Tucson Electric Power
1892-2017
125 YEARS OF SERVICE
88 East Broadway Blvd.
Tucson, AZ 85701-1720

Email: ckomadina@tep.com

Hand Delivery

June 23, 2017

Ms. Ursula Nelson, Director
Pima County Dept. of Environmental Quality
33 N. Stone Avenue, Suite 700
Tucson, AZ 85701

Subject: Air Quality Dispersion Modeling Protocol for the RICE Project
Tucson Electric Power Company – Irvington Generating Station

Dear Ms. Nelson:

Tucson Electric Power Company (TEP) operates its Irvington Generating Station (IGS) under Class I Air Quality Operating Permit No. 1052 issued by the Pima County Department of Environmental Quality (PDEQ). IGS consists mainly of four steam boiler generating units, namely, Unit I1, Unit I2, Unit I3 and Unit I4. As you may aware, TEP is proposing to modernize the station by replacing two 1950's era steam units (i.e., Units I1 and I2) with ten high-efficiency, fast-responding, state-of-the-art reciprocating internal combustion engines (RICE), each having a generating capacity of nearly 19 MW. The RICE project expects to be a major modification for CO, PM2.5/PM10 and VOCs subject to the Prevention of Significant Deterioration (PSD) permitting as such, the air quality dispersion modeling is required for the affected criteria pollutants. TEP is hereby submitting this modeling protocol which, upon PDEQ's approval, will allow TEP to begin numerical assessment of the RICE project's impact on air quality, an essential element of the PSD permitting process. TEP would appreciate if review and approval of the modeling protocol is on a fast-track and accelerated pace as time is of the essence for the RICE project.

If you have any question concerning the modeling protocol, please feel free to contact me at (520) 918-8316 or Zig Fang at (520) 918-8380.

Sincerely,

Charles W. Komadina, Manager
Corporate Environmental Compliance and Permits

Enclosure(s)

cc: R. Grimaldi, PDEQ
R. Patel, PDEQ
C. Spencer, TEP
E. Bakken, TEP
Z. Fang, TEP

RECEIVED BY
PIMA COUNTY
JUN 23 2017
DEPARTMENT OF
ENVIRONMENTAL QUALITY

AECOM

Tucson Electric Power Company Irvington (Sundt) Generating Station: Air Quality Dispersion Modeling Protocol

Tucson Electric Power Company

Project Number: 60530048

June 23, 2017

Quality information

Prepared by	Checked by	Approved by
Kimberly Zuk Sr. Air Quality Scientist & Christopher J. Warren Air Quality Scientist	Robert J. Paine Associate Vice President	Mary Kaplan Project Manager

Prepared for:

Tucson Electric Power Company

Prepared by:

Christopher J. Warren
Air Quality Scientist
T: 9789052414
E: Christopher.Warren@aecom.com

AECOM
250 Apollo Drive
Chelmsford
MA, 01824
USA
aecom.com

Copyright © 2017 by AECOM

All rights reserved. No part of this copyrighted work may be reproduced, distributed, or transmitted in any form or by any means without the prior written permission of AECOM.

Table of Contents

1. Introduction 1-1
1.1 Project Overview 1-1
1.2 Purpose of Modeling Protocol 1-1
1.3 Contents of the Modeling Protocol 1-1
2. Project Description 2-1
2.1 Project Location and Layout 2-1
2.2 Description of the Proposed Engines 2-4
2.3 Pollutant Emissions 2-4
2.3.1 Criteria Pollutant Emissions 2-4
3. Air Quality Impact Assessment Methodology 3-1
3.1 Background Discussion 3-1
3.2 Source Data 3-1
3.2.1 Normal and Startup Emissions 3-2
3.3 Model Selection 3-3
3.4 Meteorological Data for AERMOD 3-3
3.4.1 Available Meteorological Data for AERMOD 3-3
3.5 Good Engineering Practice Stack Height Analysis 3-5
3.6 Receptor Grid and AERMAP Processing 3-7
3.6.1 Terrain Processing (AERMAP) 3-7
3.7 Class II Area Modeling Analysis 3-7
3.7.1 PSD Class II Significant Impact Level Analysis 3-7
3.7.2 Class II Area Cumulative Air Quality Analysis 3-8
3.8 Class I Area 3-9
3.8.1 Class I Significant Impact Level Analysis (within 100 kilometers) 3-10
3.8.2 Class I Cumulative Impact Analysis 3-10
3.9 Modeling of Ozone Precursors 3-14
3.10 Modeling of Secondary $PM_{2.5}$ Emissions 3-14
4. Background Air Quality and Pre-Construction Monitoring 4-1
4.1 Pre-construction Monitoring Requirements 4-1
4.2 Background Concentrations for Modeling 4-2
5. Additional Impact Analysis 5-1
5.1 Visibility Analysis (within 50 kilometers) 5-1
5.1.1 Class I Areas 5-1
5.1.2 Class II Areas 5-2
5.2 Class I Analysis (beyond 50 kilometers) 5-2
5.3 Growth Analysis 5-2
5.4 Soils and Vegetation Analysis 5-2
6. Submittal of Analysis Results 6-1

Figures

Figure 2-1 Aerial Image of the Irvington Generating Station....2-2
Figure 2-2 Topographic Map Showing Terrain Features Surrounding the Irvington Generating Station 2-3
Figure 3-1 Wind Rose from Tucson International Airport 2012-2016....3-4
Figure 3-2 Plot Plant Used in the GEP Analysis....3-6
Figure 3-3 Class I Areas within 300 km of IGS....3-12
Figure 3-4 Class I Receptor Grid....3-13
Figure 4-1 Locations of Nearby Ambient Monitors....4-3

Tables

Table 2-1 PSD Significant Emission Rates for RICE Project....2-4
Table 3-1 Stack Parameters for RICEs....3-2
Table 3-2 Emissions Summary (pounds per hour per engine)....3-2
Table 3-3 Criteria Pollutant Class II Significant Impact Levels....3-8
Table 3-4 Ambient Air Quality Standards....3-9
Table 3-5 PSD Increments....3-9
Table 3-6 Criteria Pollutant Class I Significant Impact Levels....3-10
Table 3-7 Criteria Pollutant Class I PSD Increment Levels....3-11
Table 4-1 Background Design Values for TEP Project Site....4-2
Table 5-1 Injury Threshold for Vegetation....5-3

1. Introduction

1.1 Project Overview

Tucson Electric Power Company (TEP) is proposing to modify the existing Irvington (Sundt) Generating Station (IGS) located in Tucson, Arizona, approximately 2 miles northeast of Tucson International Airport. The reciprocating internal combustion engine (RICE) project involves adding ten quick-start RICEs for the purpose of load stabilization to accommodate intermittent renewable energy sources (solar and wind) that feed into the system.

1.2 Purpose of Modeling Protocol

The purpose of this document is to present the proposed methodology for air dispersion modeling analyses that will be 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 to be used in the modeling analyses, are presented in this document for review and approval by Pima County Department of Environmental Quality (PDEQ). PDEQ does not have their own dispersion modeling guidelines. In a recent phone conversation, we were informed that PDEQ will defer to the United States Environmental Protection Agency's (EPA's) Appendix W.

1.3 Contents of the Modeling Protocol

Section 2 of this protocol document 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 proposed to be used in evaluating air quality impacts of the proposed IGS project including model selection criteria, good engineering practice stack height determination, refined modeling analyses, ambient air quality compliance, and additional impacts analyses. Section 6 presents the description of the results analysis that will be submitted to PDEQ in support of the PSD permit application.

2. Project Description

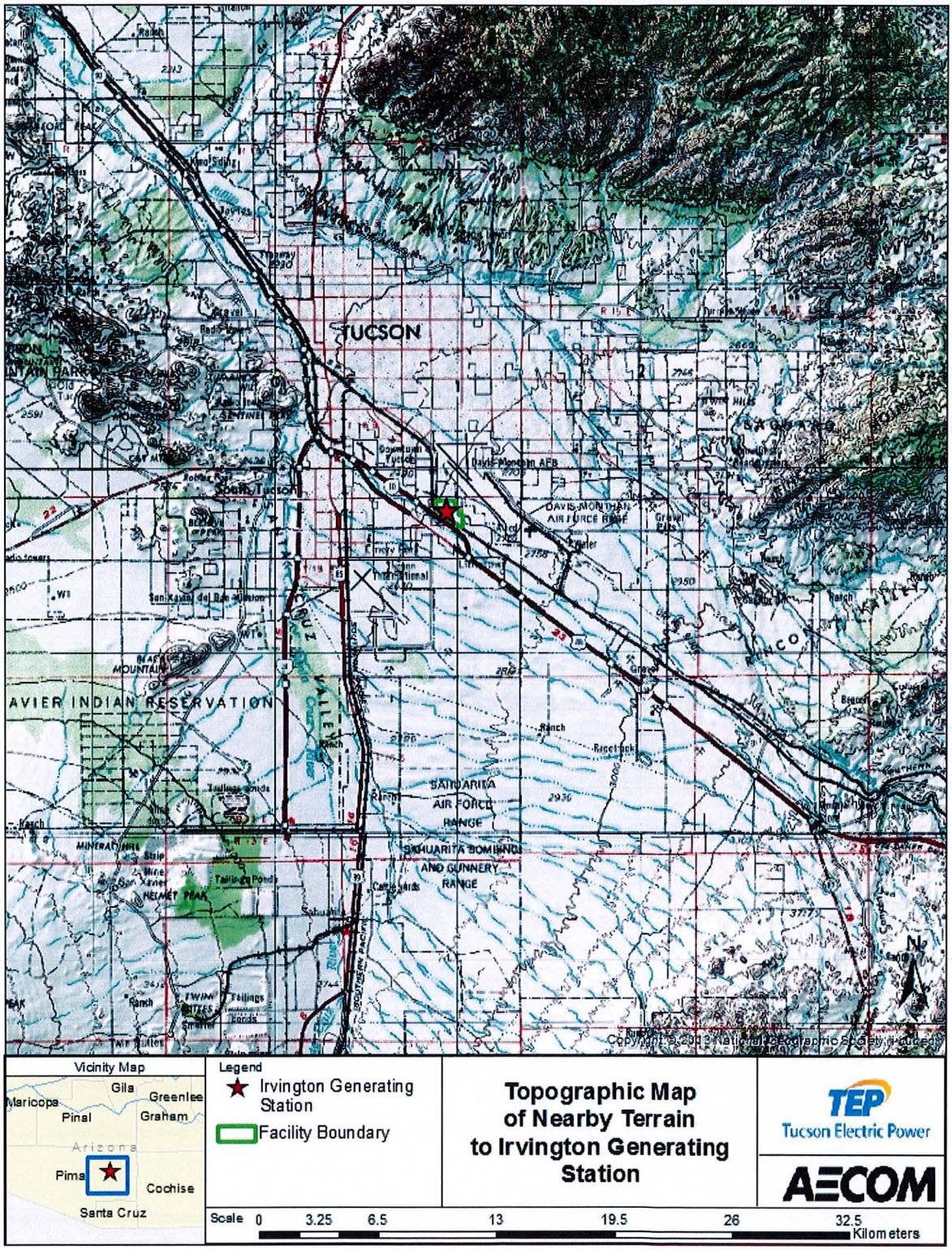
2.1 Project Location and Layout

As previously stated, the proposed RICE project will occur on 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.

Figure 2-1 Aerial Image of the Irvington Generating Station

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



2.2 Description of the Proposed Engines

The proposed modification at IGS includes the installation of ten RICEs. These engines will only be fired by natural gas and each will be installed with selective catalytic reduction (SCR) control utilizing ammonia and oxidation catalyst for CO and VOC control. The ten engines will be grouped into two sets where the five stacks from each group will be modeled as a merged stack consistent with EPA Model Clearinghouse Memo 91-II-01[1], creating the appearance of two new stacks at IGS.

2.3 Pollutant Emissions

2.3.1 Criteria Pollutant Emissions

IGS is considered a fossil fuel-fired steam electric plant (one of the "major emitting facility" 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[2]. 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 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

[1] Available at: https://cfpub.epa.gov/oarweb/MCHISRS/index.cfm?fuseaction=main.resultdetails&recnum=91-II%20%20-01.
[2] 40 CFR § 81.303.

3. Air Quality Impact Assessment Methodology

The dispersion modeling analyses conducted for the RICE project will adhere to the EPA "Revisions to the Guideline on Air Quality Models" (GAQM, which is contained in 40 CFR Part 51, Appendix W)[3], direction received from the PDEQ and local Pima County air quality guidance[4]. The following sections present the source data to be modeled, the proposed procedure for assessing ambient air impacts from the future IGS's emission sources and the standards to which the predicted impacts will be compared.

3.1 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 will be required for these pollutants. Modeling analyses to be performed will evaluate compliance with applicable thresholds for these pollutants. In addition, compliance with the National Ambient Air Quality Standards (NAAQS) and PSD increments will be evaluated if the Significant Impact Levels (SILs) are exceeded. The evaluation for VOC is discussed in Section 3.10. There are no modeling requirements for GHGs.

As will be discussed in the following sections of this protocol, the dispersion modeling for this Project will be 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. Maximum predicted impacts from the worst case scenarios will be compared to the SILs. For those pollutants which have predicted impacts below the applicable SIL, no additional analysis will be necessary since, by definition, the pollutant could not cause or contribute to a NAAQS violation or an exceedance of a PSD increment. If modeling indicates that SILs for some pollutants and averaging periods are exceeded, then a cumulative impact assessment will be undertaken. The results of the cumulative modeling will be analyzed for comparison to Federal and local ambient air quality standards and PSD increments, if applicable.

3.2 Source Data

The air dispersion modeling analysis will be 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 Project. The stack from each of the 10 engines will be bundled or clustered together in groups of five and will be modeled as two merged stacks. Modeling will assume that the exhaust from five RICEs will be 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 will be modeled is provided in **Table 3-1**. An equivalent diameter and gas exit velocity calculation for the merged stack configuration noted above, is also shown in the table.

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

[3] 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 .
[4] PCC § 17.16.590(A)(6). https://library.municode.com/az/pima_county/codes/code_of_ordinances.

3.2.1 Normal and Startup Emissions

Each engine will be modeled assuming 8,760 hours of operation per year. Except as noted below, all ten engines will be 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 3-2**. The emission rates during startup conditions are either equal to or greater than the normal operations; therefore the worst-case scenario modeled will include the startup emission rates.

For PM_{10} and primary $PM_{2.5}$, the emission rates assume 5 hours of startup emissions and 19 hours of non-startup (normal) emissions. This rate will be 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 emission rate assumes all 10 engines start simultaneously in the same hour, every hour of the year.

Table 3-1 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 3-2 Emissions Summary (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

3.3 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 air quality model guidance refers to EPA's 2004 version of Appendix W and does not yet reflect the recent EPA rule promulgation of Appendix W in May 2017. Per Section 6 part B of Pima County's guidance, if the "guideline" model is inappropriate it may be substituted with another model. We assume that given the very recent EPA rule that Pima County 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) will be 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 will utilize the newly approved regulatory low wind model option.

3.4 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[5]. 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.

3.4.1 Available Meteorological Data for AERMOD

Arizona Department of Environmental Quality (ADEQ) has pre-processed meteorological data[6] 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 will be utilized for this data set. The airport is located approximately 5 kilometers to the southwest of IGS and is the only ASOS station in the Tucson area. This data set will be used for the air quality impact analysis. A wind rose using the five-year period from 2012 to 2016 is provided as **Figure 3-1**.

---

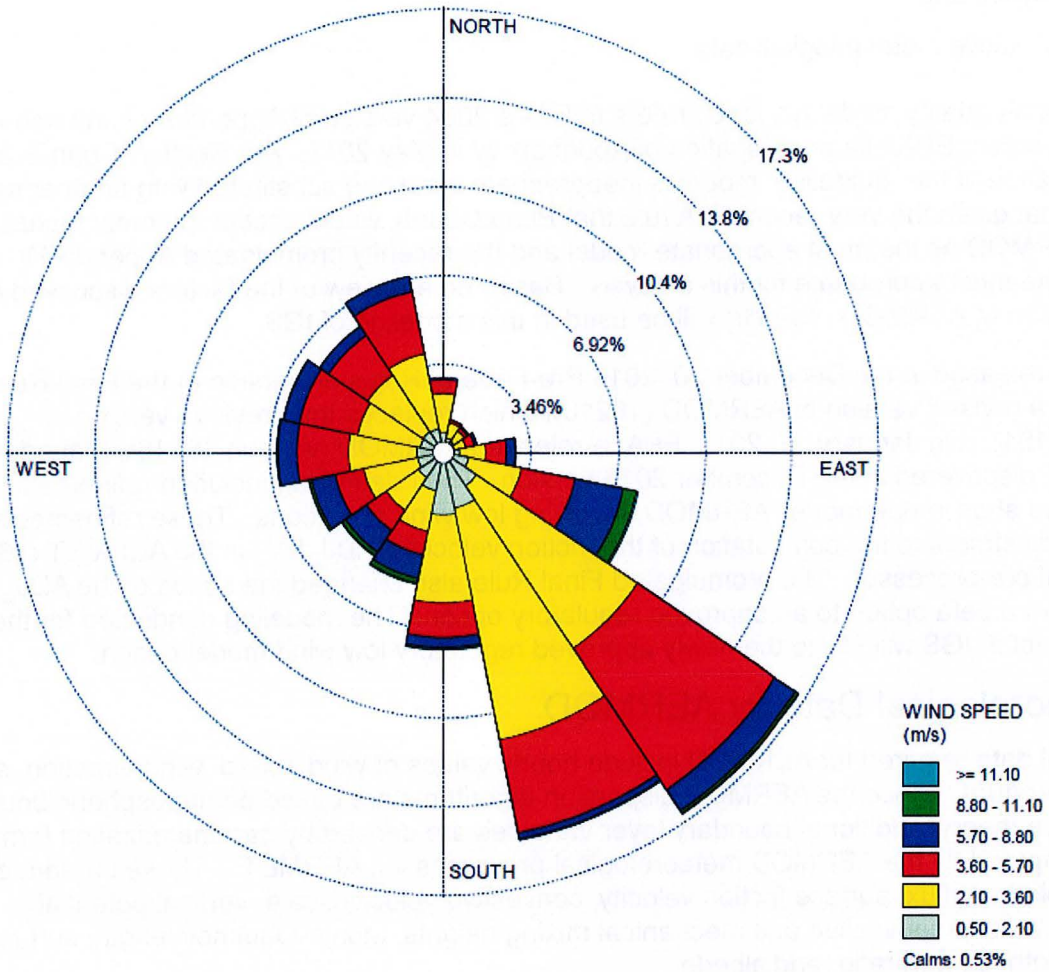
[5] EPA 2016. User's Guide for the AERMOD Meteorological Preprocessor (AERMET). EPA-454/B-16-010 (December 2016). Office of Air Quality Planning and Standards, Research Triangle Park, NC.

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

Figure 3-1 Wind Rose from Tucson International Airport 2012-2016

WIND ROSE PLOT:
Tucson International Airport
2012-2016

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 1/1/2012 - 00:00 End Date: 12/31/2016 - 23:59	AECOM	AECOM
	CALM WINDS: 0.53%	TOTAL COUNT: 43696 hrs.	
	AVG. WIND SPEED: 3.53 m/s	DATE: 6/8/2017	PROJECT NO.:

3.5 Good Engineering Practice Stack Height Analysis

A Good Engineering Practice (GEP) stack height analysis will be 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[7], Stack Height Regulations (40 CFR 51), and current Model Clearinghouse guidance will be 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. In the case where a stack is not influenced by nearby structures, the maximum GEP stack height is defined as 65 meters.

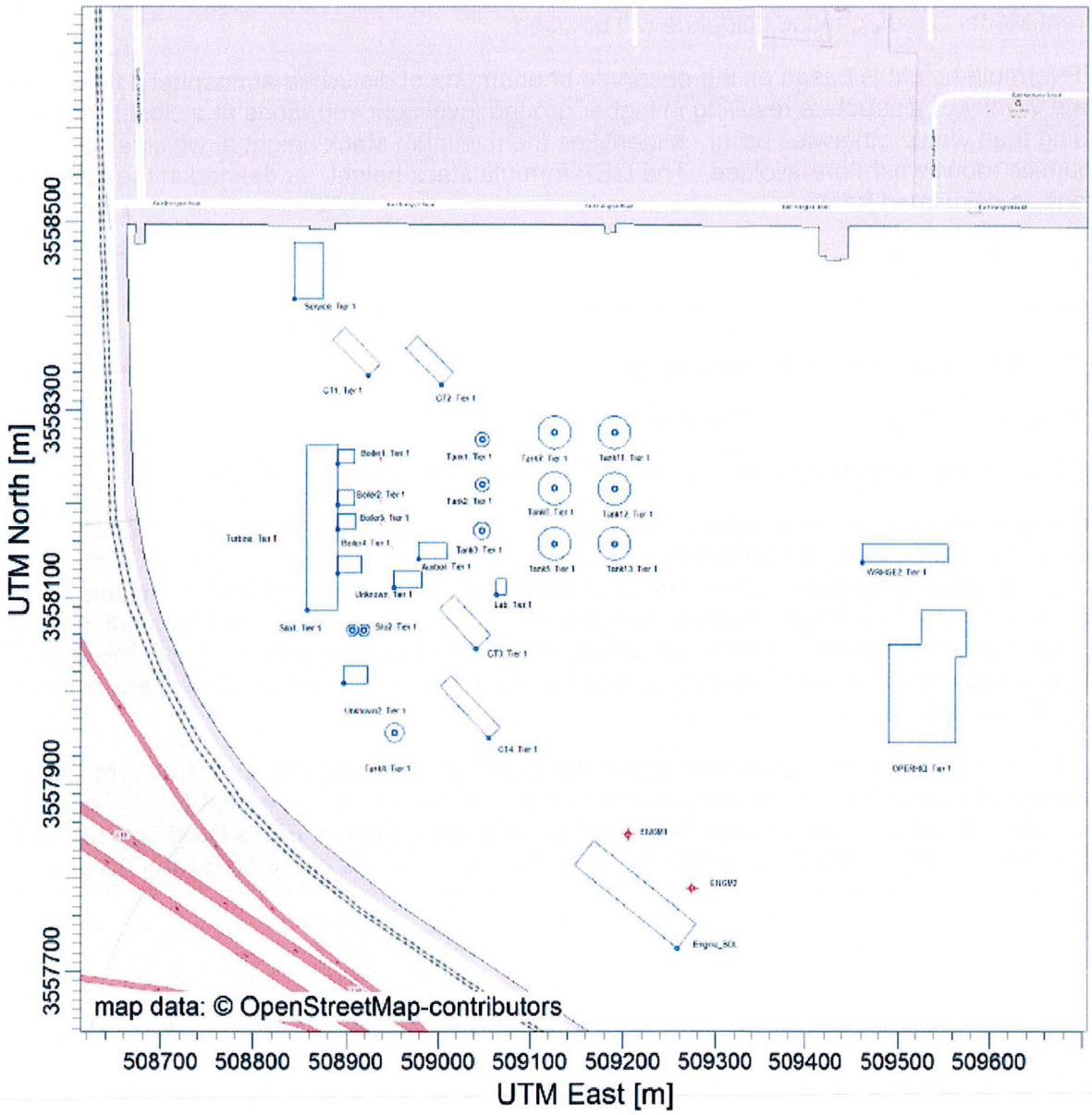
Figure 3-2 is a plot plan showing the locations of the power plant equipment, and structures that could potentially produce aerodynamic downwash of the plumes for the reciprocating RICEs. The direction-specific building dimensions will be determined using the latest version of EPA's Building Profile Input Program software (BPIP PRIME Dated 04274) using the design values of the stack and building heights.

[7] EPA 1985. Guideline for the 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.

Figure 3-2 Plot Plant Used in the GEP Analysis

PROJECT TITLE:

Tucson Electric Power Cooperative, Irvington Generating Station
Building Layout



COMMENTS:	SOURCES: 6	COMPANY NAME: AECOM	
	RECEPTORS: 7469		AECOM
		SCALE: 1:6,964 0 0.2 km	
			PROJECT NO.:

3.6 Receptor Grid and AERMAP Processing

The modeling analysis will be 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 will be based on Universal Transverse Mercator (UTM) coordinates referenced to NAD 83 datum and in zone 12.

3.6.1 Terrain Processing (AERMAP)

The latest version of AERMAP (version 11103), the AERMOD terrain preprocessor program, will be used to calculate terrain elevations and critical hill heights for the modeled receptors at each of the project facilities using National Elevation Data (NED). The dataset will be 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[8], 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.

3.7 Class II Area Modeling Analysis

A refined modeling analysis will be conducted using AERMOD (version 16216r). The analysis will be conducted to demonstrate compliance with both federal and local applicable ambient air quality standards. For those pollutants and averaging periods that predict impacts above their applicable SIL, as shown in **Table 3-3**, a refined cumulative modeling analysis that will consider additional NAAQS and PSD increment consuming sources would be conducted to determine compliance with the NAAQS and PSD increments.

3.7.1 PSD Class II Significant Impact Level Analysis

Impacts will be assessed using AERMOD at the Class II receptor locations described previously, and compared to the Class II SILs provided in **Tables 3-3**. Five years (2012-2016) of representative meteorological data will be used as input to AERMOD, as discussed in **Section 3.4**.

When modeled concentrations for a specific pollutant and averaging period are less than the SILs, the proposed source's contribution to ambient air quality is deemed to be insignificant, such that the source impact has no bearing on compliance with ambient standards and increments for that pollutant and averaging period. Significance for 24-hour $PM_{2.5}$ is determined by averaging the maximum

[8] 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.

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. When a specific pollutant and averaging period is modeled to be less than the SIL, then no additional modeling is required for that pollutant and averaging period.

Table 3-3 Criteria Pollutant Class II Significant Impact Levels

Pollutant	Averaging Time (1)				
	Annual $\mu g/m^3$	24-hour $\mu g/m^3$	8-hour $\mu g/m^3$	3-hour $\mu g/m^3$	1-hour $\mu g/m^3$
CO	-	-	500	-	2000
PM_{10}	1	5	-	-	-
$PM_{2.5}$	1.2	0.2		25	7.9

(1) Maximum modeled concentration.

3.7.2 Class II Area Cumulative Air Quality Analysis

As stated previously, for those pollutants and averaging periods determined to have modeled concentrations less than the SILs, no further analysis will be performed. The discussion below applies only to those pollutants and averaging periods for which a significant impact is predicted with AERMOD.

Compliance with the PSD increments and NAAQS would be based on the sum of the following:

- Modeled concentrations attributable to the Project;
- Modeled concentrations from "nearby" and existing facility sources; and
- Representative ambient background concentration (NAAQS only).

Modeled concentrations attributable to Project along with "nearby" and existing facility sources will be estimated using AERMOD along with the meteorological data and receptors grids described in Sections 3.4 and 3.6.

An inventory of sources will be obtained from PDEQ for each pollutant which exceeds the SIL, covering facilities that could contribute significantly to ambient concentrations within the SIL radius. Two classes of facilities will be included. For the evaluation of PSD increments, only sources that received PSD permits or have been designated by PDEQ as PSD increment consuming sources will be included, as well as any sources that expand PSD increment could also be included in the analysis. For the evaluation of NAAQS, all sources of the applicable pollutant will be evaluated for potential inclusion into the modeled NAAQS inventory. Some facilities with a low ratio of total emissions over distance from the proposed Project may not be included into the NAAQS analysis as the contribution from these sources would likely be minimal and accounted for in the ambient background concentration added to the modeled concentrations.

For the cumulative analysis, if required, the modeled design short-term and annual concentration from the proposed Project, as well as influencing nearby emission sources, will be compared with the NAAQS and PSD increments. The standards to which the modeling results will be compared to are presented in **Table 3-4** and **Table 3-5**. For the NAAQS analysis, a background concentration will be

added to modeled design short-term and annual impacts to determine compliance. **Section 4** provides more detail on the use of representative monitored ambient background concentrations.

Table 3-4 Ambient Air Quality Standards

Pollutant	Averaging Period	Class II NAAQS	Units	Form (Design)
CO	1-hour	40,000	µg/m³	Not to be exceeded more than once per year.
	8-hour	10,000	µg/m³	
PM_{10}	24-hour	150	µg/m³	Not to be exceeded more than once per year.
$PM_{2.5}$	24-hour	35	µg/m³	98th percentile, not to be exceeded as averaged over 3 years.
	Annual	12	µg/m³	Annual mean never to be exceeded.as averaged over 3 years.
Source: 40 CFR 50 and PCC § 17.08				

Table 3-5 PSD Increments

Pollutant	Averaging Period	Class II PSD Increments	Units	Form (Design)
PM_{10}	24-hour	30	µg/m³	Not to be exceeded more than once per year.
	Annual	17	µg/m³	Annual mean never to be exceeded.
$PM_{2.5}$	24-hour	9	µg/m³	Not to be exceeded more than once per year.
	Annual	4	µg/m³	Annual mean never to be exceeded.
Source: Federal Register – Vol 75, No. 202, PCC § 17.08.150, PCC § 17.16.590(A)(5)(a).				

3.8 Class I Area

PSD regulations[9] 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 3-3**:

1. Chiricahua NM
2. Chiricahua Wilderness
3. Galiuro Wilderness
4. Gila Wilderness

[9] 1992 EPA Memorandum. Clarification of Prevention of Significant Deterioration (PSD) Guideance for Modeling Class I Area Impacts. https://www.epa.gov/sites/production/files/2015-07/documents/class1.pdf.

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

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 will be assessed for the Class I areas (and portions thereof) within 300 km of the facility. The Class I SILs that the project impacts will be compared to are summarized in **Table 3-6**. In 1996, EPA proposed rulemaking[10] for Class I specific SILs for PM10 24-hour (0.3 µg/m^3) and annual (0.2 µg/m^3); however, this rule was never finalized.

Table 3-6 Criteria Pollutant Class I Significant Impact Levels

Pollutant	Averaging Time (1)	
	Annual *µg/m³*	**24-hour** *µg/m³*
PM_{10}	0.2	0.3
$PM_{2.5}$	0.05	0.27

(1) Highest 1st high concentration

3.8.1 Class I Significant Impact Level Analysis (within 100 kilometers)

This PSD Class I analysis will consider 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 will be conducted with AERMOD using the same meteorological data as the Class II modeling. It is anticipated that the Class I area modeling will result in modeled impacts that are less than the SILs for all pollutants and averaging periods.

Class I receptor grids were obtained from EPA Region 9's Class I database[11] and will be used for the PSD Class I modeling. The Galiuro Wilderness Class I area resides approximately 60 km from IGS, yet AERMOD has a maximum domain of 50 km. Therefore, for Galiuro receptors it is proposed that these receptors be shifted closer distance of 50 km from IGS in the model such that the set of receptors became contained within the model's domain. In doing so all of the Galiuro receptor elevations and hill heights will be preserved from what they are at their actual locations. **Figure 3-4** shows the proposed model receptor locations for Class I areas.

3.8.2 Class I Cumulative Impact Analysis

As stated previously, for those pollutants and averaging periods determined to have modeled concentrations less than the SILs, no further analysis will be performed. The discussion below applies only to those pollutants and averaging periods for which a significant impact is predicted with AERMOD.

[10] 61 FR 38249.
[11] EPA, Region 9 Federal Class I Areas. https://www3.epa.gov/region9/air/maps/r9_clss1.html .

Compliance with the PSD increments would be based on the sum of the modeled concentrations attributable to the Project and modeled concentrations from "nearby" and existing facility sources. Modeled concentrations attributable to Project along with "nearby" and existing facility sources will be estimated using AERMOD along with the meteorological data and receptors grids described in Sections 3.4 and 3.8.

An inventory of sources will be obtained from PDEQ and ADEQ for each pollutant which exceeds the SIL, covering facilities within 100 kilometers of the Class I Area. For the evaluation of PSD increments, only sources that received PSD permits or have been designated by PDEQ or ADEQ as PSD increment consuming sources will be included, as well as any sources that expand PSD increment could also be included in the analysis.

For the cumulative analysis, if required, the modeled design short-term and annual concentration from the proposed Project, as well as influencing nearby emission sources, will be compared with the PSD increments. The standards to which the modeling results will be compared to are presented in **Table 3-7**.

Table 3-7 Criteria Pollutant Class I PSD Increment Levels

Pollutant	Averaging Period	Class I PSD Increments	Units	Form (Design)
PM_{10}	24-hour	8	$\mu g/m^3$	Not to be exceeded more than once per year.
	Annual	4	$\mu g/m^3$	Annual mean never to be exceeded.
$PM_{2.5}$	24-hour	2	$\mu g/m^3$	Not to be exceeded more than once per year.
	Annual	1	$\mu g/m^3$	Annual mean never to be exceeded.
Source: Federal Register – Vol 75, No. 202, PCC § 17.08.150, PCC § 17.16.590(A)(5)(a).				

Figure 3-3 Class I Areas within 300 km of IGS

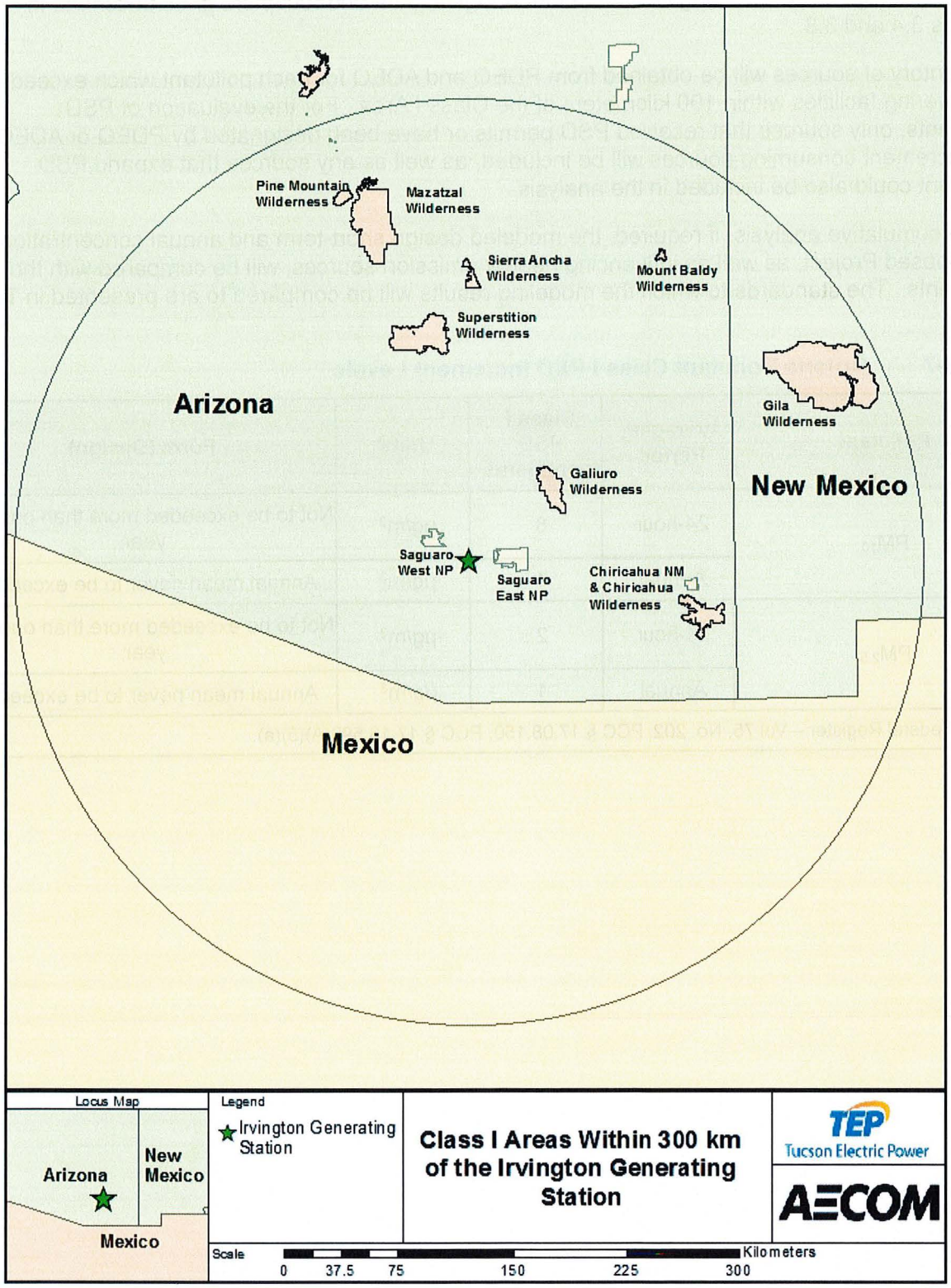
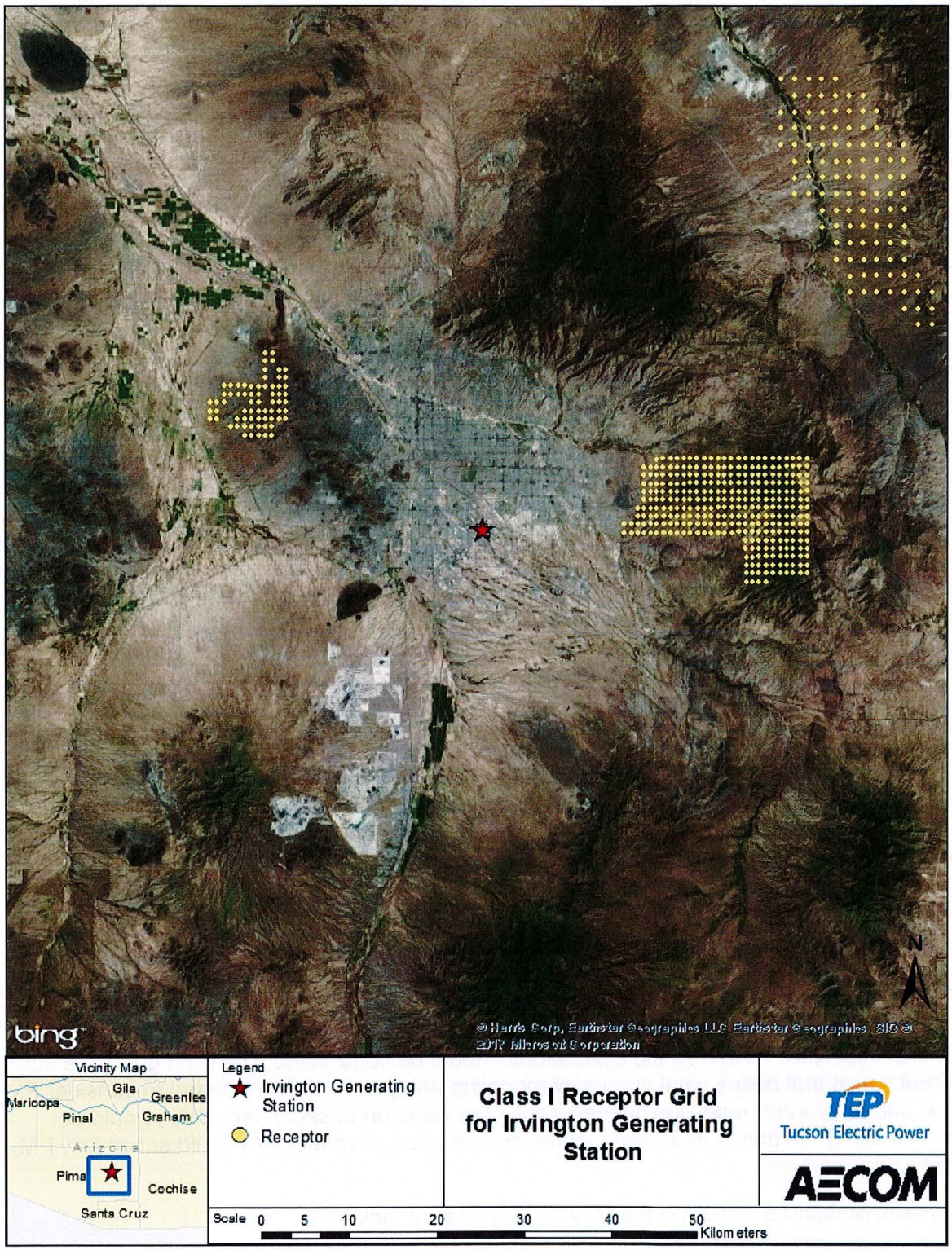


Figure 3-4 Class I Receptor Grid



3.9 Modeling of Ozone Precursors

In rulemaking promulgated in May 2017, EPA's Appendix W, Revisions to the Guideline on Air Quality Models, was signed and it provided a more specific procedure for assessing the impacts of an individual source on ozone. In conjunction with the more specific procedure, the EPA is currently finalizing a two-tiered demonstration approach for addressing individual source impacts on ozone. The first tier involves 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)[12] and Errata Memo (February 23, 2017)[13]. 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 provided for VOC for 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 will be used and its anticipated results will show the critical air quality threshold will not be exceeded and the Project will be presumed to have an insignificant impact on ozone concentrations.

Per Pima County Code § 17.16.590(A)(5)(b)), if new major source of volatile organic compounds or oxides of nitrogen, or 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 which is more than 100 kilometers from IGS, therefore a demonstration that the project will not cause or contribute to an violation is not required.

3.10 Modeling of Secondary $PM_{2.5}$ Emissions

Based on May 2014 guidance from EPA[14], 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:

[12] Available at https://www3.epa.gov/ttn/scram/guidance/guide/EPA454_R_16_006.pdf.
[13] Available at https://www3.epa.gov/ttn/scram/guidance/guide/MERPs_Data_Distribution_and_Errata_Memo-02232017.pdf.
[14] Available at https://www3.epa.gov/scram001/guidance/guide/Guidance_for_PM25_Permit_Modeling.pdf.

- 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 IGS falls into Case 2 as described above and thus a qualitative / quantitative analysis to address secondary $PM_{2.5}$ is not required.

4. Background Air Quality and Pre-Construction Monitoring

4.1 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 4-1 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 3-1**.

EPA maintains data capture statistics for all monitors in their design value tables[15]. 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 4-1 provides a summary of the most recent 3-year period (2013-2015) ambient background design values. 2016 data may be available at the time of the permit application and an updated table can be included in the modeling report submitted with the permit application.

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

Table 4-1 Background Design Values for TEP Project Site

Pollutant	Monitor Location	Avg. Period	Design Value	Units
CO	22nd & Craycroft	1-hr	1.6	ppm
CO	22nd & Craycroft	8-hr	0.8	ppm
O_3	22nd & Craycroft	8-hr	0.063	ppm
PM_{10}	South Tucson	24-hr	101	µg/m³
$PM_{2.5}$	Children's Park NCORE	24-hr	13	µg/m³
		Annual	5.5	

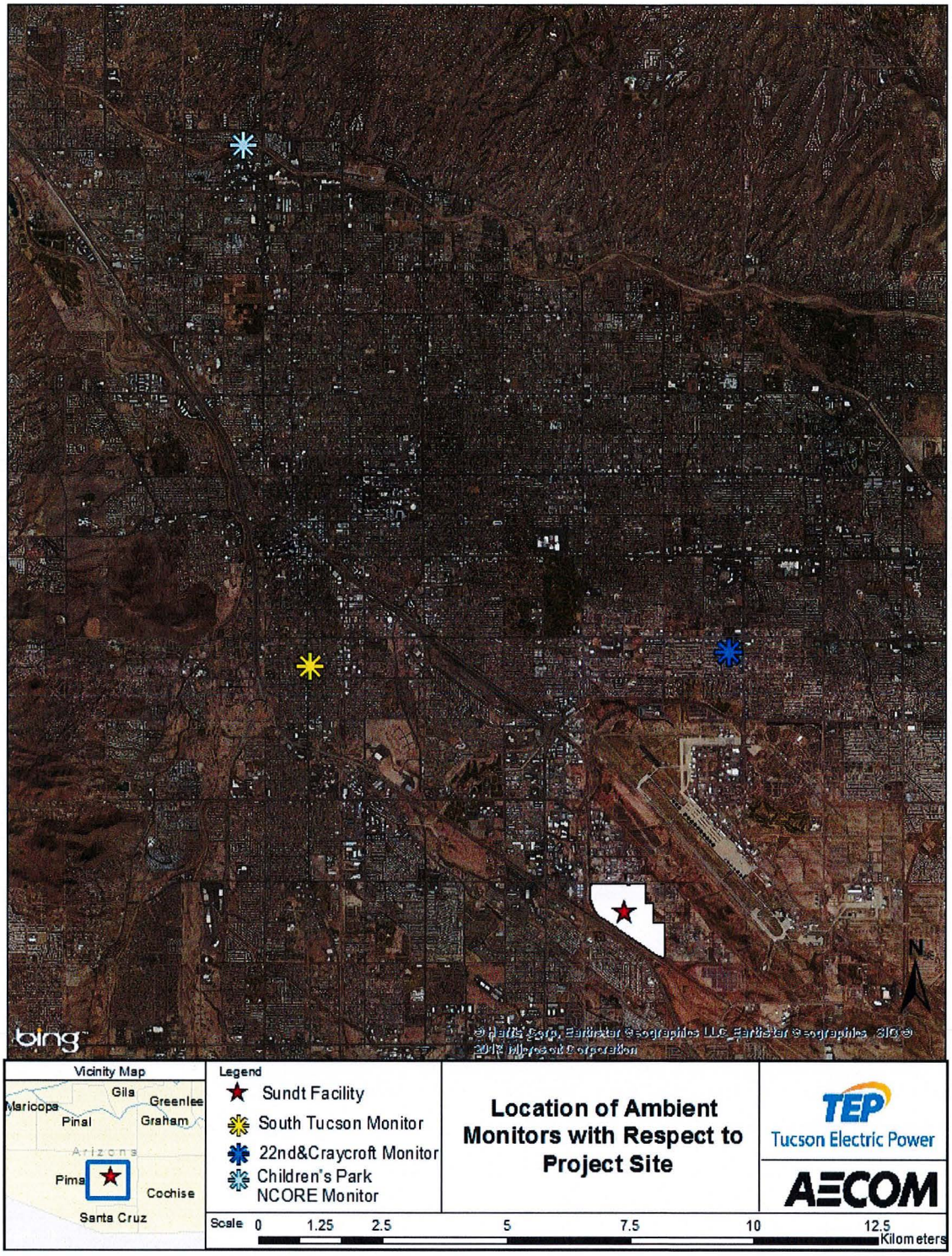
4.2 Background Concentrations for Modeling

If cumulative modeling is required, representative background concentrations will be developed for in addition to modeled impacts in the NAAQS compliance analysis. Ambient air quality data are used to represent the contribution to total ambient air pollutant concentrations from non-modeled sources. Initially, the design concentration values approved by PDEQ will be added to the modeled design concentration to estimate the total impact, for applicable pollutants. Use of seasonal and hour-of-day varying background concentrations consistent with EPA guidance in their March 1, 2011 clarification memo[16] may also be considered and applied if needed.

Depending on the nearby source inventory that the PDEQ deems necessary to include in any cumulative modeling analysis, some double-counting may result with the ambient monitors listed, adding some conservatism to the modeling results.

[16] http://www.epa.gov/ttn/scram/guidance/clarification/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf

Figure 4-1 Locations of Nearby Ambient Monitors



5. Additional Impact Analysis

EPA's guidance on new source review states that all PSD 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 grow. This section presents how these additional impact analyses would be conducted.

5.1 Visibility Analysis (within 50 kilometers)

5.1.1 Class I Areas

For any new major source or major modification, Pima County requires (PCC § 17.16.630) an analysis of the anticipated impacts of the proposed source 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 will be 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 will be applied with the guidance provided in EPA's Workbook for Plume Visual Impact Screening and Analysis ("Workbook")[18]. As such, the VISCREEN model will be 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 will be used for both the Level 1 and Level 2 (if required) screening analyses.

Initially, a Level 1 analysis will be conducted and if the VISCREEN results are less than the ΔE and Cp screening values, no further analysis will be required. If necessary, a Level 2 analysis will be conducted in accordance with the recommendations in the Workbook.

[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 Visual Impact Screening and Analysis (Revised). EPA-450/R-92-023.

5.1.2 Class II Areas

In addition to the Class I area analysis there is a requirement, as part of the PSD additional impacts analysis, for a visibility analysis to be performed within 50 km of the facility in Class II areas, especially if there are no Class I areas within 50 km (§ 52.21(o)(1)). In that regard, PDEQ will be consulted to identify a nearby state park or other sensitive area in the Project vicinity for which a visible plume analysis will be conducted, if closer than the aforementioned Class I areas.

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 will exclude 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 will be calculated for the RICE project to determine what Class I areas will be considered for the Air Quality Related Values (AQRVs) analysis.

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 Project operation, the emissions involve those that can reasonably be expected to occur; for instance, industrial, commercial, and residential growth that will occur in the Project area due to the 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 Project is not expected to employ additional employees at this time. Therefore, population growth from this project is not expected, and thus an analysis of such growth is not proposed.

5.4 Soils and Vegetation Analysis

An analysis of the Project's potential impact on soils and vegetation in the vicinity of the facility will be 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]. The highest predicted impacts from the project used in the SIL analysis in addition to a conservative background concentration will be compared to the NAAQS and screening concentrations listed in the above referenced document which are summarized in **Table 5-1**, to demonstrate compliance.

[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.

Table 5-1 Injury Threshold for Vegetation

Pollutants	**NAAQS** (µg/m^3)	**EPA's 1980 Screening Concentration**[1] (µg/ m^3)
PM (as PM_{10})	150 (24 hour)	None
O3	140 (8-hour)	392 (1-hour) 196 (4-hours) 118 (8-hours)
CO	None	1,800,000 (weekly)

1. "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals". EPA 450/2-81-078, December 1980.

6. Submittal of Analysis Results

The findings of the air quality impact analyses will be submitted to PDEQ as part of the permit application for review and approval. The permit application will address the following:

- Source Data: Source data required for evaluation of Project impacts will be provided. This will include criteria pollutant emission rates and stack exhaust parameters.
- Choice of Models: The chosen models including version numbers and selected options will be discussed.
- Receptor Data: A plot of the receptor grid used in the AERMOD analysis will be provided with the final application document.
- Meteorology: The meteorological data used in the analysis will be documented.
- Modeling Summary: Results of the modeling analyses will be documented and summarized.
- Compliance with NAAQS and PSD Increments: A demonstration of compliance with these standards will be presented and supported in the report in text, tabular and/or graphical format.
- Additional impacts: The additional impacts analysis will consist of an analysis of visible plume impacts, a growth analysis, and an analysis on impacts of soils and vegetation.
- Model Output and Databases: The model input and output files, including BPIP-Prime input and output files will be provided to PDEQ. The final modeling report will also include graphics (e.g., contour maps) that show the extent of the air quality impacts for the worst case year for each pollutant and averaging period. The figures will utilize a base map that is readily understandable by the general public. Each map will clearly identify the IGS location relative to these air quality impacts.

aecom.com