URS

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| 09-AFC-1 |
| DATE MAR 04 2010 |
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March 4, 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.

This analysis was prepared as a result of the project change from the use of anhydrous ammonia to aqueous ammonia at the request of South Coast Air Quality Management District.

This document is being submitted to the CEC for docketing.

Sincerely,
URS Corporation

Cindy Kyle-Fischer
Project Manager

Enclosures

cc: Proof of Service List

URS Corporation
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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

**March 2010**

## 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 30.0 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 30 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 |
| z0, m[8] | 0.1 | 0.1 |
| Dispersion Coefficients[9] | Urban | Urban |
| Fence line Distance, m | 182.9 | 182.9 |
| Spill Surface Area, m2.[10] | 122.88 | 2.50 |
| 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
z0 = ground elevation receptor height

**Table 1**
**OCA Modeling Data Summary**

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 met 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 (0.97) 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.

Note:

WCP =

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 3 - CalARP RMP Te of 201 ppm (1 hour average)

Figures 4 and 5 - ERPG-2 level of 150 ppm (1 hour average)

Figures 6 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

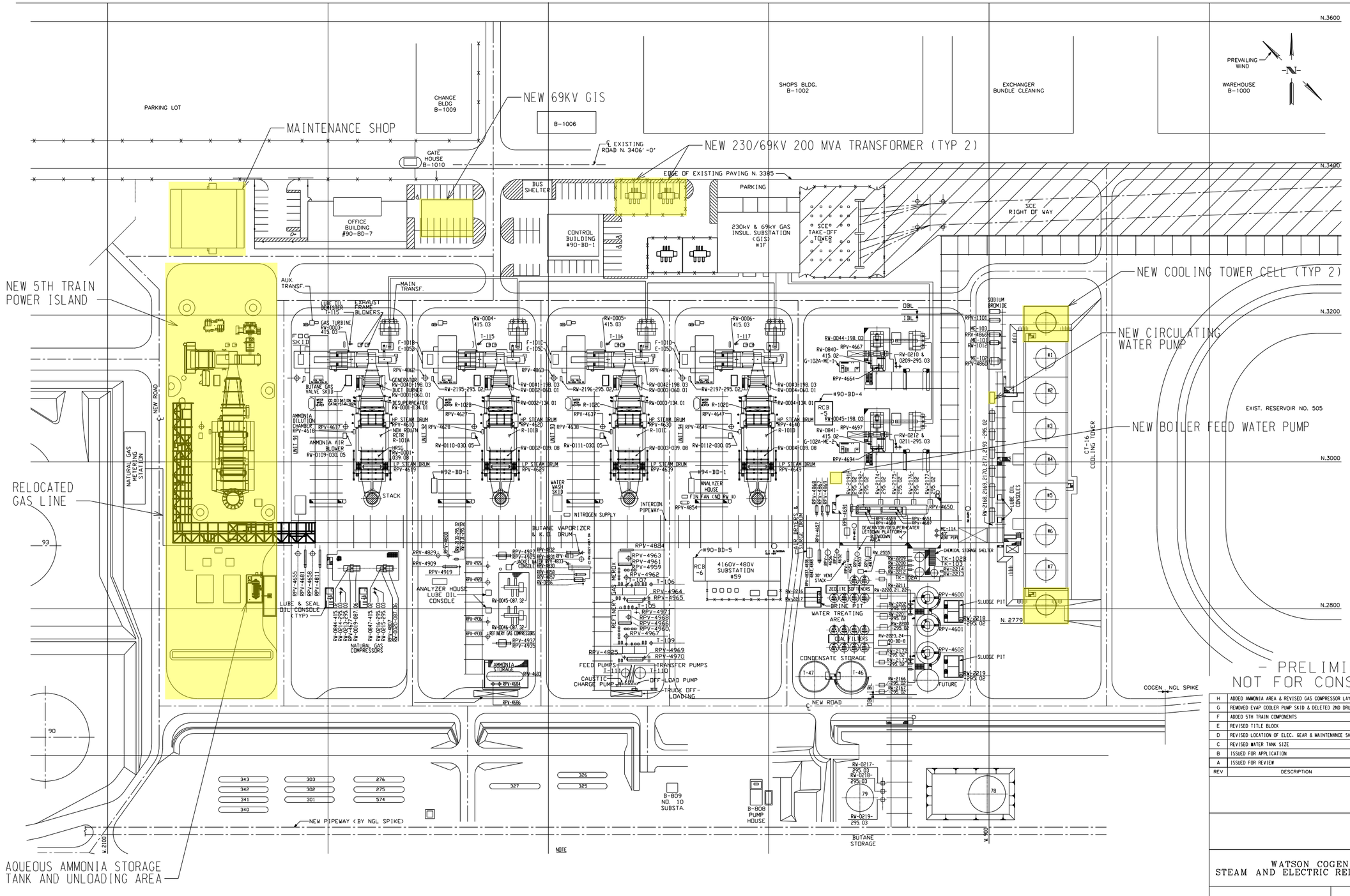
line, i.e., no off-site concentrations approaching the toxic endpoint values are noted, no zone of impact figures are needed or presented in this analysis.

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 off-site areas are predicted to experience ammonia concentrations at levels that would exceed the ammonia toxic endpoint value of 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.




PROJECT COMPONENTS

SCALE IN FEET 50 0 50 100

PLANT NORTH

– 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 | KWD | 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 0PTG

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

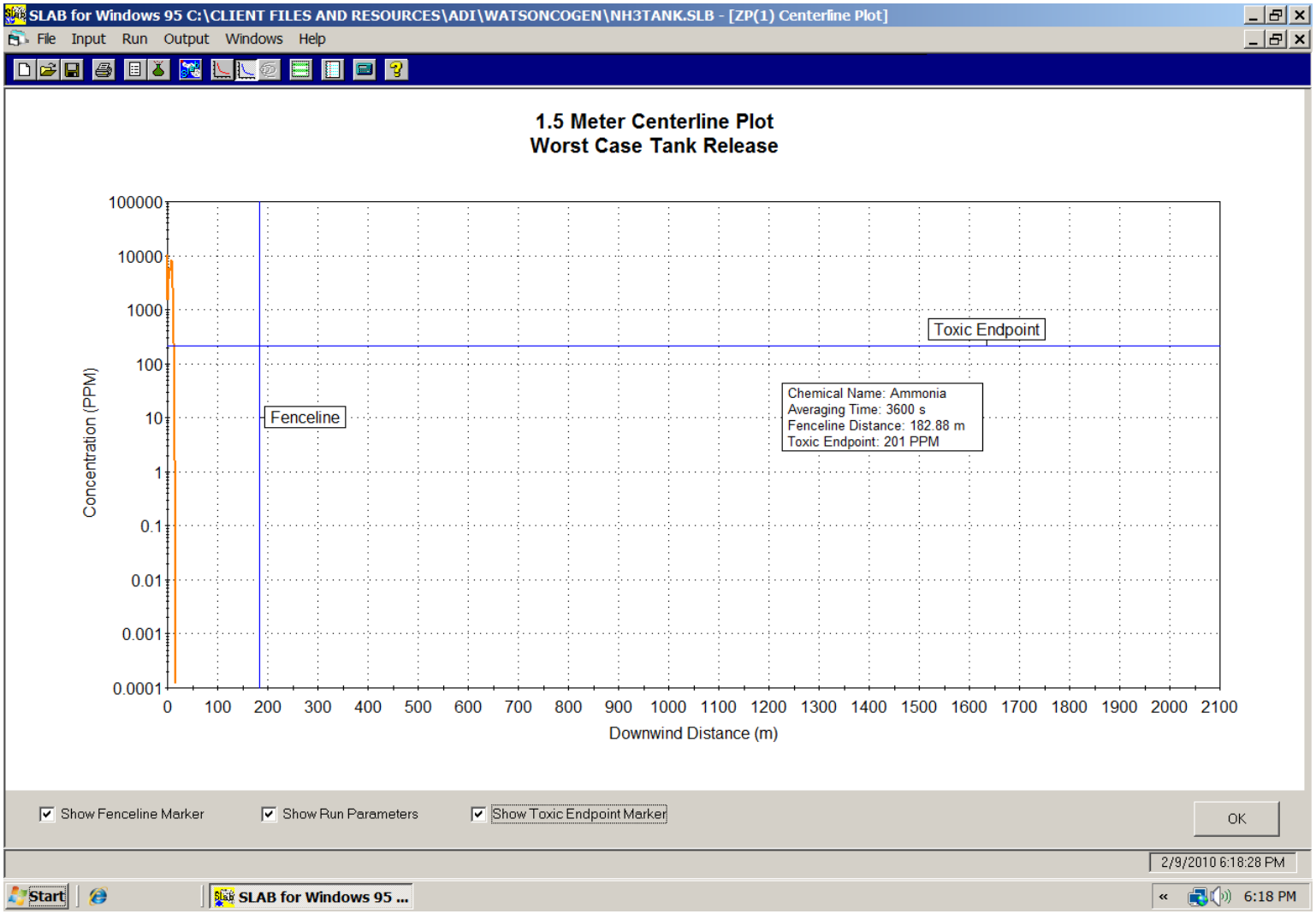


**Figure 3**
**CalARP RMP Te of 201 ppm (1 hour average)**

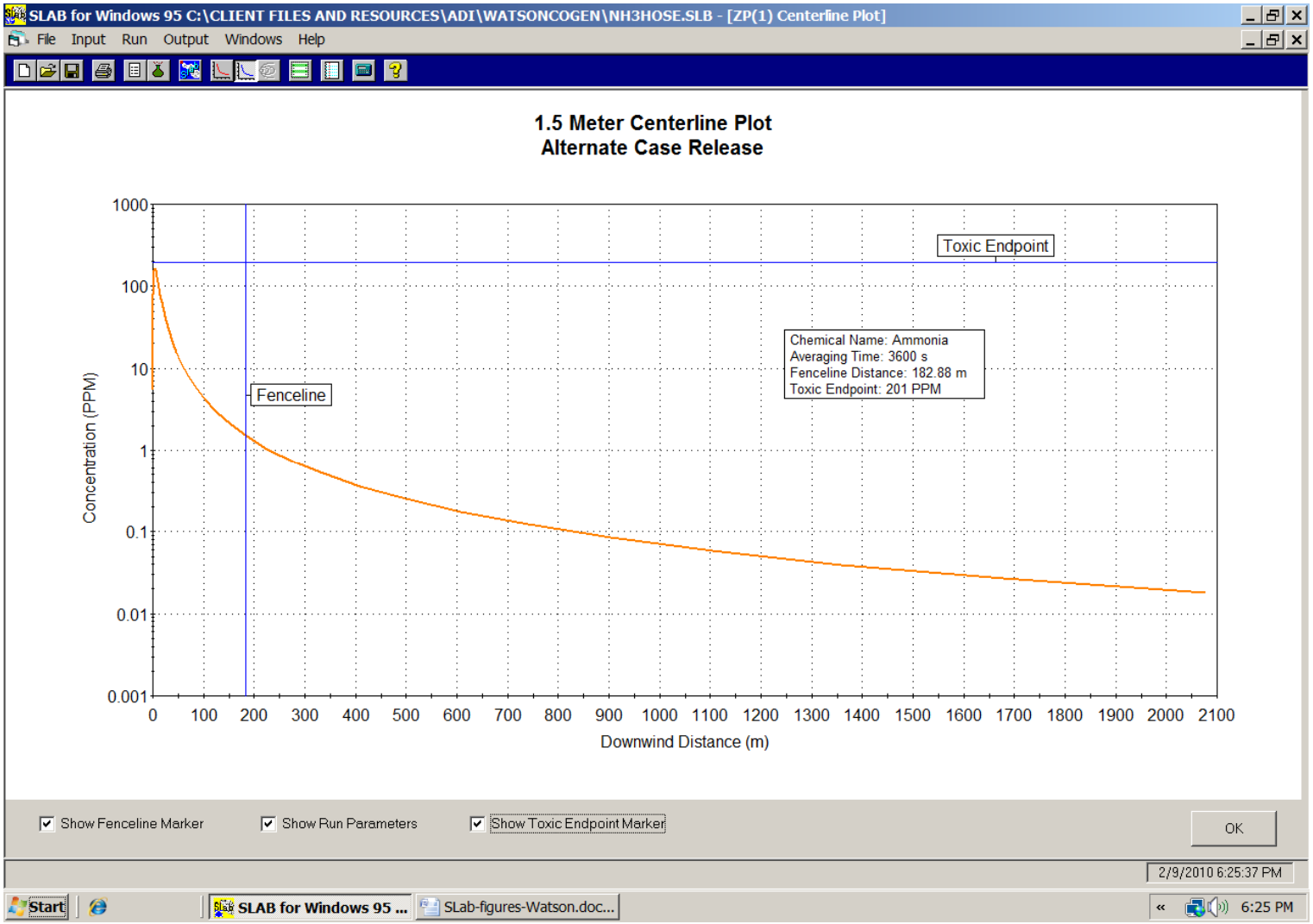


**Figure 4**
**ERPG-2 level of 150 ppm (1 hour average)**

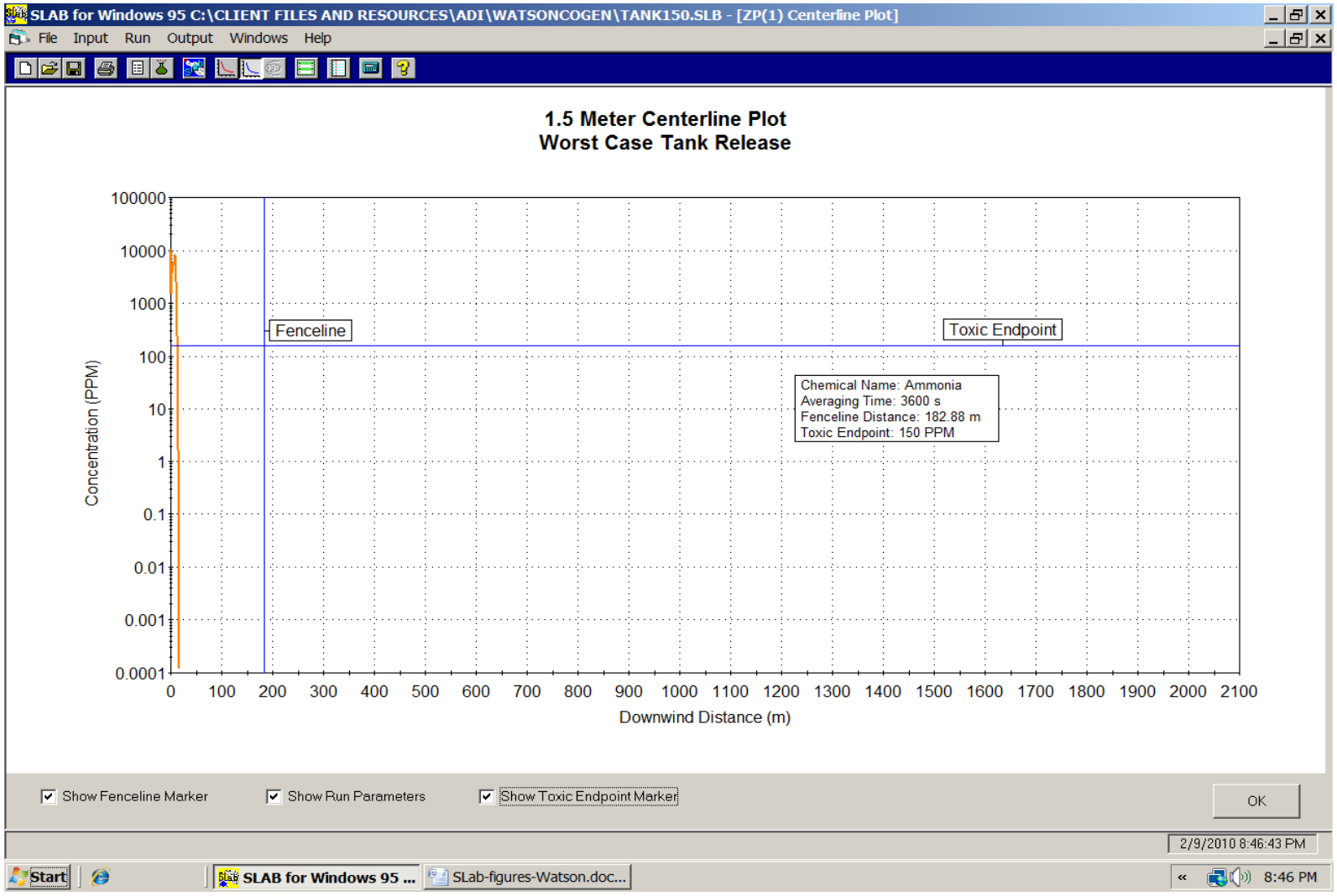


**Figure 5**
**ERPG-2 level of 150 ppm (1 hour average)**

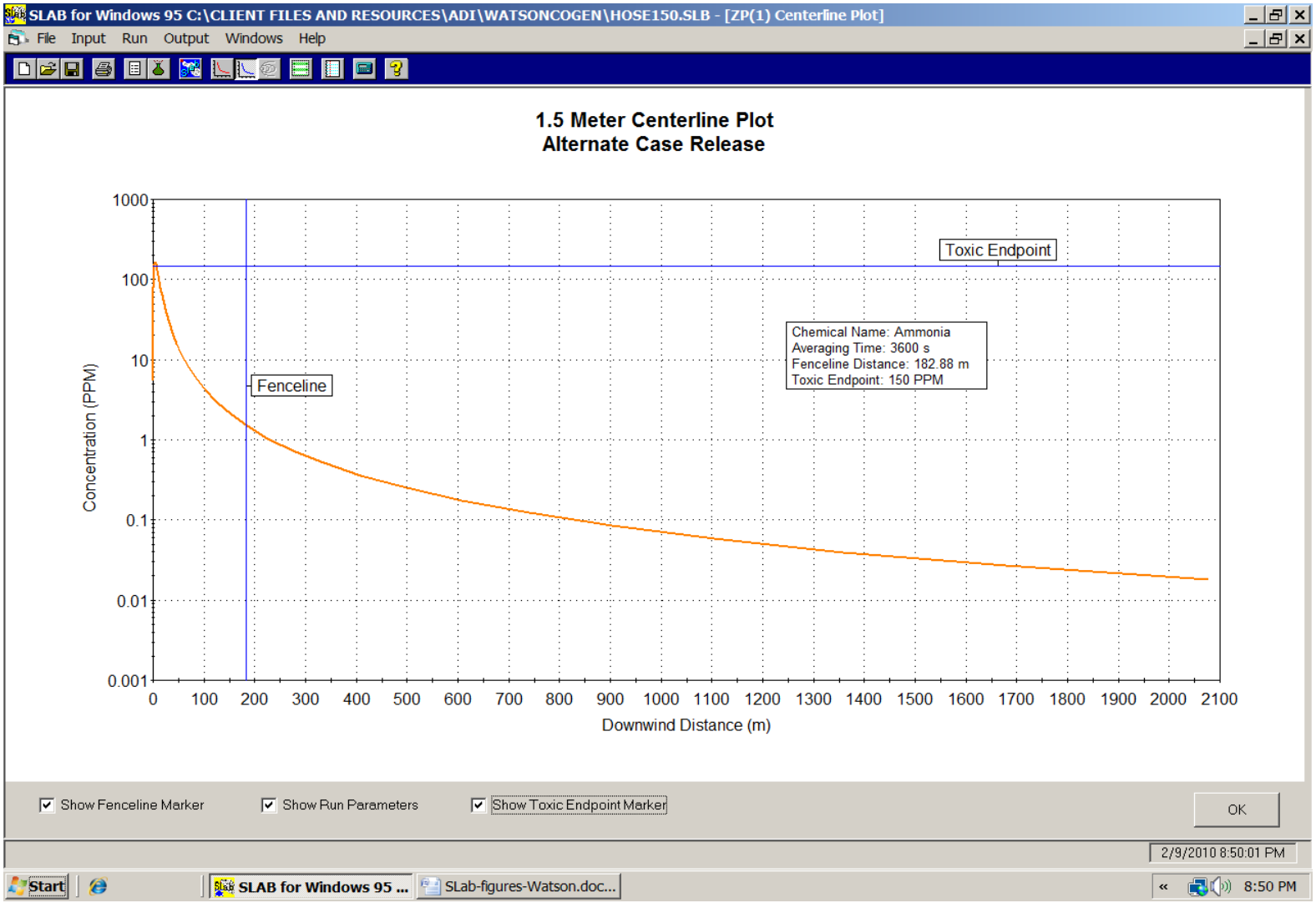


**Figure 6**
**CEC LOC of 75 ppm (30 min average)**

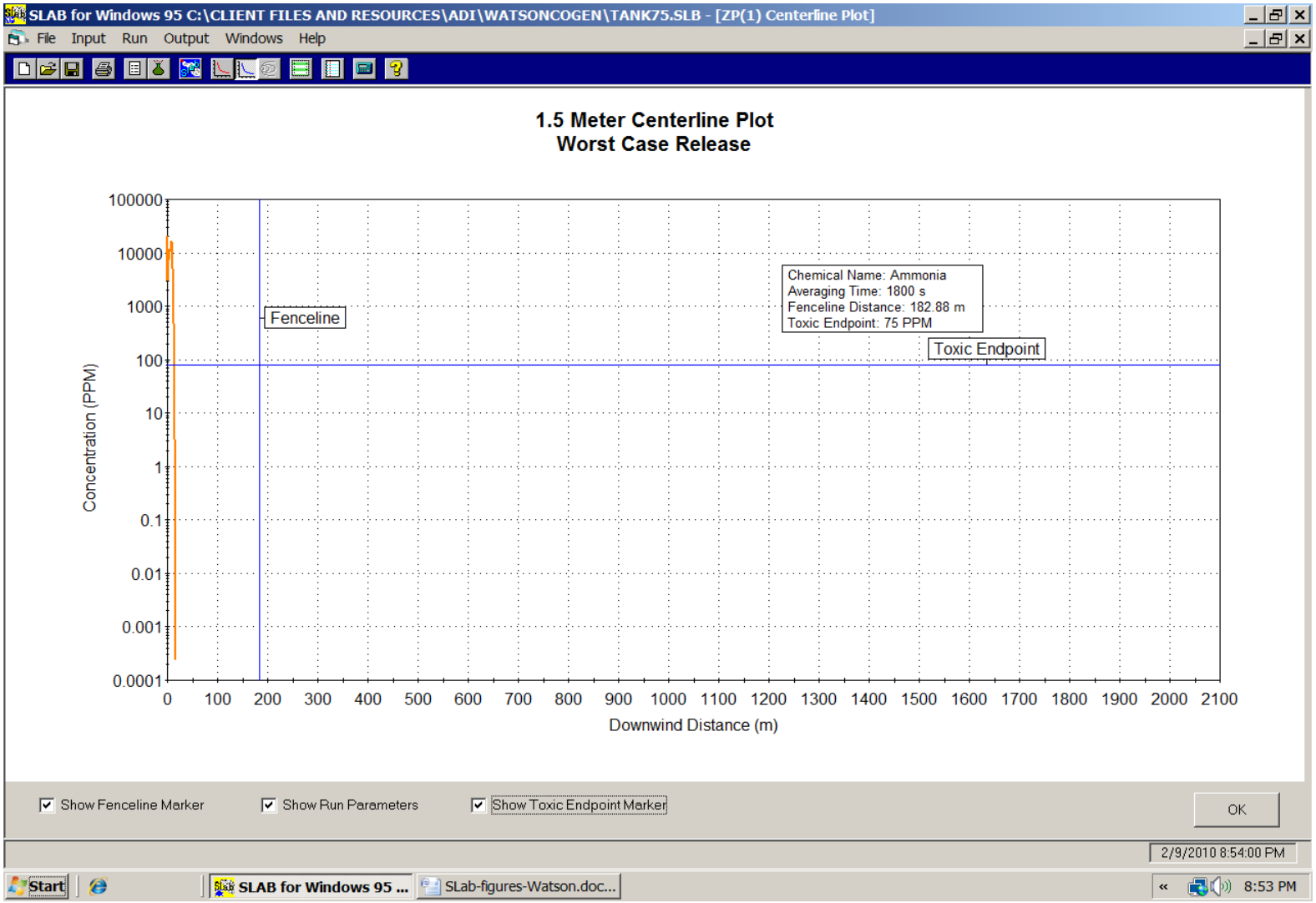
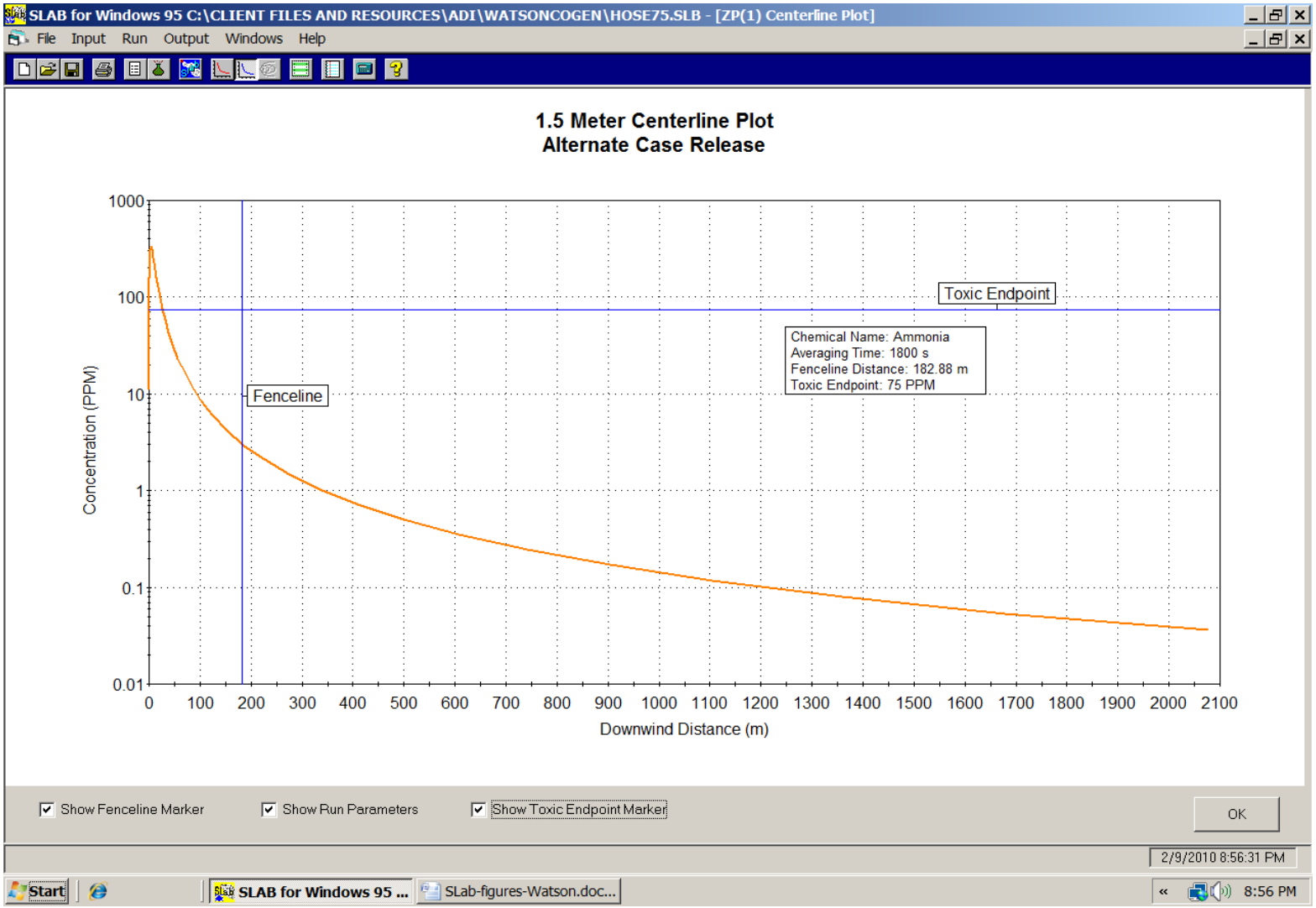


**Figure 7**
**CEC LOC of 75 ppm (30 min average)**



# Attachment 1
# Emissions Calculations

**Aqueous Ammonia Emissions Calculations for Diked Spills**
**RMP-OCA Analysis**

Site: Watson Cogen-Turbine #5

| | |
|---|---|
| Aqueous Ammonia % by Wt: | 30.00 |
| 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: | 27000 | | 22.50 | |
| 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).

**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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*indicates change

## DECLARATION OF SERVICE

I, Cindy Kyle-Fischer, declare that on March 4, 2010, I served and filed copies of the attached *Aqueous Ammonia Off-Site Consequence Analysis (Watson Cogeneration Steam and Electric Reliability Project)*, dated March 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.

**Cindy Kyle-Fischer**