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

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Quality information

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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.

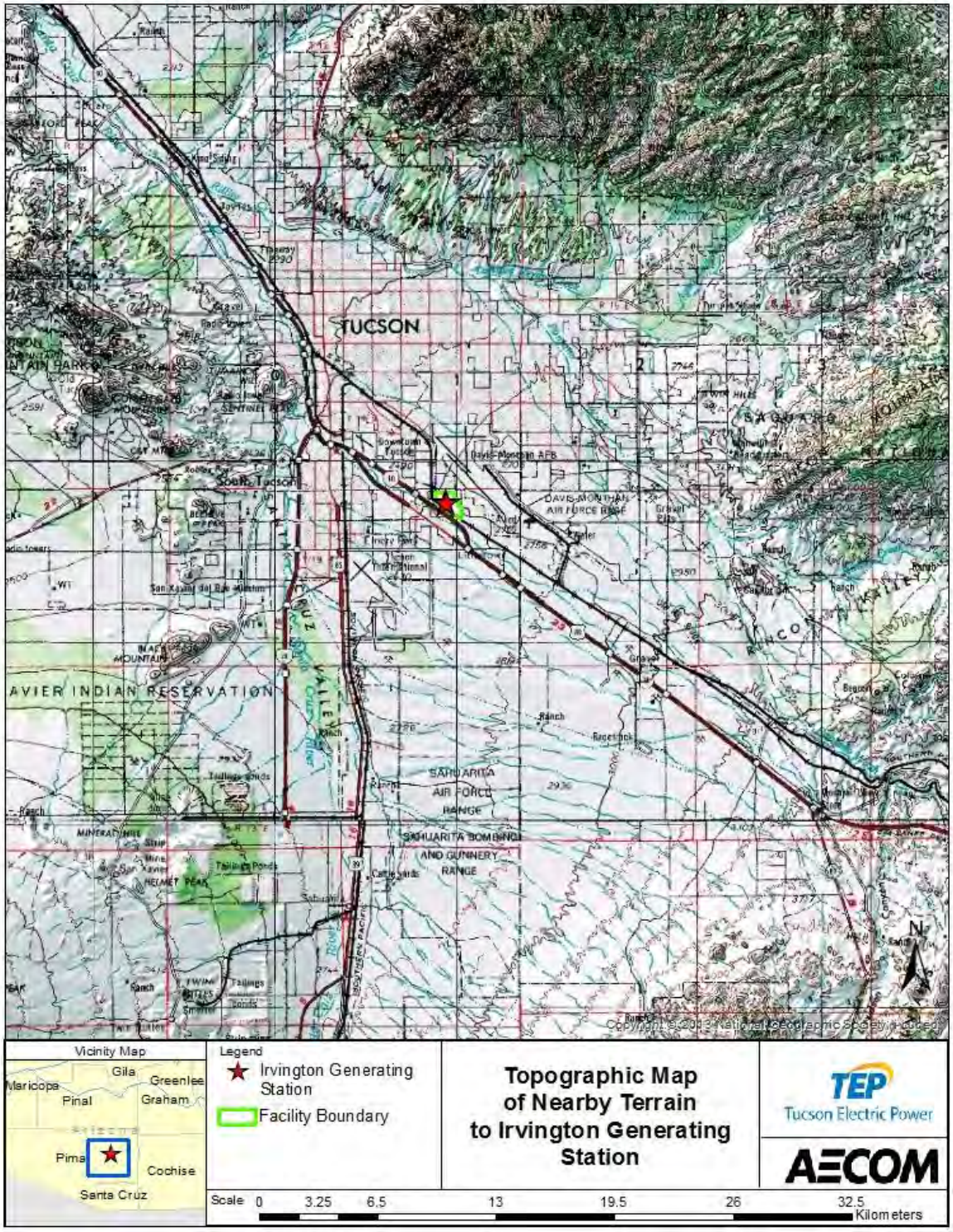
Each of the ten RICE installed at IGS will be equipped with two air pollution control devices:

- 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

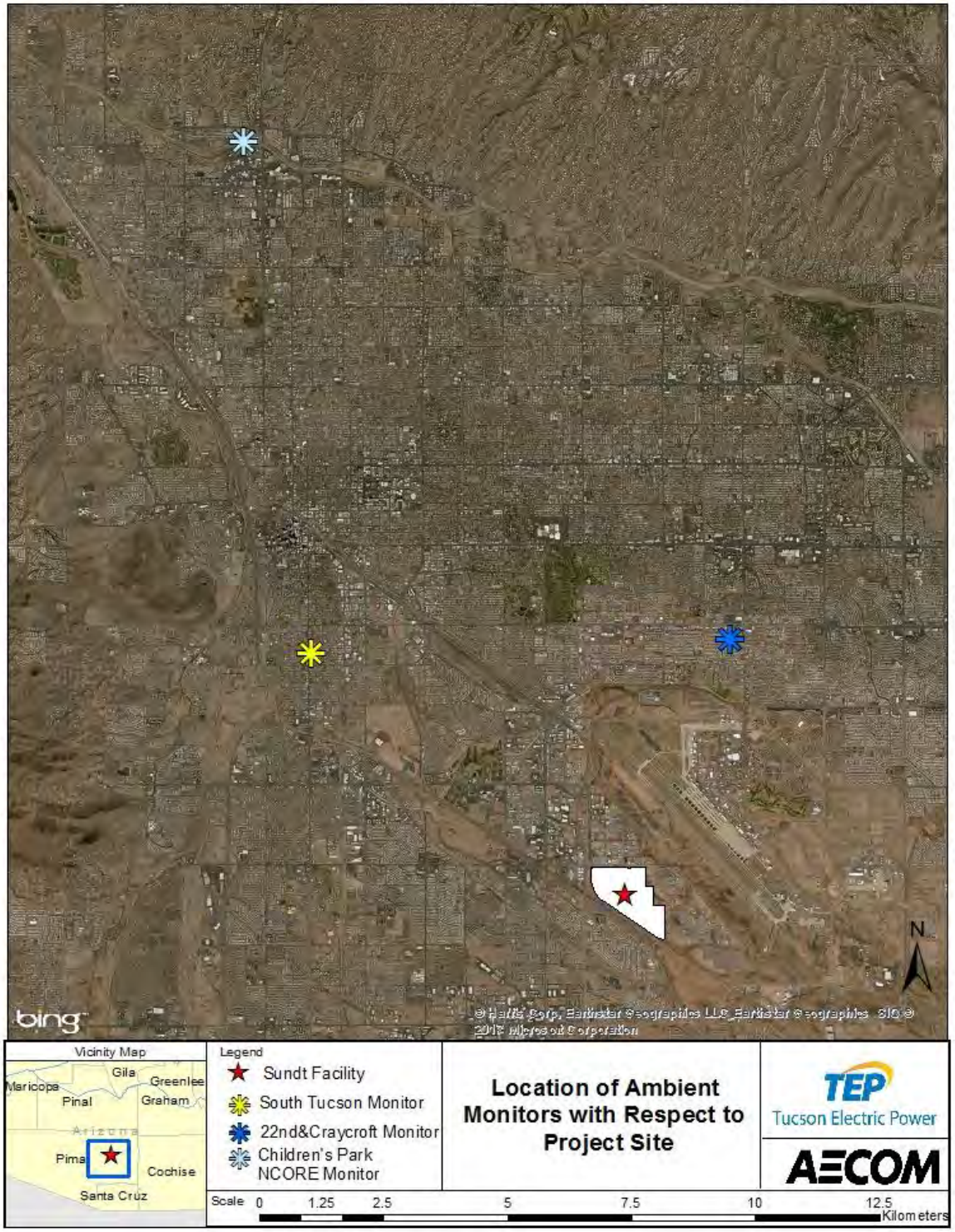
Pollutant	Monitor Location	Avg. Period	Design Value[1]	SIL	NAAQS	Units
CO	22nd & Craycroft	1-hr	1.6	1.75[2]	35	ppm
CO	22nd & Craycroft	8-hr	0.8	0.44[2]	9	ppm
O_3	22nd & Craycroft	8-hr	0.063	0.001[4]	0.070	ppm
PM_{10}	South Tucson	24-hr	101	5.0[2]	150	µg/m³
$PM_{2.5}$	Children's Park NCORE	24-hr	13	1.2[3]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

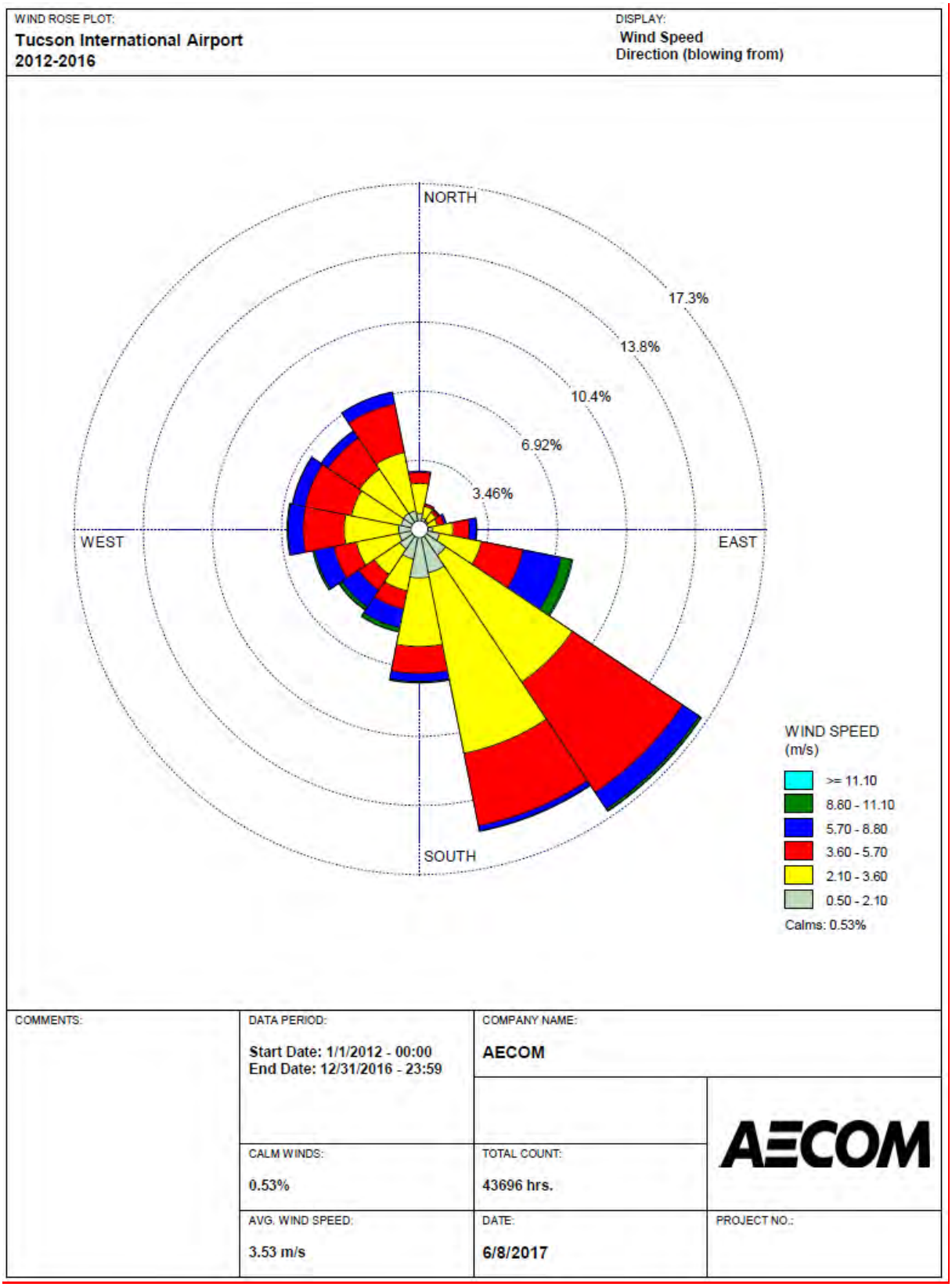
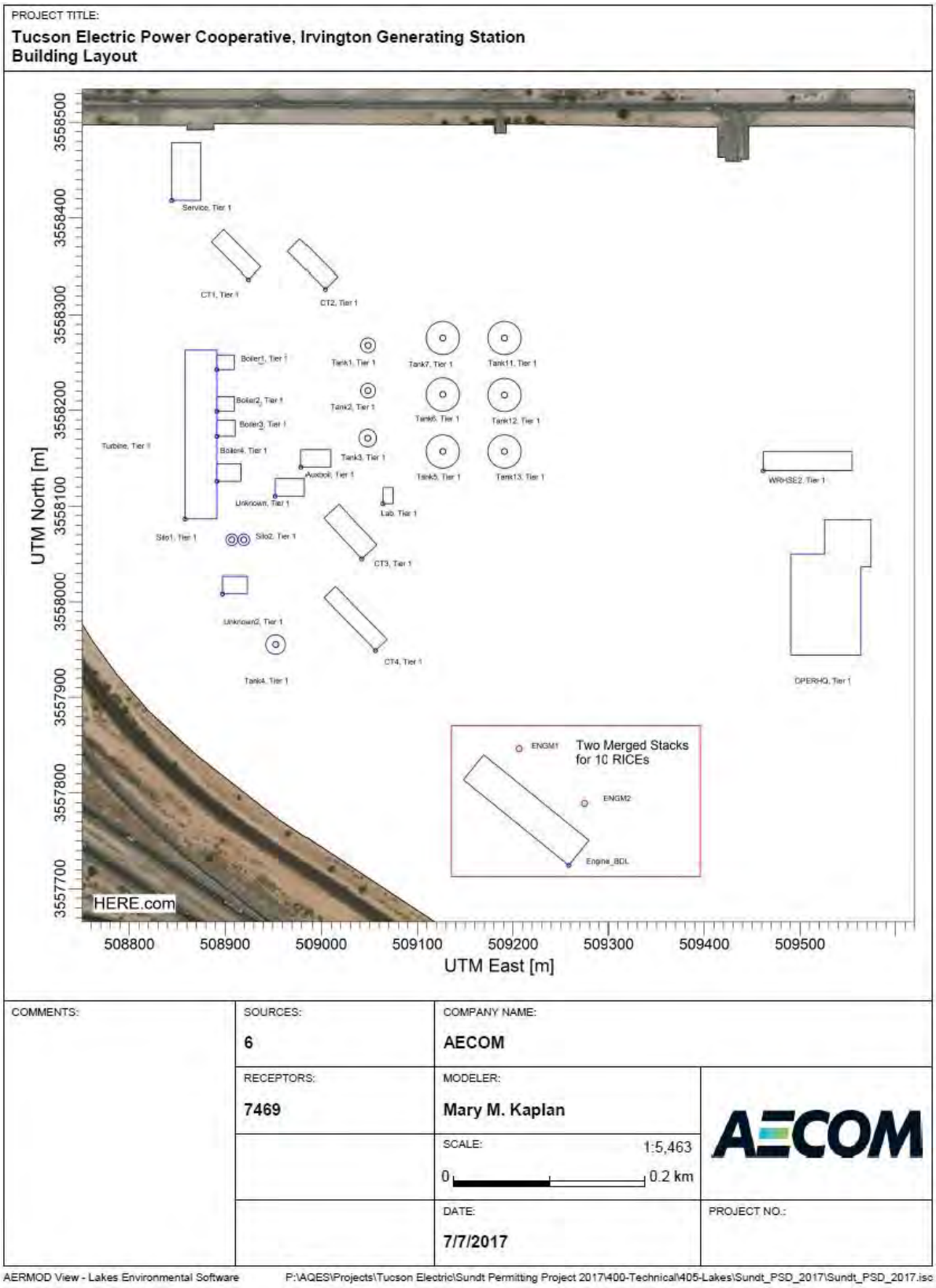


Figure 4-2 Plot Plant Used in the GEP Analysis



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

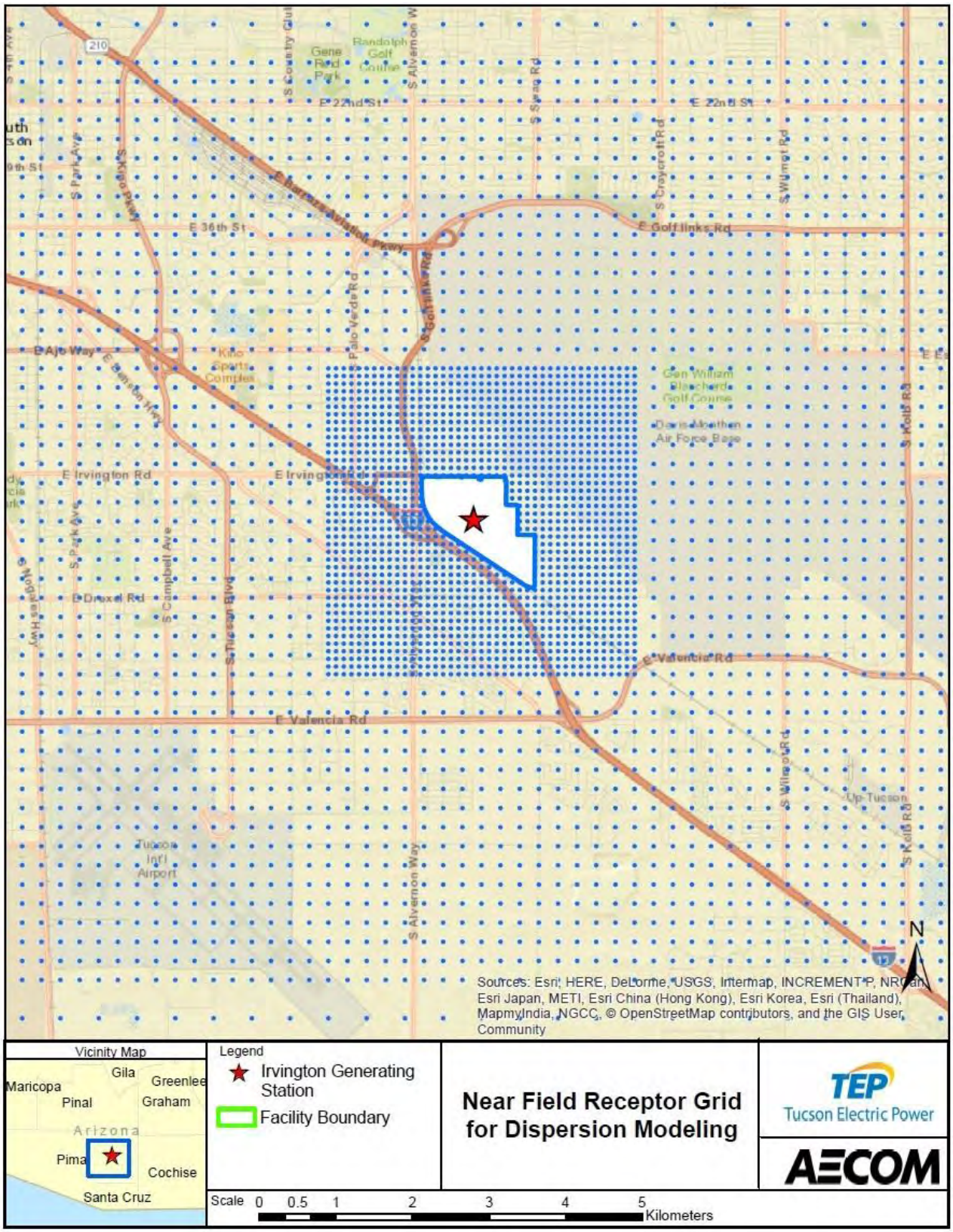
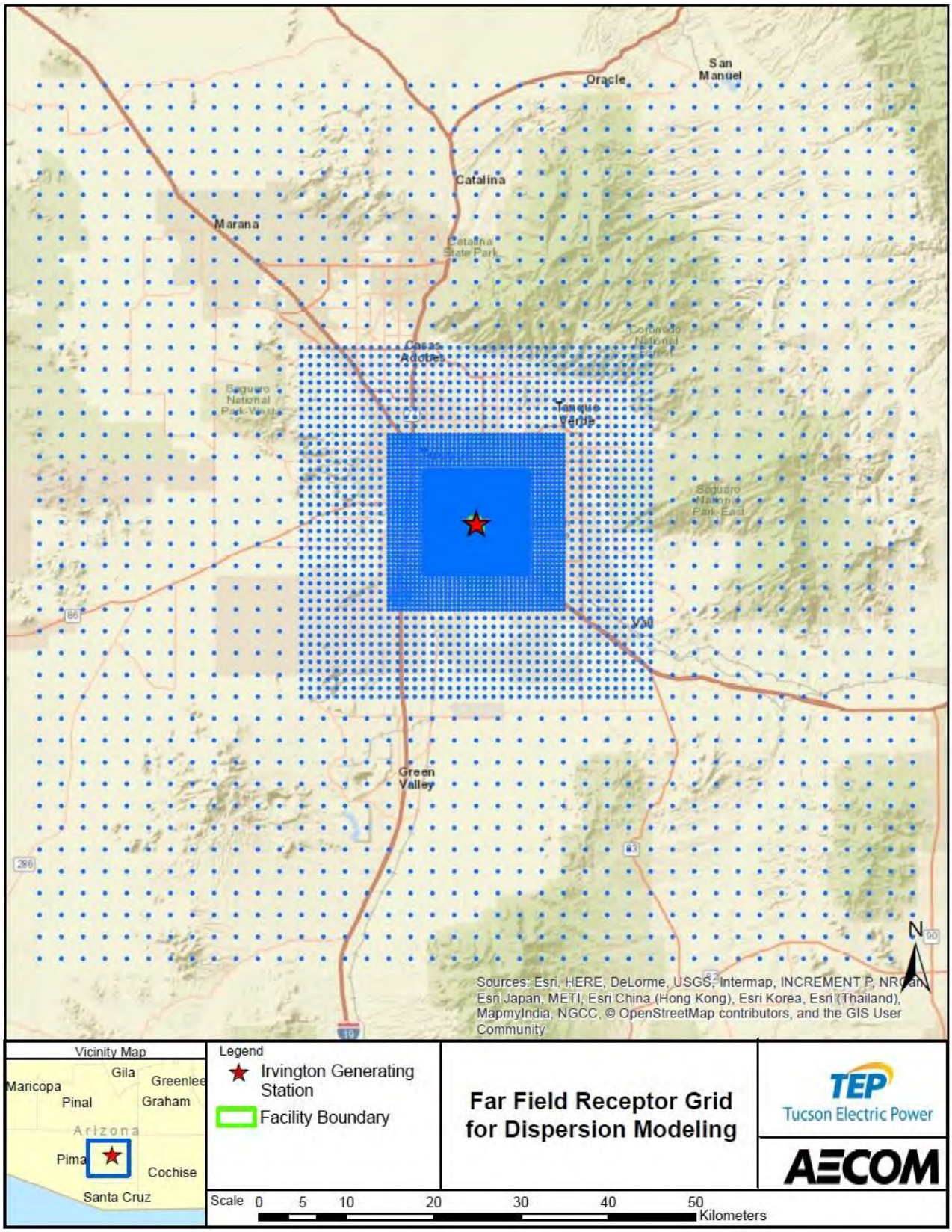


Figure 4-4 Far Field Receptor Grid



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

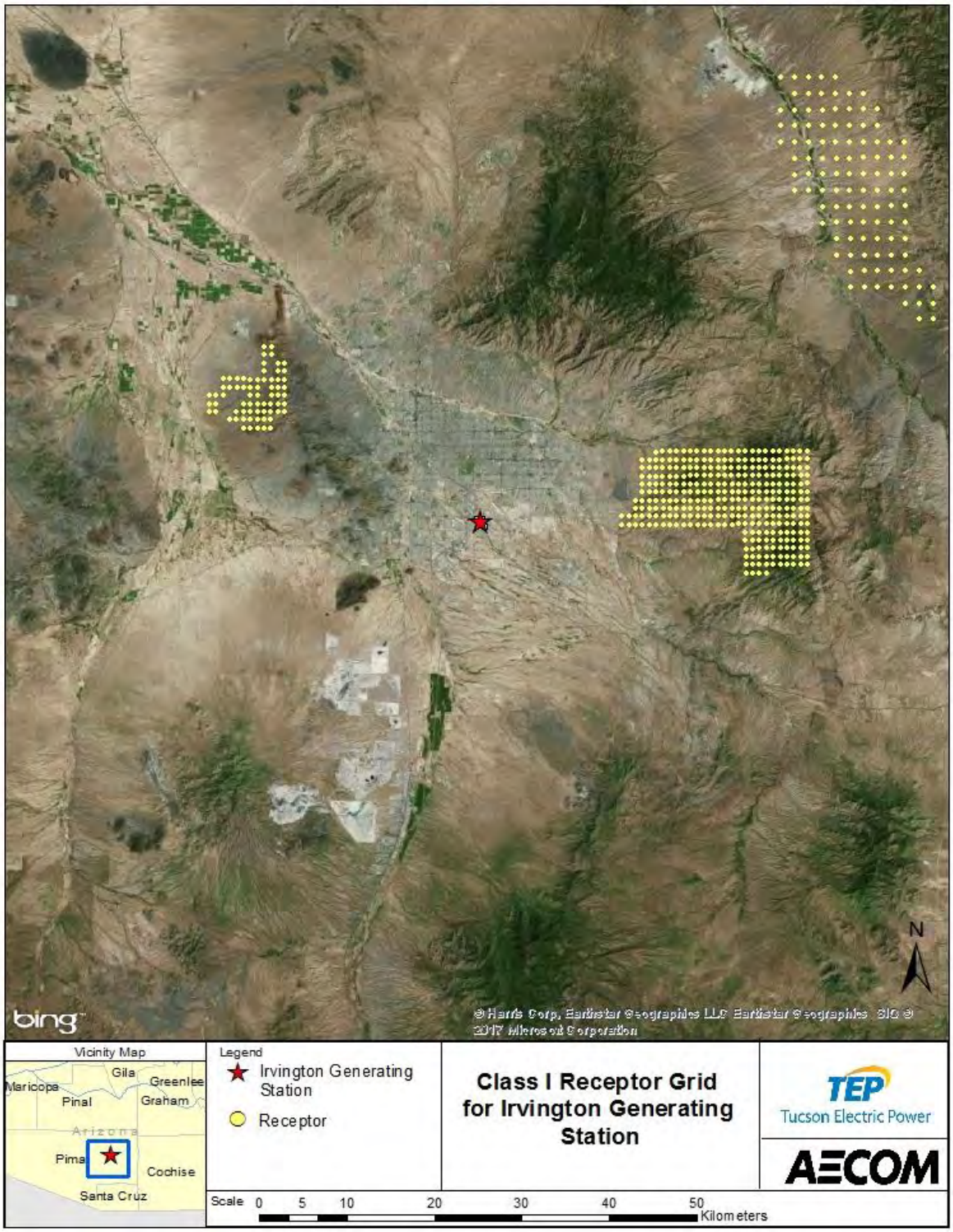


Table 4-5 Summary of Maximum AERMOD Concentrations to Significant Impact Levels

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

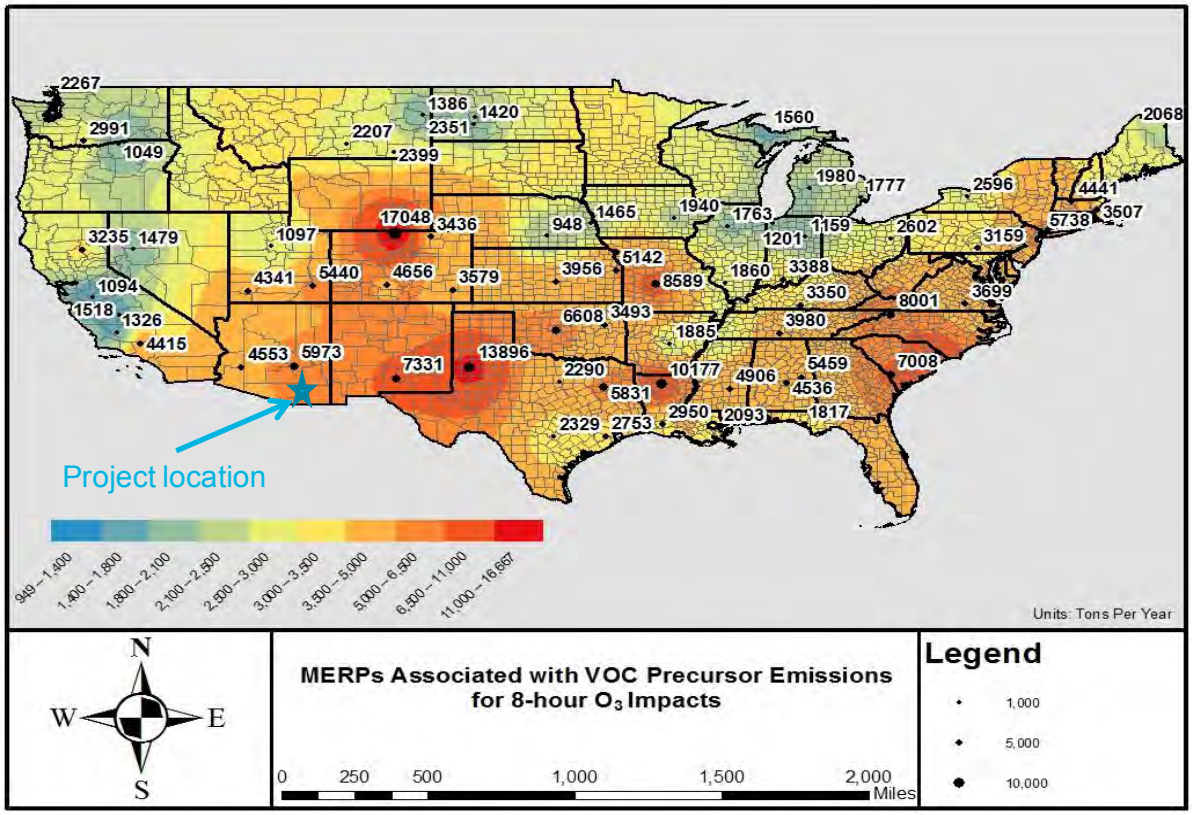
[14] Available at https://www3.epa.gov/ttn/scram/guidance/guide/EPA454_R_16_006.pdf.
[15] Available at https://www3.epa.gov/ttn/scram/guidance/guide/MERPs_Data_Distribution_and_Errata_Memo-02232017.pdf.

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

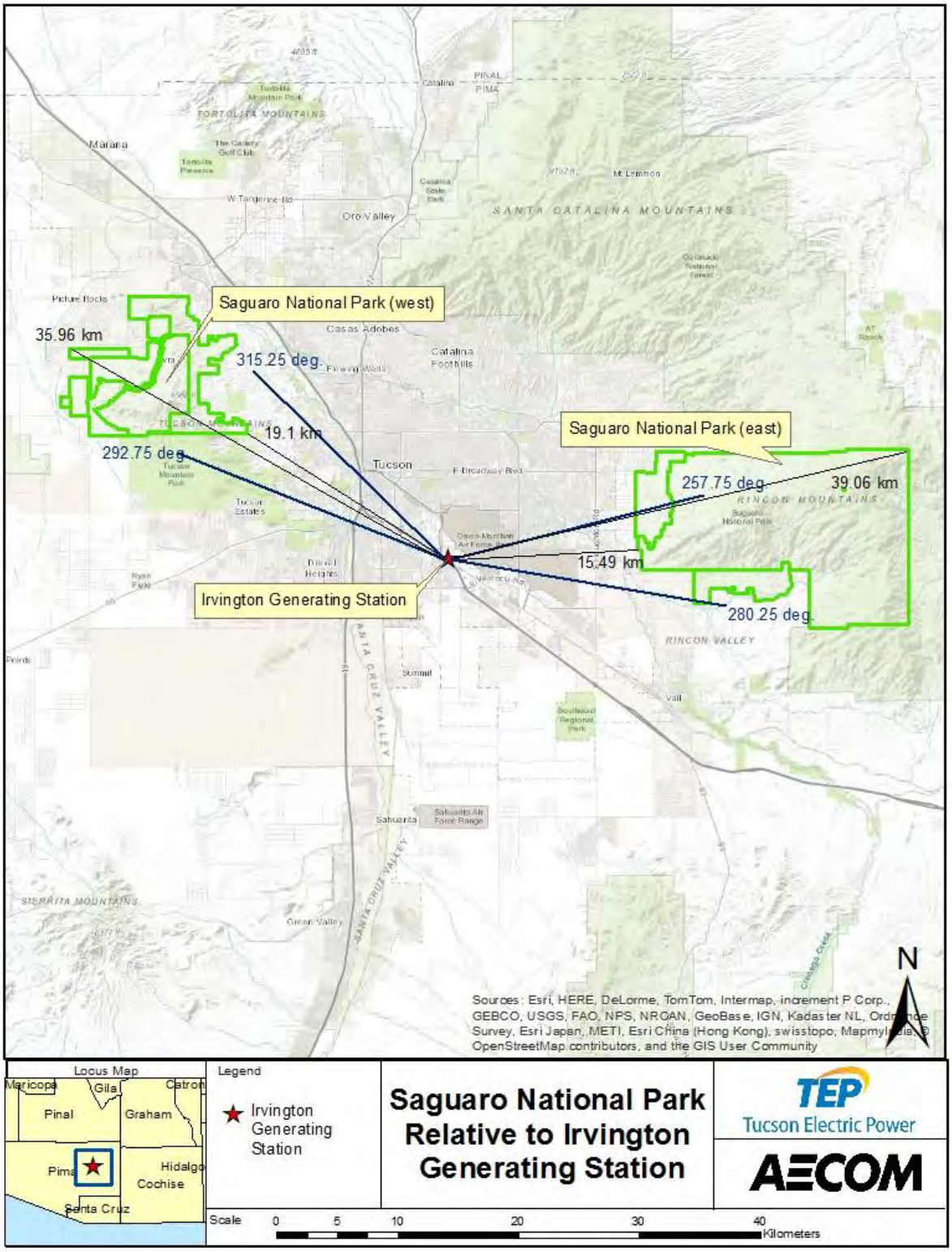

Table 5-2 Frequency Analysis of Dispersion Conditions for SNP Eastern Unit, Sector 257.75° to 280.25°

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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