URS

DOCKET	
09-AFC-1	
DATE	APR 12 2010
RECD.	APR 12 2010

April 12, 2010

Dockets Unit
California Energy Commission
1516 Ninth Street, MS 4
Sacramento, CA 95814-5512

Re: Watson Cogeneration Steam and Electric Reliability Project
Application for Certification 09-AFC-1

On behalf of Watson Cogeneration Company, the applicant for the above-referenced Watson Cogeneration Steam and Electric Reliability Project, we are pleased to submit the following:

- Aqueous Ammonia Off-Site Consequence Analysis (Revised April 2010).

This analysis was revised as a result of discussions with the CEC staff.

This document is being submitted to the CEC for docketing.

Sincerely,
URS Corporation

C Kyle-Fischer

Cindy Kyle-Fischer
Project Manager

Enclosures

cc: Proof of Service List

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WATSON COGENERATION STEAM AND ELECTRIC RELIABILITY PROJECT

AQUEOUS AMMONIA OFF-SITE CONSEQUENCE ANALYSIS

Application for Certification 09-AFC-1

Submitted to:
California Energy Commission
1516 9th Street , MS 15
Sacramento, CA 95814-5504

Submitted by:
Watson Cogeneration Company
22850 South Wilmington Avenue
Carson, CA 90745

With support from:
URS Corporation
8181 East Tufts Avenue
Denver, CO 80237

Revised April 2010

BEFORE THE ENERGY RESOURCES CONSERVATION AND DEVELOPMENT COMMISSION OF THE STATE OF CALIFORNIA
1516 NINTH STREET, SACRAMENTO, CA 95814
1-800-822-6228 – WWW.ENERGY.CA.GOV

APPLICATION FOR CERTIFICATION
FOR THE *WATSON COGENERATION STEAM AND ELECTRICITY RELIABILITY PROJECT*

Docket No. 09-AFC-1

PROOF OF SERVICE LIST
(Revised 1/27/10)

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DECLARATION OF SERVICE

I, Cindy Kyle-Fischer, declare that on April 12, 2010, I served and filed copies of the attached *Aqueous Ammonia Off-Site Consequence Analysis (Watson Cogeneration Steam and Electric Reliability Project)*, dated April 2010. The original document, filed with the Docket Unit, is accompanied by a copy of the most recent Proof of Service list, located on the web page for this project at: **[www.energy.ca.gov/sitingcases/watson]**.

The document has been sent to both the other parties in this proceeding (as shown on the Proof of Service list) and to the Commission's Docket Unit, in the following manner:

(*Check all that Apply*)

FOR SERVICE TO ALL OTHER PARTIES:

_X_ sent electronically to all email addresses on the Proof of Service list

_X__ by personal delivery or by depositing in the United States mail at Denver, Colorado with first-class postage thereon fully prepaid and addressed as provided on the Proof of Service list above to those addresses **NOT** marked "email preferred."

AND

FOR FILING WITH THE ENERGY COMMISSION:

_X_sending an original paper copy and one electronic copy, mailed and emailed respectively, to the address below (***preferred method***);

OR

____depositing in the mail an original and ___ paper copies, as follows:

CALIFORNIA ENERGY COMMISSION
Attn: Docket No. 09-AFC-1
1516 Ninth Street, MS-4
Sacramento, CA 95814-5512
docket@energy.state.ca.us

I declare under penalty of perjury that the foregoing is true and correct.

C Kyle-Fischer

_______________________:
Cindy Kyle-Fischer

Aqueous Ammonia Off-site Consequence Analysis

Figures

Attachment

List of Acronyms

°C	degrees Celsius
°F	degrees Fahrenheit
AA	Administering Agency
AFC	Application for Certification
BACT	Best Available Control Technology
CalARP	California Accidental Release Prevention
CCR	California Code of Regulations
CEC	California Energy Commission
CFR	Code of Federal Regulations
EPA	Environmental Protection Agency
Facility	Watson Cogeneration Facility
HRSG	heat recovery steam generator
mmHg	Millimeters of mercury
NO_x	nitrogen oxides
OCA	Off-site Consequences Analysis
ppm	Parts per million
Project	Watson Cogeneration Steam and Electric Reliability Project
RMP	Risk Management Plan
SCR	Selective Catalytic Reduction

AQUEOUS AMMONIA OFF-SITE CONSEQUENCE ANALYSIS

The Watson Cogeneration Steam and Electric Reliability Project (Project) is a proposed expansion of the existing steam and electrical generating (cogeneration) facility that is located in Carson, California. The Project will complete the original design of Watson Cogeneration Facility (Facility) by adding a fifth train (also referred to as Unit #5 or the Fifth Train).

The Project is required by both the Clean Air Act and the South Coast Air Quality Management District to install Best Available Control Technology (BACT) to control emissions of criteria air pollutants from the combustion turbines. The Project turbine will incorporate dry low nitrogen oxides (NO_x) combustor technology that reduces emissions of NO_x. In addition, the turbines (and heat recovery steam generator [HRSG] duct burners) emissions of NO_x will be further reduced through the use of selective catalytic reduction (SCR). The SCR control system utilizes ammonia as the reduction medium in the presence of a catalyst. Two forms of ammonia may be used in currently-designed SCR systems, i.e., anhydrous ammonia or aqueous ammonia. The existing Facility uses anhydrous ammonia. The Project is proposing to use aqueous ammonia in a 29.0 percent (by weight) solution. Aqueous ammonia is a water based ammonia solution, which can be mixed and delivered, in a wide variety of solution ratios. Solution mix ratios less than 30 percent (weight basis) are the most common. Aqueous ammonia solutions typically have a boiling point of approximately 83 degrees Fahrenheit (°F). When spilled, aqueous ammonia solutions will slowly vaporize, releasing ammonia vapors. According to data prepared for the California Energy Commission (CEC) by Ebasco (*Ammonia Release Risk Mitigation Guidance for Power Plants-Draft Report, November 1989*) when ammonia is diluted with water to solutions of less than or equal to 20 percent by volume, evaporation of ammonia gas from the fluid becomes negligible. The guidance further states that when ammonia is diluted with water at ambient temperatures to solutions less than 25 percent by weight, ammonia vapor pressure is reduced to atmospheric pressure, i.e., the evaporation of ammonia gas from the fluid would be negligible. A 29 percent solution of aqueous ammonia has an approximate vapor pressure of 118 torr at 20 degrees Celsius (°C) (approximately 520 millimeters of mercury [mm Hg] at 70 °F).

The Code of Federal Regulations 40 (CFR) Part 68, and the California Code of Regulations (CCR), Division 2, Chapter 4.5 regulate the potential accidental release of hazardous materials. CCR Article 8, Section 2770.5 includes tables of federally and state regulated substances including threshold quantities for regulation under the accidental release prevention program. Because the Project will store ammonia in excess of 500 pounds, the facility is required to have a written Risk Management Plan (RMP) and complete an Off-site Consequence Analysis (OCA). It should be noted that the existing Facility currently has an RMP in place and approved by the Administering Agency (AA) for anhydrous ammonia, which is used in the SCR systems for turbines in Units #1 through 4. The following OCA is based on present site and design information for the Fifth Train (Unit #5).

Accidental releases of ammonia (all forms) in industrial use situations are rare. Statistics compiled on the normalized accident rates for RMP chemicals for the years 1994-1999 from *Chemical Accident Risks in U.S. Industry-A Preliminary Analysis of Accident Risk Data from U.S. Hazardous Chemical Facilities, J. C. Belke, Sept 2000,* indicates that ammonia averages 0.017 accidental releases per process per year, and 0.018 accidental releases per million pounds stored per year. Data derived from *The Center for Chemical Process Safety, 1989,* indicates the following accidental release scenarios and probabilities for ammonia in general.

Accident Scenario	Failure Probability
On-site Truck Release	0.0000022
Loading Line Failure	0.005
Storage Tank Failure	0.000095
Process Line Failure	0.00053
Evaporator Failure	0.00015

The Project aqueous ammonia storage tank and unloading area is located approximately 600 feet (182.9 meters) from the closest fence line, as shown in Figure 1, Revised Project Site Plan. The tank will have a stationary fixed roof and a capacity of approximately 12,000 gallons. The tank will be enclosed by a containment berm capable of containing the full contents of the tank as well as incidental rainwater. The approximate berm dimensions are as follows:

- Length 35.5 feet
- Width 20 feet
- Depth 3.5 feet
- Capacity = 18,588 gallons

The surface area of the bermed area will be 710 square feet (65.95 square meters), and the volume will be approximately 18,588 gallons. Maximum tank storage will be administratively limited to 12,000 gallons. The delivery truck vessel is anticipated to have a capacity of 6,000 to 8,000 gallons.

An OCA was performed for the release scenario involving the complete failure and discharge of the storage tank contents into the secondary containment area. In addition, an alternative release scenario was also evaluated, i.e., failure of the truck unloading hose with a resultant spill forming a pool on the truck unloading pad. Table 1, OCA Modeling Data Summary, shows the meteorological data values used in the modeling scenarios.

Table 1
OCA Modeling Data Summary

Parameter	Worst Case	Alternate Case
Release Rate, lbs/min	49.1	0.87
Wind Speed, m/sec[1]	1.5	3.0
Stability Class[2]	F	D
Temperature, degree C[3]	43.9	18.1
Relative Humidity, percent[4]	50	50
Release Height, m[5]	0	0
Te, parts per million (ppm)[6]	201/75	201/75
Tav, mins[7]	60/30	60/30
z^0, m[8]	0.1	0.1
Dispersion Coefficients[9]	Urban	Urban
Fence line Distance, m	182.9	182.9
Spill Surface Area, m2.[10]	65.95	3.79
Spill Depth, cm[11]	NA	1.0
Dike Containment Present	Yes	No

Notes:
Cm = centimeter
CalARP = California Accidental Release Prevention
EPA = Environmental Protection Agency
Km = kilometer
Lbs/min = pounds/minute
m = meters
m/sec = meters per second
mg/L = milligrams per Liter
Te = toxic endpoint
Tav = toxic average
WSCMO = Weather Service Contract Meteorological Office
z^0 = roughness length

Explanation of table values:

1. Wind speed values are the EPA/CalARP default values for worst case and alternative case evaluations.
2. Stability class values are the EPA/CalARP default values for worst case and alternative case evaluations.
3. Worst-case temperature is the highest daily temperature for the Long Beach WSCMO (station #045085) area as derived from historical records. Alternative case temperature is the average annual for Long Beach WSCMO.
4. RH values are the EPA default values for worst case and alternative case evaluations.
5. For all scenarios, the release height is 0 feet above ground level (agl).
6. Te value of 201 ppm is equivalent to 0.14 mg/l. CEC Level of Concern (LOC) of 75 ppm is equivalent to 0.052 mg/l.
7. The Te value is based on an exposure time of 60 minutes, therefore the OCA exposure values are also based on an Tav (averaging time) of 60 minutes. CEC LOC of 75 ppm based on 30 minute averaging time.
8. Surface roughness coefficients represent an average value for areas with flat terrain, low density vegetation per CalTech research.
9. Dispersion coefficients are based on the land use criteria (Auer) for the area within 3 km of the site.
10. Dike containment may be present and accounted for in some release scenarios.
11. EPA default value of 1 centimeter assumed for all spill depths outside of diked areas.

A total of six (6) modeling runs were conducted, i.e., tank failure and truck unloading, hose failure for the meteorological scenarios listed in Table 1, and the action levels as follows:

- CalARP RMP Te of 201 ppm (1 hour average)
- ERPG-2 level of 150 ppm (1 hour average)
- CEC LOC of 75 ppm (30 min average)

OCA modeling was conducted using the SLAB model. A complete description of the SLAB model is available in *User's Manual for SLAB: An Atmospheric Dispersion Model for Denser-Than-Air-Releases, D. E. Ermak, Lawrence Livermore National Laboratory, June 1990*. The current version of SLAB is accompanied by an external substance database which includes chemical specific data for ammonia. This data was used in all modeling runs without exception or modification except for the "cmedo" value which was conservatively calculated (0.0) for each release scenario.

Emissions of ammonia from the aqueous ammonia solution were calculated pursuant to the equations and guidance given in *RMP Offsite Consequence Analysis Guidance, Environmental Protection Agency (EPA), April 1999*. See Attachment 1, Emissions Calculations spreadsheet.

Please note that per *Risk Management Program Guidance for Wastewater Treatment Plants, EPA-Office of Solid Waste and Emergency Response (OSWER), October 1998*, ammonia emissions from diked and/or surface area spills are only calculated for the first 10 minutes of the spill life. EPA states that the release of ammonia from the aqueous solution should only be used for the first 10 minutes after which the ammonia in the pool (diked area) will be more dilute than it was initially and will be evaporating much less rapidly. This assumption applies to both release scenarios.

Emissions from the surface area spill, i.e., alternative release scenario, are assumed (for purposes of a conservative alternate release analysis) to be a 100 percent loss rate of ammonia from the spilled solution over the 10-minute release period.

The specified action level values for ammonia were delineated above. These values are based on either a one-hour or 30-minute exposure, therefore, the modeling concentrations at all off-site receptors will be given in terms of one-hour or 30-minute exposures dependent upon the action level being evaluated.

The ammonia storage and unloading area is located approximately 600 feet (182.9 meters) from the closest fence line. Table 2 delineates the sensitive receptors within 1 kilometer of the tank area.

Table 2
Sensitive Receptors Within 1 Kilometer of the Ammonia Storage Area

Receptor Name	Receptor Type	Direction from Fifth Train	Distance from Fifth Train Tank Area
None	NA	NA	NA

Source: Watson Cogeneration Steam and Electric Reliability Project AFC Appendix O, Public Health, Table O-6, 2009.

Figures 2 through 7 (on the following pages) show the individual scenario results in terms of concentration vs. downwind distance for each of the scenarios and action levels delineated above.

Figures 2 and 5 - CalARP RMP Te of 201 ppm (1 hour average)

Figures 3 and 6 - ERPG-2 level of 150 ppm (1 hour average)

Figures 4 and 7 - CEC LOC of 75 ppm (30 min average)

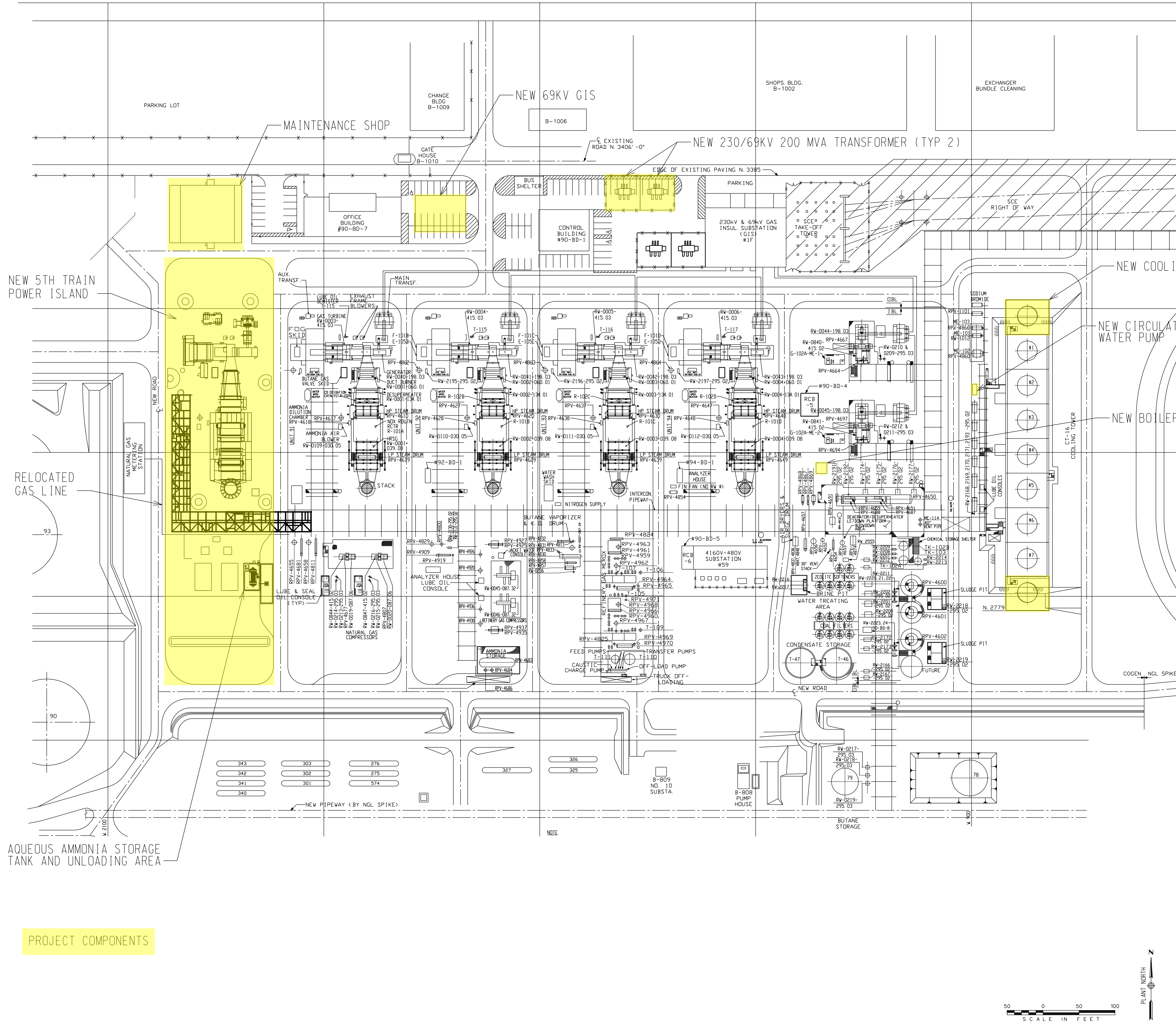
As can be seen in the figures, ammonia concentrations at the closest fence line location are well below the toxic endpoint values as noted above. The levels of exposure from the both release scenarios, at the three toxic endpoints and averaging times, are considered insignificant, and would result in no known or discernable health impacts to any member of the surrounding population. Since the zones of impact for each of the scenarios are well within the site property line, i.e., no off-site concentrations approaching the toxic endpoint values are noted, no zone of impact figures are needed or presented in this analysis.

Attachment 1 contains copies of the emissions calculations for each release scenario as well as the climatic data (highest daily temperature data) used in the modeling analysis for the worst and alternate case release scenarios.

Analysis Conclusions

The following conclusions result from the above off-site consequence analysis:

- The zone of impact (based on the toxic endpoint value for ammonia) for all cases evaluated lies clearly within the facility and Project fence lines.
- No offsite areas are predicted to experience ammonia concentrations at levels that would exceed any of the ammonia toxic endpoint values from 0.052 mg/l (75 ppm) to 0.14 mg/l (approximately 201 ppm).
- The aqueous ammonia zone of impact is significantly less than the currently analyzed zone of impact for the existing anhydrous ammonia tank which is used for the SCR system for Units 1 through 4.



- PRELIMINARY -
NOT FOR CONSTRUCTION

REV	DESCRIPTION	DWN	CHK	APP	DATE
H	ADDED AMMONIA AREA & REVISED GAS COMPRESSOR LAYOUT	PDW	SMG	SMG	03-01-10
G	REMOVED EVAP COOLER PUMP SKID & DELETED 2ND DRUM	EJS	JAR	SMG	01-27-09
F	ADDED 5TH TRAIN COMPONENTS	EJS	JAR	SMG	01-21-09
E	REVISED TITLE BLOCK	EJS	JAR	SMG	01-20-09
D	REVISED LOCATION OF ELEC. GEAR & MAINTENANCE SHOP	KWO	JAR	SMG	01-19-09
C	REVISED WATER TANK SIZE	JAH	JAR	SMG	09-10-08
B	ISSUED FOR APPLICATION	DAD	JAR	SMG	08-22-08
A	ISSUED FOR REVIEW	DAD	SMG	SMG	05-29-08

WATSON COGENERATION
STEAM AND ELECTRIC RELIABILITY PROJECT

Kiewit

Kiewit Power
9401 Renner Blvd.
Lenexa, Kansas 66219

REVISED PROJECT SITE PLAN
FIGURE 1

	by	date
DESIGNED	DAD	05-29-08
DRAWN	DAD	05-29-08
CHECKED		
APPROVED		

DRAWING NUMBER
2007-047-SP-001 OPTG

Figure 2
CalARP RMP Te 201 ppm (1 hour average)

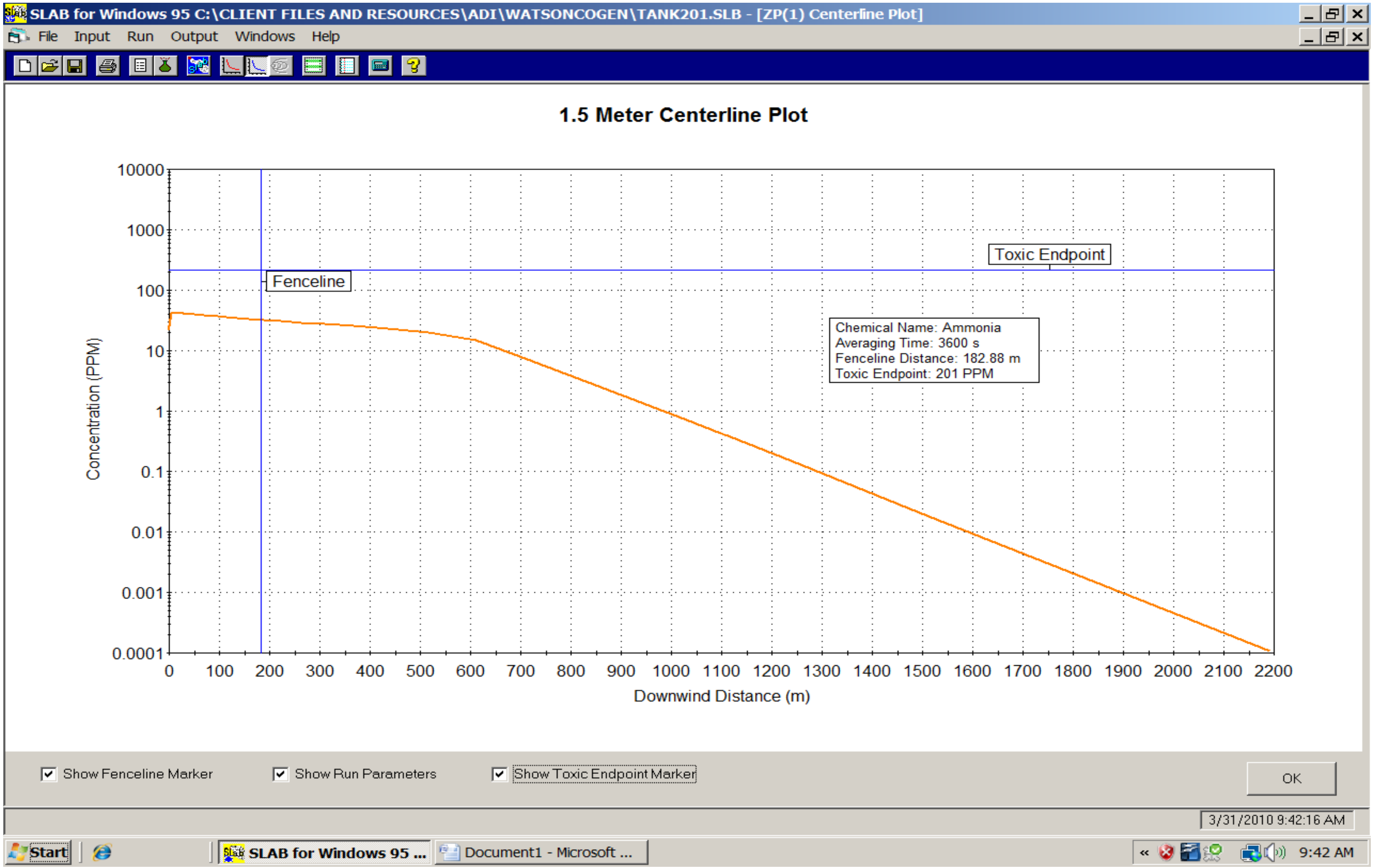


Figure 3
ERPG-2 150 ppm (1 hour average)

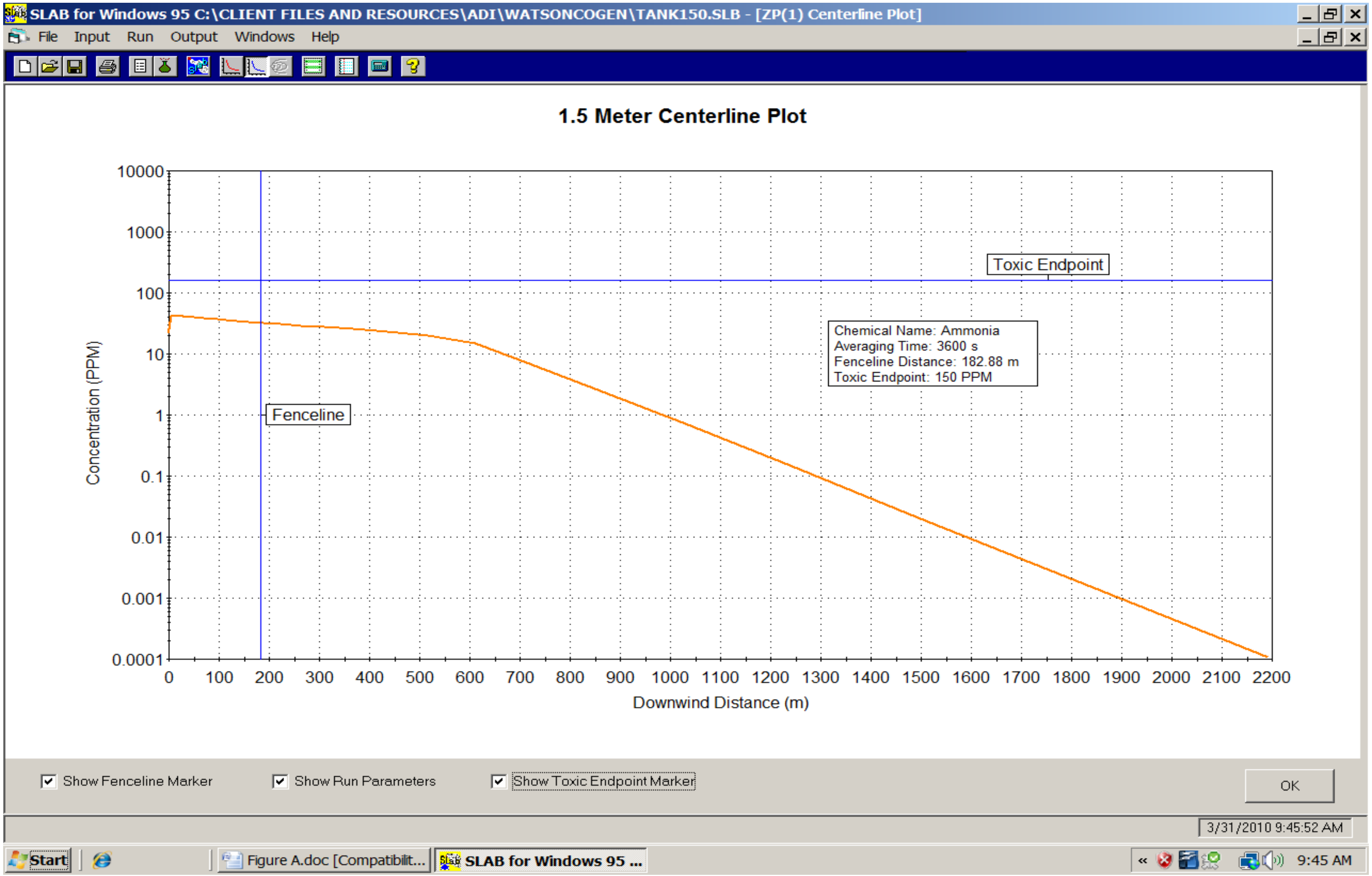


Figure 4
CEC LOC 75 ppm (30 minute average)

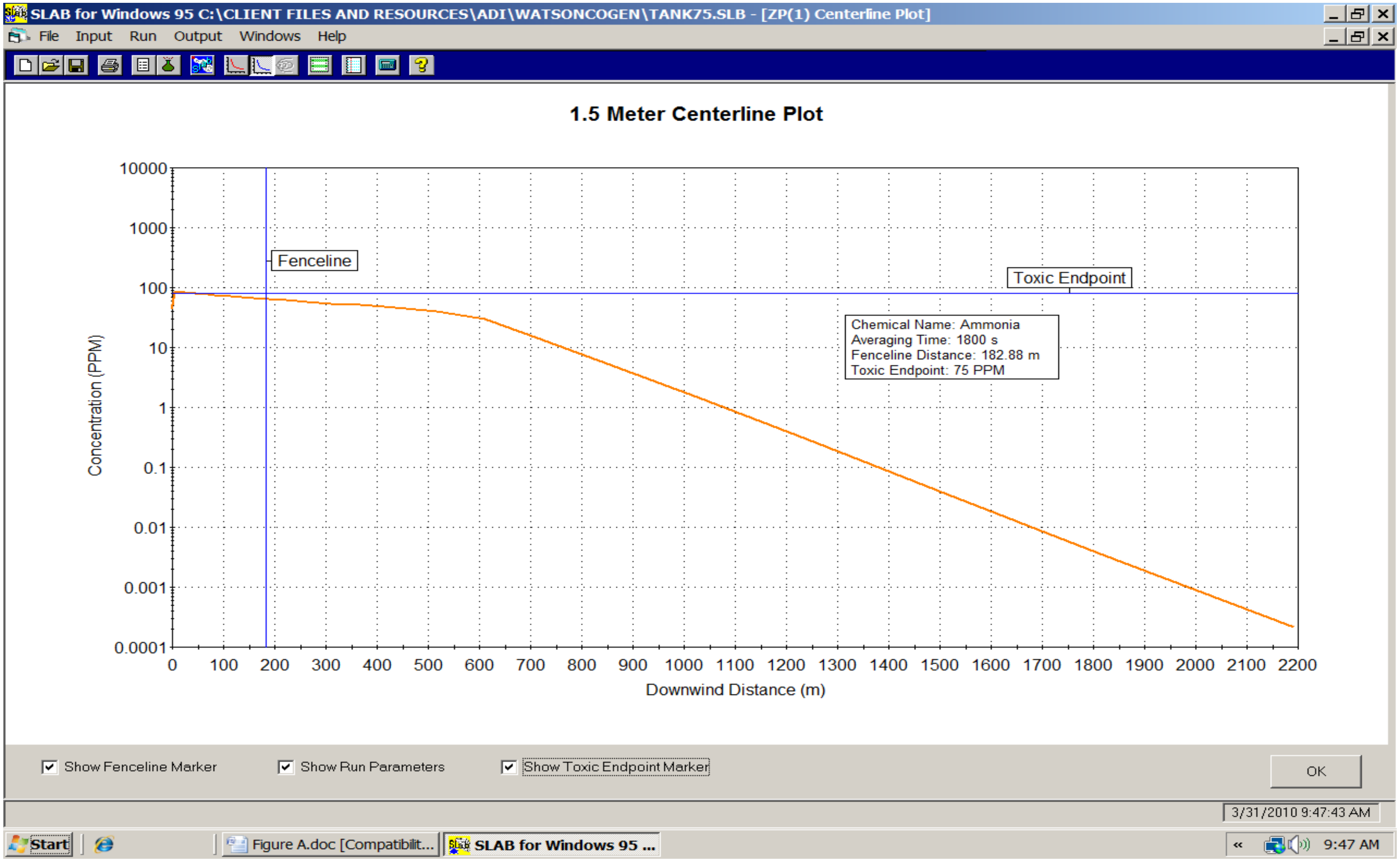


Figure 5
Alternate Case Hose Release - CalARP RMP Te of 201 ppm (1 hour average)

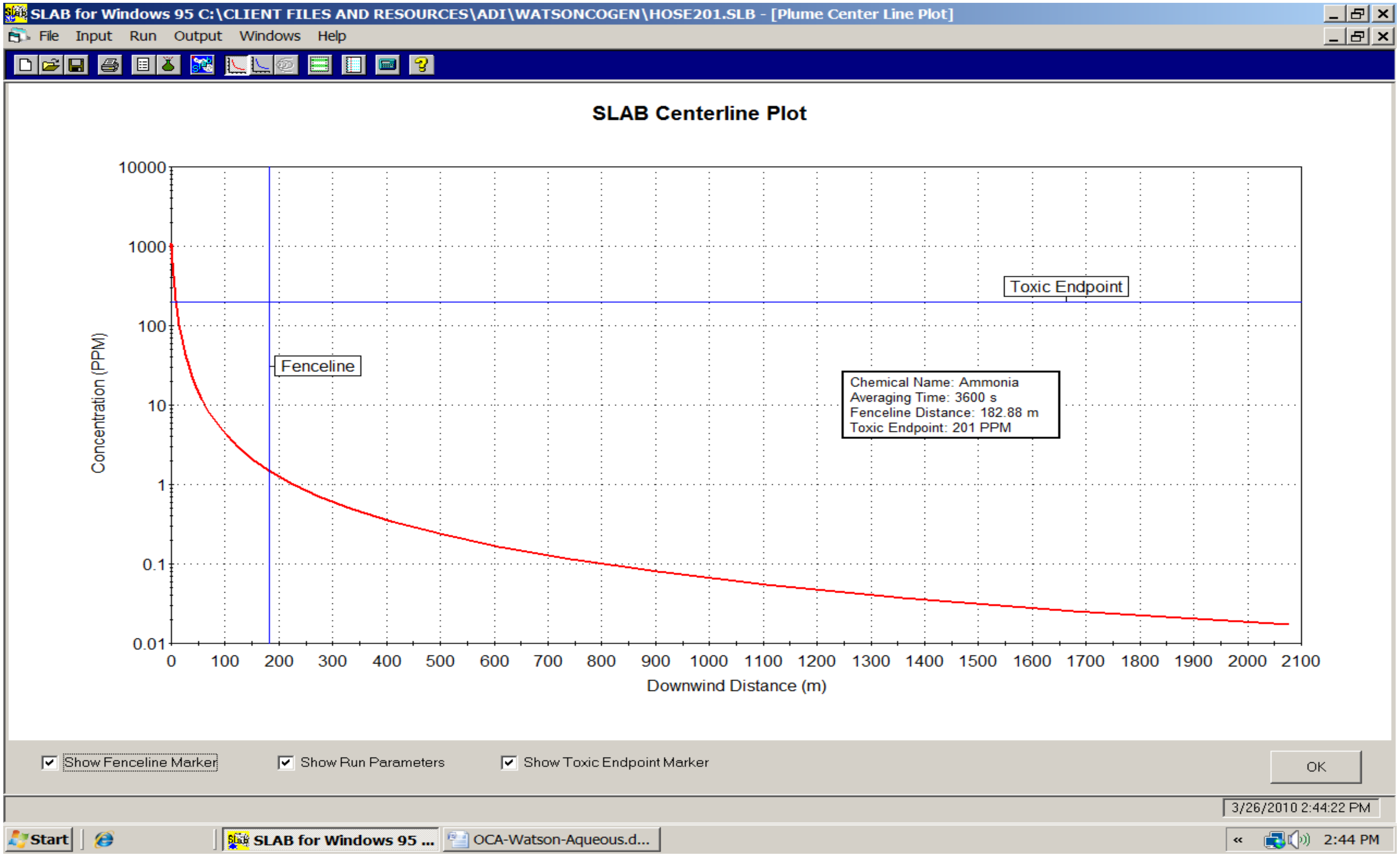


Figure 6
Alternate Case Hose Release - ERPG-2 level of 150 ppm (1 hour average)

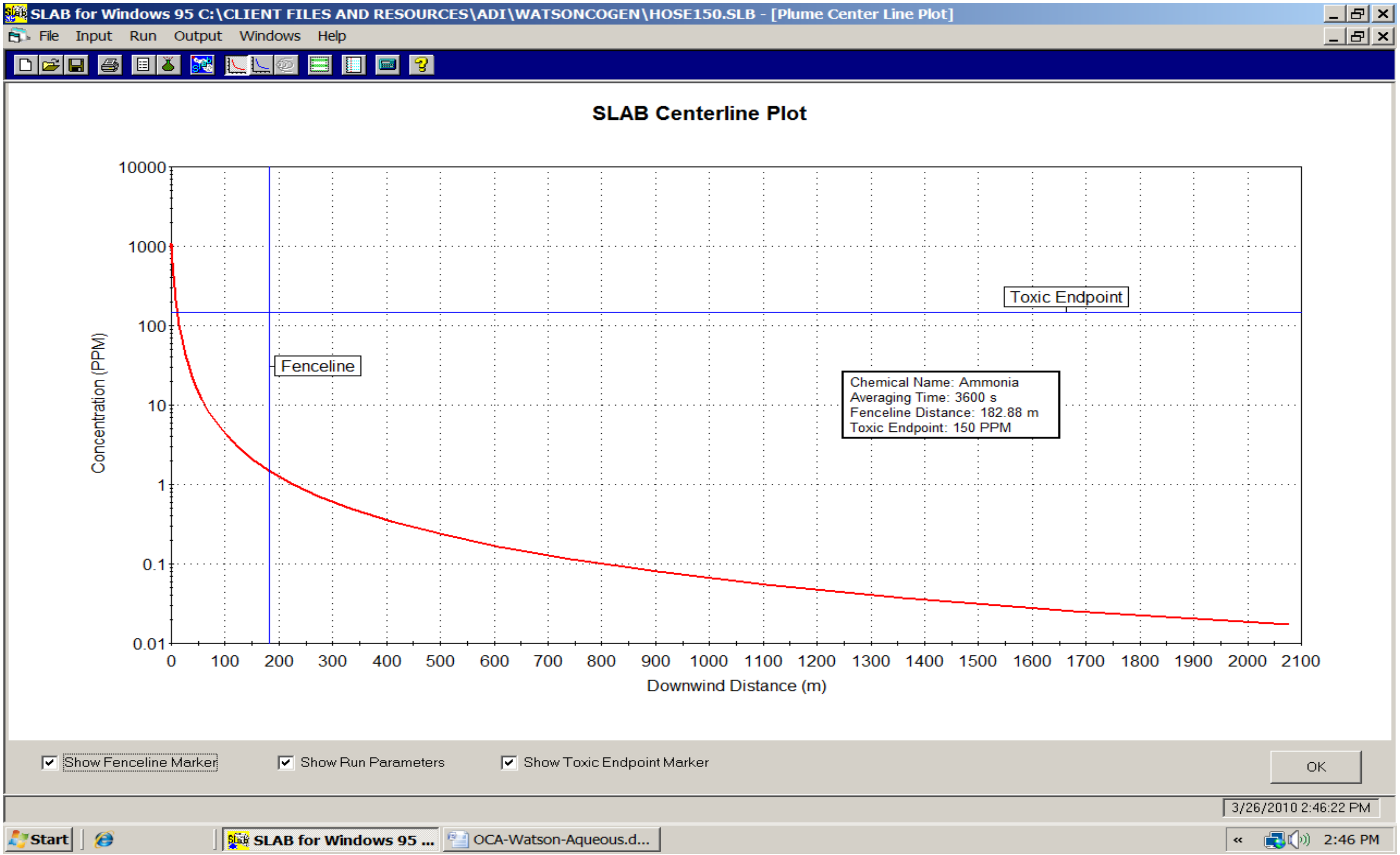
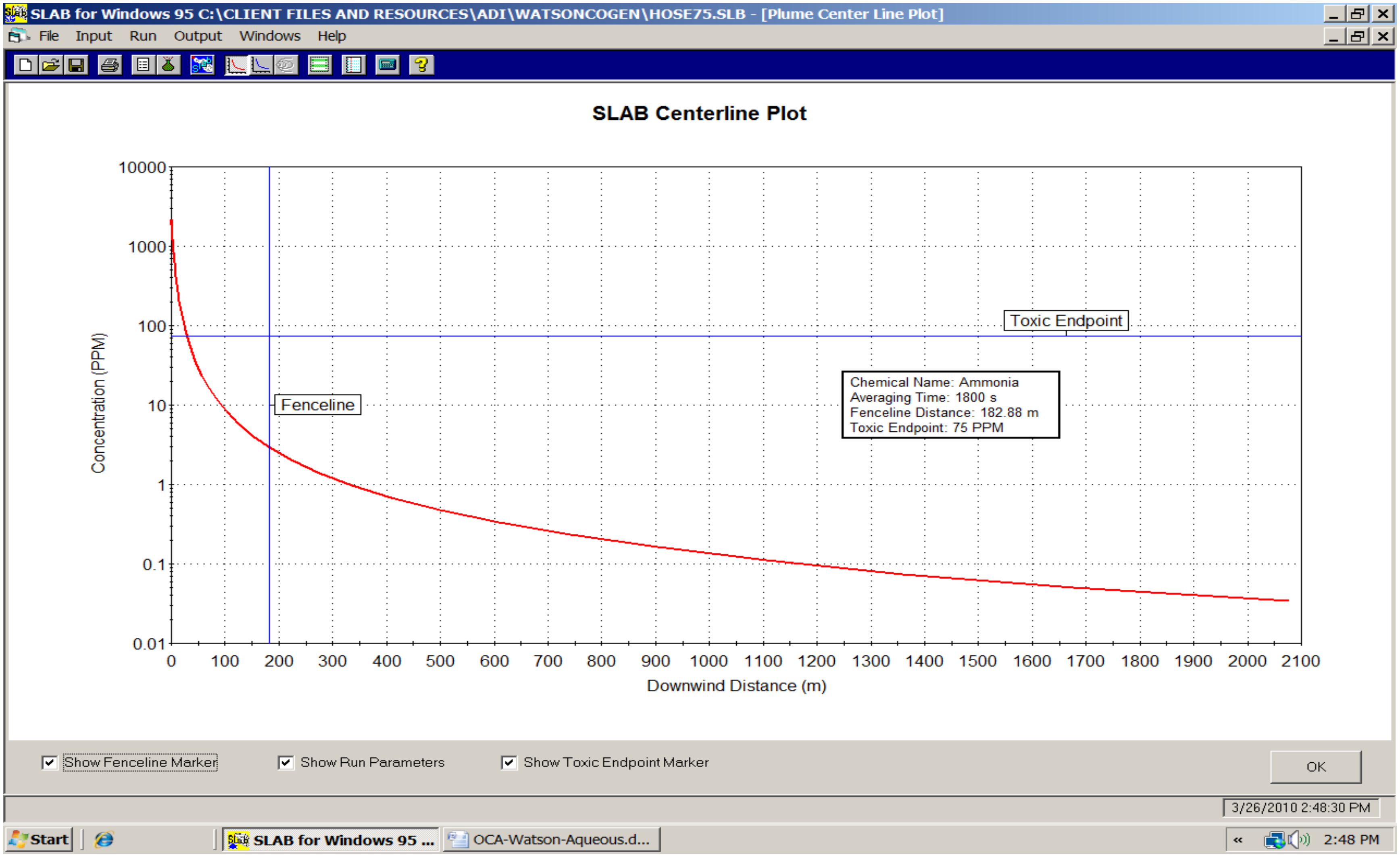


Figure 7
Alternate Case Hose Release - CEC LOC of 75 ppm (30 minute average)



Appendix 1

Emissions Calculations

Aqueous Ammonia Emissions Calculations for Diked Spills
RMP-OCA Analysis

Site: Watson Cogen-Turbine #5

Aqueous Ammonia % by Wt:	29.00
Approx Wt of Solution, lbs/gal:	7.50

Worst Case Release - Tank Rupture			**Alternate Case - Hose Rupture**		
Amount Spilled/Released, gals:	12000.00	Footnote 1		10.00	
Weight of Release, lbs:	90000			75.00	
Ammonia portion, lbs:	26100			21.75	
Berm/dike contained:	Yes			No	
Dike length, ft:	35.50			1.00	Spill Depth, cm
Dike width, ft:	20.00			3.79	Spill Area, m2
Dike depth, ft:	3.50			40.75	Spill Area, ft2
Dike Volume, ft3:	2485				
Dike Capacity, gals:	18588			0	Passive mitigation factor (Footnote 2)
Dike Sfc Area, ft2:	710.00			1	Release multiplier
Passive Mitigation Factor:	0.0				
Aqueous Ammonia LFA Value:	0.026			0.019	
Release Rate, lbs/min:	25.8			1.08	
10 Minute Release Rate, lbs:	258.4			10.84	
g/sec:	195.6			8.20	
TCF: 1.9			TCF:	0.8	
TCF Corr. Emissions (g/sec):	**371.6**		**g/sec**	**6.56**	
kg/sec:	**0.4**		**kg/sec**	**0.007**	
lbs/min	**49.1**		**lbs/min**	**0.87**	

TCF Calculation

	Worst Case	Alternate Case	
Release Temp, K	316.9	291.1	
VP at Release Temp	1344.59	517.2	mmHG
VP at 298 K	677	677	mmHG
Int Calc 1	400687.8	154125.6	
Int Calc 2	214541.3	197074.7	
TCF	**1.9**	**0.8**	

(1) Maximum spill amount based on tank storage capacity.
(2) Spill flows into specified passive mitigation device (as explained in text).

LONG BEACH WSCMO, CALIFORNIA (045085)

Period of Record Monthly Climate Summary

Period of Record : 4/ 1/1958 to 8/31/2009

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	66.9	67.2	68.3	71.7	73.6	77.1	82.4	83.9	82.2	78.1	72.2	67.1	74.2
Average Min. Temperature (F)	45.6	47.3	49.7	52.3	56.9	60.3	63.8	64.9	62.8	57.9	50.6	45.3	54.8
Average Total Precipitation (in.)	2.60	2.94	1.85	0.70	0.19	0.06	0.02	0.07	0.20	0.39	1.24	1.63	11.89
Average Total SnowFall (in.)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Percent of possible observations for period of record.
Max. Temp.: 100% Min. Temp.: 100% Precipitation: 100% Snowfall: 90% Snow Depth: 90.4%
Check Station Metadata or Metadata graphics for more detail about data completeness.

Western Regional Climate Center, wrcc@dri.edu

LONG BEACH WSCMO, CALIFORNIA

NCDC 1971-2000 Monthly Normals

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Monthly
Mean Max. Temperature (F)	68.0	68.5	68.9	72.7	74.0	78.3	82.9	84.6	83.1	78.9	73.4	68.8	75.2
Highest Mean Max. Temperature (F)	76.7	73.9	75.0	76.9	80.3	86.1	87.0	90.5	89.8	83.9	81.5	75.7	90.5
Year Highest Occurred	1976	1977	1988	1996	1997	1981	1984	1998	1984	1976	1977	1976	1998
Lowest Mean Max. Temperature (F)	63.2	64.4	64.5	66.2	68.9	73.0	78.0	80.1	76.8	71.9	68.1	64.0	63.2
Year Lowest Occurred	1995	1998	1991	1975	1995	1982	1987	1999	1986	2000	2000	1971	1995
Mean Temperature (F)	57.0	58.3	59.7	63.0	65.9	69.8	73.8	75.1	73.4	68.6	61.8	57.1	65.3
Highest Mean Temperature (F)	61.7	61.8	64.6	67.5	71.3	75.9	77.5	80.1	80.0	72.4	66.8	61.7	80.1
Year Highest Occurred	1986	1995	1978	1992	1997	1981	1984	1998	1984	1976	1977	1977	1998
Lowest Mean Temperature (F)	53.9	55.6	55.4	57.3	62.2	65.9	70.4	70.9	68.5	64.7	56.9	52.9	52.9
Year Lowest Occurred	1974	1990	1973	1975	1995	1999	1987	1999	1986	2000	1994	1971	1971
Mean Min. Temperature (F)	46.0	48.1	50.4	53.2	57.8	61.3	64.6	65.6	63.7	58.3	50.1	45.3	55.4
Highest Mean Min. Temperature (F)	50.5	52.4	56.5	58.0	62.2	65.6	67.9	69.8	70.2	62.5	54.8	52.5	70.2
Year Highest Occurred	1980	1995	1978	1992	1997	1981	1984	1983	1984	1987	1997	1977	1984
Lowest Mean Min. Temperature (F)	42.0	42.6	44.1	48.3	54.3	58.2	62.6	61.7	59.4	53.7	45.3	41.8	41.8
Year Lowest Occurred	1972	1974	1977	1971	1971	1999	1999	1999	1973	1971	1994	1974	1974
Mean Precipitation (in.)	2.95	3.01	2.43	0.60	0.23	0.08	0.02	0.10	0.24	0.40	1.12	1.76	12.94
Highest Precipitation (in.)	12.76	12.09	8.75	2.31	2.32	0.86	0.21	2.03	1.45	2.30	4.21	5.29	12.76
Year Highest Occurred	1995	1998	1983	1999	1977	1993	1986	1977	1976	2000	1985	1971	1995
Lowest Precipitation (in.)	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Year Lowest Occurred	1976	1984	1997	1997	1997	2000	2000	2000	2000	1999	2000	2000	1976
Heating Degree Days (F)	267.	205.	186.	99.	39.	5.	0.	0.	1.	16.	128.	265.	1211.
Cooling Degree Days (F)	3.	5.	10.	28.	55.	135.	260.	302.	244.	119.	20.	5.	1186.

Western Regional Climate Center, wrcc@dri.edu

LONG BEACH WSCMO, CALIFORNIA

Period of Record General Climate Summary - Temperature

Station:(045085) LONG BEACH WSCMO

From Year=1958 To Year=2009

	Monthly Averages			Daily Extremes				Monthly Extremes				Max. Temp.		Min. Temp.	
	Max.	Min.	Mean	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	<= 32 F	<= 32 F	<= 0 F
	F	F	F	F	dd/yyyy or yyyymmdd	F	dd/yyyy or yyyymmdd	F	-	F	-	# Days	# Days	# Days	# Days
January	66.9	45.6	56.3	93	31/2003	25	13/1963	62.0	2003	52.4	2001	0.1	0.0	0.2	0.0
February	67.2	47.3	57.3	91	12/1971	33	12/1965	61.8	1995	52.5	2001	0.1	0.0	0.0	0.0
March	68.3	49.7	59.0	98	25/1988	33	08/1964	64.0	1978	53.6	1962	0.3	0.0	0.0	0.0
April	71.7	52.3	62.0	105	05/1989	38	07/1975	67.2	1992	54.5	1967	0.9	0.0	0.0	0.0
May	73.6	56.9	65.2	104	03/2004	40	07/1964	71.2	1997	59.5	1964	1.0	0.0	0.0	0.0
June	77.1	60.3	68.7	109	16/1981	47	02/1967	75.1	1981	63.1	1964	1.5	0.0	0.0	0.0
July	82.4	63.8	73.1	107	01/1985	51	15/1960	77.5	2006	68.2	1965	3.6	0.0	0.0	0.0
August	83.9	64.9	74.4	105	30/1967	55	24/1978	80.1	1998	70.1	2002	5.3	0.0	0.0	0.0
September	82.2	62.8	72.5	110	26/1963	50	30/1965	79.1	1984	67.4	1964	5.5	0.0	0.0	0.0
October	78.1	57.9	68.0	111	15/1961	39	31/1972	72.2	1976	63.9	2002	3.2	0.0	0.0	0.0
November	72.2	50.6	61.4	101	01/1966	34	17/1958	66.4	1977	56.1	1964	0.7	0.0	0.0	0.0
December	67.1	45.3	56.2	92	03/1958	28	22/1990	61.1	1977	52.6	1971	0.0	0.0	0.2	0.0
Annual	74.2	54.8	64.5	111	19611015	25	19630113	66.7	1997	61.2	1964	22.2	0.0	0.4	0.0
Winter	67.1	46.1	56.6	93	20030131	25	19630113	59.3	1980	53.5	1962	0.2	0.0	0.4	0.0
Spring	71.2	53.0	62.1	105	19890405	33	19640308	65.6	1997	58.1	1964	2.2	0.0	0.0	0.0
Summer	81.1	63.0	72.1	109	19810616	47	19670602	75.6	1981	68.0	1964	10.4	0.0	0.0	0.0

Fall	77.5	57.1	67.3	111	19611015	34	19581117	71.4	1997	63.7	1964	9.4	0.0	0.0	0.0

Table updated on Dec 28, 2009
For monthly and annual means, thresholds, and sums:
Months with 5 or more missing days are not considered
Years with 1 or more missing months are not considered
Seasons are climatological not calendar seasons
Winter = Dec., Jan., and Feb. Spring = Mar., Apr., and May
Summer = Jun., Jul., and Aug. Fall = Sep., Oct., and Nov.