Appendix C

Saint Alphonsus Regional Medical Center, Boise

P-050052

Modeling Analysis
Harbi Elshaefi

From: Darrin Mehr
Sent: Wednesday, November 22, 2006 10:41 AM
To: Harbi Elshaefi; Kevin Schilling
Cc: Darrin Mehr

Subject: 1) FW: St. Al's directive; 2) Email Memorandum for the modeling approval for St. Al's RMC (Boise) REVIEW of October 6 and 18, 2006 Modeling Addendum and Files

November 22, 2006

MEMORANDUM

TO: Harbi Elshaefi, Permit Writer, Air Quality Program
FROM: Darrin Mehr, Air Quality Analyst
RE: P-050052; St. Alphonsus Regional Medical Center, Boise, Review of the October 6, 2006 Modeling Addendum to Increase Operating Hours for Emergency Electrical Generators 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11

1.0 Summary

St. Alphonsus Regional Medical Center (SARMC) submitted a revised ambient dispersion modeling analysis on October 6, 2006. The electronic modeling files were submitted on October 18, 2006. This submittal is an addendum to the 15-Day Pre-permit Permit to Construct (15-Day PTC) received on November 28, 2005, and was developed by CH2M HILL, on behalf of SARMC in response to the facility draft PTC, issued on August 30, 2006.

DEQ provided an option to revise the modeling inputs for emergency electrical generators that were equipped with horizontal discharge for the combustion exhaust. This option required that SARMC demonstrate that buoyancy flux due to thermal energy in the exhaust dominate the momentum flux due to the mass flow rate of exhaust. Typically, the exit velocity for horizontally oriented stacks is set to 0.001 meters per second instead of the actual stack velocity, which provides conservative ambient impacts. This approach was discussed in depth in the August 10, 2006 modeling memo for the facility draft 15-Day PTC.

SARMC provided a table of results of the buoyancy dominance analysis. DEQ checked the analysis for Generators 10 and 11, and agrees that the buoyancy approach is appropriate for the emergency electrical generators.

DEQ modeling staff did not check the revised emissions rates that were included in this analysis. The increase in requested operating hours will increase the average emission rate estimates for the 8-hour and 24-hour averaging periods compared to those used as a basis for the facility draft 15-Day PTC.

DEQ also checked the electronic output files for several of the pollutants and averaging periods. The revised ambient impact compliance demonstration presented by SARMC was supported by the documentation in those files that were checked. This revised analysis only affects the compliance demonstration for short-term National Ambient Air Quality Standards (NAAQS). SARMC did not submit revised impacts for annual NAAQS or annual TAPs for this project.

The emission rates utilized by SARMC and the revised ambient impacts for 1-hour and 8-hour carbon

11/22/2006

PTC Statement of Basis – Saint Alphonsus Regional Medical Center, Boise
monoxide; 3-hour and 24-hour sulfur dioxide, and 24-hour PM$_{10}$ NAAQS are presented in the October 6, 2006 modeling addendum memorandum.

2.0 Recommendation:

DEQ recommends that allowable operating hours of Generators 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11 may be increased to 8 hours per day for each individual generator.

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From: Kevin Schilling  
Sent: Tuesday, November 21, 2006 11:31 AM  
To: Darrin Mehr  
Subject: St. Al's directive

Darrin,

It is my understanding that you provided a standard review of the originally submitted modeling analyses for the St. Al's permit. After completing the review, St. Al's decided that more allowable testing hours were needed for the generators. The original permit application was not withdrawn, but revised modeling analyses were submitted to account for the revised generator operations.

Ideally, DEQ would conduct a standard, thorough review of the new analyses. However, in light of our workload I would like you to conduct an abbreviated review for this project. I suggest that you quickly check the modeling result to assure that applicable air quality standards would be met, then briefly look at modeling parameters to evaluate whether they are within reasonable ranges. I have already checked the validity of the buoyancy calculations for the method to model the generators as a vertical release, so you don't need to recheck those. I suggest spending less than an hour doing these. As for the remainder of the analyses, we will be accepting the conducted analyses as "true, accurate, and complete," as certified by the applicant.

Simply forward this email to Harbi, with your comments assuring that you checked results and briefly reviewed parameters.

I feel this approach is acceptable for this project because of the following:

- DEQ has already conducted a thorough analysis of the project with a lower operational rate. Therefore, proper setup, met data, terrain issues, etc. have already been assessed and a modeling memo was generated. That memo should be included with the SOB, along with a copy of this email with your comments.
- The generators will only be operated infrequently for testing purposes (less than 1 day each month). There is a very low probability that operations would occur during a time when dispersion characteristics are worst-case.
- The highest modeled concentrations are very localized, typically at only a few receptors. It is unlikely that public would be present at such locations when the testing will be conducted.

Let me know if you have any questions or concerns.

Thank you,

Kevin Schilling  
Stationary Source Air Modeling Coordinator  
Idaho Department of Environmental Quality  
208 373-0112

11/22/2006
Harbi Elshafai

From: Allan.Cawrse@CH2M.com
Sent: Friday, October 06, 2006 4:45 PM
To: Harbi Elshafai; William Rogers; Kevin Schilling
Cc: WILLMORG@sarmc.org; natalie.liljenwall@ch2m.com; rick.mccormick@ch2m.com
Subject: SARMC Revised Generator Run Time Model Results
Attachments: Revised_Gen_Model Report100606.doc

Harbi,

The Saint Alphonsus Regional Medical Center (SARMC) has applied for a Tier II Permit to Construct from the Idaho Department of Environmental Quality (IDEQ). This permit application described changes to three existing steam boilers, and the installation of two new emergency power generators. Review of this permit application by the IDEQ is complete, but the issuance of the final permit was stayed on 9/21/2006 at the request of SARMC staff. This action was to allow for evaluation of additional load test run time, from 4 to 6 hours, for all of the emergency power generators.

The permit application and air dispersion modeling analysis was submitted November 22, 2005. This permit application information specified that each emergency power generator would operate for a total of 4 hours for the annual load test. Air dispersion modeling was performed that demonstrated conformance with the 4 hour load test to IDAPA 58.01.01 air quality standards. However, it was determined that more than 4 hours will be required for load testing of each generator. SARMC conforms to the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) standard for emergency power generators. JCAHO standard EC.7.40 requires a 4 continuous hour load test, so additional time is required for generator start-up, system check (4 hour load test), then idle and shut down. SARMC requests that the emergency generator annual load test allowance be revised to allow for 6 hours for Generators 1, 2, 3, 5, 6, 7, 8, 9, 10, and 11.

Attached is the modeling report which evaluated SARMC emergency generators during the requested 6 hours load annual test event. This modeling report demonstrates compliance with IDAPA 58.01.01 ambient air quality standards. This modeling evaluation was performed with the generators operating on distillate oil at 0.5% sulfur content and the boilers operating on natural gas. Please review this modeling report and let me know if you have any questions or require additional information.

Allan E. Cawrse
Project Manager
CH2M HILL/CH2M HILL - Boise

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Boise, ID 83702
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Allan.Cawrse@CH2M.com

10/6/2006

PTC Statement of Basis – Saint Alphonsus Regional Medical Center, Boise
Addendum to Air Dispersion Modeling Report for St. Alphonsus Regional Medical Center Permit Application Boise, Idaho

Prepared for:
St. Alphonsus Regional Medical Center

Submitted to:
Idaho Department of Environmental Quality

October, 2008
Prepared By:
CH2M HILL
Brief Project Background

In January 2003, a Tier II Operating Permit (Tier II) was issued to St. Alphonsus Medical Regional Center (SARMC) by the Idaho Department of Environmental Quality (IDEQ). SAMRC would like to modify their existing Tier II and have recently submitted a modeling protocol, and final modeling files and modeling results for the following changes to their existing permit:

- Removal of Boiler 5 – Bryan Steam Boiler, model RV-500
- Removal of Generator 4 - Detroit Diesel, model 573RS17034BP
- Increasing the maximum heat input rating on Boiler 1, Boiler 2 and Boiler 3
- Adding two new Caterpillar 1,250 kilo Watt (kW) generators, Generator 10 and Generator 11

Since the submittal of final modeling files made in March 2006, SAMRC have decided to update the hours of operation for their annual generator load testing from 4 hours per generator to 6 hours per generator on 0.5% sulfur distillate fuel oil. The following paragraphs describe this scenario in more detail and provide the emissions, stack parameters, modeling methodology used and the modeling results.

Modeling Approach

The modeling approach used was to perform buoyancy calculations for all generators that have a horizontal release stacks. Kevin Schilling of IDEQ had used this approach for one generator on the March model run submittal. For this modeling report only the load testing scenario is presented.

Project Description

Location and Landuse

The SARMC is located a few kilometers west of Boise, Idaho. Auer's (1978) land-use classification method for determining urban vs. rural dispersion coefficients in the modeling indicates that more than 50 percent of the land use within three kilometers around the proposed facility appears to be urban. Modeling was performed using the urban dispersion coefficients.

Emissions

Source Information

The modeling analysis includes all sixteen sources that were modeling previously. The modeling analysis was conducted for only short term averaging periods and it was prepared to demonstrate the load testing for generators that will be conducted in the

October 6, 2006
summer months and will occur during a 6 hour period per generator. It was assumed that since load testing will occur in summer month, boilers will be operating on natural gas during this time. For comparison to short term standards, the emergency generators will be modeled as operating 6 hours a day, all together with all boilers operating on natural gas only. No other modeling scenarios are included in this addendum.

Building Downwash

The affect of building downwash at this specific site was included in the model. Direction specific building downwash parameters were calculated using the EPA Building Profile Input Program (BPIP-PRIME), Version 04272, and included in the ISC3-PRIME model input file.

Stack Information and Buoyancy

Table 1 identifies the future stack parameters for SARMC. The locations of all stacks were identical to model runs submitted in March 2006. For horizontal flow stack, buoyancy calculations were performed to determine if the actual flow rate could be used in place of the substituted flow rate of 0.001 m/s that is normally recommended by IDEQ guidance. This methodology was used for buoyancy calculations that were performed by Kevin Schilling of IDEQ in previous model reruns for the SAMRC permit modification. The buoyancy calculations are summarized in Table 2 below for each of the 4 generators. Buoyancy calculations show that in both unstable and stable atmospheres, the very hot and fast flow rates coming out of these four generators will still be buoyant even though the stacks are horizontal.

The equations involved are summarized below. In both cases of stable and unstable atmospheres $\Delta T$ is greater than $\Delta T_c$ and therefore buoyancy dominates.

Buoyancy Flux $F_b = (g \nu d^2 \Delta T)/4T_s$

$\Delta T$: Stack Temperature – Ambient temperature

$\Delta T_c$ for unstable conditions = 0.00297 $T_s$ ($v^{1/2} / d^{2/3}$)

$\Delta T_c$ for stable conditions = 0.019582 $T_s$ $v (s^{-1})$

Where $s = g(80/8z)/T_s$
Table 1. Stack Parameters

<table>
<thead>
<tr>
<th>Source ID</th>
<th>Source Description</th>
<th>Easting (X)</th>
<th>Northing (Y)</th>
<th>Stack Height (K)</th>
<th>Temp.</th>
<th>Exit Velocity (m/s)</th>
<th>Stack Diameter (m)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>B123_G12</td>
<td>South Tower Boiler (Circulating)</td>
<td>590080</td>
<td>4829906</td>
<td>28.56</td>
<td>592.59</td>
<td>5.18</td>
<td>1.75</td>
<td></td>
</tr>
<tr>
<td>MOBV1</td>
<td>Cardiology Building Boiler</td>
<td>560100</td>
<td>4829163</td>
<td>8.22</td>
<td>433.16</td>
<td>0.001</td>
<td>0.38</td>
<td>Raincap</td>
</tr>
<tr>
<td>MOBV2</td>
<td>Cardiology Building Boiler</td>
<td>560100</td>
<td>4829161</td>
<td>8.22</td>
<td>433.16</td>
<td>0.001</td>
<td>0.38</td>
<td>Raincap</td>
</tr>
<tr>
<td>MOBV3</td>
<td>Cardiology Building Boiler</td>
<td>560100</td>
<td>4829159</td>
<td>8.22</td>
<td>433.16</td>
<td>0.001</td>
<td>0.15</td>
<td>Raincap</td>
</tr>
<tr>
<td>GEN3</td>
<td>Information Resources Building Emergency Generator</td>
<td>560184</td>
<td>4828933</td>
<td>3.35</td>
<td>702.59</td>
<td>78.85</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>GEN5</td>
<td>Psych Center Emergency Generator</td>
<td>559238</td>
<td>4828143</td>
<td>6.09</td>
<td>810.83</td>
<td>49.88</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>GEN6</td>
<td>Orthopedic Building Emergency Generator (Horizontal Discharge)</td>
<td>558974</td>
<td>4829300</td>
<td>7.31</td>
<td>600</td>
<td>58.0</td>
<td>0.28</td>
<td>Horizontal Discharge</td>
</tr>
<tr>
<td>GEN7</td>
<td>Liberty Building Emergency Generator</td>
<td>558883</td>
<td>4820000</td>
<td>3.44</td>
<td>819.26</td>
<td>67.96</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>GEN8</td>
<td>Cardiology Building Emergency Generator (Horizontal Discharge)</td>
<td>560106</td>
<td>4829149</td>
<td>3.1</td>
<td>600</td>
<td>79.0</td>
<td>0.208</td>
<td>Horizontal Discharge</td>
</tr>
<tr>
<td>GEN9</td>
<td>Health Tech Building Emergency Generator</td>
<td>559456</td>
<td>4828005</td>
<td>1.64</td>
<td>778.15</td>
<td>0.336</td>
<td>0.78</td>
<td></td>
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<tr>
<td>GEN10</td>
<td>New Central Building Generator</td>
<td>560087</td>
<td>4829219</td>
<td>10.67</td>
<td>809.37</td>
<td>22.42</td>
<td>0.39</td>
<td>Horizontal Discharge</td>
</tr>
<tr>
<td>GEN11</td>
<td>New Central Building Generator</td>
<td>590099</td>
<td>4829219</td>
<td>10.67</td>
<td>809.37</td>
<td>22.42</td>
<td>0.39</td>
<td>Horizontal Discharge</td>
</tr>
</tbody>
</table>

Notes: For stacks with raincaps, the exit velocity was set to 0.001 m/s according to IDEQ guidance. For horizontal stack flow actual flow rates were used based on buoyancy calculations for generators 6, 8, 10 and 11.

Table 2. Buoyancy Calculations

<table>
<thead>
<tr>
<th>Generator</th>
<th>Flow Rate (acfm)</th>
<th>Diam. (meters)</th>
<th>Temp (K)</th>
<th>Vol. (m^3)</th>
<th>Buoyancy Flux Fb</th>
<th>Unstable Delta Tc</th>
<th>Delta T</th>
<th>Unstable Pass</th>
<th>Stable Delta Tc</th>
<th>Stable Pass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generator 6</td>
<td>6080</td>
<td>0.250</td>
<td>600</td>
<td>0.86</td>
<td>4.332</td>
<td>188.053</td>
<td>269</td>
<td>Yes</td>
<td>16.815</td>
<td>yes</td>
</tr>
<tr>
<td>Generator 8</td>
<td>5109</td>
<td>0.208</td>
<td>600</td>
<td>0.79</td>
<td>3.955</td>
<td>219.158</td>
<td>269</td>
<td>Yes</td>
<td>23.296</td>
<td>yes</td>
</tr>
<tr>
<td>Generator 10</td>
<td>4718</td>
<td>0.356</td>
<td>699</td>
<td>22.4</td>
<td>3.857</td>
<td>116.877</td>
<td>388.4</td>
<td>Yes</td>
<td>7.707</td>
<td>yes</td>
</tr>
<tr>
<td>Generator 11</td>
<td>4718</td>
<td>0.356</td>
<td>699</td>
<td>22.4</td>
<td>3.857</td>
<td>116.877</td>
<td>388.4</td>
<td>Yes</td>
<td>7.707</td>
<td>yes</td>
</tr>
</tbody>
</table>

October 6, 2006
Emissions Rates

For the criteria emission analysis, all of the existing and future sources were modeled to be compared to the regulatory criteria for short term averaging periods. The benzene and formaldehyde emissions that were previously modeled for generator 10 and 11 are the same and will not need to be remodeled for this model scenario.

Table 3. Short Term Emission Estimates

<table>
<thead>
<tr>
<th>SOURCE ID</th>
<th>PM10 24 Hr</th>
<th>SO2 3 Hr</th>
<th>SO2 24 HR</th>
<th>CO 1HR</th>
<th>CO 8 HR</th>
</tr>
</thead>
<tbody>
<tr>
<td>B123_G12</td>
<td>1.083</td>
<td>7.790</td>
<td>1.992</td>
<td>15.381</td>
<td>13.839</td>
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<tr>
<td>MOB1</td>
<td>0.013</td>
<td>0.001</td>
<td>0.001</td>
<td>0.144</td>
<td>0.144</td>
</tr>
<tr>
<td>MOB2</td>
<td>0.013</td>
<td>0.001</td>
<td>0.001</td>
<td>0.144</td>
<td>0.144</td>
</tr>
<tr>
<td>MOB3</td>
<td>0.004</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.040</td>
<td>0.040</td>
</tr>
<tr>
<td>GEN3</td>
<td>0.221</td>
<td>0.825</td>
<td>0.206</td>
<td>2.687</td>
<td>2.016</td>
</tr>
<tr>
<td>GEN4</td>
<td>0.099</td>
<td>0.220</td>
<td>0.055</td>
<td>0.717</td>
<td>0.537</td>
</tr>
<tr>
<td>GEN5</td>
<td>0.141</td>
<td>3.255</td>
<td>0.814</td>
<td>4.425</td>
<td>3.319</td>
</tr>
<tr>
<td>GEN6</td>
<td>0.148</td>
<td>0.550</td>
<td>0.137</td>
<td>1.792</td>
<td>1.344</td>
</tr>
<tr>
<td>GEN8</td>
<td>0.141</td>
<td>3.255</td>
<td>0.814</td>
<td>4.425</td>
<td>3.319</td>
</tr>
<tr>
<td>GEN9</td>
<td>0.022</td>
<td>0.082</td>
<td>0.021</td>
<td>0.289</td>
<td>0.202</td>
</tr>
<tr>
<td>GEN10</td>
<td>0.075</td>
<td>0.780</td>
<td>1.695</td>
<td>2.550</td>
<td>1.912</td>
</tr>
<tr>
<td>GEN11</td>
<td>0.075</td>
<td>0.780</td>
<td>1.695</td>
<td>2.550</td>
<td>1.912</td>
</tr>
</tbody>
</table>

Note: The combined stack B123_G12 is the combined emission rates for 5 sources which include Boiler 1, Boiler 2, Boiler 3 and Generator 1 and 2. The emission rates are for each generator operating for 6 hours per day.

Dispersion Model

For the air quality analysis, ISC3-PRIME (Version 01228) model was used to stay consistent with the air dispersion model previously used by IDEQ to model sources for the existing Tier II permit. ISC3-PRIME was run with the following options.
- Regulatory default options,
- Direction-specific building downwash,
- Urban land use option was used,
- Consideration of elevated terrain
- Complex/intermediate terrain algorithms.

Meteorological Data

October 6, 2006
For ISCPRIME Model, preprocessed meteorological data was used. Surface meteorological data collected from the Boise surface and upper air meteorological station was used for the analysis. Five years of data from the years 1987 to 1991 was used. This data was provided by IDEQ.

**Ambient Conditions**

Table 4 provides a summary of these background concentrations.

<table>
<thead>
<tr>
<th>TABLE 4</th>
<th>Background Criteria Pollutant Concentrations (µg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollutant</td>
<td>1-hr</td>
</tr>
<tr>
<td>SO₂</td>
<td>NA</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>NA</td>
</tr>
<tr>
<td>CO</td>
<td>12,200</td>
</tr>
</tbody>
</table>

Note: These background concentrations are based on data provided to Allan Cawse of CH2M HILL by Kevin Schilling of IDEQ via phone call on November 7, 2005.

**Receptors**

The receptors that were used for the previous modeling analysis were used for this analysis. This receptor grid includes:
- The 25-meter grid extended approximately 100 km around the facility, and
- The 50-meter grid extended approximately 1 km.

**Model Results**

The modeling results are summarized in Table 5 below. The overall concentrations for all short term averaging periods are below the NAAQs.

<table>
<thead>
<tr>
<th>TABLE 5</th>
<th>Pollutant</th>
<th>Averaging</th>
<th>Overall Conc.</th>
<th>NAAQs</th>
<th>UTM (x)</th>
<th>UTM (Y)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Period</td>
<td>(µg/m³)</td>
<td>Concentration</td>
<td>Background</td>
<td>(µg/m³)</td>
<td>(µg/m³)</td>
</tr>
<tr>
<td>SO₂</td>
<td>24-Hour</td>
<td>36.18</td>
<td>40</td>
<td>78</td>
<td>365</td>
<td>559885</td>
</tr>
<tr>
<td>SO₂</td>
<td>3-Hour</td>
<td>358.16</td>
<td>120</td>
<td>478</td>
<td>1300</td>
<td>560160</td>
</tr>
<tr>
<td>CO</td>
<td>1-Hour</td>
<td>287.44</td>
<td>12,200</td>
<td>12,487</td>
<td>40,000</td>
<td>580210</td>
</tr>
<tr>
<td>CO</td>
<td>8-Hour</td>
<td>150.66</td>
<td>6,800</td>
<td>6,961</td>
<td>10,000</td>
<td>580110</td>
</tr>
<tr>
<td>PM₁₀</td>
<td>24-Hour</td>
<td>6.81</td>
<td>100</td>
<td>107</td>
<td>150</td>
<td>559910</td>
</tr>
</tbody>
</table>

Note:
- All model runs were done with ISCPRIME
- Background concentrations provided by Kevin Schilling of DEQ, November 7, 2005

October 6, 2006
MEMORANDUM

DATE: August 10, 2006

TO: Harbi Elshafei, Permit Writer, Air Program

THROUGH: Kevin Schilling, Stationary Source Modeling Coordinator, Air Program

FROM: Darrin Mehr, Air Quality Analyst, Air Program

PROJECT NUMBER: P-050052

SUBJECT: Modeling Review for Saint Alphonsus Regional Medical Center 15-day Permit to Construct Modification Application for their facility in Boise, Idaho.

1.0 Summary

Saint Alphonsus Regional Medical Center (SARMC) submitted a 15-day Pre-Permit to Construct (PTC) application for the installation of two new package generators and the modification of existing Boilers 1, 2, and 3 to increase steam production capacity on November 28, 2005. SARMC also requested that existing Tier II/PTC No. 011-00027, issued January 17, 2003, be modified to reflect the removal of the paint spray booth, ethylene oxide sterilizer, Boiler 5 and Generator 4. Air quality analyses involving atmospheric dispersion modeling of emissions associated with the facility were submitted in support of a permit application to demonstrate that the facility would not cause or significantly contribute to a violation of any ambient air quality standard (IDAPA 58.01.01.203.02).

DEQ contacted CH2M HILL, SARMC’s consultant, on February 9, 2006, and notified them that there were errors in the BPIP (building profile input program) file for two of the SARMC buildings for a zero entry on the base of the Central Tower building and a missing section of the South Tower building.

Revised modeling was submitted on March 15, 2006. The original modeling demonstration used ISCST3 for emissions unit GEN8, with an inflated stack diameter of 17.52 meters and an exit velocity of 0.010 m/s. The revised modeling demonstration used these same stack parameters for GEN8, but used the ISC3-PRIME model.

DEQ conducted revised modeling for this project due to issues with SO₂ NAAQS compliance and the assumed anemometer height for the meteorological data sets for 1987 through 1991 that were obtained from the Boise airport met site. The anemometer height during that time period was 6.1 meters rather than the default value of ten meters. The DEQ modeling will be used to establish the modeling review compliance determination and provide recommendations for development of the PTC.

A technical review of the submitted air quality analyses was conducted by DEQ. The submitted modeling analyses in combination with DEQ’s staff analyses: 1) utilized appropriate methods and models; 2) was conducted using reasonably accurate or conservative model parameters and input data; 3) adhered to established DEQ guidelines for new source review dispersion modeling; 4) showed that predicted pollutant concentrations from emissions associated with the facility, when appropriately combined with background concentrations, were below applicable air quality standards at all receptor locations. Table 1 presents key assumptions and results that should be considered in the development of the permit.
<table>
<thead>
<tr>
<th>Criteria/Assumption/Result</th>
<th>Explanation/Consideration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generator 8 (GEN8) stack has a horizontal discharge orientation.</td>
<td>Use of an exhaust exit velocity of 0.01 m/s and an effective stack diameter of 17.52 m for GEN8 results in an assumed exhaust flow rate of 5,108 actual cubic feet per minute (ACFM) in the vertical direction. Stack-tip-induced downwash may be conservatively applied by using the large diameter for the stack and ISC3-PRIME for the model. Any future modeling for the facility will warrant discussion on this approach.</td>
</tr>
<tr>
<td>SARMC's submittal used an exit velocity of 0.01 m/s and a stack diameter of 15.72 meters. ISC3-PRIME was used for all sources in the applicant's March 15, 2006 submittal.</td>
<td>Daily operation of each generator is limited to 4 hours of testing during any day. Annual testing operating hours for each existing generator should be limited to 500 hours per year.</td>
</tr>
<tr>
<td>Generator testing was conducted using 4.0 hours per day for each generator. Multiple generators were assumed to operate concurrently during the same day. Emission rates for pollutants with averaging periods greater than 4 hours (except annual) were scaled to account for 4 hours of operation for testing. Annual emission rates of each existing generator were scaled to account for 500 hours per year. Newly proposed Generator 10 (GEN10) and Generator 11 (GEN11) were assumed to each operate for up to 4 hours in a day and 500 hours per year.</td>
<td>GEN10 and GEN11 should each be limited to 4 hours per day and 500 hours per year of operation for testing purposes.</td>
</tr>
<tr>
<td>TAPs emissions from proposed emergency electrical generators Nos. 10 and 11 were analyzed for this project. An operational restriction of 500 hours per year was requested.</td>
<td>TAPs emissions from the proposed generators relied on a controlled emissions and controlled ambient concentration scenario for the compliance demonstration with IDAPA 58.01.01.210.</td>
</tr>
<tr>
<td>TAPs and criteria air pollutant emissions resulting from the increase in heat input capacity due to burner changeouts in Boilers 1, 2, and 3 (stack B123, G12) demonstrated compliance with NAAQS and TAPs increments.</td>
<td>The rated heat capacities for Boiler 1 and Boiler 2 can be increased to 43 million Btu per hour (MMBtu/hr) for natural gas and 41 MMBtu/hr for distillate fuel oil No. 2. The rated heat capacity for Boiler 3 can be increased to 18.8 million Btu per hour (MMBtu/hr) for natural gas and 16.8 MMBtu/hr for distillate fuel oil No. 2. The increase in TAPs emissions from the difference in baseline currently-permitted heat input capacities and requested potential capacities were analyzed.</td>
</tr>
<tr>
<td>Emission rates and modeling account for 360 hours per year of operation at requested capacity on No. 2 distillate fuel oil containing 0.5 percent by weight for Boilers 1, 2, and 3.</td>
<td>Boilers 1, 2, and 3 should either be limited to 360 hours per year of operation (each boiler) on No. 2 distillate fuel oil, or, alternatively, should be limited a maximum of 107,640 gallons per year for Boilers 1 and 2 (each boiler), and 44,280 gallons per year for Boiler 3. No. 2 distillate fuel oil with a sulfur content of 0.5 percent by weight was used as the sulfur limit in the emission estimates and modeling demonstration.</td>
</tr>
<tr>
<td>Operation of Boilers 1, 2, and 3 were analyzed with the following scenario: Boiler 1-No. 2 distillate fuel oil Boiler 2-No. 2 distillate fuel oil</td>
<td>Boilers 1 and 2 will have the greatest heat input capacity of the three boilers and are the worst-case boilers with regard to emissions and impacts for SO2 and TAPs.</td>
</tr>
<tr>
<td>Criteria/Assumption/Result</td>
<td>Explanation/Consideration</td>
</tr>
<tr>
<td>----------------------------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Boiler 3-Natural gas</td>
<td>Any two boilers out of the Boiler 1, 2, and 3 group may operate on No. 2 distillate fuel oil at any time. The third boiler may operate concurrently whilecombusting natural gas with the other two boilers combusting No. 2 distillate fuel oil.</td>
</tr>
<tr>
<td>Generator 4 and Boiler 5 were omitted from the modeling demonstration.</td>
<td>Existing permitted emissions units Generator 4 and Boiler 5 are to be removed from service at the SARMC facility per the application.</td>
</tr>
<tr>
<td>The anemometer height was corrected to a user input value of 6.1 meters.</td>
<td>The 6.1 meter height is accurate for the time period of the 1987-1991 meteorological data sets at the Boise airport met site.</td>
</tr>
<tr>
<td>Generator 6 (GEN6) was modeled using the following exhaust parameters:</td>
<td>Kevin Schilling, Modeling Coordinator, DEQ, performed an analysis to identify whether the temperature buoyancy flux or the momentum flux was the dominant dispersion mechanism. This analysis assumed the exit temperature for the generator exhaust was 600 Kelvin to account for temperature loss due to some amount of radiation and convection losses as the exhaust travels from the engine’s exhaust manifold and through the exhaust stack.</td>
</tr>
<tr>
<td>- Exhaust velocity of 56 meters per second</td>
<td>CH2M HILL provided exhaust parameters for Generator 6. Therefore, DEQ’s revised analysis only revised modeling parameters for that source.</td>
</tr>
<tr>
<td>- Actual stack diameter of 0.256 meters</td>
<td>No additional operational scenarios for the facility’s sources were examined by DEQ.</td>
</tr>
<tr>
<td>- Exhaust temperature of 600 Kelvin</td>
<td>Emission rates for all emissions units were used as submitted in SARMC’s March 15, 2006 submittal.</td>
</tr>
<tr>
<td>- Modeled as an unobstructed vertical release</td>
<td></td>
</tr>
</tbody>
</table>

### 2.0 Background Information

#### 2.1 Applicable Air Quality Impact Limits and Modeling Requirements

This section identifies applicable ambient air quality limits and analyses used to demonstrate compliance.

##### 2.1.1 Area Classification

The SARMC facility is located in Ada County, designated as an attainment or unclassifiable area for sulfur dioxide (SO₂), nitrogen dioxide (NO₂), carbon monoxide (CO), lead (Pb), ozone (O₃), and particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers (PM₁₀). The area operates under limited maintenance plans for PM₁₀ and CO. There are no Class I areas within 10 kilometers of the facility.

##### 2.1.2 Significant and Full Impact Analyses

If estimated maximum pollutant impacts to ambient air from the emissions sources at the facility exceed the significant contribution levels (SCLs) of IDAPA 58.01.01.006.90, then a full impact analysis is necessary to demonstrate compliance with IDAPA 58.01.01.203.02. A full impact analysis for attainment area pollutants involves adding ambient impacts from facility-wide emissions to DEQ-approved background concentration values that are appropriate for the criteria pollutant/averaging-time at the facility location and the area of significant impact. The resulting maximum pollutant concentrations in ambient air are then compared to the National Ambient Air Quality Standards (NAAQS) listed in Table 2. Table 2 also lists SCLs and specifies the modeled value that must be used for comparison to the NAAQS.

Page 3
Table 2. CRITERIA AIR POLLUTANTS APPLICABLE REGULATORY LIMITS

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Period</th>
<th>Significant Contribution Levels a (µg/m³)</th>
<th>Regulatory Limit b (µg/m³)</th>
<th>Modeled Value Used a</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM₁₀</td>
<td>Annual</td>
<td>1.0</td>
<td>50³</td>
<td>Maximum 1st highest⁴</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>5.0</td>
<td>150³</td>
<td>Maximum 6th highest⁴</td>
</tr>
<tr>
<td>Carbon monoxide (CO)</td>
<td>8-hour</td>
<td>500</td>
<td>10,000³</td>
<td>Maximum 2nd highest⁴</td>
</tr>
<tr>
<td></td>
<td>1-hour</td>
<td>2,000</td>
<td>40,000³</td>
<td>Maximum 2nd highest⁴</td>
</tr>
<tr>
<td>Sulfur Dioxide (SO₂)</td>
<td>24-hour</td>
<td>1.0</td>
<td>80³</td>
<td>Maximum 1st highest⁴</td>
</tr>
<tr>
<td></td>
<td>3-hour</td>
<td>5</td>
<td>365¹</td>
<td>Maximum 2nd highest⁴</td>
</tr>
<tr>
<td>Nitrogen Dioxide (NO₂)</td>
<td>Annual</td>
<td>25</td>
<td>1,300¹</td>
<td>Maximum 2nd highest⁴</td>
</tr>
<tr>
<td>Lead (Pb)</td>
<td>Quarterly</td>
<td>NA</td>
<td>1.5³</td>
<td>Maximum 1st highest⁴</td>
</tr>
</tbody>
</table>

¹IDAPA 58.01.01.006.90
²Micrograms per cubic meter
³IDAPA 58.01.01.577 for criteria pollutants
⁴The maximum 1st highest modeled value is always used for significant impact analysis
⁵Particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers
⁶Never expected to be exceeded in any calendar year
⁷Concentration at any modeled receptor
⁸Never expected to be exceeded more than once in any calendar year
⁹Concentration at any modeled receptor when using five years of meteorological data
¹⁰Not to be exceeded more than once per year

The increase in emissions from the proposed modification are required to demonstrate compliance with the toxic air pollutant (TAP) increments with an ambient impact dispersion analysis for any TAP with a requested potential emission rate that exceeds the screening emission rate specified by IDAPA 58.01.01.586. Table 3 lists the applicable screening emission rates and regulatory limits (allowable increments) for the TAPs of concern for this project.

Table 3. TOXIC AIR POLLUTANTS APPLICABLE REGULATORY LIMITS

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Period</th>
<th>Screening Emission Rate Limit a (lb/hr) b</th>
<th>Regulatory Limit (AAC/AACC) c (µg/m³) d</th>
<th>Modeled Value Used a</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Methylcholanthrene</td>
<td>24-hour</td>
<td>2.5E-06</td>
<td>3.7E-04</td>
<td>Maximum 1st highest⁴</td>
</tr>
<tr>
<td>(CAS# 56-49-3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arsenic</td>
<td>Annual</td>
<td>1.5E-06</td>
<td>2.3E-04</td>
<td>Maximum 1st highest⁴</td>
</tr>
<tr>
<td>(CAS# 7440-38-2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzene</td>
<td>Annual</td>
<td>8.0E-04</td>
<td>0.12</td>
<td>Maximum 1st highest⁴</td>
</tr>
<tr>
<td>(CAS# 71-43-2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beryllium</td>
<td>Annual</td>
<td>2.8E-05</td>
<td>4.2E-03</td>
<td>Maximum 1st highest⁴</td>
</tr>
<tr>
<td>(CAS# 440-41-7)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cadmium</td>
<td>Annual</td>
<td>3.7E-06</td>
<td>5.6E-04</td>
<td>Maximum 1st highest⁴</td>
</tr>
<tr>
<td>(CAS# 7440-43-9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>Annual</td>
<td>5.1E-04</td>
<td>0.077</td>
<td>Maximum 1st highest⁴</td>
</tr>
<tr>
<td>(CAS# 50-00-0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>Annual</td>
<td>2.7E-05</td>
<td>4.2E-03</td>
<td>Maximum 1st highest⁴</td>
</tr>
<tr>
<td>(CAS# 7440-02-0)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹IDAPA 58.01.01.586 and 58.01.01.586
²Pounds per hour
³Increment for acceptable ambient concentration/acceptable ambient concentration for carcinogens
⁴Micrograms per cubic meter
⁵The maximum 1st highest modeled value is always used to establish TAPs compliance
⁶Chemical abstract service
⁷Concentration at any modeled receptor, never expected to be exceeded in any calendar year

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2.2 Background Concentrations

Ambient background concentrations were revised for all areas of Idaho by DEQ in March 2003\(^1\). Background concentrations in areas where no monitoring data are available were based on monitoring data from areas with similar population density, meteorology, and emissions sources. Background concentrations used in these analyses are listed in Table 4. Monitored concentrations for the Boise area were used for background concentrations of nitrogen dioxide (NO\(_2\)), carbon monoxide (CO), and annual PM\(_{10}\). Airshed modeling results were used for 24-hour PM\(_{10}\). Default values for urban areas were used for sulfur dioxide (SO\(_2\)).

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Period</th>
<th>Background Concentration ((\mu g/m^3))(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM(_{10})(^b)</td>
<td>24-hour</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>27</td>
</tr>
<tr>
<td>NO(_2)(^b)</td>
<td>Annual</td>
<td>40</td>
</tr>
<tr>
<td>CO(^d)</td>
<td>1-hour</td>
<td>12,200</td>
</tr>
<tr>
<td></td>
<td>8-hour</td>
<td>6,800</td>
</tr>
<tr>
<td></td>
<td>3-hour</td>
<td>120</td>
</tr>
<tr>
<td>SO(_2)(^d)</td>
<td>24-hour</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>10</td>
</tr>
</tbody>
</table>

\(^a\)Micrograms per cubic meter
\(^b\)Particulate matter with aerodynamic diameter less than or equal to a nominal ten micrometers
\(^d\)Nitrogen dioxide

3.0 Modeling Impact Assessment

3.1 Modeling Methodology

Table 5 provides a summary of the modeling parameters used in the DEQ verification analyses.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Description/Values</th>
<th>Documentation/Additional Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meteorological data</td>
<td>1987-1991</td>
<td>Boise surface and upper air data</td>
</tr>
<tr>
<td>Land Use (urban or rural)</td>
<td>Urban</td>
<td>Urban dispersion coefficients were used by SARMC based on Auer land use classification for the 3 kilometer (km) area surrounding SARMC.</td>
</tr>
<tr>
<td>Terrain</td>
<td>Considered</td>
<td>Receptor 3-dimensional coordinates were obtained by CH2M Hill from USGS DEM files and used to establish elevation of ground level receptors. DEQ did not re-import the DEM files.</td>
</tr>
<tr>
<td>Building downwash</td>
<td>Downwash algorithm</td>
<td>Building dimensions obtained from modeling files submitted, and BPIP-Prime and ISC3-Prime were used to evaluate downwash effects.</td>
</tr>
<tr>
<td>Receptor grid</td>
<td>Grid 1</td>
<td>25 meter spacing exterior to all buildings. The 25 meter spacing extends approximately 200 meters to the east, 200 meters on the north and south sides of the facility, and directly along the HLTHCH building (western portion of facility).</td>
</tr>
<tr>
<td></td>
<td>Grid 2</td>
<td>50 meter spacing for 700 meters to the east, for 650 meters to the south; for 700 meters to the north, and for 250 meters to the west.</td>
</tr>
</tbody>
</table>

\(^*\)Graphic user interface

3.1.1 Modeling protocol

A protocol was submitted by CH2M HILL, on behalf of SARMC, to DEQ prior to submission of the application, as required by IDAPA 58.01.01.213.01.c.

Written approval of the modeling protocol, with comments on modeling methodology, was issued by Kevin Schilling, Modeling Coordinator, by email dated November 21, 2005. Modeling was conducted using methods and data presented in the modeling protocol and the State of Idaho Air Quality Modeling Guideline. SARMC used an increased stack diameter and an exhaust velocity of 0.01 m/s for source GEN8 instead of the 0.10 meter diameter and 0.001 m/s exhaust velocity listed in the modeling protocol. SARMC used ISC3-Prime in the March 15, 2006, submittal instead of ISCST3 to model GEN8.

3.1.2 Model Selection

ISC3-PRIME was used by SARMC to conduct the ambient air analyses. ISCST3 is the recommended model for this instance, and the PRIME algorithm accounted for wind-induced downwash effects due to structures at the site.

3.1.3 Meteorological Data

Boise surface and upper air meteorological data were used for the SARMC site in Boise. The anemometer height was incorrectly set at 10 meters in the application's modeling demonstration. DEQ used an anemometer height of 6.1 meters in the verification analyses.

3.1.4 Terrain Effects

The modeling analyses submitted by SARMC considered elevated terrain. The actual elevation of each receptor was determined using United States Geological Survey (USGS) digital elevation map (DEM) files. Elevations of emission sources, buildings, and receptors were not regenerated from DEM files for DEQ's verification analyses.

3.1.5 Facility Layout

DEQ verified proper identification of the facility boundary and buildings on the site by comparing the modeling input to a scaled facility plot plan submitted with the application. The scaled facility plot plan depicted the existing and proposed emissions sources. Satellite images of the site were obtained from Google Earth to confirm the facility layout.

3.1.6 Building Downwash

Plume downwash effects caused by structures present at the facility were accounted for in the modeling analyses. The Building Profile Input Program-PRIME (BPIP-PRIME) was used by the applicant to calculate direction-specific building dimensions and Good Engineering Practice (GEP) stack height information from building dimensions/configurations and emissions release parameters for ISC3-PRIME. ISC3-PRIME identified the effects of structure-induced downwash on predicted ambient impacts.

DEQ's verification modeling used BPIP-PRIME and ISC3-PRIME.
3.1.7 Ambient Air Boundary

Ambient air was determined to exist for all areas immediately exterior to SAMRC buildings. This ambient air boundary is appropriate considering public access is not restricted because the facility a regional medical center.

3.1.8 Receptor Network

The receptor grids used by SARMC met the minimum recommendations specified in the State of Idaho Air Quality Modeling Guideline. DEQ verification analyses were conducted using the same receptor grid.

3.2 Emission Rates

Emissions rates used in the dispersion modeling analyses submitted by the applicant were reviewed against those in the permit application. The following approach was used for DEQ verification modeling:

- All modeled criteria and toxic air pollutant (TAP) emissions rates were equal to or greater than the SARMC facility’s emissions calculated in the PTC application or the permitted allowable rate.

Tables 6 and 7 list the criteria air pollutant emissions rates for sources included in the dispersion modeling analyses for short term and annual averaging periods, respectively. Daily emissions were modeled by SARMC for 24 hours. Annual emissions were modeled over 8,760 hours per year. See Section 3.4 of this memorandum to review a discussion on the emission rate and ambient impact of 3-methylcholanthrene.
<table>
<thead>
<tr>
<th>Source ID</th>
<th>Description</th>
<th>$PM_{10}$ (lb/hr)$^*$</th>
<th>$SO_{2}$ (lb/hr)$^*$</th>
<th>$CO$ (lb/hr)$^*$</th>
</tr>
</thead>
<tbody>
<tr>
<td>B123_G12</td>
<td>South Tower Building - Boilers 1, 2, and 3 and Emergency Generators 1 and 2 which all share a combined stack (emissions are aggregated)</td>
<td>2.20</td>
<td>48.19 (3-hr avg)$^*$</td>
<td>0.001 (3-hr avg)$^*$</td>
</tr>
<tr>
<td>MOBV1</td>
<td>Cardiology Building - Boiler 1</td>
<td>0.013</td>
<td>0.001 (3-hr avg)$^*$</td>
<td>0.001 (24-hr avg)$^*$</td>
</tr>
<tr>
<td>MOBV2</td>
<td>Cardiology Building - Boiler 2</td>
<td>0.013</td>
<td>0.001 (3-hr avg)$^*$</td>
<td>0.001 (24-hr avg)$^*$</td>
</tr>
<tr>
<td>MOBV3</td>
<td>Cardiology Building - Boiler 3</td>
<td>0.0036</td>
<td>0.0003 (3-hr avg)$^*$</td>
<td>0.0003 (24-hr avg)$^*$</td>
</tr>
<tr>
<td>GEN3</td>
<td>Information Resources Building - Generator</td>
<td>0.148</td>
<td>0.825 (3-hr avg)$^*$</td>
<td>0.137 (24-hr avg)$^*$</td>
</tr>
<tr>
<td>GEN5</td>
<td>Psychology Center Building - Emergency Generator</td>
<td>0.039</td>
<td>0.220 (3-hr avg)$^*$</td>
<td>0.037 (24-hr avg)$^*$</td>
</tr>
<tr>
<td>GEN6</td>
<td>Orthopedic Building Emergency Generator</td>
<td>0.094</td>
<td>3.25 (3-hr avg)$^*$</td>
<td>0.094 (24-hr avg)$^*$</td>
</tr>
<tr>
<td>GEN7</td>
<td>Liberty Building Emergency Generator</td>
<td>0.098</td>
<td>0.55 (3-hr avg)$^*$</td>
<td>0.092 (24-hr avg)$^*$</td>
</tr>
<tr>
<td>GEN8</td>
<td>Cardiology Building Emergency Generator</td>
<td>0.094</td>
<td>3.25 (3-hr avg)$^*$</td>
<td>0.094 (24-hr avg)$^*$</td>
</tr>
<tr>
<td>GEN9</td>
<td>Health Tech Building Emergency Generator</td>
<td>0.015</td>
<td>0.082 (3-hr avg)$^*$</td>
<td>0.014 (24-hr avg)$^*$</td>
</tr>
<tr>
<td>GEN10</td>
<td>New Central Tower Building Emergency Generator</td>
<td>0.050</td>
<td>6.78 (3-hr avg)$^*$</td>
<td>1.13 (24-hr avg)$^*$</td>
</tr>
<tr>
<td>GEN11</td>
<td>New Central Tower Building Emergency Generator</td>
<td>0.050</td>
<td>6.78 (3-hr avg)$^*$</td>
<td>1.13 (24-hr avg)$^*$</td>
</tr>
</tbody>
</table>

$^*$Particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers

$^*$Sulfur dioxide

$^*$Carbon monoxide

$^*$Pounds per hour

$^*$The carbon monoxide NAAQS have a 1-hour (hr) averaging (avg) period and an 8-hr avg period. Sulfur dioxide NAAQS have a 3-hr avg period and a 24-hr avg period.
<table>
<thead>
<tr>
<th>Source ID</th>
<th>Description</th>
<th>PM$_{2.5}$</th>
<th>NO$_x$</th>
<th>SO$_x$</th>
</tr>
</thead>
<tbody>
<tr>
<td>B123_G12</td>
<td>South Tower Building - Boilers 1, 2, and 3 and Emergency Generators 1 and 2 which all share a combined stack (emissions are aggregated)</td>
<td>0.902</td>
<td>6.90</td>
<td>2.49</td>
</tr>
<tr>
<td>MOBV1</td>
<td>Cardiology Building - Boiler 1</td>
<td>0.013</td>
<td>0.17</td>
<td>0.0010</td>
</tr>
<tr>
<td>MOBV2</td>
<td>Cardiology Building - Boiler 2</td>
<td>0.013</td>
<td>0.17</td>
<td>0.0010</td>
</tr>
<tr>
<td>MOBV3</td>
<td>Cardiology Building - Boiler 3</td>
<td>0.0036</td>
<td>0.048</td>
<td>0.0003</td>
</tr>
<tr>
<td>GEN3</td>
<td>Information Resources Building - Generator</td>
<td>0.051</td>
<td>0.71</td>
<td>0.047</td>
</tr>
<tr>
<td>GEN5</td>
<td>Psychology Center Building Emergency Generator</td>
<td>0.013</td>
<td>0.19</td>
<td>0.013</td>
</tr>
<tr>
<td>GEN6</td>
<td>Orthopedic Building Emergency Generator</td>
<td>0.032</td>
<td>1.10</td>
<td>0.186</td>
</tr>
<tr>
<td>GEN7</td>
<td>Liberty Building Emergency Generator</td>
<td>0.035</td>
<td>0.47</td>
<td>0.031</td>
</tr>
<tr>
<td>GEN8</td>
<td>Cardiology Building Emergency Generator</td>
<td>0.032</td>
<td>1.10</td>
<td>0.186</td>
</tr>
<tr>
<td>GEN9</td>
<td>Health Tech Building Emergency Generator</td>
<td>0.0050</td>
<td>0.071</td>
<td>0.0047</td>
</tr>
<tr>
<td>GEN10</td>
<td>New Central Tower Building Emergency Generator</td>
<td>0.017</td>
<td>1.48</td>
<td>0.387</td>
</tr>
<tr>
<td>GEN11</td>
<td>New Central Tower Building Emergency Generator</td>
<td>0.017</td>
<td>1.48</td>
<td>0.387</td>
</tr>
</tbody>
</table>

*Particulate matter with an aerodynamic diameter less than or equal to a nominal ten micrometers

*Nitrogen dioxide

*Sulfur dioxide

*Pounds per hour

Table 8 lists the modeled TAP emissions rates for the proposed modification project. The project, as defined in the PTC application, is subject to compliance with the TAPs increments. Daily emissions were modeled by SARMC for 24 hours. Annual emissions were modeled over 8,760 hours per year.
Table 8. Modeled Toxic Air Pollutant Emissions Rates

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>B123, G12</th>
<th>GEN16</th>
<th>GEN11</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(lb/hr)³</td>
<td>(T/yr)⁴</td>
<td>(lb/hr)</td>
</tr>
<tr>
<td>3-Methylcholanthrene</td>
<td>1.68E-04</td>
<td>7.34E-04</td>
<td>0.0</td>
</tr>
<tr>
<td>Arsenic</td>
<td>3.54E-05</td>
<td>1.55E-04</td>
<td>0.0</td>
</tr>
<tr>
<td>Benzene</td>
<td>2.02E-04</td>
<td>8.84E-04</td>
<td>5.41E-04</td>
</tr>
<tr>
<td>Beryllium</td>
<td>1.37E-05</td>
<td>5.99E-05</td>
<td>0.0</td>
</tr>
<tr>
<td>Cadmium</td>
<td>1.15E-04</td>
<td>5.0E-04</td>
<td>0.0</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>7.95E-03</td>
<td>3.48E-02</td>
<td>9.6E-04</td>
</tr>
<tr>
<td>Nickel</td>
<td>2.08E-04</td>
<td>9.1E-04</td>
<td>0.0</td>
</tr>
</tbody>
</table>

¹All TAPs for this project are carcinogenic TAPs regulated under IDAPA 58.01.01.586.
²Pounds per hour
³Tons per year
⁴South Tower Building Boilers 1, 2, and 3, and emergency electrical generators 1 and 2.

3.3 Emission Release Parameters

Table 9 provides emissions release parameters, including stack height, stack diameter, exhaust temperature, and exhaust velocity for point sources. Values used in the analyses appeared reasonable and within expected ranges. Additional documentation/verification of these parameters was not required. The approach used by SARMc for Generator 8 (GEN8) was approved by DEQ for this project. Source GEN8 has a horizontal release of exhaust and was modeled using an exhaust flow rate of 5,108 cubic feet per minute (CFM).

DEQ performed an analysis to determine whether the dispersion of the emissions plume from Generator 6 (GEN6) was dominated by thermal buoyancy flux or by the momentum flux. Calculations performed by DEQ indicate that the buoyancy flux will be the dominant dispersion mechanism. Therefore, the horizontal release point can be modeled as an uninterrupted vertical release without the model inappropriately accounting for momentum plume rise. See Attachment B of this memorandum to review this analysis. Generator 6 was remodeled by DEQ using the actual stack diameter of 0.256 meters and an exhaust velocity of 56 meters per second. The temperature at the point of release to the atmosphere was reduced to 600 Kelvin to account for heat loss of the plume within the stack. DEQ only altered the emission release point parameters.
Table 9. POINT SOURCE STACK PARAMETERS

<table>
<thead>
<tr>
<th>Release Point</th>
<th>Source Type</th>
<th>X UTM Coordinate (m)</th>
<th>Y UTM Coordinate (m)</th>
<th>Source Base Elevation (m)</th>
<th>Stack Height (m)</th>
<th>Modeled Stack Diameter (m)</th>
<th>Stack Gas Flow Temperature (K)</th>
<th>Stack Gas Flow Velocity (m/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>B123_G12</td>
<td>Point</td>
<td>560060.4</td>
<td>4828998</td>
<td>826.7</td>
<td>28.95</td>
<td>1.75</td>
<td>502.59</td>
<td>5.16</td>
</tr>
<tr>
<td>(5 co-located stacks aggregated as a single stack)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MOBV1</td>
<td>Point</td>
<td>560100.3</td>
<td>4829163</td>
<td>826.3</td>
<td>8.22</td>
<td>0.3566</td>
<td>433.15</td>
<td>0.001</td>
</tr>
<tr>
<td>MOBV2</td>
<td>Point</td>
<td>560100.3</td>
<td>4829161</td>
<td>826.3</td>
<td>8.22</td>
<td>0.3566</td>
<td>433.15</td>
<td>0.001</td>
</tr>
<tr>
<td>MOBV3</td>
<td>Point</td>
<td>560100.4</td>
<td>4829159</td>
<td>826.3</td>
<td>8.22</td>
<td>0.3566</td>
<td>433.15</td>
<td>0.001</td>
</tr>
<tr>
<td>GEN3</td>
<td>Point</td>
<td>560184</td>
<td>4828938</td>
<td>827.2</td>
<td>3.35</td>
<td>0.1524</td>
<td>702.59</td>
<td>78.65</td>
</tr>
<tr>
<td>GEN5</td>
<td>Point</td>
<td>559237.8</td>
<td>4828144</td>
<td>823</td>
<td>6.09</td>
<td>0.1</td>
<td>810.93</td>
<td>40.98</td>
</tr>
<tr>
<td>GEN6</td>
<td>Point</td>
<td>559973.8</td>
<td>4829000</td>
<td>826.6</td>
<td>7.31</td>
<td>0.256</td>
<td>724.82 (600)</td>
<td>56.0</td>
</tr>
<tr>
<td>GEN7</td>
<td>Point</td>
<td>559862.8</td>
<td>4829000</td>
<td>826.3</td>
<td>3.44</td>
<td>0.1524</td>
<td>619.26</td>
<td>57.95</td>
</tr>
<tr>
<td>GEN8</td>
<td>Point</td>
<td>560105.7</td>
<td>4829146</td>
<td>826.3</td>
<td>3.1</td>
<td>17.52</td>
<td>697.04</td>
<td>0.01</td>
</tr>
<tr>
<td>GEN9</td>
<td>Point</td>
<td>559455</td>
<td>4828906</td>
<td>825.2</td>
<td>1.64</td>
<td>0.762</td>
<td>778.15</td>
<td>0.336</td>
</tr>
<tr>
<td>GEN10</td>
<td>Point</td>
<td>560066.9</td>
<td>4829018</td>
<td>826.6</td>
<td>12.192</td>
<td>0.3556</td>
<td>699.37</td>
<td>0.001</td>
</tr>
<tr>
<td>GEN11</td>
<td>Point</td>
<td>560069.4</td>
<td>4829018</td>
<td>826.6</td>
<td>12.192</td>
<td>0.3556</td>
<td>699.37</td>
<td>0.001</td>
</tr>
</tbody>
</table>

*Universal transverse Mercator
*Meters
*Kelvin
*Meters per second
*Horizontal release for exhaust
*Stack equipped with a raincap
*A lower exhaust temperature of 600 Kelvin (or 620 degrees Fahrenheit) was assumed by DEQ.

3.4 Results for Full Impact Analyses

A significant contribution analysis was not submitted for this application. SARMIC submitted a full impact analysis for the proposed modification project. Results of DEQ's verification analyses are shown in Table 10 and were obtained using the revised exhaust parameters for Generator 6 (GEN6). DEQ verification analyses did not alter any pollutant emission rates submitted by SARMIC.

Table 10. RESULTS OF FULL IMPACT ANALYSES

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Averaging Period</th>
<th>Modeled Design Concentration (µg/m³)</th>
<th>Background Concentration (µg/m³)</th>
<th>Total Ambient Impact (µg/m³)</th>
<th>NAAQS*</th>
<th>Percent of NAAQS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PM₁₀</td>
<td>24-hour</td>
<td>8.8</td>
<td>100</td>
<td>108.8</td>
<td>150</td>
<td>72.5%</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>1.3</td>
<td>27</td>
<td>28.3</td>
<td>50</td>
<td>56.6%</td>
</tr>
<tr>
<td>SO₂</td>
<td>3-hour</td>
<td>666.2</td>
<td>120</td>
<td>786.2</td>
<td>1,300</td>
<td>60.5%</td>
</tr>
<tr>
<td></td>
<td>24-hour</td>
<td>162.3</td>
<td>40</td>
<td>202.3</td>
<td>365</td>
<td>55.4%</td>
</tr>
<tr>
<td></td>
<td>Annual</td>
<td>5.4</td>
<td>10</td>
<td>15.4</td>
<td>80</td>
<td>19.3%</td>
</tr>
<tr>
<td>CO</td>
<td>1-hour</td>
<td>562.9</td>
<td>12,200</td>
<td>12,762.9</td>
<td>40,000</td>
<td>31.9%</td>
</tr>
<tr>
<td></td>
<td>8-hour</td>
<td>109.6</td>
<td>6,800</td>
<td>6,909.6</td>
<td>10,000</td>
<td>69.1%</td>
</tr>
<tr>
<td>NO₂</td>
<td>Annual</td>
<td>23.2</td>
<td>40</td>
<td>63.2</td>
<td>100</td>
<td>63.2%</td>
</tr>
</tbody>
</table>

*Micrograms per cubic meter
*National ambient air quality standards
*Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers
*Sulfur dioxide
*Carbon monoxide
*Nitrogen dioxide
*Values in parentheses were obtained from DEQ verification modeling using BPIP-PRIME/ISC-PRIME.
Table 11 lists the maximum predicted TAP ambient impacts presented by SARMC, and the results of DEQ's verification analyses for the proposed project. TAPs compliance was evaluated for the incremental increase in emissions that would be caused by the proposed increase in heat input capacity for Boilers 1, 2, and 3, and proposed emergency electrical generators #10 and #11.

DEQ re-ran the TAPs modeling demonstration with a revised anemometer height of 6.1 meters and the ISC3-Prime model. SARMC used an anemometer height of 10 meters with the ISC3-Prime model. Predicted ambient impacts of the project's TAPs emissions did not exceed allowable increments. See Attachment A of this memorandum to review the summary output files of DEQ's modeling of criteria air pollutants and TAPs.

DEQ's verification analysis for the carcinogenic TAP of 3-methylcholanthrene did not match the results presented by SARMC. DEQ did not determine why there was such a variation in predicted ambient impacts for 3-methylcholanthrene between DEQ's and SARMC's results. An emission rate of 2.11E-05 grams per second (1.68E-04 lb/hr) was modeled by SARMC, as confirmed in the "LST" file for this pollutant.

DEQ assumes that SARMC's analysis multiplied the combined emission rate by a factor of 1000 for the model, and divided the modeled design concentration by a factor of 1000 to obtain a predicted ambient impact of 1.9E-07 μg/m³, annual average. The modeling predicts compliance with the AACC whether or not the design concentration is divided by a factor of 1000. A review of the emission estimates provided in the application lists an aggregated emissions rate of 1.80E-07 lb/hr of 3-methylcholanthrene for Boilers 1, 2, and 3. This emission rate is below the screening emission rate limit of 2.5E-06 lb/hr, which indicates modeling of this TAP is not required to comply with the TAPs rules in IDAPA 58.01.01.210 et. seq., and IDAPA 58.01.01.586.

### Table 11. TOXIC AIR POLLUTANTS ANALYSIS RESULTS

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Year</th>
<th>Average Period</th>
<th>Maximum Concentration (μg/m³)ᵃ</th>
<th>Receptor Location</th>
<th>Percent of Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-Methylcholanthrene</td>
<td>1987</td>
<td>Annual</td>
<td>1.9E-07 (1.9E-04)ᵇ</td>
<td>559,910</td>
<td>4,829,040</td>
</tr>
<tr>
<td>Arsenic</td>
<td>1987-1990</td>
<td>Annual</td>
<td>4E-05 (4E-05)ᵇ</td>
<td>559,910</td>
<td>4,829,040</td>
</tr>
<tr>
<td>Benzene</td>
<td>1989</td>
<td>Annual</td>
<td>7.4E-03 (6.4E-03)ᵇ</td>
<td>560,035</td>
<td>4,829,063</td>
</tr>
<tr>
<td>Beryllium</td>
<td>1987</td>
<td>Annual</td>
<td>2E-05 (2E-05)ᵇ</td>
<td>559,910</td>
<td>4,829,040</td>
</tr>
<tr>
<td>Cadmium</td>
<td>1987</td>
<td>Annual</td>
<td>1.3E-04 (1.3E-04)ᵇ</td>
<td>559,910</td>
<td>4,829,040</td>
</tr>
<tr>
<td>Formaldehyde</td>
<td>1989</td>
<td>Annual</td>
<td>1.63E-02 (1.28E-02)ᵇ</td>
<td>560,060</td>
<td>4,829,065</td>
</tr>
<tr>
<td>Nickel</td>
<td>1987</td>
<td>Annual</td>
<td>2.4E-04 (2.4E-04)ᵇ</td>
<td>559,910</td>
<td>4,829,040</td>
</tr>
</tbody>
</table>

ᵃMicrograms per cubic meter
ᵇMeters
ᶜAcceptable ambient concentration for carcinogens
ᵈValues in parentheses are DEQ verification analysis results, highest 1st high for design concentrations and percentages for the percent of limit values

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4.0 Conclusions

The ambient air impact analysis submitted, in combination with DEQ's verification analyses, demonstrated to DEQ's satisfaction that emissions from the facility, as represented by the applicant in the permit application, will not cause or significantly contribute to a violation of any air quality standard.
Attachment A

St. Alphonsus Regional Medical Center (Boise)

P-050052

DEQ Verification Modeling Results
Attachment B

St. Alphonsus Regional Medical Center (Boise)

P-050052

DEQ Analysis of Buoyancy Flux or Momentum Flux Dominance
For Modeling the Horizontal Discharge of Generator 6

Created by Kevin Schilling, Stationary Source Modeling Coordinator, DEQ
\[ \Delta T = 0.0195 \cdot (0.50 \cdot 56) \cdot \sqrt{6.36 \cdot 8} = 165^\circ \]

Since the minimum \( \Delta T \) is 247 and this is greater than \( \Delta T \), buoyancy will always dominate for stable conditions.

\[ S = \frac{96}{0.020} = 6.30 E-4 \]

\[ T = \frac{0.5}{0.020} = 250^\circ \]
Modeling Hot Horizontal Releases

1.0 Description of Issue

When hot gases from an industrial stack are emitted to the atmosphere the plume may experience an initial rise depending on characteristics of the released gas stream. If the gases are emitted from a vertical stack, the plume may rise because of vertical momentum. If the gases are at a temperature greater than the surrounding air, the plume may also rise because of thermal buoyancy.

The Gaussian dispersion models used in those analyses calculate plume rise based on the greater of either momentum or thermal buoyancy. If the stack gases vent in a horizontal direction or the emissions stack is capped, then only thermal buoyancy will contribute to plume rise. The models do not have a switch to disregard plume momentum for horizontal releases. Therefore, methods were developed to adjust release parameters such that momentum is effectively eliminated. The most typical method used for the ISCST3 model was to set the exit velocity to 0.001 m/sec. This effectively eliminated momentum plume rise. This unfortunately also effectively eliminated thermal buoyancy. To overcome this problem, the stack diameter was increased to a point where the modeled volumetric flow (using the 0.001 m/sec exit velocity) was equal to the actual flow. This method reestablished the proper thermal mass of emitted gases to achieve the correct plume rise from thermal buoyancy.

The above method cannot be used with models utilizing the PRIME downwash algorithm, such as AERMOD and ISC-PRIME. The algorithms in PRIME use stack diameter to define the plume radius, and the plume radius is used to solve conservation laws. EPA is aware of this problem and has provided some discussion in the AERMOD Implementation Guide, issued on September 27, 2005. The guide suggests a conservative approach of setting the exit velocity to 0.001 m/sec but not altering the stack diameter. This approach will result in an underestimation of thermal buoyancy and likely an overestimation of maximum impacts of the source.

2.0 Alternate Approach for Modeling Hot Horizontal Releases


The buoyancy flux value for the emitted plume is needed to calculate the crossover point in neutral/unstable conditions, and is calculated by the following equation:
\[ F_b = \frac{8vd^2 \Delta T}{4T_s} \]

Where:

- \( F_b \) = buoyancy Flux (m³/sec²)
- \( g \) = gravitational acceleration (9.8 m/sec²)
- \( v \) = stack velocity (m/sec)
- \( d \) = stack diameter (m)
- \( \Delta T \) = difference between stack gas temperature and ambient air temperature (K)
- \( T_s \) = stack gas temperature (K)

For \( F_b < 55 \), the critical temperature difference, beyond which momentum dominates buoyancy, is calculated by the following:

\[ \Delta T_c = 0.0297 T_s \frac{v^{1.0}}{d^{0.5}} \]

For \( F_b \geq 55 \), the critical temperature difference is calculated by:

\[ \Delta T_c = 0.00575 T_s \frac{v^{1.0}}{d^{0.5}} \]

If the minimum temperature difference between the stack gas and ambient air is greater than \( \Delta T_c \), then plume rise will always be calculated using the buoyancy algorithm. If the plume is emitted in a horizontal direction, adjusting the exit velocity to 0.001 m/sec to negate momentum is not necessary.

The stability parameter, \( s \), is needed for calculating the crossover point in stable conditions, and is given by:

\[ s = g \frac{\partial \theta}{\partial z} \frac{1}{T_s} \]

Where:

- \( \partial \theta/\partial z \) = potential temperature gradient with height (K/m)
- \( T_s \) = Ambient Temperature (K)

For stability class E (stable), a value of 0.020 K/m can be used for \( \partial \theta/\partial z \); and for stability class F (very stable), a value of 0.035 K/m can be used for \( \partial \theta/\partial z \).
The critical temperature difference is then calculated by:

$$\Delta T = 0.019582 T_{e} \sqrt{s}$$

3.0 Results for Hot, Horizontally Released Sources at Potlatch

Table 2-1 shows results of the critical temperature difference calculations. The ambient temperature of 313.4 K (104.7°F) used in the calculation was the upper 95th percentile value from the 1992 meteorological data file used in the verification modeling analyses. Using such a high ambient temperature will result in minimal $$\Delta T$$ values and a lower critical temperature at which momentum becomes the plume rise mechanism.

Calculations indicated that for all five sources having hot, horizontal releases, the ambient temperature at which momentum becomes the plume rise mechanism is well above any observed ambient air temperatures. Therefore, these sources can be correctly modeled without adjusting the stack gas exit velocity to negate vertical momentum.