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Addendum to Air Quality Modeling Report

Project number	Client	Date	Prepared by
60530048	Tucson Electic Power Company	September 27, 2017	AECOM

Land Use Classification

One of the factors affecting input parameters to dispersion models is the presence of either rural or urban conditions near the project site. The choice of rural or urban for dispersion conditions at the source location depends upon the land use characteristics within 3 kilometers of the facility being modeled (Appendix W to 40 CFR Part 51)[1]. Factors that affect the rural/urban choice, and thus the dispersion, include the extent of vegetated surface area, the water surface area, density of residential areas, types of industry and commerce, and building types and heights within this area.

An objective analysis using the Auer Method[2] was conducted using ArcGIS to extract the land use categories within a 3 km radius centered on Tucson Electric Power's Irvington Generating Station (IGS) using the digitized 2011 NLCD data. **Figure A-1** shows the land categories within 3 km of the IGS. For this approach, areas of industrial, commercial, and medium/high density residential land use are designated urban. According to EPA modeling guidelines, if more than 50% of an area within a 3-km radius of the facility is classified as rural, then rural dispersion coefficients are to be used in the dispersion modeling analysis. Conversely, if more than 50% of the area is urban, urban dispersion coefficients are used. Using the Auer method, as shown in **Table A-1**, the 3-km area surrounding IGS is comprised of 72% rural and 28% urban classifications.

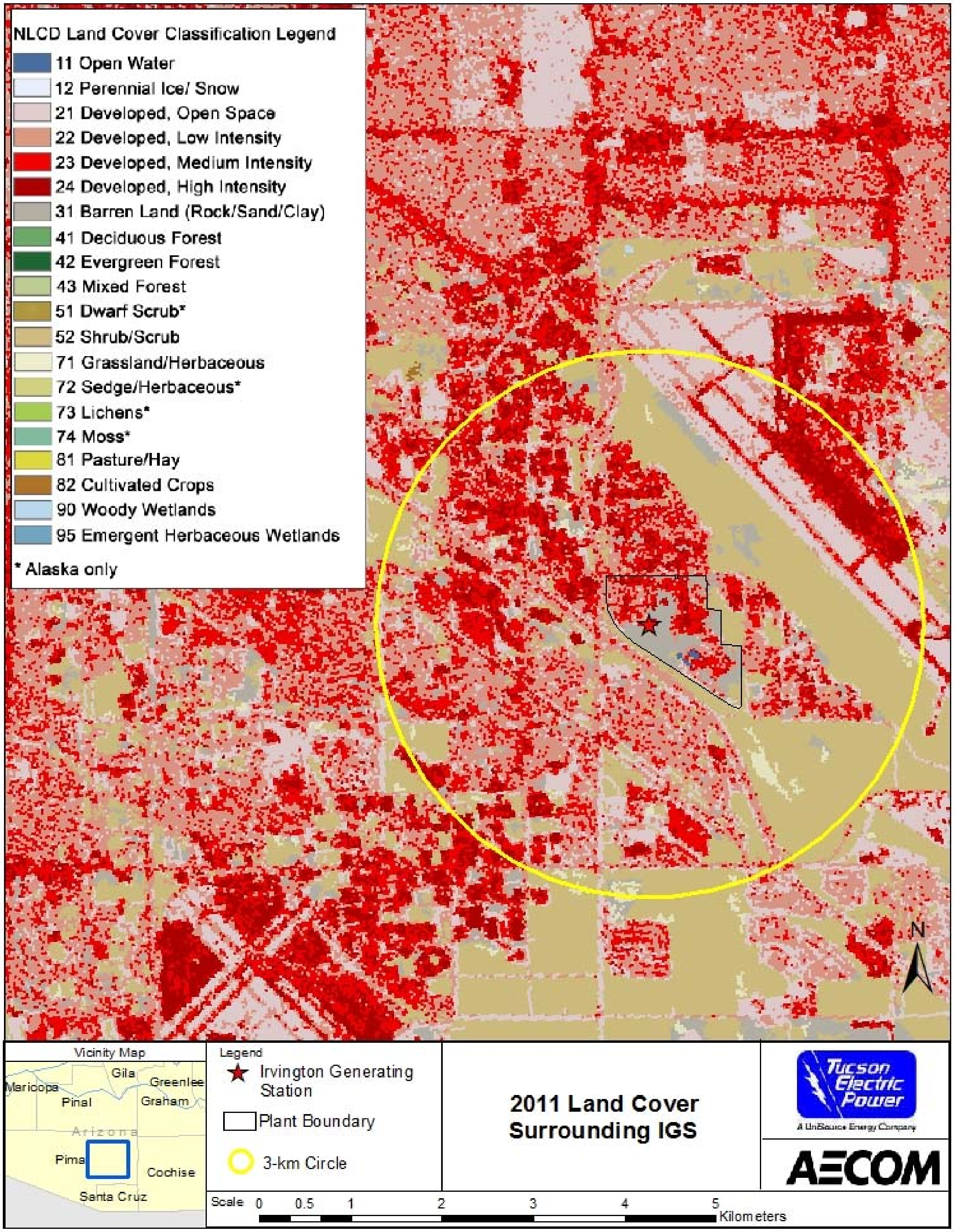
Based on the results of the Auer Method, we conclude that the designation of rural is appropriate for the modeling of the IGS for this modeling application.

Table A-1: Land Use Analysis with 2011 NLCD for Irvington Generating Station

Irvington Generating Station (IGS) Study Area Auer's Analysis				IGS 3km Ring		
NLCD Value	**NLCD 2011 Description**	**Auer's Code**	**Auer's Class**	**Cell Count**	**Percentage**	**Totals**
23	Developed, Medium Intensity	R2/R3	**Urban**	5,848	18.68%	**28.08%**
24	Developed, High Intensity	I1/I2/C1		2,942	9.40%	
11	Open Water	A5	**Rural**	18	0.06%	**71.92%**
21	Developed, Open Space	A1/R4		4,283	13.68%	
22	Developed, Low Intensity	R1		8,435	26.95%	
31	Barren Land	A		1,268	4.05%	
52	Shrub/Scrub	A4		8,220	26.26%	
71	Herbaceuous	A3		288	0.92%	
Analysis based on 30 meter by 30 meter raster cells extracted for each area.			***Total***	***31,302***	***100.00%***	***100.00%***

[1] EPA's Guideline on Air Quality Models, available at https://www3.epa.gov/ttn/scram/appendix_w/2016/AppendixW_2017.pdf.
[2] Auer, August (1977). Correlation of Land Use and Cover with Meteorological Anomalies. http://journals.ametsoc.org/doi/pdf/10.1175/1520-0450(1978)017%3C0636:COLUAC%3E2.0.CO;2

Figure A-1: 2011 National Land Cover Database (NLCD) within 3 km of the Fort Smallwood Complex



RICE Load Analysis

Prior to performing the Class II area impact analysis, a load analysis was performed to determine what operating load resulted in the highest modeled concentration for the RICE project. The analysis was performed for minimum-load (5 MW / 25%), mid-load (10 MW / 50%) and full load (20 MW / 100%). The emissions and velocities were scaled from full load conditions, linearly, for the minimum and mid-load scenarios, as shown in **Table A-2**. Stack temperature is relatively constant for the RICEs and was therefore kept constant across the varying operating load model runs. Each load scenario was run with their respective parameters with AERMOD using 5 years of meteorology (2012-2016) from the Tucson International Airport, building downwash, and Class II receptors as described in Sections 4.4.1, 4.5 and 4.6 of the modeling report, respectfully.

The results of the RICE load analysis are shown in **Table A-3**. The analysis indicates that full-load is the worst-case operating load for all averaging periods and pollutants. As such, this operating load was used to perform the Class II area impact analysis as discussed in Section 4.7.1 of the modeling report.

Table A-2: RICE Load Analysis Parameters

Pollutant	Avg. Period	Parameter	Full Load	Mid Load	Min Load
PM10/ PM2.5	24 hour/ Annual	Emissions (g/s)	2.142	1.071	0.536
		Velocity (m/s)	29.452	14.726	7.363
CO	1 hour	Emissions (g/s)	11.478	5.739	2.869
		Velocity (m/s)	29.452	14.726	7.363
	8 hour	Emissions (g/s)	8.221	4.1105	2.055
		Velocity (m/s)	29.452	14.726	7.363

Table A-3: RICE Load Analysis Modeling Results

Operating Load	Maximum Modeled Concentration (µg/m^3)				
	CO		PM2.5	PM10	PM2.5/PM2.5
	1-hour	8-hour	24-hour	24-hour	Annual
Full-Load	**25.682**	**3.202**	**0.207**	**0.281**	**0.012**
50%	22.166	2.005	0.133	0.176	0.007
25%	15.984	1.433	0.083	0.129	0.004

Visibility Analysis Justification

Analysis Approach

Included in Section 5.1 of the modeling report of the PSD application is an analysis of the anticipated impacts of the Project sources on visibility in any Class I areas, within 50 km of the Irvington Generating Station, which may be affected by the emissions from the Project sources. EPA's screening model VISCREEN was used for this visibility analysis to estimate two visual parameters, plume perceptibility (ΔE) and plume contrast (Cp). VISCREEN was applied with the guidance provided in EPA's Workbook for Plume Visual Impact Screening and Analysis ("Workbook")[3].

Since the visibility analysis for TEP's RICE project is being conducted as a modification of the existing Irvington Generating Station, a net increase (or decrease) in the number of days with a visible plume at each sensitive area can be determined. VISCREEN only uses inputs of NO_X and PM_{10} emissions. For TEP's RICE project, there is a net decrease in NOx emissions with the installation of the RICEs and the retirement of boiler units 1 and 2. The most current version of VISCREEN does not allow for negative input values. However, the Iowa Department of Natural Resources (DNR) Environmental Services Division outlines an approach to appropriately model for net decrease scenarios in their air dispersion modeling guidelines for PSD projects guidance[4]. The DNR guidance states that a two-step Level-2 analysis shall be conducted; the first for the existing facility-wide emissions, and the second for the proposed facility-wide emissions. The difference between the RICE project and the Baseline (Units 1 and 2) was used to compare against the visibility thresholds.

The CalPortland (Arizona Portland Cement) Company located in Rillito, AZ also utilized the visibility screening approach discussed above in support of their permit application in 2008. The application for the "Kiln 6 Project" was approved and the PSD Construction Permit (Permit Number 38592) was issued by the Arizona Department of Environmental Quality (ADEQ) on December 16, 2008. The construction permit expired in June 2010. The Kiln 6 Project proposed the retirement of Kilns 1 through 4 and the construction of Kiln 6. Similar to the RICE project, the Kiln 6 Project would have resulted in a large decrease in NOx but an increase in PM10 when comparing past actual emissions to future potential emissions. In the attached Technical Support Document, ADEQ noted that "The Department has reviewed this analysis and agrees with the Permittee's conclusions. In particular, the Department notes that the Permittee's analysis was conservative, as it did not take into account the significant NO_X emission reductions to be achieved, and the resultant benefits in terms of synergistic impacts of SO_2 and NO_X ambient concentrations." in reference to the Soils, Vegetation, and Visibility Impacts Analysis on Page 39 of the Technical Support Document.

Emission Calculations for VISCREEN Analysis

VISCREEN requires the input of total NOx emissions and particulate matter emissions based on a short-term/24-hour emission rate, and does not allow for the input of negative emission rates as discussed above. For the Unit 1 and 2 emissions model run (Baseline), RTP determined the maximum combined NOx and PM 24-hour (daily) emission rate based on the most recent two years (2015-2016) of actual emissions to represent the worst case emission rates for Units 1 and 2 and calculated the PM emissions from the Units 1 and 2 cooling towers that would also be retired as part of the project.

Units 1 and 2 emitted 4,096 lbs combined in 24-hours on June 20, 2016 which converts to 747.52 tons/year for input to VISCREEN. On that day, the two units emitted 126 lbs of PM and the two cooling

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

[4] DNR. PSD Modeling Guidance. http://www.iowadnr.gov/Environmental-Protection/Air-Quality/Modeling/Dispersion-Modeling#249516-psd-modeling-guidance.

towers emitted 394 lbs for a total of 562 lbs which converts to 102.62 tons/year of PM. For the project, the 10 engines are expected to emit 3.4 lb/hr of PM each (148.92 tons/year), which is conservative as the requested permit rate is currently 2.84 lb/hr. The NOx emission rate for each of the 10 engines is based on one cold start, one warm start, three hot starts and 19 hours of normal operation which results in a 24-hour weighted average emission rate of 1.88 lb/hr (82.34 tons/year for all 10 engines).