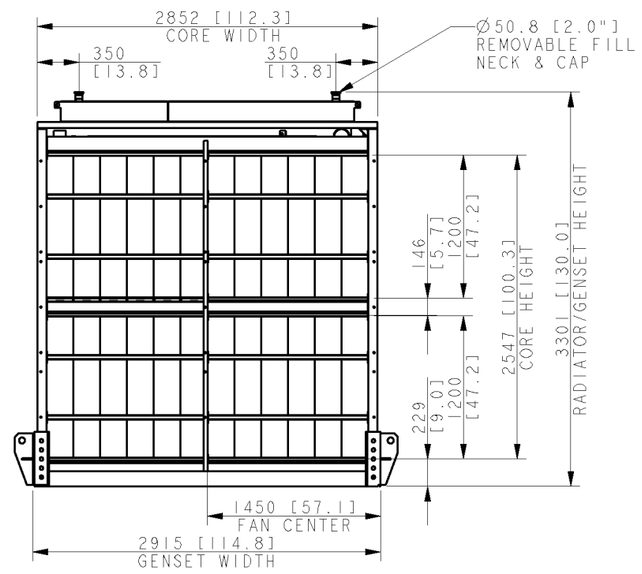
TITLE
DIMENSION PRINT, KD2500-4 (T4 CERTIFIED)

SCALE 0.08 | CAD NO. | SHEET 3 of 3

DWG NO. ADV-9163 | D







MODEL	ALTERNATOR	GENSET MAXIMUM WEIGHT (WET) KG [LB]	HORIZONTAL CG (WET) MM [IN]	GENSET LENGTH MM [IN]
KD2000	KH04970TO4D	22417 [49422]	3114 [122.6]	6215 [244.7]
KD2000	KH07080TO4D	25447 [56101]	3439 [135.4]	6958 [273.9]
KD2000/ KD2250	KH05790TO4D	22940 [50574]	3171 [124.9]	6215 [244.7]
KD2000/ KD2250	KH06220TO4D	22936 [50565]	3202 [126.1]	6715 [264.4]
KD2000/ KD2250	KH07630TO4D	25859 [57010]	3472 [136.7]	6715 [264.4]
KD2250/ KD2500	KH08100TO4D	26883 [59266]	3567 [140.4]	6958 [273.9]
KD2000/ KD2250/ KD2500	KH06930TO4D	23471 [51744]	3222 [126.8]	6215 [244.7]
KD2000/ KD2250/ KD2500	KH07000TO4D	23486 [51778]	3257 [128.2]	6715 [264.4]
KD2000/ KD2250/ KD2500	KH07770TO4D	23881 [52648]	3326 [130.9]	6715 [264.4]
KD2000/ KD2250/ KD2500	KH09270TO4D	27033 [59598]	3597 [141.6]	6958 [273.9]
KD2000/ KD2250/ KD2500	KH08430TO4D	24205 [53363]	3362 [132.4]	6715 [264.4]

ALL VIEWS REPRESENTED WITH 50C RADIATOR

NOTES:
1) DIMENSIONS IN [ ] ARE ENGLISH EQUIVALENTS.

2) IF AN ENCLOSURE IS USED THE FUEL LINE MUST BE STUBBED UP FROM DIRECTLY UNDER THE UNIT. REFER TO ENCLOSURE ADV.

3) IF IBC OR OSHPD CERTIFICATION IS REQUIRED SEE SEISMIC ADV FOR INSTALLATION INSTRUCTIONS.

4) IF SUBBASE FUEL TANK AND/OR ENCLOSURE IS USED, REFER TO SUBBASE FUEL TANK/ENCLOSURE ADV TO DETERMINE MOUNTING LOCATIONS.

KD2000, KD2250, KD2500
KD62V12

REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
K	9APR2019	(A-2) TOLERANCES REMOVED; (C-3)REDUNDANT	
		RADIATOR LINES REMOVED [CT194818]	SUD
L	12-20-19	(C-3,2,1) RADIATOR DIMENSIONS TABLE REMOVED;	
		(D-4,3) 50C RADIATOR NOTE ADDED; SHEET 2 ADDED;	
		CONTENT FROM SHEET 2,3,4,5,6,7 & 8 MOVED TO	
		3,4,5,6,7,8 & 9 RESPECTIVELY; SEE SHEET 2 & 3	
		[CT200775]	SLR
M	19MAY2020	(D-8,-7,-6) CONTROLLER CALLOUT, 1702 [67.0], 680	
		[26.8] & 335 [13.2] ADDED; SEE SHEET 3 [CT204162]	PAR
N	10AUG2021	SHEET 10 ADDED; SEE SHEET 5 [CT213945]	RVM

DO NOT SCALE. REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS IN MILLIMETERS GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	BGW	11-29-16
CHECKED	WDG	11-29-16
APPROVED	WDG	11-29-16

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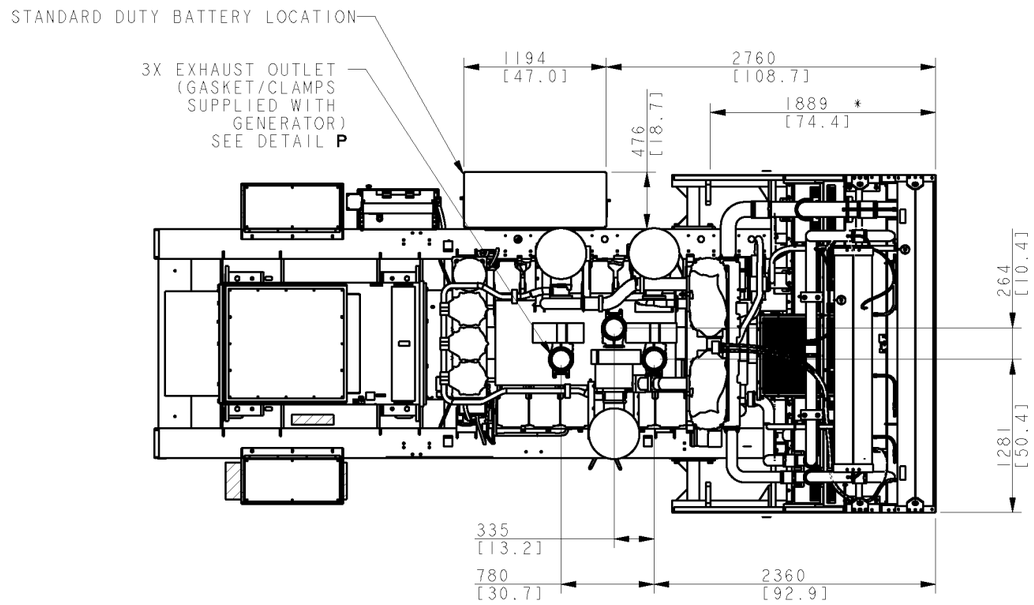
TITLE: DIMENSIONAL PRINT, KD2000-2500

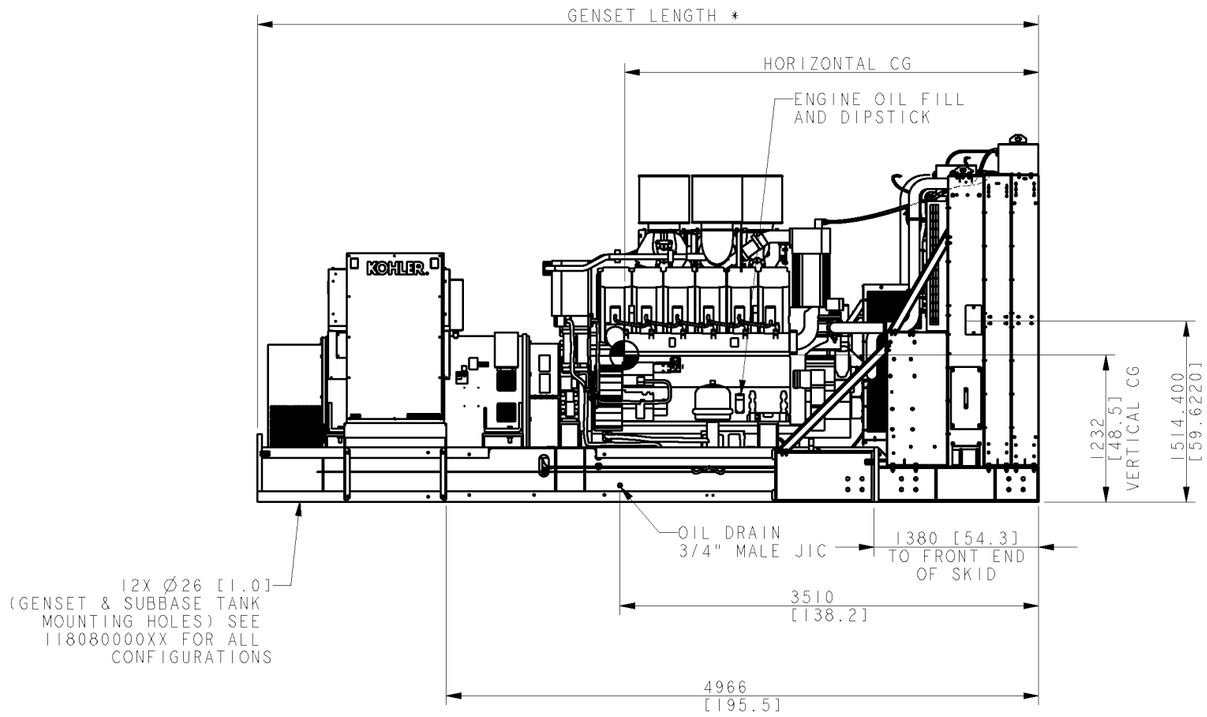
SCALE 0.04 | CAD NO. | SHEET of 10

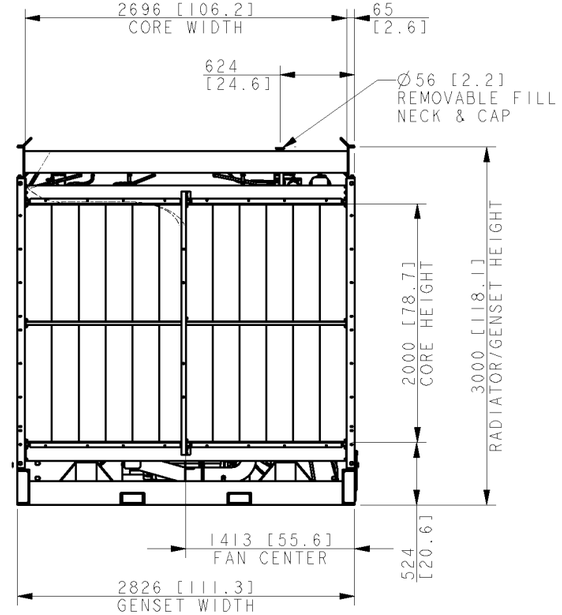
DWG NO. ADV-8925 | D

MODEL	ALTERNATOR	GENSET MAXIMUM WEIGHT (WET) KG [LB]	HORIZONTAL CG (WET) MM [IN]	GENSET LENGTH MM [IN]
KD2000	KH04970TO4D	22417 [49422]	2952 [116.2]	6053 [238.3]
KD2000	KH07080TO4D	25447 [56101]	3277 [129.0]	6796 [267.5]
KD2000/ KD2250	KH05790TO4D	22940 [50574]	3009 [118.4]	6053 [238.3]
KD2000/ KD2250	KH06220TO4D	22936 [50565]	3040 [119.7]	6553 [258.0]
KD2000/ KD2250	KH07630TO4D	25859 [57010]	3310 [130.3]	6553 [258.0]
KD2250/ KD2500	KH08100TO4D	26883 [59266]	3405 [134.0]	6796 [267.5]
KD2000/ KD2250/ KD2500	KH06930TO4D	23471 [51744]	3060 [120.4]	6053 [238.3]
KD2000/ KD2250/ KD2500	KH07000TO4D	23486 [51778]	3095 [121.8]	6553 [258.0]
KD2000/ KD2250/ KD2500	KH07770TO4D	23881 [52648]	3164 [124.5]	6553 [258.0]
KD2000/ KD2250/ KD2500	KH09270TO4D	27033 [59598]	3435 [135.2]	6796 [267.5]
KD2000/ KD2250/ KD2500	KH08430TO4D	24205 [53363]	3200 [126.0]	6553 [258.0]

ALL VIEWS REPRESENTED WITH 40C RADIATOR







*40C GENERATOR LIFT POINTS

REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
L	12-18-19	VIEWS FOR 40C RADIATOR ADDED, SEE SHEET 1 & 3 [CT200775]	SLR
M	19MAY2020	SEE SHEET 1 & 3 [CT204162]	PAR
N	10AUG2021	SEE SHEET 5 [CT213945]	RVM

DO NOT SCALE. REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS IN MILLIMETERS GENERAL TOLERANCES: X.XX ± 0.25, X.X ± 1.0, X ± 1.5, ANGLES ± 0°30' SURFACE FINISH √ MAX.

THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	BGW	12-18-19
CHECKED	WDG	12-18-19
APPROVED	WDG	12-18-19

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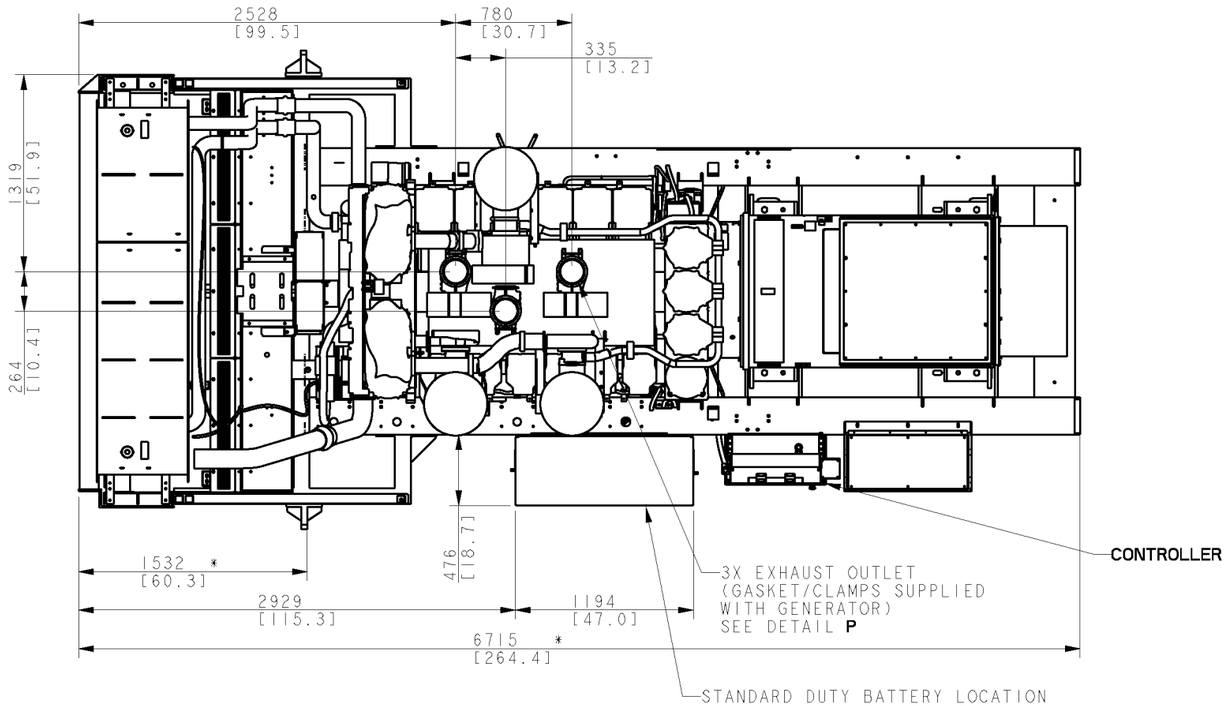
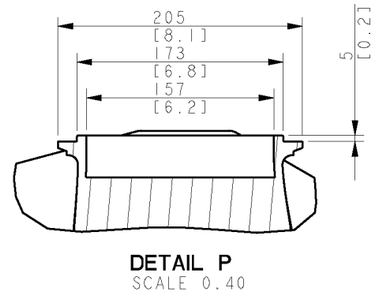
TITLE: DIMENSIONAL PRINT, KD2000-2500

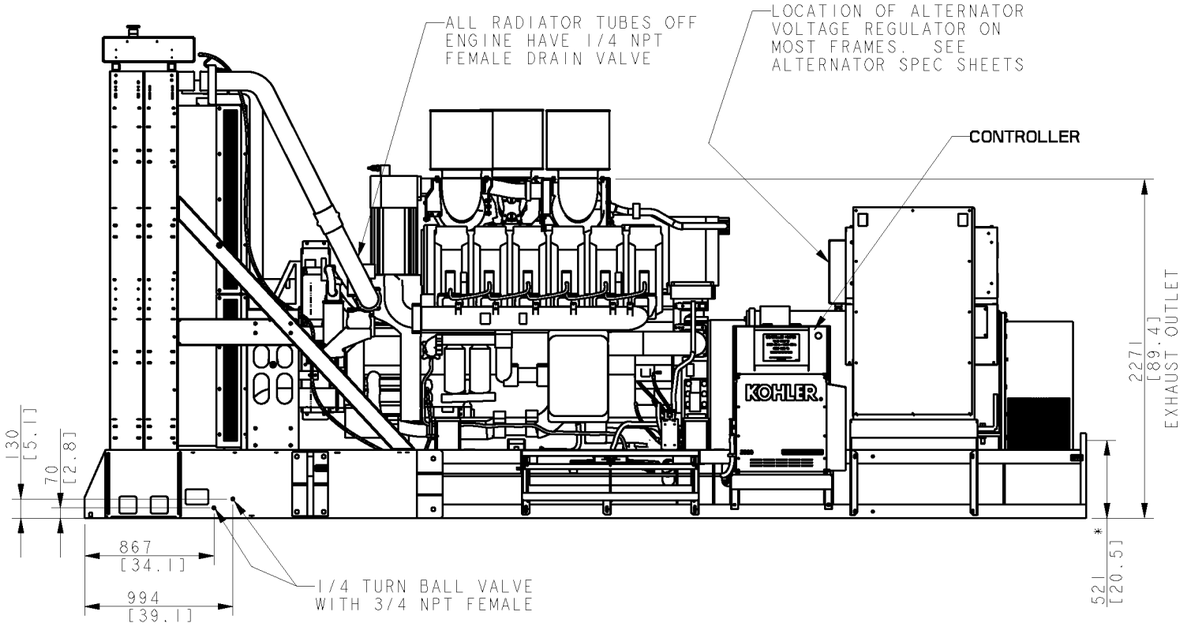
SCALE 0.04 | CAD NO. | SHEET 2 of 10

DWG NO. ADV-8925 | D





DETAIL P
SCALE 0.40



VIEWS SHOWN WITH 50C RADIATOR
* 50C GENERATOR RADIATOR LIFT POINTS

KD2000, KD2250, KD2500
KD62V12

REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
G	4-4-18	SEE SHEET 4 & 5 [CT186192]	SSS
H	12-5-18	SEE SHEET 3 [CT192176]	ADP
J	1-17-19	SEE SHEET 1 & 3 [PR07774]	BGW
K	9APR2019	(A-2) TOLERANCES REMOVED [CT194818]	SUD
L	12-20-19	CONTENTS OF SHEET 2 MOVED TO THIS SHEET, (A-2) 50C	
		RADIATOR NOTE ADDED; [C-4,3) GENERATOR LIFT POINTS	
		NOTE REMOVED; SEE SHEET 1 & 2 [CT200775]	SLR
M	19MAY2020	(B,C-4) CONTROLLER CALLOUT ADDED; SEE SHEET 1 [CT204162]	PAR
N	10AUG2021	SEE SHEET 5 [CT213945]	RVM

DO NOT SCALE. REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS IN MILLIMETERS
GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	BGW	11-29-16
CHECKED	WDG	11-29-16
APPROVED	WDG	11-29-16

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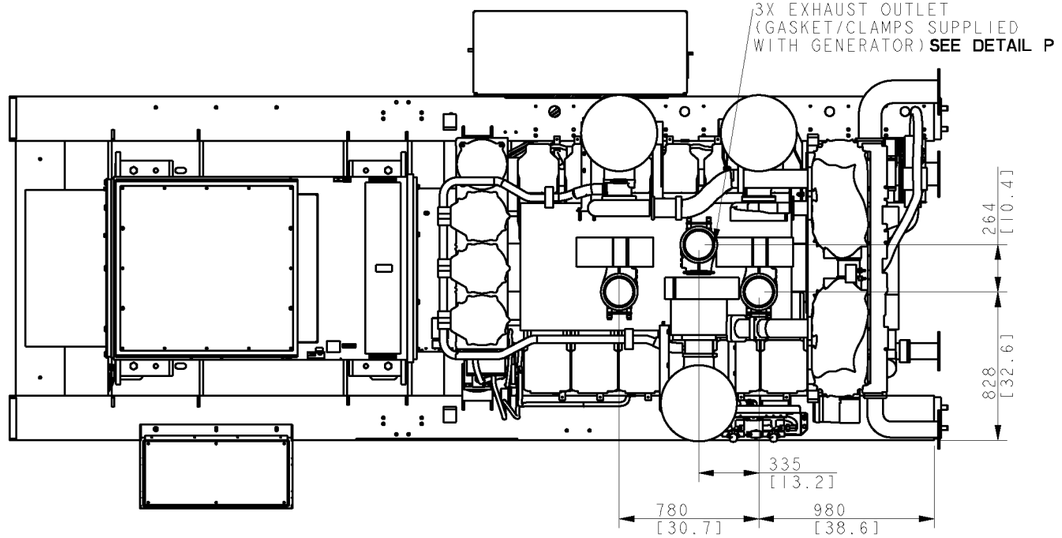
TITLE: DIMENSIONAL PRINT, KD2000-2500

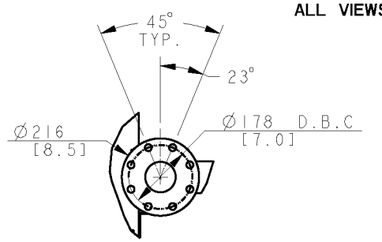
SCALE 0.05 | CAD NO. | SHEET 3 of 10

DWG NO. ADV-8925 | D

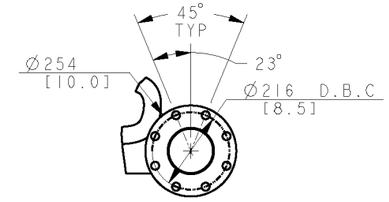
MODEL	ALTERNATOR	GENSET MAXIMUM WEIGHT (WET) KG [LB]	HORIZONTAL CG (WET) MM [IN]	GENSET LENGTH MM [IN]
KD2000	KH04970TO4D	18487 [40758]	2041 [80.4]	4667 [183.7]
KD2000	KH07080TO4D	21517 [47438]	2359 [92.9]	5410 [213.0]
KD2000/ KD2250	KH05790TO4D	19010 [41910]	2098 [82.6]	4667 [183.7]
KD2000/ KD2250	KH06220TO4D	19006 [41901]	2135 [84.0]	5167 [203.4]
KD2000/ KD2250	KH07630TO4D	21929 [48346]	2389 [94.0]	5167 [203.4]
KD2250/ KD2500	KH07000TO4D	19556 [43114]	2187 [86.1]	5167 [203.4]
KD2250/ KD2500	KH08100TO4D	22953 [50602]	2479 [97.6]	5410 [213.0]
KD2000/ KD2250/ KD2500	KH06930TO4D	19541 [43081]	2145 [84.5]	4667 [183.7]
KD2000/ KD2250/ KD2500	KH07770TO4D	19957 [43998]	2259 [88.9]	5167 [203.4]
KD2000/ KD2250/ KD2500	KH09270TO4D	23103 [50934]	2512 [98.9]	5410 [213.0]
KD2000/ KD2250/ KD2500	KH08430TO4D	20037 [44174]	3840 [151.2]	6715 [264.4]

ALL VIEWS REPRESENTED WITH REMOTE RADIATOR.

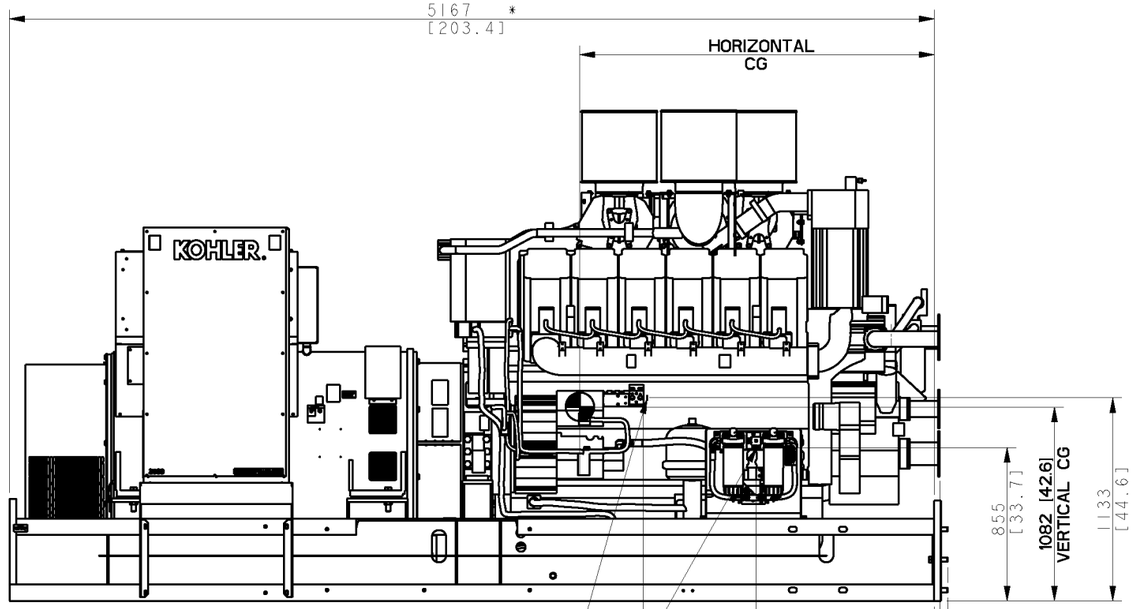




DETAIL A
SCALE 0.1



DETAIL B
SCALE 0.1



* REMOTE RADIATOR GENERATOR LIFT POINTS

REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
G	4-4-18	SEE SHEET 4 & 5 [CT186192]	SSS
H	12-5-18	(D-5,6,7) TOP VIEW ADDED, EXHAUST OUTLET	
		DIM. ADDED [CT192176]	ADP
J	1-17-19	SEE SHEET 1 OF 8, (D-1) KH07630TO4D: 5167	
		[203.4] WAS 5410 [213.0] [PR07774]	BGW
K	9APR2019	(A-2) TOLERANCES REMOVED [CT194818]	SUD
L	12-20-19	CONTENTS OF SHEET 3 MOVED TO THIS SHEET, SEE	
		SHEET 1, 2 & 3 [CT200775]	SLR
M	19MAY2020	SEE SHEET 1 & 3 [CT204162]	PAR
N	10AUG2021	SEE SHEET 5 [CT213945]	RVM

DO NOT SCALE. REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS IN MILLIMETERS
GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	BGW	11-29-16
CHECKED	WDG	11-29-16
APPROVED	WDG	11-29-16

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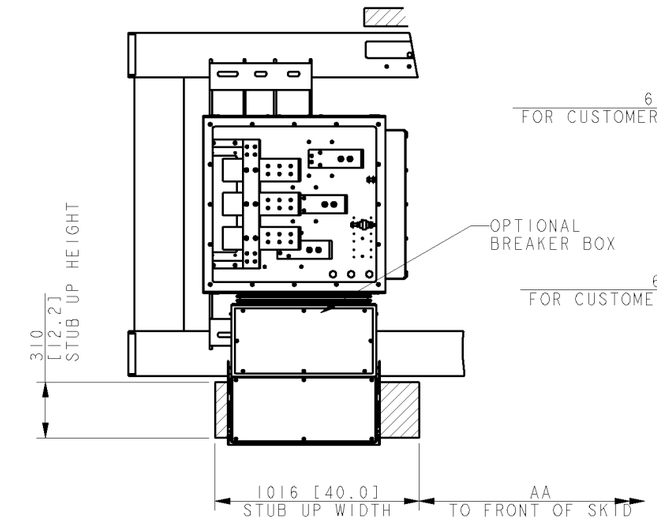
TITLE: DIMENSIONAL PRINT, KD2000-2500

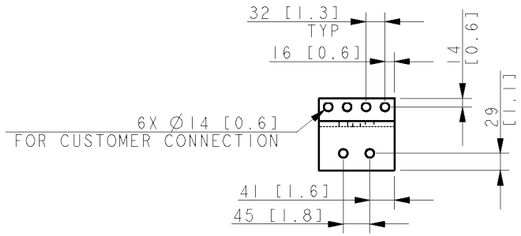
SCALE 0.06 | CAD NO. | SHEET 4 of 10

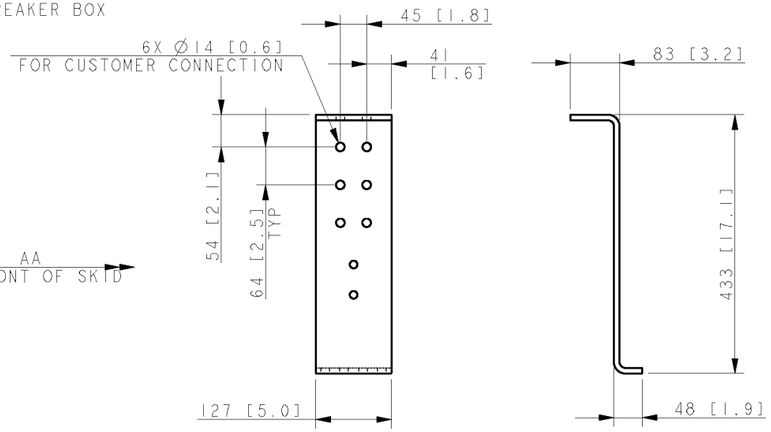
DWG NO. ADV-8925 | D

KD2000, KD2250, KD2500
KD62V12

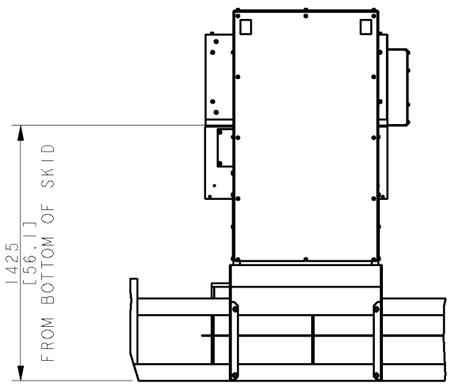
LOW VOLTAGE 380V, 600V		
ALTERNATOR	**AA**	**AB**
KH08430TO4D	3556 [140]	1420 [56]

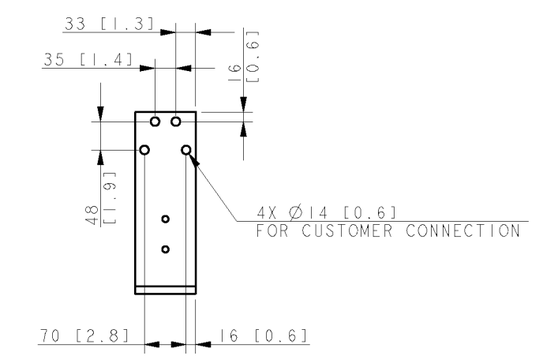


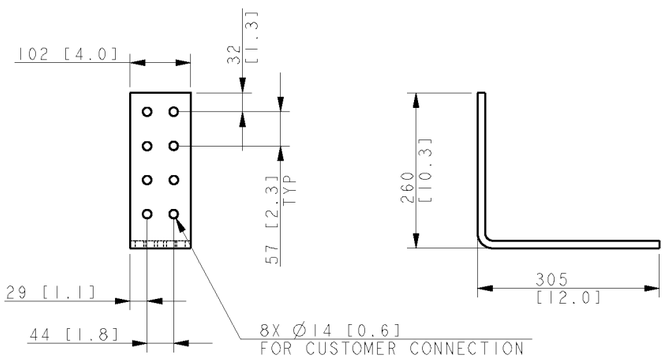




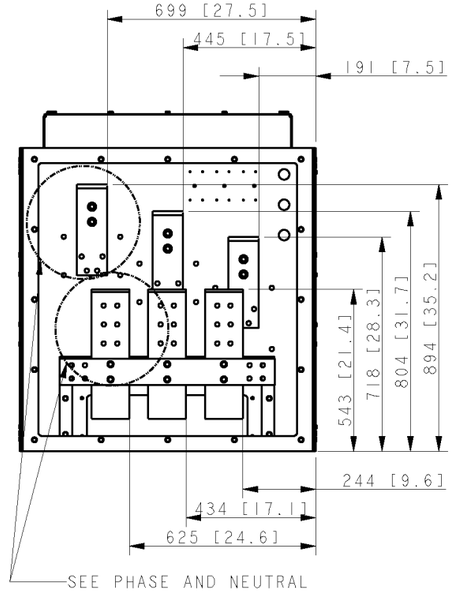
NEUTRAL TERMINAL DETAIL

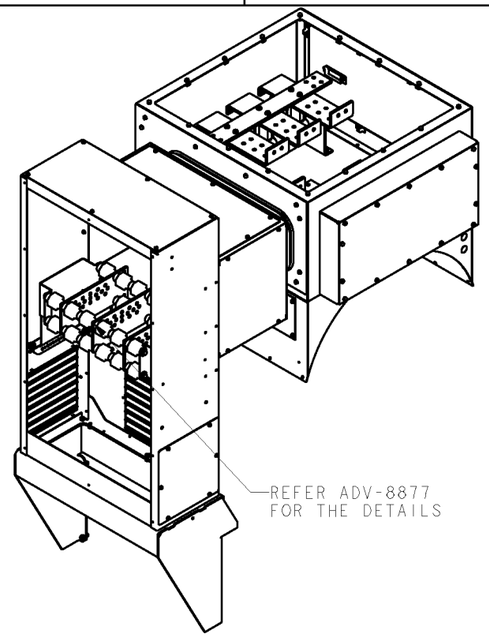




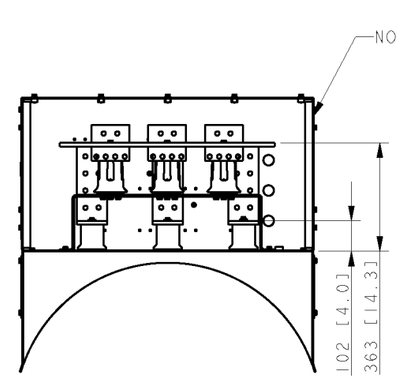


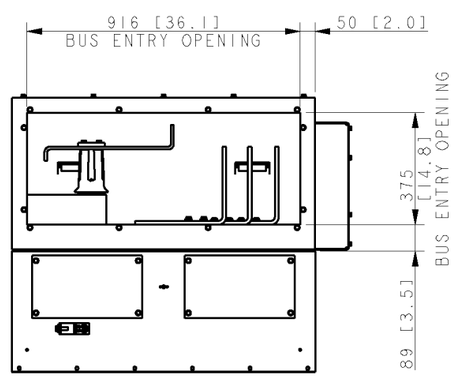
PHASE TERMINAL DETAIL





OPTIONAL BUS BAR JUNCTION BOX





REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
H	12-5-18	SEE SHEET 3 [CT192176]	ADP
J	1-17-19	SEE SHEET 1 & 3 [PR07774]	BGW
K	9APR2019	(A-2) TOLERANCES REMOVED [CT194818]	SUD
L	12-20-19	CONTENTS OF SHEET 4 MOVED TO THIS SHEET, SEE	
		SHEET 1, 2 & 3 [CT200775]	SLR
M	19MAY2020	SEE SHEET 1 & 3 [CT204162]	PAR
N	10AUG2021	LV ALTERNATOR CONNECTION DETAILS ADDED &	
		OPTIONAL BUS BAR J-BOX VIEW ADDED; MV	
		ALTERNATOR VIEWS AND TABLE MOVED TO SHEET 6	
		[CT213945]	RVM

DO NOT SCALE. REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS IN MILLIMETERS
GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	BGW	4-3-18
CHECKED	WDG	4-3-18
APPROVED	WDG	4-3-18

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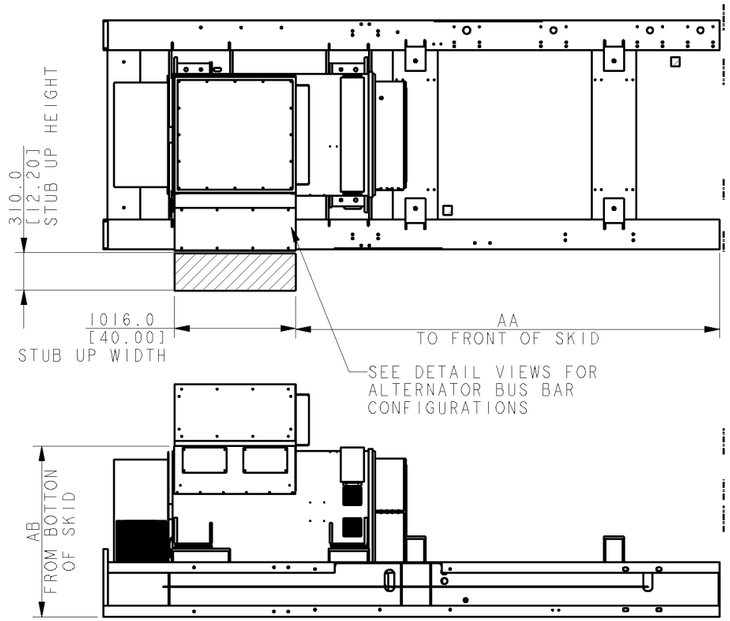
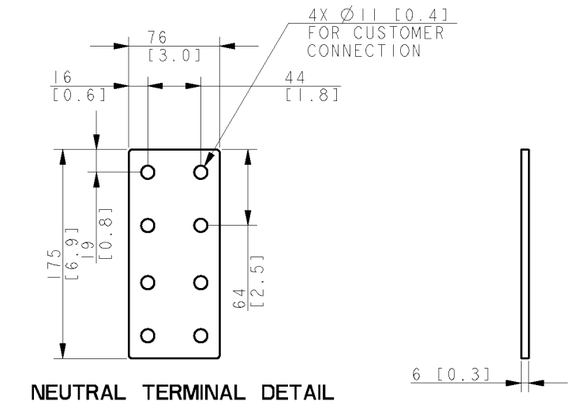
TITLE: **DIMENSIONAL PRINT, KD2000-2500**

SCALE 0.04 | CAD NO. | SHEET 5 of 10

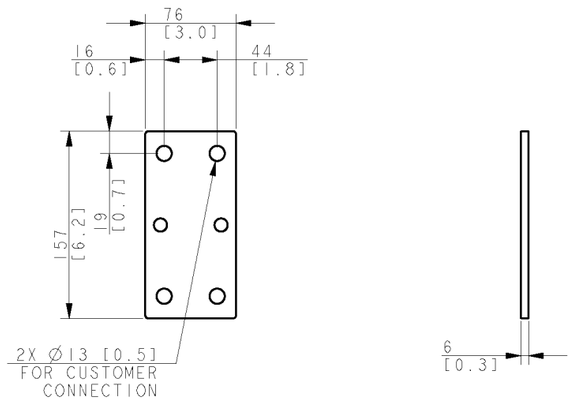
DWG NO. **ADV-8925** | **D**

MEDIUM VOLTAGE 3300V, 4160V		
ALTERNATOR	**AA**	**AB**
KH07770TO4D	3556 [140]	1420 [56]
KH08430TO4D	3556 [140]	1420 [56]
KH07000TO4D	3416 [134]	1420 [56]
KH06220TO4D	3416 [134]	1420 [56]

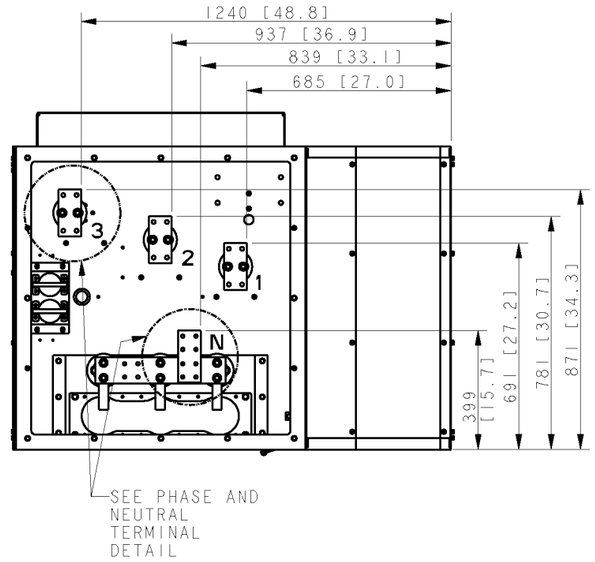


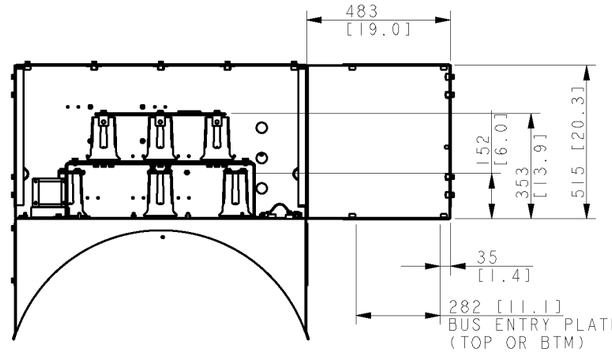


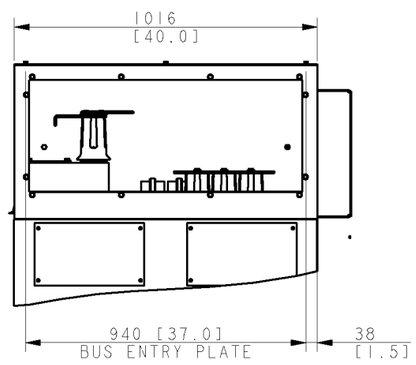
NEUTRAL TERMINAL DETAIL



PHASE TERMINAL DETAIL







REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
H	12-5-18	SEE SHEET 3 [CT192176]	ADP
J	1-17-19	SEE SHEET 1 & 3 [PR07774]	BGW
K	9APR2019	(A-2) TOLERANCES REMOVED [CT194818]	SUD
L	12-20-19	CONTENTS OF SHEET 5 MOVED TO THIS SHEET, SEE	
		SHEET 1, 2 & 3 [CT200775]	SLR
M	19MAY2020	SEE SHEET 1 & 3 [CT204162]	PAR
N	10AUG2021	ALL CONTENT MOVED TO SHEET 7; SEE SHEET 5	
		[CT213945]	RVM

DO NOT SCALE. REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS IN MILLIMETERS
GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

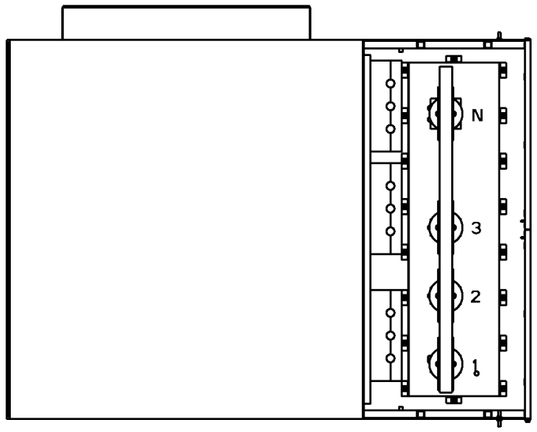
APPROVALS		DATE
DRAWN	BGW	11-16-17
CHECKED	WDG	11-16-17
APPROVED	WDG	11-16-17

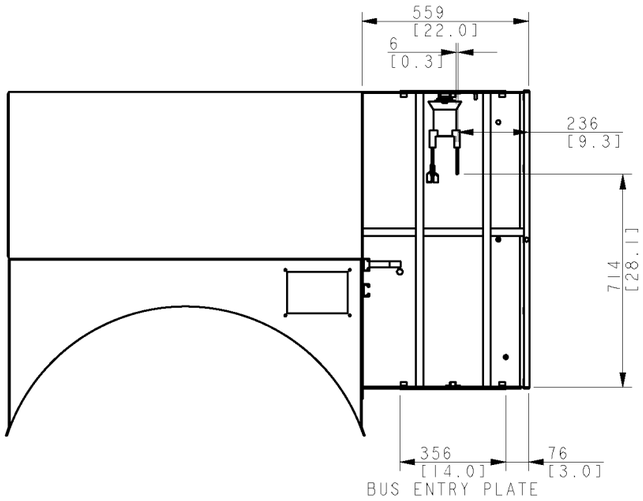
TITLE: **DIMENSIONAL PRINT, KD2000-2500**

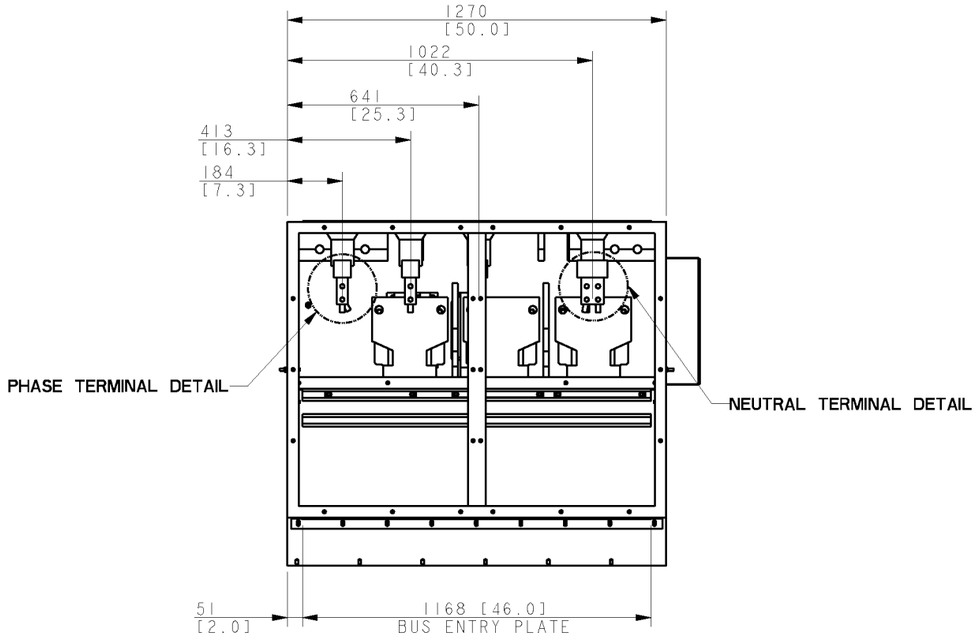
SCALE 0.30 | CAD NO. | SHEET 6 of 10

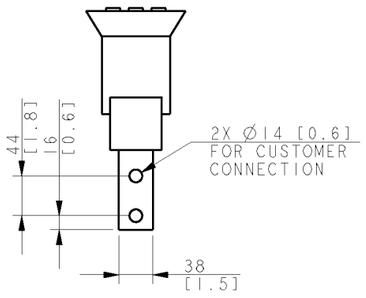
DWG NO. **ADV-8925** | **D**

ALTERNATOR	VOLTAGE	AA	AB
KH08100TO4D	12470 V, 13200V, 13800V	3445 [136]	1145 [45]
KH09270TO4D	6600V	3546 [140]	1145 [45]
KH09270TO4D	11000V, 12470V, 13200V, 13800V	3546 [140]	1145 [45]
KH08100TO4D	6600V, 11000V	3445 [136]	1145 [45]
KH07630TO4D	6600V	3442 [136]	1145 [45]
KH07630TO4D	11000V, 12470V, 13200V, 13800V	3442 [136]	1145 [45]
KH07080TO4D	6600V	3440 [135]	1145 [45]
KH07080TO4D	11000V, 12470V, 13200V, 13800V	3440 [135]	1145 [45]

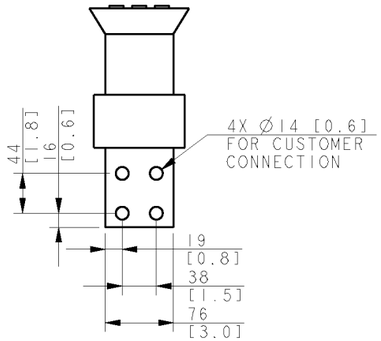








PHASE TERMINAL DETAIL



NEUTRAL TERMINAL DETAIL

KD2000, KD2250, KD2500
KD62V12

REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
G	4-4-18	CONTENTS OF SHEET 4 MOVED TO THIS SHEET, SEE	
		SHEET 4 & 5 [CT186192]	SSS
H	12-5-18	SEE SHEET 3 [CT192176]	ADP
J	1-17-19	SEE SHEET 1 & 3 [PR07774]	BGW
K	9APR2019	(A-2) TOLERANCES REMOVED [CT194818]	SUD
L	12-20-19	CONTENTS OF SHEET 6 MOVED TO THIS SHEET, SEE	
		SHEET 1, 2 & 3 [CT200775]	SLR
M	19MAY2020	SEE SHEET 1 & 3 [CT204162]	PAR
N	10AUG2021	ALL CONTENT MOVED TO SHEET 8; SEE SHEET 5	
		[CT213945]	RVM

DO NOT SCALE. REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS IN MILLIMETERS
GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	BGW	11-29-16
CHECKED	WDG	11-29-16
APPROVED	WDG	11-29-16

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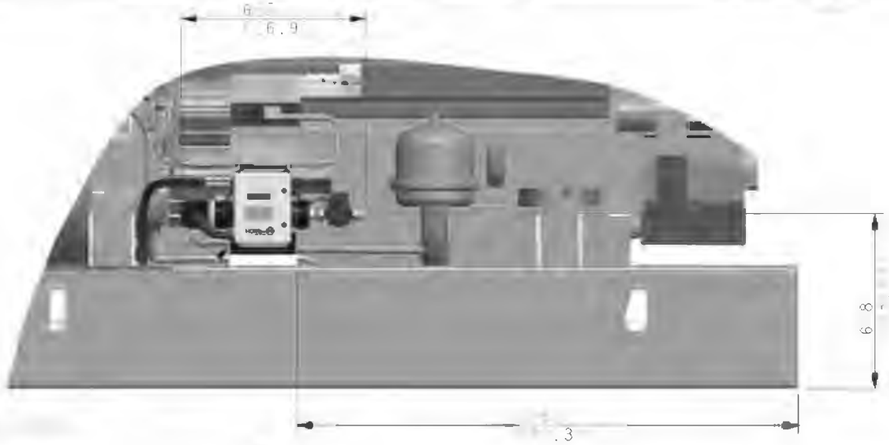
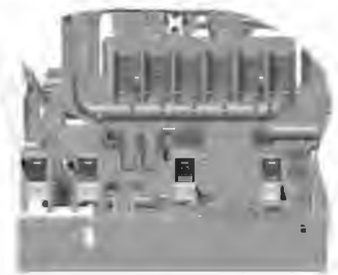
TITLE: DIMENSIONAL PRINT, KD2000-2500

SCALE 0.10 | CAD NO. | SHEET 7 of 10

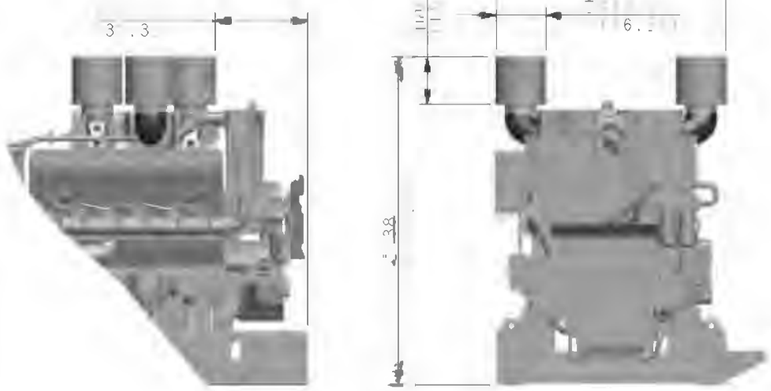
DWG NO. ADV-8925 | D



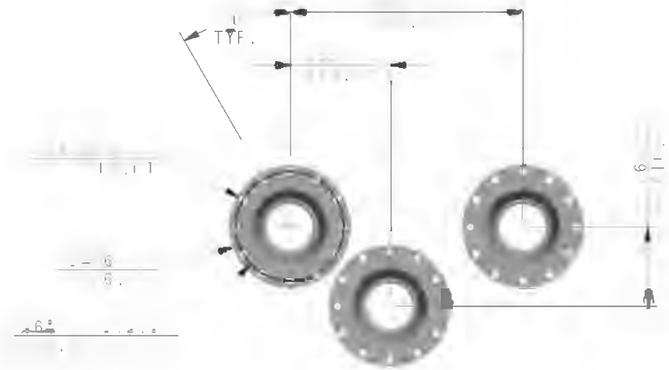
BLOCK HEATER

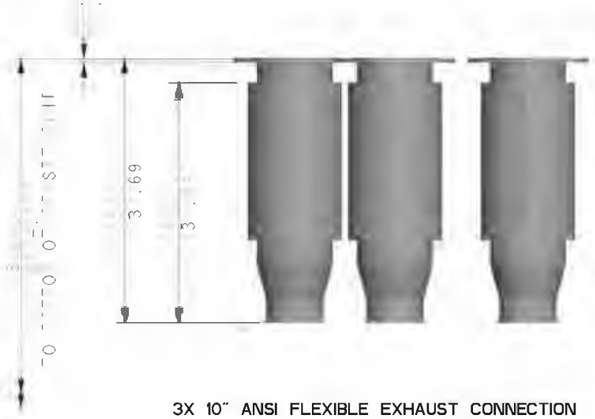


BATTERY CHARGER KITS



STANDARD DUTY AIR CLEANER





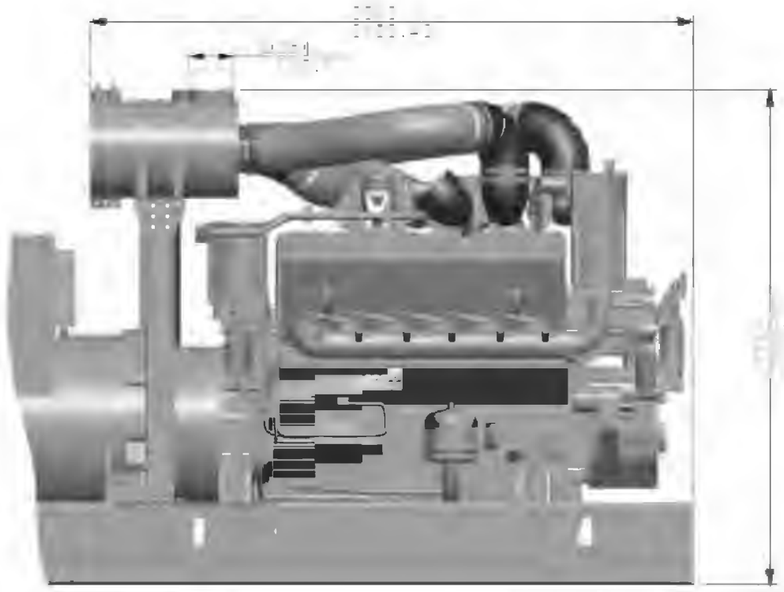
3X 10" ANSI FLEXIBLE EXHAUST CONNECTION

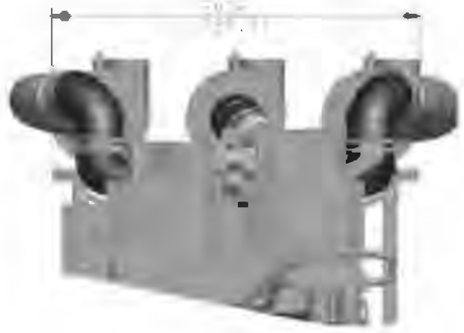
KD2000, KD2250, KD2500
KD62V12

KOHLER
KOHLER, WISCONSIN 53044

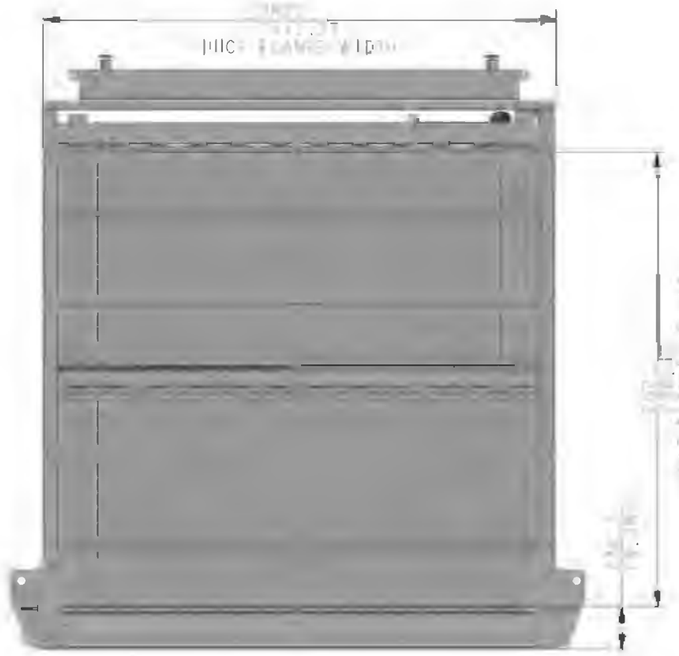
DIMENSIONAL PRINT,
KD2000-2500

ADV-8925 D

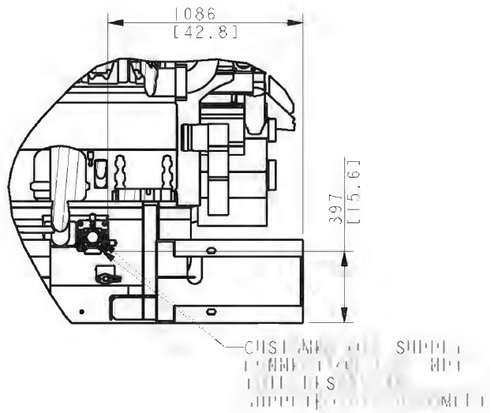




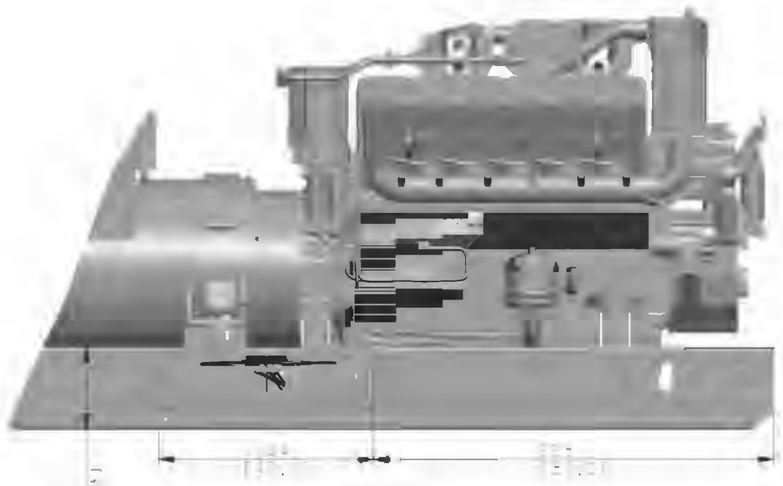
HEAVY DUTY AIR CLEANER



DUCT FLANGE AND STONE GUARD



AUTOMATIC OIL REPLENISHMENT SYSTEM



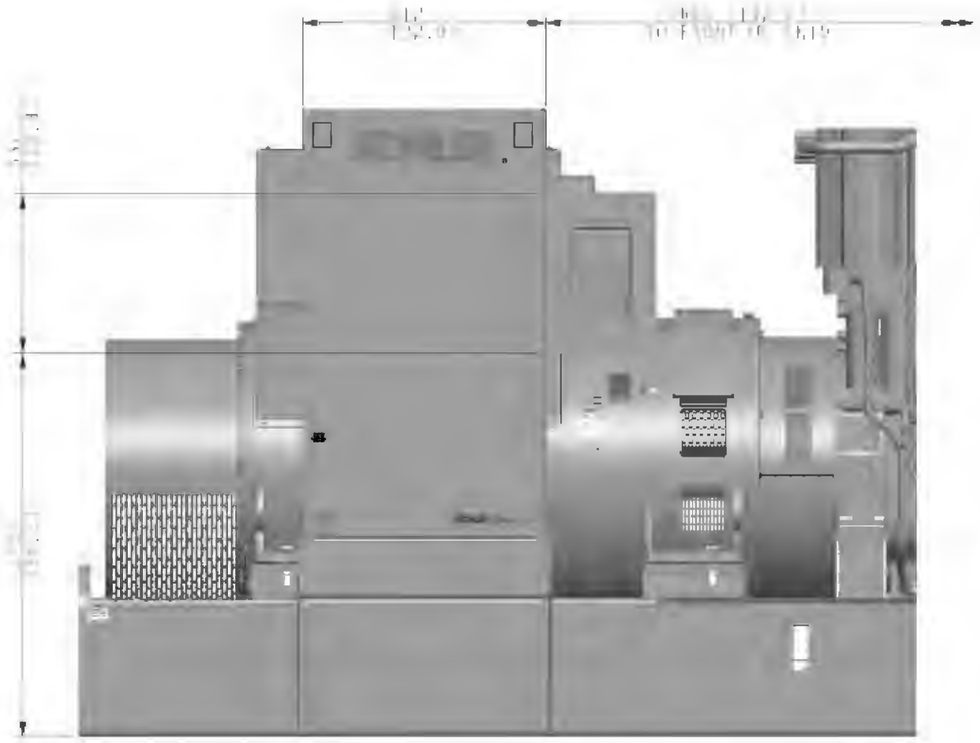
REDUNDANT BATTERY RACK KIT

KD2000, KD2250, KD2500
KD62V12

KOHLER
KOHLER, WISCONSIN 53044

DIMENSIONAL PRINT,
KD2000-2500

ADV-8925 D



BASIC ELECTRICAL PACKAGE (BEP) LOAD CENTER

STRICTION GAUGE

AIR FILTER RESTRICTION INDICATOR

KD2000, KD2250, KD2500
KD62V12

R V	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REV S ON LEVEL	BY
N	10AUG2021	CONTENT FROM SHEET 9 MOVED TO THIS SHEET;	
		SEE SHEET 5 [CT213945]	RVM

DO NOT SCALE. REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS IN MILLIMETERS
GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

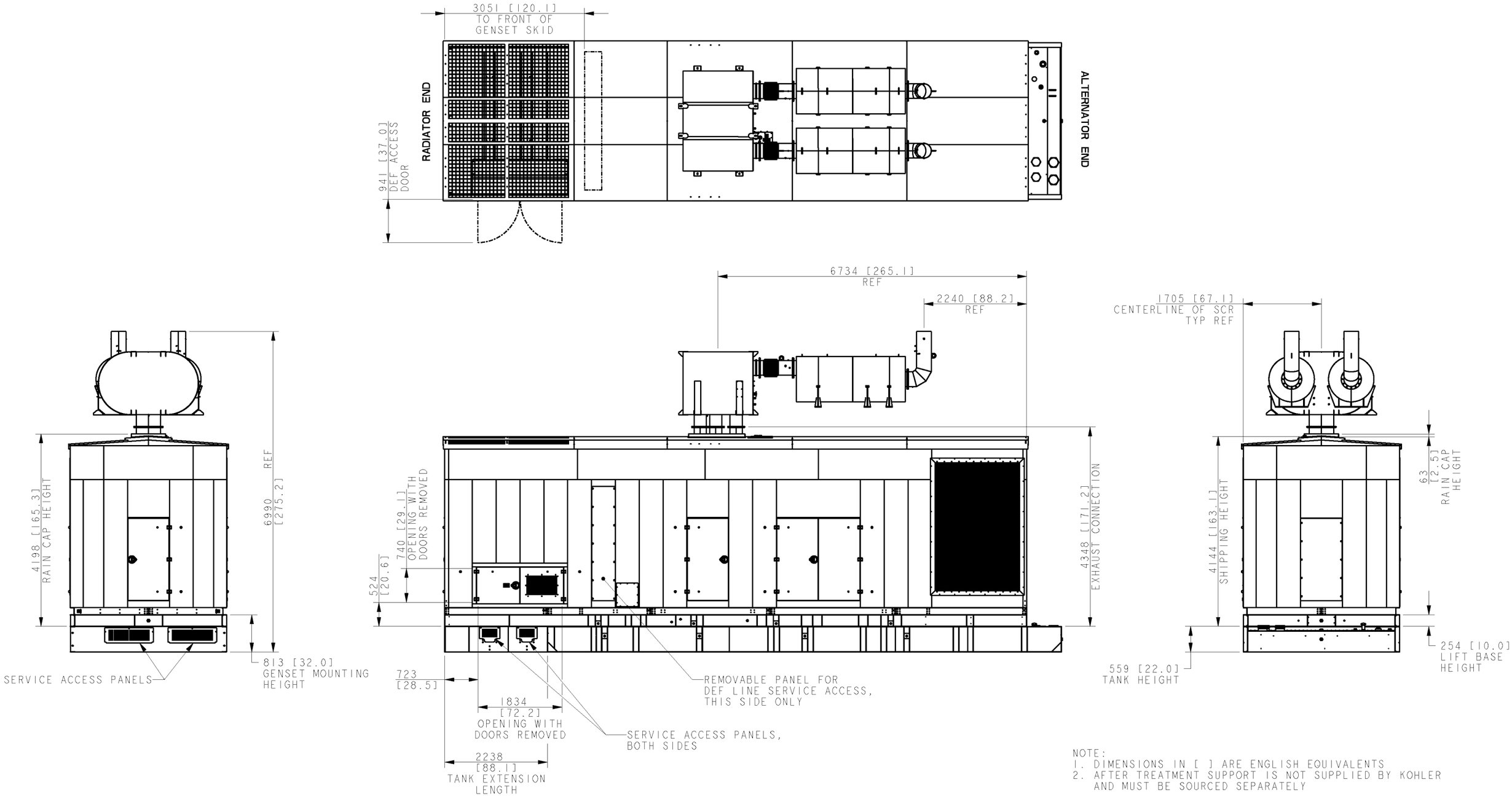
APPROVALS		DATE
DRAWN	BGW	29-16
CHECKED	WDG	29 16
APPROVED	WDG	29-16

KOHLER.
KOHLER, WISCONSIN 53044

TITLE: DIMENSIONAL PRINT, KD2000-2500

SCALE 0.06 | CAD NO. | SHEET NO. 10 of 10

DWG NO. ADV-8925 | D



NOTE:
1. DIMENSIONS IN [ ] ARE ENGLISH EQUIVALENTS
2. AFTER TREATMENT SUPPORT IS NOT SUPPLIED BY KOHLER AND MUST BE SOURCED SEPARATELY

*ENCLOSURE WEIGHT DOES NOT INCLUDE EXTERNAL EXHAUST COMPONENTS

ALUM. SL2 ENCLOSURE WEIGHT KG [LBS]	4518 [9960]

REFERENCE ENCLOSURE & TANK ADV-9075 FOR ADDITIONAL INFORMATION

EXHAUST COMPONENTS SHOWN FOR REFERENCE. REFER TO GENSET ADV-9163 FOR DETAILS

NON-TABLED DIMENSIONS ARE TYPICAL

PACKAGE INFORMATION		
TANK LITERS [GALLONS]	WEIGHT KG [LBS] (NO FUEL)	TANK EXTENSION WEIGHT KG [LBS]
SL2 LIFT BASE	2648 [5,838]	NA
14130 [3733]	8142 [17,952]	409 [901]

TANK EXTENSIONS NOT TO BE LIFTED WITH TANK AND/OR ENCLOSURE

KD2500-4 SL2 TIER 4 ENCLOSURE AND LIFTING BASE WITH SUB BASE TANK OPTION

REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
-	31JAN2020	NEW DRAWING [CT2020114]	ZJS
A	14APR2020	(A-8) ADDED TIER 4 GENSET ADV REFERENCE	
		NOTE; (B-7) ADDED GENSET MOUNTING HEIGHT;	
		(D-6) ADDED DIMENSION TO FRONT OF GENSET	
		SKID; (C-2) ADDED DIMENSION TO CENTERLINE OF	
		SCR [CT203358]	ZJS
B	22OCT2020	(B-7) REF DIM 6990 ADDED [CT207157]	CEK
C	23JAN2023	(A-3) NOTE 2 ADDED [CT224851]	APM

DO NOT SCALE. REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS IN MILLIMETERS
GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

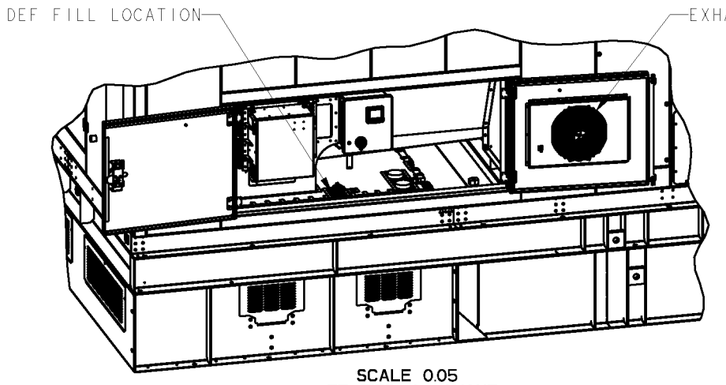
APPROVALS		DATE
DRAWN	ZJS	31JAN2020
CHECKED	KJB	31JAN2020
APPROVED	AJW	31JAN2020

KOHLER.
KOHLER, WISCONSIN 53044

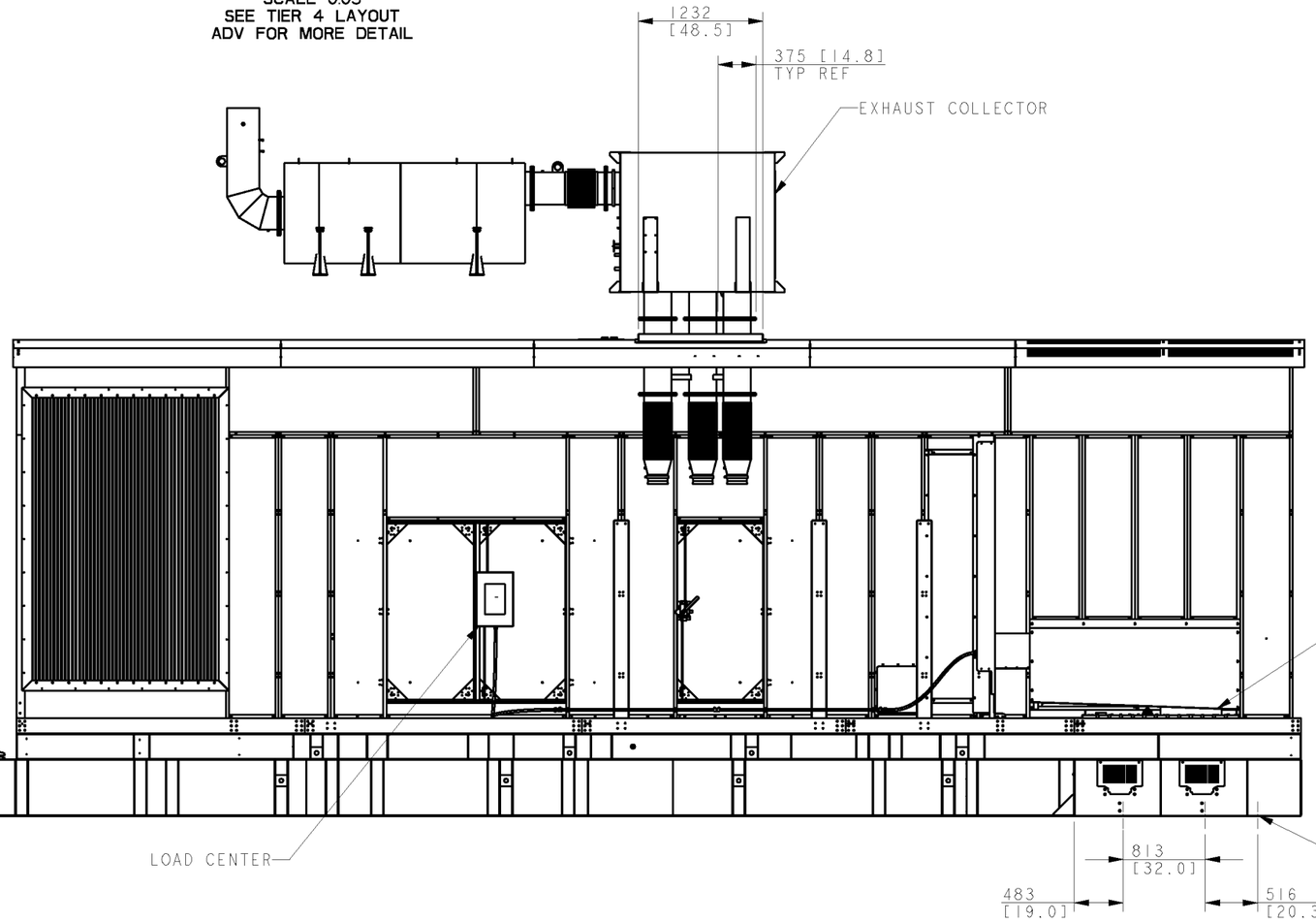
TITLE: DIMENSION PRINT KD2500-4 TIER4 ENCL/TANK

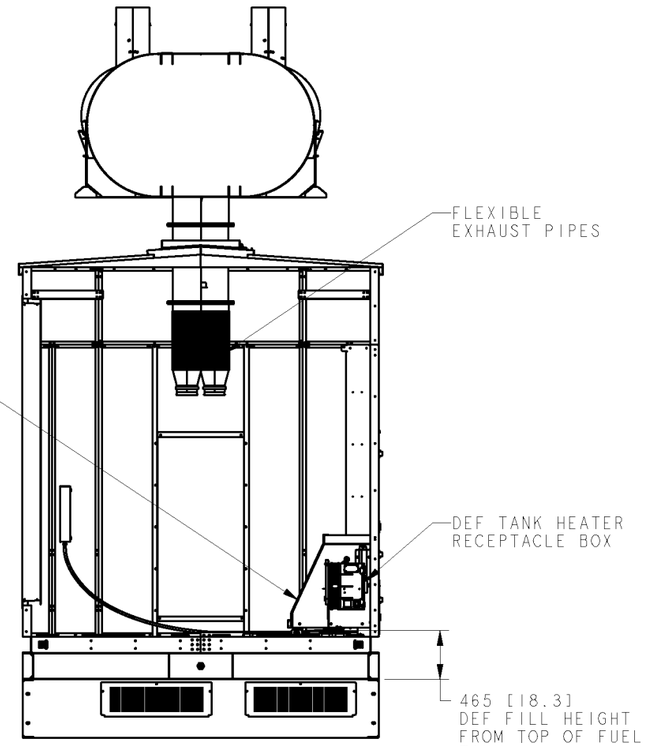
SCALE NA | CAD NO. | SHEET 1 of 3

DWG NO. ADV-9179 | D



SCALE 0.05
SEE TIER 4 LAYOUT
ADV FOR MORE DETAIL





SL2 EXTENSION MOUNTING,
ENCLOSURE COMPONENT LOCATION

REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
-	31JAN2020	NEW DRAWING [CT2020014]	ZJS
A	14APR2020	SEE SHEET 1 [CT203358]	ZJS
B	22OCT2020	SEE SHEET 1 [CT207157]	CEK
C	23JAN2023	SEE SHEET 1 [CT224851]	APM

DO NOT SCALE. REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS IN MILLIMETERS
GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	ZJS	31JAN2020
CHECKED	KJB	31JAN2020
APPROVED	AJW	31JAN2020

KOHLER.
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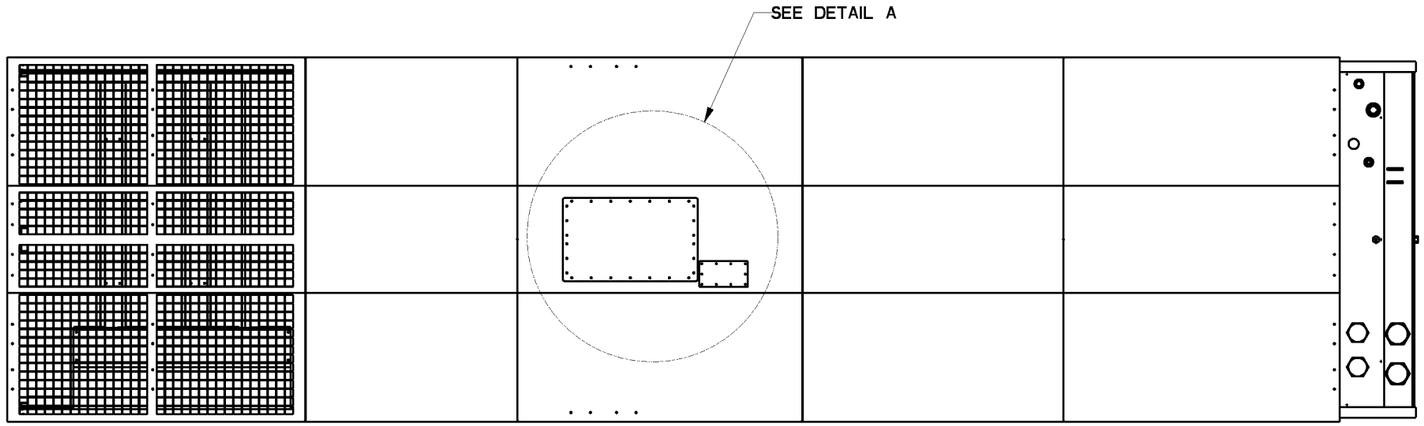
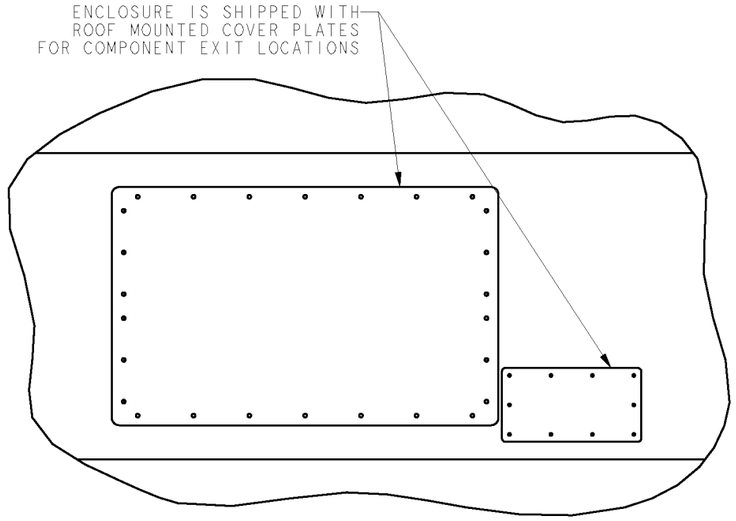
TITLE: DIMENSION PRINT KD2500-4 TIER4 ENCL/TANK

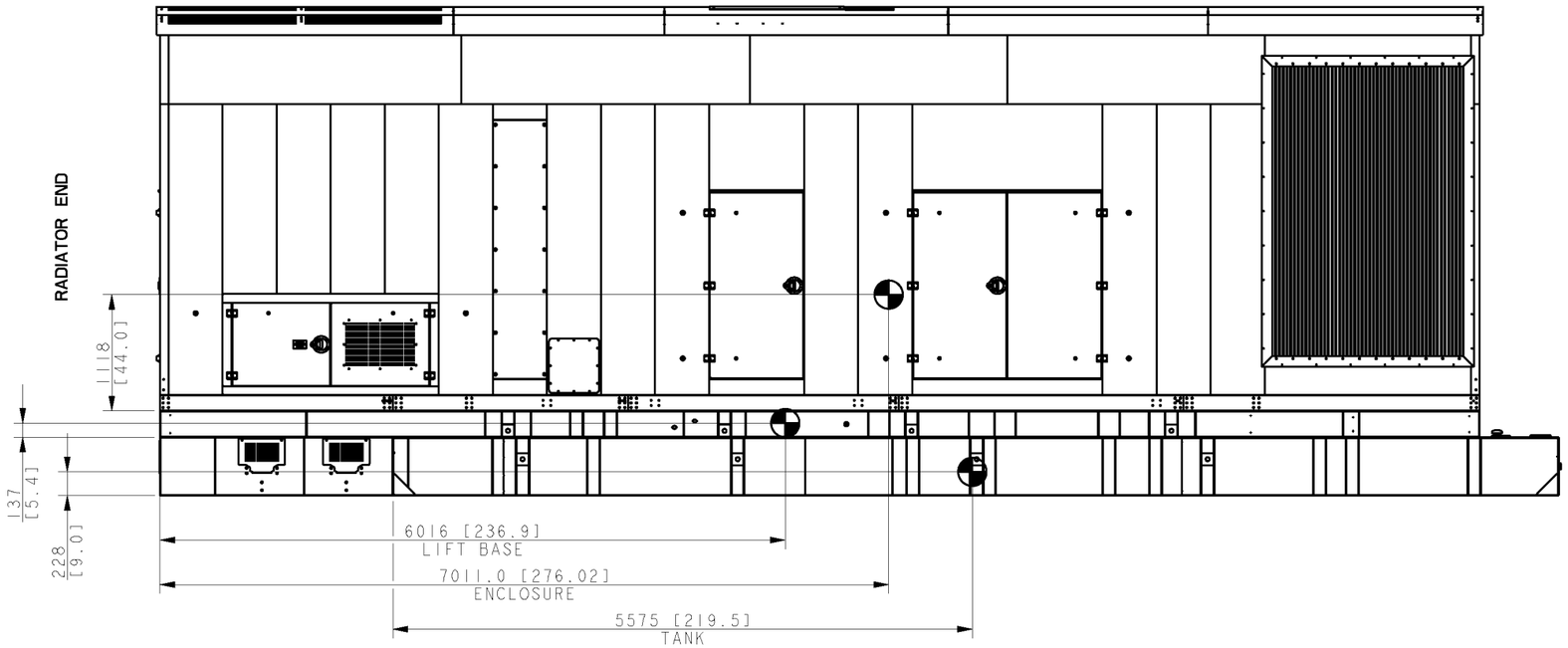
SCALE: NA | CAD NO. | SHEET 2 of 3

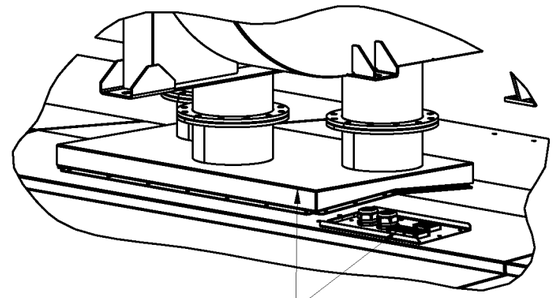
DWG NO. ADV-9179 | D





DETAIL A
SCALE 0.10





SCALE 0.10

SL2 CENTER OF GRAVITY POINTS FOR
ENCLOSURE, LIFT BASE, AND TANK VARIATIONS

REV	DATE	ON COMPOSITE DWGS, SEE PART NO. FOR REVISION LEVEL	BY
-	31JAN2020	NEW DRAWING [CT2020014]	ZJS
A	14APR2020	SEE SHEET 1 [CT203358]	ZJS
B	22OCT2020	SEE SHEET 1 [CT207157]	CEK
C	23JAN2023	SEE SHEET 1 [CT224851]	APM

DO NOT SCALE. REFERENCE THE MODEL FOR ALL UNSPECIFIED DIMENSIONS

UNLESS OTHERWISE SPECIFIED:
ALL DIMENSIONS IN MILLIMETERS
GENERAL TOLERANCES: N/A

THIRD ANGLE PROJECTION

APPROVALS		DATE
DRAWN	ZJS	31JAN2020
CHECKED	KJB	31JAN2020
APPROVED	AJW	31JAN2020

KOHLER.
KOHLER, WISCONSIN 53044

TITLE: DIMENSION PRINT KD2500-4
TIER4 ENCL/TANK

SCALE: NA | CAD NO. | SHEET 3 of 3

DWG NO. ADV-9179 | D

JM

Tier 4F compliant emission control

Save installation costs with compact factory assembled emission control system

Johnson Matthey
Inspiring science, enhancing life

CompactSCRT™ system technology guarantees compliance with USEPA Tier 4F

Standby diesel generators are essential for sustainable operations which rely on uninterrupted electric power. In many situations, the optimum diesel genset is Tier 1, 2 or Tier 3 rated. But due to project requirements, the emissions need to comply with Tier 4F, or even more stringent regulations.

That is where reliability and accountability are essential.

The CompactSCRT combines 25+ years of experience in providing our diesel particulate filter science with our selective catalytic reduction technology in a single platform.

Typical CompactSCRT emission reduction efficiencies

Pollutant	Typical Raw Emission Reduction Percentage to Achieve Tier 4F	Tier 4F Emission Requirement (g/kw hr)
NOx	>95%	0.67
CO	>90%	3.5
HC	>95%	0.19
PM	>92%	0.03

Benefits:

- Reduce expensive installation costs with single-lift factory assembly
- Place in tight spaces with compact design
- Minimize exhaust noise with integrated 40-45 dB(A) silencer

Two factory assembled CompactSCRT systems arriving at the jobsite. A single crane lift per unit eases installation.

Why choose Johnson Matthey?

Trusted experience

- Johnson Matthey is the number one global supplier of emission control technology for both on-road and off-road diesel equipment
- Johnson Matthey was the first to develop and patent the passive diesel particulate technology
- Johnson Matthey supplied SCR technology for over 1.9 GW of stationary engine power
- Ammonia slip control catalysts for CO / NH_3 control

We have been innovating diesel emission control systems for over 25 years and no other supplier can match our experience.

About Johnson Matthey

Johnson Matthey is a global leader in science that enables a cleaner and healthier world. With over 200 years of sustained commitment to innovation and technological breakthroughs, JM improves the function, performance and safety of our customer's products. Our science has a global impact in areas such as low emission transport, pharmaceuticals, chemical processing and making the most efficient use of the planet's natural resources.Today more than 13,000 Johnson Matthey professionals with operations in over 30 countries collaborate with our network of customers and partners to make a real difference to the world around us. For more information, visit www.matthey.com

Inspiring science, enhancing life

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For product specific information, visit: www.matthey.com

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1. DESIGN PARAMETERS

The following conditions were used to design the SCR systems.

Table 1. Full Load Design Parameters

Generator Set/Engine	KD2500
Engine kW Rating	2500
Application	Standby Diesel Generator
Operating Hours per Year	TBD - Standby
Fuel	Ultra-Low Sulfur Diesel
Exhaust Gas Flow Rate (full load)	20,477 ACFM
Exhaust Gas Temperature (full load)	500°C (1)
Exhaust O2 assumed	10%
Exhaust H2O Concentration	8% (assumed)
NOx, CO, HC, PM (raw g/bhp-hr)*	3.88, 0.85, 0.16, 0.07
NOx, CO, HC, PM (raw g/bhp-hr)*	0.5, 0.17, 0.05, 0.01

(1) The urea injection permissive is 575°F-600°F and filter regeneration is expected at 40% load or greater.

* System is designed for worse-case raw emissions at 100% load, and to pass Tier 4F compliance.

Table 22. Full Load SCR System Data

	KD2500	
	Conventional SCRT®	CompactSCRT®
Max. Ammonia Slip	10 ppmvd @ 15% O2	10 ppmvd @ 15% O2
Estimated Maximum 32.5% Urea Usage	8.0 USGPH worst case	8.0 USGPH worst case
Estimated SCRT System Pressure Loss	16“ w.c. with clean filters and 24” w.c. when filters are soot coated and need regeneration	16“ w.c. with clean filters and 24” w.c. when filters are soot coated and need regeneration
Maximum allowable backpressure	Approximately 27” W.C.	Approximately 27” W.C.
Insertion Loss Estimate	30-35dB(A) conventional SCRT	40-45 dB(A) CompactSCRT

NOTES:

Johnson Matthey has calculated the appropriate catalyst volume and necessary equipment to achieve the stated emission reductions based on the above Design Parameters. If the actual operating conditions are different from above conditions more catalyst and/or different equipment may be required for the system to achieve the required emission reductions. For this reason, all operating conditions must be closely reviewed and confirmed because different Parameters will void the warranty.

Specification sheet

Fire Pump Drive Engine

CFP15E-F10

CFP15EVS-F10

TAG#: 036-000-D_PA-360001-A/B
036-000-D_PA-360002-A/B

Description

Engine Series - Cummins QSX 15
Exhaust Emissions - EPA Tier 3

With advanced electronics, higher torque, and better speed control, the CFP15E allows for shorter service times, longer maintenance intervals, and increased fuel economy. The speed-range tested CFP15E Industrial model with the Variable Speed Pressure Limiting Control (VSPLC) option is the right choice for the heavy duty engine market.

Features

Control System - The industry-leading, state-of-the-art Fire Pump Digital Panel (FPDP) provides total fire pump drive engine system integration and intuitive operation, including:

- Color touchscreen;
- Dual microprocessors for critical signal redundancy; and
- Standard J1939 parameter and Cummins fault code display.

Variable Speed Pressure Limiting Control (VSPLC) - Cummins' VSPLC-equipped fire pump drive engines are capable of maintaining a constant pump discharge pressure by controlling the engine speed down to 1400 RPM, while still maintaining T3 emissions certification. VSPLC fire pump drive engines provide design flexibility in the fire pump system for high-rise applications; compensate for varying discharge pressure; allow the system architect to apply a larger pump and/or a pump with a steeper curve; and significantly reduce water consumption during the weekly test.

Warranty and Service - Our models are backed by a comprehensive warranty and worldwide distributor network.

Certified Power - The CFP15E-F10 complies with NFPA 20 and is UL 1247-listed and FM 1333-approved. The CFP15EVS-F10 complies with NFPA 20 and is FM 1333-approved.

Ratings in HP (kW)

Operating Speed (RPM)	1470		1760		1900		2100		2250	
CFP15E-F10	382	(285)	460	(343)	488	(364)	488	(364)	380	(283)
CFP15EVS-F10	N/A	N/A	460	(343)	488	(364)	488	(364)	380	(283)

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General Engine Data

Engine Family	Industrial
Engine Type	4 Cycle; In-Line, 6 Cylinder
Aspiration	Turbocharged and Charge-Air Cooled
Bore and Stroke	5.39 x 6.65 in. (137 x 169 mm)
Displacement	915 in^3 (15.0 L)
Rotation	Counterclockwise from flywheel end
Compression Ratio	17.0:1
Valves per Cylinder	Intake - 2 Exhaust - 2
Fuel System	High-pressure Injection (HPI)
Maximum Allowable Bending Moment @ Rear Face of Block	1500 lb.-ft. (2034 N-m)
Estimated Wet Weight*	4850 lbs. (2200 kg)

* Weight includes engine, cooling loop, heat exchanger, dual Electronic Control Modules (ECMs), Fire Pump Digital Panel (FPDP), standard air cleaner, standard exhaust flex, and all fluids.

Equipment	Standard	Optional
Air Cleaner	Disposable; treated for high humidity, indoor service	Heavy-duty, two-stage with replaceable elements
Alternator	24V-DC, 70 amps; includes belt guard	N/A
Cooling Loop (maximum pressure of 300 PSI)	1" diameter for fresh water; includes alarm sensors and FM-approval	Cu Ni construction available for sea water applications; approved loops up to 1 1/4"
Cooling System	Tube and shell type, 60 PSI with NPTF connections	Radiator[1]; sea water tube and shell
Engine Heater	120V-AC, 2250 watts	240V-AC, 2250 watts
Exhaust Protection	Metal guards on manifolds and turbocharger	N/A
Exhaust Flex Connection	Steel, flanged	Stainless steel flex, NPT
Flywheel Power Take-Off	Flywheel	Driveshaft system, stub shaft
Fuel Connections	Fire-resistant flexible supply and return lines	N/A
Fuel Filter	Primary with priming pump	N/A
Governor, Speed	Constant speed, adjustable	VSPLC[2]
Fire Pump Digital Panel (FPDP)	7" color touchscreen; enclosure rated as Type 2/ Type 4X; Imperial and metric values	Optional 316SS construction; custom gauges with digital panel expansion module (DPEM)
Lube Oil Cooler	Engine-water-cooled, plate type	N/A
Lube Oil Filter	Full-flow with by-pass valve	N/A
Lube Oil Pump	Gear-driven	N/A
Manual Start Controls	On FPDP and/or contactors	N/A
Overspeed Controls	Electronic with reset and test on FPDP	N/A
Starter	24V-DC	24V-DC/pneumatic[3]/hydraulic[3]

[1] Not UL-listed and not FM-approved.

[2] FM-approved, but not UL-listed.

[3] Only approved as a secondary starter

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Air Induction System

Maximum Temperature Rise Between Ambient Air and Engine Air Inlet	30 °F (16.7 °C)
Maximum Inlet Restriction with Dirty Filter	25 in. H_2O (635 mm H_2O)
Recommended Air Cleaner Element - (Standard)	K&N Serviceable/Disposable RC-3070
Recommended Air Cleaner Element - (Heavy Duty)	Optional: primary element AF25544; secondary element AF25545

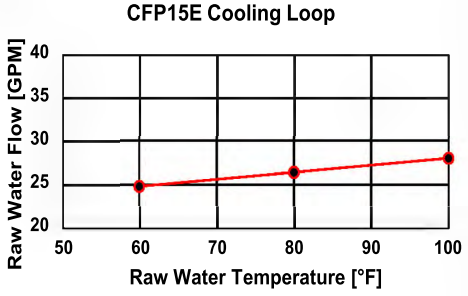
Lubrication System

Oil Pressure Range at Rated	35-40 PSI (242-276 kPa)
Oil Capacity of Pan (High - Low)	48-40 qt. (45-38 L)
Total System Capacity	13 gal. (49 L)
Recommended Lube Oil Filter	Cummins Filtration LF9000

Cooling System

Raw Water Working Pressure Range at Heat Exchanger	60 PSI (413 kPa) MAX
Recommended Minimum Water Supply Pipe Size to Heat Exchanger	1 in. (25.4 mm)
Recommended Minimum Water Discharge Pipe Size From Heat Exchanger	1.25 in. (31.75 mm)
Coolant Water Capacity (Engine Only)	13.9 gal. (52.6 L)
Standard Thermostat - Type	Modulating
Standard Thermostat - Range	180-200 °F (82-93 °C)
Normal Operating Temperature	180-212 °F (82-100 °C)
Minimum Raw Water Flow:	
- with Water Temperatures to 60 °F (16 °C)	24.8 GPM (1.56 L/sec)
- with Water Temperatures to 80 °F (27 °C)	26.4 GPM (1.67 L/sec)
- with Water Temperatures to 100 °F (38 °C)	28 GPM (1.77 L/sec)
Recommended Cooling Water Filter	Cummins Filtration WF2126

* A jacket water heater is mandatory on this engine. The recommended heater wattage is 3000 down to 40 °F (4 °C)



Exhaust System

Maximum Allowable Back Pressure by Complete Exhaust System	40.8 in. H_2O (10.2 kPa)
Exhaust Pipe Size Normally Acceptable	6 in. (152 mm)

Noise Emissions - The noise emission values are estimated sound pressure levels at 3.3 ft. (1 m).

Top	97.7 dBa
Right Side	98.3 dBa
Left Side	99.6 dBa
Front	98.9 dBa
Exhaust	120.0 dBa

Fuel Supply/Drain System

Operating Speed in RPM	1470		1760		1900		2100		2250	
Fuel Rate - Gal/hr (L/hr)	19.9	(75)	22.5	(85)	23.6	(90)	24.7	(93)	19.6	(74)

Fuel Type	No. 2 diesel only
Minimum Supply Line Size	0.75 in. (19.05 mm)
Minimum Drain Line Size	0.75 in. (19.05 mm)
Maximum Fuel Height above C/L Fuel Pump	105 in. (2.7 m)
Recommended Fuel Filter - Primary	Cummins Filtration FS1041
Recommended Fuel Filter - Secondary	None
Maximum Restriction @ Lift Pump-Inlet - With Clean Filter	6.0 in. Hg (152 mm Hg)
Maximum Restriction @ Lift Pump-Inlet - With Dirty Filter	10.0 in. Hg (254 mm Hg)
Maximum Return Line Restriction - Without Check Valves	9 in. Hg (229 mm Hg)
Minimum Fuel Tank Vent Capability	70 ft^3/hr (2.1 m^3/hr)
Maximum Fuel Temperature @ Lift Pump Inlet	160 °F (71 °C)

Starting and Electrical System

Min. Recommended Battery Capacity - Cold Soak at 0 °F (-18 °C) or Above	**24V**
Engine Only - Cold Cranking Amperes	1400 CCA*
Engine Only - Reserve Capacity	430 minutes*

*Based on FM requirement for a minimum of 900 CCA and 430 Reserve Capacity Minutes

Battery Cable Size - Minimum of 2/0 AWG and Maximum Cable Length Not to Exceed 6 ft. (1.5 m)	**24V**
Maximum Resistance of Starting Circuit	0.002 Ohms
Typical Cranking Speed	100 RPM
Alternator (Standard), Internally Regulated	70 amps

Operating Conditions

Operating Speed in RPM	1470		1760		1900		2100		2250	
Output - BHP (kW)	382	(285)	460	(343)	488	(364)	488	(364)	380	(283)
Ventilation Air Required - CFM (litre/sec)	970	(458)	1217	(574)	1357	(641)	1469	(693)	1542.5	(728)
Exhaust Gas Flow - CFM (litre/sec)	2500	(1180)	2881	(1360)	3099	(1463)	3308	(1561)	3473.4	(1639)
Exhaust Gas Temperature - °F (°C)	1025	(552)	1025	(552)	1025	(552)	1025	(552)	1025	(552)
Heat Rejection to Coolant - BTU/min. (kW)	6361	(112)	6947	(122)	7730	(136)	8085	(142)	8166	(143)
Heat Rejection to Ambient - BTU/min. (kW)	1423	(25)	1637	(29)	2064	(36)	1905	(33)	1886	(33)

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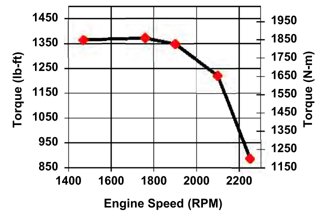
Engine Performance Curve for CFP15E-F10

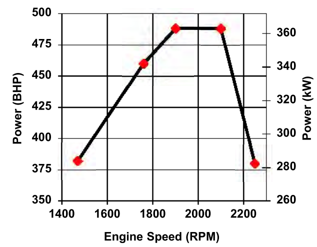
Torque Output

RPM	lb-ft	N-m
1470	1365	1850
1760	1373	1861
1900	1349	1829
2100	1220	1655
2250	887	1203



Horsepower Output

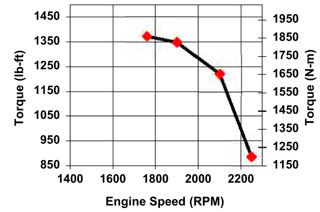
RPM	BHP	kW
1470	382	285
1760	460	343
1900	488	364
2100	488	364
2250	380	283



Engine Performance Curve for CFP15EVS-F10

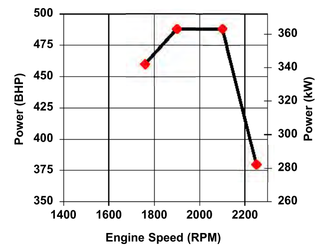
Torque Output

RPM	lb-ft	N-m
1760	1373	1861
1900	1349	1829
2100	1220	1655
2250	887	1203



Horsepower Output

RPM	BHP	kW
1760	460	343
1900	488	364
2100	488	364
2250	380	283



All data is based on the engine operating with a fuel system, water pump, lubricating oil pump, air cleaner, and alternator. The fan, optional equipment, and driven components are not included. Data is based on operation at SAE standard J1394 conditions of 300 ft. (91.4 m) altitude, 29.61 in. (752 mm) Hg dry barometer, and 77 °F (25 °C) intake air temperature, using No.2 diesel fuel only.

Altitude above which output should be limited*:	300 ft. (91.4 m)
Correction factor per 1000 ft. (305 m) above altitude limit:	3%
Temperature above which output should be limited:	77 °F (25 °C)
Correction factor per 10 °F (11 °C) above temperature limit:	1% (2%)

* Above 5,000 feet, contact Cummins for derate information.

US EPA NSPS Tier 3 Emissions Compliance

	D2 Cycle Exhaust Emissions*									
	Grams per BHP - HR					Grams per kW - HR				
Fuel Percentage of Sulfur	**NMHC**	**NO_x**	**NMHC + NO_x**	**CO**	**PM**	**NMHC**	**NO_x**	**NMHC + NO_x**	**CO**	**PM**
15 PPM Diesel Fuel	0.086	2.565	2.651	0.671	0.078	0.116	3.439	3.555	0.900	0.105
300-4000 PPM Diesel Fuel	0.104	2.781	2.886	0.671	0.089	0.14	3.730	3.870	0.900	0.120

*The emissions values above are based on CARB approved calculations for converting EPA (500 ppm) fuel to CARB (15 ppm) fuel.

Refer to the engine data tag for the EPA Standard Engine Family.

No special options are needed to meet current regulation emissions for all fifty states.
Tests conducted using alternate test methods, instrumentation, fuel, or reference conditions can yield different results.

Diesel Fuel Specifications:

- Cetane Number: 40-48
- Reference: ASTM D975 No. 2-D

Reference Conditions:

- Air Inlet Temperature: 25 °C (77 °F)
- Fuel Inlet Temperature: 40 °C (104 °F)
- Barometric Pressure: 100 kPa (29.53 in Hg)
- Humidity: 107 g H_2O/kg (75 grains H_2O/lb) of dry air; required for NO_x correction
- Intake Restriction set to a maximum allowable limit for clean filter
- Exhaust Back Pressure set to maximum allowable limit

Fire Pump Digital Panel (FPDP)

The Cummins FPDP is an integrated microprocessor-based control system that provides full digital technology with enhanced accuracy and built-in redundancy.

Reliable design - Designed and tested with isolated mounting to minimize vibration for longer life and durability, the Cummins FPDP proves reliable in harsh environments.

Advanced control methodology - The Cummins FPDP allows for Input/Output (I/O) expansion and remote monitoring capabilities, as well as automatic Electronic Control Module (ECM) switching for electronic engines.

Certified Quality - The Cummins FPDP is UL 1247-listed and FM 1333-approved.

Operator Panel Features

Operator/Display Panel

- 7” TFT LCD (thin-film-transistor liquid-crystal display) - color, 24-bit, 800x480 (WVGA).
- Auto, manual, start, stop, and fault reset.
- Assembly enclosure that meets Type 2 and Type 4X design requirements and is water, corrosion, fire, and impact-resistant.

Electronic Engine Communications - SAE J1939 protocol.

- Comprehensive full-authority engine (FAE) data: oil pressure and temperature; coolant temperature; and intake manifold pressure and temperature.
- Cummins fault code display.
- Sensor failure indication.
- Optional RS-485 serial - Modbus® RTU/Modbus® TCP/IP.

Variable Speed Pressure Limiting Control (VSPLC) Capabilities

- Display indicates when VSPLC is active.
- Pump discharge pressure display.
- Ability to run the engine at fixed speed from the FPDP at start-up for commissioning.

Other Control Features

- Digital Panel Expansion Module (DPEM) for additional analog/digital inputs and configurable dry relay contact output.
- Ability to idle at start-up for commissioning of electronic engines.
- Idle cool down for electronic engines.
- DC voltage.

Functional

- Configurable display units for temperature in degrees Fahrenheit or Celsius and pressure in PSI or kPa.
- Manual ECM selector switch on electronic engines.
- Ability to crank the fire pump drive engine from Battery A, Battery B, or both.
- Fixed engine speed adjustments in +/- 10 RPM increments.
- Overspeed shutdown.

Environmental

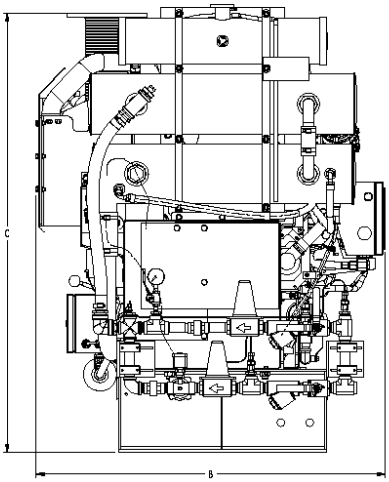
- Operating temperature - 4 to 158 °F (minus 20 to 70 °C).
- Storage temperature - minus 22 to 176 °F (minus 30 to 80 °C).
- Meets CISPR 11 Class B radiated emissions.
- Vibration: 7 G_{PEAK}; three-axis.

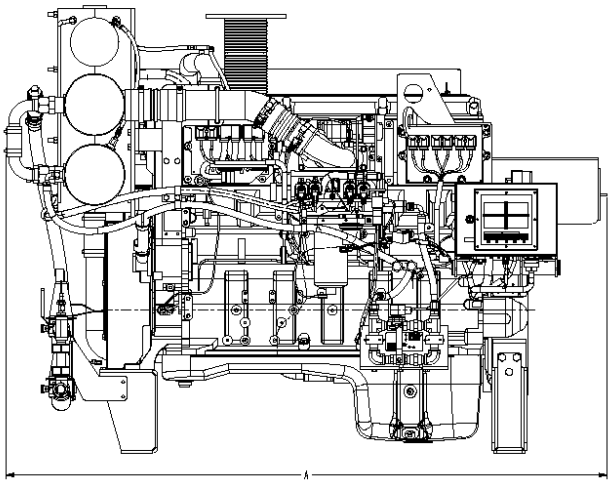
Electrical

- 8-30 VDC operating voltage.
- Reverse polarity protected.
- Spring cage terminal block interface.
- Built-in dual micro controllers for increased reliability.

Mechanical

- 1 3/8” pre-cut customer conduit knockout for easy field installation.
- Simplified internal design for efficiency and ease of customer connections.
- 16GA ASTM A366 material - 316 stainless steel optional.
- RAL3001 red powder coat finish.





This outline drawing is for reference only.
Do not use for installation design.

	Dim "A" in. (mm)	Dim "B" in. (mm)	Dim "C" in. (mm)
CFP15E F10-F30	83 (2101)	48 (1219)	60 (1530)

NOTE: Consult drawings or contact the factory for additional information.

This product has been manufactured under the controls established by a Bureau Veritas Certification approved management system that conforms with ISO 9001:2015.

NOTE: Codes or standards compliance may not be available with all model configurations - consult factory for availability. Specifications are subject to change without notice.

For more information, contact firepumpsales@cummins.com.

Cummins Sales and Service
875 Lawrence Drive
DePere, Wisconsin 54115
1 920 337 9750

power.cummins.com/fire-power

Doc. A042J611 Rev. 1

Attachment 6
Emissions Quantification

Appendix 5.1A - TABLE 1
Emissions Calculations for Criteria Pollutants and Greenhouse Gases from Diesel Emergency Generators
Operation Phase
Hydrostor - Ansel Site

Criteria and Regulated Pollutants	CAS	Engine Size (bkW)[a]	Engine Size (bhp)	Emission Factors [b]		Annual Hours of Operation [c]	Hourly Emissions (lb/hr)	Annual Emissions (tons/yr) One Diesel Generator	Annual Emissions (tons/yr) Three Diesel Generators
				Value	Unit				
PM_{10}	85101	2500	3621	0.020	g/bhp-hr	200	0.1597	0.0160	0.0479
$PM_{2.5}$ [d]	88101	2500	3621	0.020	g/bhp-hr	200	0.1597	0.0160	0.0479
NO_X	42603	2500	3621	0.500	g/bhp-hr	200	3.9915	0.3991	1.1974
CO	42101	2500	3621	2.600	g/bhp-hr	200	20.7557	2.0756	6.2267
SO_2 [e]	42401	2500	3621	0.00500	g/bhp-hr	200	0.0399	0.0040	0.0120
VOC	43104	2500	3621	0.140	g/bhp-hr	200	1.1176	0.1118	0.3353

Greenhouse Gases (GHGs)	Fuel Consumption (gal/hr) [a]	Fuel Density (btu/gal) [a]	Hourly Heat Rate (MMBtu/hr) [f]	Emission Factor (lb/MMBtu) [g]	Global Warming Potential (GWP)	Emission Rate (lb/hr)	Annual Operating Hours	Emission Rate (lb/hr CO_2e)	Annual Emissions (TPY CO_2e) One Diesel Generator	Annual Emissions (TPY CO_2e) Three Diesel Generators
Carbon dioxide (CO_2)	174.5	137000	23.920	163.05	1	3,900.156	200	3,900	390	1,170
Methane (CH_4)	174.5	137000	23.920	0.006614	25	0.158	200	3.96	0.40	1
Nitrous oxide (N_20)	174.5	137000	23.920	0.001323	298	0.032	200	9.43	0.94	3
							Total	3,914	391	1,174

Notes:

[a] Based on the Kohler KD2500-4 specifications for a diesel generator set. See engine specification brochure in Appendix.

[b] Emissions factors (g/bhp-hr) based on compliance with the EPA Tier 4 standards with add-on controls for Nox, CO, VOC, and PM10/2.5 (DPF).

[c] Emergency engines are limited to 200 hours of operation according to Kern County APCD. Nominal fuel use rate is 174.6 gals/hr = 23.92 mmbtu/hr.

[d] PM2.5 assumed equal to PM10. PM10 = DPF for purposes of the HRA operations analysis.

[e] SO_2 emission factor was calculated based on ULSD with a maximum of 15 ppm sulfur content (0.0015%) default to 0.005 g/hp-hr for all loads.

[f] Heating value for diesel fuel is based on the Typical parameters of various fuels, AP-42 - Appendix A. (7.05 lbs/gal and 137,000 btu/gal)

[g] Emission factors from 40 CFR 98 Table C-1 and C-2

Appendix 5.1A - TABLE 2

Emissions Calculations for Criteria Pollutants and Greenhouse Gases from Diesel Emergency Fire Pump

Operation Phase

Hydrostor - Ansel Site

Criteria and Regulated Pollutants	CAS	Engine Size (bkW)[a]	Engine Size (bhp)[a]	Emission Factors [b]		Annual Hours of Operation [c]	Hourly Emissions (lb/hr)	Annual Emissions (tons/yr) One Diesel Fire Pump
				Value	Unit			
PM_{10}	85101	343	460	0.150	g/bhp-hr	200	0.1521	0.0152
$PM_{2.5}$ [d]	88101	343	460	0.150	g/bhp-hr	200	0.1521	0.0152
NO_X	42603	343	460	2.850	g/bhp-hr	200	2.8903	0.2890
CO	42101	343	460	2.600	g/bhp-hr	200	2.6367	0.2637
SO_2 [e]	42401	343	460	0.00500	g/bhp-hr	200	0.0051	0.0005
VOC	43104	343	460	0.150	g/bhp-hr	200	0.1521	0.0152

Greenhouse Gases (GHGs)	Fuel Consumption (gal/hr) [a]	Fuel (btu/gal) [a]	Hourly Fuel Rate (MMBtu/hr) [f]	Emission Factor (lb/MMBtu) [g]	Global Warming Potential (GWP)	Emission Rate (lb/hr)	Annual Operating Hours	Emission Rate (lb/hr CO_2e)	Annual Emissions (TPY CO_2e) One Diesel Fire Pump
Carbon dioxide (CO_2)	22.5	137000	3.083	163.05	1	502.68	200	503	50
Methane (CH_4)	22.5	137000	3.083	0.006614	25	0.020	200	0.51	0.05
Nitrous oxide (N_20)	22.5	137000	3.083	0.001323	298	0.004	200	1.22	0.12
						Total		504.4	50.4

Notes:

[a] Based on the Cummins QST15 specifications for a diesel fire pump. See engine specification brochure in Appendix.

[b] Emissions factors (g/bhp-hr) based on compliance with the EPA Tier 3 standards.CARB procedure used to derive separate Nox and VOC values from combined ATCM values.

[c] Emergency engines are limited to 200 hours of operation according to Kern County APCD. Nominal fuel use rate is 22.5 gals/hr or 3.083 mmbtu/hr.

[d] PM2.5 assumed equal to PM10. PM10 = DPF for purposes of the HRA operations analysis.

[e] SO_2 emission factor was calculated based on ULSD with a maximum of 15 ppm sulfur content (0.0015%) default to 0.005 g/hp-hr for all loads.

[f] Heating value for diesel fuel is based on the Typical parameters of various fuels, AP-42 - Appendix A. (7.05 lbs/gal and 137,000 btu/gal)

[g] Emission factors from 40 CFR 98 Table C-1 and C-2

Appendix 5.1A - TABLE 3
Sources Location, Stack and Operating Parameters
Operation Phase
Hydrostor - Ansel Site

Source Description	Model ID	UTM Location [a]		Stack Parameters [b]				Operating Parameters [c]				
		Easting	Northing	Height		Diameter		Flowrate	Velocity		Temperature	
		(m)	(m)	(ft)	(m)	(ft)	(m)	(acfm)	(ft/s)	(m/s)	(°F)	(°K)
Emergency Diesel Generator 2.5MW	EGEN 1	394,612.1	3,863,819.9	22.93	6.989	1.033	0.315	9734	193.5	58.960	914	763
Emergency Diesel Generator 2.5MW	EGEN 2	394,611.3	3,863,816.8	22.93	6.989	1.033	0.315	9734	193.5	58.960	914	763
Emergency Diesel Generator 2.5MW	EGEN 3	394,632.4	3,863,813.7	22.93	6.989	1.033	0.315	9734	193.5	58.960	914	763
Fire Pump Engine	FP	394606.40	3864004.40	15	4.57	0.5	0.152	2881	245	74.67	1025	825

[a] Locations are based on UTM Zone 11, NAD83 Datum. EGEN 1,2,3 Ops parameters apply to each stack (2 stacks per engine).

[b] Stack parameters are based on Applicant supplied design data.

[c] Operating parameters are based on the Kohler KD2500-4 and Cummins QST15 engines. See Appendix for engine brochures and specifications.

Table 5.1A-4 Fixed Roof Tank Emissions Estimates

Hydrostor-WRESC Operations

Kohler Engine Tanks

Ref: AP-42, Section 7.1, 11/2006

Tanks converted from rectangular to horizontal cylindrical for purposes of these calculations.

indicates input

Standing Storage Losses			***Comments***	**Note**
Type of organic liquid:	#2 ULS Diesel		~3740 gal tank for each Kohler engine	
Vapor molecular weight:	Mw	130	AP-42	
Vapor density, lbs/ft3:	Vd	0.00014664		
Liquid density, lbs/gal	Dl	7.1	AP-42	
TVP, psia @ 60F	Vp	0.0065	AP-42 (consistent with Ta below)	
~ Tank diameter, ft.	D	8		
~ Tank height or length, ft.	H	11		
~ Tank capacity, gals	Tc	3800		
Avg vapor space height, ft.	Hv	2	annual avg value based on use versus tank refills	
Vapor space volume, ft3	Vv	100.53		
~Total tank volume, ft3	Tv	508	Based on actual tank dimensions	
Avg Annual Temp, F	Ta	77	Lancaster, Ca. www.usclimatedata.com	
Avg diurnal temp change, F	Tc	30	Avg max minus avg min.	
Paint factor	Pf	0.05	AP-42, Table 7.1-6, solar absorbance value	1
Product factor	Pd	1	Crude = 0.75, all others = 1	
			If turnover <36/year, the factor = 1. If >36 then calculate Kn.	
Turnover factor	Kn	1	Per AP-42.	
Annual throughput, gals/yr	At	8730		
Vapor space expansion factor	Ke	0.04	AP-42, default value	
Vapor saturation factor	Ks	0.9993		
# of similar tanks		3		2
Standing Loss	**Ls**	**0.22**	**lbs/yr (breathing and standing losses)**	

Working Losses			
Vapor molecular weight:	Mw	130	
Vapor pressure, psia @ 70F	Vp	0.0065	
Throughput, bbl/yr	Q	207.9	
Turnover factor	Kn	1	
Working loss product factor	Kp	1	
Working Loss	**Lw**	**0.18**	**lbs/yr (tank filling and withdrawal losses)**
	Ls+Lw	**0.39**	
Engineering Uncertainty Factor		1.2	
Uncontrolled Total Tank Losses		**0.47**	**lbs/yr each tank**
		1.41	**lbs/yr all tanks**
Control System ?	No	0	control fraction
System type, etc.	NA, no controls are required on #2 fuel oil storage tanks or delivery systems		
Controlled Total Tank Losses		**0.47**	**lbs/yr each tank**
		1.41	**lbs/yr all tanks**
		0.001	**TPY all tanks**

Note 1 - paint factor reduced due to tanks being inside the bldg on the ground floor not subject to ambient sunlight exposure.

Note 2 - based on Applicant supplied data

Note 3 - consult agency regulations for permitting requirements

Air Toxics Emissions - Source: SJVUAPCD AB2588 Air Toxics Profiles (Profile 23 Diesel Fuel Storage)

Toxic Pollutant	EF, lb/lb VOC	Emissions, lbs/yr (all tanks)	lbs/hr
Benzene	0.00088	0.0012	1.413E-07
Toluene	0.00482	0.0068	7.73941E-07
Xylenes	0.0042	0.0059	6.74388E-07

Table 5.1A-5 Fixed Roof Tank Emissions Estimates

Hydrostor-WRESC Operations

Cummins Engine Tank

Ref: AP-42, Section 7.1, 11/2006

Tanks converted from rectangular to horizontal cylindrical for purposes of these calculations.

indicates input

Standing Storage Losses			***Comments***	**Note**
Type of organic liquid:	#2 ULS Diesel		~550 gal tank for Cummins engine	
Vapor molecular weight:	Mw	130	AP-42	
Vapor density, lbs/ft3:	Vd	0.00014664		
Liquid density, lbs/gal	Dl	7.1	AP-42	
TVP, psia @ 60F	Vp	0.0065	AP-42 (consistent with Ta below)	
~ Tank diameter, ft.	D	4		
~ Tank height or length, ft.	H	6		
~ Tank capacity, gals	Tc	550		
Avg vapor space height, ft.	Hv	1	annual avg value based on use versus tank refills	
Vapor space volume, ft3	Vv	12.57		
~Total tank volume, ft3	Tv	74	Based on actual tank dimensions	
Avg Annual Temp, F	Ta	77	Lancaster, CA. www.usclimatedata.com	
Avg diurnal temp change, F	Tc	30	Avg max minus avg min.	
Paint factor	Pf	0.05	AP-42, Table 7.1-6, solar absorbance value	1
Product factor	Pd	1	Crude = 0.75, all others = 1	
			If turnover <36/year, the factor = 1. If >36 then calculate Kn.	
Turnover factor	Kn	1	Per AP-42.	
Annual throughput, gals/yr	At	1125		
Vapor space expansion factor	Ke	0.04	AP-42, default value	
Vapor saturation factor	Ks	0.9997		
# of similar tanks		1		2
Standing Loss	**Ls**	**0.03**	**lbs/yr (breathing and standing losses)**	
Working Losses				
Vapor molecular weight:	Mw	130		
Vapor pressure, psia @ 70F	Vp	0.0065		
Throughput, bbl/yr	Q	26.8		
Turnover factor	Kn	1		
Working loss product factor	Kp	1		
Working Loss	**Lw**	**0.02**	**lbs/yr (tank filling and withdrawal losses)**	
	Ls+Lw	**0.05**		
Engineering Uncertainty Factor		1.2		
Uncontrolled Total Tank Losses		**0.06**	**lbs/yr each tank**	
		0.06	**lbs/yr all tanks**	
Control System ?	No	0	control fraction	
System type, etc.	NA, no controls are required on #2 fuel oil storage tanks or delivery systems			3
Controlled Total Tank Losses		**0.06**	**lbs/yr each tank**	
		0.06	**lbs/yr all tanks**	
		0.000	**TPY all tanks**	

Note 1 - paint factor reduced due to tanks being inside the bldg on the ground floor not subject to ambient sunlight exposure.

Note 2 - based on Applicant supplied data

Note 3 - consult agency regulations for permitting requirements

Air Toxics Emissions - Source: SJVUAPCD AB2588 Air Toxics Profiles (Profile 23 Diesel Fuel Storage)

Toxic Pollutant	EF, lb/lb VOC	Emissions, lbs/yr (all tanks)	lbs/hr
Benzene	0.00088	0.0001	5.97049E-09
Toluene	0.00482	0.0003	3.2702E-08
Xylenes	0.0042	0.0002	2.84955E-08

Attachment 7
Impact Analysis Summary
Criteria Pollutants

Operations Impact Summary – Criteria Pollutants

Operations Air Quality Impact Results – No-Architectural Berm Option

Pollutant	Averaging Time	Maximum Concentration (µg/m³)	Background (µg/m³)	Total (µg/m³)	USEPA SIL (µg/m³)	Ambient Air Quality Standards (µg/m³)	
						CAAQS	NAAQS
NO_2	1-hour (highest)	121.2	97.9	219.1	NA	339	-
	1-hour (98th percentile) [a]	3.1	75.91	79.0	7.5	-	188
	Annual Maximum	0.3	15.7	16.0	1	57	100
CO	1-hour (highest)	501.6	1,832	2,333.6	2,000	23,000	40,000
	8-hour (highest)	59.3	1,260	1,319.3	500	10,000	10,000
SO_2	1-hour (highest)	1.0	11.2	12.2	NA	655	--
	1-hour (99th percentile)	.04	10.5	10.5	7.5	--	196
	24-hour (highest)	.03	8.9	8.9	5	105	--
	Annual	.003	4.6	4.6	1	105	--
PM10	24-hour (highest)	0.1	351	351.1	5	50	--
	24-hour (6th highest)	0.1	112	112.1	NA	-	150
	Annual maximum	0.02	32.7	32.7	1	20	-
PM2.5	24-hour (98th percentile)	0.08	27.0	27.1	1.2	-	35
	5-year average annual	0.01	6.3	6.3	0.3	9.0*	9.0*

Source: Appendix 5.1E.

[a] Modeling for 1-hour NO_2 NAAQS utilized the annual emissions to assess the 98th percentile concentrations as these units are emergency generators and are, therefore, classified as "intermittent," USEPA Memorandum, March 1, 2011.

µg/m³ = micrograms per cubic meter; CAAQS = California Ambient Air Quality Standards; CO = carbon monoxide; NO_2 = nitrogen dioxide; NAAQS = National Ambient Air Quality Standards; PM10 = particulate matter less than 10 microns; PM2.5 = particulate matter less than 2.5 microns SO_2 = sulfur dioxide, - = not applicable, *USEPA has recently lowered the annual PM2.5 standard from 12 *u*g/m³ down to 9 *u*g/m³: * = the current form of the annual PM2.5 standard is 12.0 *u*g/m³ but is expected to decrease to 9.0 *u*g/m³ within the next 90 days (approximately). To account for this anticipated rulemaking, the new standard was used for this analysis.

Attachment 8
Health Risk Assessment Summary

Operations HRA Summary Tables for the

Berm and No Berm Options

Health Risk Assessment Summary for the Operations Phase

Berm Option						
Type of Risk	**Receptor Type**	**Exposure Duration**	**Risk**	**Receptor ID**	**UTM E (meters)**	**UTM N (meters)**
Cancer	PMI	30 Years	1.26E-5	61	394,832.36	3,863,973.48
	MEIR		7.96E-8	4,494	393,510.00	3,865,060.00
	MEIS		2.65E-8	1,911	393,160.00	3,858,860.00
	MEIW	25 Years	2.34E-8	4,494	393,510.00	3,865,060.00
Chronic HI	PMI	Annual	2.85E-3	61	394,832.36	3,863,973.48
	MEIR		1.80E-5	4,494	393,510.00	3,865,060.00
	MEIS		6.00E-6	1,911	393,160.00	3,858,860.00
	MEIW		1.80E-5	4494	393,510.00	3,865,060.00
					394,832.36	3,863,973.48

MEIR = maximum exposed individual residential; MEIS = maximum exposed individual sensitive; MEIW = maximum exposed individual worker; PMI = point of maximum impact; UTM = Universal Transverse Mercator

Health Risk Assessment Summary for the Operations Phase

No-Berm Option						
Type of Risk	**Receptor Type**	**Exposure Duration**	**Risk**	**Receptor ID**	**UTM E (meters)**	**UTM N (meters)**
Cancer	PMI	30 Years	1.26E-5	40	394,833.27	3,863,977.23
	MEIR		7.96E-8	4,388	393,480.00	3,865,110.00
	MEIS		2.65E08	1,848	393,160.00	3,858,860.00
	MEIW	25 Years	2.34E-8	4,388	393,480.00	3,865,110.00
Chronic HI	PMI	Annual	2.85E-3	40	394,833.27	3,863,977.23
	MEIR		1.80E-5	4,388	393,480.00	3,865,110.00
	MEIS		6.00E-6	1,848	393,160.00	3,858,860.00
	MEIW		1.80E-5	4,388	393,480.00	3,865,110.00

Source: HARP2 (ADMRT 22118) model run by ADI, December 2023
The PMI in both scenarios is located on the eastern fence line and is not a residential receptor.
The MEIS in both scenarios is the Rosamond Elementary School.
MEIR = maximum exposed individual residential; MEIS = maximum exposed individual sensitive; MEIW = maximum exposed individual worker; PMI = point of maximum impact; UTM = Universal Transverse Mercator