RACT Evaluation Report – Springville City Corporation – Whitehead Power Plant

UTAH $PM_{2.5}$ SIP RACT

Provo City Nonattainment Area

Utah Division of Air Quality

Major New Source Review Section

October 1, 2014

1.2.L SPRINGVILLE CITY POWER

1. Emission Limitations and Stack Testing:

Emissions to the atmosphere from the indicated emission point shall not exceed the following rates and concentrations:

For either of the two 9,750 horsepower Transamerica Delaval DSRV-6-4 dual fuel reciprocating engines:

NO_x 79.5 lbs/hr 3.70 gram/HP-hr (4.96 g/Kw-hr)

Stack testing to show compliance with the above emission limitations shall be performed (for both engines) within 180 days after promulgation of this regulation, and they shall be retested every 3 years.

2. Visible Emissions:

With the exception of an initial startup period of 15 minutes, visible emissions from any point or stationary fugitive emission source associated with the installation or control facilities shall not exceed 10% opacity.

3. Production Limitations:

The following production limits shall not be exceeded without prior approval in accordance with Section 3.1, UACR:

A. Production of 43,000 MW-hours per year

Energy production shall be determined by reading and recording Watt-Hour meters which shall be accurate to within 10 MW-hours. The records shall be kept on a daily basis.

4. Operating Parameters:

The following operating parameters shall be maintained within the indicated ranges:

A. Combustion air manifold pressure - shall be no less than ((% engine load - 35.46) / (1.81)). The pressure is measured in inches Hg, and the allowable variation is plus or minus 0.1 inch.

B. Pilot oil injection rack setting - shall be 6.25 mm, plus or minus 0.5 mm.

C. Cylinder exhaust temperature - shall be maintained at ((1054 - % engine load) / (1.11)) in degrees F for each cylinder. The

allowable variation is plus or minus 125° F. This applies to the load range of 50 to 100 percent only.

They shall be monitored with equipment located such that an inspector can at any time safely read the output. All instruments shall be calibrated against a primary standard at least once every 90 days. The primary standard shall be specified by the Executive Secretary.

5. Fuel Requirements:

A. The owner/operator shall use only natural gas as the primary fuel and number 2 fuel oil as the pilot fuel in the two dual fuel engines. If any other fuel is to be used, an approval order shall be required in accordance with Section 3.1, UACR. The sulfur content of any fuel oil burned shall not exceed 0.45 percent by weight sulfur as determined by ASTM Method D-4294-89. The sulfur content shall be tested if directed by the Executive Secretary.

B. The two engines shall only be operated in the dual fuel mode, and the amount of diesel fuel in the mixture shall not exceed that level indicated by the pilot oil injection rack setting. Under no circumstances (other than an initial startup period of 15 minutes) may either engine be operated using straight diesel fuel.

6. Allowable Emissions:

"Allowable emissions" as defined in Section 1.12, UACR, for this source (the entire plant) are hereby established at 1.30 tons/yr for particulate, 1.30 tons/yr for PM_{10}, 3.20 tons/yr for SO_2, and 235.1 tons/yr for NO_x.

OLENE S. WALKER
Governor

GAYLE F. McKEACHNIE
Lieutenant Governor

State of Utah

Department of
Environmental Quality

Dianne R. Nielson, Ph.D.
Executive Director

DIVISION OF AIR QUALITY
Richard W. Sprott
Director

DAQE-AN0819007-03

December 30, 2003

Joe Cal Baxter
Superintendent
Springville City Corporation
50 South Main
Springville, Utah 84663

Dear Mr. Baxter:

Re: Approval Order: Modify Power Plant Approval Order to Add CO Catalytic Oxidizers
Utah County, CDS-A, NONATT, Title V
Project Code: N0819-007

The attached document is the Approval Order (AO) for the above-referenced project.

Future correspondence on this Approval Order should include the engineer's name as well as the DAQE number as shown on the upper right-hand corner of this letter. Please direct any technical questions you may have on this project to Mr. Nando Meli. He may be reached at (801) 536-4052.

Sincerely,

Richard W. Sprott, Executive Secretary
Utah Air Quality Board

RWS:NM:jc

cc: Utah County Health Department
Mike Owens, EPA Region VIII

STATE OF UTAH

Department of Environmental Quality

Division of Air Quality

APPROVAL ORDER: MODIFY POWER PLANT APPROVAL ORDER TO ADD CO CATALYTIC OXIDIZERS

Prepared By: Nando Meli, Engineer
(801) 536-4052
Email: nmeli@utah.gov

APPROVAL ORDER NUMBER

DAQE-AN0819007-03

Date: December 30, 2003

Springville City Corporation
Source Contact
Matt Hancock
(801) 489-2750
Ext. 11

Richard W. Sprott
Executive Secretary
Utah Air Quality Board

Abstract

Springville City is requesting approval to install a catalytic oxidizer on one of their General Motors Electromotive Diesel (EMD) 645-E-4-B, internal-combustion, dual-fuel engine generator. These generators have an output rating of 2.685 megawatts per hour. These engines run on 95% natural gas and 5% diesel. This oxidizer will reduce the CO emissions by approximately 20 tons per year. Springville City will be installing a continuous emissions monitoring (CEM) system on all seven engines. Springville has requested approval to increase the lbs/hour and grams/Kw-hour NO_x and CO emission limits on the engine generators. The daily and rolling 12-month total emission limits will not be increased. The CO emissions will be reduced from the installation of a catalytic oxidizer on the EMD engine generator. Utah County is a Non-attainment area of the National Ambient Air Quality Standards (NAAQS) for PM10. Title V of the 1990 Clean Air Act applies to this source. The CO emissions will decrease by 20 tons per year (tpy). The changes in emissions will result in the following potential to emit totals in tpy: PM_{10} = 2.50, NO_x = 249.00, SO_2 = 3.21, CO = 200.60, VOC = 65.00.

The project has been evaluated and found to be consistent with the requirements of the Utah Administrative Code Rule 307 (UAC R307). A public comment period was held in accordance with UAC R307-401-4 and all comments received were addressed. The comments were evaluated and no comment was found to be adverse to the proposed AO. This air quality Approval Order (AO) authorizes the project with the following conditions, and failure to comply with any of the conditions may constitute a violation of this order.

General Conditions:

1. This Approval Order (AO) applies to the following company:

   Site Office
   Springville City Corporation
   50 South Main
   Springville, Utah 84663

   Telephone: (801) 489-2700
   Fax Number: (801) 489-2709

   The equipment listed in this AO shall be operated at the following location:

   Universal Transverse Mercator (UTM) Coordinate System: UTM Datum NAD27
   4,446 kilometers Northing, 448.3 kilometers Easting, Zone 12

2. All definitions, terms, abbreviations, and references used in this AO conform to those used in the Utah Administrative Code (UAC) Rule 307 (R307) and Title 40 of the Code of Federal Regulations (40 CFR). Unless noted otherwise, references cited in these AO conditions refer to those rules.

3. The limits set forth in this AO shall not be exceeded without prior approval in accordance with R307-401.

4. Modifications to the equipment or processes approved by this AO that could affect the emissions covered by this AO must be reviewed and approved in accordance with R307-401-1.

5. All records referenced in this AO or in applicable NSPS and/or NESHAP and/or MACT standards, which are required to be kept by the owner/operator, shall be made available to the Executive Secretary or Executive Secretary's representative upon request, and the records shall include the two-year period prior to the date of the request. Records shall be kept for the following minimum periods:

   A. Emission inventories Five years from the due date of each emission statement or until the next inventory is due, whichever is longer.

   B. All other records Five years

6. Springville City Corporation (Springville City) shall install and operate the catalytic oxidizers and shall conduct its operations of the power plant in accordance with the terms and conditions of this AO, which was written pursuant to Springville City's Notice of Intent submitted to the Division of Air Quality (DAQ) on August 8, 2003, and additional information submitted to the DAQ on September 30, 2003, October 24, 2003, October 28, 2003, and November 5, 2003.

7. The language of Sections IX, Part H, 1.a and 1.b.E of the 2002 State Implementation Plan (SIP) for Utah County have been incorporated into this AO.

8. This AO shall replace the AO (DAQE-AN0819-005-03) dated March 4, 2003.

9. The approved installations shall consist of the following equipment or equivalent*:

   A. Four internal-combustion, dual-fuel Enterprise DGSRV-16-4 engine generators

      1) Output rating K1, K2 & K3 are rated at 7.0 megawatts (Mw) per hour
         K4 is rated at 5.1 Mw/hr

      2) NO_x Control for K1, K2, K3 & K4 Cooper-Bessemer Clean Burn Technology

      Catalytic Oxidizers for CO control shall be installed on at least two of the Enterprise engine generators

   B. Three internal combustion, dual-fuel General Motors ElectroMotive Diesel (GM EMD) 645-E-4-B engine generators

      1) Output rating K5, K6 & K7 are with a rated output of 2.7 Mw/hr.

      Catalytic Oxidizers for CO control shall be installed on at least one of the EMD engine generators

C. One 2.5 MMBTU/hr, digester-gas boiler.

D. One 6.0 MMBTU/hr, natural gas boiler.

* Equivalency shall be determined by the Executive Secretary.

10. Springville City shall notify the Executive Secretary in writing when the installation of the catalytic oxidizers listed in Condition #9.A and #9.B has been completed and is operational, as an initial compliance inspection is required. To insure proper credit when notifying the Executive Secretary, send your correspondence to the Executive Secretary, attn: Compliance Section.

If installation has not been completed within eighteen months from the date of this AO, the Executive Secretary shall be notified in writing on the status of the construction and/or installation. At that time, the Executive Secretary shall require documentation of the continuous construction and/or installation of the operation and may revoke the AO in accordance with R307-401-11.

Limitations and Tests Procedures

11. Visible emissions from any point or stationary fugitive emission source associated with the installation or control facilities shall not exceed 10% opacity, with the exception of an initial start-up period of 15 minutes.

12. Emissions to the atmosphere from the indicated emission point shall not exceed the following rates and concentrations:

A. Emissions from the operation of the Enterprise engines at the plant:

		lb/hr	grams/kW-hr
1)	NO_x	27.00	2.50
2)	CO	24.50	2.00 with no controls
		2.50	0.20 with CO catalytic oxidizers

B. Emissions from the operation of the General Motor EMD engines at the plant:

		lb/hr	grams/kW-hr
1)	NO_x	24.00	4.90
2)	CO	60.00	10.6 with no controls
		6.00	1.10 with CO catalytic oxidizers

13. Stack testing to show compliance with the emission limitations stated in condition 12 above shall be performed as specified below:

A. Testing Frequency

Emissions Point	Pollutant	Testing Status and Frequency
Enterprise Engines		
K1, K2 & K3	NO_x	*
	CO	*
K4	NO_x	*
	CO	*
General Motor EMD	NO_x	*
K5, K6 & K7	CO	*

B. Testing Status
*Compliance shall be determined with CEM monitoring.

14. Total emissions from the operation of all engines at the plant shall not exceed the following limits:

1) NO_x
   a) 1.68 tons per calendar day
   b) 248.0 tons per rolling 12-month period

2) CO
   a) 1.15 tons per calendar day
   b) 200.0 tons per rolling 12-month period

A. Emissions from the internal combustion engines shall be calculated using the following equations and CEMS data for NO_x and CO:

Daily Rate Calculation:

X* = grams/kW-hr rate for each generator
K* = total kW-hr generated by the generator each day
D = daily output of pollutant in lbs/day
Time when engine is not operating shall not be included in the average.

$$D = \frac{X \times K}{453.6}$$

Monthly Rate Calculation:

M = monthly output of pollutant in lbs/month
M = ΣD where D is summed over a one month calendar period for each engine-generator

Annual Rate Calculation:

A = annual output of pollutant in tons per rolling 12-month period

$$A = \frac{\Sigma M}{2000 \text{ lbs/ton}}$$ (where M is summed over a rolling 12-month period)

* CEMS recorded data.

Emissions totals from the natural gas internal combustion dual fuel engines shall be kept in table format, listing month, operating hours, and emissions, for each individual engine. CEMS record keeping shall be performed in accordance with UAC, R307-170.

To determine compliance with a rolling 12-month total the owner/operator shall calculate a new 12-month total by the twentieth day of each month using data from the previous 12 months. Records of emissions shall be kept for all periods when the plant is in operation.

15. The boilers shall not exceed 5,000 hours of operation per rolling 12-month period. To determine compliance with a rolling 12-month total the owner/operator shall calculate a new 12-month total by the twentieth day of each month using data from the previous 12 months. Records of operation shall be kept for all periods when the plant is in operation. An hour meter shall determine hours of operation.

Fuels

16. Springville City Corporation shall use the specified fuel mixtures as a primary fuel in the following equipment:

    A. Not less than 99.0% natural gas for the Enterprise engine generators except during the 30 minutes of start-up or shutdown.
    B. Not less than 95.0% natural gas for the General Motors EMD engine generators except during the 15 minutes of start-up or shutdown.
    C. Natural gas 100% of the time in the 6.0 MMBTU/hr boiler
    D. The engine-generators may be run on diesel when there is a natural gas curtailment. Springville shall notify the Executive Secretary within 24 hours of the natural gas being curtailed, the reason for the curtailment, and the length of the curtailment.

    The engines may be operated using straight diesel fuel only during the initial startup mode, shutdown mode or during natural gas curtailment. Hours of operation during natural gas curtailment shall be limited to 72 hours per calendar year.

17. The sulfur content of any diesel burned shall not exceed 0.05 percent by weight for fuels used in the duel fuel engines.

    The sulfur content shall be determined by ASTM Method D-4294-89 or approved equivalent. Certification of diesel fuel sulfur content shall be either by Springville City's own testing or test reports from the fuel marketer.

Monitoring - Continuous Emissions Monitoring

18. The owner/operator shall install, calibrate, maintain, and operate a continuous emissions monitoring system on generator exhaust stacks. The owner/operator shall record the output of the system, for measuring the NO_x emissions and the CO emissions. The monitoring system shall comply with all applicable sections of R307-170

    All continuous emissions monitoring devices as required in federal regulations and state rules shall be installed and operational within 180-days from the date this AO is issued.

    Except for system breakdown, repairs, calibration checks, and zero and span adjustments required under paragraph (d) 40 CFR 60.13, the owner/operator of an affected source shall continuously operate all required continuous monitoring systems and shall meet minimum frequency of operation requirements as outlined in 40 CFR 60.13 and Section R307-170.

Records & Miscellaneous

19. At all times, including periods of startup, shutdown, and malfunction, owners and operators shall, to the extent practicable, maintain and operate any equipment approved under this Approval Order including associated air pollution control equipment in a manner consistent with good air pollution control practice for minimizing emissions. Determination of whether acceptable operating and maintenance procedures are being used will be based on information available to the Executive Secretary which may include, but is not limited to, monitoring results, opacity observations, review of operating and maintenance procedures, and inspection of the source. All maintenance performed on equipment authorized by this AO shall be recorded.

20. The owner/operator shall comply with R307-150 Series. Inventories, Testing and Monitoring.

21. The owner/operator shall comply with R307-107. General Requirements: Unavoidable Breakdowns.

The Executive Secretary shall be notified in writing if the company is sold or changes its name.

This AO in no way releases the owner or operator from any liability for compliance with all other applicable federal, state, and local regulations including R307.

A copy of the rules, regulations and/or attachments addressed in this AO may be obtained by contacting the Division of Air Quality. The Utah Administrative Code R307 rules used by DAQ, the Notice of Intent (NOI) guide, and other air quality documents and forms may also be obtained on the Internet at the following web site:
http://www.airquality.utah.gov/

The annual emission estimations below include point source, and do not include fugitive emissions, fugitive dust, road dust, tail pipe emissions and grandfathered emissions. These emissions are for the purpose of determining the applicability of Prevention of Significant Deterioration, non-attainment area, maintenance area, and Title V source requirements of the R307. <u>They are not to be used for determining compliance</u>.

The Potential To Emit (PTE) emissions for the Springville City Corporation power plant are currently calculated at the following values:

	Pollutant	Tons/yr
A.	PM_{10}	2.59
B.	SO_2	3.21
C.	NO_x	249.00
D.	CO	200.60
E.	VOC	43.24
F.	HAPs	
	Acetaldehyde	0.447
	Acrolein	0.275
	Benzene	0.022
	Formaldehyde	3.209
	Hexane	0.059
	Methanol	0.134
	Toluene	0.022
	Xylenes	0.010
	Total HAPs	4.18

Approved By:

Richard W. Sprott, Executive Secretary
Utah Air Quality Board

RACT EVALUATION REPORT
SPRINGVILLE CITY CORPORATION – WHITEHEAD POWER PLANT

1.0 INTRODUCTION AND FACILITY DESCRIPTION

The following is an updated version of the original RACT evaluation that was completed on October 1, 2013 as a part of the Technical Support Documentation for Section IX, Parts H.11, 12 and 13 of the Utah SIP; to address the Salt Lake City PM2.5 and Provo, Utah PM2.5 Nonattainment Areas.

1.1 Facility Identification

Name: Springville City Corporation – Whitehead Power Plant
Address: 450 West 700 North, Springville, Utah, Utah County
Owner/Operator: Springville City Corporation
UTM coordinates: 447,400 East 4,447,250 North Zone 12

1.2 Facility Process Summary

Springville City Corporation (SCC) operates Whitehead Power Plant, a peaking power plant consisting of seven dual-fuel internal combustion (IC) engines. Engines #1, #2, and #3 are rated at 7.0 MW each; engine #4 is rated at 5.1 MW; and engines #5, #6 and #7 are rated at 2.7 MW each. There are also two small boilers on site. One is fired on natural gas (6.0 MMBtu/hr), while the second is fired on digester gas (2.5 MMBtu/hr). Finally three storage tanks hold diesel fuel for startup of the engines.

The power plant is operated as a peaking and supplemental power plant to provide electrical power to municipal power customers in and around the City of Springville. The plant is defined as a Title V major source located in Utah County, and within the Provo, Utah $PM_{2.5}$ nonattainment area.

Operation of the plant is dependent on local demand and cost of utility power. The IC engines operate primarily on natural gas, with ultra-low sulfur diesel fuel used for start-up.

1.3 Facility Criteria Air Pollutant Emissions Sources

As previously discussed the facility consists of the following emission sources:
7.0 MW dual-fuel fired IC engine (IC #1)
7.0 MW dual-fuel fired IC engine (IC #2)
7.0 MW dual-fuel fired IC engine (IC #3)
5.1 MW dual-fuel fired IC engine (IC #4)
2.7 MW dual-fuel fired IC engine (IC #5)
2.7 MW dual-fuel fired IC engine (IC #6)
2.7 MW dual-fuel fired IC engine (IC #7)

6.0 MMBtu/hr natural gas-fired boiler (boiler #1)
2.5 MMBtu/hr digester (methane) gas-fired boiler (boiler #2)
Diesel storage tanks (tanks 1-3)

1.4 RACT Cut-off Threshold

A RACT cut-off threshold was established generally for all facilities based on Utah DAQ's existing small source exemption rule R307-401-9. This rule exempts sources of pollution with emissions less than 5 tpy from permitting requirements. Therefore, sources with baseline actual emissions which fall below this threshold could be exempted from evaluation under this general establishment.

However, SCC is a municipal power plant which operates both as a peaking plant and as part of the general municipal power generator network – which means it operates well below its established allowable (permitted) emissions. In SCC's 2008 baseline inventory, all of its emission sources were below the 5 tpy emission threshold. Instead of using actual emissions for purposes of evaluating RACT, a PTE basis will be used for these sources. This brings the IC engines and boilers back into evaluation.

The diesel storage tanks have both potential and actual emissions which remain below the 5 tpy threshold. These sources will not be included for evaluation.

Diesel storage tanks: VOCs < 1 tpy

2.0 RACT Evaluation

2.1 Dual-fuel Fired IC Engines

Rather than evaluating the seven dual-fuel fired IC engines individually, DAQ has chosen to evaluate all seven IC engines as a group.

These engines are all fired on ultra-low sulfur diesel fuel for start-up, and then switched to natural gas for primary operation. Currently, two of the larger 7.0 MW engines are equipped with oxidation catalysts, as is one of the 2.7 MW engines.

The 2008 baseline actual emissions for all seven engines combined were estimated at the following values:

$PM_{2.5}$ = 0.1 tpy
SO_2 = 0.01 tpy
NOx = 0.1 tpy
VOC = 0.1 tpy

<u>$PM_{2.5}$</u>

Available Control Technology

No additional add-on control technology has been identified by DAQ that can further reduce direct particulate emissions from natural gas combustion. All particulate generated from natural gas combustion is considered to be PM1. Typical add-on control devices – such as fabric filtration, electrostatic precipitation, or cyclonic separation – have extremely limited effectiveness in such an environment.

Since no additional available controls have been identified for the control of particulate emissions, the only remaining control is the default "no control" option of exclusive firing on pipeline quality natural gas.

During the start-up condition when firing on diesel fuel, diesel particulate filters are the only identified add-on control option for control of particulate emissions.

Technically Infeasible RACT Controls

No vendor has been found that will supply diesel particulate filters for diesel engines of the age of those at SCC. The vendors have all supplied the same reason – "the extreme age of these engines lead to fouling and plugging of the diesel particulate filters and rapid degradation of their performance."

For this reason, diesel particulate filters are considered technically infeasible.

Evaluation and Ranking of Technically Feasible RACT Controls

N/A – the only remaining control technique, no add-on controls, does not require ranking or further evaluation.

Selection of RACT Controls

No additional control required. Combustion of pipeline quality natural gas as fuel for control of particulate emissions is recommended as RACT. Diesel fuel may be used for startup periods.

SO_2

Available Control Technology

Similarly, no additional add-on control technology has been identified by DAQ that can further reduce emissions of SO_2 from IC engines. Pipeline quality natural gas is inherently low in sulfur. During the period when diesel fuel is used for startup, ultra-low sulfur diesel fuel is required, which has a sulfur content of 0.0015%.

Most sulfur control technologies require the use of some sort of acid reducing agent such as lime slurry or limestone injection. This leads to residual solid or liquid waste which

requires subsequent disposal. The remaining control techniques rely on reducing emissions of particulates and allowing any residual sulfur to be captured with the particulate. With so little SO_2 (or particulate) being generated in the first place, further reductions of SO_2 using either active or passive control techniques are therefore next to impossible.

Technically Infeasible RACT Controls

N/A – no additional controls identified.

Evaluation and Ranking of Technically Feasible RACT Controls

N/A – no additional controls identified.

Selection of RACT Controls

No additional control required. Combustion of pipeline quality natural gas as fuel for control of SO_2 emissions is recommended as RACT. Ultra-low sulfur diesel fuel may be used for startup periods.

<u>VOC</u>

Available Control Technology

Only one add-on control technology has been identified by DAQ to reduce emissions of VOC from IC engines – the use of oxidation catalysts. An oxidation catalyst is similar in design and operation to a catalytic control system on a passenger vehicle, in that an inline, self-regenerating, catalyst system is placed within the exhaust stream prior to the final stack, so that emissions of CO and VOC can be further oxidized to CO2 and water. Oxidation of VOC can approach efficiencies of 70%, depending on initial concentrations and stack characteristics.

Technically Infeasible RACT Controls

N/A – oxidation catalysts are technically feasible; therefore this section does not apply.

Evaluation and Ranking of Technically Feasible RACT Controls

Installation of additional oxidation catalysts on the IC engines at SCC would reduce emissions of VOC by at best 0.1 tons per year based on the 2008 baseline actual emissions. Estimates of the cost of an oxidation catalyst are about $100,000 installed per engine, or $400,000 total for the remaining four engines. Annualizing and dividing, yields a RACT "cost" of approximately $921,000/ton.

Selection of RACT Controls

Owing to the extremely high RACT cost for adding oxidation catalysts on the remaining

four IC engines at SCC, the addition of an oxidation catalyst is not economically justified. However, it is likely that SCC will be required to install oxidation catalysts to meet the CO emission requirements of 40 CFR 63, Subpart ZZZZ. Should subsequent testing require such installation, the VOC emission reductions obtained can be credited.

NOx

Available Control Technology

The following technologies have been identified as potential control methodologies for control of NOx emissions: good combustion practices (GCP – no additional controls, but proper operation of existing equipment); low emission combustion (LEC); selective non-catalytic reduction (SNCR); and selective catalytic reduction as potential NOx emission control technologies.

Technically Infeasible RACT Controls

Low emission combustion controls would require a redesign of the existing equipment. As this source is a municipal power plant, it is subject to the funding requirements of the City of Springville. Therefore, direct replacement of the existing equipment is considered economically infeasible (although please see the RACT analysis for Direct Replacement of Existing Equipment).

Selective non-catalytic reduction is the simple injection of ammonia into the exhaust stream. This is technically feasible.

Selective catalytic reduction is the same, although with the addition of a catalyst bed to facilitate reduction at a lower exhaust stream temperature. This is also technically feasible.

Evaluation and Ranking of Technically Feasible RACT Controls

The remaining three control methodologies are then ranked in terms of control effectiveness.

1. SCR
2. SNCR
3. GCP

Both SCR and SNCR require ammonia injection, which generates ammonia slip – a source of particulate emissions. Direct particulate emissions are of greater impact on attainment demonstration than NOx emissions. Although the exact ratio is subject to debate depending on numerous factors; in general, the prevention of direct particulate emissions is good – especially for a relatively small reduction in NOx emissions.

While the exact cost for installation of either an SCR or SNCR unit has not been

determined at SCC, at best a retrofit SCR unit would be about 50% effective in controlling NOx emissions. The IC engines at SCC do not generate the high concentration, high temperature exhaust required for a maximum high-efficiency SCR unit to operate. Retrofit units would be placed into the exhaust stream as space allows, not as optimal temperature and mixing requirements would dictate. Similar sized engines operating in limited use mode show a best case reduction of 12.5 tons of NOx at a control value of $7,500/ton for SCR and 7 tons of NOx for $12,000/ton for SNCR, but this was for an engine with annual actual emissions of greater than 25 tons per year.

The IC engines at SCC have extremely limited emissions of NOx (less than 0.1 tpy total), with much of these emissions being generated during startup and shutdown modes when neither SCR nor SNCR would achieve any emission reductions.

Selection of RACT Controls

Based on the above evaluation, add-on SCR or SNCR controls are not economically or environmentally justified. The remaining control methodology, GCP is therefore recommended.

2.2 Natural Gas-fired and Digester Gas-fired Boiler

The natural gas fired boiler is fueled exclusively on pipeline-quality natural gas, while the second boiler is fired on digester gas, which is primarily methane. Neither of these boilers reported any emissions for the 2008 baseline period:

$PM_{2.5}$ = 0 tpy
NOx = 0 tpy
SO_2 = 0 tpy
VOC = 0 tpy

$PM_{2.5}$

Available Control Technology

No additional add-on control technology has been identified by DAQ that can further reduce direct particulate emissions from natural gas or digester gas combustion. All particulate generated from such combustion is considered to be PM 1. Typical add-on control devices – such as fabric filtration, electrostatic precipitation, or cyclonic separation – have extremely limited effectiveness in such an environment.

Since no additional available controls have been identified for the control of particulate emissions, the only remaining control is the default “no control” option of exclusive firing on pipeline quality natural gas.

Technically Infeasible RACT Controls

N/A – no additional controls identified.

Evaluation and Ranking of Technically Feasible RACT Controls

N/A – no additional controls identified.
Selection of RACT Controls

No additional control required. Combustion of such gas as fuel is recommended as RACT.

<u>SO_2</u>

Available Control Technology

Similarly, no additional add-on control technology has been identified by DAQ that can further reduce emissions of SO_2 from combustion of natural gas. Pipeline quality natural gas is inherently low in sulfur. Digester gas contains trace amounts of sulfur, depending on the amount of sulfur present in the feedstock. However, no scrubbing technology for such a small volume of generated gas has been identified.

Technically Infeasible RACT Controls

N/A – no additional controls identified.

Evaluation and Ranking of Technically Feasible RACT Controls

N/A – no additional controls identified.

Selection of RACT Controls

No additional control required. Combustion of existing gas feedstocks as fuel for control of SO_2 emissions is recommended as RACT.

<u>VOC</u>

Available Control Technology

Only one add-on control technology has been identified by DAQ to reduce emissions of VOC from natural gas-fired boilers – the use of oxidation catalysts. An oxidation catalyst is similar in design and operation to a catalytic control system on a passenger vehicle, in that an inline, self-regenerating, catalyst system is placed within the exhaust stream prior to the final stack, so that emissions of CO and VOC can be further oxidized to CO2 and water. Oxidation of VOC can approach efficiencies of 70%, depending on initial concentrations and stack characteristics.

Technically Infeasible RACT Controls

N/A – oxidation catalysts are technically feasible; therefore this section does not apply.

Evaluation and Ranking of Technically Feasible RACT Controls

Installation of oxidation catalysts on the boilers at SCC would not show any emission reductions. For both boilers, emissions for the baseline period of 2008 were reported as 0 for all pollutants of concern, including VOC; therefore, no emission reductions are possible. Estimates of the cost of an oxidation catalyst are again about $100,000 for each boiler. With no way to calculate the control value, no economic evaluation is possible.

Selection of RACT Controls

The addition of oxidation catalysts to two boilers at SCC is not economically justified.

<u>NOx</u>

Available Control Technology

The following technologies have been identified as potential control methodologies for control of NOx emissions: good combustion practices (GCP – no additional controls, but proper operation of existing equipment); low emission combustion (LEC); selective non-catalytic reduction (SNCR); and selective catalytic reduction as potential NOx emission control technologies.

Technically Infeasible RACT Controls

Low emission combustion controls would require a redesign of the existing equipment. As this source is a municipal power plant, it is subject to the funding requirements of the City of Springville. Therefore, direct replacement of the existing equipment is considered technically infeasible (although please see the RACT analysis for Direct Replacement of Existing Equipment).

Selective non-catalytic reduction is the simple injection of ammonia into the exhaust stream. This is technically feasible.

Selective catalytic reduction is the same, although with the addition of a catalyst bed to facilitate reduction at a lower exhaust stream temperature. This is also technically feasible.

Evaluation and Ranking of Technically Feasible RACT Controls

The remaining three control methodologies are then ranked in terms of control effectiveness.

1. SCR
2. SNCR
3. GCP

Both SCR and SNCR require ammonia injection, which generates ammonia slip – a source of particulate emissions. Direct particulate emissions are of greater impact on attainment demonstration than NOx emissions. Although the exact ratio is subject to debate depending on numerous factors; in general, the prevention of direct particulate emissions is good – especially for a relatively small reduction in NOx emissions.

While the exact cost for installation of either an SCR or SNCR unit has not been determined at SCC, at best a retrofit SCR unit would be about 50% effective in controlling NOx emissions. The boilers at SCC do not generate the high concentration, high temperature exhaust required for a maximum high-efficiency SCR unit to operate. A retrofit unit would be placed into the exhaust stream as space allows, not as optimal temperature and mixing requirements would dictate.

As with the calculation for the oxidation catalyst above, no reduction of NOx is possible, as the 2008 baseline emissions for both boilers were 0 tpy. Therefore, determination of the control value cannot be made.

Selection of RACT Controls

Based on the above evaluation, add-on SCR or SNCR controls are not economically or environmentally justified. The remaining control methodology, GCP is therefore recommended.

2.3 Direct Replacement of Equipment

The final control option is to outright replace the dual-fueled IC engines and/or the boilers. These are available control options which would involve replacing either emission unit with an equivalent, but lower emitting more modern unit.

<u>Emission Reductions</u>

Available Control Technology

Direct replacement of an emission unit is obviously an available control option.

Technically Infeasible RACT Controls

N/A – Direct replacement of an emission unit is technically feasible.

Evaluation and Ranking of Technically Feasible RACT Controls

SCC is a municipal power plant, and therefore subject to the funding concerns of the City of Springville. Funding would require issuing new bonds for the replacement of little used, existing equipment.

Selection of RACT Controls

Based on the above evaluations, replacement of existing equipment is not economically justified. No changes are recommended

3.0 Conclusion- Emissions Reduction through RACT implementation

In summary, the recommendation is to make no changes to the existing equipment or operations at SCC. The operations at SCC generate so few actual emissions at any additional add-on controls are not economically justified. However, the requirements of 40 CFR 63 Subpart ZZZZ will shortly require that all engines of this type meet a CO emission limitation as a surrogate for HAP emissions. Although these engines have not yet demonstrated compliance with the requirements of subpart ZZZZ, experience has shown that without add-on control such as an oxidation catalyst, the engines will be unable to meet the CO emission limitation. Therefore, SCC can either install oxidation catalysts on the remaining four IC engines, or operate only those engines which already have catalysts installed.

Total emission reductions expected = 0.1 tons VOC, to be achieved by the 2017 projection year.

4.0 Startup / Shutdown

In order to minimize emissions generated during startup and shutdown of the IC engines, SCC is required to maintain a defined emission minimization plan. The plan is similar in scope to those at all the smaller municipal power generation facilities, and consists of two main components: limiting the total duration of startup and shutdown periods on an annual and daily basis, and ensuring that startups and shutdowns are summed across all of the IC engines at the facility.

As most startup and/or shutdown periods are of very short duration, standard stack testing cannot be used to obtain emission totals when operating in these modes. Similarly, requiring use of expensive, expanded operating range CEM equipment to obtain emission information is of limited use when the ultimate goal is emission reduction through limiting the total amount of time the IC engines are operating outside of steady-state.

In order to ensure a level of equity between the three municipal power generators in the Provo, Utah PM2.5 Nonattainment Area the same set of assumptions were used to “scale up” existing operations. Each facility reported a similar number of total plant startups – approximately 150 to 200 per annum. This value was scaled up by calculating the following:

(Operational days/week) x (Potential Startups/day) x (Weeks/year) = startups per engine

(3) x (3) x (52) = 468 startups per year per engine at the facility. For SCC’s seven engines, this

value is 3276. Using a base assumption of 15 minutes as the amount of time required for startup and shutdown (or 30 minutes for both periods combined), a limit of 10.5 hours per day and 1638 hours per year can be assigned for total startup and shutdown events for all engines combined.

5.0 Implementation Schedule

As stated previously, SCC has oxidation catalysts on three of the seven engines at the Whitehead Utility Center. No implementation deadline has been established under IX.H.13.g of the SIP for installation of oxidation catalysts, as no modeled emission reduction credit has been taken for their installation. Therefore, no implementation schedule is required at this time.

6.0 References

Springville City Corporation – Major Source RACT Determination
Springville Whitehead Utility Center – letter dated April 28, 2014
Fairbanks Morse Engine emission estimations
Caterpillar performance estimates

RACT Evaluation Report – Springville City Corporation – Whitehead Power Plant

UTAH $PM_{2.5}$ SIP RACT

Provo City Nonattainment Area

Supporting Information