APPENDIX 6.12-C – POWER PLANT PREDICTIVE NOISE MODELING AND ANALYSIS

1.0 Introduction

To analyze the proposed project and the possible noise mitigation options, a PC-based noise prediction program was used to simulate and model the noise propagation from the proposed Orange Grove Project. This proprietary, in-house model uses industry-accepted propagation algorithms based on standards written by CONCAWE[1]. The calculations account for classical sound wave divergence (spherical spreading loss with adjustments for source directivity from point sources) plus attenuation factors due to air absorption[2], basic ground effects, and barrier/shielding. This model has been validated over the years via noise measurements at several operating plants that had been previously modeled during the engineering design phases.

2.0 Future Orange Grove Project Noise Environment Analysis

The modeling study for the proposed Project used plant layout configurations and equipment information as supplied by J-Power USA and Sega (an Engineering and Construction company retained by J Power USA)). All continuous-operation equipment items that were deemed to be significant noise sources at the proposed Project were included in the noise model. Specifically, the study focused on the potential noise generated by the proposed two trains of gas-fired combustion turbines (General Electric LM 6000's), inlet chiller/cooling tower, fin/fan oil-to-air coolers, water pumps, power transformers, and other associated process and support equipment. Items that were considered insignificant sources, such as pumps less than 20 horsepower, were excluded from the analysis.

The sound power levels representing the standard performance of each of these components are assigned based either on field measurements of similar equipment made at other existing plants, data supplied by manufacturers, or information found in the technical literature. Note that the noise emissions factors for this AFC analysis are updated and refined with respect to earlier project designs (such as during the SPPE phase). Using these sound power levels to define the individual sources, the model calculates the sound pressure level that would occur at each defined receptor from each source given a set of sound propagation factors and attenuation effects that have been adopted from industry standards. These attenuation and reduction factors include losses from distance, air absorption, ground attenuation effects, and intervening barriers (both building and topography) are considered. The sum of all these individual source levels, after incorporating the propagation terms, is the total plant level at the selected receptor location.

Per the permit application, the plant was assumed to operate 24 hours per day at maximum loads, which means its noise output would be constant, regardless of time-of-day. This scenario is conservative because electricity demand normally ramps downward at night when commercial activities decline and when residential usage decreases (as people turn off lights, televisions, and

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1 CONCAWE is the oil companies' European organization for environment, health, and safety and is headquartered in Brussels, Belgium. The noise propagation standard was originally published in 1981 under the title "The propagation of noise from petroleum and petrochemical complexes to neighboring communities". Parts of this method are also included in the ISO 9613, ISO 1913 (Part 1), ANSI 12.6, or ISO 3891 standards.

2 Atmospheric absorption assumed "standard-day" conditions of 59° F and 70 percent relative humidity. More advanced effects due to wind, inversion, and gradient conditions are discussed later in this section.

appliances before going to sleep). Further, as a peaking plant, operations past 10 p.m. would only be in very rare instances wherein the CAISO would call for peak-demand power. These very rare instances are estimated to be on the order of 40 hours per year over a 20 to 40 day period in the hottest months. The operation of this plant beyond midnight would connote that there is a serious problem on the power grid and such late-night operations could be categorized as 'exceedingly rare' (to the point of 'almost never' occurring). Nevertheless, the modeling was performed assuming 24 hours of maximum loads to assess the potential noise environment at all hours of the day and night.

The proposed plant was modeled as an open-air plant. That is, the base case noise model assumed no buildings or large enclosures around major equipment items. However, topographical features are important to this site and the ridgelines around the Site were included in the noise prediction model. A reasonable attenuation factor for vegetation (e.g. trees and ground cover, both existing and future) was considered. Lastly, as is standard practice in the description of environmental noise, stable atmospheric conditions were assumed (suitable for reproducible measurements and that are favorable for noise to travel greater distances). These inherent conservative factors and assumptions result in a noise model that tends be biased to higher predicted values than would be expected in the actual environment around the Project.

The pertinent project drawings[3] were used to establish the overall noise analysis area and the position of the noise sources, respectively. The source and receptor locations/elevations were translated into x, y, z input coordinates for the noise modeling program. Calculations in the model are performed using octave band sound power levels (abbreviated PWL or Lw) as inputs from each noise source. Rather than use estimated source inputs levels that can be calculated from accepted industry references[4], the modeling inputs used noise emission values that were obtained from equipment vendors on several recent design efforts on similar peaker plants. This use of vendor-supplied noise level information for the specific equipment that is planned for the Orange Grove Project means that the modeling has a higher level of accuracy, as compared to modeling done with generic type and size information for the power plant equipment.

A baseline model was generated and the results were found to cause noise impacts; both in terms of the CEC impact criterion and with respect to the County of Sand Diego regulations. The modeling effort was therefore repeated in an iterative fashion to analyze increasingly quiet configurations of plant equipment until a plant design was arrived at that was considered the feasibility limit for practical noise mitigation techniques and that resulted in compliance with the County's regulations at the property line and with the CEC significant impact threshold. This feasibility-constrained array of noise control design features was included in the plant noise modeling.

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[3] "Orange Grove Project, Site Layout Plan", Sega drawing number 07201-C100, rev. L, of 6/2/08. "Orange Grove Project, Yard Layout Plan", Sega drawing number 07201-Y100, rev. F, of 6/2/08. "Existing Manmade Features and Sensitive Receptors", TRC drawing Figure 6.9-3, undated. USGS quad map 33117-C1-TF-024, Pala, California, photorevised 1988.

[4] Such as the Edison Electric Institute Technical Report, "Electric Power Plant Environmental Noise Guide"

The main noise control features are large sound walls around each power generation train and sound walls around the fuel gas compressors. Specifically, GTG and SCR trains will each be inside of an open-top acoustic enclosure (three-sided, open to the west, and approximately 48 feet tall), the main chiller and cooling systems will also be inside an open-top acoustic enclosure (three-sided, open to the west, and approximately 48 feet tall), and the fuel gas compression and cooling systems will be inside a 24-foot high, three sided, open-toped enclosure; all to prevent the plant from creating noise impacts to receptors to the north, northeast, east, and southeast. Provisions will be included for the possible implementation of the fourth wall on all these enclosure, should additional noise control be necessitated by future developments on or beyond SDG&E property to the west.

The inputs to the noise prediction models are given on the following pages.

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Table 6.12-C1 – Predictive Noise Model Inputs

units: ENGLISH

RECEPTORS

Name	X	Y	Z
Loc LT-1	4665	4983	563
Loc ST-1	5726	4636	346
Loc ST-2	4743	5926	867
House B	4294	7076	1220
House C	6253	1958	410
Casino	11411	5207	370
Prop A_NW	1081	4610	763
Prop B_N	2765	4619	541
Prop D_NE	4877	4635	537
Prop x_E	4888	4198	476
Prop E_E	4891	3963	362
Prop G_angle	3842	3227	353
Prop H_angle	3078	2565	342
Prop J_angle	2666	1892	417
Prop L_SW	1075	435	474
Prop M_W	1077	3060	951
APN-26_E	4174	3926	380
APN-26_S	3185	3218	382
APN-26_SW	2780	3206	380
APN-26_WSW	2787	3468	400

SOURCES

Item	Name	Dir'y	X	Y	Z	63	125	250	500	1k	2k	4k	8k
1	ChllrFan1	3	3125	3580	420	111	109	109	104	99	92	87	84
2	ChllrFan2	3	3095	3562	420	109	107	108	103	98	92	87	83
3	SCR1StkExh	0	3114	3647	490	113	104	101	94	70	53	57	56
4	SCR2StkExh	0	3178	3539	490	113	104	101	94	70	53	57	56
5	SCR1Case	3	3082	3628	435	115	110	108	99	82	73	69	58

6	SCR2Case	3	3146	3520	435	115	110	108	99	82	73	69	58
7	FuelGsCmp1	3	3142	3409	415	100	101	105	108	104	105	105	103
8	FuelGsCmp2	3	3175	3428	415	100	101	105	108	104	105	105	103
9	GTG1AirInl	0	3007	3583	443	108	100	109	104	99	92	89	92
10	GTG2AirInl	0	3071	3476	443	108	100	109	104	99	92	89	92
11	GT1inlDuct	3	3011	3586	433	80	95	103	86	89	88	86	79
12	GT2inlDuct	3	3075	3479	433	80	95	103	86	89	88	86	79
13	GTG1Turbin	3	3017	3589	424	103	101	100	97	89	88	86	79
14	GTG2Turbin	3	3081	3482	424	103	101	100	97	89	88	86	79
15	GTG1TmpFn1	3	3060	3593	414	95	90	91	87	84	83	82	77
16	GTG2TmpFn1	3	3123	3489	414	95	90	91	87	84	83	82	77
17	GTG1TrbFan	3	3003	3585	424	93	97	98	92	92	94	92	86
18	GTG2TrbFan	3	3071	3472	424	93	97	98	92	92	94	92	86
19	GTG1TrbVnt	3	3007	3579	426	105	97	94	79	77	76	70	60
20	GTG2TrbVnt	3	3067	3478	426	105	97	94	79	77	76	70	60
21	GTG1Genr	3	2998	3578	424	97	100	102	90	91	84	75	65
22	GTG2Genr	3	3062	3471	424	97	100	102	90	91	84	75	65
23	GTG1GenExh	3	2999	3569	420	106	94	83	72	72	71	68	62
24	GTG2GenExh	3	3054	3476	420	106	94	83	72	72	71	68	62
25	GTG1GenVnt	3	2994	3566	426	89	98	114	97	97	92	84	75
26	GTG2GenVnt	3	3049	3474	426	89	98	114	97	97	92	84	75
27	GTG1AuxSkd	3	3030	3579	414	87	92	104	106	102	99	101	80
28	GTG2AuxSkd	3	3079	3498	414	87	92	104	106	102	99	101	80
29	GTG1AuxClr	3	3034	3575	414	80	83	93	78	68	67	63	57
30	GTG2AuxClr	3	3076	3504	414	80	83	93	78	68	67	63	57
31	GTG1Sprint	3	3016	3573	414	78	79	79	81	80	76	70	62
32	GTG2Sprint	3	3067	3490	414	78	79	79	81	80	76	70	62
33	GTG1WtInSk	3	3012	3563	414	95	96	94	98	94	92	87	83
34	GTG2WtInSk	3	3057	3489	414	95	96	94	98	94	92	87	83
35	GTG1FinFan	3	3027	3556	420	109	102	99	97	93	90	86	79
36	GTG2FinFan	3	3056	3507	420	109	102	99	97	93	90	86	79
37	NH3VprSkd1	3	3049	3587	414	78	79	79	81	80	76	70	62
38	NH3VprSkd2	3	3093	3511	414	78	79	79	81	80	76	70	62
39	GTG1TmpFn2	3	3042	3623	414	95	90	91	87	84	83	82	77
40	GTG2TmpFn2	3	3106	3518	414	95	90	91	87	84	83	82	77

41	SCR1ExpJnt	3	3045	3606	420	110	102	96	89	86	83	85	88
42	SCR2ExpJnt	3	3109	3499	420	110	102	96	89	86	83	85	88
43	GTG1Xfrmr	3	2913	3473	422	103	97	97	92	86	83	80	80
44	GTG2Xfrmr	3	2931	3441	422	103	97	97	92	86	83	80	80
45	NH3PmpSkd	3	3143	3591	413	79	82	82	86	84	84	80	77
46	DminWtrSkd	3	3161	3734	413	79	82	82	86	84	84	80	77
47	GasMeterg	3	3245	3462	414	82	85	87	89	90	88	83	76
48	GasCmpFnFn	3	3192	3427	420	104	101	99	94	90	92	90	89
49	ChillerMod	3	3063	3544	420	80	79	85	85	86	90	89	75
50	MkUpWtrSkd	3	2898	3564	414	79	82	82	86	84	84	80	77
51	Aux Xfrmr1	3	2947	3482	416	96	88	84	80	78	74	74	69
52	Aux Xfrmr2	3	2956	3466	416	96	88	84	80	78	74	74	69
53	Aux Xfrmr3	3	2965	3450	416	96	88	84	80	78	74	74	69
54	Aux Xfrmr4	3	2975	3433	416	96	88	84	80	78	74	74	69

3.0 Future Orange Grove Project Noise Environment Results

The computer outputs are in terms of octave band and overall A-weighted sound pressure levels (abbreviated SPL or Lp) at specific receptor positions or at grid map nodes (in preparation for computing a contour map). The output listing is ranked by relative noise contribution from each noise source, as is calculated at each receptor location. The modeling effort used the same receptors for the future conditions analysis as were used during the April 2007 and December 2007 ambient surveys.

Many modeling runs were made over the course of the project's development, in response to changes in layout, planned equipment, and operations conditions. For each modeling scenario, the ranked listing of noise contributors at each receptor location was studied to evaluate which set of equipment should have noise control options applied. This iterative analysis approach enabled the use of a balanced and reasonable set of noise control treatments could be employed to achieve compliance with both the County's and the Commission's significant impact thresholds.

These results of the predictive modeling efforts are summarized in the Tables and Contour Map Figure of Section 6.12.5.3 of the AFC Main Text.

The compliant noise levels were achieved using the following extensive array of design features:

- Housing the main power generation trains inside an open-top acoustic enclosure (three-sided, open to the west, and approximately 48 feet tall);
- Housing the chiller and main cooling systems inside an open-top acoustic enclosure (three-sided, open to the west, and approximately 48 feet tall);
- Implementation of appropriate silencing in the exhaust path within the SCR (pre-catalyst bed, post-catalyst bed, or in the stack);
- Low-noise sound level specifications for vent silencers; and
- Housing the fuel gas compressors and coolers inside an open-top acoustic enclosure (three-sided, open to the west, and approximately 24 feet tall).

The implementation and refinement of these design features during the detailed design process will result in the Project meeting the San Diego Noise Ordinance, as well as meeting the CEC's significance impact threshold. Consequently, no significant noise impacts during ongoing operations are expected and, thus, no mitigation measures are expected to be required.