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ATTACHMENT A

Air Quality Review and Comments:

Puente Power Project

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I. Introduction

At the request of the Sierra Club, I reviewed the Ambient Air Quality Analysis (AAQA) and Risk Management Review, Appendix G, of the Ventura County Air Pollution Control District Preliminary Determination of Compliance (PDOC) for the Puente Power Project (P3).

I have discovered some false assumptions made in the AAQA's modeling methodology that result in a gross underestimation of modeled concentrations of all pollutants. I performed my own modeling analysis based on current U.S. EPA guidelines to correct for these errors and found that P3 will cause violations of both the NO_2 1-hour NAAQS and CAAQS. In the following sections, I will describe in detail the deficiencies in the AAQA modeling as well as my own modeling process and results.

II. The AAQA modeling fails to include existing sources that will continue to operate alongside the proposed P3.

The modeling analysis presented in the AAQA is incomplete because only the new equipment – the new natural gas turbine and diesel emergency engine – were explicitly modeled. This omission runs contrary to best practices in air quality modeling for point sources, and will result in inaccurate estimates of air quality impairment. The modeling analysis should include the emissions from existing, on-site sources that will continue to operate after P3 is commissioned and begins generating power and air pollution. There are three excluded sources that should have been modeled:

(1) Mandalay Generating Station (MGS) Unit 3, a gas-fired combustion turbine, which has no retirement date,
(2) MGS Unit 1, which must shut down prior to December 31, 2020, but which will continue to operate for a period after P3 is commissioned, and
(3) The McGrath natural gas plant, a new facility constructed in 2012 which lies just outside the MGS property line and has no planned retirement date.

I can only speculate on why these exclusions were made. The existing Mandalay Units were included in the preliminary air quality modeling the District released in December 2015. The AAQA makes no attempt to explain this change in approach. A separate Modeling Protocol document provided by the VCAPCD suggests that the District was concerned including these sources would result in double-counting their emissions, writing:

> "…MEC [Mandalay Energy Center] is proposing to include existing permitted equipment (Unit 3 and the DICEs) to the

> modeling scenarios. Based on the project description on page 2 of the protocol, these units will not be modified as part of the project. Section 3.6.1 of the protocol indicates that the existing units will be added to the modeling concentration from the proposed unit and the background monitor concentration to determine the maximum impact from the project. Using this procedure may overestimate the NOx impact, as the monitoring site being used for this assessment would also include the impact from existing units (1, 2, 3, and the DICEs). By including Unit 3 and the DICEs as additional sources has the potential to double count the NOx emissions from these units. Therefore, the District recommends that Unit 3 and the DICEs be excluded from the Tier III assessment and the monitoring site be used to represent the NOx background concentration within the vicinity of the project when evaluating the project's impact for NSR purposes."

This concern regarding double-counting is unwarranted. It is extremely unlikely that the monitored pollution levels even at the closest monitoring station are anywhere near representative of peak impacts from existing equipment. The closest monitoring site used for background levels in the AAQA is the El Rio – Rio Mesa High School #2 station in Oxnard, 11 kilometers away from the facility. The best method for ensuring that emissions from existing units are not double counted is to model what emissions from existing units are at the monitoring station, and then to subtract that value from the monitored background level to obtain a reduced background measurement. This procedure needs to be repeated for each pollutant modeled in the AAQA. Then, modeling is repeated for the entire facility, including both new equipment and existing on-site equipment that will continue to operate. The resulting pollutant concentrations from the entire facility are then added to the adjusted background level, and compared to the air quality standards.

III. The AAQA fails to identify 1-hour NO_2 NAAQS and CAAQS violations.

As a demonstration of how the aforementioned deficiency in the AAQA modeling underestimates modeled concentrations, I performed my own modeling analysis of 1-hour NO_2. When using the methods currently approved by the U.S. EPA, my results show violations of both the NAAQS (188 $\mu g/m^3$) and the CAAQS (339 $\mu g/m^3$) limits. If modeling predicts a project will cause pollution levels equaling or exceeding these standards, the project should not be approved. The following is a description of my analysis and results. Modeling output files are available upon request.

a. Modeling Methodology

This section describes the modeling methodology I used in my analysis of 1-hour NO_2 for verification of compliance with the NAAQS and CAAQS.

i. Dispersion Model

I performed 1-hour NO_2 modeling with U.S. EPA's AERMOD program, v. 15181, obtained from the Support Center for Regulatory Atmospheric Modeling (SCRAM) website. Version 15181 is the latest version of the AERMOD model, which was completed on June 30, 2015. AERMOD is the preferred air dispersion model for determining air impacts within 50 kilometers of air pollution emission sources.[1]

ii. Geographical Inputs

The first step of all air dispersion modeling analyses is establishing a coordinate system for identifying the geographical location of emission sources and receptors. These geographical locations are used to determine local characteristics (such as land use and elevation), and also to ascertain source to receptor distances and relationships.

I used the Universal Transverse Mercator (UTM) NAD83 zone 11 coordinate system for identifying the easting (x) and northing (y) coordinates of the modeled sources and receptors. I obtained the source locations from modeling files associated with the AAQA as well as previous modeling attempts that included existing sources, as provided by the VCAPCD. I verified the source coordinates using Google Earth Pro orthoimagery, which ensures consistency with the UTM NAD83 coordinate system.

iii. Receptors

For consistency with the existing modeling described in the AAQA, I modeled the same 73,190 receptors as those included in the associated AAQA modeling files. The receptor grid is described in the AAQA:

> "The VCAPCD used a Cartesian coordinate receptor grid to provide adequate spatial coverage surrounding the project area, to identify the extent of significant impacts, and to identify the

[1] USEPA, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions, Appendix W to 40 CFR Part 51, November 9, 2005.

> maximum impact location. In the analyses, the VCAPCD used a grid with 25 meter spacing telescoping from the facility fence line to 250 meter spacing out to a distance of 20 km. After a preliminary modeling run was completed, subgrids of varying sizes, with 25 meter spacing were placed at the points of maximum impact for each averaging period in order refine their impact values and locations."

iv. *Meteorological Data*

For the sake of consistency, I used the same meteorological data files as in the AAQA modeling analysis. This data set covers five years, 2010 through 2014. Surface data is obtained from the Oxnard Airport station (KOXR), and upper air data is obtained from the Vandenberg Air Force Base station (KVGB).

The AAQA reported results using meteorological data both with and without the adjusted U* option. The AAQA claims that "[t]he adjusted U* option in AERMET is focused on improving model performance during periods of stable/low-wind conditions." While it is true that the adjusted U* option does adjust calculated friction velocity under these conditions, it is a non-default beta option as of the latest version of AERMET (v. 15181). The U.S. EPA explicitly explains that use of beta options changes the status of the model from preferred to alternative:

> "It should be noted that the inclusion by EPA of a beta option into any part of the AERMOD Modeling System or any other preferred model listed in Appendix A to Appendix W does not bestow any special status or implicit approval of that non-regulatory beta option. If a beta option within an EPA preferred model is used in a regulatory application, then the status of the preferred model is changed to that of an alternative model." [2]

For this reason, it is not appropriate to include modeling results with the adjusted U* option in the AAQA. In my modeling analysis, I used the non-adjusted U* meteorological data included in the AAQA modeling files.

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[2] USEPA, Memorandum: Clarification on the Approval Process for Regulatory Application of the AERMOD Modeling System Beta Options, December 10, 2015.

v. Source Parameters and Emission Rates

I modeled using source parameters and emission rates consistent with modeling presented in the AAQA for the proposed new equipment. To model the entire facility for NAAQS and CAAQS compliance, I also modeled existing equipment that will continue to operate after the commissioning of the new equipment. I obtained source parameters and emission rates for the existing equipment from modeling files used in a December 2015 analysis that considered emissions from both new and existing equipment.

I modeled emissions for operating conditions during the commissioning period as well as during normal operation. The source parameters and emission rates I used in my modeling analysis are listed in the following Tables 1 and 2.

Table 1: Commsisioning Period Source Parameters and Emissions

Source	UTM Easting	UTM Northing	NOx Emission Rate (g/s)	Release Height (m)	Temp. (degrees K)	Exit Velocity (m/s)	Stack Diameter (m)
New Natural Gas Turbine	292538.0	3787499.0	31.0	57.3	755.4	47.2	6.7
Existing Units 1 and 2	292589.1	3787338.6	1.9	61.0	355.9	13.6	5.3
Existing Unit 3 A	292639.3	3787251.9	34.8	16.5	650.9	50.0	3.9
Existing Unit 3 B	292635.8	3787250.4	34.8	16.5	650.9	50.0	3.9
Existing Unit 3 C	292621.0	3787244.1	34.8	16.5	650.9	50.0	3.9
Existing Unit 3 D	292617.5	3787242.7	34.8	16.5	650.9	50.0	3.9

Table 2: Normal Operations Source Parameters and Emissions

Source	UTM Easting	UTM Northing	NOx Emission Rate (g/s)	Release Height (m)	Temp. (degrees K)	Exit Velocity (m/s)	Stack Diameter (m)
New Natural Gas Turbine	292538.0	3787499.0	31.0	57.3	755.4	47.2	6.7
New Diesel Emergency Engine	292539.8	3787494.8	0.1	21.3	957.0	82.4	0.2
Existing Unit 1	292589.1	3787338.6	1.2	61.0	355.9	13.6	5.3
Existing Unit 3 A	292639.3	3787251.9	34.8	16.5	650.9	50.0	3.9
Existing Unit 3 B	292635.8	3787250.4	34.8	16.5	650.9	50.0	3.9
Existing Unit 3 C	292621.0	3787244.1	34.8	16.5	650.9	50.0	3.9
Existing Unit 3 D	292617.5	3787242.7	34.8	16.5	650.9	50.0	3.9

vi. NO_2 Modeling Methodology

Section 5.2.7.1 of the AAQA describes the process of NO_2 modeling:

> "While the new 1-hour NO_2 NAAQS is defined relative to ambient concentrations of NO_2, the majority of NOx emissions from

> stationary sources are in the form of nitric oxide (NO) rather than NO_2. Appendix W notes that the impact of an individual source on ambient NO_2 depends in part "on the chemical environment into which the source's plume is to be emitted" (see Appendix W, Section 5.1.j). Because of the role NOx chemistry plays in determining ambient impact levels of NO_2 based on modeled NOx emissions, Section 5.2.4 of Appendix W recommends a three-tiered screening approach for NO_2 modeling."

The three-tiered screening process mentioned in the AQAA is described in detail by the U.S. EPA:

- Tier 1: assume full conversion of NO to NO_2, where total NOx concentrations are computed with a refined modeling technique specified in Section 4.2.2 of Appendix W.
- Tier 2: multiply Tier 1 results by empirically derived NO_2/NOx ratios, with 0.75 as the national default ratio for annual NO_2 (Chu and Meyer, 1991) and 0.80 as the national default ratio for hourly NO_2 (Want, et al, 2011; Janssen, et al, 1991), as recommended in U.S. EPA, 2011.
- Tier 3: detailed screening methods may be used on a case-by-cases basis. At this time, OLM (Cole and Summerhays, 1979) and the PVMRM (Hanrahan, 1999) are considered to be appropriate as detailed screening techniques. [3]

Tier 3 methods are currently <u>non-default beta options</u> in AERMOD. As such, "application of AERMOD with the OLM or PVMRM option is no longer considered a 'preferred model' and, therefore, requires justification and approval by the Regional Office on a case-by-case basis." [4] Using Tier 3 methods for comparison to the NO_2 NAAQS and CAAQS in this case is not appropriate. However, for the sake of argument, I have performed modeling analyses applying practices covering all three tiers for comparison to the NAAQS and CAAQS. My Tier 3 modeling analysis utilizes the Ozone Limiting Method with assumptions made in previous modeling analyses presented by the VCAPCD.

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[3] USEPA, Memorandum: Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the N02 National Ambient Air Quality Standard, September 30, 2014.
[4] USEPA, Memorandum: Applicability of Appendix W Modeling Guidance for the 1-hour N02 National Ambient Air Quality Standard, June 28, 2010.

vii. Background Concentrations

The analysis presented in the AAQA uses NO_2 background concentrations from the El Rio – Rio Mesa High School #2 monitoring station in Oxnard, 11 kilometers away from the facility. To account for emissions from existing sources that may be "double counted" in the background concentration, I modeled NOx emissions from the existing MGS Units 1, 2, and 3 using Tier 1 NO_2 modeling practices, assuming all NOx converts to NO_2. I then subtracted these modeled concentrations from the background concentrations assumed in the AAQA. The resulting differences are the values I used as background concentrations in my own analysis. These results are detailed in Table 3.

Table 3: NO_2 Background Concentrations

Averaging Time	AAQS (μg/m³)		2012 Rio Mesa Monitored Background Concentration (μg/m³)	2012 Modeled Concentration of Existing Sources at Rio Mesa Monitor (μg/m³)	Background Concentration from Outside Sources (μg/m³)
	California	National (Primary)			
1-hour Max	339	---	107.0	38.4	68.6
1-hour 98th Percentile	---	188	68.0	27.2	40.8

It should be noted that the background concentrations listed in Table 5-5 of the AAQA do not reflect the maximum design values for 2012-2014 as claimed. The values listed for NO_2 appear to be from more distant years and are actually higher than those for the last available three years. The values listed above in Table 3 reflect the correct maximum design values for 2012-2014.

b. Modeling Results

My modeling analysis indicates that the proposed P3 facility would cause both NAAQS and CAAQS violations when using default U.S. EPA approved options in AERMOD.

When Puente is modeled along with MGS Units 1 and 3, AERMOD predicts emissions will violate the NAAQS and CAAQS even before considering any background concentrations. Even when using non-default Tier 3 NO_2 modeling methods, which result in the lowest predictions of air pollution, the facility would be in violation of the NAAQS. This is true of both the commissioning period and normal operations scenarios when reduced background calculations are added to the modeled concentrations. My modeled results are detailed in the following Tables 4 through 9.

Table 4: Commissioning Period Tier 1 NO_2 Concentrations - New CTG and MGS Units 1, 2, and 3						
	AAQS (μg/m³)					
Averaging Time	California	National (Primary)	Modeled Concentration (μg/m³)	Background Concentration (μg/m³)	Total Concentration (μg/m3)	Exceeds Standard?
1-hour Max	339	---	476.2	68.6	544.9	YES
1-hour 98th Percentile	---	188	353.4	40.8	394.2	YES

Table 5: Commissioning Period Tier 2 NO_2 Concentrations - New CTG and MGS Units 1, 2, and 3						
	AAQS (μg/m³)					
Averaging Time	California	National (Primary)	Modeled Concentration (μg/m³)	Background Concentration (μg/m³)	Total Concentration (μg/m3)	Exceeds Standard?
1-hour Max	339	---	381.0	68.6	449.6	YES
1-hour 98th Percentile	---	188	282.7	40.8	323.5	YES

Table 6: Commissioning Period Tier 3 NO_2 Concentrations - New CTG and MGS Units 1, 2, and 3						
	AAQS (μg/m³)					
Averaging Time	California	National (Primary)	Modeled Concentration (μg/m³)	Background Concentration (μg/m³)	Total Concentration (μg/m3)	Exceeds Standard?
1-hour Max	339	---	216.8	68.6	285.4	NO
1-hour 98th Percentile	---	188	180.3	40.8	221.1	YES

Table 7: Normal Operations Tier 1 NO_2 Concentrations - New Equipment and MGS Units 1 and 3						
	AAQS (μg/m³)					
Averaging Time	California	National (Primary)	Modeled Concentration (μg/m³)	Background Concentration (μg/m³)	Total Concentration (μg/m3)	Exceeds Standard?
1-hour Max	339	---	469.8	68.6	538.4	YES
1-hour 98th Percentile	---	188	347.5	40.8	388.3	YES

Table 8: Normal Operations Tier 2 NO_2 Concentrations - New Equipment and MGS Units 1 and 3						
	AAQS (μg/m³)					
Averaging Time	California	National (Primary)	Modeled Concentration (μg/m³)	Background Concentration (μg/m³)	Total Concentration (μg/m3)	Exceeds Standard?
1-hour Max	339	---	375.8	68.6	444.5	YES
1-hour 98th Percentile	---	188	278.0	40.8	318.8	YES

Table 9: Normal Operations Tier 3 NO_2 Concentrations - New Equipment and MGS Units 1 and 3						
	AAQS (µg/m^3)					
Averaging Time	California	National (Primary)	Modeled Concentration (µg/m^3)	Background Concentration (µg/m^3)	Total Concentration (µg/m3)	Exceeds Standard?
1-hour Max	339	---	215.1	68.6	283.7	NO
1-hour 98th Percentile	---	188	178.7	40.8	219.4	YES

These significant impacts were not identified in the AAQA because of the failure to model the entire facility, with all operating emissions sources. Since the project impacts would also exceed the significant impact level (SIL) of 7.5 µg/m^3, the project must not go forward.

Even without considering the impacts of MGS Unit 1, the project will still cause NAAQS and CAAQS violations. As shown in Tables 10 through 12, the operation of Puente in conjunction with only MGS Unit 3 will cause violations of both the CAAQS and NAAQS before adding background concentrations. Even using non-default Tier 3 modeling methods, results are in violation of the NAAQS.

Table 10: Normal Operations Tier 1 NO_2 Concentrations - New Equipment and MGS Unit 3						
	AAQS (µg/m^3)					
Averaging Time	California	National (Primary)	Modeled Concentration (µg/m^3)	Background Concentration (µg/m^3)	Total Concentration (µg/m3)	Exceeds Standard?
1-hour Max	339	---	465.1	68.6	533.7	YES
1-hour 98th Percentile	---	188	342.7	40.8	383.5	YES

Table 11: Normal Operations Tier 2 NO_2 Concentrations - New Equipment and Unit 3						
	AAQS (µg/m^3)					
Averaging Time	California	National (Primary)	Modeled Concentration (µg/m^3)	Background Concentration (µg/m^3)	Total Concentration (µg/m3)	Exceeds Standard?
1-hour Max	339	---	372.1	68.6	440.7	YES
1-hour 98th Percentile	---	188	274.2	40.8	315.0	YES

Table 12: Normal Operations Tier 3 NO_2 Concentrations - New Equipment and Unit 3						
	AAQS (µg/m^3)					
Averaging Time	California	National (Primary)	Modeled Concentration (µg/m^3)	Background Concentration (µg/m^3)	Total Concentration (µg/m3)	Exceeds Standard?
1-hour Max	339	---	214.7	68.6	283.3	NO
1-hour 98th Percentile	---	188	178.0	40.8	218.7	YES

The newest nearby power plant is SCE's McGrath peaker facility, which is located just beyond the fence line of the Mandalay Generating Station. This power plant was constructed in 2012, and is anticipated to continue operation indefinitely. In order to model the cumulative impacts with McGrath, I further reduced the background concentrations to remove any impact from McGrath, as described above in Section III(vii). I then modeled the expected emissions of Puente and McGrath, using facility data obtained from the Air Quality Impact Analysis prepared during the approval process for the McGrath Project, as detailed in Table 13.[5]

Table 13: McGrath Normal Operations Source Parameters and Emissions

Source	UTM Easting	UTM Northing	NOx Emission Rate (g/s)	Release Height (m)	Temp. (degrees K)	Exit Velocity (m/s)	Stack Diameter (m)
McGrath LM6000	292960.0	3787045.0	0.5	24.4	629.3	18.7	4.0
McGrath Black ICE	293024.0	3787038.9	0.2	4.4	723.7	44.8	0.3

The results, shown in Tables 14 through 16, indicate both NAAQS and CAAQS violations before adding background concentrations using Tier 1 and Tier 2 modeling methods, and NAAQS violations when using non-default Tier 3 methods.

Table 14: Normal Operations Tier 1 NO_2 Concentrations - McGrath plus New Equipment and MGS Unit 3

Averaging Time	AAQS (µg/m³) California	AAQS (µg/m³) National (Primary)	Modeled Concentration (µg/m³)	Background Concentration (µg/m³)	Total Concentration (µg/m3)	Exceeds Standard?
1-hour Max	339	---	466.3	68.1	534.4	YES
1-hour 98th Percentile	---	188	344.8	40.6	385.4	YES

Table 15: Normal Operations Tier 2 NO_2 Concentrations - McGrath plus New Equipment and MGS Unit 3

Averaging Time	AAQS (µg/m³) California	AAQS (µg/m³) National (Primary)	Modeled Concentration (µg/m³)	Background Concentration (µg/m³)	Total Concentration (µg/m3)	Exceeds Standard?
1-hour Max	339	---	373.1	68.1	441.1	YES
1-hour 98th Percentile	---	188	275.8	40.6	316.5	YES

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[5] McGrath facility data obtained from Southern California Edison, Appendix D: *Mandalay Peaker Project Air Quality Impact Analysis* (February 2007). Available at https://www.sce.com/NR/rdonlyres/E515C7D3-0662-430F-8232-312CD5E5D966/0/EnvironmentalDocumentsMND0702Appendix.pdf

Table 16: Normal Operations Tier 3 NO_2 Concentrations - McGrath plus New Equipment and MGS Unit 3						
	AAQS (μg/m^3)					
Averaging Time	California	National (Primary)	Modeled Concentration (μg/m^3)	Background Concentration (μg/m^3)	Total Concentration (μg/m3)	Exceeds Standard?
1-hour Max	339	---	215.3	68.1	283.4	NO
1-hour 98th Percentile	---	188	179.0	40.6	219.6	YES

For the sake of argument, I also modeled these three facilities using the adjusted U* model, even though it is not appropriate to use this beta model for the Puente AAQA. Even when using the adjusted U* model, the operation of Puente, MGS Unit 3 and McGrath are expected to cause violations of the NO_2 CAAQS.

Table 17: Normal Operations Tier 1 NO_2 Concentrations - McGrath Plus New Equipment and MGS Unit 3, with ADJ_U*						
	AAQS (μg/m^3)					
Averaging Time	California	National (Primary)	Modeled Concentration (μg/m^3)	Background Concentration (μg/m^3)	Total Concentration (μg/m3)	Exceeds Standard?
1-hour Max	339	---	291.1	68.1	359.2	YES
1-hour 98th Percentile	---	188	144.2	40.6	184.8	NO

IV. Conclusion

The P3 AAQA featured in the PDOC is seriously flawed in that not all facility sources were modeled. This oversight led to the failure of the AAQA to identify hour NO_2 exceedances of both the NAAQS and CAAQS when using the EPA's preferred option in AERMOD. NAAQS and CAAQS violations occur in emissions scenarios for both the commissioning period of P3 as well as during normal operations, after MGS Units 1 and 2 are both retired in 2020. The impacts of P3 and MGS Unit 3 together are significant: Even when using the non-default beta ozone limiting method for modeling NO_2 impacts and reducing background NO_2 levels, the combined impacts of P3 and MGS Unit 3 would result in 1-hour NO_2 NAAQS violations. Based on these results, this project must not be approved to go forward.

V. Expert Qualifications

I hold an M.A. (2012) degree in Geography from California State University, Northridge, where I specialized in GIS and air dispersion modeling. My thesis, titled "Diesel Trucks: Health Risk and Environmental Equity," involved the use of U.S. EPA's AERMOD model to determine concentrations of diesel particulate matter (DPM) around several Southern California freeways, focusing on pollution from port-related diesel truck traffic. I also performed a population analysis examining inequities related to race and income groups exposed to DPM.

I have broad experience as a consultant providing litigation support. I have performed numerous air quality modeling analyses using AERMOD and other air dispersion models, prepared meteorological data using AERMET, performed health risk assessments, and created many detailed maps and graphics. I have experience preparing analyses of various emission types from many sources and facilities including coal-fired power plants, agricultural fields, and mobile sources. My resume is included as Attachment B.