Application for a Prevention of Significant Deterioration (PSD) Authorization and Significant Revision to Class I Air Quality Permit for Irvington Generating Station

Submitted to:

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APPENDICES

Appendix A Permit Application Forms
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Appendix C Impact Analyses

1. Introduction and Summary

1.1 Introduction

The Tucson Electric Power Company ("TEP") owns and operates the Irvington Generating Station ("IGS"), also known as the H. Wilson Sundt Generating Station, pursuant to Class I Air Quality Permit No. 1052 issued by the Pima County Dept. of Environmental Quality ("PDEQ"). The IGS is located within the City of Tucson, approximately two miles northeast of Tucson International Airport. The facility currently comprises six electric generating units with a combined, nominal, net generating capacity of 470 megawatts ("MW").

TEP herein requests a revision to the Class I permit for the IGS, an authorization pursuant to the preconstruction Prevention of Significant Deterioration ("PSD") permitting regulations to expand the IGS, and an approval of construction of new affected sources under federal National Emissions Standards for Hazardous Air Pollutants ("NESHAP"). As part of the proposed expansion project, TEP proposes to install up to ten natural gas-fired, reciprocating internal combustion engines ("RICE"), each with a nominal net generating capacity of 19 MW. In conjunction with the RICE project, TEP will permanently cease operation of Units 1 and 2 at IGS, leaving the facility with a nominal, net generating capacity of 498 MW.

The proposed RICE project constitutes a major modification for certain pollutants under the preconstruction PSD permitting regulations and requires a significant revision under the Title V / Class I operating permit regulations. This permit application contains all of the required information, analyses and demonstrations under the applicable federal and Pima County air quality permitting regulations.

1.2 Project Schedule

TEP currently plans to commence construction of the RICE project in January 2018 and, at a maximum, will commence construction within 18 months following receipt of the PSD approval. TEP currently plans to complete construction and begin operation of the first five engines by 2020. TEP will begin actual construction of the remaining engines within 18 months after the date on which the fifth engine begins operating and expects to complete construction and begin operation of these engines by no later than 2022.[1]

1.3 Permit Application Required Content and Forms

This document is TEP's application for a significant revision to Class I Air Quality Permit No. 1052, for an authorization pursuant to the preconstruction PSD permitting regulations, and for approval of construction of new affected sources under the NESHAP program. This Section 1

[1] TEP may refer informally to this construction schedule as comprising two phases. This should not be construed as "phased construction" as that term is used in the preconstruction PSD permitting program, as the expansion project will be constructed pursuant to a single, continuous program of construction.

contains the introduction and a summary of the permit application. Section 2 presents a description of the proposed RICE project. Project emissions are presented in Section 1. Section 4 presents a regulatory applicability analysis. Section 5 presents the planned control technologies and proposed emissions limitations.

Requirements for the information to be included in this permit application are set forth in the following regulations:

- The PDEQ "Standard Permit Application Form for Class I Sources" and "Standard Permit Application Form Filing Instructions."[2]
- Additional requirements for Class I permits as specified in Pima County Code Section ("PCC §") 17.12.160(F)-(I).
- Additional requirements for major modifications as specified in PCC §§ 17.16.550(B), 17.16.590(A), 17.16.600, and 17.16.630.
- Requirements for preconstruction PSD approval as specified in 40 CFR § 52.21(n).
- Requirements for approval of construction under the NESHAP program as specified in 40 CFR § 63.5(d).

Completed permit application forms are contained in Appendix A to this permit application. Specific, required content of the permit application is tabulated below with cross-references identifying the location of this information in the permit application.

Table 1-1. Permit Application Contents

Content Description	Citation(s)	Location of Information in this Permit Application
General identifying information	40 CFR § 63.5(d)(1)(ii)(A) 40 CFR § 63.5(d)(1)(ii)(B) 40 CFR § 63.5(d)(1)(ii)(C) Standard Application Form	Appendix A
Emissions information	40 CFR § 63.5(d)(1)(ii)(H) Standard Application Form	Subsections 3.1 and 3.2, Appendix A
Description of the process to be carried out in each unit.	40 CFR § 52.21(n)(1)(i), 40 CFR § 63.5(d)(2) Filing Instructions #1	Subsections 2.2 through 2.5
Description of raw materials, intermediates, and product(s).	40 CFR § 52.21(n)(1)(i), Filing Instructions #2	Subsection 2.3

[2] See, webcms.pima.gov/UserFiles/Servers/Server_6/File/Government/Environmental%20Quality/Air/AQ%20Operating%20Permits/Class%20I/Application-Forms-for-Class-I.pdf and webcms.pima.gov/UserFiles/Servers/Server_6/File/Government/Environmental%20Quality/Air/AQ%20Operating%20Permits/Class%20I/ApplicationFormFilingInstructionsforClassI.pdf, respectively. The application form referenced in PCC § 17.12.160(B), formerly codified in Appendix 1 to Title 18, Chapter 2 of the Arizona Administrative Code, has been repealed. See, Arizona Administrative Register, Vol. 23, p. 333, Feb. 10, 2017.

Table 1-1. Permit Application Contents

Content Description	Citation(s)	Location of Information in this Permit Application
A flow diagram for all processes.	40 CFR § 52.21(n)(1)(i), Filing Instructions #5	Subsection 2.2
Citation and description of all applicable requirements	40 CFR § 63.5(d)(1)(ii)(D) Filing Instructions #8	Section 4
Explanation of proposed exemptions	Filing Instructions #9	Section 4
Design capacity and operating schedule for each process unit and emissions unit	40 CFR § 63.5(d)(2), 40 CFR § 52.21(n)(1)(i), Filing Instructions #10	Subsection 2.3
Description of planned air pollution control systems and proposed BACT determinations.	40 CFR § 63.5(d)(2); 40 CFR § 52.21(n)(1)(iii); Filing Instructions #11, #14.b-d, # #19.b.ii	Subsection 2.4 and Section 5
Site diagram showing plant location and layout	40 CFR § 52.21(n)(1)(i), Filing Instructions #13	Appendix C
Detailed schedule for construction of the major modification.	40 CFR § 52.21(n)(1)(ii), 40 CFR § 63.5(d)(1)(ii)(E) 40 CFR § 63.5(d)(1)(ii)(F)	Subsection 1.2
Description of or reference to applicable test methods for determining compliance with each applicable requirement.	Filing Instructions #14.a	Subsection 4.1
Compliance plan, including a description of compliance status with respect to all applicable requirements and a compliance schedule	PCC § 17.16.550(B)(2), PCC § 17.16.550(B)(5), Filing Instructions #16	Appendix A
Certification of compliance with all applicable requirements	Filing Instructions #17	Appendix A
Assessment of the applicability of the requirements of PCC Chapter 17.16, Article VIII.	PCC § 17.12.160(F)(2)	Subsections 4.4 and 4.5
Assessment of the applicability of the requirements of PCC Chapter 17.16, Article IX.	PCC § 17.12.160(F)(3), PCC § 17.16.550(B)(6)	Subsection 4.9
Analysis of impacts to visibility and other air quality related values in Class I areas	PCC § 17.16.550(B)(3), PCC § 17.16.550(B)(9), PCC § 17.16.630	Appendix C
Analysis of air quality impacts	PCC § 17.16.550(B)(1), PCC § 17.16.590(A)(5) , 40 CFR § 52.21(k)(1), 40 CFR § 52.21(n)(2)(i) Filing Instructions #14.e	Appendix C

Table 1-1. Permit Application Contents

Content Description	Citation(s)	Location of Information in this Permit Application
Analysis of ambient air quality	PCC § 17.16.600(A)-(D), 40 CFR § 52.21(m)(1), Filing Instructions #19.b.iii	Appendix C
Analysis of impacts due to general commercial, residential, industrial and other growth associated with the project	PCC § 17.16.600(I)(2), 40 CFR § 52.21(n)(2)(ii), 40 CFR § 52.21(o)(2)	Appendix C
Analysis of impairment to soils and vegetation	PCC § 17.16.600(I)(1), 40 CFR § 52.21(o)(1)	Appendix C
Analysis of impairment to visibility	PCC § 17.16.600(I)(1), 40 CFR § 52.21(o)(1)	Appendix C
In conjunction with emissions caps, other emission limitations, or other requirements voluntarily proposed in order to avoid one or more applicable requirements, demonstration that such proposed requirements are at least as stringent as the emissions limitations that would otherwise apply, will ensure compliance with all applicable requirements, and will be permanent, quantifiable and otherwise enforceable as a practical matter.	PCC § 17.12.160(F)(5), PCC § 17.12.190(C), PCC § 17.12.195(C)	Subsection 4.5.3
Calculations on which all information in this application is based.	40 CFR § 63.5(d)(2) Filing Instructions #20	Section 1, Appendix B
Certification of the truth, accuracy, and completeness of submitted information.	PCC § 17.12.160(I)	Appendix A

2. Project Description

2.1 Project Context

TEP is dedicated to providing safe, clean, and reliable power to its customers. In order to ensure that these goals are met, TEP must maintain, within narrow limits, a continuous balance between the output of its diverse electricity-generating resources and the energy used by its customers.

As the balancing authority for the Tucson area, TEP is the entity legally responsible for integrating the resources required to meet system load, maintaining a balance between load and generation within its designated area and for supporting interconnection frequency in real time. Because customer energy use varies continuously and due to fluctuation of renewable generation, TEP must maintain a certain ramping capacity within its generation fleet capable of responding minute-to-minute to changes in customer energy use.

As part of TEP's long-term strategy to build a more responsive and sustainable resource portfolio, as described in greater detail in its 2017 Integrated Resource Plan ("IRP"),[3] TEP plans to continue expanding solar and wind generation with a goal of delivering at least 30 percent of its retail load from renewable resources by 2030. The company anticipates adding about 800 MW of new renewable energy capacity – primarily utility scale solar and wind technologies – by 2030. TEP also is supportive of distributed generation, *i.e.*, small-scale renewable resources sited on customer premises.

These intermittent, renewable resources and distributed generation technologies increase intra-hour variability, necessitating an increase in ramping capacity in order to maintain load- generation balance and to maintain frequency and voltage control across the system. TEP has adjusted to the higher variability experienced to date by carrying higher levels of spinning reserves on the system, implementing cost effective enhancements to improve the ramping capabilities of existing resources, and adding Energy Storage Systems ("ESS") to our portfolio.

With respect to ESS, in early 2017, two battery projects contracted by TEP, each with a capacity of 10 MW, were commissioned at two locations in Tucson in order to support distribution system operations. TEP is also considering three additional ESS projects, with operation currently planned to commence in 2019, 2021, and 2031. The first two of these systems may be up to 50 MW each; the third may be up to 100 MW. The primary purpose of each of these systems is to facilitate the integration of more renewable energy into TEP's resource mix by providing grid balancing and load leveling resources. The locations of these ESS projects within TEP's system are currently unknown; final decisions regarding both siting and timing will be made based on operational needs within the transmission and distribution systems.

ESS facilities, however, cannot be relied upon to meet TEP's minimum local generation requirements at any time of day or year as discussed below, cannot practically and reasonably

[3] See, www.tep.com/wp-content/uploads/2017/04/TEP-2017-Integrated-Resource.pdf.

meet TEP's growing ramping requirements, and cannot practically and reasonably provide full capacity during extended periods of peak demand.

By 2024, TEP expects to double its capacity in renewable energy resources to over 20% of retail load, which will dramatically increase its ramping requirements, as illustrated by comparing Figure 2-1 and Figure 2-2. Given this magnitude of change, TEP will not be able to rely on its existing generation fleet to meet the reliability obligations associated with this level of variability.[4] New, fast-ramping resources will be required in order to support increased renewable integration.

Given the need for additional fast ramping capacity, the RICE technology would best support TEP's long-term renewable goal of serving 30 percent of its retail load with renewables by 2030. The RICE technologies provided the best combination of flexibility and efficiency.

Because TEP's balancing authority area includes a concentrated load center in and around the Tucson metropolitan area, and because this concentrated load is served largely by generating resources located outside of TEP's load center, a minimum level of electrical load must be carried by a local area resource at all times in order to ensure the system has sufficient voltage support in the case of a loss of power or transmission from one of the remote generating units. This need for minimum local generation, which can vary from as low as 6 MW to in excess of 350 MW, must be taken into account in siting generating resources in the Tucson area.

The existing Irvington Generating Station Units 1 and 2 have the flexibility to operate as base-load or peaking resources. These two steam units, however, are limited in their turndown capability, which, as shown in Figure 2-3, results in an over-dispatch of these resources relative to what is necessary to meet minimum must-run generation requirements for significant portions of the year.

In comparison to IGS Units 1 and 2, RICE generators are capable of operating at low turn-down capacities without significant heat rate degradation. In addition, their modular capacity (*i.e.*, multiple engines) will allow TEP to dedicate one or two RICE (at any given time with multiple back-up units) to serve the minimum must-run generation requirements, thereby eliminating uneconomical unit dispatch with the added benefit of lower emissions due to the installed Best Available Control Technology ("BACT") at these minimum levels.

[4] Over the next five years, TEP will reduce its coal-fired capacity by 508 MW through planned retirements. TEP plans to exit San Juan Generating Station ("San Juan") Unit 2 at the end of 2017, exit the Navajo Generating Station ("Navajo") at the end of 2019, and exit San Juan Unit 1 at the end of June 2022.

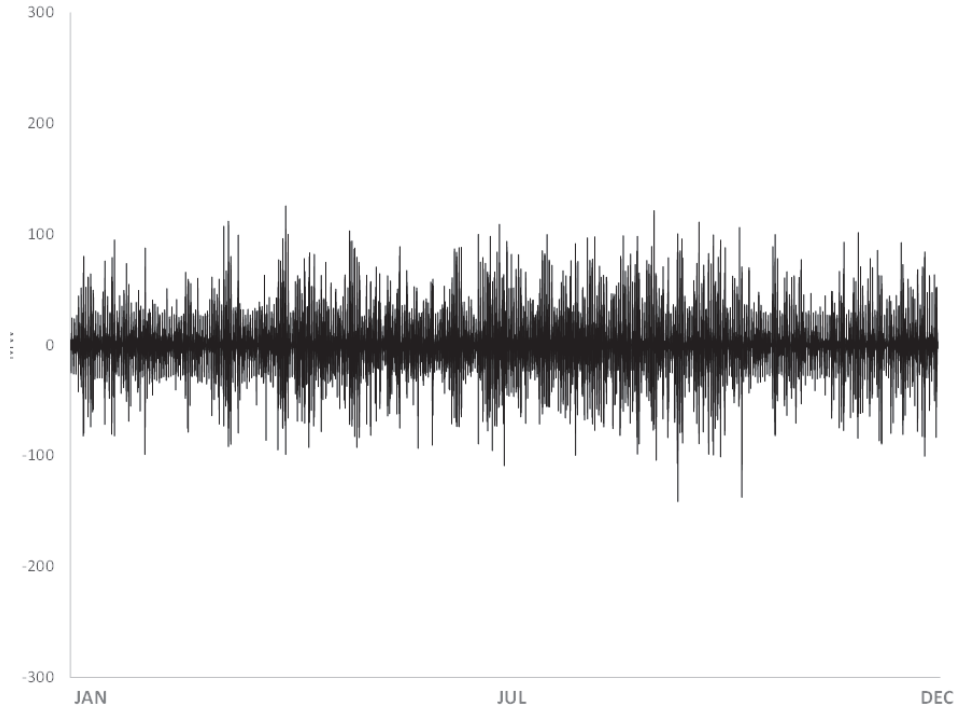

Figure 2-1. 10-Minute Changes in TEP Renewable Energy Generation (2016)

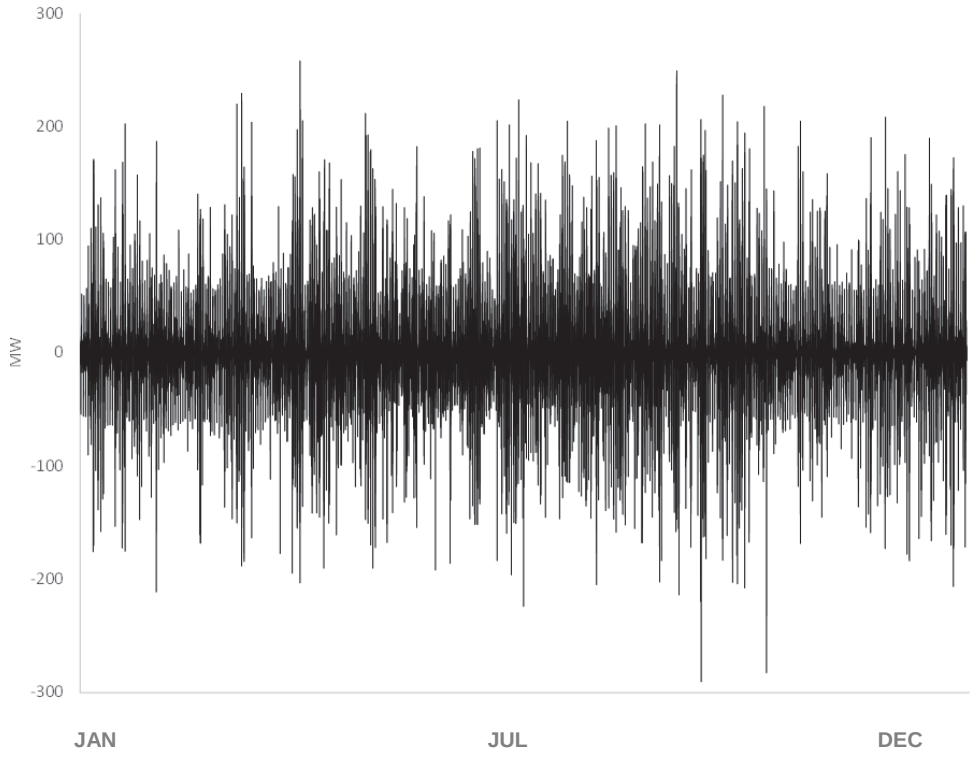

Figure 2-2. 10-Minute Changes in TEP Renewable Energy Generation (2024)

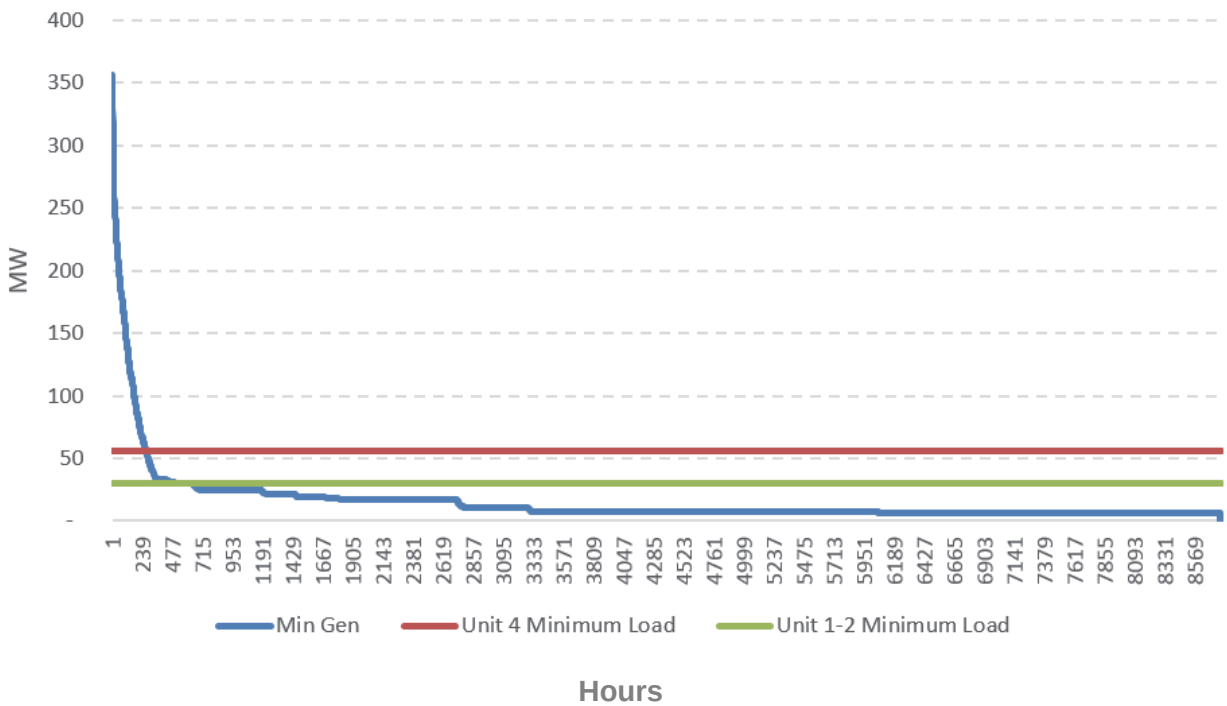

Figure 2-3. Local Area Minimum Generation

2.2 Project Overview

Following extensive analysis as described above, TEP identified RICE as the optimal technology for meeting the need for thermal generating resources in the Tucson area and identified the existing IGS plant site as the optimal location for the RICE project.

The IGS is located within the City of Tucson, approximately two miles northeast of Tucson International Airport, on a site bounded by South Alvernon Way on the west, East Irvington Road on the north, and the Union Pacific Railroad on the south.

TEP selected RICE technology for numerous reasons based on consideration of all factors relevant to system needs. RICE are uniquely designed to dispatch flexibly in order to meet changes in load. They are capable of operating (i.e., idling) at load levels as low as 30 percent of design capacity; this is critical to meeting TEP's needs, as it enables each RICE to spin or stand ready to react immediately to disturbances or renewable generation reductions and to satisfy requirements for minimum local generation indefinitely. The RICE technology is capable of being on-line at full load within two minutes on a hot start and within four minutes on a warm start. Once operational, each RICE can ramp between 30 percent and 100 percent load in approximately 40 seconds.

Unlike renewable generating resources or currently available ESS technologies, RICE can provide 100 percent of their effective load carrying capability ("ELCC") during multiple peak periods of any length.

From a reliability standpoint, RICE are ideally suited to the identified purpose, as their performance and reliability are degraded only by run-time hours, not by cycling, and they can withstand multiple start-ups within a day.

The proposed RICE project will modernize and expand the IGS by replacing two 1950's era electric utility steam generating units (*i.e.*, IGS Units 1 and 2) with ten high-efficiency, fast-responding, state-of-the-art RICE, each having a generating capacity of 19 MW (nominal). TEP's basic purpose and fundamental objective for the RICE project is to meet a critical need in its resource portfolio: Reliable, efficient, grid-balancing resources which can ramp up quickly and provide 100 percent of their ELCC during multiple peak periods of any length. In conjunction with ESS projects and other efforts described in the 2017 IRP, the RICE project will support the integration of renewable resources, consistent with TEP's 30 percent target by 2030. Tangential benefits of the proposed RICE project include anticipated reductions in the capacity factors of the less-efficient steam generating units at IGS and improved overall environmental performance, including decreased water usage and wastewater discharge.

An overall process flow diagram for the project is provided in Figure 2-4.

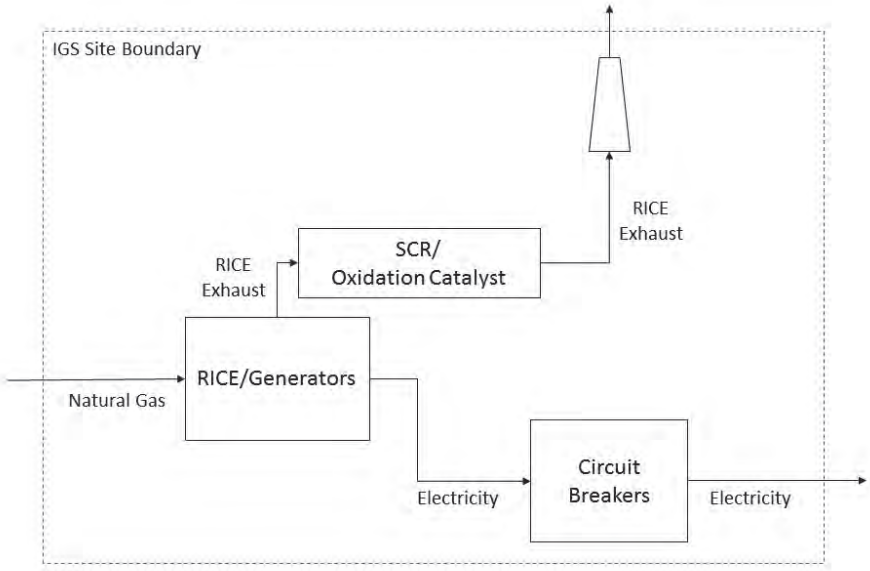

Figure 2-4. Simplified Process Flow Diagram for RICE Project

2.3 RICE and Electric Generators

The ten RICE that will be installed as part of the proposed project are technologically similar to the innumerable engines used in automobiles, trucks, railroad locomotives, marine propulsion, construction equipment, and industrial power applications.

Modern RICE used for electric power generation are four-stroke internal combustion engines in which an air-fuel mixture is compressed by a piston and ignited within a cylinder. (A four-stroke engine completes an induction stroke, a compression stroke, a power stroke, and an exhaust stroke, with two revolutions of the crankshaft, in each repetition of the cycle.) RICE are generally characterized by the type of combustion: spark-ignited ("SI"), as in a typical gasoline-powered vehicle, or compression-ignited ("CI"), also known as diesel engines. SI RICE are further characterized by whether the engine is operated fuel-lean (*i.e.*, with an air-to-fuel ratio significantly greater than the stoichiometric ratio required for complete combustion) or fuel-rich (*i.e.*, with an air-to-fuel ratio equal to or slightly greater than the stoichiometric ratio) and by the fuel used and the number of cylinders. The RICE proposed for installation at IGS are 18-cylinder, four-stroke, lean-burn SI RICE fueled exclusively by pipeline natural gas. Each RICE will be connected to an air-cooled generator to produce electricity.

Each RICE will have a nominal design heat input capacity equal to or less than 154.5 million British thermal units ("MMBtu") per hour ("MMBtu/hr") at the IGS plant site (elevation 2,623 feet above mean sea level) under summer conditions (105 °F and 19 percent relative humidity). Each RICE will have a nominal mechanical output capacity of 26,820 horsepower ("hp") and each electric generator will have a nominal gross design electric output capacity of 19.0 MW. Each RICE will operate up to 24 hours per day, 365 days per year and will have no more than five shutdown/startup cycles per calendar day.

2.4 Air Pollution Control Equipment for RICE

Each of the ten RICE installed at IGS will be equipped with two air pollution control devices:

- An oxidation catalyst system to control emissions of volatile organic compounds ("VOC"), carbon monoxide (CO), and organic hazardous air pollutants such as formaldehyde; and,

- A selective catalytic reduction ("SCR") system to control emissions of nitrogen oxides (NO_X). Aqueous ammonia will be injected upstream of the SCR catalyst module to act as a reductant.

2.5 Ancillary Emitting Equipment

In addition to the RICE, electric generators, and air pollution control devices described previously, equipment installed as part of the RICE project will include natural gas piping and electrical circuit breakers.

Natural gas is primarily methane (CH_4). New natural gas piping installed at the IGS as part of the RICE project will include valves, flanges, and other connectors. These piping components are potential sources of methane emissions due to leaks.

High-voltage electrical circuit breakers installed as part of the RICE project will include sulfur hexafluoride (SF_6) as an insulating material. SF_6 is a colorless, odorless, non-flammable, and non-toxic synthetic gas with a unique and extremely stable molecular structure which makes it an efficient electrical insulator.

3. Project Emissions

For each new source to be installed as part of the RICE project, the estimated potential to emit ("PTE") of all regulated air pollutants, expressed in both pounds per hour ("lb/hr") and tons per year ("tpy"), is summarized in tabular form in the completed application form presented in Appendix A to this permit application.

This section of the permit application describes the underlying emissions calculations. Further detail regarding these calculations is provided in Appendix B to this permit application.

In general terms, pursuant to the definition of "regulated air pollutant" at PCC § 17.04.340(A)(194), two categories of regulated air pollutants will be emitted from the new sources to be installed as part of the RICE project: Pollutants regulated by the PSD program, as discussed in detail in subsection 4.5 herein, and hazardous air pollutants ("HAP"), as discussed in subsections 4.8 and 4.9 herein. For clarity, these categories of pollutants are addressed separately in the following subsections 3.1 and 3.2, respectively.

3.1 Emissions of PSD Pollutants

The new sources to be installed as part of the RICE project include ten RICE, as discussed in subsection 2.3 herein, and natural gas piping and electrical circuit breakers, as discussed in subsection 2.5 herein.

The regulated air pollutants which will be emitted by the RICE and which are generally regulated by the PSD program include CO, VOC, NO_X, sulfur dioxide (SO_2), filterable particulate matter ("PM"), particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers (µm) ("PM10"), and particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 µm ("PM2.5"), sulfuric acid mist, and greenhouse gases ("GHG"). GHG also is emitted by the natural gas piping and the electrical circuit breakers.

Potential emissions from the RICE are calculated in different ways for different pollutants, as discussed below.

3.1.1 Emissions of SO_2 and Sulfuric Acid Mist

Emissions of SO_2 and sulfuric acid mist are dependent on the quantity and the sulfur content of the pipeline natural gas used as fuel. Potential emissions of these pollutants have been calculated based on the conservative assumption that each RICE operates at its maximum heat input capacity for 8,760 hours per year. As noted in subsection 2.3 herein, the nominal heat input capacity of each RICE to be installed at the IGS is 154.5 MMBtu/hr. Sulfur content of natural gas has been conservatively assumed to be 7,500 grains per million cubic feet.

Conservatively assuming 100 percent of fuel sulfur forms SO_2, emissions of SO_2 from each RICE are calculated as follows:

$$\frac{7500\ \frac{gr\ S}{10^6 ft^3} \times \frac{64.06\ lb\ SO_2}{32.06\ lb\ S}}{7000 \frac{gr\ S}{lb\ S} \times 1020 \frac{MMBtu}{10^6 ft^3}} = 0.0021 \frac{lb}{MMBtu}$$

$$154.5\ \frac{MMBtu}{hr} \times 0.0021 \frac{lb}{MMBtu} = 0.32 \frac{lb}{hr}$$

$$0.32 \frac{lb}{hr} \times 8{,}760 \frac{hr}{yr} \div 2000 \frac{lb}{ton} = 1.4 \frac{tons}{yr}$$

Conservatively assuming 10 percent of fuel sulfur forms SO_3 and is reported as sulfuric acid mist,[5] emissions of this pollutant from each RICE are calculated using the relative molecular weights of SO_2 and H_2SO_4, as follows:

$$0.32 \frac{lb\ SO_2}{hr} \times 10\% \times \frac{98.08\ lb\ \mathrm{H_2SO_4}}{64.06\ lb\ SO_2} = 0.050 \frac{lb}{hr}$$

$$0.050 \frac{lb}{hr} \times 8{,}760 \frac{hr}{yr} \div 2000 \frac{lb}{ton} = 0.22 \frac{tons}{yr}$$

3.1.2 Emissions of PM

Emissions of PM from each RICE have been calculated using an emission factor of 0.0000771 lb/MMBtu heat input published by U.S. EPA[6] based on the conservative assumption that the RICE operates at its maximum heat input capacity for 8,760 hours per year. As noted in subsection 2.3 herein, the nominal heat input capacity of each RICE to be installed at the IGS is 154.5 MMBtu/hr. The calculations are performed as follows:

$$154.5\ \frac{MMBtu}{hr} \times 0.0000771 \frac{lb}{MMBtu} = 0.0119 \frac{lb}{hr}$$

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[5] The pollutant name "sulfuric acid mist" is a misnomer. Pursuant to the definition at 40 CFR § 60.81(b) and, by reference, the provisions of Reference Method 8 codified in appendix A-4 to 40 CFR part 60, the pollutant includes all SO_3 and H_2SO_4, regardless of physical state, reported as H_2SO_4.

[6] *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources (AP-42).* Section 3.2: Natural Gas-fired Reciprocating Engines, Table 3.2-2 – Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines. July 2000. U.S. EPA.

$$0.0119\frac{lb}{hr} \times 8{,}760\frac{hr}{yr} \div 2000\frac{lb}{ton} = 0.0522\frac{tons}{yr}$$

3.1.3 Emissions of NO_X

Potential hourly emissions of NO_X are governed by the NSPS emission limit of 1.0 g/hp·hr as discussed in subsection 4.7.2 herein.[7] As noted in subsection 2.3 herein, the nominal mechanical output capacity of each RICE to be installed at the IGS is 26,820 hp. The hourly emission rate is as follows:

$$26{,}820\ hp\ \times 1.0\frac{g}{hp \cdot hr} \div 453.59\frac{g}{lb} = 59.1\frac{lb}{hr}$$

The unrestricted potential annual emissions of NO_X from each RICE are greater than the voluntarily proposed emission cap of 179.0 tpy as discussed in subsection 4.5.3 herein; thus, potential annual emissions of NO_X are equal to the emission cap of 179.0 tpy.

As discussed in subsection 2.4 herein, SCR will be installed on each RICE. These control devices will reduce actual NO_X emissions from each RICE by a substantial amount. Thus, the PTE calculations performed in the manner above are conservative with respect to (*i.e.*, they overestimate) actual emissions. However, because TEP is not voluntarily proposing any enforceable restrictions which quantitatively limit NO_X emissions from any individual RICE, the effect of the SCR has generally not been considered.

3.1.4 Emissions of CO, VOC, PM10, and PM2.5

For each of these pollutants, emissions during startup periods are higher than during non-startup periods; thus, for these pollutants, emissions are calculated separately for the startup periods and for non-startup periods.

Emissions of PM10 and PM2.5 from natural gas-fired RICE consist mainly of condensable particulate matter; only a small percentage of the emissions of PM10 and PM2.5 are filterable particulate matter.[8] All of the filterable material is believed to be PM2.5 (i.e., to have a nominal mean aerodynamic diameter less than or equal to 2.5 μm). Thus, PM10 and PM2.5 emission rates are equal.

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[7] Based on vendor-specified emissions performance and operating conditions during startup events, including the requirement for minimum downtime prior a startup, emissions during any hour containing a startup event are not greater than the emission rate calculated here for non-startup hours.

[8] Based on U.S. EPA's published emission factors, 99 percent of engine exhaust particulate matter emissions are condensable and 1 percent filterable. *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources (AP-42)*. Section 3.2: Natural Gas-fired Reciprocating Engines, Table 3.2-2 – Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines. July 2000. U.S. EPA.

Potential emissions during startup periods are based on information provided by prospective RICE vendors. This information indicates maximum emissions per 30-minute startup event are as follows:

- PM10/PM2.5: 3.0 lbs
- CO: 16.0 lbs
- VOC: 7.9 lbs

Emissions of these pollutants during non-startup periods are governed by the proposed BACT emission limits. As discussed in subsections 5.3.6 and 5.4.6, the maximum hourly emission rates are as follows:

- PM10/PM2.5: 2.50 lb/hr
- CO: 4.43 lb/hr
- VOC: 4.49 lb/hr

Potential hourly emission rates for these pollutants are calculated as the sum of the emissions from one 30-minute startup event plus the emissions from 30 minutes (*i.e.*, ½ hour) at the allowable non-startup hourly emission rate. These rates are as follows:

- PM10/PM2.5: 4.3 lb/hr
- CO: 18.2 lb/hr
- VOC: 10.1 lb/hr

Each RICE will "lose" at least one hour of potential non-startup operating time for each shutdown/startup cycle and, as noted in subsection 2.3 herein, will undergo no more than five such cycles per day; thus, for purposes of calculating potential daily or annual emission rates for these pollutants, each RICE is conservatively assumed to undergo five startup events per day and to operate for 19 hours per day at the maximum allowable rate for non-startup periods. The calculation is as follows, using PM10 to illustrate:

$$3.0\frac{lb}{startup} \times 5\frac{startups}{day} + 2.5\frac{lb}{hr} \times 19\frac{hr}{day} = 62.5\frac{lb}{day}$$

$$62.5\frac{lb}{day} \times 365\frac{day}{yr} \div 2000\frac{lb}{ton} = 11.4\frac{tons}{yr}$$

3.1.5 Emissions of GHG from RICE

As defined at 40 CFR § 52.21(b)(49)(i), the regulated air pollutant GHG is the aggregate group of six greenhouse gases. Three of these gases are emitted from natural gas-fired RICE: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

As noted in subsection 4.5.2 herein, the PSD applicability analysis for GHG is dependent on two different sets of GHG calculations. The first calculation is based on total mass emission rate for all individual GHG constituents emitted.

Mass emissions of GHG from each RICE have been calculated using the emission factors for each GHG constituent codified in Tables C-1 and C-2 to 40 CFR part 98. These emission factors are expressed in kilograms per MMBtu heat input. The calculation is based on the conservative assumption that the RICE operates at its maximum heat input capacity for 8,760 hours per year. As noted in subsection 2.3 herein, the nominal heat input capacity of each RICE to be installed at the IGS is 154.5 MMBtu/hr.

The second calculation, performed in accordance with 40 CFR § 52.21(b)(49)(iii), is based on CO_2-equivalent ("CO_2e") emission rate, taking into account the global warming potential ("GWP") for each GHG constituent as codified in Table A-1 to 40 CFR part 98.

Potential emissions of each GHG constituent and of total GHG from each RICE on both a mass basis and a CO_2e basis are shown in Table 3-1.

Table 3-1. GHG PTE for Each RICE

	40 CFR 98 kg/MMBtu	mass lb/hr (per engine)	mass tpy (per engine)
CO_2	53.02	1.81E+04	7.91E+04
CH_4	1.0E-03	3.41E-01	1.49E+00
N_2O	1.0E-04	3.41E-02	1.49E-01
mass total GHG		1.81E+04	7.91E+04

	mass lb/hr (per engine)	40 CFR 98 GWP	CO_2e lb/hr (per engine)	CO_2e tpy (per engine)
CO_2	18,059	1	1.81E+04	7.91E+04
CH_4	3.4E-01	25	8.52E+00	3.73E+01
N_2O	3.4E-02	298	1.02E+01	4.45E+01
CO_2e total GHG			1.81E+04	7.92E+04

Using CH_4 to illustrate, the calculations are performed as follows:

$$154.5\,\frac{MMBtu}{hr} \times 0.001\,\frac{kg}{MMBtu} \times 2.2046\,\frac{lb}{kg} = 0.34\,\frac{lb_m}{hr}$$

$$0.34\,\frac{lb_m}{hr} \times 25\,\frac{lb_{CO2e}}{lb_m} = 8.5\,\frac{lb_{CO2e}}{hr}$$

$$0.34\frac{lb_m}{hr} \times 8{,}760\frac{hr}{yr} \div 2000\frac{lb_m}{ton_m} = 1.5\frac{tons_m}{yr}$$

$$8.5\frac{lb_{CO2e}}{hr} \times 8{,}760\frac{hr}{yr} \div 2000\frac{lb_{CO2e}}{ton_{CO2e}} = 37.3\frac{tons_{CO2e}}{yr}$$

3.1.6 Emissions of GHG from Natural Gas Piping

The valves, flanges, and other connectors included with the natural gas piping installed at the IGS as part of the RICE project are potential sources of GHG (*i.e.*, CH_4) emissions due to leaks.

As discussed in subsection 3.1.5 herein, GHG emissions are calculated both on a mass basis and on a CO_2e basis. Emissions of CH_4 on a mass basis are calculated based on emission factors published by U.S. EPA.[9] Emissions on a CO_2e basis are calculated using the GWP for CH_4 as codified in Table A-1 to 40 CFR part 98. Potential emissions of GHG from natural gas piping components on both a mass basis and a CO_2e basis are shown in Table 3-2.

Table 3-2. GHG PTE for Natural Gas Piping

Component Type	Components	*Protocol* kg/hr/component	mass CH_4 lb/hr	mass CH_4 tpy
valves in gas/vapor service	60	2.68E-02	3.55E+00	1.55E+01
flanges/connectors	150	2.5E-04	8.27E-02	3.62E-01
pressure relief valves	10	1.6E-01	3.53E+00	1.54E+01
mass total GHG			7.16E+00	3.13E+01

	mass CH_4 lb/hr	40 CFR 98 GWP	CO_2e lb/hr	CO_2e tpy
All component types	7.16E+00	25	1.79E+02	7.83E+02
CO_2e total GHG			1.79E+02	7.83E+02

3.1.7 Emissions of GHG from Circuit Breakers

The high-voltage electrical circuit breakers installed as part of the RICE project are potential sources of GHG emissions. Specifically, pursuant to the definition of GHG at 40 CFR § 52.21(b)(49)(i), sulfur hexafluoride (SF_6) is a GHG, and the circuit breakers are potential sources of SF_6 emissions due to leaks.

[9] *Protocol for Equipment Leak Emission Estimates* (EPA-453/R-95-017). Table 2-2, Refinery Average Emission Factors. Nov. 1995. U.S. EPA.

As discussed in subsection 3.1.5 herein, GHG emissions are calculated both on a mass basis and on a CO_2e basis. Emissions of SF_6 from circuit breakers on a mass basis are calculated based on a conservatively assumed leak rate of 0.5 percent per year. Emissions on a CO_2e basis are calculated using the GWP for SF_6 as codified in Table A-1 to 40 CFR part 98. Potential emissions of GHG from circuit breakers on both a mass basis and a CO_2e basis are shown in Table 3-3.

Table 3-3. GHG PTE for Circuit Breakers

	Circuit Breakers	lbs SF_6 per circuit breaker	SF_6 leak rate (% per year)	mass SF_6 tpy
circuit breakers	8	65	0.5%	1.30E-03
mass total GHG				1.30E-03

	mass SF_6 tpy	40 CFR 98 GWP	CO_2e tpy
circuit breakers	1.30E-03	22,800	2.96E+01
CO2e total GHG			2.96E+01

3.1.8 Summary of Annual Emissions Increases for PSD Pollutants

Total emissions of pollutants regulated by the PSD program, from all new sources to be installed as part of the RICE project, are summarized in Table 3-4.

Table 3-4. Total Annual PTE for PSD Pollutants from RICE Project

Pollutant	tpy
SO_2	14.2
sulfuric acid mist	2.2
PM	0.5
PM10/PM2.5	114.1
CO	299.6
VOC	227.8
NO_X	179.0
GHG (mass)	791,048
GHG (CO_2e)	792,631

3.2 Emissions of Hazardous Air Pollutants

The only HAP-emitting units to be installed as part of the RICE project are the new RICE.

Potential emissions of HAP from the RICE, as shown in Table 3-5, have been calculated based on emission factors published by U.S. EPA.[10] These emission factors reflect uncontrolled emissions and are expressed in terms of lb per MMBtu heat input. HAP emission calculations for each RICE are based on the conservative assumption that the RICE operates at maximum heat input capacity for 8,760 hours per year. As noted in subsection 2.3 herein, the nominal heat input capacity of each RICE to be installed at the IGS is 154.5 MMBtu/hr. Using formaldehyde to illustrate, the calculations are performed as follows:

$$154.5\ \frac{MMBtu}{hr} \times 0.0528 \frac{lb}{MMBtu} = 8.16 \frac{lb}{hr}$$

$$8.16 \frac{lb}{hr} \times 8{,}760 \frac{hr}{yr} \div 2000 \frac{lb}{ton} = 35.7 \frac{tons}{yr}$$

As discussed in subsection 2.4 herein, oxidation catalyst will be installed on each RICE. These control devices will reduce actual HAP emissions by a substantial amount. (For example, in developing the NESHAP for Stationary RICE, codified at subpart ZZZZ of 40 CFR part 63, U.S. EPA relied on an estimated HAP emission control efficiency of 75 percent for oxidation catalyst installed on four-stroke, lean-burn, SI RICE.[11]) Thus, the PTE calculations performed using uncontrolled emission factors are conservative with respect to (*i.e.*, they overestimate) actual emissions. However, because TEP is not voluntarily proposing any enforceable restrictions which quantitatively limit HAP emissions, the effect of the oxidation catalyst has generally not been considered.

The one exception is for formaldehyde, because the PTE estimate performed using U.S. EPA's uncontrolled emission factors exceeds the VOC BACT emission limit of 4.49 lb/hr proposed in subsection 5.4.6 herein. Thus, a second set of PTE calculations has been performed for formaldehyde, taking this limit into account.

Table 3-5. HAP PTE for each RICE

Pollutant	AP-42 EF lb/MMBtu	lb/hr (per engine)	tpy (per engine)
1,3-Butadiene	2.67E-04	4.13E-02	1.81E-01
2,2,4-Trimethylpentane	2.50E-04	3.86E-02	1.69E-01
Acetaldehyde	8.36E-03	1.29E+00	5.66E+00
Acrolein	5.14E-03	7.94E-01	3.48E+00
Benzene	4.40E-04	6.80E-02	2.98E-01

[10] *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources (AP-42).* Section 3.2: Natural Gas-fired Reciprocating Engines, Table 3.2-2 – Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines. July 2000. U.S. EPA.

[11] Memorandum from M. Taylor, Alpha-Gamma Technologies, to S. Roy, U.S. EPA, "Environmental Impacts of the Proposed Reciprocating Internal Combustion Engine MACT," Aug. 1, 2002. Available at www.regulations.gov/contentStreamer?documentId=EPA-HQ-OAR-2002-0059-0065. (Last accessed 6/30/2017).

Pollutant	AP-42 EF lb/MMBtu	lb/hr (per engine)	tpy (per engine)
Biphenyl	2.12E-04	3.28E-02	1.43E-01
Ethylbenzene	3.97E-05	6.13E-03	2.69E-02
Formaldehyde	5.28E-02	8.16E+00	3.57E+01
Formaldehyde (considering VOC BACT limit)		4.49E+00	1.97E+01
Methanol	2.50E-03	3.86E-01	1.69E+00
Dichloromethane (methylene chloride)	2.00E-05	3.09E-03	1.35E-02
n-Hexane	1.11E-03	1.71E-01	7.51E-01
Naphthalene	7.44E-05	1.15E-02	5.03E-02
Phenol	2.40E-05	3.71E-03	1.62E-02
Tetrachloroethane	2.48E-06	3.83E-04	1.68E-03
Toluene	4.08E-04	6.30E-02	2.76E-01
Vinyl Chloride	1.49E-05	2.30E-03	1.01E-02
Xylene	1.84E-04	2.84E-02	1.25E-01

4. Regulatory Applicability Review

A review of the potentially applicable regulatory requirements has been conducted for the IGS and for the proposed RICE project. The following subsections summarize the results of this review.

4.1 Performance Tests

The PDEQ general provisions relating to performance tests are codified at PCC § 17.12.050. These provisions include the following requirements. Except as noted, these requirements are consistent with the corresponding provisions of federal standards as discussed in subsections 4.7 and 4.8 herein.

- Initial performance tests, where required, shall be conducted within 60 days after the affected facility or source has achieved the capability to operate at its maximum production rate on a sustained basis, but no later than 180 days after initial startup of such facility or source.

- The owner or operator of such source shall provide PDEQ a written report of the results of each performance test.

- Performance tests shall be conducted and data reduced in accordance with the reference test methods and procedures contained in the Arizona Testing Manual; appendices D and E of 40 CFR part 52; appendices A through F of 40 CFR part 60; and appendices B and C of 40 CFR part 61, unless PDEQ specifies or approves the use of a reference method with minor changes in methodology, an equivalent method, or an alternative method. This is generally consistent with the requirements of federal standards except that, as discussed in subsections 4.8 herein, reference methods codified in appendix A to 40 CFR part 63 are required for certain HAPs. In addition to the test methods specified by federal standards, TEP proposes to use the following test methods to quantify emissions from the new emissions units installed as part of the RICE project:

    - For particulate matter, Method 5 in appendix A-3 to 40 CFR part 60 and Method 202 in appendix M to 40 CFR part 51.

- Performance tests shall be conducted under such conditions as PDEQ shall specify. TEP shall make available to PDEQ such records as may be necessary to determine the conditions of the performance tests. Operations during periods of start-up, shutdown, and malfunction shall not constitute representative conditions of performance tests unless otherwise specified in the applicable standard.

- TEP shall provide two weeks' prior notice of the performance test to afford PDEQ the opportunity to have an observer present. This requirement is less stringent than the requirement for 60 calendar days' prior notice in certain federal standards as discussed in subsections 4.7 and 4.8 herein.

- The owner or operator of a permitted source shall provide, or cause to be provided, performance testing facilities as follows:

    - Sampling ports adequate for test methods applicable to such facility
    - Safe sampling platform(s)
    - Safe access to sampling platform(s);
    - Utilities for sampling and testing equipment.

- Each performance test shall consist of three separate runs using the applicable test method. Each run shall be conducted for the time and under the conditions specified in the applicable standard. For the purpose of determining compliance with an applicable standard, the arithmetic means of results of the three runs shall apply. In the event that a sample is accidentally lost or conditions occur in which one of the three runs is required to be discontinued because of forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances beyond the owner or operator's control, compliance may, upon PDEQ's approval, be determined using the arithmetic means of the results of the two other runs. If a PDEQ observer is present, tests may only be stopped with PDEQ's approval. If no PDEQ observer is present, tests may only be stopped for good cause, which includes forced shutdown, failure of an irreplaceable portion of the sample train, extreme meteorological conditions, or other circumstances beyond the operator's control. Termination of testing without good cause after the first run is commenced shall constitute a failure of the test.

4.2 Compliance Assurance Monitoring

The federal Compliance Assurance Monitoring rules ("CAM") required by §§ 114(a)(3) and 504(b) of the federal Clean Air Act are codified at 40 CFR part 64. These federal regulations are incorporated by reference at PCC § 17.12.180(A)(3).

Pursuant to 40 CFR § 64.2(a), CAM requirements are generally applicable to a particular emissions unit, on a pollutant-specific basis, if the unit is subject to an emission limitation for that pollutant, and the unit uses a control device to achieve compliance with the limitation, and the unit has potential pre-control device emissions of the pollutant that are equal to or greater than 100 tons per year. Pursuant to 40 CFR § 64.2(b)(1)(i) and (b)(1)(v), respectively, CAM requirements are not applicable to an emission limitation which was proposed by U.S. EPA after November 15, 1990 pursuant to § 111 or 112 of the federal Clean Air Act, or to an emission cap that meets the requirements specified in 40 CFR § 70.4(b)(12).

As discussed in subsection 2.4 herein, each RICE to be installed at the IGS will use control devices to control emissions of VOC, CO, and NO_X. Applicability of the CAM rule with respect to emissions of these three pollutants is discussed below.

4.2.1 VOC Emissions

CAM requirements do not apply with respect to VOC emissions from the RICE to be installed at the IGS because potential pre-control device emissions from each RICE are less than 100 tons per year. Specifically, conservatively using the uncontrolled VOC emission factor of 0.118 lb/MMBtu from U.S. EPA's AP-42 emission factor compilation[12] and assuming continuous operation at maximum rated capacity for 24 hours per day and 365 days per year, the potential pre-control device emissions from each RICE are 79 tons per year.

4.2.2 CO Emissions

CAM requirements do not apply with respect to the CO emission limit imposed in the New Source Performance Standards, as discussed in subsection 4.7.2 herein, or in the NESHAP, as discussed in subsection 4.8.2 herein, because these rules were proposed by U.S. EPA after November 15, 1990 pursuant to § 111 or 112 of the federal Clean Air Act.

CAM requirements will apply with respect to the CO BACT emission limit for each RICE to be installed at the IGS. The monitoring and recordkeeping requirements proposed by TEP satisfy CAM requirements as summarized below:

- Consistent with the enhanced monitoring requirements established by U.S. EPA in the NESHAP for Stationary RICE, 40 CFR § 63.6600(b), as discussed in subsection 4.8.2 herein, TEP proposes to establish two indicators of control device performance for each RICE: Temperature of the stationary RICE exhaust at the catalyst inlet and pressure drop across the oxidation catalyst.

- The indicator range for temperature is 450 °F to 1350 °F. The indicator range for pressure drop across the catalyst will be established during the initial performance test as ±2 inches of water from the pressure drop across the catalyst that was measured during the test.

4.2.3 NO_X Emissions

CAM requirements do not apply with respect to the proposed NO_X emission cap because it is an emission cap that meets the requirements specified in 40 CFR § 70.4(b)(12).

CAM requirements do not apply with respect to the NO_X emission limit imposed in the New Source Performance Standards, as discussed in subsection 4.7.2 herein, because this rule was proposed by U.S. EPA after November 15, 1990 pursuant to § 111 of the federal Clean Air Act.

[12] *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources (AP-42).* Section 3.2: Natural Gas-fired Reciprocating Engines, Table 3.2-2 – Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines. July 2000. U.S. EPA.

4.3 Individual Source Permits

The PDEQ regulations relating to air quality permits for individual sources are codified at Article II of PCC Chapter 17.12. As required by PCC § 17.12.140(B), TEP has already obtained a Class I Air Quality Permit (Permit No. 1052, issued January 6, 2017, and having an expiration date of January 5, 2022).

Requirements of Article II applicable to the RICE project are as follows:

- Pursuant to PCC § 17.12.140(A), TEP is prohibited from commencing construction of a modification to the IGS without first obtaining a permit revision from PDEQ. This document constitutes the required application for a revision to the facility's Class I permit.

- Pursuant to PCC § 17.12.140(D), TEP is prohibited from constructing any major source of HAPs unless PDEQ first determines that applicable standards under § 112 of the federal Clean Air Act will be met. As discussed in subsection 4.8.1 herein, this document constitutes the required application for the necessary approval pursuant to 40 CFR § 63.5(d) and Clean Air Act § 112(i)(1).

- General requirements pertaining to permit applications are set forth at PCC § 17.12.160. TEP's obligations under those rule provisions are addressed in subsection 1.3 herein.

- Provisions of the federal Compliance Assurance Monitoring rule, 40 CFR part 64, are incorporated by reference at PCC § 17.12.180(A)(3). These provisions are addressed in subsection 4.2 herein.

- Requirements pertaining to emission caps, other emission limitations, and other requirements voluntarily proposed in permit applications are set forth at PCC §§ 17.12.190 and 17.12.195. TEP's obligations under those rule provisions are addressed in subsection 4.5.3 herein.

- As required by PCC § 17.12.200(A), TEP is obligated to provide a complete copy of this permit application to the U.S. EPA Administrator at the time of submittal of the application to PDEQ.

- As provided by PCC §§ 17.12.255(A) and 17.12.260(A), a change at a Class I source that requires a case-by-case determination of an emission limitation or a source specific determination of ambient impacts or a visibility or increment analysis or which is a modifications under any provision of title I of the federal Clean Air Act is required to be processed as a significant permit revision. This document constitutes the required application for a significant revision to the Class I permit for the IGS.

4.4 Nonattainment New Source Review

PDEQ's nonattainment new source review program, implementing requirements under § 173 of the federal Clean Air Act, are codified at PCC § 17.16.560 *et seq*. These requirements apply only to certain stationary sources in nonattainment areas.

The IGS is located in an area designated by U.S. EPA as attainment or unclassifiable for all criteria pollutants at 40 CFR § 81.303; thus, nonattainment new source review program requirements are not applicable to the RICE project.

4.5 Prevention of Significant Deterioration

PDEQ's PSD preconstruction permitting program, implementing requirements under § 165 of the federal Clean Air Act, are codified at Article VIII of PCC Chapter 17.16. In addition, pursuant to 40 CFR § 52.144, the federal PSD preconstruction permitting program codified at 40 CFR § 52.21 applies where PDEQ has jurisdiction, including at the IGS. These federal and county regulations are substantially equivalent.

Applicability of PSD preconstruction permitting program requirements is discussed in the following subsections.

4.5.1 General Requirements

Pursuant to PCC § 17.15.550(A) and 40 CFR § 52.21(a)(2)(iii), TEP is prohibited from beginning actual construction of a "major modification" without first obtaining a PSD permit.[13] As discussed in subsection 4.5.2, the RICE project is a major modification. This document constitutes the required application for a PSD permit.

4.5.2 Major Modification

Pursuant to PCC § 17.04.340(A)(127) and 40 CFR § 52.21(a)(2)(iv) and (b)(2), a project is a "major modification" if it will cause a net emissions increase that is significant for any pollutant regulated by the PSD program. "Significant" is defined for each pollutant, using an annual emission rate in tpy, at PCC § 17.04.340(A)(212) and 40 CFR §§ 52.21(b)(23) and (b)(49)(iii).[14] Emissions increases from the RICE project are discussed in subsection 3.1 herein and, as shown in Table 4-1, exceed the PSD significance level for six pollutants: NO_X, VOC, CO, PM10, PM2.5, and GHG.

[13] The prohibitory language in PCC § 17.15.550(A) actually refers to "commence construction" rather than "begin actual construction." The former term is defined at PCC § 17.04.340(A)(51) to include as a precondition "that the owner or operator has all necessary preconstruction approvals or permits required." Thus, by definition, TEP will not have commenced construction of the RICE project until after it has obtained a PSD permit and the prohibition as written is void of any practical effect.

[14] For GHG, BACT is applicable only if both the mass-based threshold and the CO_2e-based threshold are exceeded.

As discussed in subsection 4.5.3, due to the shutdown of Units 1 and 2 at the IGS, the net emissions increase for NO_X is not significant and PSD review is not required with respect to NO_X.

For five pollutants, TEP is not claiming any creditable decreases in actual emissions, and the net emissions increases are equal to the emissions increases from the RICE project. Thus, the project is a major modification and a PSD permit establishing BACT emission limits for these five pollutants is required.

Table 4-1. Project Emissions Increases for PSD Pollutants

Pollutant	RICE Project Increase (tpy)	Net Emissions Increase (tpy)	Significant Level (tpy)	Subject to PSD?
NO_X	179.0	39.4	40	no
VOC	227.8	n/a	40	yes
CO	299.6	n/a	100	yes
PM10	114.1	n/a	15	yes
PM2.5	114.1	n/a	10	yes
GHG (as CO_2e)	792,631	n/a	75,000	yes
GHG	791,048	n/a	any increase	yes
SO_2	14.2	n/a	40	no
sulfuric acid mist	2.2	n/a	25	no
PM	0.5	n/a	25	no

4.5.3 Voluntarily Proposed Emission Caps and Operational Restrictions

As provided by PCC §§ 17.12.190 and 17.12.195, TEP is voluntarily proposing three separate requirements that will ensure the net emissions increase for NO_X as a result of the RICE project is not significant: A requirement to shut down permanently either Unit 1 or Unit 2 at the IGS within 180 days following initial startup of the fifth RICE; a requirement to have shut down permanently both Units 1 and 2 at the IGS within 180 days following initial startup of the tenth and final RICE; and a NO_X emission cap of 179.0 tpy for the ten RICE to be installed at the IGS. In conjunction with the emission cap, TEP is proposing the following monitoring, testing, and recordkeeping requirements as compliance demonstration measures:

- TEP shall equip each RICE with an SCR system and shall at all times, including periods of startup, shutdown, and malfunction, to the extent practicable, maintain and operate the SCR system in a manner consistent with good air pollution control practice for minimizing NO_X emissions.
- TEP shall perform NO_X emissions testing of each RICE using the methods and procedures in 40 CFR § 60.4244 and Table 2 of 40 CFR part 60, subpart JJJJ. Initial testing of each RICE shall be performed within 180 days after initial startup and subsequent testing shall be performed at least once per five years.
- Using the results of each NO_X emissions test, TEP shall determine a NO_X emission factor for non-startup periods expressed in lb per MMBtu heat input.
- On a monthly basis, TEP shall monitor and make a record of heat input to (*i.e.*, natural gas usage in) each RICE, excluding heat input during startup periods.

- On a monthly basis, TEP shall make a record of the number of startup events for each RICE.
- On a monthly basis, for each RICE, TEP shall calculate and record NO_X emissions using the monthly heat input records, the NO_X emission factor for non-startup periods as determined during the most recent emissions test for that RICE, the number of startup events during the month, and the vendor-guaranteed NO_X emission rate for each startup event.
- On a monthly basis, TEP shall calculate and record total NO_X emissions for the ten RICE, both for the most recent month and as an annual sum calculated using data from the most recent month and the eleven immediately preceding months.

As discussed below, this proposal satisfies all regulatory requirements applicable to such voluntarily proposed requirements and to a PSD net emissions increase determination (the "netting analysis").

4.5.3.1 NO_X Emissions Decreases

The following requirements apply to the proposed shutdown of Units 1 and 2 at IGS and to the NO_X emissions decrease that will result from such shutdown:

- As required by 40 CFR § 52.21(b)(3)(ii), the emissions decrease from the proposed shutdown is contemporaneous because it will occur on or before the date on which the emissions increase from the RICE is deemed to occur. Pursuant to 40 CFR § 52.21(b)(3)(viii), this date is the end of the reasonable shakedown period for the RICE.

- As provided by 40 CFR § 52.21(b)(3)(i)(*b*) and (b)(3)(vi)(*a*), the creditable amount of the emissions decrease from the proposed shutdown is the amount by which the baseline actual emissions exceeds the new level of actual emissions. Pursuant to 40 CFR § 52.21(b)(48)(i), TEP has selected the 24-month period from January 2013 through December 2014, inclusive, as the baseline period. This baseline period is permissible because it occurs entirely within the five-year period immediately preceding when TEP will begin actual construction of the project. The average actual NO_X emissions rates during this period, based on U.S. EPA Air Markets Program Data, are 69.8 tpy from Unit 1 (76.0 tons in 2013 and 63.5 tons in 2014) and 69.9 tpy from Unit 2 (63.3 tons in 2013 and 76.4 tons in 2014).[15] The new level of actual emissions will be zero. The creditable amount of the emissions decrease is 139.6 tpy.

- As required by PCC § 17.12.190 and 40 CFR § 52.21(b)(3)(vi)(*b*) and (b)(3)(vi)(*a*), the emissions decrease from the proposed shutdown is permanent, quantifiable, and otherwise enforceable as a practical matter. TEP requests that, as part of the requested significant revision to the facility's Class I permit, PDEQ add permit terms requiring permanent shutdown of either Unit 1 or Unit 2 no later than 180 days following the initial startup of the fifth RICE installed at the IGS and permanent shutdown of both Units 1 and

[15] See, https://ampd.epa.gov/ampd/.

2 no later than 180 days following the initial startup of the tenth RICE installed at the IGS.

- As required by PCC § 17.12.190, the proposed requirement for permanent shutdown of Units 1 and 2 is at least as stringent as the emissions limitations, controls or other requirements that would otherwise be applicable and the requested permit does not waive, or make less stringent, any limitations or requirements. Specifically, without the voluntarily proposed shutdown of Units 1 and 2, there would be no requirement to reduce emissions from any existing units at the IGS and the net emissions increase from the RICE project would be significantly greater than the level shown in subsection 4.5.3.3.

4.5.3.2 NO_X Emission Cap

The following requirements apply to the proposed NO_X emission cap of 179.0 tpy for the ten RICE to be installed at the IGS:

- Pursuant to 40 CFR § 52.21(a)(2)(iv)(*d*), the emission cap of 179.0 tpy represents the emissions increase from the RICE project because it represents the difference between the total "potential to emit" and the total "baseline actual emissions" of the ten RICE. Pursuant to 40 CFR § 52.21(b)(48)(iii), the baseline actual emissions of the ten RICE are zero. Pursuant to 40 CFR § 52.21(b)(4), the emission cap of 179.0 tpy represents the total "potential to emit" of the ten RICE because it is legally and practicably enforceable by a state or local air pollution control agency.[16]

- As provided by PCC § 17.12.195(A), the requested emission cap for the ten RICE to be installed at the IGS is expressed in tpy as determined on a 12-month rolling total basis.

- As required by PCC § 17.12.195(C)(1), the requested emission cap, in conjunction with other permit terms, will ensure compliance with all applicable requirements for NO_X emissions from the ten RICE to be installed at the IGS. Specifically, other than the requested emission cap and the testing and recordkeeping requirements that TEP proposes as compliance demonstration measures in conjunction with the emission cap, the only applicable requirements for NO_X emissions from the RICE are those arising under the New Source Performance Standards. Compliance with those NO_X emission limitation will be demonstrated as discussed in section 4.7.2 herein.

- As required by PCC § 17.12.195(C)(2), TEP is proposing replicable procedures to ensure that the emissions cap is enforceable as a practical matter. Specifically:

[16] The codified regulatory language would require the limitation be "federally enforceable" rather than "legally and practicably enforceable by a state or local air pollution control agency." However, this rule language was vacated in *Chemical Mfrs. Ass'n v. EPA*, 1995 U.S. App. LEXIS 31475, Case No. 89-1514 (D.C. Cir. Sept. 15, 1995). Following that decision, pursuant to federal case law and U.S. EPA policy, limits must be legally and practicably enforceable by a state or local air pollution control agency. *See, e.g., U.S. v. Questar Gas Management Co.*, 2011 U.S. Dist. LEXIS 50648, Case No. 2:08-CV-167 (D. Ut. May 11, 2011).

- The proposed permit conditions, including the emission cap and the proposed monitoring, testing, and recordkeeping requirements, are permanent and quantifiable.
- The proposed permit conditions include a legally enforceable obligation to comply.
- The proposed permit conditions include a requirement for the use of in-place air pollution control equipment (*i.e.*, the proposed SCR systems).
- The proposed permit conditions include limits with averaging times consistent with the averaging times of the applicable requirement. (For purposes of this demonstration, the PSD significant level of 40 tpy is conservatively assumed to be an "applicable requirement.")
- The proposed permit conditions are enforceable and are independent of any other applicable limitations.

4.5.3.3 NO_X Netting

Pursuant to 40 CFR § 52.21(b)(3), other than the increases and decreases discussed above, there have been and will be no creditable increases or decreases in actual emissions at the IGS within the contemporaneous period. Thus, the net emissions increase is as follows:

NO_X increase from RICE project	179.0
NO_X decrease from shutdown of Units 1-2	139.6
Net NO_X increase	39.4
Significant level	40
Increase significant?	No

4.5.4 PSD Permit Application Requirements

Requirements pertaining to PSD permit applications are set forth at PCC §§ 17.16.550(B), 17.16.590(A), 17.16.600, and 17.16.630 and at 40 CFR § 52.21(n) and are summarized in subsection 1.3 herein. TEP's obligations with respect to substantive requirements of the PSD preconstruction permitting program are addressed below:

- Pursuant to PCC § 17.16.550(B)(2) and 40 CFR § 52.21(j)(1), applicable new source performance standards in Article VI of PCC Chapter 17.16 are addressed in subsection 4.7 herein.

- Pursuant to PCC §§ 17.16.590(A)(2) and 40 CFR § 52.21(j)(3), TEP has presented a proposed BACT analysis in Section 5 herein.

- As required by PCC §§ 17.16.550(C) and 17.16.590(A)(5) and 40 CFR § 52.21(k)(1) and (n)(2)(i), TEP has presented an air quality impacts analysis in Appendix C to this permit application.

- As required by PCC § 17.16.600(A)-(D) and 40 CFR § 52.21(m)(1), TEP has presented an ambient air quality analysis in Appendix C to this permit application.

- As required by PCC §§ 17.16.550(B)(3), 17.16.600(I), and 17.16.630 and 40 CFR § 52.21(o)(1), TEP has presented a visibility impairment analysis in Appendix C to this permit application.

4.6 Existing Stationary Source Performance Standards

The PDEQ emission standards for existing, stationary point sources are codified in Article IV of PCC Chapter 17.16. These standards do not apply to the RICE project because all point sources (i.e., each of the ten RICE) to be installed at the IGS will be a new source rather than an existing source.

4.7 New Source Performance Standards

The federal New Source Performance Standards ("NSPS") required by § 111 of the federal Clean Air Act are codified at 40 CFR part 60. These federal regulations are incorporated by reference at PCC § 17.16.490(A). Two NSPS rules are applicable to the RICE project, as discussed below.

4.7.1 NSPS General Provisions

As discussed in subsection 4.7.2 herein, each RICE to be installed at the IGS will be an affected facility under the NSPS for SI RICE.

Pursuant to 40 CFR § 60.1(a), the NSPS general provisions codified in subpart A of 40 CFR part 60 are applicable to the owner or operator of any stationary source which contains an affected facility subject to the requirements of any NSPS rule. The general provisions include notifications, compliance testing, monitoring, recordkeeping and reporting requirements.

Pursuant to 40 CFR § 60.4246 in the NSPS for SI RICE, the following are the specific applicable requirements for the RICE project under the NSPS general provisions.

- As required by 40 CFR § 60.4(a), all required reports and other submittals under the NSPS program shall be submitted in duplicate to the Director, Region IX Air Division, U.S. EPA, 75 Hawthorne Street, San Francisco, CA 94105. In addition, as required by 40 CFR § 60.4(b), all reports and required submittals under the NSPS general provisions shall be submitted to PDEQ. Because U.S. EPA has not delegated to PDEQ the authority to implement the NSPS for SI RICE, submittal requirements under that rule are not covered by the duplicate submission requirement at 40 CFR § 60.4(b).

- As provided by 40 CFR § 60.12, the owner or operator of an affected facility shall not build, erect, install, or use any article, machine, equipment or process, the use of which conceals an emission which would otherwise constitute a violation of an applicable standard.

In addition, if TEP elects to comply with the emission standards in the NSPS for SI RICE through performance testing, TEP shall meet the following requirements in the NSPS general provisions:

- Pursuant to 40 CFR §§ 60.7(a)(1) and 60.4245(c), TEP shall submit written notification of the date construction of an affected facility is commenced postmarked no later than 30 days after such date.

- Pursuant to 40 CFR §§ 60.8 and 60.4244(a), TEP shall provide performance testing facilities, conduct performance tests, and submit reports of the results of such performance tests in accordance with § 60.8(a) through (i).

Finally, pursuant to 40 CFR § 60.4246 in the NSPS for SI RICE, the following are notable requirements under the NSPS general provisions which are not applicable to the RICE project:

- Notification and recordkeeping requirements in 40 CFR § 60.7 are not applicable except to the limited extent that an initial notification is required pursuant to 40 CFR § 60.4245(c), as discussed above, if TEP elects to comply with the emission standards through performance testing.

- Performance testing requirements in 40 CFR § 60.8 are not applicable unless TEP elects to comply with the emission standards through performance testing.

- General duty requirements in 40 CFR § 60.11(d) are not applicable. Instead, the requirements of subpart JJJJ apply, including requirements either to operate according to the manufacturer's emission-related written instructions pursuant to 40 CFR § 60.4243(a)(1) or to operate the engine in a manner consistent with good air pollution control practice for minimizing emissions pursuant to 40 CFR § 60.4243(a)(2)(iii) or (b)(2)(ii).

- Monitoring requirements in 40 CFR § 60.13 are not applicable.

4.7.2 NSPS for Stationary SI RICE

Each RICE to be installed at the IGS will be an affected facility under this regulation, codified at subpart JJJJ of 40 CFR part 60, because it is a "stationary internal combustion engine" using "spark ignition," as those terms are defined at 40 CFR § 60.4248, and because TEP will commence construction after June 12, 2006, and each engine will be manufactured after July 1, 2007.

Following are the specific applicable requirements for each RICE under the NSPS for Stationary SI RICE:

- As required by 40 CFR § 60.4233(e), TEP shall comply with the applicable emission standards in Table 1 of subpart JJJJ.[17] Pursuant to 40 CFR § 60.4234, these emission standards apply over the entire life of the RICE. Because each RICE to be installed at the IGS is a natural gas-fueled, non-emergency SI RICE with a maximum engine power ≥ 500 horsepower and with a manufacture date after July 1, 2010, the applicable standards in Table 1 are as follows:

  - NO_X: 1.0 g/hp·hr
  - CO: 2.0 g/hp·hr
  - VOC (less formaldehyde): 0.7 g/hp·hr

- As required by 40 CFR § 60.4243(b), TEP has three options for demonstrating compliance with the emission standards:

  - Pursuant to 40 CFR § 60.4243(b)(1) and (a)(1): Purchase an engine certified according to procedures specified in subpart JJJJ, for the same model year; operate and maintain the engine and control device according to the manufacturer's emission-related written instructions; and keep records of conducted maintenance.
  - Pursuant to 40 CFR § 60.4243(b)(1) and (a)(2)(iii): Purchase an engine certified according to procedures specified in subpart JJJJ, for the same model year; keep a maintenance plan and records of conducted maintenance; to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions; conduct an initial performance test within 1 year of engine startup and conduct subsequent performance testing every 8,760 hours or 3 years, whichever comes first, thereafter.
  - Pursuant to 40 CFR § 60.4243(b)(2) and (b)(2)(ii): Purchase a non-certified engine; keep a maintenance plan and records of conducted maintenance; to the extent practicable, maintain and operate the engine in a manner consistent with good air pollution control practice for minimizing emissions; conduct an initial performance test and conduct subsequent performance testing every 8,760 hours or 3 years, whichever comes first, thereafter.

- If TEP elects to comply with the emission standards through performance testing, TEP shall follow the procedures in 40 CFR § 60.4244(a) through (g) for such testing.

- As required by 40 CFR § 60.4245(a)(1) and (a)(2), TEP shall maintain records of all notifications submitted to comply with subpart JJJJ, records of all documentation supporting any such notification; and records of maintenance conducted on the engine.

[17] For each engine category and each pollutant, Table 1 of subpart JJJJ includes both an output-based limit expressed in g/hp·hr and a concentration-based limit expressed in ppmvd. The facility owner or operator may elect to comply with either limit. Because the RICE to be installed at the IGS are highly efficient, the output-based limits are less restrictive; thus, only those limits are listed here.

- Pursuant to 40 CFR § 60.4245(a)(3), if TEP elects to comply with the emission standards by purchasing a certified engine, TEP shall maintain records of documentation from the manufacturer that the engine is certified to meet the applicable emission standards.

- Pursuant to 40 CFR § 60.4245(a)(4), if TEP elects to comply with the emission standards through performance testing, TEP shall maintain records of documentation that the engine meets the applicable emission standards in Table 1 of subpart JJJJ.

- Pursuant to 40 CFR § 60.4245(c), if TEP elects to comply with the emission standards through performance testing, TEP shall submit an initial notification as required in 40 CFR § 60.7(a)(1). The notification shall include the following information:

  - Name and address of the owner or operator;
  - The address of the affected source;
  - Engine information including make, model, engine family, serial number, model year, maximum engine power, and engine displacement;
  - Emission control equipment; and
  - Fuel used.

- Pursuant to 40 CFR § 60.4245(d), if TEP elects to comply with the emission standards through performance testing, TEP shall submit a copy of each performance test as required under 40 CFR § 60.4244 within 60 days after the test has been completed.

4.7.3 NSPS for Greenhouse Gas Emissions for Electric Generating Units

Each RICE to be installed at the IGS will not be an affected facility under this regulation, codified at subpart TTTT of 40 CFR part 60, because it is not an "electric generating unit," "integrated gasification combined cycle facility," "stationary combustion turbine," or "steam generating unit," as those terms are defined at 40 CFR § 60.5580.

4.8 National Emissions Standards for Hazardous Air Pollutants

The federal NESHAP regulations required by § 112 of the federal Clean Air Act, as amended, are codified at 40 CFR part 63. These federal regulations are incorporated by reference at PCC § 17.16.530(A). Two NESHAP rules are applicable to the RICE project, as discussed below.

4.8.1 NESHAP General Provisions

As discussed in subsection 4.8.2 herein, each RICE to be installed at the IGS will be an affected source under the NESHAP for Stationary RICE.

Pursuant to 40 CFR § 63.1(a)(4), certain of the NESHAP general provisions codified in subpart A of 40 CFR part 63 are applicable to the owner or operator of any affected source subject to the requirements of any NESHAP rule, as specified in that NESHAP rule; the general provisions applicable under the NESHAP for Stationary RICE are specified in 40 CFR § 63.6665. The

general provisions include notifications, compliance testing, monitoring, recordkeeping and reporting requirements.

Pursuant to 40 CFR § 63.6665, the following are the specific applicable requirements for the RICE project under the NESHAP general provisions.

- As provided by 40 CFR § 63.4(b), the owner or operator of an affected source shall not build, erect, install, or use any article, machine, equipment, or process to conceal an emission that would otherwise constitute noncompliance with a relevant standard.

- As provided by 40 CFR § 63.5(b)(3), no person may, without obtaining written approval in advance from PDEQ in accordance with the procedures specified in 40 CFR § 63.5(d), construct a new affected source at a major source of HAP emissions.

- As required by 40 CFR § 63.5(d)(1)-(2), TEP shall submit to PDEQ, as soon as practicable before actual construction of the RICE project begins, an application for approval of construction of each RICE. This document constitutes the required permit application. In addition, as provided by 40 CFR §§ 63.9(b)(1)(iii), 63.9(b)(4)(i), and 63.6645(c), the permit application also satisfies TEP's obligation to submit written notification of its intention to construct new affected sources subject to the NESHAP for Stationary RICE.

- As required by 40 CFR § 63.7(a)(2), and consistent with the requirements of 40 CFR § 63.6610(a), TEP shall conduct initial performance tests of each affected source within 180 days after startup. As provided in 40 CFR § 63.7(a)(4), if a force majeure is about to occur, occurs, or has occurred for which TEP intends to assert a claim of force majeure, TEP shall take the following actions. (For purposes of this provision, force majeure is defined at 40 CFR § 63.2 as "an event that will be or has been caused by circumstances beyond the control of the affected facility, its contractors, or any entity controlled by the affected facility that prevents the owner or operator from complying with the regulatory requirement to conduct performance tests within the specified timeframe despite the affected facility's best efforts to fulfill the obligation.")

    - TEP shall submit notification, in writing as soon as practicable following the date TEP first knew, or through due diligence should have known that the event may cause or caused a delay in testing beyond the performance test deadline, but the notification shall occur before the performance test deadline unless the initial force majeure or a subsequent force majeure event delays the notice, and in such cases, the notification shall occur as soon as practicable.
    - TEP shall include in the notification a written description of the force majeure event and a rationale for attributing the delay in testing beyond the performance test deadline to the force majeure; describe the measures taken or to be taken to minimize the delay; and identify a date by which TEP proposes to conduct the performance test. The performance test shall be conducted as soon as practicable after the force majeure occurs.

- As required by 40 CFR §§ 63.7(b)(1), 63.9(e), 63.6645(a), and 63.6645(g), TEP shall submit written notification of its intention to conduct a performance test at least 60 calendar days before the performance test is initially scheduled to begin to allow PDEQ, upon request, to review and approve the site-specific test plan required under 40 CFR § 63.7(c) and to have an observer present during the test. Pursuant to 40 CFR § 63.7(b)(2), in the event TEP is unable to conduct the performance test on the date specified in the notification due to unforeseeable circumstances beyond TEP's control, TEP shall submit notification as soon as practicable and without delay prior to the scheduled performance test date and specify the date when the performance test is rescheduled.

- As required by 40 CFR §§ 63.7(c)(2)(i) and 63.6645(a), before conducting a required performance test, TEP shall develop and, if requested by PDEQ, shall submit a site-specific test plan for approval. The test plan shall include a test program summary, the test schedule, data quality objectives, and both an internal and external quality assurance ("QA") program. Data quality objectives are the pretest expectations of precision, accuracy, and completeness of data.

- As required by 40 CFR §§ 63.7(c)(2)(ii) and 63.6645(a), the internal QA program required by 40 CFR § 63.7(c)(2)(i) shall include, at a minimum, the activities planned by routine operators and analysts to provide an assessment of test data precision; an example of internal QA is the sampling and analysis of replicate samples.

- As required by 40 CFR §§ 63.7(c)(2)(iii) and 63.6645(a), the performance testing required by 40 CFR § 63.7(a)(2) shall include a test method performance audit ("PA") during the performance test. The PAs consist of blind audit samples supplied by an accredited audit sample provider and analyzed during the performance test in order to provide a measure of test data bias. Gaseous audit samples are designed to audit the performance of the sampling system as well as the analytical system and must be collected by the sampling system during the performance test just as the compliance samples are collected. If a liquid or solid audit sample is designed to audit the sampling system, it must also be collected by the sampling system during the performance test. If multiple sampling systems or sampling trains are used during the performance test for any of the test methods, the tester is only required to use one of the sampling systems per method to collect the audit sample. The audit sample must be analyzed by the same analyst using the same analytical reagents and analytical system and at the same time as the compliance samples. Retests are required when there is a failure to produce acceptable results for an audit sample. However, if the audit results do not affect the compliance or noncompliance status of the affected source, PDEQ may waive the reanalysis requirement, further audits, or retests and accept the results of the performance test. Acceptance of the test results shall constitute a waiver of the reanalysis requirement, further audits, or retests. PDEQ may also use the audit sample failure and the performance test results as evidence to determine the compliance or noncompliance status of the affected source. A blind audit sample is a sample whose value is known only to the sample provider and is not revealed to the tested facility until after they report the measured value of the audit sample. For pollutants that exist in the gas phase at

ambient temperature, the audit sample shall consist of an appropriate concentration of the pollutant in air or nitrogen that can be introduced into the sampling system of the test method at or near the same entry point as a sample from the emission source. If no gas phase audit samples are available, an acceptable alternative is a sample of the pollutant in the same matrix that would be produced when the sample is recovered from the sampling system as required by the test method. For samples that exist only in a liquid or solid form at ambient temperature, the audit sample shall consist of an appropriate concentration of the pollutant in the same matrix that would be produced when the sample is recovered from the sampling system as required by the test method. An accredited audit sample provider ("AASP") is an organization that has been accredited to prepare audit samples by an independent, third party accrediting body. TEP or its representative shall obtain an audit sample, if commercially available, from an AASP for each test method used for regulatory compliance purposes. No audit samples are required for Method 10 of appendix A-4 of 40 CFR part 60 and Method 320 of appendix A of 40 CFR part 63. If multiple sources at a single facility are tested during a performance test event, only one audit sample is required for each method used during a performance test. PDEQ may waive the requirement to include an audit sample if they believe that an audit sample is not necessary. "Commercially available" means that two or more independent AASPs have blind audit samples available for purchase. If TEP or its representative cannot find an audit sample for a specific method, TEP or its representative shall consult the U.S. EPA Web site at the following URL, www.epa.gov/ttn/emc, to confirm whether there is a source that can supply an audit sample for that method. If the U.S. EPA Web site does not list an available audit sample at least 60 days prior to the beginning of the performance test, TEP or its representative shall not be required to include an audit sample as part of the quality assurance program for the performance test. When ordering an audit sample, TEP or its representative shall give the sample provider an estimate for the concentration of each pollutant that is emitted by the source or the estimated concentration of each pollutant based on the permitted level and the name, address, and phone number of PDEQ. TEP or its representative shall report the results for the audit sample along with a summary of the emission test results for the audited pollutant to PDEQ and shall report the results of the audit sample to the AASP. TEP or its representative shall make both reports at the same time and in the same manner or shall report to PDEQ first and then report to the AASP. If the method being audited is a method that allows the samples to be analyzed in the field and the tester plans to analyze the samples in the field, the tester may analyze the audit samples prior to collecting the emission samples provided a representative of PDEQ is present at the testing site. The tester may request, and PDEQ may grant, a waiver to the requirement that a representative of PDEQ must be present at the testing site during the field analysis of an audit sample. TEP or its representative may report the results of the audit sample to PDEQ and then report the results of the audit sample to the AASP prior to collecting any emission samples. The test protocol and final test report shall document whether an audit sample was ordered and utilized and the pass/fail results as applicable.

- As required by 40 CFR §§ 63.7(c)(2)(iv) and 63.6645(a), TEP shall submit the site-specific test plan to PDEQ upon request at least 60 calendar days before the performance test is scheduled to take place, that is, simultaneously with the notification of intention to

conduct a performance test required under 40 CFR § 63.7(b), or on a mutually agreed upon date.

- As provided by 40 CFR §§ 63.7(c)(3) and 63.6645(a), if submittal of the site-specific test plan is requested by PDEQ pursuant to 40 CFR § 63.7(c)(2)(i) and PDEQ fails to approve or disapprove the site-specific test plan within 30 calendar days after receipt of the original plan, or within 30 calendar days after receipt of any supplementary information submitted by TEP in response to notification of PDEQ's intention to disapprove the plan, the following conditions shall apply:

    - If TEP intends to demonstrate compliance using the test method(s) specified in 40 CFR § 63.6620(a), or with only minor changes to those tests methods, TEP shall conduct the performance test within the time specified in 40 CFR § 63.7(a)(2), using the method(s) specified in 40 CFR § 63.6620(a).
    - If TEP intends to demonstrate compliance by using an alternative to any test method specified in subpart ZZZZ, TEP is authorized to conduct the performance test using an alternative test method after PDEQ approves the use of the alternative method when PDEQ approves the site-specific test plan (if review of the site-specific test plan is requested) or after the alternative method is approved by PDEQ. However, TEP is authorized to conduct the performance test using an alternative method in the absence of notification of approval 45 days after submission of the site-specific test plan or request to use an alternative method. TEP is authorized to conduct the performance test within 60 calendar days after receiving authorization to demonstrate compliance using an alternative test method. Notwithstanding the requirements in the preceding three sentences, TEP may proceed to conduct the performance test required by 40 CFR § 63.7(a)(2) (without PDEQ's prior approval of the site-specific test plan) using the testing and monitoring methods specified in subpart ZZZZ instead of the alternative method(s).

- As required by 40 CFR § 63.7(d), TEP shall provide performance testing facilities for each RICE as follows:

    - Sampling ports adequate for test methods specified in 40 CFR § 63.6620. This includes constructing the air pollution control system such that volumetric flow rates and pollutant emission rates can be accurately determined by applicable test methods and procedures and providing a stack or duct free of cyclonic flow during performance tests, as demonstrated by applicable test methods and procedures;
    - Safe sampling platform(s);
    - Safe access to sampling platform(s);
    - Utilities for sampling and testing equipment; and
    - Any other facilities that PDEQ deems necessary for safe and adequate testing of a source.

- As required by 40 CFR §§ 63.7(g), 63.9(h), 63.10(d)(2), and 63.6645(a) and (h), TEP shall submit to PDEQ a Notification of Compliance Status, including a report containing

the results of each performance test required by 40 CFR §§ 63.6610(a) and 63.6620(a)-(b), in accordance with the following:

- Results shall be submitted before the close of business on the 60th day following the completion of each performance test or other relevant compliance demonstration activity. A performance test is "completed" when field sample collection is terminated. For example, a notification shall be sent before close of business on the 60th day following completion of the initial performance test and again before the close of business on the 60th day following the completion of any subsequent required performance test. Notifications may be combined as long as the due date requirement for each notification is met.
- Results of a performance test shall include the analysis of samples, determination of emissions, and raw data.
- The report for a performance test shall include general identification information for the facility including a mailing address, the physical address, the owner or operator or responsible official (where applicable) and his/her email address, and the appropriate Federal Registry System number for the facility; identification of the company conducting the performance test including the primary office address, telephone number, and the contact for this test including his/her email address; the purpose of the test including the applicable regulation requiring the test, the pollutant(s) and other parameters being measured, the applicable emission standard, and any process parameter component; a brief process description; a description of the emission unit tested including fuel burned, control devices, and vent characteristics; the appropriate source classification code; the permitted maximum process rate (where applicable); the sampling location; descriptions of sampling and analysis procedures used and any modifications to standard procedures; descriptions of quality assurance procedures and results; a record of process operating conditions that demonstrate the applicable test conditions are met; values for any operating parameters for which limits were being set during the test; and, if such records are required by the test method, records of preparation of standards, records of calibrations, raw data sheets for field sampling, raw data sheets for field and laboratory analyses, chain-of-custody documentation, and example calculations for reported results.
- If TEP submits estimates or preliminary information in the application for approval of construction required in 40 CFR § 63.5(d) in place of the actual emissions data or control efficiencies required in 40 CFR § 63.5(d)(1)(ii)(H) and (d)(2), TEP shall submit the actual emissions data and other correct information as soon as available but no later than with the initial notification of compliance status.

- As required by 40 CFR § 63.8(c)(1), for each CEMS required by subpart ZZZZ, TEP shall maintain and operate the CEMS as specified in 40 CFR § 63.6625(a) and in a manner consistent with good air pollution control practices and shall keep the necessary parts for routine repairs of the affected CEMS equipment readily available.

- As required by 40 CFR § 63.8(c)(2), for each CEMS required by subpart ZZZZ, the CEMS must be installed such that representative measures of emissions from the affected source are obtained. TEP shall ensure the read out (that portion of the CEMS that

provides a visual display or record), or other indication of operation, is readily accessible on site for operational control or inspection by the operator of the equipment. In addition, the CEMS must be located according to procedures contained in the applicable performance specification(s).

- As required by 40 CFR § 63.8(c)(3), each CEMS required by subpart ZZZZ shall be installed, operational, and the data verified either prior to or in conjunction with conducting performance tests as required by 40 CFR § 63.7. Verification of operational status shall, at a minimum, include completion of the manufacturer's written specifications or recommendations for installation, operation, and calibration of the system.

- As provided by 40 CFR § 63.8(c)(7), a CEMS is out-of-control if the zero (low-level), mid-level (if applicable), or high-level calibration drift ("CD") exceeds two times the applicable CD specification in the applicable performance specification or if the CEMS fails a performance test audit (*e.g.*, cylinder gas audit), relative accuracy audit, relative accuracy test audit, or linearity test audit. When a CEMS required by subpart ZZZZ is out-of-control, TEP shall take the necessary corrective action and shall repeat all necessary tests which indicate that the system is out of control. TEP shall take corrective action and conduct retesting until the performance requirements are below the applicable limits. The beginning of the out-of-control period is the hour TEP conducts a performance check (*e.g.*, calibration drift) that indicates an exceedance of the applicable performance requirements. The end of the out-of-control period is the hour following the completion of corrective action and successful demonstration that the system is within the allowable limits. During the period the CEMS is out-of-control, recorded data shall not be used in data averages and calculations, or to meet any applicable data availability requirement.

- As required by 40 CFR § 63.8(c)(8), for each CEMS required by subpart ZZZZ, TEP shall submit all information concerning out-of-control periods, including start and end dates and hours and descriptions of corrective actions taken, in the excess emissions and performance report required under 40 CFR § 63.10(e)(3).

- As required by 40 CFR § 63.8(d)(2), for each CEMS required by subpart ZZZZ, TEP shall develop and implement a quality control program. As part of the quality control program, TEP shall develop and submit to PDEQ for approval upon request a site-specific performance evaluation test plan for the performance evaluation required in 40 CFR § 63.8(e)(3). In addition, each quality control program shall include, at a minimum, a written protocol that describes procedures for each of the following operations:

  - Initial and any subsequent calibration of the CEMS;
  - Determination and adjustment of the calibration drift of the CEMS;
  - Preventive maintenance of the CEMS, including spare parts inventory;
  - Data recording, calculations, and reporting;
  - Accuracy audit procedures, including sampling and analysis methods; and
  - Program of corrective action for a malfunctioning CEMS.

- As required by 40 CFR §§ 63.8(d)(3) and 63.6655(b)(2), for each CEMS required by subpart ZZZZ, TEP shall keep the written procedures required by 40 CFR § 63.8(d)(2) on record for the life of the affected source or until the affected source is no longer subject to the provisions of subpart ZZZZ, to be made available for inspection, upon request, by PDEQ. If the performance evaluation plan is revised, TEP shall keep previous (*i.e.*, superseded) versions of the performance evaluation plan on record to be made available for inspection, upon request by PDEQ, for a period of five years after each revision to the plan.

- As required by 40 CFR §§ 63.8(e)(2) and 63.6645(a), for each CEMS required by subpart ZZZZ, TEP shall notify PDEQ in writing of the date of the performance evaluation simultaneously with the notification of the performance test date required under 40 CFR § 63.7(b).

- As required by 40 CFR §§ 63.8(e)(3)(i) and 63.6645(a), for each CEMS required by subpart ZZZZ, before conducting a required CEMS performance evaluation, TEP shall develop and submit a site-specific performance evaluation test plan to PDEQ for approval upon request. The performance evaluation test plan shall include the evaluation program objectives, an evaluation program summary, the performance evaluation schedule, data quality objectives, and both an internal and external QA program. Data quality objectives are the pre-evaluation expectations of precision, accuracy, and completeness of data.

- As required by 40 CFR §§ 63.8(e)(3)(ii) and 63.6645(a), the internal QA program required by 40 CFR § 63.8(e)(3)(i) shall include, at a minimum, the activities planned by routine operators and analysts to provide an assessment of CEMS performance. The external QA program shall include, at a minimum, systems audits that include the opportunity for on-site evaluation by PDEQ of instrument calibration, data validation, sample logging, and documentation of quality control data and field maintenance activities.

- As required by 40 CFR §§ 63.8(e)(3)(iii) and 63.6645(a), TEP shall submit the site-specific performance evaluation test plan (if requested by PDEQ) at least 60 days before the performance test or performance evaluation is scheduled to begin, or on a mutually agreed upon date, and review and approval of the performance evaluation test plan by PDEQ will occur with the review and approval of the site-specific test plan (if review of the site-specific test plan is requested).

- As required by 40 CFR § 63.8(e)(3)(v), in the event that PDEQ fails to approve or disapprove the site-specific performance evaluation test plan within the time period specified in 40 CFR § 63.7(c)(3), the following conditions shall apply:

    - If TEP intends to demonstrate compliance using the monitoring method(s) specified in 40 CFR § 63.6625(a), TEP shall conduct the performance evaluation within the

time specified in 40 CFR § 63.8(e)(4), using the method(s) specified in 40 CFR § 63.6625(a).

- If TEP intends to demonstrate compliance by using an alternative to a monitoring method specified in 40 CFR § 63.6625(a), TEP shall refrain from conducting the performance evaluation until PDEQ approves the use of the alternative method. If PDEQ does not approve the use of the alternative method within 30 days before the performance evaluation is scheduled to begin, the performance evaluation deadlines specified in 40 CFR § 63.8(e)(4) may be extended such that TEP shall conduct the performance evaluation within 60 calendar days after PDEQ approves the use of the alternative method. Notwithstanding the requirements in the preceding two sentences, TEP may proceed to conduct the performance evaluation required by 40 CFR § 63.8(e)(1) (without PDEQ's prior approval of the site-specific performance evaluation test plan) using the monitoring method(s) specified in 40 CFR § 63.6625(a) instead of the alternative method(s).

- As required by 40 CFR § 63.8(e)(4), for each CEMS required by subpart ZZZZ, TEP shall conduct a performance evaluation during any performance test required under 40 CFR § 63.7 in accordance with the applicable performance specification specified in 40 CFR § 63.6625(a).

- As required by 40 CFR § 63.8(e)(5), for each performance evaluation required by 40 CFR § 63.8(e)(1) and (e)(4), TEP shall report the results of the performance evaluation simultaneously with the results of the performance test required under 40 CFR § 63.7.

- As provided by 40 CFR § 63.9(b)(4)(v), TEP shall provide to PDEQ in writing a notification of the actual date of startup of each RICE, delivered or postmarked within 15 calendar days after that date.

- As required by 40 CFR §§ 63.9(g) and 63.6645, TEP shall submit notification of the date each CEMS performance evaluation required under 40 CFR § 63.8(e)(1) and (e)(4) is scheduled to begin. Such notification shall be submitted simultaneously with the notification of the performance test date required under 40 CFR § 63.7(b).

- As required by 40 CFR § 63.9(j), any change in the information already provided under 40 CFR § 63.9 shall be provided to PDEQ in writing within 15 calendar days after the change.

- As required by 40 CFR §§ 63.9(a)(4)(ii), 63.10(a)(4)(ii), and 63.13(a), all required reports and other submittals under the NESHAP program shall be submitted to the Director, Region IX Air Division, U.S. EPA, 75 Hawthorne Street, San Francisco, CA 94105. In addition, as required by 40 CFR §§ 63.10(a)(4)(ii), 63.12(c), and 63.13(b), all reports and required submittals under the NESHAP general provisions shall be submitted to PDEQ. However, as documented at 40 CFR § 63.99(a)(3), U.S. EPA has not delegated to PDEQ the authority to implement the NESHAP for Stationary RICE; thus, submittal requirements under that rule are not covered by the duplicate submission requirement at 40 CFR §§ 63.10(a)(4)(ii), 63.12(c), and 63.13(b).

- As required by 40 CFR §§ 63.7(g)(3), 63.10(b)(1) and 63.6655(a)(1), TEP shall maintain files of all information (including all reports and notifications) required by the NESHAP program recorded in a form suitable and readily available for expeditious inspection and review. The files shall be retained for at least five years following the date of each occurrence, measurement, maintenance, corrective action, report, or record. At a minimum, the most recent two years of data shall be retained on site. The remaining three years of data may be retained off site. Such files may be maintained on microfilm, on a computer, on computer floppy disks, on magnetic tape disks, or on microfiche.

- As required by 40 CFR §§ 63.10(b)(1) and 63.6655(b)(2)(xiv), TEP shall maintain records of all documentation supporting initial notifications and notifications of compliance status submitted pursuant to 40 CFR § 63.9.

- As required by 40 CFR §§ 63.10(b)(2)(viii) and 63.6655(a)(3), TEP shall maintain records of any performance tests and any CEMS or CPMS performance evaluations required by subpart ZZZZ.

- As required by 40 CFR §§ 63.10(b)(2)(iii) and 63.6655(a)(4), TEP shall maintain records of all required maintenance performed on the air pollution control equipment and monitoring equipment required by subpart ZZZZ.

- As required by 40 CFR §§ 63.10(b)(2)(vi) and 63.6655(b)(1), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of each period during which the CEMS or CPMS is malfunctioning or inoperative (including out-of-control periods).

- As required by 40 CFR §§ 63.10(b)(2)(vii), 63.6655(b)(1) and 63.6655(d), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of all required measurements needed to demonstrate compliance with a relevant standard (including, but not limited to, 15-minute averages of CEMS or CPMS data, raw performance testing measurements, and raw performance evaluation measurements, that support data that the source is required to report). For a CEMS, the following additional provisions apply:

    - This paragraph applies if the installed CEMS is automated and the calculated data averages do not exclude periods of CEMS breakdown or malfunction. An automated CEMS records and reduces the measured data to the form of the pollutant emission standard through the use of a computerized data acquisition system. In lieu of maintaining a file of all CEMS subhourly measurements as otherwise required under 40 CFR § 63.10(b)(2)(vii), TEP shall retain the most recent consecutive three averaging periods of sub hourly measurements and a file that contains a hard copy of the data acquisition system algorithm used to reduce the measured data into the reportable form of the standard.
    - This paragraph applies if the measured data is manually reduced to obtain the reportable form of the standard and the calculated data averages do not exclude periods of CEMS breakdown or malfunction. In lieu of maintaining a file of all CEMS sub hourly measurements as otherwise required under 40 CFR

§ 63.10(b)(2)(vii), TEP shall retain all sub hourly measurements for the most recent reporting period. The sub hourly measurements shall be retained for 120 days from the date of the most recent summary or excess emission report submitted to the U.S. EPA Administrator.

- As required by 40 CFR §§ 63.10(b)(2)(ix) and 63.6655(b)(1), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of all measurements as may be necessary to determine the conditions of required performance tests and performance evaluations.

- As required by 40 CFR § 63.10(b)(2)(x), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of all required adjustments and maintenance performed on the CEMS or CPMS.

- As required by 40 CFR § 63.10(b)(2)(xi), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of all required CEMS or CPMS calibration checks.

- As required by 40 CFR § 63.10(c)(1), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of all required CEMS or CPMS measurements (including monitoring data recorded during unavoidable CEMS or CPMS breakdowns and out-of-control periods).

- As required by 40 CFR § 63.10(c)(5), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of the date and time identifying each period during which the CEMS or CPMS was inoperative except for zero (low-level) and high-level checks.

- As required by 40 CFR § 63.10(c)(6), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of the date and time identifying each period during which the CEMS or CPMS was out-of-control, as defined in 40 CFR § 63.8(c)(7).

- As required by 40 CFR § 63.10(c)(7), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of the specific identification (*i.e.*, the date and time of commencement and completion) of each period of excess emissions and parameter monitoring exceedances, as defined in subpart ZZZZ, that occurs during startups, shutdowns, and malfunctions of the affected source.

- As required by 40 CFR § 63.10(c)(8), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of the specific identification (*i.e.*, the date and time of commencement and completion) of each time period of excess emissions and parameter monitoring exceedances, as defined in subpart ZZZZ, that occurs during periods other than startups, shutdowns, and malfunctions of the affected source.

- As required by 40 CFR § 63.10(c)(10), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of the nature and cause of any malfunction (if known).

- As required by 40 CFR § 63.10(c)(11), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of the corrective action taken or preventive measures adopted.

- As required by 40 CFR § 63.10(c)(12), TEP shall maintain records of the nature of the repairs or adjustments to any CEMS or CPMS required by subpart ZZZZ that was inoperative or out-of-control.

- As required by 40 CFR § 63.10(c)(13), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of the total process operating time during each semiannual reporting period.

- As required by 40 CFR § 63.10(c)(14), for each CEMS or CPMS required by subpart ZZZZ, TEP shall maintain records of all procedures that are part of a quality control program developed and implemented for the CEMS or CPMS under 40 CFR § 63.8(d).

- As required by 40 CFR § 63.10(e)(2), for each CEMS or CPMS required by subpart ZZZZ, TEP shall submit a written report of the results of the CEMS or CPMS performance evaluation, as required under 40 CFR § 63.8(e), simultaneously with the results of the performance test required under 40 CFR § 63.7.

- As required by 40 CFR § 63.10(e)(3), for each CEMS or CPMS required by subpart ZZZZ, TEP shall submit an excess emissions and performance report and/or a summary report semiannually in accordance with the following provisions:

    - All excess emissions and monitoring system performance reports and all summary reports, if required, shall be delivered or postmarked by the 30th day following the end of each calendar half or quarter, as appropriate.
    - If the total duration of excess emissions or process or control system parameter exceedances for the reporting period is less than 1 percent of the total operating time for the reporting period, and CEMS or CPMS downtime for the reporting period is less than 5 percent of the total operating time for the reporting period, only the summary report shall be submitted, and the full excess emissions and continuous monitoring system performance report need not be submitted.
    - If the total duration of excess emissions or process or control system parameter exceedances for the reporting period is 1 percent or greater of the total operating time for the reporting period, or the total CEMS or CPMS downtime for the reporting period is 5 percent or greater of the total operating time for the reporting period, both the summary report and the excess emissions and continuous monitoring system performance report shall be submitted.
    - Written reports of excess emissions or exceedances of process or control system parameters shall include all the information required in 40 CFR §§ 63.8(c)(7)-(8) and 40 CFR § 63.10(c)(5)-(13) and shall contain the name, title, and signature of the responsible official who is certifying the accuracy of the report. When no excess emissions or exceedances of a parameter have occurred, or a CEMS or CPMS has not

been inoperative, out-of-control, repaired, or adjusted, such information shall be stated in the report.

- Summary reports shall be entitled "Summary Report—Gaseous and Opacity Excess Emission and Continuous Monitoring System Performance" and shall contain the following information: company name and address of the affected source; identification of each hazardous air pollutant monitored at the affected source; the beginning and ending dates of the reporting period; a brief description of the process units; the applicable emission and operating parameter limitations; the monitoring equipment manufacturer(s) and model number(s); the date of the latest CEMS or CPMS certification or audit; the total operating time of the affected source during the reporting period; an emission data summary (or similar summary if the owner or operator monitors control system parameters), including the total duration of excess emissions during the reporting period (recorded in hours for gases), the total duration of excess emissions expressed as a percent of the total source operating time during that reporting period, and a breakdown of the total duration of excess emissions during the reporting period into those that are due to startup/shutdown, control equipment problems, process problems, other known causes, and other unknown causes; a performance summary for the CEMS or CPMS (or similar summary if the owner or operator monitors control system parameters), including the total CEMS or CPMS downtime during the reporting period (recorded in hours), the total duration of CEMS or CPMS downtime expressed as a percent of the total source operating time during that reporting period, and a breakdown of the total CEMS or CPMS downtime during the reporting period into periods that are due to monitoring equipment malfunctions, nonmonitoring equipment malfunctions, quality assurance/quality control calibrations, other known causes, and other unknown causes; a description of any changes in CEMS or CPMS, processes, or controls since the last reporting period; the name, title, and signature of the responsible official who is certifying the accuracy of the report; and the date of the report.

Finally, pursuant to 40 CFR § 63.6665 and Table 8 in the NESHAP for Stationary RICE, the following are notable requirements under the NESHAP general provisions which are not applicable to the RICE project:

- Operation and maintenance requirements in 40 CFR § 63.6(e) are not applicable.

- Requirements in 40 CFR § 63.8 are not applicable to any CPMS because U.S. EPA has not promulgated performance specifications for CPMS and, pursuant to § 63.8(a)(2), the provisions of § 63.8 apply only to monitoring systems for which U.S. EPA has promulgated performance specifications.

4.8.2 NESHAP for Stationary RICE

Each RICE to be installed at the IGS will be an affected source under this regulation, codified at subpart ZZZZ of 40 CFR part 63, because it is a "stationary RICE" and a "new stationary RICE" as those terms are defined at 40 CFR §§ 63.6675 and 63.6590(a)(2), respectively. In addition, as established in Class I Air Quality Permit No. 1052, the IGS is a major source of HAP emissions,

so each RICE will be subject to the NESHAP requirements for a new stationary RICE located at a major source of HAP emissions.

Following are the specific applicable requirements for each RICE under the NESHAP for Stationary RICE:

- As required by 40 CFR § 63.6600(b), TEP shall comply with the applicable emission limitation for periods other than startup in Table 2a of subpart ZZZZ. Compliance with the emission limitations is based on the average of three 1-hour runs using the testing requirements and procedures in 40 CFR § 63.6620 and Table 4 of subpart ZZZZ. Because each RICE to be installed at the IGS is new, four-stroke, lean-burn, stationary RICE with a site rating ≥ 500 brake horsepower and located at a major source of HAP emissions, the applicable emission limitations in Table 2a are as follows. TEP shall elect to comply with one of these limitations.

    - Except during periods of startup, when operating at 100 percent load plus or minus 10 percent, reduce CO emissions by 93 percent or more, or
    - Except during periods of startup, when operating at 100 percent load plus or minus 10 percent, limit concentration of formaldehyde in the stationary RICE exhaust to 14 ppmvd or less at 15 percent O_2.

- As required by 40 CFR §§ 63.6600(b) and 63.6625(h), during periods of startup, TEP shall minimize the engine's time spent at idle and minimize the engine's startup time to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes, after which time the non-startup emission limitation applies.

- As required by 40 CFR § 63.6600(b), TEP shall comply with the applicable operating limitation in Table 2b of subpart ZZZZ. Because each RICE to be installed at the IGS is new, four-stroke, lean-burn, stationary RICE with a site rating ≥ 500 brake horsepower, located at a major source of HAP emissions, and using an oxidation catalyst, the applicable operating limitations in Table 2b are as follows.

    - Except during periods of startup, maintain the oxidation catalyst so that the pressure drop across the catalyst does not change by more than 2 inches of water at 100 percent load plus or minus 10 percent from the pressure drop across the catalyst that was measured during the initial performance test; and
    - Except during periods of startup, maintain the temperature of the stationary RICE exhaust so that the catalyst inlet temperature is greater than or equal to 450 °F and less than or equal to 1350 °F.

- As required by 40 CFR § 63.6605, TEP shall, at all times, operate and maintain each RICE, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions. The general duty to minimize emissions does not require TEP to make any further efforts to reduce emissions if levels required by this standard have been achieved. Determination of whether such operation and maintenance procedures are being used will

be based on information available to the U.S. EPA Administrator which may include, but is not limited to, monitoring results, review of operation and maintenance procedures, review of operation and maintenance records, and inspection of the source.

- As required by 40 CFR §§ 63.6610(a) and 63.6620(a)-(b), within 180 days after startup, TEP shall conduct the initial performance test required by Table 4 of subpart ZZZZ according to the provisions in 40 CFR § 63.7(a)(2) and (a)(4).

- As required by 40 CFR §§ 63.6615 and 63.6620(a)-(b), TEP shall conduct subsequent performance tests on each RICE semiannually. After TEP has demonstrated compliance for two consecutive tests, TEP may reduce the frequency of subsequent performance tests to annually. If the results of any subsequent annual performance test indicate the RICE is not in compliance with the applicable emission limitation, or TEP deviates from any of the operating limitations required by 40 CFR § 63.6600(b), TEP shall resume semiannual performance tests.

- As provided by 40 CFR § 63.6620(b), each initial and subsequent performance test shall be conducted at any load condition within plus or minus 10 percent of 100 percent load. As provided by 40 CFR § 63.6620(i), the engine percent load during a performance test shall be determined by documenting the calculations, assumptions, and measurement devices used to measure or estimate the percent load in a specific application. A written report of the average percent load determination shall be included in the notification of compliance status required by 40 CFR §§ 63.9(h) and 63.6645(h). The following information shall be included in the written report: the engine model number, the engine manufacturer, the year of purchase, the manufacturer's site-rated brake horsepower, the ambient temperature, pressure, and humidity during the performance test, and all assumptions that were made to estimate or calculate percent load during the performance test shall be clearly explained. If measurement devices such as flow meters, kilowatt meters, beta analyzers, strain gauges, etc. are used, the model number of the measurement device, and an estimate of its accuracy in percentage of true value shall be provided.

- As required by 40 CFR § 63.6620(d), each initial and subsequent performance test shall comprise three separate test runs and each test run shall last at least 1 hour.

- As required by 40 CFR § 63.6620(e), for each initial and subsequent performance test, data shall be reduced in accordance with § 63.6620(e)(1)-(2), as applicable.

- As required by 40 CFR § 63.6630(a), TEP shall demonstrate initial compliance in accordance with Table 5 of subpart ZZZZ, including the requirements relating to monitoring. Because each RICE to be installed at the IGS is new, four-stroke, lean-burn, stationary RICE with a site rating ≥ 500 brake horsepower and located at a major source of HAP emissions, the applicable monitoring requirements in Table 5 are as follows. TEP shall comply with one of the following requirements, as applicable:

    - If TEP elects to comply with the requirement to reduce CO emissions as provided by 40 CFR § 63.6600(b), TEP may elect to install, operate, and maintain a continuous

emissions monitoring system ("CEMS") to monitor CO and either O_2 or CO_2 at both the inlet and outlet of the oxidation catalyst; or

- If TEP elects to comply with either the requirement to reduce CO emissions or the requirement to limit the concentration of formaldehyde in the RICE exhaust as provided by 40 CFR § 63.6600(b), TEP may elect to install a continuous parameter monitoring system ("CPMS") to monitor catalyst inlet temperature.

- As required by 40 CFR §§ 63.8(c)(4), 63.8(e)(1), 63.8(g), and 63.6625(a), if TEP elects to elects to install a CEMS, TEP shall meet the following requirements:

  - Each CEMS shall be installed, operated, and maintained according to the applicable performance specifications of 40 CFR part 60, appendix B.
  - TEP shall conduct an initial performance evaluation and an annual relative accuracy test audit ("RATA") of each CEMS according to the requirements in 40 CFR § 63.8 and according to the applicable performance specifications of 40 CFR part 60, appendix B as well as daily and periodic data quality checks in accordance with 40 CFR part 60, appendix F, procedure 1.
  - Except for system breakdowns, out-of-control periods, repairs, maintenance periods, calibration checks, and zero (low-level) and high-level calibration drift adjustments, each CEMS required by subpart ZZZZ shall be in continuous operation, shall meet minimum frequency of operation requirements, and shall complete a minimum of one cycle of operation (sampling, analyzing, and data recording) for each successive 15-minute period.
  - Monitoring data recorded during periods of unavoidable CEMS breakdowns, out-of-control periods, repairs, maintenance periods, calibration checks, and zero (low-level) and high-level adjustments must not be included in any data average computed under this part.
  - Data from CEMS shall be reduced to 1-hour averages computed from four or more data points equally spaced over each 1-hour period, except during periods when calibration, quality assurance, or maintenance activities are being performed. During these periods, a valid hourly average shall consist of at least two data points with each representing a different 15-minute period. Alternatively, an arithmetic or integrated 1-hour average of CEMS data may be used. Data from CEMS shall be recorded in parts per million at 15 percent oxygen or the equivalent CO_2 concentration.
  - Data from CEMS shall be converted into units of the relevant standard for reporting purposes. After conversion into units of the relevant standard, the data may be rounded to the same number of significant digits as used in that standard to specify the emission limit (*e.g.*, rounded to the nearest 1 percent opacity).

- As required by 40 CFR § 63.6625(b), if TEP elects to elects to install, operate, and maintain a CPMS, TEP shall meet the following requirements:

  - TEP shall prepare a site-specific monitoring plan that addresses the following monitoring system design, data collection, and quality assurance and quality control elements: Performance criteria and design specifications for the monitoring system equipment, including the sample interface, detector signal analyzer, and data

acquisition and calculations; sampling interface (*e.g.*, thermocouple) location such that the monitoring system will provide representative measurements; equipment performance evaluations, system accuracy audits, or other audit procedures; ongoing operation and maintenance procedures in accordance with provisions in 40 CFR § 63.8(c)(1)(ii) and (c)(3); and ongoing reporting and recordkeeping procedures in accordance with provisions in 40 CFR § 63.10(c), (e)(1), and (e)(2)(i).

- TEP shall install, operate, and maintain each CPMS in continuous operation according to the procedures in the site-specific monitoring plan.
- The CPMS must collect data at least once every 15 minutes.
- For a CPMS for measuring temperature range, the temperature sensor must have a minimum tolerance of 2.8 °C (5 °F) or 1 percent of the measurement range, whichever is larger.
- TEP shall conduct the CPMS equipment performance evaluation, system accuracy audits, or other audit procedures specified in the site-specific monitoring plan at least annually.
- TEP shall conduct a performance evaluation of each CPMS in accordance with the site-specific monitoring plan.

- As required by 40 CFR §§ 63.6630(a)-(b) and 63.6640(b), if TEP elects to install a CPMS rather than a CO CEMS, TEP shall demonstrate compliance in accordance with Table 5 of subpart ZZZZ, including the following requirements relating to establishment of operating limitations: TEP shall record the catalyst pressure drop and catalyst inlet temperature during the initial performance test. In the event that the oxidation catalyst is replaced, TEP shall reestablish the values of the operating parameters measured during the initial performance test. At the time the values of your operating parameters are reestablished, TEP shall also conduct a performance test to demonstrate that TEP is meeting the applicable emission limitation pursuant to 40 CFR § 63.6600(b).

- As required by 40 CFR § 63.6635, except for monitor malfunctions, associated repairs, required performance evaluations, and required quality assurance or control activities, TEP shall operate the required CEMS or CPMS continuously at all times that the stationary RICE is operating. A monitoring malfunction is any sudden, infrequent, not reasonably preventable failure of the monitoring to provide valid data. Monitoring failures that are caused in part by poor maintenance or careless operation are not malfunctions. TEP may not use data recorded during monitoring malfunctions, associated repairs, and required quality assurance or control activities in data averages and calculations used to report emission or operating levels. TEP shall, however, use all the valid data collected during all other periods.

- As required by 40 CFR § 63.6640(a), TEP shall demonstrate continuous compliance in accordance with Table 6 of subpart ZZZZ, including the requirements relating to monitoring. Because each RICE to be installed at the IGS is new, four-stroke, lean-burn, stationary RICE with a site rating ≥ 500 brake horsepower and located at a major source of HAP emissions, the applicable monitoring requirements in Table 6 are as follows. TEP shall comply with the following requirements, as applicable:

- If TEP elects to comply with the requirement to reduce CO emissions as provided by 40 CFR § 63.6600(b) and elects to install a CO CEMS, TEP shall install, operate, and maintain the CO CEMS and collect monitoring data according to the requirements in 40 CFR § 63.6625(a). TEP shall demonstrate continuous compliance by reducing the measurements to 1-hour averages, calculating the percent reduction according to §63.6620, and demonstrating that the catalyst achieves the required percent reduction of CO emissions over the 4-hour averaging period.
- If TEP elects to comply with either the requirement to reduce CO emissions or the requirement to limit the concentration of formaldehyde in the RICE exhaust as provided by 40 CFR § 63.6600(b) and elects to install a CPMS rather than a CO CEMS, TEP shall install, operate, and maintain the CPMS and collect the catalyst inlet temperature data according to the requirements in 40 CFR § 63.6625(b). TEP shall demonstrate continuous compliance by reducing these data to 4-hour rolling averages and maintaining the 4-hour rolling averages within the operating limitation for catalyst inlet temperature. TEP also shall measure the pressure drop across the catalyst once per month and demonstrate that the pressure drop across the catalyst is within the operating limitation established during the performance test.

- As provided by 40 CFR § 63.6640(d), deviations from the emission or operating limitations that occur during the first 200 hours of operation from engine startup (engine burn-in period) are not violations.

- As required by 40 CFR § 63.6650, TEP shall submit semiannual compliance reports in accordance with the following provisions:

  - The first compliance report shall cover the period beginning on the date of startup and ending on June 30 or December 31, whichever date is the first date following the end of the first calendar half after the date of startup. The first compliance report shall be postmarked or delivered no later than July 31 or January 31, whichever date follows the end of the first calendar half after the date of startup.
  - Each subsequent compliance report shall cover the semiannual reporting period from January 1 through June 30 or the semiannual reporting period from July 1 through December 31 and shall be postmarked or delivered no later than July 31 or January 31, whichever date is the first date following the end of the semiannual reporting period.
  - Each compliance report shall contain the company name and address; a statement by a responsible official, with that official's name, title, and signature, certifying the accuracy of the content of the report; and the date of the report and the beginning and ending dates of the reporting period.
  - If there are no deviations from any applicable emission limitations or operating limitations under subpart ZZZZ, the compliance report shall contain a statement that there were no deviations from the emission limitations or operating limitations during the reporting period.
  - If there were no periods during which the CEMS or CPMS required by subpart ZZZZ was out-of-control, as specified in 40 CFR § 63.8(c)(7), the compliance report shall

contain a statement that there were no periods during which the CEMS or CPMS was out-of-control during the reporting period.

- If TEP had a deviation from any applicable emission limitation or operating limitation under subpart ZZZZ and for which TEP is not using a CEMS or CPMS to demonstrate compliance with the emission or operating limitations, the report shall contain, for each such deviation during the reporting period, the total operating time of the stationary RICE at which the deviation occurred during the reporting period; information on the number, duration, and cause of deviations (including unknown cause, if applicable), as applicable; and the corrective action taken.
- If TEP had a deviation from any applicable emission limitation or operating limitation under subpart ZZZZ and for which TEP is using a CEMS or CPMS to demonstrate compliance with the emission or operating limitations, the report shall contain, for each such deviation during the reporting period, including any periods during which the CEMS or CPMS required by subpart ZZZZ was out-of-control as specified in 40 CFR § 63.8(c)(7), the date and time that any malfunction started and stopped; the date, time, and duration that each CEMS or CPMS was inoperative, except for zero (low-level) and high-level checks; the date, time, and duration that each CEMS or CPMS was out-of-control, including the information in 40 CFR § 63.8(c)(8); the date and time that each deviation started and stopped, and whether each deviation occurred during a period of malfunction or during another period; a summary of the total duration of the deviation during the reporting period, and the total duration as a percent of the total source operating time during that reporting period; a breakdown of the total duration of the deviations during the reporting period into those that are due to control equipment problems, process problems, other known causes, and other unknown causes; a summary of the total duration of CEMS or CPMS downtime during the reporting period, and the total duration of CEMS or CPMS downtime as a percent of the total operating time of the stationary RICE at which the CEMS or CPMS downtime occurred during that reporting period; an identification of each parameter and pollutant (CO or formaldehyde) that was monitored at the stationary RICE; a brief description of the stationary RICE; a brief description of the CEMS or CPMS; the date of the latest CEMS or CPMS certification or audit; and a description of any changes in CEMS or CPMS, processes, or controls since the last reporting period.
- If TEP had a malfunction during the reporting period, the report shall include the number, duration, and a brief description for each type of malfunction which occurred during the reporting period and which caused or may have caused any applicable emission limitation to be exceeded. The report shall also include a description of actions taken by TEP during a malfunction of an affected source to minimize emissions in accordance with 40 CFR § 63.6605(b), including actions taken to correct a malfunction.

- As required by 40 CFR § 63.6655(a)(2), TEP shall maintain records of the occurrence and duration of each malfunction of operation (i.e., process equipment) or the air pollution control and monitoring equipment required by subpart ZZZZ.

- As required by 40 CFR § 63.6655(a)(5), TEP shall maintain records of actions taken during periods of malfunction to minimize emissions in accordance with 40 CFR § 63.6605(b), including corrective actions to restore malfunctioning process and air pollution control and monitoring equipment to its normal or usual manner of operation.

4.9 Emissions of Hazardous Air Pollutants

The Pima County program for control of Hazardous Air Pollutants ("HAP") required by A.R.S. § 49-480.04 is codified at Article IX of PCC Chapter 17.16. The RICE project will not be subject to any applicable requirements under this program for the reasons presented below.

As discussed in subsection 4.8.2 herein, each RICE to be installed at the IGS will be an affected source under the NESHAP for Stationary RICE and will be subject to emissions limitations under 40 CFR § 63.6600(b).

Pursuant to PCC § 17.16.655(B)(1), the provisions of Article IX shall not apply to "[a]ffected sources for which a standard under 40 C.F.R. 61 or 40 CFR 63 imposes an emissions limitation." For purposes of this provision, pursuant to PCC § 17.16.650(3), the term "affected source" has the meaning given in 40 CFR § 63.2, which in turn refers to the definition at 40 CFR § 63.6590(a): each new stationary RICE is a separate affected source.

Because each new RICE is an affected source subject to an emissions limitation under 40 CFR part 63, the provisions of Article IX do not apply.

4.10 Acid Rain

The federal acid rain program required by title IV of the federal Clean Air Act is codified at 40 CFR parts 72, 74, 75, and 76. These federal regulations are incorporated by reference at PCC § 17.12.365(A).

Each new RICE to be installed at the IGS falls within the meanings of "unit," "new unit," and "utility unit" under the Acid Rain program as those terms are defined at 40 CFR § 72.2. In the absence of an exemption, each RICE would be an affected unit subject to program requirements. However, pursuant to 40 CFR §§ 72.6(b)(9) and 72.7, each RICE is not an affected unit and is exempt from all substantive requirements. The only applicable requirements arising under the Acid Rain program are as follows.

- Pursuant to 40 CFR § 72.7(f)(1)(i), each RICE shall serve only one or more electric generators with a total nameplate capacity of 25 MW or less and shall burn only gaseous fuel with an annual average sulfur content of 0.05 percent or less by weight. Because each RICE will be coupled with a single electric generator having a capacity of 19 MW and will burn only pipeline natural gas, these requirements are met based on the inherent design of each RICE to be installed at the IGS.

- Pursuant to 40 CFR § 72.7(b)(2), TEP's designated representative for the IGS shall submit, for each RICE, by December 31 of the first calendar year for which the unit is to be exempt, a new unit exemption statement in a format prescribed by the U.S. EPA Administrator.[18] The statement shall identify the unit, state the nameplate capacity of each generator served by the unit and the fuels currently burned or expected to be burned by the unit and their sulfur content by weight, and state that the owners and operators of the unit will comply with the applicable requirements of 40 CFR § 72.7(f).

- Pursuant to 40 CFR §§ 72.7(d)(1) and 72.7(f)(3)(i), for each RICE, TEP shall maintain records indicating natural gas is the only fuel burned. Each such record shall be maintained for a period of five years from the date the record is created.

[18] The current form is available on U.S. EPA's internet web site at www.epa.gov/sites/production/files/2016-12/documents/new_unit_exemption.pdf (last accessed 6/26/2017).

5. Best Available Control Technology

This section of the permit application presents TEP's proposed BACT determinations,[19] with supporting analyses, for the RICE project. It includes a general discussion of the BACT analysis procedure employed followed by case-by-case BACT analyses.

5.1 BACT Applicability

For a major modification under the PSD preconstruction permitting program, BACT applicability is set forth at PCC § 17.16.590(A)(2):

> A major modification shall apply BACT for each [PSD pollutant] for which the modification would result in a significant net emissions increase at the source. This requirement applies to each proposed emissions unit at which a net emissions increase in the pollutant would occur as a result of a physical change or change in the method of operation in the unit.

These applicability criteria are substantially the same as the definition in the federal PSD rule at 40 CFR § 52.21(j)(3).

As described in subsection 4.5.2 herein, the RICE project is a major modification subject to PSD preconstruction permitting requirements for emissions of VOC, CO, PM10, PM2.5, and GHG. BACT analyses for the RICE to be installed at the IGS are presented in subsections 5.3 (for PM10 and PM2.5 emissions), 5.4 (for CO and VOC emissions), and 5.5 (for GHG emissions). In addition, BACT analyses for GHG emissions from natural gas supply piping and from circuit breakers are presented in subsections 5.6 and 5.7, respectively.

5.2 BACT General Approach

The following subsections present an outline of the approach used by TEP in performing BACT analyses and making proposed BACT determinations for the RICE project.

5.2.1 Best Available Control Technology Definition

The definition of BACT at PCC § 17.04.340(A)(37) is as follows:

> "Best available control technology (BACT)" means an emission limitation, including a visible emissions standard, based on the maximum degree of reduction for each regulated air pollutant which would be emitted from any proposed major stationary source or major modification which the control officer on a case-by-case basis, taking into account energy, environmental and economic impact and other costs, determines to be achievable

[19] TEP notes that item 19.b.ii in the filing instructions accompanying the Standard Application Form purports to require a "determination of BACT." As noted in the text, BACT is a case-by-case determination made by the PSD permitting authority. TEP has presented in the permit application a proposed BACT determination for PDEQ's consideration.

> for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combination techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR parts 60 and 61. If the control officer determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard or combination thereof may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results.

This definition of BACT is substantially the same as the definition in the federal PSD rule at 40 CFR § 52.21(b)(12) and it is generally consistent with that in the federal Clean Air Act as amended in 1977.[20] However, there are two differences between this definition and that in currently applicable federal law. First, the federal Clean Air Act definition establishes as a legal floor for a BACT determination "any applicable standard established pursuant to section 111 or 112 of this Act." This includes, in addition to those federal rules codified in 40 CFR parts 60 and 61, standards in 40 CFR part 63.[21] Second, the Clean Air Act Amendments of 1990 added the phrase "clean fuels" to the list of candidate methods, systems, and techniques.[22] Neither PDEQ's nor U.S. EPA's regulations have been revised to be consistent with the federal statute.

5.2.2 Methodology for the BACT Analysis

Neither PDEQ's nor U.S. EPA's regulations prescribe a procedure for conducting a case-by-case BACT analyses. However, by convention, BACT determinations are typically made following a top-down methodology, and that general approach is used here.

Under the "top-down" approach, progressively less stringent control technologies are analyzed until a level of control considered BACT is determined, based on the most effective control option that is determined to result in acceptable environmental, energy, and economic impacts. More specifically, the top-down BACT analysis methodology used by TEP consists of five steps as follows:

- Step 1: Identify all available control options with practical potential for application to the emissions unit and regulated pollutant under evaluation;
- Step 2: Eliminate those available options that are technically infeasible to apply to the specific emissions unit under consideration;
- Step 3: Considering the remaining control options in combination as appropriate, rank control options or strategies by effectiveness;

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[20] P.L. 95-95, § 127(a).
[21] See, for example, 69 *Fed. Reg.* 33474 at p. 33475, explaining that U.S. EPA promulgated the *National Emission Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines* pursuant to the mandate in Clean Air Act § 112(d).
[22] P.L. 101-549, § 403(d). See, also, current 42 U.S.C. § 7479(3).

- Step 4: Evaluate economic, energy and/or environmental impacts of each control option as applied to the subject unit, starting with the highest ranked option, rejecting those options for which the adverse impacts are unacceptable in relation to the beneficial impacts; and
- Step 5: Based on the most effective control option not rejected in Step 4, establish an emission limit or work practice standard as BACT, reflecting the level of control continuously achievable with the selected control option.

5.2.3 Basic Purpose and Design of the RICE Project

The BACT applicability provisions for a major modification, as summarized in subsection 5.1 herein, differ significantly from those which apply to a new power plant or other new major stationary source. For a major modification, such as the RICE project, BACT is determined individually for each proposed emissions unit, not for the entire stationary source; thus, if an identified control option is not available for application to the proposed emissions unit, it cannot represent BACT for such emissions unit.

To determine whether a particular technology or technique is "available" for consideration in the BACT analysis, or would fundamentally redefine the proposed emissions unit, and must therefore be omitted from consideration in the BACT analysis "a permitting authority should look first at the administrative record to see how the applicant defined its goal, objectives, purpose or basic design."[23] The permitting authority must take a "hard look" and "must discern which design elements are inherent to that purpose, articulated for reasons independent of air quality permitting, and which design elements may be changed to achieve pollutant emissions reductions without disrupting the applicant's basic business purpose" for the stationary source or emissions unit for which BACT is being determined.[24]

As discussed in greater detail in subsections 2.1 and 2.2 herein and in its 2017 IRP,[25] TEP's basic business purpose and fundamental objective for the proposed project and for each of the proposed new emissions units is to modernize and expand the IGS in a way that will allow TEP to meet a critical need in its resource portfolio: Reliable, efficient, grid-balancing resources which can ramp up quickly and provide 100 percent of their ELCC during multiple peak periods of any length. The RICE project will support the integration of renewable resources, consistent with TEP's 30 percent target by 2030, and distributed generation. Technologies or techniques that are incompatible with this basic purpose and fundamental objective have not been considered as available control options in the BACT analyses presented herein.

5.2.4 BACT Baseline

As used in the BACT analyses presented herein, the term "BACT baseline" refers to the following requirement in the definition of BACT:

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[23] *PSD and Title V Permitting Guidance for Greenhouse Gases*, EPA-457/B-11-001, March 2011, at p. 26.
[24] *In re Prairie State*, 13 E.A.D. at 23, 26-27 (EAB 2006).
[25] See, www.tep.com/wp-content/uploads/2017/04/TEP-2017-Integrated-Resource.pdf.

> In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR parts 60 and 61.

As noted in subsection 5.2.1 herein, the federal Clean Air Act extends this requirement to include NESHAP under 40 CFR part 63 as well. Thus, any emission standard in an NSPS or NESHAP which limits emissions of the pollutant subject to BACT and which is applicable to a particular emissions unit serves as a legal floor, or baseline, for purposes of the BACT determination.

5.2.5 Available Control Strategies

In the first step of the BACT analysis, all potentially available control strategies are identified for further consideration. In the context of the first step of a top-down BACT analysis, U.S. EPA's guidance describes "available" control strategies as:

> [T]hose air pollution control technologies or techniques with a practical potential for application to the emissions unit and the regulated pollutant under evaluation.[26]

In the BACT analyses herein, the term "available" is used, consistent with U.S. EPA guidance, to refer to any control strategy that is potentially applicable to the source type in question (*i.e.*, a technology or control option that has a practical potential for application to the source category in general). These may include fuel cleaning or treatment, inherently lower polluting processes, and end-of-pipe control devices. All identified control strategies that are not inconsistent with the fundamental purpose and basic design of the proposed facility are listed in this step.

As discussed in subsection 5.2.6 below, the second step of the BACT analysis addresses site-specific or design-specific criteria that would prevent an otherwise available technology from being applied in the particular case of the proposed project. This "technical feasibility" question is separate and distinct from the criteria used to determine whether a control option is considered to be "available" for purposes of determining BACT.

5.2.6 BACT Technical Feasibility Criteria

In the second step of a top-down BACT analysis, available control options identified under Step 1 are evaluated to determine their technical feasibility. A technically feasible control option is one that has been demonstrated to function efficiently on an emissions unit that is identical or similar to the emissions unit under review.[27] For the purposes of assessing technical feasibility of an add-on control technology, the determination of whether an emissions unit should be considered to be identical or similar is usually based on both the industrial category of the unit and the physical and chemical characteristics of the gas stream to be controlled. An add-on control technology applicable to one emissions unit may not be technically feasible for application to an apparently similar unit depending on differences in physical and chemical gas

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[26] "New Source Review Workshop Manual, DRAFT," Oct. 1990, at page B.5.
[27] *Prevention of Significant Deterioration Workshop Manual*, EPA-450/2-80-081, October 1980, at pp. I-B-6 through I-B-7.

stream characteristics, and rejection of a control option based on an absence of demonstrated technical feasibility for BACT purposes is appropriate if "it is uncertain the control device will work in the situation currently undergoing review."[28]

5.3 BACT Analysis for PM10/PM2.5 Emissions from RICE

This section presents the required BACT analysis for PM10/PM2.5 emissions from the proposed RICE.

Emissions of PM10 and PM2.5 from natural gas-fired RICE consist mainly of condensable particulate matter; only a small percentage of the emissions of PM10 and PM2.5 are filterable particulate matter.[29] All of the filterable and condensable material is believed to be PM2.5 (i.e., to have a nominal mean aerodynamic diameter less than or equal to 2.5 μm). Thus, these separate indicators of particulate matter are appropriately considered together for purposes of the BACT analysis.

5.3.1 BACT Baseline

The proposed RICE are not subject to any PM10 or PM2.5 emission limitations under NSPS or NESHAP rules that would establish a regulatory baseline for the BACT analysis.

5.3.2 Step 1 – Identify Available Control Options

Based on a review of the literature and recent permitting decisions for RICE, including recent BACT determinations for similar projects, the only available PM10/PM2.5 control option for natural gas-fired RICE is the use of good combustion practices.

Other technologies in use for control of particulate matter emissions, such as fabric filters and electrostatic precipitators, have not been applied to and do not have a practical potential for application to natural gas-fired RICE because the concentration of filterable particulate matter emissions is negligible.[30]

5.3.3 Step 2 – Eliminate Technically Infeasible Control Options

The only available control option identified in subsection 5.3.2 – good combustion practices – is technically feasible for controlling PM10/PM2.5 emissions from the RICE to be installed at the IGS.

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[28] *PSD and Title V Permitting Guidance for Greenhouse Gases*, EPA-457/B-11-001, March 2011, at p. 34.

[29] Based on U.S. EPA's published emission factors, 99 percent of engine exhaust particulate matter emissions are condensable and 1 percent filterable. *Compilation of Air Pollutant Emission Factors, Volume I: Stationary Point and Area Sources (AP-42)*. Section 3.2: Natural Gas-fired Reciprocating Engines, Table 3.2-2 – Uncontrolled Emission Factors for 4-Stroke Lean Burn Engines. July 2000. U.S. EPA.

[30] High-efficiency fabric filters in some applications may be able to achieve outlet concentrations of 0.0002 grains per cubic foot of exhaust gas. Using the emission factor for filterable particulate matter referenced in footnote 29, potential filterable particulate matter emissions from one RICE are 0.01 lb/hr. Assuming an exhaust gas flow rate of approximately 125,000 cubic feet per minute, the concentration of filterable particulate matter at the inlet to a control device would be 0.00001 grain/scf. No quantifiable reduction in emission rate would be achieved through application of a fabric filter or other end-of-pipe control device.

5.3.4 Step 3 – Rank Technically Feasible Control Strategies

The top-ranked control strategy for controlling PM10/PM2.5 emissions from the RICE to be installed at the IGS is the use of good combustion practices. No other technically feasible control strategies have been identified.

5.3.5 Step 4 – Evaluate Impacts of Technically Feasible Control Strategies

Use of good combustion practices to control PM10/PM2.5 emissions from the RICE to be installed at the IGS will not have any material adverse energy, environmental or economic impacts. Therefore, it is appropriate that this strategy serve as the basis for establishing BACT for PM10/PM2.5 emissions.

5.3.6 Step 5 – Propose Emission Limits Representing BACT

Under the definition of BACT as presented in subsection 5.2.1 herein, equipment design or work practice requirements are acceptable under the definition of BACT only when technological or economic limitations on the application of measurement methodology would make the imposition of an emissions standard infeasible. That criterion is not met with respect to PM10/PM2.5 emissions from the RICE to be installed at the IGS during operating periods other than startup. However, that criterion is met during periods of startup, because those periods are too transient and brief to allow measurement of PM10/PM2.5 emissions using available performance testing methodologies.

The achievable PM10/PM2.5 emission limit for the RICE to be installed at the IGS is 2.50 lb/hr, excluding periods of startup. TEP proposes that compliance with this limit be determined based on performance testing using U.S. EPA reference methods for filterable and condensable particulate matter with a minimum two-hour duration for each of three test runs. As shown in Table 5-1, this proposed limit is consistent with those imposed in recent BACT determinations for comparable facilities.

Table 5-1. Recent PM10/PM2.5 BACT Limits for Natural Gas-Fired RICE

Facility (State)	Permit Date	Engine Model (Capacity)	Limit(s)
Red Gate (TX)	Dec. 2013	Wärtsilä 18V50SG (19 MW)	3.10 lb/hr excluding startup/shutdown* 4.42 lb/hr during startup/shutdown* * - no testing required
Port Westward (OR)	Mar. 2013	Wärtsilä 18V50SG or equivalent (19 MW)	5.3 lb/hr excluding startup/shutdown
Lacey Randall (KS)	Jan. 2014	Wärtsilä 20V34SG (9.34 MW)	2.22 lb/hr excluding startup, 24-hr avg.* 2.65 lb/hr during startup, 24-hr avg. * - testing at ≥ 90% load
Rubart (KS)	Mar. 2016	Caterpillar G20CM34 (10 MW)	1.31 lb/hr excluding startup, 24-hr avg.* 1.68 lb/hr during startup, 24-hr avg. * - testing at ≥ 90% load
Schofield (HI)	Sept. 2016	Wärtsilä 20V34DF (8.4 MW)	2.42 lb/hr* * - testing at ≥ 90% load

Because technological and economic limitations on the application of measurement methodology would make demonstration of compliance with respect to a numeric emission limit infeasible during periods of startup, work practices are proposed as BACT.[31] Specifically, TEP proposes the following:

- As required by 40 CFR §§ 63.6600(b) and 63.6625(h), during periods of startup, TEP shall minimize the engine's time spent at idle and minimize the engine's startup time to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes, after which time the non-startup emission limitation applies.

- As required by 40 CFR §§ 60.4243 and 63.6605, TEP shall, at all times, operate and maintain each RICE, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions.

5.4 BACT Analysis for CO and VOC Emissions from RICE

This section presents the required BACT analyses for CO and VOC emissions from the proposed RICE.

Emissions of both CO and VOC from natural gas-fired RICE occur as a result of incomplete combustion of fuel, and the control options for emissions these two pollutants are the same. Thus, for brevity, although the BACT determinations will be separate, the BACT analyses for these two pollutants are presented together.

5.4.1 BACT Baseline

As discussed in subsection 4.7.2 herein, each RICE to be installed at the IGS is subject to the following emission standards pursuant to 40 CFR § 60.4233(e):

- CO: 2.0 g/hp·hr
- VOC (less formaldehyde): 0.7 g/hp·hr

In addition, as discussed in subsection 4.8.2 herein, pursuant to 40 CFR § 63.6600(b), each RICE to be installed at the IGS is required to meet one of the following emission limitations.

- Except during periods of startup, when operating at 100 percent load plus or minus 10 percent, reduce CO emissions by 93 percent or more, or

[31] It should be noted that U.S. EPA has established work practices rather than numeric emission standards for RICE during startup periods. The determination which must be made by U.S. EPA under the federal Clean Air Act in order to justify establishing work practices rather than numeric emission standards and the associated criteria are equivalent to those set forth in the definition of BACT. *See*, 42 U.S.C. § 7411(h)(1), allowing a work practice for NSPS purposes only "if in the judgment of the Administrator, it is not feasible to prescribe or enforce a standard of performance." *See*, also, 42 U.S.C. § 7412(h)(1), allowing a work practice for NESHAP purposes only "if it is not feasible in the judgment of the Administrator to prescribe or enforce an emission standard."

- Except during periods of startup, when operating at 100 percent load plus or minus 10 percent, limit concentration of formaldehyde in the stationary RICE exhaust to 14 ppmvd or less at 15 percent O_2.

These limits establish the CO and VOC BACT baselines for the RICE to be installed at the IGS. Control strategies which would not meet these limits are not considered in this BACT analysis.

5.4.2 Step 1 – Identify Available Control Options

Based on a review of the literature and recent permitting decisions for RICE, including recent BACT determinations for similar projects, the available control options for CO and VOC emissions from lean-burn, natural gas-fired RICE are the use of good combustion practices and the use of oxidation catalyst.

For natural gas fueled engines, the typical oxidation catalyst is a noble metal (*e.g.*, rhodium or platinum) catalyst on an alumina support material. This catalyst is typically installed in a reactor with exhaust gas inlet and outlet distribution plates. CO and VOC react with oxygen (O_2) in the presence of the catalyst to form carbon dioxide (CO_2) and water (H_2O) according to the following general equations:

$$2CO + O_2 \rightarrow 2CO_2$$

$$2C_nH_{2n+2} + (3n + 1)O_2 \rightarrow 2nCO_2 + (2n+2)H_2O$$

Acceptable catalyst operating temperatures generally range from 400 °F to 1,350 °F. No chemical reagent addition is required. When catalyst operating temperature is less than approximately 400 °F, such as during RICE startup, catalyst activity is negligible.

5.4.3 Step 2 – Eliminate Technically Infeasible Control Options

Each of the available control options identified in subsection 5.4.2 – good combustion practices and oxidation catalyst – is technically feasible for controlling CO and VOC emissions from the RICE to be installed at the IGS.

5.4.4 Step 3 – Rank Technically Feasible Control Strategies

The top-ranked control strategy for controlling CO and VOC emissions from the RICE to be installed at the IGS is the use of good combustion practices in combination with oxidation catalyst. Lower-ranked control options include the use of good combustion practices without oxidation catalyst.

5.4.5 Step 4 – Evaluate Impacts of Technically Feasible Control Strategies

Use of good combustion practices in combination with oxidation catalyst to control CO and VOC emissions from the RICE to be installed at the IGS will not have any material adverse energy, environmental or economic impacts. Therefore, it is appropriate that this strategy serve as the basis for establishing BACT for CO and VOC emissions.

5.4.6 Step 5 – Propose Emission Limits Representing BACT

Under the definition of BACT as presented in subsection 5.2.1 herein, equipment design or work practice requirements are acceptable under the definition of BACT only when technological or economic limitations on the application of measurement methodology would make the imposition of an emissions standard infeasible. That criterion is not met with respect to CO or VOC emissions from the RICE to be installed at the IGS during operating periods other than startup. However, that criterion is met during periods of startup, because those periods are too transient and brief to allow measurement of CO or VOC emissions using available performance testing methodologies.

The achievable CO and VOC emission limits for the RICE to be installed at the IGS are 4.43 lb/hr and 4.49 lb/hr, respectively, both excluding periods of startup.[32] TEP proposes that compliance with these limits be determined based on performance testing using U.S. EPA reference methods. As shown in Table 5-2 and Table 5-3, respectively, these proposed limits are consistent with those imposed in recent BACT determinations for comparable facilities.

Table 5-2. Recent CO BACT Limits for Natural Gas-Fired RICE

Facility (State)	Permit Date	Engine Model (Capacity)	Limit(s)
Red Gate (TX)	Dec. 2013	Wärtsilä 18V50SG (19 MW)	5.95 lb/hr excluding startup/shutdown 0.30 g/hp·hr excluding startup/shutdown 19.51 lb/hr during startup/shutdown
Port Westward (OR)	Mar. 2013	Wärtsilä 18V50SG or equivalent (19 MW)	7.48 lb/hr excluding startup/shutdown when operating at <90% load 4.13 lb/hr excluding startup/shutdown when operating at ≥ 90% load
Lacey Randall (KS)	Jan. 2014	Wärtsilä 20V34SG (9.34 MW)	2.67 lb/hr excluding startup, 1-hr avg.* 9.72 lb/hr during startup, 1-hr avg. * - testing at ≥ 90% load
Rubart (KS)	Mar. 2016	Caterpillar G20CM34 (10 MW)	3.86 lb/hr excluding startup, 1-hr avg.* 39.23 lb/hr during startup, 1-hr avg. * - testing at ≥ 90% load

[32] The proposed BACT limits are much more stringent than the BACT baselines (i.e., the CO limit of 2.0 g/hp·hr and the VOC less formaldehyde limit of 0.7 g/hp·hr) discussed in subsection 5.4.1. The CO baseline equates to 118 lb/hr at maximum capacity and the VOC baseline equates to 41 lb/hr, excluding formaldehyde.

Table 5-3. Recent VOC BACT Limits for Natural Gas-Fired RICE

Facility (State)	Permit Date	Engine Model (Capacity)	Limit(s)
Red Gate (TX)	Dec. 2013	Wärtsilä 18V50SG (19 MW)	5.95 lb/hr excluding startup/shutdown* 0.30 g/hp·hr excluding startup/shutdown* 15.54 lb/hr during startup/shutdown* * - excluding formaldehyde
Port Westward (OR)	Mar. 2013	Wärtsilä 18V50SG or equivalent (19 MW)	4.49 lb/hr excluding startup/shutdown
Lacey Randall (KS)	Jan. 2014	Wärtsilä 20V34SG (9.34 MW)	2.67 lb/hr excluding startup, 1-hr avg.* 4.21 lb/hr during startup, 3-hr avg. * - testing at ≥ 90% load
Rubart (KS)	Mar. 2016	Caterpillar G20CM34 (10 MW)	5.82 lb/hr excluding startup, 1-hr avg.* 8.44 lb/hr during startup, 3-hr avg. * - testing at ≥ 90% load
Schofield (HI)	Sept. 2016	Wärtsilä 20V34DF (8.4 MW)	3.56 lb/hr* 94.1 ppmvd @ 15 percent O_2* * - reported as CH_4; testing at ≥ 90% load

Because technological and economic limitations on the application of measurement methodologies would make demonstration of compliance with respect to numeric emission limits infeasible during periods of startup, work practices are proposed as BACT for CO and VOC emissions.[33] Specifically, TEP proposes the following:

- As required by 40 CFR §§ 63.6600(b) and 63.6625(h), during periods of startup, TEP shall minimize the engine's time spent at idle and minimize the engine's startup time to a period needed for appropriate and safe loading of the engine, not to exceed 30 minutes, after which time the non-startup emission limitation applies.

- As required by 40 CFR §§ 60.4243 and 63.6605, TEP shall, at all times, operate and maintain each RICE, including associated air pollution control equipment and monitoring equipment, in a manner consistent with safety and good air pollution control practices for minimizing emissions.

[33] It should be noted that U.S. EPA has established work practices rather than numeric emission standards for RICE during startup periods. The determination which must be made by U.S. EPA under the federal Clean Air Act in order to justify establishing work practices rather than numeric emission standards and the associated criteria are equivalent to those set forth in the definition of BACT. *See*, 42 U.S.C. § 7411(h)(1), allowing a work practice for NSPS purposes only "if in the judgment of the Administrator, it is not feasible to prescribe or enforce a standard of performance." *See*, also, 42 U.S.C. § 7412(h)(1), allowing a work practice for NESHAP purposes only "if it is not feasible in the judgment of the Administrator to prescribe or enforce an emission standard."

5.5 BACT Analysis for GHG Emissions from RICE

This section presents the required BACT analysis for GHG emissions from the proposed RICE.[34]

As discussed in subsection 3.1.5 herein, emissions of GHG from natural gas-fired RICE include CO_2, CH_4, and N_2O. Emissions of CO_2 result from complete oxidation of natural gas hydrocarbons (*e.g.*, $CH_4 + 2\ O_2 = CO_2 + 2\ H_2O$) and comprise 99.998 percent of GHG emissions on a mass basis and 99.9 percent of GHG emissions on a CO_2e basis. Trace emissions of CH_4 result from incomplete combustion of the natural gas fuel. Trace emissions of N_2O result primarily from low temperature combustion.

5.5.1 BACT Baseline

The proposed RICE are not subject to any GHG emission limitations under NSPS or NESHAP rules that would establish a regulatory baseline for the BACT analysis.

5.5.2 Step 1 – Identify Available Control Options

Based on a review of the literature and recent permitting decisions for comparable facilities, including recent BACT determinations for similar projects, the potentially available options for controlling GHG emissions from the proposed RICE are the following:

- Energy efficient combustion and generating technologies;
- Carbon capture and storage.

Each of these options is reviewed below.

5.5.2.1 Energy Efficient Combustion and Generating Technologies

The use of energy efficient combustion and electric power generation technologies is a key mechanism for minimizing GHG emissions from fossil fuel-fired power plants such as the proposed RICE project. In the case of the proposed RICE, efficient combustion means minimizing the energy input (*i.e.*, the quantity of natural gas fired) per unit of energy output consistent with the intended purpose of the facility.

Modern RICE, including the ones identified as candidates for the RICE project, have sophisticated automation and instrumentation to optimize and control combustion. These systems monitor the fuel and air flows, and other aspects of operation to achieve optimal high-efficiency low-emission performance for full-load and part-load conditions.

5.5.2.2 Carbon Capture and Storage ("CCS")

The CCS process involves three main steps:

[34] As discussed in Section 2, TEP is proposing RICE as the optimal technology for meeting the need for thermal generating resources in the Tucson area and identified the existing IGS plant site as the optimal location for the RICE project. This BACT analysis therefore focuses on the RICE, as other technology would redefine the source.

- Capturing and concentrating CO_2 at its source by separating it from other constituents in the engine exhaust gas stream;
- Transporting the captured CO_2 to a suitable storage location, typically in compressed/liquid form; and
- Storing the CO_2 away from the atmosphere indefinitely, for instance in underground geological formations or in the deep ocean.

In a conventional RICE design, the oxygen required for combustion of fuel is provided by air. Because air contains about 79 percent nitrogen, the CO_2 concentration in the exhaust gas stream from the engine is diluted by the inert nitrogen and excess oxygen along with other products of combustion. As a result, the CO_2 concentration in the exhaust gas from the RICE will be no more than 4 to 5 percent by volume. Therefore, capture and concentration of CO_2 is an important element of any CCS strategy that would be applied to the proposed RICE.

Capture and/or concentration of CO_2 from a combustion source can theoretically be achieved either through pre-combustion methods or through post-combustion methods. The availability of each of these techniques for application to the proposed RICE project is discussed below.

5.5.2.2.1 Pre-Combustion CO_2 Concentration

For some combustion sources, one option that theoretically can be used to increase the CO_2 concentration in the exhaust gas stream is to use oxygen instead of air to combust the fuel (*i.e.*, oxy-combustion). This technique results in a more concentrated CO_2 exhaust gas stream with the combustion exhaust gases containing primarily CO_2, H_2O and O_2. This stream would still need to be further processed to produce a relatively pure stream suitable for transportation and storage, but the size, costs and complexity of downstream processing equipment are significantly reduced relative to the equipment required if air is used in the combustion step.

Direct use of oxygen for combustion is not an available option for increasing the exhaust gas CO_2 concentration in the RICE to be installed at the IGS as no RICE manufacturer is offering an oxy-combustion RICE; thus, application of oxy-combustion technology to RICE will not be given further consideration in the evaluation of CCS as a control option as part of this GHG BACT analysis.

5.5.2.2.2 CO_2 Capture Using Post-Combustion Techniques

Post-combustion CO_2 capture methods can, in theory, be applied to conventional combustion systems that use air and carbon-containing fuels in the combustion process. Technologies that might be applied for post-combustion CO_2 capture are described below.

<u>Absorption of the CO_2 with chemical solvents such as amines</u>: This technique has been demonstrated with combustion exhaust gas compositions that are somewhat similar to the

proposed RICE,[35] and it is currently the most common method being evaluated for CO_2 capture from combustion stack gases. The process is illustrated in Figure 5-1. The most notable projects are the recently operational full-scale demonstrations of amine-based CCS systems on a 240 MW equivalent slipstream from the coal-fired W.A. Parish plant near Houston, Texas,[36] and on a 139 MW coal-fired unit at SaskPower's Boundary Dam Power Station in Saskatchewan, Canada.[37]

Monoethanolamine ("MEA") solvent has the advantage of fast reaction with CO_2 at the relatively low partial pressures found in most combustion exhaust gases, including the exhaust gas from the proposed RICE. Some of the main concerns with MEA and other amine solvents are corrosion due to the presence of O_2 and other impurities in the exhaust gas, high solvent degradation rates because of solvent irreversible reactions with SO_2 and NOx, and the large amount of energy required for solvent regeneration. Notwithstanding these concerns, it is conservatively assumed for the purposes of this GHG BACT analysis that a CO_2 capture system based on MEA solvent is available.

Calcium cycle separation: In theory, quicklime (*i.e.*, CaO) can be used to capture CO_2 yielding limestone, which can then be heated, releasing the captured CO_2 in a concentrated stream and regenerating the quicklime for reuse. Technology using this technique is not commercially available; thus, this CO_2 capture and concentration technique will not be given further consideration in the evaluation of CCS as a control option as part of this GHG BACT analysis.

Cryogenic separation: This technique is based on solidifying CO_2 by frosting it to separate it from other gaseous components in the exhaust gas stream. However, the low concentration of CO_2 in the exhaust gas from conventional air-based combustion processes such as RICE renders this technology impractical. Technology using this technique is not commercially available for application to RICE; thus, this CO_2 capture and concentration technique will not be given further consideration in the evaluation of CCS as a control option as part of this GHG BACT analysis.

[35] Note that the CO_2 concentration in coal-fired flue gases is dilute at about 13 percent by volume, but generally higher than the CO_2 concentrations found in the stack gases exiting the planned RICE which will be on the order of 4 percent by volume.

[36] See, "W.A. Parish Post-Combustion CO_2 Capture and Sequestration Project." U.S. Department of Energy, National Energy Technology Laboratory, March 2017. (Available at www.netl.doe.gov/File%20Library/Research/Coal/major%20demonstrations/ccpi/FE0003311.pdf.)

[37] *See*, IEAGHG, *Integrated Carbon Capture and Storage Project at SaskPower's Boundary Dam Power Station*, 2015/06, August 2015. (Available at http://ieaghg.org/docs/General_Docs/Reports/2015-06.pdf.)

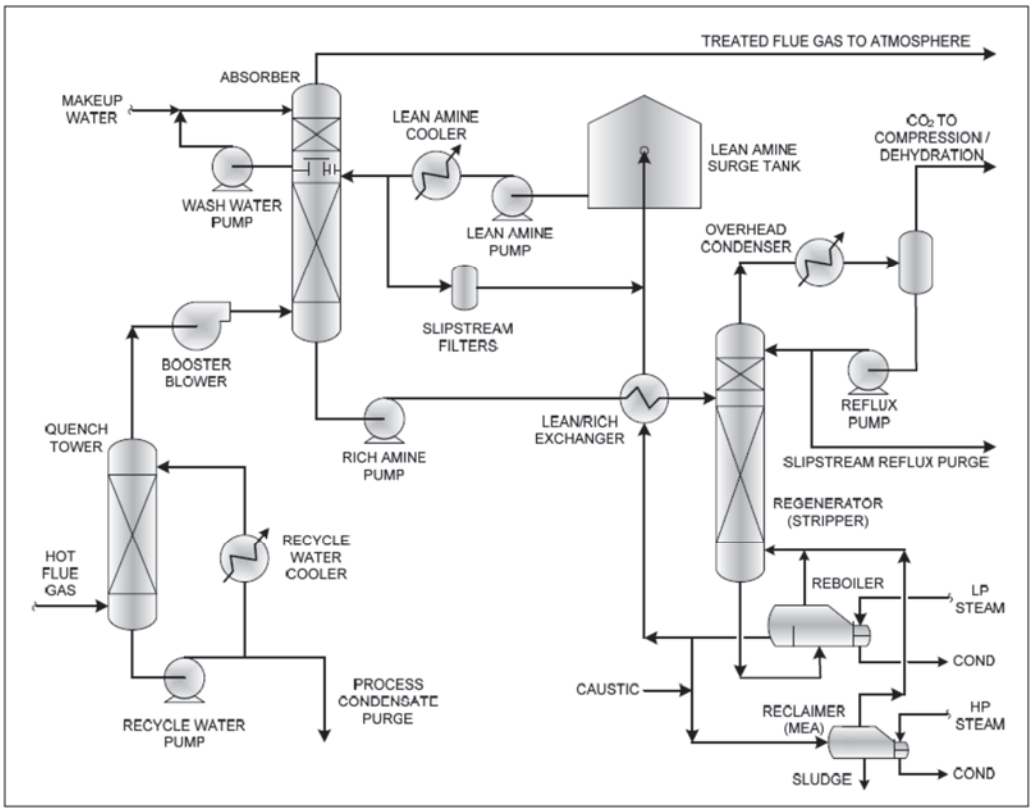

Figure 5-1. Simplified Process Flow Diagram for CO_2 Capture and Concentration

Membrane separation: This technique is commonly used for CO_2 removal from natural gas at high pressure and relatively high CO_2 concentrations. Technology using this technique is not commercially available for application to RICE; thus, this CO_2 capture and concentration technique will not be given further consideration in the evaluation of CCS as a control option as part of this GHG BACT analysis.

5.5.2.2.3 CO_2 Transportation

Where on-site storage is not available for large quantities of CO_2, as is true at the IGS site, the captured CO_2 must be compressed for transportation in a pipeline. This aspect of a CCS system is commercially available.

5.5.2.2.4 CO_2 Storage in Geologic Formations

There are several options currently being evaluated for permanent storage of CO_2. These options include storage in various geological formations such as saline formations, unmineable coal seams, and exhausted oil and gas fields). Each of these options is discussed in more detail below.

In general, the geologic formations that may be appropriate for CO_2 storage consist of layers of porous rock deep underground that are "capped" by a layer or multiple layers of non-porous rock above them. In geologic storage, a well is drilled down into the porous rock and pressurized CO_2 is injected into it. Under high pressure, CO_2 turns to liquid and can move through a formation as a fluid. Once injected, the liquid CO_2 tends to be buoyant and will flow upward until it

encounters a barrier of non-porous rock, which can trap the CO_2 and prevent further upward migration.

Figure 5-2 illustrates the status of Arizona's potential CO_2 storage resources. As shown, virtually all of the potential CO_2 storage capacity in Arizona is in a saline formation. Figure 5-3 shows the location of this formation, generally north of Interstate 40 and east of Flagstaff. The distance from the IGS to this formation is approximately 200 miles.

Figure 5-2 also illustrates the degree of uncertainty presently surrounding the potential for geologic storage of captured CO_2 in Arizona. The data show the wide range of estimates of CO_2 storage capacity in various geologic formations. As an example, the storage capacity estimates for saline formations in Arizona range from a low of approximately 0.1 billion metric tons to a high of more than 1.1 billion metric tons.

Some of the major unresolved issues with respect to CO_2 sequestration in geologic formations pertain to the legal framework for closing and remediating geologic storage sites, including liability for accidental releases from these sites. In December 2010, U.S. EPA promulgated a final rule establishing minimum federal requirements under the Safe Drinking Water Act for underground injection of CO_2 for the purpose of geologic sequestration.[38] This rule set minimum technical criteria for the permitting, geologic site characterization, area of review and corrective action, financial responsibility, well construction, operation, mechanical integrity testing, monitoring, well plugging, post-injection site care, and site closure of wells for the purposes of protecting underground sources of drinking water.

There are several types of geologic formations in which CO_2 can be stored, and each has different opportunities and challenges as briefly described below.

<u>Saline Formations:</u> Saline formations are layers of porous rock that are saturated with brine. They are much more commonplace than coal seams or oil and gas bearing rock, and saline formations may have a significant potential for CO_2 storage. However, much less is known about saline formations than is known about crude oil reservoirs and coal seams, and there is a greater degree of uncertainty associated with their ability to store CO_2. Saline formations contain minerals that could react with injected CO_2 to form solid carbonates and the carbonate reactions have the potential to be both a positive and a negative. The formed solid carbonates can increase storage permanence but also may plug up the formation in the immediate vicinity of an injection well.

[38] 75 *Fed. Reg.* 77230. December 10, 2010.

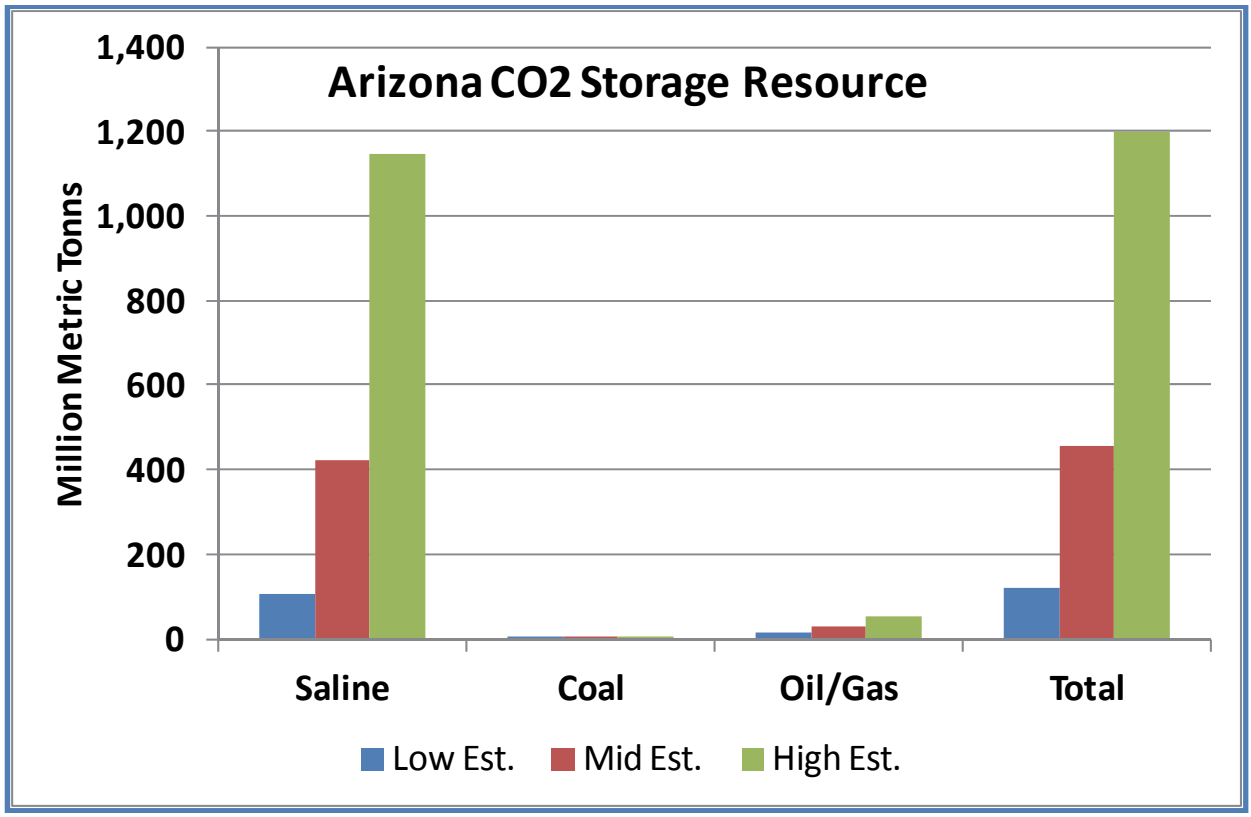

Figure 5-2. Estimate of Geologic CO_2 Storage Capacity in Arizona[39]

Potential use of saline formations for CO_2 storage is an area that has significant ongoing research. One of the most advanced projects in the U.S. is a large-scale research effort aimed at evaluating the technical and commercial feasibility of storing CO_2 in the Mt. Simon sandstone saline formation which lies more than a mile below the surface in Illinois. In the ongoing demonstration project, current plans call for injection of approximately five million tons of CO_2 into this formation through two injection wells over a period of approximately five years. This research work involves comprehensive testing and monitoring elements aimed at furthering the present understanding of CO_2 sequestration. Use of saline formations for CO_2 storage is not presently commercially available; thus, this CO_2 storage technique will not be given further consideration in the evaluation of CCS as a control option as part of this GHG BACT analysis.

[39] Source: http://www.natcarbviewer.com (last accessed June 8, 2016).

Figure 5-3. Arizona's Saline Formation Location

Unmineable Coal Seams: Unmineable coal seams are seams that are too deep or too thin to be mined economically. All coals have varying amounts of methane adsorbed onto pore surfaces, and wells can be drilled into unmineable coal beds to recover this coal bed methane ("CBM"). Initial CBM recovery methods (*i.e.*, dewatering and depressurization) leave a fair amount of CBM in the reservoir. Additional CBM recovery can be achieved by sweeping the coal bed with nitrogen or CO_2. Injected CO_2 preferentially adsorbs onto the surface of the coal, releasing the methane. Because two or three molecules of CO_2 are adsorbed for each molecule of methane released, unmineable coals seams theoretically provide a good storage sink for CO_2. However, one potential barrier to injecting CO_2 into unmineable coal seams is swelling. When coal adsorbs CO_2, it swells in volume. In an underground formation, swelling can cause a sharp drop in permeability, which not only restricts the flow of CO_2 into the formation but also impedes the recovery of displaced CBM.

As shown in Figure 5-2, there are virtually no coal bed resources in Arizona which potentially could be used for CO_2 storage. In addition, use of unmineable coal seams for CO_2 storage is not presently commercially available; thus, this CO_2 storage technique will not be given further consideration in the evaluation of CCS as a control option as part of this GHG BACT analysis.

Depleted or Depleting Oil and Gas Reservoirs: These reservoirs, which typically once provided large crude oil and natural gas resources at some point in time, are characterized by a layer of porous rock with a layer of non-porous rock which forms a dome. This dome offers the potential to trap CO_2 making this type of formation potentially suited to GHG sequestration. As a side benefit of this type of sequestration, CO_2 injected into a depleting oil reservoir may enable recovery of additional oil and gas ("enhanced oil recovery" or "EOR"). When injected into a depleting oil-bearing formation, the CO_2 dissolves in the trapped oil and reduces its viscosity. This process frees more of the oil by improving its ability to move through the pores in the rock and flow with a pressure differential toward a recovery well.

A CO_2 flood typically enables recovery of an additional 10 to 15 percent of the original oil in place. CO_2 injection is currently being used for the purpose of EOR but, in general, the CO_2 being used is not being recovered from combustion exhaust gases.[40]

The EOR CO_2 pipeline nearest to the IGS site is located in southwestern Colorado as illustrated in Figure 5-4. Thus, the use of CO_2 captured and concentrated from the planned RICE for enhanced oil recovery would require construction of a new pipeline, approximately 300 miles in length, to connect to the existing CO_2 EOR pipeline network.

[40] One notable exception is SaskPower's Boundary Dam CCS demonstration project in Canada. *See*, IEAGHG, *Integrated Carbon Capture and Storage Project at SaskPower's Boundary Dam Power Station*, 2015/06, August 2015 (found at http://ieaghg.org/docs/General_Docs/Reports/2015-06.pdf).

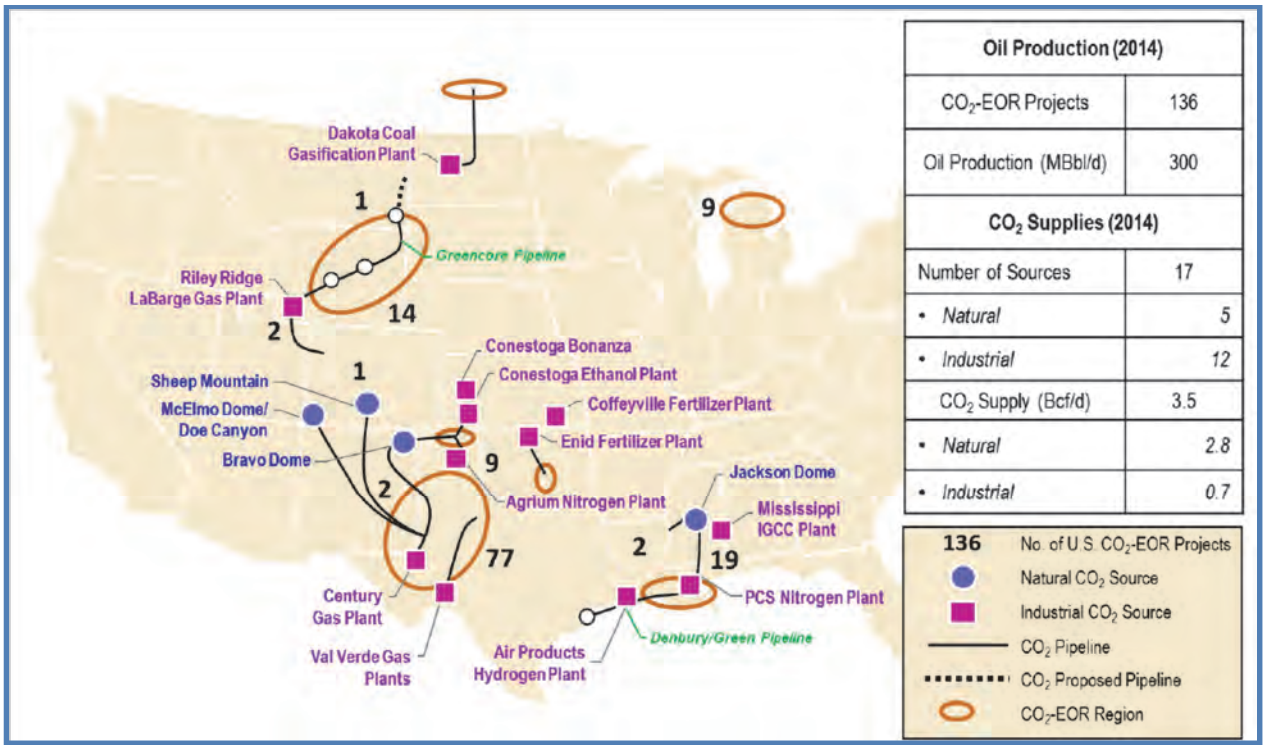

Figure 5-4. Current CO_2-EOR operations and infrastructure in the U.S.[41]

<u>Basalt and Organic Rich Shale Formations:</u> Two additional geological environments being investigated for long-term CO_2 storage are basalt formations and organic shale formations. Basalt formations are geological formations of solidified lava. These formations have a unique chemical makeup that could potentially convert injected CO_2 into a solid mineral form, thus isolating it from the atmosphere permanently. Some key factors affecting the capacity and injectivity of CO_2 into basalt formations are effective porosity and interconnectivity. Current efforts are focused on enhancing and utilizing the mineralization reactions and increasing CO_2 flow within basalt formations.

Organic-rich shale formations are another potential geological storage option. Shale is formed from silicate minerals, which are degraded into clay particles that accumulate over millions of years. The plate-like structure of these clay particles causes them to accumulate in a flat manner, resulting in rock layers with extremely low permeability in a vertical direction.

There are no identified basalt formations or organic-rich shale basins in the vicinity of the IGS site which potentially could be used for long-term CO_2 storage. In addition, at this time, long-term CO_2 storage in basalt formation or organic rich shale basins is not a commercially

[41] *A Review of the CO_2 Pipeline Infrastructure in the U.S.*, U.S. Department of Energy, DOE/NETL-2014/1681, April, 2015 (available at: http://energy.gov/sites/prod/files/2015/04/f22/QER%20Analysis%20-%20A%20Review%20of%20the%20CO2%20Pipeline%20Infrastructure%20in%20the%20U.S_0.pdf).

available technique, regardless of location. Thus, this CO_2 storage technique will not be given further consideration in the evaluation of CCS as a control option as part of this GHG BACT analysis.

5.5.2.2.5 CO_2 Storage in the Deep Ocean

It is theorized that the oceans will eventually absorb 80 to 90 percent of the CO_2 in the atmosphere and transfer it to the deep ocean.[42] Although the ocean has huge potential as a carbon storage sink, the scientific understanding to enable ocean sequestration to be considered as a real option is not yet available; thus, CO_2 storage in the deep ocean will not be given further consideration in the evaluation of CCS as a control option as part of this GHG BACT analysis.

5.5.3 Step 2 – Eliminate Technically Infeasible Control Options

In section 5.5.2, two available options for GHG emissions from the proposed RICE were identified – energy efficient combustion and generating technologies and a CCS system using MEA for CO_2 capture, a new CO_2 pipeline for transport, and a depleting oil reservoir in southwestern Colorado for long-term CO_2 storage. Technical feasibility of these controls options is addressed below.

5.5.3.1 Energy Efficient Combustion and Generating Technologies

The use of energy efficient combustion and generating technologies is inherent in the design of the proposed RICE to be installed at the IGS and is technically feasible.

5.5.3.2 Carbon Capture and Storage

As discussed in subsection 5.5.2.2, CO_2 capture, concentration, and permanent storage has not been commercially demonstrated as a GHG control technique and significant technical and legal uncertainties remain before this control option can be considered commercially available in the context of a GHG BACT analysis. Further, this option should not be considered a technically feasible GHG control option in the context of determining BACT for the RICE project because it is unclear that an acceptable long-term storage option could be identified. Nonetheless, in order to ensure that this BACT analysis is conservative, TEP will proceed to treat as if it were technically feasible (*i.e.*, to evaluate in Steps 3 and 4) a CCS system using MEA for CO_2 capture, a new CO_2 pipeline for transport, and a depleting oil reservoir in southwestern Colorado for long-term CO_2 storage.

5.5.4 Step 3 – Rank Technically Feasible Control Strategies

As noted in subsection 5.5.3.2, it has been assumed for purposes of this analysis that a CCS system using MEA for CO_2 capture, a new CO_2 pipeline for transport, and a depleting oil reservoir in southwestern Colorado for long-term CO_2 storage is technically feasible. Thus, the top-ranked identified GHG control strategy for the proposed RICE involves the use of CCS in

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[42] See, for example, *Free Ocean CO_2 Enrichment (FOCE) System: Technology for Chemical and Biological Studies of a High CO_2 Ocean*, Kirkwood, W. J., and Brewer, P. G., IEEE Forth International Workshop on Scientific Use of Submarine Cables and Related Technologies 2006, February 2006.

conjunction with the energy efficient combustion and generating technologies that are inherent in the project design. Assuming 90 percent capture efficiency of CO_2, this control strategy would reduce total GHG emissions from the RICE project by approximately 380,000 tons per year.[43,44] For purposes of this BACT analysis, it is assumed that 100 percent of the captured CO_2 would be permanently sequestered although actual sequestration efficiency is likely to be less than 100 percent.

The second-ranked GHG control strategy is based on the use of the energy efficient combustion and generating technologies that are inherent in the project design.

5.5.5 Step 4 – Evaluate Impacts of Technically Feasible Control Strategies

As noted in subsections 5.5.3.2 and 5.5.4, it has been assumed that a CCS system using MEA for CO_2 capture, a new CO_2 pipeline for transport, and a depleting oil reservoir in southwestern Colorado for long-term CO_2 storage is technically feasible and is a part of the top-ranked control strategy for purposes of this BACT analysis.

For the purposes of the impacts evaluation for this control strategy, it has been assumed that the combustion exhaust gases from the RICE would be ducted from engine exhaust outlet to an absorption system where the gases would be quenched and then the CO_2 would be captured in an amine solution. The amine solution would be regenerated to release the CO_2 as a concentrated stream which would then be dehydrated and compressed into a liquid at a pressure of approximately 2,200 pounds per square inch. The liquid CO_2 would be transported to the hypothesized EOR pipeline end-user via a new 300-mile pipeline running from the IGS site to southwestern Colorado.

As discussed previously, permanent CO_2 capture from a RICE exhaust gas has not been commercially demonstrated as a GHG control technique and significant technical uncertainties remain. In addition, as shown in Table 5-4 and in the following discussion, the adverse economic, energy, and environmental impacts of CCS as applied to the RICE project are significant.

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[43] A capture efficiency of 90 percent is typical of the efficiencies that have been used in studies of CO_2 capture systems installed on natural gas combustion sources. See, for example, *Cost and Performance Baseline for Fossil Energy Plants Volume 1: Bituminous Coal and Natural Gas to Electricity Revision 2*, DOE/NETL-2010/1397, November, 2010.

[44] Conservatively assuming continuous operation of each RICE at maximum capacity for 8,760 hours per year, the GHG emission reduction from the ten RICE would be approximately 700,000 tpy. The net emission reduction is less due to the significant GHG emissions of the additional equipment needed to meet the energy needs of the CCS system as discussed in subsection 5.5.5.2.

Table 5-4. Summary of CCS Impacts Analysis for the Project

Parameter	Value	
Economic Impacts		
CCS+Pipeline: Total Installed Cost	378,989,586	$
Annualized Costs	96,050,476	$/year
Net CO_2 Reduced	384,046	ton/year
Control Cost-Effectiveness	250	$/ton
Environmental Impacts (CCS Steam & Power Related Emissions)		
Increased NOx Emissions	92	T/year
Increased SO_2 Emissions	17	T/year
Energy Impacts		
Increased CCS Power Demand	82,496	MWh/year
Increased CCS Natural Gas Demand	2,145	MMSCF/year

5.5.5.1 Economic Impacts Evaluation

The economic costs of a CCS system for the RICE to be installed at the IGS, including concentration, dehydration, compression, and transportation costs, are shown in Table 5-4. As shown, the estimated capital cost for the equipment and infrastructure needed for concentration and compression of CO_2 from the RICE project is approximately $380 million. The annualized cost of implementing CCS, including operating and maintenance costs and the costs of CO_2 transportation, is estimated to be in excess of $96 million per year.

Pursuant to a long-standing policy of U.S. EPA, cost effectiveness is an appropriate metric for evaluating and weighing economic and environmental impacts in Step 4 of a top-down BACT analysis. The cost effectiveness of the top-ranked control strategy for GHG emissions from the proposed RICE is approximately $250 per ton of CO_2 emissions reduction. This cost is well above the range of cost effectiveness values considered to be reasonable or acceptable in BACT determinations for control of GHG emissions. For example:

- In making the GHG BACT determination for Copano Processing, U.S. EPA determined that control of GHG emissions at a cost effectiveness of $54/ton is not BACT because it is "economically prohibitive."[45]

[45] *Statement of Basis: Draft Greenhouse Gas Prevention of Significant Deterioration Preconstruction Permit for the Copano Processing*, L.P., Houston Central Gas Plant, Permit Number: PSD-TX-104949-GHG. U.S. EPA Region 6, December 2012. (Cost effectiveness calculated based on listed cost of $10.9 million/yr for annual emission reduction of 202,000 tons per year.)

- In making the GHG BACT determination for the City of Palmdale, U.S. EPA determined that control of GHG emissions at a cost effectiveness of $45/ton is not BACT because it is "economically infeasible."[46]
- In making the GHG BACT determination for Valero's McKee Refinery, U.S. EPA determined that control of GHG emissions at a cost effectiveness of $134/ton is not BACT.[47]
- In making the GHG BACT determination for Freeport LNG Development, L.P.'s Freeport LNG Liquefaction Project, U.S. EPA determined that control of GHG emissions from the amine treatment units was cost prohibitive. The cost effectiveness of this control option was estimated at approximately $14/ton of CO_2 sequestered.[48]

Based on these values and the impact that CCS would have on the required capital investment, the cost of applying CCS to the RICE project of approximately $250 per ton of CO_2 sequestered is unreasonable and unacceptable in light of the small environmental benefit to be achieved.

5.5.5.2 Energy Impacts Evaluation

The electric power that would be required to compress captured CO_2 from the RICE to be installed at the IGS is approximately 83,000 MWh per year. This represents approximately 4 percent of the maximum potential power output of the RICE project and is enough electricity to power about 7,500 average American homes.[49] In addition, more than 2 billion cubic feet of natural gas would be consumed annually in generating the steam needed to operate the CO_2 capture and concentration system. This is enough natural gas to heat about 30,000 average U.S. homes during a winter.[50] These are significant, adverse energy impacts.

5.5.5.3 Environmental Impacts Evaluation

The significant, adverse environmental impacts of implementing CCS for controlling CO_2 emissions from the RICE to be installed at the IGS are primarily those associated with the collateral increase in GHG and other pollutants emitted from steam and electricity generation required to meet the steam and power demands of the CCS system as described above.

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[46] *Responses to Public Comments on the Proposed Prevention of Significant Deterioration Permit for the Palmdale Hybrid Power Project*. U.S. EPA Region 9, October 2011. (Cost effectiveness calculated based on listed cost of $78 million/yr for annual emission reduction of 1.7 million tons per year.)

[47] *Statement of Basis: Draft Greenhouse Gas Prevention of Significant Deterioration Preconstruction Permit for the Diamond Shamrock Refining Company, L.P., Valero McKee Refinery Permit Number: PSD-TX-861-GHG*, July 2013, p. 7; and *Diamond Shamrock Refining Company, L.P., a Valero Company Greenhouse Gas Prevention of Significant Deterioration Permit Application for Crude Expansion Project Valero McKee Refinery Sunray, Texas*, Updated December 2012, p. 4-15.

[48] *Statement of Basis: Draft Greenhouse Gas Prevention of Significant Deterioration Preconstruction Permit for the Freeport LNG Development, L.P., Freeport LNG Liquefaction Project*, Permit Number: PSD-TX-1302-GHG, December 2013, p. 31; and *Greenhouse Gas PSD Application, Freeport LNG Development, L.P.*, December 2011, p. 10-21.

[49] Source: based on the 2014 U.S. average annual consumption rate of 10,935 kWh per year: http://www.eia.gov/tools/faqs/faq.cfm?id=97&t=3 (last accessed July 8, 2016).

[50] Based on March 2015 EIA estimates that an average home heating with gas consumed 64,800 cubic feet of natural gas during the winter of 2014/15 (see: http://www.eia.gov/tools/faqs/faq.cfm?id=867&t=8 Table WF01 - last accessed July 8, 2016).

5.5.5.4 Summary of Impacts Evaluation for CCS

Based on these values and the impact that CCS would have on the required capital investment, the cost of applying CCS to the RICE project of approximately $250 per ton of CO_2 sequestered is unreasonable and unacceptable. In conjunction with the significant adverse energy and environmental impacts of CCS for this application, this control strategy does not represent an appropriate basis for establishing BACT for emissions from the RICE project.

5.5.6 Step 5 – Propose Emission Limits Representing BACT

The BACT emission limits for the RICE must be achievable at all times, across all load ranges for which the RICE will operate, for the entire life of the source. As described in subsections 2.1 and 2.2 herein, the RICE must have the ability to start quickly, ramp load quickly, and idle at low loads. To meet these requirements, the RICE are designed to operate at loads as low as 30 percent of their maximum output capability. Thus, the GHG BACT emission limit must be established that is achievable while operating frequently at low load with multiple shutdown/startup cycles per day.

In general, the heat rate and the CO_2 emission rate per unit of output of a RICE increases as the load is decreased, and the long-term average heat rate is further decreased by the relative frequency of shutdown/startup events. In addition, even with proper operation and maintenance, the constant-load production-normalized CO_2 emission rate of a particular RICE will rise over time due to decreased efficiency which will result from the normal operation and wear of RICE and electric generator components.

U.S. EPA provided a framework for addressing these issues in the setting of GHG emission limits as a function of electric output in a PSD permit action in 2012.[51] Because it is not possible to predict the extent of part-load operation over the life of the generating facility and because peaking plants are designed to meet a range of operating levels, U.S. EPA stated that "it would be inappropriate to establish a permit limit that prevents the facility from generating electricity as intended."[52] EPA determined that the appropriate methodology for setting the GHG BACT emission limit was to set the final BACT limit "at a level achievable during the 'worst-case' (*i.e.*, lowest load) of normal operating conditions." This same methodology has been used to develop the GHG BACT limits for the proposed RICE.

Because the operating load will vary not only with the time of day but also the time of year, the averaging period for the proposed GHG BACT emission limit must be 12 months to

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[51] See: *Responses to Public Comments on the Proposed Prevention of Significant Deterioration Permit for the Pio Pico Energy Center*, November 2012, p. 7. Available at: http://docketpublic.energy.ca.gov/PublicDocuments/Regulatory/11-AFC-1%20Pio%20Pico/2012/November/TN%2068643%2011-19-12%20US%20EPA%20Responses%20to%20Public%20Comments%20on%20Proposed%20PSD%20Permit.pdf and *Title V Operating Permit Revision and Prevention of Significant Deterioration Air Pollution Control Permit Application Ocotillo Power Plant Modernization Project*, September 30 2015, p. 62. Available at: https://yosemite.epa.gov/OA/EAB_WEB_Docket.nsf/Filings%20By%20Appeal%20Number/FC8890EB564F2E6A85257F9D00635EE7?OpenDocument (Attachment 5).

[52] *Ibid.*, p. 15.

appropriately encompass the expected variability in operation. A CO_2 emission limit on a 12-month rolling average basis is consistent with other recent GHG BACT determinations for electric generating facilities using natural gas-fueled RICE, as discussed below.

Taking all of the above into account, the achievable GHG emission rate for each RICE to be installed at the IGS is 1,100 pounds CO_2 per megawatt hour of gross electric output based on a rolling 12-month average. This is the proposed BACT limit. TEP proposes that compliance with this limit be determined based on monitoring and recordkeeping for natural gas usage and gross power output.

As shown in Table 5-5, the proposed limit is consistent with those imposed in recent BACT determinations for comparable facilities.

Table 5-5. Recent GHG BACT Limits for Natural Gas-Fired RICE

Facility (State)	Permit Date	Engine Model (Capacity)	Limit(s)
Red Gate (TX)	Dec. 2013	Wärtsilä 18V50SG (19 MW)	1,145 lb CO_2 per gross MWh electric output, 12-month rolling average
Lacey Randall (KS)	Jan. 2014	Wärtsilä 20V34SG (9.34 MW)	1.08 lb CO_2 per gross kWh electric output, 12-month rolling average
Rubart (KS)	Mar. 2016	Caterpillar G20CM34 (10 MW)	1.25 lb CO_2 per gross kWh electric output, 12-month rolling average
Schofield (HI)	Sept. 2016	Wärtsilä 20V34DF (8.4 MW)	1,700 lb CO_2 per gross MWh electric output, 12-month rolling average

5.6 BACT Analysis for GHG Emissions from Natural Gas Piping

This section presents the required BACT analyses for GHG emissions from natural gas supply piping and associated components to be installed as part of the RICE project. As discussed in subsection 3.1.6 herein, these components are potential sources of GHG (*i.e.*, CH_4) emissions due to leaks.

5.6.1 BACT Baseline

The natural gas supply piping and associated components to be installed as part of the RICE project are not subject to any GHG emission limitations under NSPS or NESHAP rules that would establish a regulatory baseline for the BACT analysis.

5.6.2 Step 1 – Identify Available Control Options

The only potentially available control options identified to reduce GHG emissions from equipment leaks are leak detection and repair ("LDAR") programs. An LDAR program is a set of work practices involving periodic monitoring to identify components with leak rates above a set threshold and, when such components are identified, making efforts to reduce or eliminate leaks by repairing or replacing the component. In general terms, there are two types of LDAR

programs – programs based on audio, visual, and olfactory ("AVO") monitoring and programs based on instrumental monitoring.

5.6.3 Step 2 – Eliminate Technically Infeasible Control Options

The available control options identified in subsection 5.6.2 – LDAR programs – are technically feasible for controlling GHG emissions from the natural gas supply piping and associated components to be installed at the IGS.

5.6.4 Step 3 – Rank Technically Feasible Control Strategies

The top-ranked control strategy for controlling GHG emissions from the natural gas supply piping and associated components to be installed at the IGS involves implementation of an LDAR program based on instrumental monitoring. Based on U.S. EPA data,[53] it is assumed for purposes of this analysis that the control efficiencies (*i.e.*, emissions reductions) achieved with such a program would be 96 percent for valves, 81 percent for flanges and other connectors, and zero percent for pressure relief valves. The overall control efficiency is 48 percent, or a GHG emission reduction of approximately 15 tpy.

The second-ranked control option involves implementation of an LDAR program based on AVO monitoring. This type of program is effective with natural gas piping because an odorant is added to pipeline natural gas for safety purposes.[54] The Texas Commission on Environmental Quality estimates a control efficiency as high as 97 percent for such a program.[55] For purposes of this BACT analysis, a control efficiency of 30 percent and an emission reduction of 9 tpy are assumed.

5.6.5 Step 4 – Evaluate Impacts of Technically Feasible Control Strategies

Based on U.S. EPA data, the annualized cost of implementing an instrumental LDAR program to control GHG emissions from the natural gas supply piping and associated components to be installed at the IGS would be approximately $65,000.[56] This is an unacceptable economic impact in light of the negligible environmental benefit that would be achieved. Conservatively assuming implementation of an instrumental LDAR program would reduce GHG emissions by 6 tpy relative to the LDAR program based on AVO monitoring, the cost effectiveness of the top control option is more than $10,000 per ton of GHG controlled on a mass basis and more than $400 per ton of GHG controlled on a CO_2e basis. As discussed in subsection 5.5.5 herein, those

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[53] *Protocol for Equipment Leak Emission Estimates* (EPA-453/R-95-017). Table 5-3, Control Effectiveness for an LDAR Program at a Refinery Process Unit. Nov. 1995. U.S. EPA.

[54] See, for example, the internet web page of Southwest Gas at https://swgas.com/safety: "For safety reasons, Southwest Gas injects an element called mercaptan, which emits an odor similar to sulfur or rotten eggs." (Last accessed July 5, 2017.)

[55] "Control Efficiencies for TCEQ Leak Detection and Repair Programs." July 2011. Available at www.tceq.texas.gov/assets/public/permitting/air/Guidance/NewSourceReview/control_eff.pdf. (Last accessed July 5, 2017.)

[56] *Hazardous Air Pollutant Emissions from Process Units in the Synthetic Organic Chemical Manufacturing Industry – Background Information for Proposed Standards. Volume 1C: Model Emission Sources* (EPA-453/D-92-016c). Nov. 1992. U.S. EPA.

cost effectiveness figures are well outside the range of what has been deemed acceptable for GHG emissions reductions.

5.6.6 Step 5 – Propose Emission Limits Representing BACT

Under the definition of BACT as presented in subsection 5.2.1 herein, equipment design or work practice requirements are acceptable under the definition of BACT only when technological or economic limitations on the application of measurement methodology would make the imposition of an emissions standard infeasible. That criterion is met with respect to GHG emissions from the natural gas supply piping and associated components to be installed at the IGS because there are no feasible emissions measurement methodologies applicable to these fugitive emissions. Therefore, TEP proposes to implement work practices – specifically, an LDAR program based on daily AVO monitoring, with repair of components identified as leaking within 15 days – as BACT.

As shown in Table 5-6, these proposed requirements are consistent with those imposed in recent BACT determinations for comparable facilities.

Table 5-6. Recent GHG BACT Limits for Natural Gas Piping at RICE Facilities

Facility (State)	Permit Date	Requirements
Red Gate (TX)	Dec. 2013	Work practices: daily AVO monitoring, repair leaking components within 15 days
Lacey Randall (KS)	Jan. 2014	No limits or requirements
Rubart (KS)	Mar. 2016	No limits or requirements
Schofield (HI)	Sept. 2016	No limits or requirements

5.7 BACT Analysis for GHG Emissions from Circuit Breakers

This section presents the required BACT analyses for GHG emissions from circuit breakers to be installed as part of the RICE project. As discussed in subsection 3.1.7 herein, these components are potential sources of GHG (*i.e.*, SF_6) emissions due to leaks.

5.7.1 BACT Baseline

The circuit breakers to be installed as part of the RICE project are not subject to any GHG emission limitations under NSPS or NESHAP rules that would establish a regulatory baseline for the BACT analysis.

5.7.2 Step 1 – Identify Available Control Options

Two control options have been identified for controlling GHG emissions from circuit breakers:

- Use of a different dielectric material in the circuit breakers; or
- Use of SF_6-containing circuit breakers with a low-leak design coupled with a leak detection system.

5.7.3 Step 2 – Eliminate Technically Infeasible Control Options

Use of an alternative dielectric material in high-voltage circuit breakers to be installed as part of the RICE project is not a feasible control option as there are no commercially available alternatives which provide adequate performance for this service. Decades of investigation have found alternatives for medium voltage electric power equipment, but there is no viable alternative to SF_6 for high-voltage equipment.[57]

5.7.4 Step 3 – Rank Technically Feasible Control Strategies

The top-ranked, technically feasible control strategy for controlling GHG emissions from high-voltage circuit breakers to be installed as part of the RICE project is the use of a low-leak design coupled with a leak detection system.

5.7.5 Step 4 – Evaluate Impacts of Technically Feasible Control Strategies

The use of a low-leak design for high-voltage circuit breakers coupled with a leak detection system will not have any material adverse energy, environmental or economic impacts. Therefore, it is appropriate that this strategy serve as the basis for establishing BACT for GHG emissions.

5.7.6 Step 5 – Propose Emission Limits Representing BACT

Under the definition of BACT as presented in subsection 5.2.1 herein, equipment design or work practice requirements are acceptable under the definition of BACT only when technological or economic limitations on the application of measurement methodology would make the imposition of an emissions standard infeasible. That criterion is met with respect to GHG emissions from high-voltage circuit breakers to be installed as part of the RICE project because there are no feasible emissions measurement methodologies applicable to these emissions. Therefore, TEP proposes to implement equipment design standards and work practices as BACT. Specifically, TEP proposes to install and operate enclosed high-voltage circuit breakers having a vendor-guaranteed leak rate of 0.5 percent or less per year and with density monitor alarm systems.

As shown in Table 5-7, these proposed requirements are consistent with those imposed in recent BACT determinations for comparable facilities.

[57] See, for example, *Emission Reduction Partnership for Electric Power Systems, 2014 Annual Report*, March 2015, U.S. EPA ("Because there is no clear alternative to SF_6, Partners reduce their greenhouse gas emissions through implementing emission reduction strategies such as detecting, repairing, and/or replacing problem equipment …" (Available at: https://www.epa.gov/sites/production/files/2016-02/documents/sf6_annrep_2015_v9.pdf.) (Last accessed July 5, 2017.)

Table 5-7. Recent GHG BACT Limits for Circuit Breakers at RICE Facilities

Facility (State)	Permit Date	Requirements
Red Gate (TX)	Dec. 2013	Equipment design: Equipped with leak detection system able to detect leak of 0.5 percent per year and low-pressure alarm
Lacey Randall (KS)	Jan. 2014	Equipment design: Guaranteed loss rate of 0.5 percent or less per year and equipped with density monitor alarm system
Rubart (KS)	Mar. 2016	Equipment design: Guaranteed loss rate of 0.5 percent or less per year and equipped with density monitor alarm system
Schofield (HI)	Sept. 2016	No limits or requirements

Appendix A
PDEQ Standard Permit Application Form

PIMA COUNTY DEPARTMENT OF ENVIRONMENTAL QUALITY
Air Program
33 N. Stone Avenue ▪ Suite 700 ▪ Tucson, AZ 85701 ▪ Phone: (520) 243-7400

STANDARD PERMIT APPLICATION FORM FOR CLASS I SOURCES

(As required by A.R.S. § 49-480, and Title 17 of the Pima County Code)

1. Permit to be issued to (Arizona Corporate Commission Registered Name): Tucson Electric Power Company

2. Mailing Address: 88 East Broadway Boulevard, Mail Stop HQW602, P.O. Box 711
   City: Tucson State: AZ ZIP: 85702

3. Plant Name (if different than item #1): Irvington Generating Station

4. Name (or names) of Owner or Operator: Tucson Electric Power Company
   FAX #: Phone:
   Email:

5. Name of Owner's Agent: Charles W. Komadina
   FAX #: (520) 918-8250 Phone: (520) 918-8316

6. Plant/Site Manager/Contact Person: Conrad Spencer
   FAX #: Phone: (520) 745-3388
   Email: CSpencer@tep.com

7. Proposed Equipment/Plant Location Address: 3950 East Irvington Road
   City: Tucson State: AZ ZIP: 85714
   Indian Reservation (if applicable): n/a T/R/S, Lat/Long, Elev: T15S, R14E, S3 / 032° 09' 37" N / 110° 54' 20" W / 2608'

8. General Nature of Business: Electric Power Generation
   Standard Industrial Classification Code: 4911 State Permit Class: Class I

9. Type of Organization: ☒ Corporation ☐ Individual Owner ☐ Partnership ☐ Government Entity ☐ Other

10. Permit Application Basis *(Check all that apply):* ☐ New Source ☐ General Permit
    ☐ Renewal *Revision:* ☐ Administrative ☐ Minor ☒ Significant Existing Permit # 1052
    Date of Commencement of Construction or Modification: Jan. 2018
    Is any of the equipment to be leased to another individual or entity? ☐ Yes ☒ No

11. Signature of Responsible Official of Organization:
    Official Title of Signer: Director, Tucson Power Production

12. Typed or Printed Name & E-mail of Signer: Conrad Spencer (CSpencer@tep.com)
    Date: Telephone Number: (520) 745-3388

EQUIPMENT LIST

The following table should include all equipment utilized at the facility and be complete with all data requested. The date of manufacture must be included in order to determine if portions of the facility are subject to NSPS. Make additional copies of this form if necessary.

Type of Equipment	Maximum Rated Capacity	Make	Model	Serial Number	Equipment ID Number	Date of Manufacture
SI RICE	19 MW	to be determined	to be determined	to be determined	RICE01	est. 2017
SI RICE	19 MW	to be determined	to be determined	to be determined	RICE02	est. 2017
SI RICE	19 MW	to be determined	to be determined	to be determined	RICE03	est. 2017
SI RICE	19 MW	to be determined	to be determined	to be determined	RICE04	est. 2017
SI RICE	19 MW	to be determined	to be determined	to be determined	RICE05	est. 2017
SI RICE	19 MW	to be determined	to be determined	to be determined	RICE06	est. 2017
SI RICE	19 MW	to be determined	to be determined	to be determined	RICE07	est. 2017
SI RICE	19 MW	to be determined	to be determined	to be determined	RICE08	est. 2017
SI RICE	19 MW	to be determined	to be determined	to be determined	RICE09	est. 2017
SI RICE	19 MW	to be determined	to be determined	to be determined	RICE10	est. 2017

EMISSION SOURCES

COMPANY NAME: Tucson Electric Power Company

DATE July 2017

Estimated "Potential to Emit" per 17.04.340.A.164.
Review of applications and issuance of permits will be expedited by supplying all necessary information on this Table.

REGULATED AIR POLLUTANT DATA					EMISSION POINT DISCHARGE PARAMETERS									
EMISSION POINT [1]		CHEMICAL COMPOSITION OF TOTAL STREAM	REG. AIR POLLUTANT EMISSION RATE		UTM COORDINATES OF EMISSION POINT [5]			STACK SOURCES [6]					NONPOINT SOURCES [7]	
NUMBER	NAME	REGULATED AIR POLLUTANT NAME [2]	#/ HR. [3]	TONS/ YEAR [4]	ZONE	EAST (Mtrs)	NORTH (Mtrs)	HEIGHT ABOVE GROUND (ft)	HEIGHT ABOVE STRUC. (ft)	EXIT DATA DIA. (ft)	EXIT DATA VEL (fps)	EXIT DATA TEMP. (°F)	LENGTH (ft)	WIDTH (ft)
RICE01	RICE01	SO2	0.32	1.4	See Appendix C									
		sulfuric acid mist	0.05	0.22										
		filterable PM	0.01	0.05										
		PM10/PM2.5	4.3	11.4										
		CO	18.2	30.0										
		VOC	10.1	22.8										
		NOx	59.1	179.0										
		GHG	18,100	79,100										
		HAP	7.4	32.6										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL 2608 feet. PDEQ STANDARD CONDITIONS ARE 293K AND 101.3 KILOPASCALS (17.04.340.A.210)

General Instructions:

1. Identify each emission point with a unique number for this plant site, consistent with emission point identification used on plot plan, previous permits, and Emissions Inventory Questionnaire. Include fugitive emissions. Limit emission point number to eight (8) character spaces. For each emission point use as many lines as necessary to list regulated air pollutant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are O.K.
2. Components to be listed include regulated air pollutants as defined in 17.04.340.A.182. Examples of typical component names are: Carbon Monoxide (CO), Nitrogen Oxides (NO_X), Sulfur Dioxide (SO_2), Volatile Organic Compounds (VOC), particulate matter (PM), particulate less than 10 microns (PM_{10}), etc. Abbreviations are O.K.
3. Pounds per hour (#/HR) is maximum potential emission rate expected by applicant.
4. Tons per year is annual maximum potential emission expected by applicant, which takes into account process operating schedule.
5. As a minimum applicant shall furnish a facility plot plan as described in the filing instructions. UTM coordinates are required only if the source is a major source or is required to perform refined modeling for the purposes of demonstrating compliance with ambient air quality guidelines.
6. Supply additional information as follows if appropriate:
   (a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.
   (b) Stack's height above supporting or adjacent structures if structure is within 3 times the "stack height above the ground" of stack.
7. Dimensions of nonpoint sources as defined in 17.04.34.A.147.

EMISSION SOURCES

COMPANY NAME: Tucson Electric Power Company

DATE July 2017

Estimated "Potential to Emit" per 17.04.340.A.164.
Review of applications and issuance of permits will be expedited by supplying all necessary information on this Table.

REGULATED AIR POLLUTANT DATA					EMISSION POINT DISCHARGE PARAMETERS									
EMISSION POINT [1]		CHEMICAL COMPOSITION OF TOTAL STREAM	REG. AIR POLLUTANT EMISSION RATE		UTM COORDINATES OF EMISSION POINT [5]			STACK SOURCES [6]					NONPOINT SOURCES [7]	
NUMBER	NAME	REGULATED AIR POLLUTANT NAME [2]	#/ HR. [3]	TONS/ YEAR [4]	ZONE	EAST (Mtrs)	NORTH (Mtrs)	HEIGHT ABOVE GROUND (ft)	HEIGHT ABOVE STRUC. (ft)	EXIT DATA DIA. (ft)	EXIT DATA VEL (fps)	EXIT DATA TEMP. (°F)	LENGTH (ft)	WIDTH (ft)
RICE02	RICE02	SO2	0.32	1.4	See Appendix C									
		sulfuric acid mist	0.05	0.22										
		filterable PM	0.01	0.05										
		PM10/PM2.5	4.3	11.4										
		CO	18.2	30.0										
		VOC	10.1	22.8										
		NOx	59.1	179.0										
		GHG	18,100	79,100										
		HAP	7.4	32.6										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL 2608 feet. PDEQ STANDARD CONDITIONS ARE 293K AND 101.3 KILOPASCALS (17.04.340.A.210)

General Instructions:

1. Identify each emission point with a unique number for this plant site, consistent with emission point identification used on plot plan, previous permits, and Emissions Inventory Questionnaire. Include fugitive emissions. Limit emission point number to eight (8) character spaces. For each emission point use as many lines as necessary to list regulated air pollutant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are O.K.
2. Components to be listed include regulated air pollutants as defined in 17.04.340.A.182. Examples of typical component names are: Carbon Monoxide (CO), Nitrogen Oxides (NO_X), Sulfur Dioxide (SO_2), Volatile Organic Compounds (VOC), particulate matter (PM), particulate less than 10 microns (PM_{10}), etc. Abbreviations are O.K.
3. Pounds per hour (#/HR) is maximum potential emission rate expected by applicant.
4. Tons per year is annual maximum potential emission expected by applicant, which takes into account process operating schedule.
5. As a minimum applicant shall furnish a facility plot plan as described in the filing instructions. UTM coordinates are required only if the source is a major source or is required to perform refined modeling for the purposes of demonstrating compliance with ambient air quality guidelines.
6. Supply additional information as follows if appropriate:
   (a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.
   (b) Stack's height above supporting or adjacent structures if structure is within 3 times the "stack height above the ground" of stack.
7. Dimensions of nonpoint sources as defined in 17.04.34.A.147.

EMISSION SOURCES

COMPANY NAME: Tucson Electric Power Company

DATE July 2017

Estimated "Potential to Emit" per 17.04.340.A.164.
Review of applications and issuance of permits will be expedited by supplying all necessary information on this Table.

REGULATED AIR POLLUTANT DATA					EMISSION POINT DISCHARGE PARAMETERS									
EMISSION POINT [1]		CHEMICAL COMPOSITION OF TOTAL STREAM	REG. AIR POLLUTANT EMISSION RATE		UTM COORDINATES OF EMISSION POINT [5]			STACK SOURCES [6]					NONPOINT SOURCES [7]	
NUMBER	NAME	REGULATED AIR POLLUTANT NAME [2]	#/ HR. [3]	TONS/ YEAR [4]	ZONE	EAST (Mtrs)	NORTH (Mtrs)	HEIGHT ABOVE GROUND (ft)	HEIGHT ABOVE STRUC. (ft)	EXIT DATA DIA. (ft)	EXIT DATA VEL (fps)	EXIT DATA TEMP. (°F)	LENGTH (ft)	WIDTH (ft)
RICE03	RICE03	SO2	0.32	1.4	See Appendix C									
		sulfuric acid mist	0.05	0.22										
		filterable PM	0.01	0.05										
		PM10/PM2.5	4.3	11.4										
		CO	18.2	30.0										
		VOC	10.1	22.8										
		NOx	59.1	179.0										
		GHG	18,100	79,100										
		HAP	7.4	32.6										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL 2608 feet. PDEQ STANDARD CONDITIONS ARE 293K AND 101.3 KILOPASCALS (17.04.340.A.210)

General Instructions:

1. Identify each emission point with a unique number for this plant site, consistent with emission point identification used on plot plan, previous permits, and Emissions Inventory Questionnaire. Include fugitive emissions. Limit emission point number to eight (8) character spaces. For each emission point use as many lines as necessary to list regulated air pollutant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are O.K.
2. Components to be listed include regulated air pollutants as defined in 17.04.340.A.182. Examples of typical component names are: Carbon Monoxide (CO), Nitrogen Oxides (NO_X), Sulfur Dioxide (SO_2), Volatile Organic Compounds (VOC), particulate matter (PM), particulate less than 10 microns (PM_{10}), etc. Abbreviations are O.K.
3. Pounds per hour (#/HR) is maximum potential emission rate expected by applicant.
4. Tons per year is annual maximum potential emission expected by applicant, which takes into account process operating schedule.
5. As a minimum applicant shall furnish a facility plot plan as described in the filing instructions. UTM coordinates are required only if the source is a major source or is required to perform refined modeling for the purposes of demonstrating compliance with ambient air quality guidelines.
6. Supply additional information as follows if appropriate:
   (a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.
   (b) Stack's height above supporting or adjacent structures if structure is within 3 times the "stack height above the ground" of stack.
7. Dimensions of nonpoint sources as defined in 17.04.34.A.147.

EMISSION SOURCES

COMPANY NAME: Tucson Electric Power Company

DATE July 2017

Estimated "Potential to Emit" per 17.04.340.A.164.
Review of applications and issuance of permits will be expedited by supplying all necessary information on this Table.

REGULATED AIR POLLUTANT DATA					EMISSION POINT DISCHARGE PARAMETERS									
EMISSION POINT [1]		CHEMICAL COMPOSITION OF TOTAL STREAM	REG. AIR POLLUTANT EMISSION RATE		UTM COORDINATES OF EMISSION POINT [5]			STACK SOURCES [6]					NONPOINT SOURCES [7]	
NUMBER	NAME	REGULATED AIR POLLUTANT NAME [2]	#/ HR. [3]	TONS/ YEAR [4]	ZONE	EAST (Mtrs)	NORTH (Mtrs)	HEIGHT ABOVE GROUND (ft)	HEIGHT ABOVE STRUC. (ft)	EXIT DATA DIA. (ft)	EXIT DATA VEL (fps)	EXIT DATA TEMP. (°F)	LENGTH (ft)	WIDTH (ft)
RICE04	RICE04	SO2	0.32	1.4	See Appendix C									
		sulfuric acid mist	0.05	0.22										
		filterable PM	0.01	0.05										
		PM10/PM2.5	4.3	11.4										
		CO	18.2	30.0										
		VOC	10.1	22.8										
		NOx	59.1	179.0										
		GHG	18,100	79,100										
		HAP	7.4	32.6										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL 2608 feet. PDEQ STANDARD CONDITIONS ARE 293K AND 101.3 KILOPASCALS (17.04.340.A.210)

General Instructions:

1. Identify each emission point with a unique number for this plant site, consistent with emission point identification used on plot plan, previous permits, and Emissions Inventory Questionnaire. Include fugitive emissions. Limit emission point number to eight (8) character spaces. For each emission point use as many lines as necessary to list regulated air pollutant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are O.K.
2. Components to be listed include regulated air pollutants as defined in 17.04.340.A.182. Examples of typical component names are: Carbon Monoxide (CO), Nitrogen Oxides (NO_X), Sulfur Dioxide (SO_2), Volatile Organic Compounds (VOC), particulate matter (PM), particulate less than 10 microns (PM_{10}), etc. Abbreviations are O.K.
3. Pounds per hour (#/HR) is maximum potential emission rate expected by applicant.
4. Tons per year is annual maximum potential emission expected by applicant, which takes into account process operating schedule.
5. As a minimum applicant shall furnish a facility plot plan as described in the filing instructions. UTM coordinates are required only if the source is a major source or is required to perform refined modeling for the purposes of demonstrating compliance with ambient air quality guidelines.
6. Supply additional information as follows if appropriate:
   (a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.
   (b) Stack's height above supporting or adjacent structures if structure is within 3 times the "stack height above the ground" of stack.
7. Dimensions of nonpoint sources as defined in 17.04.34.A.147.

EMISSION SOURCES

COMPANY NAME: Tucson Electric Power Company

DATE July 2017

Estimated "Potential to Emit" per 17.04.340.A.164.
Review of applications and issuance of permits will be expedited by supplying all necessary information on this Table.

REGULATED AIR POLLUTANT DATA					EMISSION POINT DISCHARGE PARAMETERS									
EMISSION POINT [1]		CHEMICAL COMPOSITION OF TOTAL STREAM	REG. AIR POLLUTANT EMISSION RATE		UTM COORDINATES OF EMISSION POINT [5]			STACK SOURCES [6]					NONPOINT SOURCES [7]	
NUMBER	NAME	REGULATED AIR POLLUTANT NAME [2]	#/ HR. [3]	TONS/ YEAR [4]	ZONE	EAST (Mtrs)	NORTH (Mtrs)	HEIGHT ABOVE GROUND (ft)	HEIGHT ABOVE STRUC. (ft)	EXIT DATA DIA. (ft)	EXIT DATA VEL (fps)	EXIT DATA TEMP. (°F)	LENGTH (ft)	WIDTH (ft)
RICE05	RICE05	SO2	0.32	1.4	See Appendix C									
		sulfuric acid mist	0.05	0.22										
		filterable PM	0.01	0.05										
		PM10/PM2.5	4.3	11.4										
		CO	18.2	30.0										
		VOC	10.1	22.8										
		NOx	59.1	179.0										
		GHG	18,100	79,100										
		HAP	7.4	32.6										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL 2608 feet. PDEQ STANDARD CONDITIONS ARE 293K AND 101.3 KILOPASCALS (17.04.340.A.210)

General Instructions:

1. Identify each emission point with a unique number for this plant site, consistent with emission point identification used on plot plan, previous permits, and Emissions Inventory Questionnaire. Include fugitive emissions. Limit emission point number to eight (8) character spaces. For each emission point use as many lines as necessary to list regulated air pollutant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are O.K.
2. Components to be listed include regulated air pollutants as defined in 17.04.340.A.182. Examples of typical component names are: Carbon Monoxide (CO), Nitrogen Oxides (NO_X), Sulfur Dioxide (SO_2), Volatile Organic Compounds (VOC), particulate matter (PM), particulate less than 10 microns (PM_{10}), etc. Abbreviations are O.K.
3. Pounds per hour (#/HR) is maximum potential emission rate expected by applicant.
4. Tons per year is annual maximum potential emission expected by applicant, which takes into account process operating schedule.
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   (a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.
   (b) Stack's height above supporting or adjacent structures if structure is within 3 times the "stack height above the ground" of stack.
7. Dimensions of nonpoint sources as defined in 17.04.34.A.147.

EMISSION SOURCES

COMPANY NAME: Tucson Electric Power Company

DATE July 2017

Estimated "Potential to Emit" per 17.04.340.A.164.
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REGULATED AIR POLLUTANT DATA					EMISSION POINT DISCHARGE PARAMETERS									
EMISSION POINT [1]		CHEMICAL COMPOSITION OF TOTAL STREAM	REG. AIR POLLUTANT EMISSION RATE		UTM COORDINATES OF EMISSION POINT [5]			STACK SOURCES [6]					NONPOINT SOURCES [7]	
NUMBER	NAME	REGULATED AIR POLLUTANT NAME [2]	#/ HR. [3]	TONS/ YEAR [4]	ZONE	EAST (Mtrs)	NORTH (Mtrs)	HEIGHT ABOVE GROUND (ft)	HEIGHT ABOVE STRUC. (ft)	EXIT DATA DIA. (ft)	EXIT DATA VEL (fps)	EXIT DATA TEMP. (°F)	LENGTH (ft)	WIDTH (ft)
RICE06	RICE06	SO2	0.32	1.4	See Appendix C									
		sulfuric acid mist	0.05	0.22										
		filterable PM	0.01	0.05										
		PM10/PM2.5	4.3	11.4										
		CO	18.2	30.0										
		VOC	10.1	22.8										
		NOx	59.1	179.0										
		GHG	18,100	79,100										
		HAP	7.4	32.6										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL 2608 feet. PDEQ STANDARD CONDITIONS ARE 293K AND 101.3 KILOPASCALS (17.04.340.A.210)

General Instructions:

1. Identify each emission point with a unique number for this plant site, consistent with emission point identification used on plot plan, previous permits, and Emissions Inventory Questionnaire. Include fugitive emissions. Limit emission point number to eight (8) character spaces. For each emission point use as many lines as necessary to list regulated air pollutant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are O.K.
2. Components to be listed include regulated air pollutants as defined in 17.04.340.A.182. Examples of typical component names are: Carbon Monoxide (CO), Nitrogen Oxides (NO_X), Sulfur Dioxide (SO_2), Volatile Organic Compounds (VOC), particulate matter (PM), particulate less than 10 microns (PM_{10}), etc. Abbreviations are O.K.
3. Pounds per hour (#/HR) is maximum potential emission rate expected by applicant.
4. Tons per year is annual maximum potential emission expected by applicant, which takes into account process operating schedule.
5. As a minimum applicant shall furnish a facility plot plan as described in the filing instructions. UTM coordinates are required only if the source is a major source or is required to perform refined modeling for the purposes of demonstrating compliance with ambient air quality guidelines.
6. Supply additional information as follows if appropriate:
   (a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.
   (b) Stack's height above supporting or adjacent structures if structure is within 3 times the "stack height above the ground" of stack.
7. Dimensions of nonpoint sources as defined in 17.04.34.A.147.

EMISSION SOURCES

COMPANY NAME: Tucson Electric Power Company

DATE July 2017

Estimated "Potential to Emit" per 17.04.340.A.164.
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REGULATED AIR POLLUTANT DATA					EMISSION POINT DISCHARGE PARAMETERS									
EMISSION POINT [1]		CHEMICAL COMPOSITION OF TOTAL STREAM	REG. AIR POLLUTANT EMISSION RATE		UTM COORDINATES OF EMISSION POINT [5]			STACK SOURCES [6]					NONPOINT SOURCES [7]	
NUMBER	NAME	REGULATED AIR POLLUTANT NAME [2]	#/ HR. [3]	TONS/ YEAR [4]	ZONE	EAST (Mtrs)	NORTH (Mtrs)	HEIGHT ABOVE GROUND (ft)	HEIGHT ABOVE STRUC. (ft)	EXIT DATA DIA. (ft)	EXIT DATA VEL (fps)	EXIT DATA TEMP. (°F)	LENGTH (ft)	WIDTH (ft)
RICE07	RICE07	SO2	0.32	1.4	See Appendix C									
		sulfuric acid mist	0.05	0.22										
		filterable PM	0.01	0.05										
		PM10/PM2.5	4.3	11.4										
		CO	18.2	30.0										
		VOC	10.1	22.8										
		NOx	59.1	179.0										
		GHG	18,100	79,100										
		HAP	7.4	32.6										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL 2608 feet. PDEQ STANDARD CONDITIONS ARE 293K AND 101.3 KILOPASCALS (17.04.340.A.210)

General Instructions:

1. Identify each emission point with a unique number for this plant site, consistent with emission point identification used on plot plan, previous permits, and Emissions Inventory Questionnaire. Include fugitive emissions. Limit emission point number to eight (8) character spaces. For each emission point use as many lines as necessary to list regulated air pollutant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are O.K.
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3. Pounds per hour (#/HR) is maximum potential emission rate expected by applicant.
4. Tons per year is annual maximum potential emission expected by applicant, which takes into account process operating schedule.
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7. Dimensions of nonpoint sources as defined in 17.04.34.A.147.

EMISSION SOURCES

COMPANY NAME: Tucson Electric Power Company

DATE July 2017

Estimated "Potential to Emit" per 17.04.340.A.164.
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REGULATED AIR POLLUTANT DATA					EMISSION POINT DISCHARGE PARAMETERS									
EMISSION POINT [1]		CHEMICAL COMPOSITION OF TOTAL STREAM	REG. AIR POLLUTANT EMISSION RATE		UTM COORDINATES OF EMISSION POINT [5]			STACK SOURCES [6]					NONPOINT SOURCES [7]	
NUMBER	NAME	REGULATED AIR POLLUTANT NAME [2]	#/ HR. [3]	TONS/ YEAR [4]	ZONE	EAST (Mtrs)	NORTH (Mtrs)	HEIGHT ABOVE GROUND (ft)	HEIGHT ABOVE STRUC. (ft)	EXIT DATA DIA. (ft)	EXIT DATA VEL (fps)	EXIT DATA TEMP. (°F)	LENGTH (ft)	WIDTH (ft)
RICE08	RICE08	SO2	0.32	1.4	See Appendix C									
		sulfuric acid mist	0.05	0.22										
		filterable PM	0.01	0.05										
		PM10/PM2.5	4.3	11.4										
		CO	18.2	30.0										
		VOC	10.1	22.8										
		NOx	59.1	179.0										
		GHG	18,100	79,100										
		HAP	7.4	32.6										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL 2608 feet. PDEQ STANDARD CONDITIONS ARE 293K AND 101.3 KILOPASCALS (17.04.340.A.210)

General Instructions:

1. Identify each emission point with a unique number for this plant site, consistent with emission point identification used on plot plan, previous permits, and Emissions Inventory Questionnaire. Include fugitive emissions. Limit emission point number to eight (8) character spaces. For each emission point use as many lines as necessary to list regulated air pollutant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are O.K.
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EMISSION SOURCES

COMPANY NAME: Tucson Electric Power Company

DATE July 2017

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REGULATED AIR POLLUTANT DATA					EMISSION POINT DISCHARGE PARAMETERS									
EMISSION POINT [1]		CHEMICAL COMPOSITION OF TOTAL STREAM	REG. AIR POLLUTANT EMISSION RATE		UTM COORDINATES OF EMISSION POINT [5]			STACK SOURCES [6]					NONPOINT SOURCES [7]	
NUMBER	NAME	REGULATED AIR POLLUTANT NAME [2]	#/ HR. [3]	TONS/ YEAR [4]	ZONE	EAST (Mtrs)	NORTH (Mtrs)	HEIGHT ABOVE GROUND (ft)	HEIGHT ABOVE STRUC. (ft)	EXIT DATA DIA. (ft)	EXIT DATA VEL (fps)	EXIT DATA TEMP. (°F)	LENGTH (ft)	WIDTH (ft)
RICE09	RICE09	SO2	0.32	1.4	See Appendix C									
		sulfuric acid mist	0.05	0.22										
		filterable PM	0.01	0.05										
		PM10/PM2.5	4.3	11.4										
		CO	18.2	30.0										
		VOC	10.1	22.8										
		NOx	59.1	179.0										
		GHG	18,100	79,100										
		HAP	7.4	32.6										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL 2608 feet. PDEQ STANDARD CONDITIONS ARE 293K AND 101.3 KILOPASCALS (17.04.340.A.210)

General Instructions:

1. Identify each emission point with a unique number for this plant site, consistent with emission point identification used on plot plan, previous permits, and Emissions Inventory Questionnaire. Include fugitive emissions. Limit emission point number to eight (8) character spaces. For each emission point use as many lines as necessary to list regulated air pollutant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are O.K.
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3. Pounds per hour (#/HR) is maximum potential emission rate expected by applicant.
4. Tons per year is annual maximum potential emission expected by applicant, which takes into account process operating schedule.
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   (a) Stack exit configuration other than a round vertical stack. Show length and width for a rectangular stack. Indicate if horizontal discharge with a note.
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7. Dimensions of nonpoint sources as defined in 17.04.34.A.147.

EMISSION SOURCES

COMPANY NAME: Tucson Electric Power Company

DATE July 2017

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REGULATED AIR POLLUTANT DATA					EMISSION POINT DISCHARGE PARAMETERS									
EMISSION POINT [1]		CHEMICAL COMPOSITION OF TOTAL STREAM	REG. AIR POLLUTANT EMISSION RATE		UTM COORDINATES OF EMISSION POINT [5]			STACK SOURCES [6]					NONPOINT SOURCES [7]	
NUMBER	NAME	REGULATED AIR POLLUTANT NAME [2]	#/ HR. [3]	TONS/ YEAR [4]	ZONE	EAST (Mtrs)	NORTH (Mtrs)	HEIGHT ABOVE GROUND (ft)	HEIGHT ABOVE STRUC. (ft)	EXIT DATA DIA. (ft)	EXIT DATA VEL (fps)	EXIT DATA TEMP. (°F)	LENGTH (ft)	WIDTH (ft)
RICE10	RICE10	SO2	0.32	1.4	See Appendix C									
		sulfuric acid mist	0.05	0.22										
		filterable PM	0.01	0.05										
		PM10/PM2.5	4.3	11.4										
		CO	18.2	30.0										
		VOC	10.1	22.8										
		NOx	59.1	179.0										
		GHG	18,100	79,100										
		HAP	7.4	32.6										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL 2608 feet. PDEQ STANDARD CONDITIONS ARE 293K AND 101.3 KILOPASCALS (17.04.340.A.210)

General Instructions:

1. Identify each emission point with a unique number for this plant site, consistent with emission point identification used on plot plan, previous permits, and Emissions Inventory Questionnaire. Include fugitive emissions. Limit emission point number to eight (8) character spaces. For each emission point use as many lines as necessary to list regulated air pollutant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are O.K.
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7. Dimensions of nonpoint sources as defined in 17.04.34.A.147.

EMISSION SOURCES

COMPANY NAME: Tucson Electric Power Company

DATE July 2017

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REGULATED AIR POLLUTANT DATA					EMISSION POINT DISCHARGE PARAMETERS									
EMISSION POINT [1]		CHEMICAL COMPOSITION OF TOTAL STREAM	REG. AIR POLLUTANT EMISSION RATE		UTM COORDINATES OF EMISSION POINT [5]			STACK SOURCES [6]					NONPOINT SOURCES [7]	
NUMBER	NAME	REGULATED AIR POLLUTANT NAME [2]	#/ HR. [3]	TONS/ YEAR [4]	ZONE	EAST (Mtrs)	NORTH (Mtrs)	HEIGHT ABOVE GROUND (ft)	HEIGHT ABOVE STRUC. (ft)	EXIT DATA DIA. (ft)	EXIT DATA VEL (fps)	EXIT DATA TEMP. (°F)	LENGTH (ft)	WIDTH (ft)
NGFUG	Natural Gas Fugitive	GHG	7.16	31.3	See Appendix C									
CB	Circuit Breakers	GHG		0.001										

GROUND ELEVATION OF FACILITY ABOVE MEAN SEA LEVEL 2603 feet. PDEQ STANDARD CONDITIONS ARE 293K AND 101.3 KILOPASCALS (17.04.340.A.210)

General Instructions:

1. Identify each emission point with a unique number for this plant site, consistent with emission point identification used on plot plan, previous permits, and Emissions Inventory Questionnaire. Include fugitive emissions. Limit emission point number to eight (8) character spaces. For each emission point use as many lines as necessary to list regulated air pollutant data. Typical emission point names are: heater, vent, boiler, tank, reactor, separator, baghouse, fugitive, etc. Abbreviations are O.K.
2. Components to be listed include regulated air pollutants as defined in 17.04.340.A.182. Examples of typical component names are: Carbon Monoxide (CO), Nitrogen Oxides (NO_X), Sulfur Dioxide (SO_2), Volatile Organic Compounds (VOC), particulate matter (PM), particulate less than 10 microns (PM_{10}), etc. Abbreviations are O.K.
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   (b) Stack's height above supporting or adjacent structures if structure is within 3 times the "stack height above the ground" of stack.
7. Dimensions of nonpoint sources as defined in 17.04.34.A.147.

Certification of Compliance with all Applicable Requirements

Permit Number (If existing source) 1052

This certification must be signed by a Responsible Official. Applications without a signed certification will be deemed incomplete.

> *The responsible official is defined as a person who is in charge of principal business functions or who performs policy or decision making functions for the business. This may also include an authorized representative for such persons. For a complete definition, see Pima County Air Quality Control, Title 17, Section 17.04.340(A)(186).*

I certify that I have knowledge of the facts herein set forth, that the same are true, accurate and complete to the best of my knowledge and belief, and that all information not identified by me as confidential in nature shall be treated by the Pima County Department of Environmental Quality (PDEQ) as public record. I also attest that I am in compliance with the applicable requirements and will continue to comply with such requirements and any future requirements that become effective during the life of my permit. I will present a certification of compliance to PDEQ no less than annually and more frequently if specified by PDEQ. I further state that I will assume responsibility for the construction, modification, or operation of the source in accordance with the requirements of Title 17 of the Pima County Code and any permit issued thereof.

Name (Print/Type): Conrad Spencer Title: Director, Tucson Power Production

(Signature):_____ Date: _____

Certification of Truth, Accuracy, and Completeness

17.12.160(H) - Certification of Truth, Accuracy, and Completeness. Any application form, report, or compliance certification submitted pursuant to this Chapter shall contain certification by a responsible official of truth, accuracy, and completeness. This certification shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the documents are true, accurate, and complete.

By my signature I,(Name) Conrad Spencer, hereby certify that based on information and belief formed after reasonable inquiry, the statements and information in this document are true, accurate, and complete.

Signature of Responsible Official of Organization:_____

Title: Director, Tucson Power Production Date:_____

Appendix B – Emissions Calculations

HAP for which PTE is calculated using heat input capacity and fuel use-based emission factor:
heat input capacity (MMBtu/hr HHV): 154.5

	AP-42 lb/MMBtu	lb/hr (per engine)	tpy (per engine)
1,3-Butadiene	2.67E-04	4.13E-02	1.81E-01
2,2,4-Trimethylpentane	2.50E-04	3.86E-02	1.69E-01
Acetaldehyde	8.36E-03	1.29E+00	5.66E+00
Acrolein	5.14E-03	7.94E-01	3.48E+00
Benzene	4.40E-04	6.80E-02	2.98E-01
Biphenyl	2.12E-04	3.28E-02	1.43E-01
Ethylbenzene	3.97E-05	6.13E-03	2.69E-02
Formaldehyde	5.28E-02	8.16E+00	3.57E+01
Methanol	2.50E-03	3.86E-01	1.69E+00
Dichloromethane (methylene chloride)	2.00E-05	3.09E-03	1.35E-02
n-Hexane	1.11E-03	1.71E-01	7.51E-01
Naphthalene	7.44E-05	1.15E-02	5.03E-02
Phenol	2.40E-05	3.71E-03	1.62E-02
Tetrachloroethane	2.48E-06	3.83E-04	1.68E-03
Toluene	4.08E-04	6.30E-02	2.76E-01
Vinyl Chloride	1.49E-05	2.30E-03	1.01E-02
Xylene	1.84E-04	2.84E-02	1.25E-01

Formaldehyde (considering VOC limit)		4.49E+00	1.97E+01

PSD pollutants for which PTE is calculated using heat input capacity and fuel use-based emission factor:
heat input capacity (MMBtu/hr HHV): 154.5

	lb/MMBtu	lb/hr (per engine)	tpy (per engine)
SO2	2.1E-03	3.2E-01	1.4E+00
sulfuric acid mist	3.2E-04	5.0E-02	2.2E-01
PM	7.71E-05	1.19E-02	5.22E-02

PSD pollutants for which PTE is calculated using vendor-specified rate during startup periods and BACT limit during non-startup periods:

	30-min startup (lb/event)	non-startup (lb/hr)	max lb/hr (per engine)	tpy (per engine)
PM10/PM2.5	3.0	2.50	4.3	11.4
CO	16.0	4.43	18.2	30.0
VOC	7.9	4.49	10.1	22.8

PSD pollutant for which PTE is calculated using NSPS limit and emission cap:
mechanical output capacity (hp): 26,820

	NSPS g/hphr	lb/hr (per engine)	tpy (per engine)
NOx	1.0E+00	5.91E+01	1.79E+02

PSD pollutant for which RICE PTE is calculated using heat input capacity, fuel use-based emission factors, and GWP:
heat input capacity (MMBtu/hr HHV): 154.5

	40 CFR 98 kg/MMBtu	mass lb/hr (per engine)	mass tpy (per engine)
CO2	53.02	1.81E+04	7.91E+04
CH4	1.0E-03	3.41E-01	1.49E+00
N2O	1.0E-04	3.41E-02	1.49E-01
mass total GHG		1.81E+04	7.91E+04

	mass lb/hr (per engine)	40 CFR 98 GWP	CO2e lb/hr (per engine)	CO2e tpy (per engine)
CO2	18,059	1	1.81E+04	7.91E+04
CH4	3.4E-01	25	8.52E+00	3.73E+01
N2O	3.4E-02	298	1.02E+01	4.45E+01
CO2e total GHG			1.81E+04	7.92E+04

GHG from NG piping leaks:

	Components	*Protocol* kg/hr/component	mass CH4 lb/hr	mass CH4 tpy
valves in gas/vapor service	60	2.68E-02	3.55E+00	1.55E+01
flanges/connectors	150	2.5E-04	8.27E-02	3.62E-01
pressure relief valves	10	1.6E-01	3.53E+00	1.54E+01
mass total GHG			7.16E+00	3.13E+01

	mass CH4 lb/hr	40 CFR 98 GWP	CO2e lb/hr	CO2e tpy
all component types	7.16E+00	25	1.79E+02	7.83E+02
CO2e total GHG			1.79E+02	7.83E+02

GHG from circuit breakers:

	Circuit Breakers	lbs SF6 per circuit breaker	SF6 leak rate (% per year)	mass SF6 tpy
circuit breakers	8	65	0.5%	1.30E-03
mass total GHG				1.30E-03

	mass SF6 tpy	40 CFR 98 GWP		CO2e tpy
circuit breakers	1.30E-03	22,800		2.96E+01
CO2e total GHG				2.96E+01

PSD pollutants total:

	tpy
SO2	14.2
sulfuric acid mist	2.2
PM	0.5
PM10/PM2.5	114.1
CO	299.6
VOC	227.8
NOx	179.0
mass total GHG	791,048
CO2e total GHG	792,631

Appendix C – Impact Analyses

AECOM

Air Quality Dispersion Modeling Report in Support of the Application for a Prevention of Significant Deterioration (PSD) Authorization and Significant Revision to Class I Air Quality Permit for Irvington Generating Station

Tucson Electric Power Company

Project Number: 60530048

July 27, 2017

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1. Introduction

1.1 Project Overview

The Tucson Electric Power Company ("TEP") owns and operates the Irvington Generating Station ("IGS"), also known as the H. Wilson Sundt Generating Station, pursuant to Class I Air Quality Permit No. 1052 issued by the Pima County Dept. of Environmental Quality ("PDEQ"). The facility currently comprises six electric generating units with a combined, nominal, net generating capacity of 470 megawatts ("MW").

TEP is requesting a revision to the Class I permit for the IGS, an authorization pursuant to the preconstruction Prevention of Significant Deterioration ("PSD") permitting regulations to expand the IGS, and an approval of construction of new affected sources under federal National Emissions Standards for Hazardous Air Pollutants ("NESHAP"). As part of the proposed expansion project, TEP proposes to install up to ten natural gas-fired, reciprocating internal combustion engines ("RICE"), each with a nominal net generating capacity of 19 MW. In conjunction with the RICE project, TEP will permanently cease operation of Units 1 and 2 at IGS, leaving the facility with a nominal, net generating capacity of 498 MW.

The proposed RICE project will modernize and expand the IGS by replacing two 1950's era electric utility steam generating units (IGS Unit 1 and 2) with ten high-efficiency, fast-responding, state-of-the-art RICE, each having a generating capacity of 19 MW (nominal). TEP's basic purpose and fundamental objective for the RICE project is to meet a critical need in its resource portfolio: Reliable, efficient, grid-balancing resources which can ramp up quickly and provide 100 percent of their ELCC during multiple peak periods of any length. In conjunction with ESS projects and other efforts described in the 2017 IRP, the RICE project will support the integration of renewable resources, consistent with TEP's 30 percent target by 2030. Tangential benefits of the proposed RICE project include anticipated reductions in the capacity factors of the less-efficient steam generating units at IGS and improved overall environmental performance, including decreased water usage and wastewater discharge.

The dispersion modeling analyses conducted for the RICE project adhere to the United States Environmental Protection Agency (EPA) "Revisions to the Guideline on Air Quality Models" (GAQM, which is contained in 40 CFR Part 51, Appendix W)[1], direction received from the Pima County Department of Environmental Quality (PDEQ) and local Pima County air quality guidance[2] and with the air dispersion modeling protocol submitted to PDEQ on June 23, 2017.

1.2 Purpose of Modeling Report

The purpose of this document is to present the air dispersion modeling analyses that were performed in support of the air permit application for the RICE project. Modeling methods and assumptions, including model selection and options, meteorological data and source parameters used in the modeling analyses, are presented in this document for review and approval by PDEQ.

[1] 82 FR 5182. https://www.federalregister.gov/documents/2017/01/17/2016-31747/revisions-to-the-guideline-on-air-quality-models-enhancements-to-the-aermod-dispersion-modeling .
[2] PCC § 17.16.590(A)(6). https://library.municode.com/az/pima_county/codes/code_of_ordinances.

1.3 Contents of the Modeling Report

Section 2 of this report contains a project description, including information regarding the equipment, location and the expected air pollutant emissions. Sections 3 through 5 present a detailed description of the modeling approach used in evaluating air quality impacts of the proposed RICE project including preconstruction ambient air quality, model selection criteria, good engineering practice stack height determination, refined modeling analyses, ambient air quality compliance, and additional impacts analyses.

2. Project Description

2.1 Project Location and Layout

As previously stated, the proposed RICE project will be constructed at the existing IGS located in Tucson, Arizona, approximately 2 miles northeast of Tucson International Airport. The coordinates of the IGS are 509,448.00 meters Easting, 3,557,910.00 meters Northing in Universal Transverse Mercator (UTM) Zone 12 referenced to NAD 83. An aerial map of the site region is provided in **Figure 2-1**.

The terrain surrounding IGS is generally flat within 10 kilometers before the landscape changes with the addition of rolling hills, rugged canyons and mountain peaks. **Figure 2-2** shows the varying elevations associated with these features near IGS.

2.2 Description of the Proposed Engines

The proposed modification at IGS includes the installation of ten RICEs. These engines will only be fired with natural gas and each will be installed with selective catalytic reduction (SCR) control utilizing ammonia for NO_x control and oxidation catalyst for CO and VOC control. The ten engines will be grouped into two sets where the five stacks from each group were modeled as a merged stack consistent with EPA Model Clearinghouse Memo 91-II-01[3], creating the appearance of two new stacks at IGS.

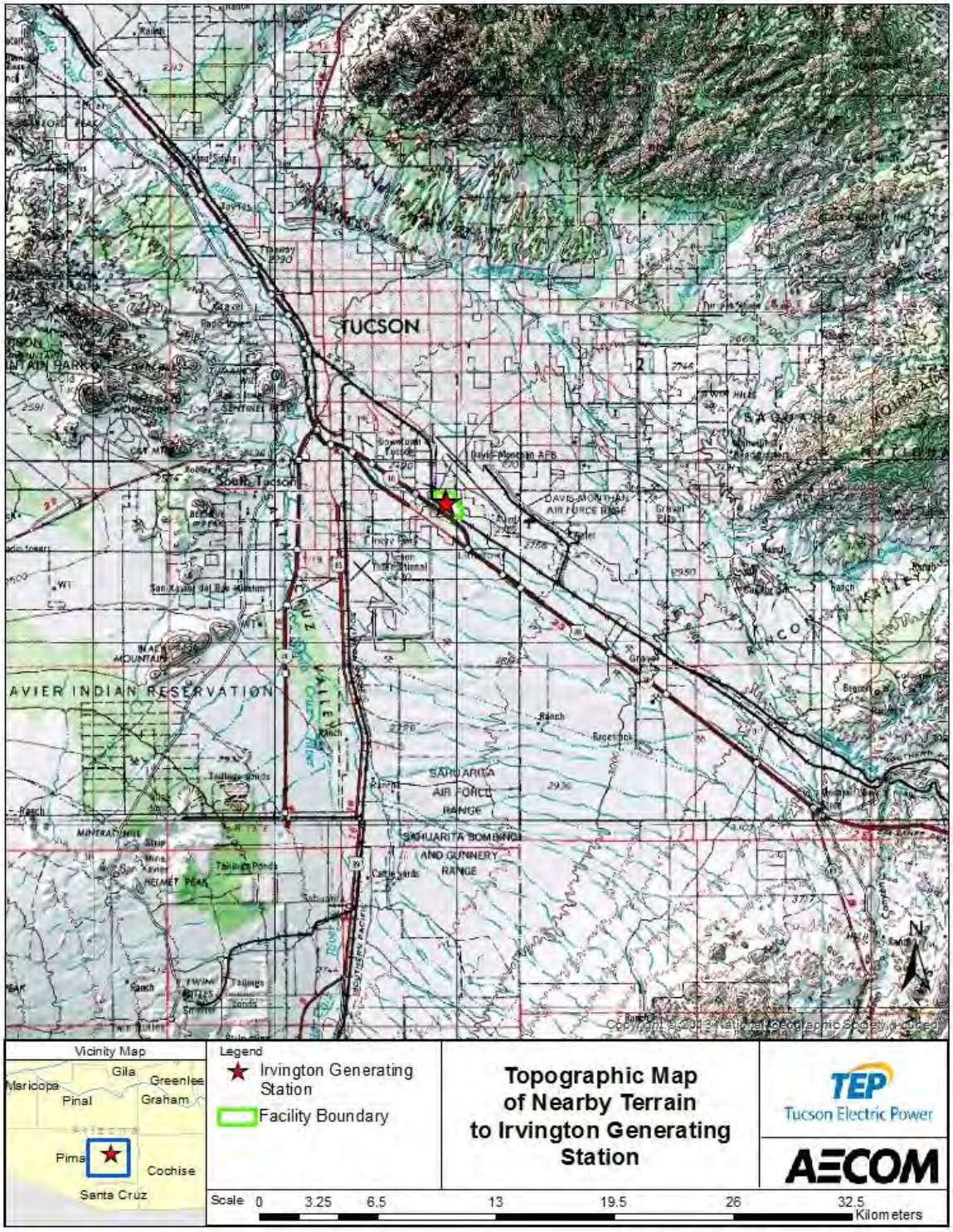
Each of the ten RICE installed at IGS will be equipped with two air pollution control devices:

- An oxidation catalyst system to control emissions of volatile organic compounds ("VOC"), carbon monoxide (CO), and organic hazardous air pollutants such as formaldehyde; and,
- A selective catalytic reduction ("SCR") system to control emissions of nitrogen oxides (NO_X). Aqueous ammonia will be injected upstream of the SCR catalyst module to act as a reductant.

[3] Available at: https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=91-II%20%20-01.

Figure 2-1 Aerial Image of the Irvington Generating Station

Figure 2-2 Topographic Map Showing Terrain Features Surrounding the Irvington Generating Station



2.3 PSD Applicability

IGS is considered a fossil fuel-fired steam electric plant (one of the "major source categories" identified in section 169 of the Clean Air Act), and is therefore subject to the Prevention of Significant Deterioration (PSD) permitting requirements. The area around IGS is currently designated as attainment or unclassifiable for all criteria pollutants[4]. The expected annual emissions increases from the proposed engines were compared to the PSD significant levels in **Table 2-1** to determine the PSD applicability. The RICE project at IGS will constitute a major modification at IGS and has the potential to increase emissions by more than 100 tons per year of carbon monoxide (CO), 15 tons PM_{10}, 10 tons of $PM_{2.5}$, and 40 tons of volatile organic compounds (VOC). In addition, the project will exceed the PSD threshold for Greenhouse Gas (GHG). The Project will not exceed PSD thresholds for NO_2, SO_2, or Lead. Based on this review, CO, VOC, PM_{10} and $PM_{2.5}$ will trigger dispersion modeling requirements.

Table 2-1 PSD Significant Emission Rates for RICE Project

Pollutant	PSD Threshold Emission Rates (tons/year)
Carbon monoxide (CO)	100
Nitrogen oxides (NO_x)	40
Sulfur dioxide (SO_2)	40
Particulate matter (PM)	25
Particulate matter (PM_{10})	15
Particulate matter ($PM_{2.5}$)	10
Volatile Organic Compounds (VOC)	40

[4] 40 CFR § 81.303. https://www.gpo.gov/fdsys/granule/CFR-2012-title40-vol18/CFR-2012-title40-vol18-sec81-303.

3. Background Air Quality and Pre-Construction Monitoring

3.1 Pre-construction Monitoring Requirements

In accordance with pre-construction monitoring requirements (40 CFR 52.21(m)), an application for a PSD permit must contain an analysis of ambient air quality in the vicinity of the proposed Project for each pollutant subject to PSD review. The definition of existing air quality can be satisfied by air measurements from either a state-operated or private network, or by a pre-construction monitoring program that is specifically designed to collect data in the vicinity of the proposed source. A source can fulfill the pre-construction monitoring requirement for PSD without conducting on-site monitoring if data collected from existing monitoring sites are conservatively representative of the air quality in the vicinity of the proposed Project site.

The existing monitoring data must be determined by the reviewing authority to be representative of air quality for the area in which the proposed project would be constructed and operated. In determining whether ambient monitoring data can be considered representative for satisfying the PSD pre-construction monitoring requirement for a project, the EPA guidance in "*Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD)*" (EPA-450/4-87-007, May 1987) was reviewed. The PSD ambient monitoring guidelines note three major items which need to be considered in determining the representativeness of existing data: 1) ambient monitor location, 2) quality of the data, and 3) currentness of the data. These three criteria are discussed below.

Figure 3-1 shows the locations of these monitors relative to the Project site. The CO/Ozone monitor at 22nd and Craycroft is approximately 5 kilometers northeast of IGS. The South Tucson PM10 monitor is located approximately 6 kilometers northwest of IGS and the Children's Park PM2.5 monitor is located approximately 15 kilometers north-northwest of IGS. These monitors are well situated such that emissions from IGS and other sources in the downtown Tucson area would impact these monitors based on the windrose in **Figure 4-1**.

EPA maintains data capture statistics for all monitors in their design value tables[5]. Data capture for CO is 99%, O3 is 100%, PM10 is 96% and PM2.5 is 90%. These monitors meet the data capture requirements set by EPA for the most recent three year period available (2013-2015).

Currentness requires that the data generally have been collected for the most recent one-year period preceding a PSD permit application. However, in some cases, older ambient monitoring data could be considered conservative for representative background purposes if there have not been substantial changes in the operations of existing sources in the area and no new sources have been permitted in the interim. Such older data would also be considered conservative since various new air pollution control programs, such as the reduction in particulate emissions from diesel vehicles, have been implemented in the interim period between data collection and submittal of the permit application.

Table 3-1 provides a summary of the most recent 3-year period (2013-2015) ambient background design values. Design values for the 2014-2016 period have yet to be posted on EPA's website.

[5] https://www.epa.gov/air-trends/air-quality-design-values#report

Table 3-1 Background Design Values for TEP Project Site

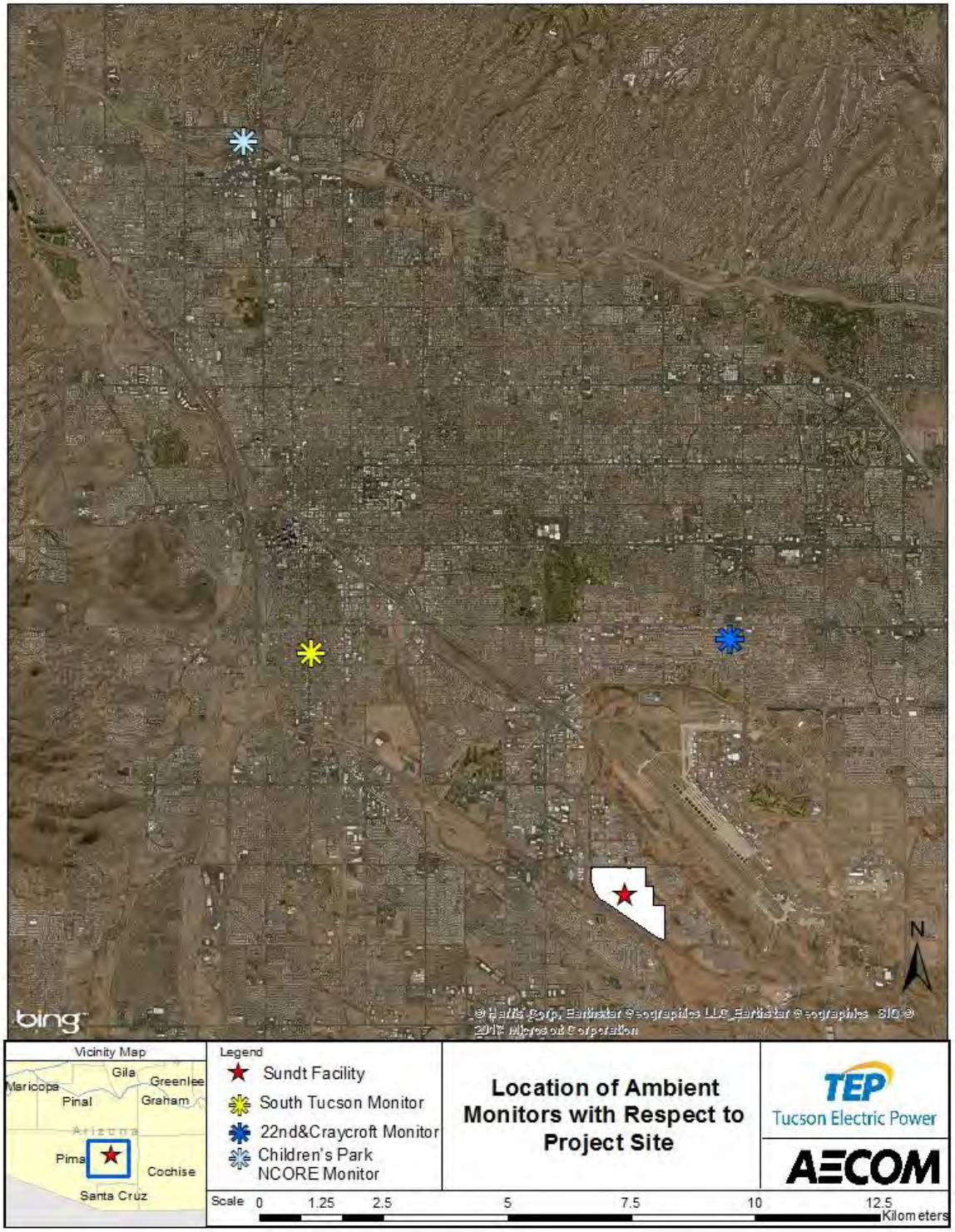
Pollutant	Monitor Location	Avg. Period	Design Value[1]	SIL	NAAQS	Units
CO	22nd & Craycroft	1-hr	1.6	1.75[2]	35	ppm
CO	22nd & Craycroft	8-hr	0.8	0.44[2]	9	ppm
O_3	22nd & Craycroft	8-hr	0.063	0.001[4]	0.070	ppm
PM_{10}	South Tucson	24-hr	101	5.0[2]	150	µg/m³
$PM_{2.5}$	Children's Park NCORE	24-hr	13	1.2[3]	35	µg/m³
		Annual	5.5	0.3[3]	12	

[1] *Design Values based on 2013-2015 period.*
[2] *40 CFR 51.165(b)(2).https://www.gpo.gov/fdsys/pkg/CFR-2011-title40-vol2/pdf/CFR-2011-title40-vol2-sec51-165.pdf.*
[3] *Guidance for $PM_{2.5}$ Permit Modeling.* https://www3.epa.gov/scram001/guidance/guide/Guidance_for_PM25_Permit_Modeling.pdf.
[4] *Draft Guidance on Significant Impact Level for Ozone and Fine Particles. https://www.epa.gov/sites/production/files/2016-08/documents/pm2_5_sils_and_ozone_draft_guidance.pdf*

3.2 Background Concentrations for Modeling

Recent guidance states that modeled impacts should not be compared to the Significant Impact Levels (SILs) if the background monitor values, when added to the SILs, exceed the NAAQS. **Table 3-1** shows the ambient monitor values for the most recent three years in comparison to the SILs and the NAAQS. It is evident that the monitored values plus the SILs are well below the NAAQS, so the SILs may be used to obtain a waiver from cumulative modeling for this modeling application.

Figure 3-1 Locations of Nearby Ambient Monitors



4. Air Quality Impact Assessment

4.1 Background Discussion

The proposed Project will be a major modification for VOCs, CO, $PM_{2.5}$, and PM_{10}; therefore, PSD review and associated dispersion modeling analysis is required for these pollutants. Modeling analyses performed for these pollutants have been evaluated for compliance with applicable thresholds and are presented in Sections 4.7 and 4.8. The evaluation for VOC is discussed in Section 4.9. There are no modeling requirements for GHGs.

As will be discussed in the following sections of this report, the dispersion modeling for the RICE project has been conducted in a manner that utilizes the engines' worst-case operating conditions in an effort to predict the highest impact for each pollutant and averaging period.

4.2 Source Data

The air dispersion modeling analysis was conducted with emission rates and flue gas exhaust characteristics (flow rate and temperature) that are expected to represent the worst-case parameters for the proposed RICE project. The stacks from each of the 10 engines were bundled or clustered together in two groups of five and were modeled as two merged stacks. Modeling assumes that the exhaust from five RICEs are tied in to each merged stack (i.e., Stack 1 includes exhaust from engines 1-5 and Stack 2 accommodates engines 6-10).

A summary of the engine exhaust data for the PSD-regulated pollutants that were modeled is provided in **Table 4-1**. An equivalent diameter and gas exit velocity calculation for the merged stack configuration noted above, is also shown in the table. The formulas used to calculate the equivalent diameter and gas exit velocity of the merged stacks are provided in equations 1 and 2, respectfully.

$$\text{Equivalent Diameter} = 2 * \sqrt{\frac{((\pi * (\frac{d}{2}))^2) * 5}{\pi}} \quad (1)$$

$$\text{Velocity} = \frac{ACFM * 5}{60 * \pi * \left(\frac{equivalent\ d}{2}\right)^2} \quad (2)$$

Where;

ACFM = Gas flow from single stack in units of actual cubic feet per minute,

d is the diameter of each the 10 individual stacks in feet,

equivalent diameter is in units of feet, and

velocity is in units of feet per second.

Criteria pollutant emissions for the engines are presented in the following sub-sections.

4.2.1 Normal and Startup Emissions

Each engine was modeled assuming 8,760 hours of operation per year. Except as noted below, all ten engines were conservatively assumed to start simultaneously for each hour modeled over the course of the 5-year period.

The emission rates for each engine are summarized in **Table 4-2**. The emission rates during startup conditions are either equal to or greater than the normal operations; therefore the worst-case scenario modeled included the startup emission rates.

For PM_{10} and primary $PM_{2.5}$, the daily average emission rates assume 5 hours of startup emissions and 19 hours of non-startup (normal) emissions. This rate was used for the 24-hour and annual averaging periods. For the 8-hour averaging period of CO, the emission rate assumes 5 hours of startup emissions and 3 hours of non-startup emissions. As stated above, for the 1-hour averaging period of CO, the modeled emission rate assumes all 10 engines start simultaneously in the same hour, every hour of the year.

Table 4-1 Stack Parameters for RICEs

Description	Source ID	Stack Height (ft)	Temperature (F)	Exit Velocity (ft/s)	Stack Diameter (ft)	Stack Gas Flow (scfm)	Ambient Pressure (psia)	Stack Gas Flow (acfm)
Engine 1	ENG01	150	680	96.63	5.25	52,200	13.40	125,507
Engine 2	ENG02	150	680	96.63	5.25	52,200	13.40	125,507
Engine 3	ENG03	150	680	96.63	5.25	52,200	13.40	125,507
Engine 4	ENG04	150	680	96.63	5.25	52,200	13.40	125,507
Engine 5	ENG05	150	680	96.63	5.25	52,200	13.40	125,507
Engine 6	ENG06	150	680	96.63	5.25	52,200	13.40	125,507
Engine 7	ENG07	150	680	96.63	5.25	52,200	13.40	125,507
Engine 8	ENG08	150	680	96.63	5.25	52,200	13.40	125,507
Engine 9	ENG09	150	680	96.63	5.25	52,200	13.40	125,507
Engine 10	ENG10	150	680	96.63	5.25	52,200	13.40	125,507
Merged Stacks								
Engines 1-5	ENGM1	150	680	96.63	11.7	261,000	13.40	627,533
Engines 6-10	ENGM2	150	680	96.63	11.7	261,000	13.40	627,533

Table 4-2 Emissions Summary for Modeling (pounds per hour per engine)

Pollutant	Averaging Period	RICE Emissions (lb/hr per engine)
PM_{10}	24-hr	3.40
	Annual	3.40
$PM_{2.5}$	24-hr	3.40
	Annual	3.40
CO	1-hr	18.22
	8-hr	13.05

4.3 Model Selection

The suitability of an air quality dispersion model for a particular application is dependent upon several factors. The following selection criteria were evaluated:

- stack height relative to nearby structures;
- dispersion environment;
- local terrain; and
- representative meteorological data.

Pima County's rule pertaining to air quality modeling refers to EPA's 2005 version of Appendix W and does not yet reflect the recent EPA rule promulgation of Appendix W in May 2017. Section 6 part B of Pima County's rule (PCC § 17.16.590(A)(6)) states that if the "guideline" model is inappropriate it may be modified or substituted with another model. We assume that given the very recent EPA rule that Pima County and the EPA would accept the most recent version of AERMOD as the most appropriate model and the recently promulgated Appendix W guidance as the most appropriate for this analysis. Based on a review of the factors discussed below, the latest version of AERMOD (16216r) was used in this modeling of IGS.

In rulemaking released in the December 20, 2016 Pre-Federal Register Version of the Final Rule, the EPA provided a revised version of AERMOD (16216), which replaces the previous version of AERMOD (15181). On January 17, 2017, EPA re-released AERMOD (version 16216r) that addressed several "bugs" discovered in the December 2016 version. The rulemaking included refinements to EPA's preferred short-range model, AERMOD, involving low wind conditions. These refinements included an adjustment to the computation of the friction velocity ("ADJ_U*") in the AERMET (16216) meteorological pre-processor. The promulgated Final Rule also changed the status of the ADJ_U* refinement from a beta option to an approved regulatory option. The modeling conducted for the proposed project at IGS utilizes the newly approved regulatory low wind model option.

4.4 Meteorological Data for AERMOD

Meteorological data required for AERMOD include hourly values of wind speed, wind direction, and ambient temperature. Since the AERMOD dispersion algorithms are based on atmospheric boundary layer dispersion theory, additional boundary layer variables are derived by parameterization formulas,

which are computed by the AERMOD meteorological preprocessor, AERMET[6]. These parameters include sensible heat flux, surface friction velocity, convective velocity scale, vertical potential temperature gradient, convective and mechanical mixing heights, Monin-Obukhov length, surface roughness length, Bowen ratio, and albedo.

4.4.1 Available Meteorological Data for AERMOD

Arizona Department of Environmental Quality (ADEQ) has pre-processed meteorological data[7] for 2012-2016 for the Tucson International Airport (surface and upper air), using AERMET version 16216 along with AERMINUTE version 15272 and AERSURFACE version 13016. The recently-approved low wind ADJ_U* guideline option was utilized for this data set. The representative airport site is located approximately 5 kilometers to the southwest of IGS and is the only ASOS station in the Tucson area. It is representative of the application site because there is no intervening terrain between the airport and IGS, and both sites share similar (arid) surface characteristics. This data set was used for the air quality impact analysis. A wind rose using the five-year period from 2012 to 2016 is provided as **Figure 4-1**.

4.5 Good Engineering Practice Stack Height Analysis

A Good Engineering Practice (GEP) stack height analysis was performed to determine the potential for building-induced aerodynamic downwash. The analysis procedures described in EPA's Guidelines for Determination of Good Engineering Practice Stack Height[8], Stack Height Regulations (40 CFR 51), and current Model Clearinghouse guidance was used.

The GEP formula height is based on the observed phenomena of disturbed atmospheric flow in the immediate vicinity of a structure resulting in higher ground-level concentrations at a closer proximity to the building than would otherwise occur. It identifies the minimum stack height at which significant aerodynamics (downwash) are avoided. The GEP formula stack height, as defined in the 1985 final regulations, is calculated from:

$$H_{GEP} = H_{BLDG} + 1.5L$$

where:

H_{GEP} is the maximum GEP stack height;

H_{BLDG} is the height of the nearby structure; and

L is the lesser dimension (height or projected width) of the nearby structure.

Both the height and width of the structure are determined from the frontal area of the structure projected onto a plane perpendicular to the direction of the wind. In all instances, the GEP stack height is based on the plane projections of any nearby building that results in the greatest justifiable height. For purposes of the GEP analysis, “nearby” refers to the “sphere of influence,” defined as five times the height or width of the building, whichever is less, downwind from the trailing edge of the structure.

[6] EPA 2016. User’s Guide for the AERMOD Meteorological Preprocessor (AERMET). EPA-454/B-16-010 (December 2016). Office of Air Quality Planning and Standards, Research Triangle Park, NC. https://www3.epa.gov/ttn/scram/7thconf/aermod/aermet_userguide.pdf.

[7] Arizona Department of Environmental Quality (ADEQ) AERMOD-ready meteorological data files are available at http://www.azdeq.gov/node/2127.

[8] EPA 1985. Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) - Revised. EPA-450/4-80-023R, US EPA, Research Triangle Park, NC 27711. https://www3.epa.gov/scram001/guidance/guide/gep.pdf.

In the case where a stack is not influenced by nearby structures, the maximum GEP stack height is defined as 65 meters.

Figure 4-2 is a plot plan showing the locations of the power plant equipment, and structures that could potentially produce aerodynamic downwash of the plumes for the reciprocating RICEs. The direction-specific building dimensions were determined using the latest version of EPA's Building Profile Input Program software (BPIP PRIME Dated 04274) using the design values of the stack and building heights.

Figure 4-1 Wind Rose from Tucson International Airport 2012-2016

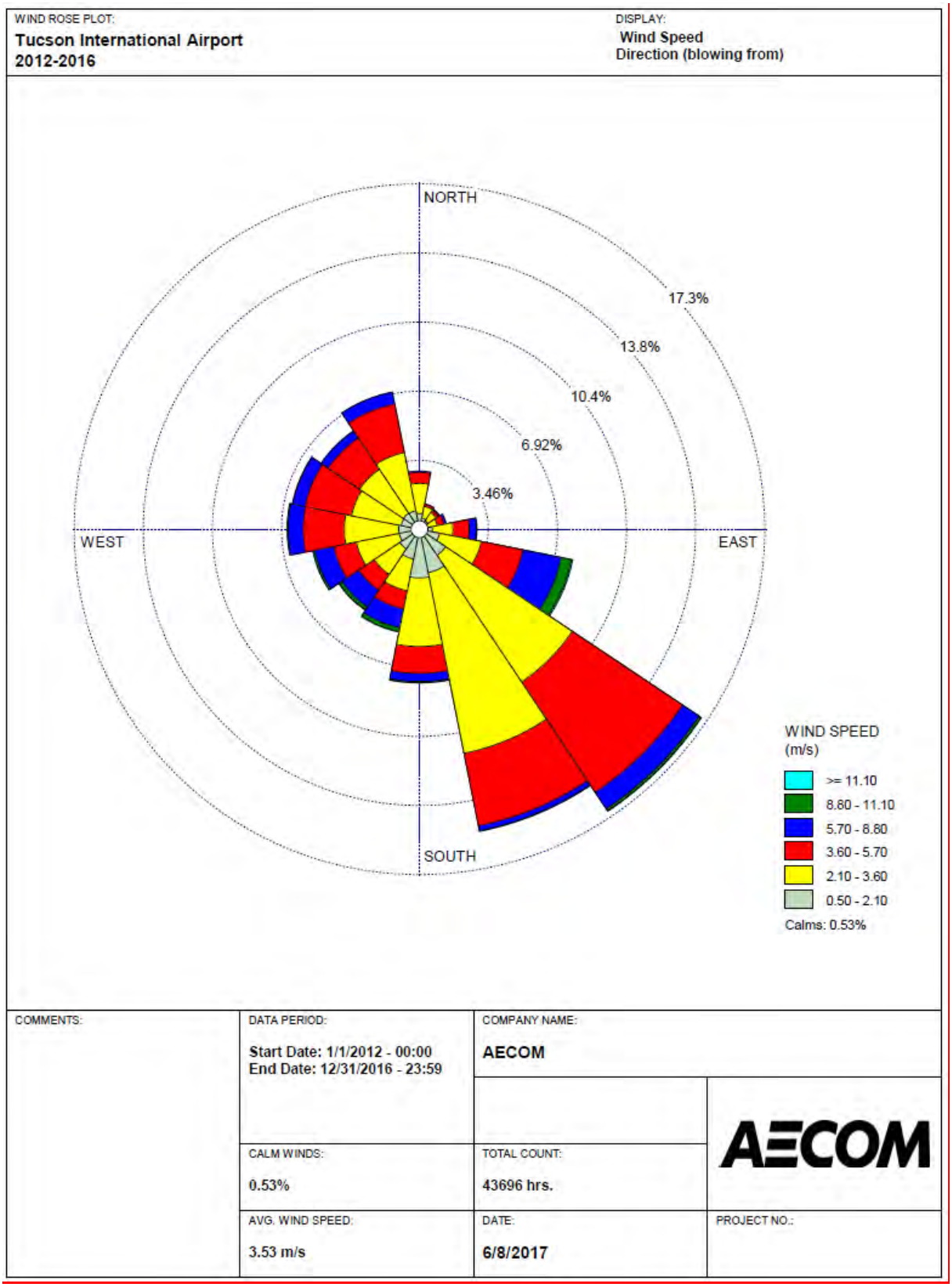
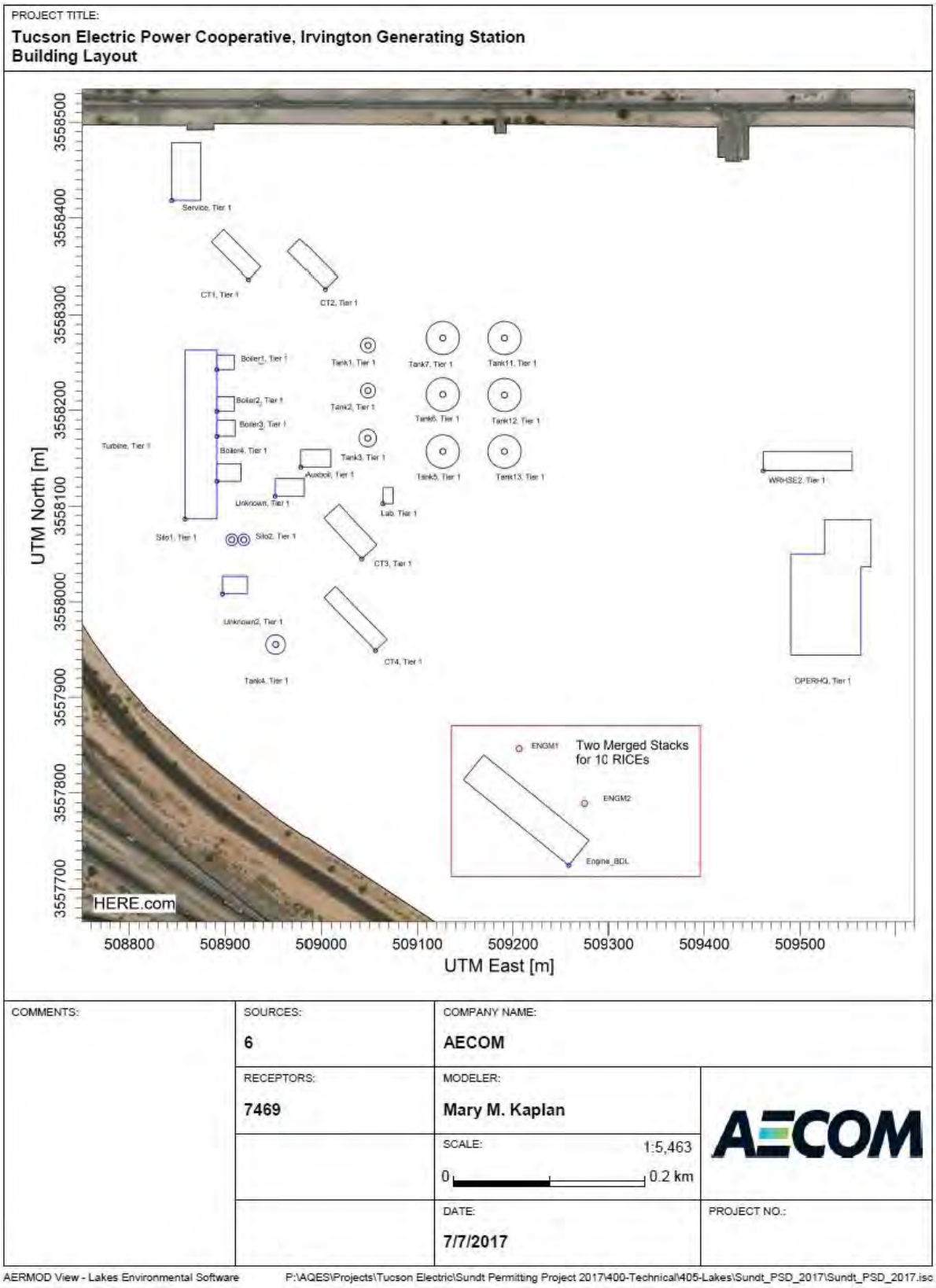


Figure 4-2 Plot Plant Used in the GEP Analysis



4.6 Receptor Grid and AERMAP Processing

The modeling analysis was conducted using the following Cartesian receptor grid design for Class II areas.

- 25-m receptor spacing along the IGS boundary;
- 100-m receptor spacing extending out 2 kilometers from the grid center (located near the center of the facility at 509448.00 meters Easting, 3557910.00 meters Northing);
- 250-m receptor spacing between 2 and 6 kilometers from the grid center;
- 500-m receptor spacing between 6 and 10 kilometers from the grid center;
- 1,000-m receptor spacing between 10 and 20 kilometers from the grid center; and
- 2,000-m receptor spacing beyond 20 kilometers (out to 50 km).

The receptor grid used in the modeling analysis was based on Universal Transverse Mercator (UTM) coordinates referenced to NAD 83 datum Zone 12 and is shown in **Figure 4-3** and **Figure 4-4**.

4.6.1 Terrain Processing (AERMAP)

The latest version of AERMAP (version 11103), the AERMOD terrain preprocessor program, was used to calculate terrain elevations and critical hill heights for the modeled receptors using National Elevation Data (NED). The dataset was downloaded from the USGS website (http://viewer.nationalmap.gov/viewer/) and consists of 1/3 arc second (~10 m resolution) NED. As per the AERMAP User's Guide[9], the domain was sufficient to ensure all significant nodes were included such that all terrain features exceeding a 10% elevation slope from any given receptor, are considered.

4.7 Class II Area Modeling Analysis

A refined modeling analysis was conducted using AERMOD (version 16216r). The analysis was conducted to demonstrate compliance with both federal and local applicable ambient air quality standards.

4.7.1 PSD Class II Significant Impact Level Analysis Results

Impacts were assessed using AERMOD at the Class II receptor locations described previously, and compared to the Class II SILs to determine if the impacts were significant for CO, PM_{10} and $PM_{2.5}$. Five years (2012-2016) of representative meteorological data were used as input to AERMOD, as discussed in **Section 4.4**. Significance for 24-hour $PM_{2.5}$ is determined by averaging the maximum daily concentrations for each year modeled at each receptor over the 5 years and comparing to the SIL (AERMOD performs this calculation internally). All other pollutants/averaging periods are determined by comparing the maximum concentration for any year modeled to the SIL.

[9] EPA 2004. User's Guide for the AERMOD Terrain Preprocessor (AERMAP). EPA-454/B-03-003 (October 2004 – Addendum March 2011). Office of Air Quality Planning and Standards, Research Triangle Park, NC. https://www3.epa.gov/scram001/dispersion_related.htm.

Figure 4-3 Near-Field Receptor Grid

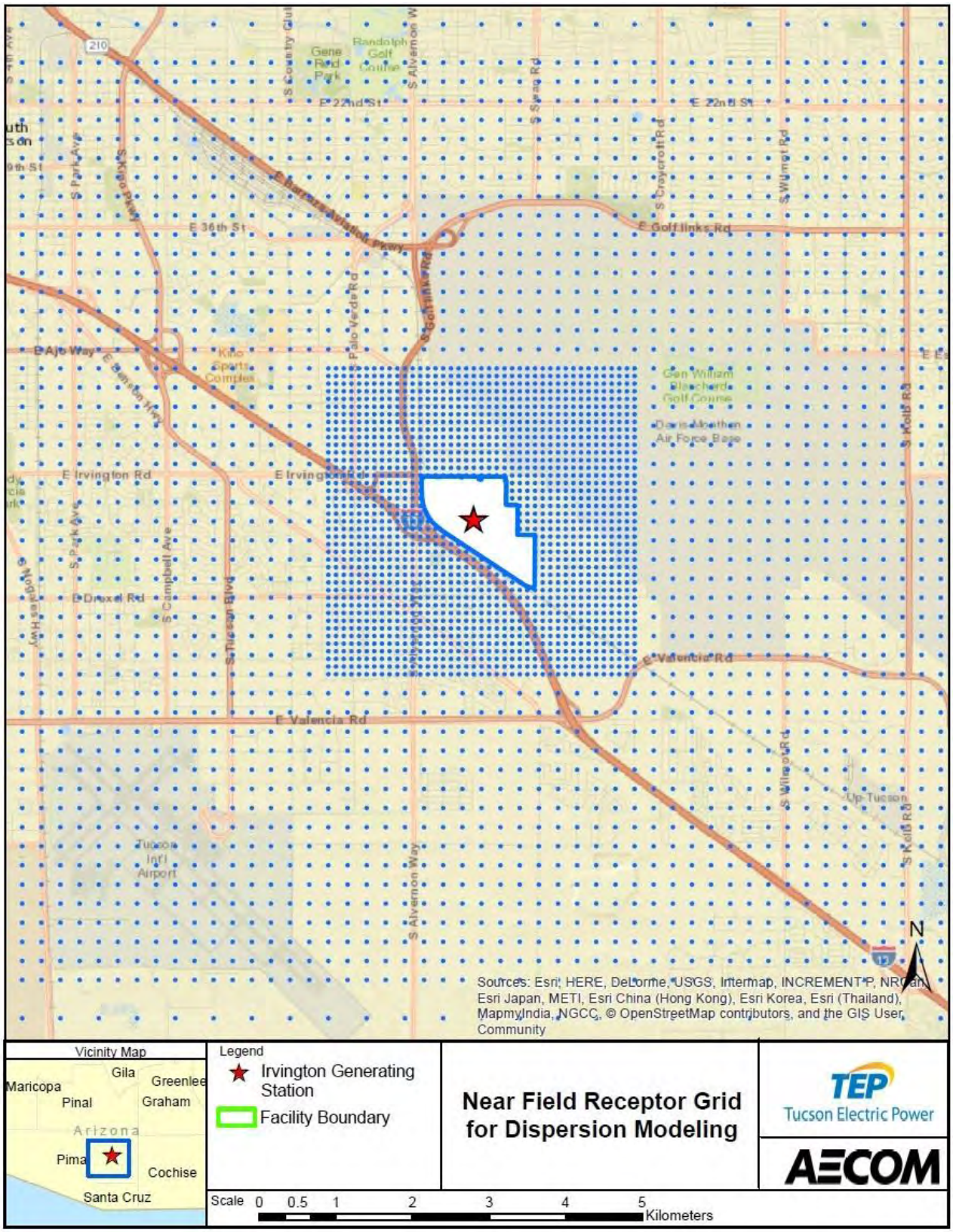
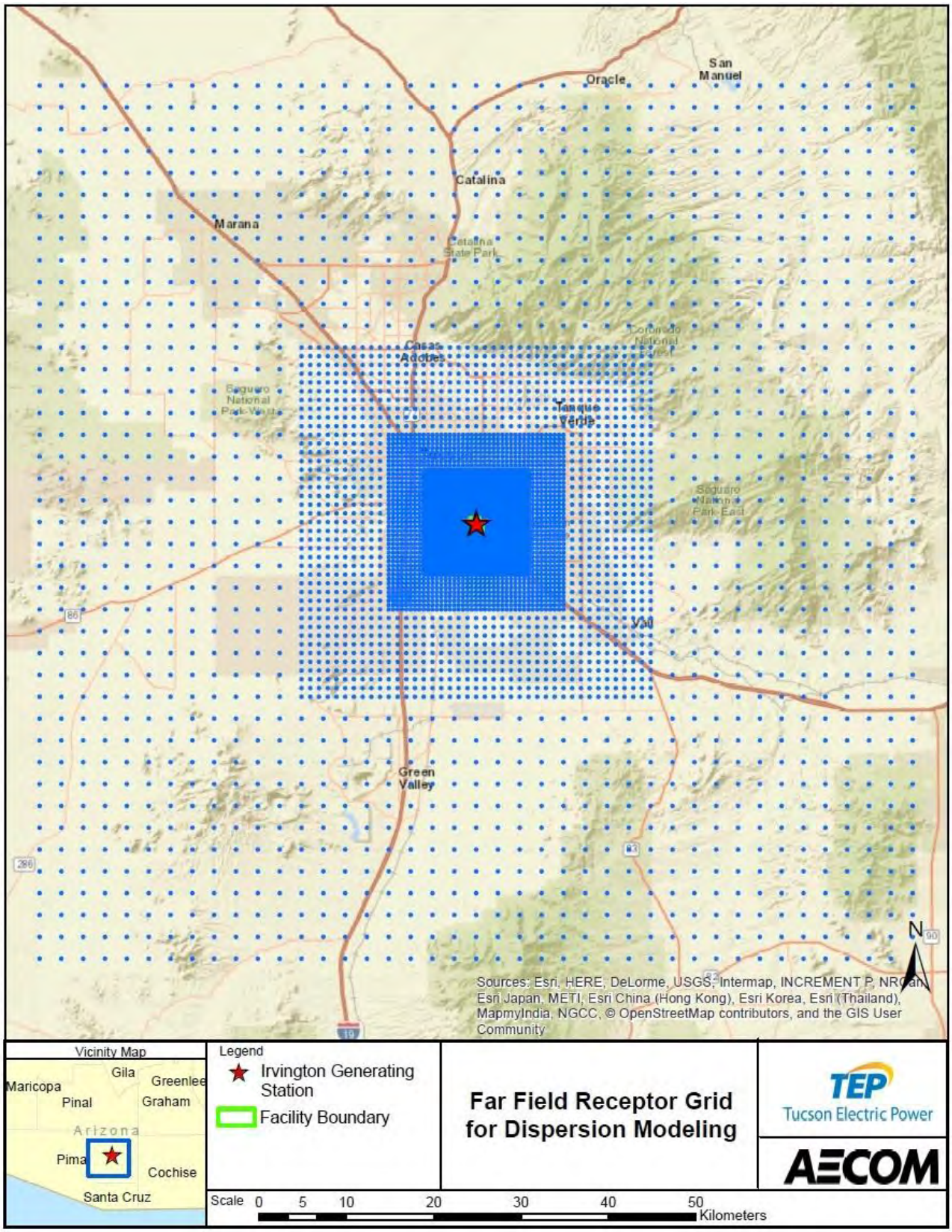


Figure 4-4 Far Field Receptor Grid



For those pollutants and averaging periods with modeled concentrations less than their SILs, no further modeling was required because, by definition, those pollutants and averaging periods cannot cause or contribute to a violation of a NAAQS or exceedances of the PSD increments as discussed in Section 3. A comparison of the overall maximum modeled concentrations with the SILs is presented in **Table 4-3** for the worst-case emission rates and the locations are shown in **Figure 4-5**. As is depicted in **Table 4-3,** all modeled concentrations are below their respective SILs. As such, no further analyses were required for these pollutants.

Table 4-3 Summary of Maximum AERMOD Concentrations to Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration ($\mu g/m^3$)	SIL	Significant? (Yes or No)
CO	1-Hour	42.51	2,000	N
	8-Hour	10.00	500	N
PM_{10}	24-Hour	1.23	5	N
	Annual	0.14	1	N
$PM_{2.5}$	24-Hour	1.00	1.2	N
	Annual	0.13	0.3	N

4.8 Class I Area

PSD regulations[10] recommend that facilities within 100 km of a PSD Class I area perform a modeling evaluation of the ambient air quality in terms of Class I PSD Increments and Air Quality Related Values. In addition, large projects beyond 100 km (but less than 300 km) from the nearest Class I area may be requested to conduct an evaluation of air quality impacts by the Federal Land Managers (FLMs). There are ten Class I areas within 300 km of IGS as shown in **Figure 4-6**:

1. Chiricahua NM
2. Chiricahua Wilderness
3. Galiuro Wilderness
4. Gila Wilderness
5. Mazatzal Wilderness
6. Mount Baldy Wilderness
7. Pine Mountain Wilderness
8. Saguaro National Park (East and West)
9. Sierra Ancha Wilderness
10. Superstition Wilderness

[10] 1992 EPA Memorandum. Clarification of Prevention of Significant Deterioration (PSD) Guidance for Modeling Class I Area Impacts. https://www.epa.gov/sites/production/files/2015-07/documents/class1.pdf.

Figure 4-5 Location of Maximum Concentrations

Figure 4-6 Class I Areas within 300 km of IGS

There are no other Class I areas within 300 km of IGS. Project impacts for PM_{10} and $PM_{2.5}$ pollutants subject to PSD review were assessed for the Class I areas (and portions thereof) within 300 km of the facility. The Class I SILs that the project impacts were compared to are summarized in **Table 4-4**. In 1996, EPA proposed rulemaking[11] for Class I specific SILs for PM10 24-hour (0.3 µg/m^3) and annual (0.2 µg/m^3). Although this rule was never finalized, the proposed SILs for PM10 have been widely used in previous permitting applications. The PM2.5 SILs are based upon guidance[12] issued by EPA in August, 2016.

Table 4-4 Criteria Pollutant Class I Significant Impact Levels

Pollutant	Averaging Time (1)	
	Annual *µg/m^3*	**24-hour** *µg/m^3*
PM_{10}	0.2	0.3
$PM_{2.5}$	0.05	0.27
(1) Highest 1st high concentration		

4.8.1 Class I Significant Impact Level Analysis Results (within 100 kilometers)

This PSD Class I analysis considers the closest Class I areas, Saguaro National Park (East and West) and Galiuro Wilderness, which are within 100 kilometers of IGS. The Significant Impact Analysis for compliance with PSD Class I increments was conducted with AERMOD using the same meteorological data as the Class II modeling.

Class I receptor grids were obtained from EPA Region 9's Class I database[13] and were used for the PSD Class I modeling. The Galiuro Wilderness Class I area resides approximately 60 km from IGS, yet AERMOD has a maximum distance applicability of 50 km. Therefore, modeling for impacts at Galiuro was conducted with receptors conservatively placed at a distance of 50 km along a line connecting the project location to Galiuro. In doing so, all of the Galiuro receptor elevations and hill heights were preserved from what they are at their actual locations. **Figure 4-7** shows the model receptor locations for Class I areas. All of the modeled pollutants and averaging periods resulted in modeled concentrations less than their SILs; therefore, no further analysis was performed.

For those pollutants and averaging periods with modeled concentrations less than their SILs, no further modeling was conducted. A comparison of the overall maximum modeled concentrations with the SILs is presented in **Table 4-5** for the worst-case emission rates. As is depicted in **Table 4-5**, all modeled concentrations are below their respective SILs. As such, no further analyses were required for these pollutants.

[11] 61 FR 38249. https://www.gpo.gov/fdsys/pkg/FR-1996-08-20/pdf/96-21281.pdf.
[12] https://www.epa.gov/nsr/draft-guidance-comment-significant-impact-levels-ozone-and-fine-particle-prevention-significant.
[13] EPA, Region 9 Federal Class I Areas. https://www3.epa.gov/region9/air/maps/r9_clss1.html .

Figure 4-7 Class I Receptor Grid

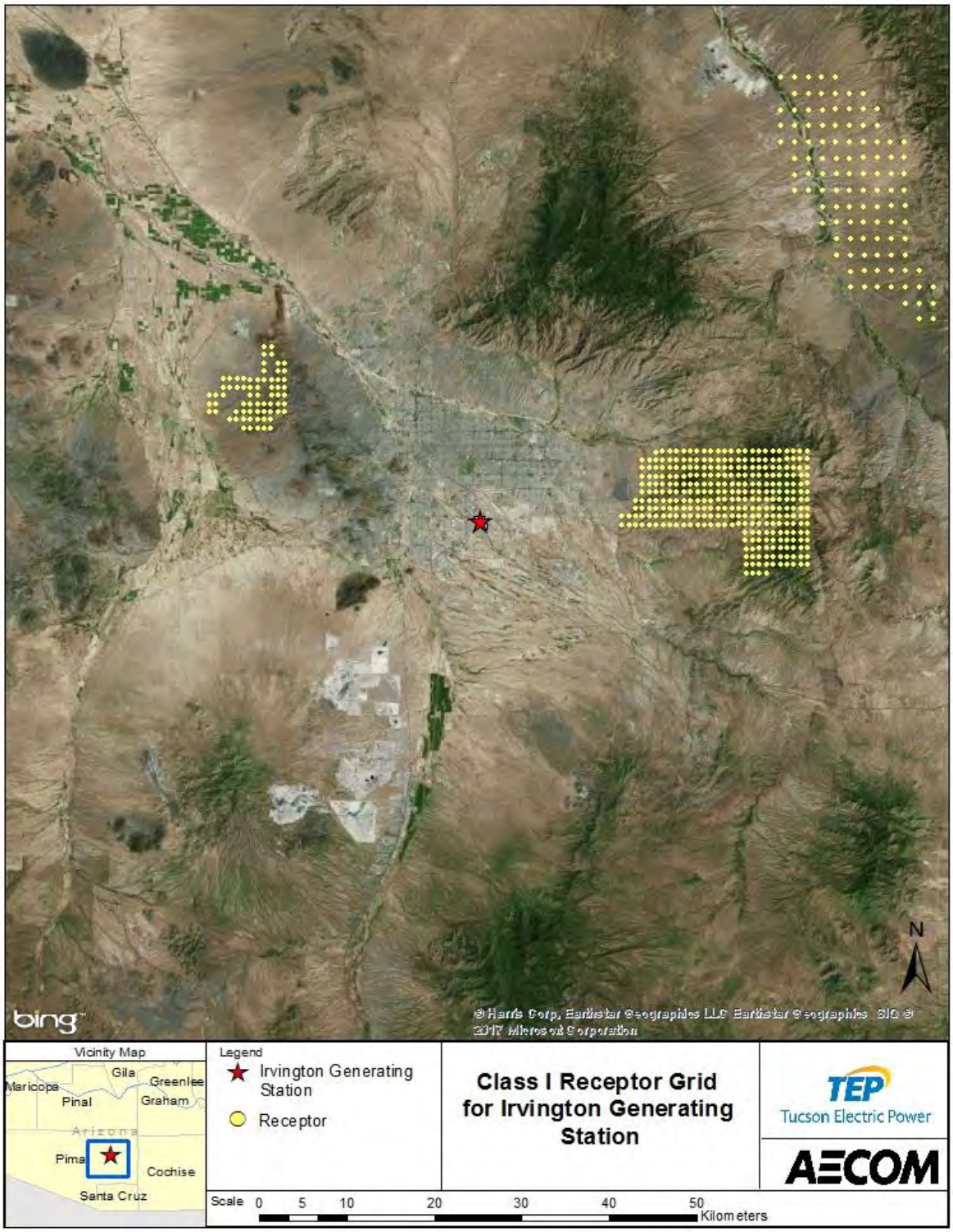


Table 4-5 Summary of Maximum AERMOD Concentrations to Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration ($\mu g/m^3$)	SIL	Significant? (Yes or No)
Saguaro National Park - East				
PM_{10}	24-Hour	0.281	0.3	N
	Annual	0.014	0.2	N
$PM_{2.5}$	24-Hour	0.207	0.27	N
	Annual	0.014	0.05	N
Saguaro National Park - West				
PM_{10}	24-Hour	0.226	0.3	N
	Annual	0.012	0.2	N
$PM_{2.5}$	24-Hour	0.161	0.27	N
	Annual	0.012	0.05	N
Galiuro Wilderness Area				
PM_{10}	24-Hour	0.011	0.3	N
	Annual	0.001	0.2	N
$PM_{2.5}$	24-Hour	0.009	0.27	N
	Annual	0.001	0.05	N

4.9 Modeling of Ozone Precursors

In rulemaking that was effective as of May 22, 2017, EPA's Appendix W, Revisions to the Guideline on Air Quality Models, provided a more specific procedure for assessing the impacts of an individual source on ozone. In conjunction with this new procedure, the EPA finalized a two-tiered demonstration approach for addressing individual source impacts on ozone. The first tier involves the use of technically credible relationships between precursor emissions and a source's impacts while the second tier involves application of more sophisticated case-specific chemical transport models. The EPA has recently issued draft guidance providing recommendations on air quality modeling and related technical analyses to satisfy compliance demonstration requirements for ozone for permit-related assessments under the PSD program; Guidance on the Development of Modeled Emission Rates for Precursors (MERPs) as a Tier 1 Demonstration Tool for Ozone and $PM_{2.5}$ under the PSD Permitting Program (December 02, 2016)[14] and Errata Memo (February 23, 2017)[15]. The draft guidance provides a Tier 1 demonstration tool for ozone (and $PM_{2.5}$). The MERPs are screening thresholds for precursor emissions, where VOC and NO_x screening values are provided for ozone, that are expected to result in an insignificant increase in ambient ozone relative to the NAAQS; i.e., an impact less than the 8-hour ozone SIL of 1 ppb. The MERP values were derived based on modeling conducted by EPA for locations across the U.S. For this project, since PSD review requirements are not triggered with respect to NO_X, only a comparison against VOC MERPs is required.

Table 7.1 of the guidance, as updated in the Errata Memo, provides the "Most Conservative (Lowest) Illustrative MERP Values (tons per year) by Precursor, Pollutant and Region". MERP values are

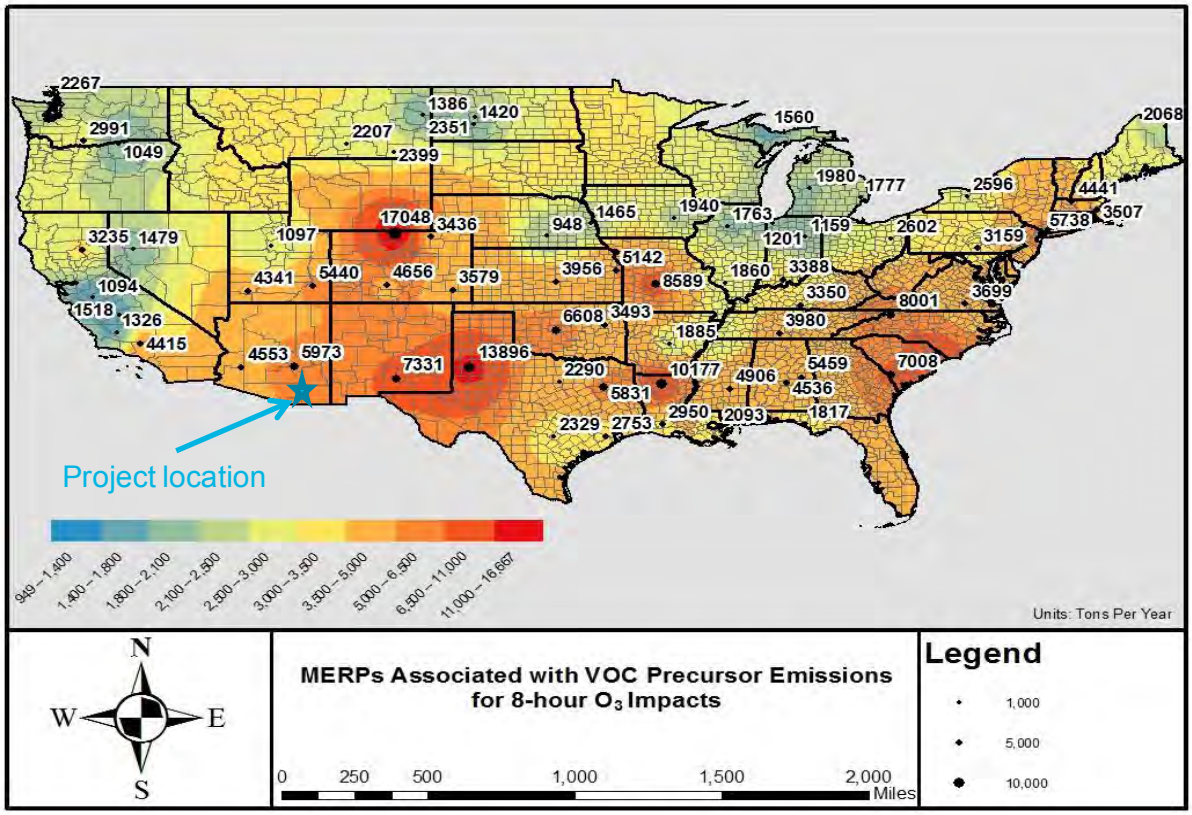
[14] Available at https://www3.epa.gov/ttn/scram/guidance/guide/EPA454_R_16_006.pdf.
[15] Available at https://www3.epa.gov/ttn/scram/guidance/guide/MERPs_Data_Distribution_and_Errata_Memo-02232017.pdf.

provided for VOC in the central, eastern and western U.S. To determine if an individual source will exceed the critical air quality threshold, the emissions increase is calculated as a percent of the lowest MERP for each precursor requiring analysis and summed. The equation prescribed for this determination of additive secondary impacts on 8-hour daily maximum ozone was used and its anticipated results show the critical air quality threshold is not exceeded and the Project is presumed to have an insignificant impact on ozone concentrations.

The modeled values presented in the appendices to the EPA single-source modeling guidance can be used to display the precursor emission rates expressed in tons per year that would result in a modeled impact exactly equal to the ozone SIL. The MERP results for VOC precursor emissions in **Figure 4-8**, with the project location shown as a blue star. The estimated MERP value (taken from the nearby EPA reference point) is 6,000 tons per year for VOCs. Since the project emissions (short-term rate expressed in tons per year) are only 248.3 tons per year for VOCs, it is evident that the project impacts will be well below the MERPs as shown in the calculation in EPA's Scenario A presented below:

(248.3 TPY VOC from source/6,000 TPY VOC 8-hr daily maximum O_3 MERP) = 0.041 * 100 = 4.1% of the SIL, or 0.041 ppb.

Figure 4-8 VOC Precursor MERPs for Ozone (TPY)



Even with possible spatial variations of the MERPs, this value is so far below the SIL that it is clear that the project's impact on ozone will be insignificant.

Per Pima County Code § 17.16.590(A)(5)(b)), a major modification to a major source of volatile organic compounds or oxides of nitrogen shall be presumed to contribute to violations of the Arizona ambient air quality standards for ozone if it will be located within fifty kilometers of a nonattainment

area for ozone. The only ozone nonattainment area in Arizona is located in Maricopa County and a small portion of Pinal County, more than 100 kilometers from IGS; therefore, a demonstration that the project will not cause or contribute to an violation is not required.

4.10 Modeling of Secondary $PM_{2.5}$ Emissions

Based on May 2014 guidance from EPA[16], a tiered approach is recommended for determining which sources would be important to consider when assessing secondary $PM_{2.5}$ concentrations, but the guidance lacks specifics as to how the evaluations should be conducted. The draft guidance suggests four different cases that define what air quality modeling analysis would be needed to consider $PM_{2.5}$ emissions, and any further modeling needed if the consideration of secondary $PM_{2.5}$ would be required. The MERP guidance and Errata Memo can be used as reference should secondary $PM_{2.5}$ consideration be required.

The four cases presented by EPA in the May 2014 guidance include:

- Case 1: If the $PM_{2.5}$ emissions < 10 tons per year (TPY) and NOx and SO2 emissions < 40 TPY; then a $PM_{2.5}$ compliance modeling demonstration IS NOT required.
- Case 2: If the $PM_{2.5}$ emissions > 10 TPY and NO_x and SO_2 emissions < 40 TPY; then a $PM_{2.5}$ compliance modeling demonstration IS required for primary $PM_{2.5}$, but consideration of secondary $PM_{2.5}$ is NOT necessary.
- Case 3: If the $PM_{2.5}$ emissions > 10 TPY and NO_x and/or SO_2 emissions > 40 TPY; then a $PM_{2.5}$ compliance modeling demonstration IS required for primary $PM_{2.5}$ and secondary $PM_{2.5}$ MUST BE accounted for from the project source.
  - EPA suggests the assessment of the effect of precursor emissions on secondary PM2.5 could be completely qualitative in nature, could be a hybrid qualitative/quantitative approach, or may require full photochemical modeling. However, EPA believes that not many cases will require full photochemical modeling.
- Case 4: If the $PM_{2.5}$ emissions < 10 TPY and NO_x and/or SO_2 remissions > 40 TPY; then a $PM_{2.5}$ compliance demonstration is NOT required for primary $PM_{2.5}$ but an assessment of secondary $PM_{2.5}$ is required. Much like Case 3, the assessment could be completely qualitative in nature, could be a hybrid qualitative/ quantitative approach, or may require full photochemical modeling (unlikely).
  - EPA noted that this case is still under review.

$PM_{2.5}$ modeling for the RICE project falls into Case 2 as described above and thus a qualitative / quantitative analysis to address secondary $PM_{2.5}$ is not required.

[16] Available at https://www3.epa.gov/scram001/guidance/guide/Guidance_for_PM25_Permit_Modeling.pdf.

5. Additional Impact Analysis

Under the PSD regulations, permit applicants must prepare an additional impact analysis for each pollutant subject to regulation. This analysis assesses the impacts of air, ground and water pollutions on soils, vegetation, and visibility caused by any increase in emissions of any regulated pollutant from the source or modification under review, and from associated growth. The various components of the additional impact analyses are discussed below.

5.1 Visibility Analysis (within 50 kilometers)

For any new major source or major modification, Pima County requires (PCC § 17.16.630) an analysis of the anticipated impacts of the proposed sources on visibility in any Class I areas which may be affected by the emissions from that source. Furthermore, *Federal Land Managers'Air Quality Related Values Work Group Phase 1 Report – Revised (2010)*[17] recommends that the applicant perform an analysis of visibility impairment (i.e., plume blight) at Class I areas within 50 kilometers of the proposed Project site, in this case Saguaro National Park (eastern and western units).

The visible plume analysis was conducted with the most current version of EPA's screening model VISCREEN to determine if project emissions during normal operations have the potential to cause visibility impairment. VISCREEN was applied with the guidance provided in EPA's Workbook for Plume Visual Impact Screening and Analysis ("Workbook")[18]. As such, the VISCREEN model was applied to estimate two visual impact parameters, plume perceptibility (ΔE) and plume contrast (Cp). Screening-level guidance indicates that values above 2.0 for ΔE and +/- 0.05 for Cp are considered perceptible. The Workbook offers two levels of analysis. Level 1 screening analysis which is the most simplified and conservative approach employing default meteorological data with no site-specific conditions. The Level 2 analysis takes into account representative meteorological data and site-specific conditions. According to Table 10 in the FLAG 2010 report, the maximum monthly average background visual range recommended for Saguaro NP area is 252 kilometers. This background visual range was used for the Level 2 screening analyses.

A Level 2 analysis was conducted in accordance with the recommendations in the Workbook for the RICE project.

The Level 2 analysis was conducted with five years (2012-2016) of surface observations and mixing height data from the Tucson International Airport in Tucson, Arizona. The meteorological data was obtained from the AERMOD-ready files downloaded from ADEQ's site and is identical to the dataset used in the AERMOD modeling.

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[17] National Park Service, 2010. Phase I Report of the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Revised 2010. National Park Service, Air Resources Division; U.S. Forest Service, Air Quality Program; U.S. Fish and Wildlife Service, Air Quality Branch. http://www.nature.nps.gov/air/Pubs/pdf/flag/FLAG_2010.pdf.

[18] EPA 1992. Workbook for Plume Visual Impact Screening and Analysis (Revised). EPA-454/R-92-023. http://dnr.mo.gov/gatewayvip/docs/viscreen.pdf.

The source data required by VISCREEN are total NOx emissions (82.34 ton/yr) and particulate matter emissions (148.92 ton/yr) for the RICE project. These emissions represent worst case emission rates for a 24-hour period. As discussed in Section 1, the RICE project will be replacing two existing boilers (Units 1 and 2) at IGS. The difference between the RICE project and the Baseline (Units 1 and 2) was used to compare against the visibility thresholds. The maximum combined NOx and PM 24-hour (daily) emission rate was used to represent the worst case emission rates of the Baseline. The total NOx emissions (747.52 ton/yr) and particulate matter emissions (102.62 ton/yr) were used for the Baseline.

The wind direction sectors that would transport emissions from IGS toward Saguaro National Parks East and West chosen for analysis, along with the closest distance from the parks to the project site, are shown in **Table 5-1**. The location of Saguaro National Parks East and West relative to IGS is shown in **Figure 5-1**.

Table 5-1 VISCREEN Level 2 Input Data for RICE Project Sources

Class I Area	Wind Sector (degrees)	Closest Distance to the Source (km)	Furthest Distance from the Source (km)	Level 2 Worst Case Stability Class	Level 2 Worst Case Wind Speed (m/s)
Saguaro NP East	257.75 – 280.25	15.49	39.08	D	4
Saguaro NP West	112.75 – 135.25	19.1	35.86	E	3

Based on this information, and the five years of meteorological data, a table of joint frequency of occurrence of wind speed, wind direction, and stability class was developed as outlined in the Workbook. The dispersion conditions, defined by wind speed and stability class, were ranked by evaluating the product of σ_y, σ_z, and u, where σ_y and σ_z are the Pasquill-Gifford horizontal and vertical diffusion coefficients for the given stability class and downwind distance and u is the wind speed. The dispersion conditions were then ranked in ascending order according to the value of $\sigma_y \sigma_z u$ as shown in **Tables 5-2** and **5-3** for Saguaro NP East and West, respectfully.

According to the Workbook, VISCREEN is to be applied with the worst-case meteorological conditions that have a $\sigma_y \sigma_z u$ product with a cumulative probability of one percent. That is, the dispersion condition is selected such that the sum of all frequencies of occurrence of conditions worse than this condition totals one percent. Note that as recommended by the Workbook, dispersion conditions that result in greater than 12 hours of plume transport time are discounted from the analysis, since it is unlikely that steady-state plume conditions would persist for more than 12 hours.

According to **Table 5-2**, the worst-case daylight (6 am – 6 pm) dispersion conditions with cumulative frequency of 1 percent are D stability, 4 m/sec for Saguaro NP East. For Saguaro NP West, **Table 5-3** shows the worst-case daylight (6 am – 6 pm) dispersion conditions with cumulative frequency of 1 percent are E stability, 3 m/sec. Therefore, VISCREEN was applied with D stability and a wind speed of 4 m/sec for Saguaro NP East and E stability and a wind speed of 3 m/sec for Saguaro NP West. As recommended by the FLAG 2010 report, a visual range of 252 kilometers was used.

Figure 5-1 Angles and Distances Used in Level 2 VISCREEN Analysis

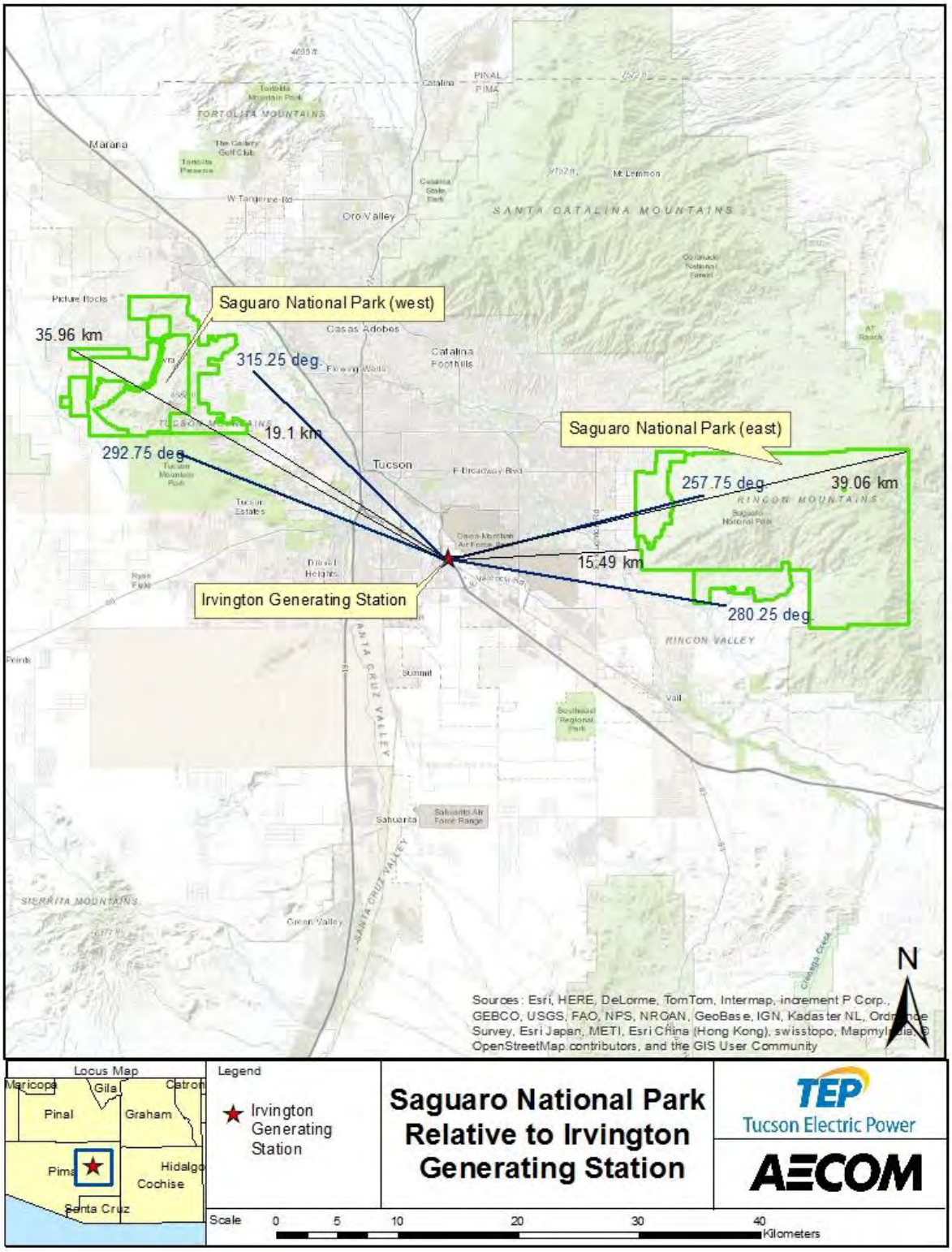

Table 5-2 Frequency Analysis of Dispersion Conditions for SNP Eastern Unit, Sector 257.75° to 280.25°

Dispersion Conditions				Frequency By Time of Day				Cumulative Frequency By Time of Day			
Stability Class	Wind Speed (m/sec)	$\sigma_y\sigma_z u$ (m^3/s)	Transport Time (hours)	0-6	6-12	12-18	18-24	0-6	6-12	12-18	18-24
F	1	22166	9	0.05	0.00	0.00	0.04	0.05	0.00	0.00	0.04
F	2	44332	3	0.35	0.06	0.01	0.71	0.40	0.06	0.01	0.75
E	1	58225	9	0.00	0.00	0.00	0.00	0.40	0.06	0.01	0.75
F	3	66498	2	0.00	0.00	0.00	0.00	0.40	0.06	0.01	0.75
E	2	116450	3	0.31	0.08	0.03	0.79	0.71	0.14	0.04	1.54
D	1	138532	9	0.00	0.00	0.00	0.00	0.71	0.14	0.04	1.54
E	3	174675	2	0.76	0.04	0.15	3.54	1.46	0.18	0.18	5.07
E	4	232900	1	0.57	0.05	0.12	2.98	2.04	0.22	0.30	8.06
D	2	277065	3	0.00	0.02	0.01	0.00	2.04	0.24	0.31	8.06
E	5	291125	1	0.08	0.04	0.06	1.58	2.12	0.28	0.37	9.63
D	3	415598	2	0.00	0.08	0.11	0.04	2.12	0.36	0.48	9.67
D	4	554130	1	0.00	0.18	0.77	0.06	2.12	0.53	1.25	9.72
D	5	692662	1	0.00	0.27	1.95	0.15	2.12	0.80	3.20	9.87
D	6	831195	1	0.00	0.12	1.23	0.16	2.12	0.92	4.44	10.03
D	7	969728	1	0.00	0.10	1.12	0.07	2.12	1.02	5.56	10.10
D	8	1108260	1	0.00	0.09	0.56	0.04	2.12	1.11	6.12	10.14

Table 5-3 Frequency Analysis of Dispersion Conditions for SNP Western Unit, Sector 112.75° to 135.25°

Dispersion Conditions				Frequency By Time of Day				Cumulative Frequency By Time of Day			
Stability Class	Wind Speed (m/sec)	$\sigma_y\sigma_z u$ (m^3/s)	Transport Time (hours)	0-6	6-12	12-18	18-24	0-6	6-12	12-18	18-24
F	1	28568	11	0.000	0.009	0.000	0.028	0.00	0.01	0.00	0.03
F	2	57137	4	0.838	0.138	0.028	0.488	0.84	0.15	0.03	0.52
E	1	77277	11	0.000	0.000	0.000	0.000	0.84	0.15	0.03	0.52
F	3	85705	2	0.000	0.000	0.000	0.000	0.84	0.15	0.03	0.52
E	2	154553	4	0.866	0.129	0.018	0.368	1.70	0.28	0.05	0.88
D	1	187689	11	0.000	0.000	0.000	0.000	1.70	0.28	0.05	0.88
E	3	231830	2	6.004	0.764	0.009	1.621	7.71	1.04	0.06	2.51
E	4	309106	2	4.871	1.004	0.009	1.381	12.58	2.04	0.06	3.89
D	2	375377	4	0.000	0.110	0.009	0.009	12.58	2.16	0.07	3.90
E	5	386383	1	2.772	0.617	0.009	0.866	15.35	2.77	0.08	4.76
D	3	563066	2	0.000	0.322	0.064	0.018	15.35	3.09	0.15	4.78
D	4	750755	2	0.000	1.041	0.276	0.018	15.35	4.13	0.42	4.80
D	5	938444	1	0.000	1.068	0.442	0.018	15.35	5.20	0.87	4.82
D	6	1126132	1	0.000	0.755	0.451	0.009	15.35	5.96	1.32	4.83
D	7	1313821	1	0.000	0.875	0.414	0.009	15.35	6.83	1.73	4.83
D	8	1501510	1	0.000	0.838	0.341	0.000	15.35	7.67	2.07	4.83

The VISCREEN results are summarized in **Table 5-4** using worst-case operations emissions. VISCREEN provides results of ΔE and C_p for both sky and terrain backgrounds. The difference between the RICE project and the Baseline are compared to the significance criteria. The results are below the significance criteria. Therefore, the plume is expected to be imperceptible against background sky and terrain.

Table 5-4 VISCREEN Model Results

Class I Area	Background	Distance (km)	Plume Perceptibility (ΔE)			Plume Contrast (C_p)		
			VISCREEN[1]		Criteria	VISCREEN[1]		Criteria
			Theta 10	Theta 140		Theta 10	Theta 140	
Saguaro NP East	Sky	39.1	0.14	-0.45	2.00	0.02	0.00	0.05
	Terrain	39.1	1.31	-0.31	2.00	0.01	0.00	0.05
Saguaro NP West	Sky	36.0	0.19	-0.99	2.00	0.03	0.01	0.05
	Terrain	19.1	1.37	-0.04	2.00	0.01	0.00	0.05

1. VISCREEN results are provided for the two VISCREEN default worst-case theta angles. The two theta angles represent the sun being in front of the observer (theta = 10 degrees) or behind the observer (theta = 140 degrees).
2. A negative ΔE means the plume is less perceptible on the basis of the color difference between the plume and the background.
3. A negative C_p means the plume has a darker contrast than the background sky.

5.2 Class I Analysis (beyond 50 kilometers)

In accordance with the revised FLAG 2010 guidance that is recommended by the Federal Land Managers, we have excluded from modeling consideration Class I areas that are beyond the FLAG-specified screening distance from IGS. The screening distance is determined by adding the permitted short-term emissions from proposed routine (non-emergency) point sources for SO_2 + NO_x + PM_{10} + H_2SO_4. A FLAG-prescribed screening distance has been calculated for the RICE project to determine what Class I areas will be considered for the Air Quality Related Values (AQRVs) analysis.

The sum of these emissions is not expected to exceed 244.22 tons per year (12.6 tons SO_2 + 82.7 tons NO_x + 148.92 tons PM_{10} and H_2SO_4) for the RICE project not including the reductions in emissions from Unit 1 and 2. With a FLAG-prescribed screening distance of 244/10 = 24.4 km, this results in the determination that only impacts within the Saguaro National Park were considered for Air Quality Related Values (AQRVs), since all other Class I areas are beyond this distance and beyond 50 km from the project location.

5.3 Growth Analysis

A growth analysis examines the potential emissions from secondary sources associated with the proposed Project. While these activities are not directly involved in the RICE project, the emissions involve those that can reasonably be expected to occur; for instance, industrial, commercial, and residential growth that will occur in the RICE project area due to the RICE project itself. Secondary emissions do not include any emissions which come directly from a mobile source, such as emissions from the tailpipe of any on-road motor vehicle or the

propulsion of a train. They also do not include sources that do not impact the same general area as the source under review.

The RICE project is not expected to employ additional personnel at this time. Therefore, population growth from this project is not expected, and thus an analysis of such growth was not performed.

5.4 Soils and Vegetation Analysis

An analysis of the RICE project's potential impact on soils and vegetation in the vicinity of the facility was performed in accordance with the procedures recommended in EPA's "A Screening Procedure for Impacts of Air Pollution Sources on Plants, Soils and Animals"[19]. For particulate matter, the 1980 screening procedure does not have a threshold to compare against; therefore, the impacts were compared to the NAAQS.

The highest modeled concentrations of PM_{10}, O_3 and CO from the RICE project were compared to the screening concentrations as shown in **Table 5-1**. As shown, the modeled concentrations are all well below their screening thresholds; therefore, no significant impacts on local vegetation is expected as a result of the RICE project.

Table 5-5 Injury Threshold for Vegetation

Pollutants	Averaging Period	Maximum Modeled Concentration (µg/m^3)	NAAQS (µg/m^3)	EPA's 1980 Screening Concentration[1] (µg/ m^3)
PM (as PM_{10})	24-hour	1.23	150	None
O_3	1-hour[2]	0.64	None	392
	4-hour[3]	0.16	None	196
	8-hour[4]	0.08	140	118
CO[5]	Weekly	10.00	None	1,800,000

1. "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals". EPA 450/2-81-078, December 1980.
2. O_3 concentration calculated in Section 4.9 multiplied by 8.
3. O_3 concentration calculated in Section 4.9 multiplied by 4.
4. O_3 concentration calculated in Section 4.9.
5. CO concentration is the 8-hour concentration.

[19] EPA 1980. A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals. EPA-450/2-81-078. EPA, Research Triangle Park, NC 27711.

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