

# NOISE AND VIBRATION

Testimony of Shahab Khoshmashrab

## SUMMARY OF CONCLUSIONS

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The Orange Grove Project, if built and operated in conformance with the proposed conditions of certification below, would comply with all applicable noise and vibration laws, ordinances, regulations and standards, and would produce no significant adverse noise impacts on people within the affected area, directly, indirectly, or cumulatively. The applicant has proposed appropriate mitigation, in the form of good design practice and selection of appropriate project equipment, that would avoid any significant adverse impacts.

## INTRODUCTION

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The construction and operation of any power plant creates noise or unwanted sound. The character and loudness of this noise, the times of day or night that it is produced, and the proximity of the facility to sensitive receptors all combine to determine whether the facility would meet applicable noise control laws and ordinances and whether it would cause significant adverse environmental impacts. In some cases, vibration may be produced as a result of power plant construction practices such as blasting or pile driving. The ground-borne energy of vibration has the potential to cause structural damage and annoyance.

The purpose of this analysis is to identify and examine the likely noise and vibration impacts from the construction and operation of the Orange Grove Project (OGP), and to recommend procedures to ensure that the resulting noise and vibration impacts would be adequately mitigated to comply with applicable laws, ordinances, regulations and standards (LORS). For an explanation of technical terms used in this section, please refer to **NOISE APPENDIX A**, immediately following.

## LAWS, ORDINANCES, REGULATIONS, AND STANDARDS

**Noise Table 1  
Laws, Ordinances, Regulations and Standards**

Applicable Law	Description
<b><u>Federal:</u></b>	
Occupational Safety & Health Act (OSHA): 29 U.S.C. § 651 et seq.	Protects workers from the effects of occupational noise exposure
U.S. Environmental Protection Agency (USEPA)	Assists state and local government entities in development of state and local LORS for noise
<b><u>State:</u></b>	
California Occupational Safety & Health Act (Cal-OSHA): 29 U.S.C. § 651 et seq., Cal. Code Regs., tit. 8, §§ 5095-5099	Protects workers from the effects of occupational noise exposure
<b><u>Local:</u></b>	
County of San Diego Code of Regulatory Ordinances, Title 3, Public Safety	Establishes acceptable noise level limits at various land uses.  Limits noisy construction to daytime hours and to no louder than 75 dBA $L_{eq}$ at the property lines of any sensitive noise receptor <sup>1</sup> .

### FEDERAL

Under the Occupational Safety and Health Act of 1970 (OSHA) (29 U.S.C. § 651 et seq.), the Department of Labor, Occupational Safety and Health Administration, (OSHA) adopted regulations (29 C.F.R. § 1910.95) designed to protect workers against the effects of occupational noise exposure. These regulations list permissible noise exposure levels as a function of the amount of time during which the worker is exposed (see **Noise Appendix A Table A4**, immediately following this section). The regulations further specify a hearing conservation program that involves monitoring the noise to which workers are exposed, assuring that workers are made aware of overexposure to noise, and periodically testing the workers' hearing to detect any degradation.

Guidelines are available from the U.S. Environmental Protection Agency (USEPA) to assist state and local government entities in developing state and local LORS for noise. Because there are existing local LORS that apply to this project, the USEPA guidelines are not applicable.

There are no federal laws governing off-site (community) noise.

<sup>1</sup> A sensitive noise receptor, also referred to as a noise-sensitive receptor, is a receptor at which there is a reasonable degree of sensitivity to noise (such as residences, schools, hospitals, elder care facilities, libraries, cemeteries, and places of worship).

The Federal Transit Administration (FTA) has published guidelines for assessing the impacts of ground-borne vibration associated with construction of rail projects, which have been applied by other jurisdictions to other types of projects. The FTA-recommended vibration standards are expressed in terms of the “vibration level,” which is calculated from the peak particle velocity measured from ground-borne vibration. The FTA measure of the threshold of perception is 65 vibrational decibel (VdB), which correlates to a peak particle velocity of about 0.002 inches per second (in/sec). The FTA measure of the threshold of architectural damage for conventional sensitive structures is 100 VdB, which correlates to a peak particle velocity of about 0.2 in/sec.

## **STATE**

California Government Code Section 65302(f) encourages each local governmental entity to perform noise studies and implement a noise element as part of its general plan. In addition, the California Office of Planning and Research has published guidelines for preparing noise elements, which include recommendations for evaluating the compatibility of various land uses as a function of community noise exposure.

The State of California, Office of Noise Control, prepared the Model Community Noise Control Ordinance, which provides guidance for acceptable noise levels in the absence of local noise standards. This model also defines a simple tone, or “pure tone,” as one-third octave band sound pressure levels that can be used to determine whether a noise source contains annoying tonal components. The Model Community Noise Control Ordinance further recommends that when a pure tone is present the applicable noise standard should be lowered (made more stringent) by five A-weighted decibels (dBA).

The California Occupational Safety and Health Administration (Cal-OSHA) has promulgated occupational noise exposure regulations (Cal. Code Regs., tit. 8, §§ 5095-5099) that set employee noise exposure limits. These standards are equivalent to federal OSHA standards (see **Noise Appendix A Table A4**).

## **LOCAL**

### **County of San Diego LORS**

The project is located within the unincorporated San Diego County, California. The County of San Diego Code of Regulatory Ordinances, Title 3, Public Safety (County 2008) applies to this project.

The noise standards are found in Chapter 4 of the County’s Regulatory Ordinances. Section 36.404 establishes acceptable noise level limits for various land uses. According to this section, operational noise levels are limited to 45 dBA  $L_{eq}$  during the nighttime hours of 10:00 p.m. to 7:00 a.m. and 50 dBA  $L_{eq}$  during the daytime hours of 7:00 a.m. to 10:00 p.m., at any residential property.

Section 36.410 limits noisy construction to the hours of 7:00 a.m. to 7:00 p.m. Mondays through Fridays and to no louder than 75 dBA  $L_{eq}$  at the property lines of any noise-sensitive receptor.

## SETTING

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The proposed OGP site is located on an approximately 8.5-acre parcel north of State Route 76 (SR-76) and east of Interstate 15 in rural San Diego County, California. The land use designation of the project site is agricultural (see **Noise Figure 1**). Existing land uses adjacent to the project site include an electric substation, the private Pala Del Norte Road, grove land, and open space. To the west, north, and east of the site, moderately steep slopes of open space rise up to two ridgelines, with three houses near the ridgeline northeast of the site. These houses represent the closest residential receptors to the project site. Zalinda Farms Nursery (the nursery) and a few single family homes are located to the east and northeast of the site, beyond the ridgeline. Currently, there are occupied care-taker residences on the nursery's property.

Sources of noise in the project area include vehicle traffic on SR-76, mechanical equipment, Pala Casino and Resort (located approximately 1.5 miles east of the project site), a motor-driven wind propeller at the nursery, natural sounds (frogs, crickets, and barking dogs), and occasional aircraft overflights. In general, the noise environment in the project vicinity is typical of a sparsely-populated rural setting that includes a relatively heavily traveled roadway (SR-76) (OGE 2008a, AFC §6.12.4.1).

For purposes of evaluating the project's operational impacts on residential uses, the project noise is compared with measured ambient noise levels.

## ASSESSMENT OF IMPACTS AND DISCUSSION OF MITIGATION

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### METHODS AND THRESHOLDS FOR DETERMINING SIGNIFICANCE

#### California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires that significant environmental impacts be identified and either eliminated or mitigated to the extent feasible. Section XI of Appendix G of CEQA's guidelines (Cal. Code Regs., tit. 14, App. G) describes some characteristics that could signify a potentially significant impact. Specifically, a significant effect from noise may exist if a project would result in:

1. exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
2. exposure of persons to or generation of excessive ground borne vibration or ground borne noise levels;
3. substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project; or
4. substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

The Energy Commission staff, in applying Item 3, above, to the analysis of this and other projects, has concluded that a potential for a significant noise impact exists where

the noise of the project plus the background exceeds the background by 5 dBA or more at the nearest sensitive receptor, including those receptors that represent the area's minority population.

Staff has concluded that an increase in background noise levels up to 5 dBA in a residential setting is insignificant; an increase of more than 10 dBA, however, is clearly significant. An increase of between 5 and 10 dBA should be considered adverse, but could be either significant or insignificant, depending upon the particular circumstances of a particular case.

Factors to be considered in determining the significance of an adverse impact as defined above include:

1. the resulting noise level;<sup>1</sup>
2. the duration and frequency of the noise;
3. the number of people affected; and
4. the land use designation of the affected receptor sites.

Noise due to construction activities is usually considered to be insignificant in terms of CEQA compliance if:

- the construction activity is temporary; and
- the use of heavy equipment and noisy<sup>2</sup> activities is limited to daytime hours.

Staff uses the above method and threshold to protect the most sensitive populations, including the area's minority population.

### **Ambient Noise Monitoring**

In order to establish a baseline for the comparison of predicted project noise with existing ambient noise, the applicant has presented the results of an ambient noise survey (OGE 2008a, AFC §6.12.4.1, Tables 6.12-6, 6.12-7, 6.12-8, Figures 6.12-1, 6.12-4, Appendix 6.12-A). This survey was performed from Wednesday, April 18 through Thursday, April 19, 2007, using acceptable equipment and techniques. The survey monitored existing noise levels at the following five locations, shown in **Noise Figure 2**.

1. Location LT1: Nearest residence to the project site. This location is approximately 2,050 feet northeast of the center of the project site. This location was monitored continuously from 3:35 p.m. on April 18 through 5:04 p.m. on April 19, 2007.

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<sup>1</sup> For example, a noise level of 40 dBA would be considered quiet in many locations. A noise limit of 40 dBA would be consistent with the recommendations of the California Model Community Noise Control Ordinance for rural environments, and with industrial noise regulations adopted by European jurisdictions. If the project would create an increase in ambient noise no greater than 10 dBA at nearby sensitive receptors, and the resulting noise level would be 40 dBA or less, the project noise level would likely be insignificant.

<sup>2</sup> Noise that draws legitimate complaint.

2. Location ST1: The nursery (Zalinda Farms Nursery). This location is approximately 2,600 feet east-northeast of the center of the project site. It was monitored for 12 minutes starting at 8:32 p.m. on April 18, again for 15 minutes starting at 2:00 a.m. on April 19, and finally for 16 minutes starting at 3:14 p.m., on April 19, 2007.
3. Location ST2: A residence located approximately 2,875 feet northeast of the center of the project site. This location was monitored for 15 minutes starting at 9:15 p.m. on April 18, 2007. The applicant attempted to measure the ambient noise levels at this location during the late-night and mid-day hours, but no data was recorded due to strong winds.
4. Location House B: A residence located approximately 3,675 feet north-northeast of the center of the project site. This location was not monitored, but the applicant has estimated the existing ambient noise levels at this location using values from similar locations and conditions.
5. Location House C: A residence located approximately 3,150 feet southeast of the center of the project site. This location was not monitored, but the applicant has estimated the existing ambient noise levels at this location using values from similar locations and conditions.

As explained above, the noise environment in the vicinity of the project site is dominated by transportation-related sources.

**Noise Table 2** summarizes the ambient noise measurements at the nearest residential receptors (OGE 2008a, AFC §6.12.4.1, Tables 6.12-6, 6.12-7, 6.12-8, 6.12-9, Figure 6.12-2).

**Noise Table 2  
Summary of Measured Noise Levels**

Measurement Site	Measured Noise Levels, dBA		
	Nighttime Hours L <sub>90</sub>	Average During Daytime Hours L <sub>eq</sub>	Average During Nighttime Hours L <sub>eq</sub>
LT1, Residence 2,050 feet Northeast of the Site	27 <sup>1</sup>	35-38	30-33
ST1, Nursery 2,600 feet East-northeast of the Site	33	54	59
ST2, Residence 2,875 feet Northeast of the Site	34	46	46
House B, Residence 3,675 feet North-northeast of the Site	27-30 <sup>2</sup>	~35 <sup>2</sup>	~30 <sup>2</sup>
House C, Residence 3,150 feet Southeast of the Site	27-30 <sup>2</sup>	~35 <sup>2</sup>	~30 <sup>2</sup>

Source: OGE 2008a, AFC §6.12.4.1, Tables 6.12-6, 6.12-7, 6.12-8, 6.12-9, Figure 6.12-2, Appendix 6.12-A

<sup>1</sup> Calculations of average of four quietest consecutive hours of the nighttime

<sup>2</sup> Estimated value; using measurement data from similar locations and conditions

## **DIRECT IMPACTS AND MITIGATION**

Noise impacts associated with the project can be created by short-term construction activities and normal long-term operation of the project.

### **Construction Impacts and Mitigation**

Construction noise is usually a temporary phenomenon. Construction of the OGP is expected to be typical of similar projects in terms of schedule, equipment used, and other types of activities (OGE 2008a, AFC §§1.3, 6.12.5.2).

### **Compliance with LORS**

Construction of an industrial facility such as a power plant is typically noisier than permissible under usual noise ordinances. In order to allow the construction of new facilities, construction noise during certain hours of the day is commonly exempt from enforcement by local ordinances.

The applicant has predicted construction noise levels. They are summarized here in **Noise Table 3**.

**Noise Table 3**  
**Predicted Construction Noise Levels**

Receptor	Project Noise Level (dBA)	Existing Ambient, Average Daytime $L_{eq}$ (dBA)	Cumulative, Using Lowest Ambient Noise Level	Change in Ambient
LT1	48	35 <sup>1</sup>	48	+13
ST1	27	54	54	0
ST2	44	46	48	+2
House B	41	~35	~42	+7
House C	28	~35	~36	+1

Sources: OGE 2008a, AFC §6.12.5.2, Table 6.12-15, Appendix 6.12-B; NOISE Table 2

<sup>1</sup> For conservatism, staff uses the lowest ambient noise level from NOISE Table 2, above.

Section 36.410 of the San Diego County Regulatory Ordinances limits construction to no louder than 75 dBA  $L_{eq}$  at the property lines of any noise-sensitive receptor. As seen above, in **Noise Table 3**, the project's construction activities would generate noise levels ranging from 27 dBA to 48 dBA at the project's noise-sensitive receptors, well below the above LORS limit.

The applicable local noise LORS limit noisy construction to daytime hours. Noisy construction work would be allowed only during the daytime hours of 7:00 a.m. to 7:00 p.m. on weekdays. To ensure that these hours are, in fact, enforced, staff proposes Condition of Certification **NOISE-6**.

Therefore, the noise impacts of the OGP construction activities would comply with the noise LORS.

### **CEQA Impacts**

Since construction noise typically varies with time, it is most appropriately measured by, and compared with, the  $L_{eq}$  (energy average) metric.

As seen in **Noise Table 3** above, last column, the increases in the ambient noise levels at ST1, ST2, and House C would range from 0 dBA to 2 dBA. An increase of 2 dBA is not noticeable, and thus, the project's construction impacts at these locations would be less than significant.

Also as seen in **Noise Table 3**, the highest increase in the ambient noise level at House B would be 7 dBA. Thus, project construction would be audible at this residence. However, because construction is considered temporary in nature, and because it would occur only during the daytime hours, staff considers this impact to be less than significant.

**Noise Table 3** also shows that the highest increase in the ambient noise level at LT1 would be 13 dBA. Project construction would be clearly audible at this location. However, due to the temporary nature of construction, and because construction would occur only during the daytime hours, staff considers this impact to be less than significant.

To ensure the project construction would create less than significant adverse impacts at the most noise-sensitive receptors, in addition to Condition of Certification **NOISE-6**, staff proposes Conditions of Certification **NOISE-1** and **NOISE-2**, which would establish a noise complaint process to resolve any complaints regarding construction noise.

In light of the above proposed conditions of certification, the noise impacts of the OGP construction activities would be less than significant.

### **Linear Facilities**

New offsite linear facilities would include an approximately 2.4-mile long natural gas pipeline that would be connected to an existing San Diego Gas and Electric's main gas pipeline and an approximately 1/3-mile long underground electric transmission line that would be connected to the existing Pala Substation (OGE 2008a, AFC §§2.1, 6.12.5.2).

Construction of linear facilities typically moves along at a rapid pace, thus not subjecting any one receptor to noise impacts for more than two or three days. Further, construction activities would be limited to daytime hours. To ensure that these hours are, in fact, adhered to, in compliance with the LORS, staff proposes Condition of Certification **NOISE-6**.

### **Vibration**

The only construction operation likely to produce vibration that could be perceived off site would be pile driving. The applicant anticipates that pile driving would not be required for construction of the OGP (OGE 2008a, AFC §6.12.5.2). Therefore, staff believes that no significant vibration impacts would be expected.

### **Worker Effects**

The applicant has acknowledged the need to protect construction workers from noise hazards and has recognized the applicable LORS that would protect construction workers (OGE 2008a, AFC §6.12.5.2). To ensure that construction workers are, in fact, adequately protected, staff has proposed Condition of Certification **NOISE-3**.

### **Operation Impacts and Mitigation**

The primary noise sources of the OGP include combustion turbine generators and their exhaust stacks, inlet air chillers, fuel gas compressors, electric transformers, and various pumps and fans. Staff compares the projected project noise with applicable LORS, in this case the San Diego County LORS. In addition, staff evaluates any increase in noise levels at sensitive receptors due to the project in order to identify any significant adverse impacts.

Proposed noise mitigation measures include the following (OGE 2008a, AFC §6.12.6, Appendix 6.12-C):

- 48-foot tall sound walls around gas turbines and inlet air chillers;
- 24-foot tall sound walls around fuel gas compressors;
- combustion turbine generator exhaust stack silencing;
- combustion turbine generator enclosure vent silencing; and
- black start generator enclosure.

In addition, the project would avoid the creation of annoying tonal (pure-tone) noises by balancing the noise emissions of various power plant features during plant design (OGE 2008a, AFC §6.12.5.3.1).

### Compliance with LORS

The applicant performed noise modeling to determine the project's noise impacts on sensitive receptors (OGE 2008a, AFC §6.12.5.3, Tables 6.12-16, 6.12-17, 6.12-18, Figure 6.12-16, Appendix 6.12-C). The applicant has predicted operational noise levels; they are summarized in **Noise Table 4** and **Noise Table 5**, below.

**Noise Table 4**  
**Predicted Operational Noise Levels and Noise LORS**

Receptor	Project Alone Operational Noise Level (dBA)	Existing Ambient, Average Daytime $L_{eq}$ (dBA) <sup>1</sup>	Project Plus Daytime Ambient $L_{eq}$ (dBA)	San Diego County Daytime $L_{eq}$ Limit (dBA)	Cumulative (Project Plus Ambient) Compared to County Limit (dBA)	Existing Ambient, Average Nighttime $L_{eq}$ (dBA) <sup>1</sup>	Project Plus Nighttime Ambient $L_{eq}$ (dBA)	San Diego County Nighttime $L_{eq}$ Limit (dBA)	Cumulative (Project Plus Ambient) Compared to County Limit (dBA)
LT1	31	35 <sup>2</sup>	36	50	-14	30 <sup>2</sup>	34	45	-11
ST1	24	54	54	50	Existing Ambient Exceeds LORS	59	59	45	Existing Ambient Exceeds LORS
ST2	18	46	46	50	-4	46	46	45	Existing Ambient Exceeds LORS
House B	25	~35	~35	50	-15	~30	31	45	-14
House C	27	~35	~36	50	-14	~30	32	45	-13

Sources: OGE 2008a, AFC §6.12.5.3, Tables 6.12-17, 6.12-18

<sup>1</sup> NOISE Table 2, above

<sup>2</sup> For conservatism, staff uses the lowest ambient noise level from NOISE Table 2, above.

As seen in **Noise Table 4**, above, the project's operational noise levels, when added to the existing daytime and nighttime ambient noise levels at the project's most-sensitive noise receptors, would result in levels that would be in compliance with the County's LORS limits.

Therefore, the project's operational noise impacts would be in compliance with the applicable LORS. To ensure compliance, staff proposes Condition of Certification **NOISE-4**.

### CEQA Impacts

Power plant noise is unique. A power plant operates as, essentially, a steady, continuous, broadband noise source, unlike the intermittent sounds that make up most of the noise environment. Power plant noise therefore contributes to, and becomes a part of, background noise levels, or the sound heard when most intermittent noises stop. Where power plant noise is audible, it tends to define the background noise level. For this reason, staff typically compares projected power plant noise to existing ambient background ( $L_{90}$ ) noise levels at affected sensitive receptors. If this comparison identifies a significant adverse impact, then feasible mitigation must be applied to the project to either reduce or remove that impact.

For residential receptors, staff evaluates project noise emissions by comparing them with nighttime ambient background levels; this evaluation assumes that the potential for public annoyance from power plant noise is greatest at night when residents are trying to sleep. Nighttime ambient noise levels are typically lower than daytime levels; differences in background noise levels of 5 to 10 dBA are common. Staff believes it is prudent to average the lowest nighttime hourly background noise levels to arrive at a reasonable baseline for comparison with the project's predicted noise level.

Adverse impacts on residential receptors can be identified by comparing predicted power plant noise levels with the nighttime ambient background noise levels at the nearest sensitive residential receptors.

The applicant has predicted operational noise levels; they are summarized here in **Noise Table 5**.

**Noise Table 5**  
**Predicted Operational Noise Levels and CEQA Guidelines**

Receptor	Project Alone Operational Noise Level (dBA)	Existing Ambient, Lowest Nighttime $L_{90}$ (dBA) <sup>1</sup>	Project Plus Ambient $L_{90}$ (dBA)	Change in Ambient (dBA)
LT1	31	27	32	+5
ST1	24	33	34	+1
ST2	18	34	34	0
House B	25	27 <sup>2</sup>	29	+2
House C	27	27 <sup>2</sup>	30	+3

Sources: OGE 2008a, AFC §6.12.5.3, Table 6.12-16

<sup>1</sup> NOISE Table 2, above

<sup>2</sup> For conservatism, staff uses the lowest ambient noise level from NOISE Table 2, above.

Combining the ambient noise level of 27 dBA  $L_{90}$  (**Noise Table 5**, above) with the project noise level of 31 dBA at LT1 would result in 32 dBA  $L_{90}$ , 5 dBA above the ambient. Such an increase is generally noticeable. However, as described above (below the **METHOD AND THRESHOLD FOR DETERMINING SIGNIFICANCE** subheading), staff regards an increase of up to 5 dBA as a less-than-significant impact. Therefore, staff considers the above noise impact at LT1 to be less than significant.

Combining the ambient noise level of 33 dBA  $L_{90}$  (**Noise Table 5**) with the project noise level of 24 dBA at ST1 would result in 34 dBA  $L_{90}$ , 1 dBA above the ambient. Such an increase is not noticeable. Thus, the project would have no adverse noise impact at this location.

Combining the ambient noise level of 34 dBA  $L_{90}$  (**Noise Table 5**) with the project noise level of 18 dBA at ST2 would result in 34 dBA  $L_{90}$ . The project would not affect the nighttime ambient noise at this location (the project would be inaudible). Thus, the project would have no adverse noise impact at ST2.

Combining the ambient noise level of 27 dBA  $L_{90}$  (**Noise Table 5**, above) with the project noise level of 25 dBA at House B would result in 29 dBA  $L_{90}$ , 2 dBA above the ambient. Such an increase is barely noticeable. Staff regards an increase of up to 5 dBA as a less-than-significant impact. Therefore, staff considers the above noise impact at House B to be less than significant.

Combining the ambient noise level of 27 dBA  $L_{90}$  (**Noise Table 5**, above) with the project noise level of 27 dBA at House C would result in 30 dBA  $L_{90}$ , 3 dBA above the ambient. Such an increase is barely noticeable. Staff regards an increase of up to 5 dBA as a less-than-significant impact. Therefore, staff considers the above noise impact at House C to be less than significant.

Staff proposes Condition of Certification **NOISE-4** to ensure that the noise levels due to the project operation would not create significant noise impacts at these locations.

### **Tonal Noises**

One possible source of annoyance could be strong tonal noises. Tonal noises are individual sounds (such as pure tones) which, while not louder than permissible levels, stand out in sound quality. The applicant plans to address overall noise in project design, and to take appropriate measures, as needed, to eliminate tonal noises as possible sources of annoyance (OGE 2008a, AFC §6.12.5.3.1). To ensure that tonal noises do not cause public annoyance, staff proposes Condition of Certification **NOISE-4**.

### **Linear Facilities**

All linear facilities would be underground and therefore silent during plant operation. Noise effects from electrical interconnection lines typically do not extend beyond the lines' right-of-way easements and would be inaudible to receptors.

## **Vibration**

Vibration from an operating power plant could be transmitted through two primary means: ground (ground-borne vibration), and air (airborne vibration).

The operating components of a simple cycle power plant consist of high-speed gas turbines, gas compressors, and various pumps. All of these pieces of equipment must be carefully balanced in order to operate; permanent vibration sensors are attached to the turbines and generators. Gas turbine generator facilities using the GE LM6000 machine have not resulted in ground-borne or airborne vibration impacts. Energy Commission staff agrees with the applicant that ground-borne vibration from the OGP would be undetectable by any likely receptor.

Airborne vibration (low frequency noise) can rattle windows and objects on shelves, and can rattle the walls of lightweight structures. The OGP's chief source of airborne vibration would be the gas turbines' exhaust. In a power plant such as the OGP, however, the exhaust must pass through the selective catalytic reduction units (SCRs) and the stack silencers before it reaches the atmosphere. The SCRs act as efficient mufflers. The combination of SCRs and stack silencers makes it highly unlikely that the OGP would cause perceptible airborne vibration effects.

## **Worker Effects**

The applicant acknowledges the need to protect plant operating and maintenance workers from noise hazards and commits to compliance with all applicable LORS (OGE 2008a, AFC §§6.12.3.2, 6.12.6). Signs would be posted in areas of the plant with noise levels exceeding 85 dBA (the level that OSHA recognizes as a threat to workers' hearing), and hearing protection would be required and provided. To ensure that plant operation and maintenance workers are adequately protected, Energy Commission staff has proposed Condition of Certification **NOISE-5**.

## **CUMULATIVE IMPACTS AND MITIGATION**

Section 15130 of the CEQA guidelines (Cal. Code Regs., tit. 14) requires a discussion of cumulative environmental impacts. Cumulative impacts are two or more individual impacts that, when considered together, compound or increase other environmental impacts. CEQA guidelines require that this discussion reflect the severity of the impacts and the likelihood of their occurrence, but do not need to provide as much detail as the discussion of impacts solely attributable to the project.

In the AFC, the applicant has listed 12 projects that could potentially create cumulative adverse environmental impacts when combined with the OGP (OGE 2008a, AFC §§6.1.2, 6.12.5.3.4). However, these projects are either located too far from the OGP site for noise impacts to accumulate, or are not considered reasonably foreseeable projects. Therefore, staff does not consider these projects to create cumulative noise impacts when combined with the OGP.

Staff is not aware of any other projects which, when combined with the OGP, would create direct cumulative noise impacts in the project area. Therefore, the project's cumulative noise impact is considered to be less than significant.

## **FACILITY CLOSURE**

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All operational noise from the project would cease when the OGP closes, and no further adverse noise impact from its operation would be possible. The remaining potential temporary noise source would be the dismantling of the project structures and equipment, as well as any site restoration work that may be performed. Since this noise would be similar to that caused by the original construction, it could be similarly treated -- that is, noisy work could be performed during daytime hours with machinery and equipment that are properly equipped with mufflers. Any noise LORS in existence at that time would apply. Unless modified, applicable conditions of certification included in the Energy Commission decision would also apply.

## **RESPONSES TO AGENCY AND PUBLIC COMMENTS**

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No agency or public comments in the area of **Noise and Vibration** have been received.

## **CONCLUSIONS**

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Staff concludes that the OGP, if built and operated in conformance with the proposed conditions of certification below, would comply with all applicable noise and vibration LORS and would produce no significant adverse noise impacts on people within the project area, including the minority population, directly, indirectly, or cumulatively.

## **PROPOSED CONDITIONS OF CERTIFICATION**

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**NOISE-1** At least 15 days prior to the start of ground disturbance, the project owner shall notify all residents within one mile of the project site and one-half mile of the linear facilities, by mail or by other effective means, of the commencement of project construction. At the same time, the project owner shall establish a telephone number for use by the public to report any undesirable noise conditions associated with the construction and operation of the project. If the telephone is not staffed 24 hours a day, the project owner shall include an automatic answering feature, with date and time stamp recording, to answer calls when the phone is unattended. This telephone number shall be posted at the project site during construction where it is visible to passersby. This telephone number shall be maintained until the project has been operational for at least one year.

**Verification:** Prior to ground disturbance, the project owner shall transmit to the compliance project manager (CPM) a statement, signed by the project owner's project manager, stating that the above notification has been performed, and describing the method of that notification. This communication shall also verify that the telephone number has been established and posted at the site, and shall provide that telephone number.

## **NOISE COMPLAINT PROCESS**

**NOISE-2** Throughout the construction and operation of the project, the project owner shall document, investigate, evaluate, and attempt to resolve all project-related noise complaints. The project owner or authorized agent shall:

- use the Noise Complaint Resolution Form (below), or a functionally equivalent procedure acceptable to the CPM, to document and respond to each noise complaint;
- attempt to contact the person(s) making the noise complaint within 24 hours;
- conduct an investigation to determine the source of noise in the complaint;
- if the noise is project related, take all feasible measures to reduce the source of the noise; and
- submit a report documenting the complaint and actions taken. The report shall include: a complaint summary, including the final results of noise reduction efforts and, if obtainable, a signed statement by the complainant stating that the noise problem has been resolved to the complainant's satisfaction.

**Verification:** Within five days of receiving a noise complaint, the project owner shall file a Noise Complaint Resolution Form, shown below, with both the local jurisdiction and the CPM that documents the resolution of the complaint. If mitigation is required to resolve the complaint, and the complaint is not resolved within a three-day period, the project owner shall submit an updated Noise Complaint Resolution Form when the mitigation is performed and complete.

**NOISE-3** The project owner shall submit to the CPM for review and approval a noise control program. The noise control program shall be used to reduce employee exposure to high (above permissible) noise levels during construction in accordance to the applicable OSHA and Cal-OSHA standards.

**Verification:** At least 30 days prior to the start of ground disturbance, the project owner shall submit the noise control program to the CPM. The project owner shall make the program available to Cal-OSHA upon request.

## **NOISE RESTRICTIONS**

**NOISE-4** The project design and implementation shall include appropriate noise mitigation measures adequate to ensure operation of the project will not cause the noise levels due to plant operation alone, during the four quietest consecutive hours of the nighttime, to exceed an average of 31 dBA measured at or near monitoring location LT1 (approximately 2,050 feet northeast of the center of the project site), an average of 24 dBA measured at or near monitoring location ST1 (the nursery), an average of 18 dBA measured at or near monitoring location ST2 (approximately 2,875 feet northeast of the center of the project site), an average of 25 dBA measured at or near monitoring location House B (approximately 3,675 feet north-northeast of the center of the project site), and an average of 27 dBA

measured at or near monitoring location House C (approximately 3,150 feet southeast of the center of the project site).

No new pure-tone components shall be caused by the project. No single piece of equipment shall be allowed to stand out as a source of noise that draws legitimate complaints.

- A. When the project first achieves a sustained output of 85% or greater of rated capacity, the project owner shall conduct a 25-hour community noise survey at monitoring location LT1, or at a closer location acceptable to the CPM. This survey during the power plant's full-load operation shall also include measurement of one-third octave band sound pressure levels to ensure that no new pure-tone noise components have been caused by the project.

During the period of this survey, the project owner shall conduct a short-term survey of noise at monitoring locations ST1, ST2, House B, and House C, or at closer locations acceptable to the CPM. The short-term noise measurements at these locations shall be conducted during the nighttime hours of 10:00 p.m. to 7:00 a.m.

The measurement of power plant noise for the purposes of demonstrating compliance with this condition of certification may alternatively be made at a location, acceptable to the CPM, closer to the plant (e.g., 400 feet from the plant boundary) and this measured level then mathematically extrapolated to determine the plant noise contribution at the affected residence. The character of the plant noise shall be evaluated at the affected receptor locations to determine the presence of pure tones or other dominant sources of plant noise.

- B. If the results from the noise survey indicate that the power plant noise at the affected receptor sites exceeds the above values during the four quietest consecutive hours of the nighttime, mitigation measures shall be implemented to reduce noise to a level of compliance with these limits.
- C. If the results from the noise survey indicate that pure tones are present, mitigation measures shall be implemented to eliminate the pure tones.

**Verification:** The survey shall take place within 30 days of the project first achieving a sustained output of 85% or greater of rated capacity. Within 15 days after completing the survey, the project owner shall submit a summary report of the survey to the CPM. Included in the survey report will be a description of any additional mitigation measures necessary to achieve compliance with the above listed noise limits, and a schedule, subject to CPM approval, for implementing these measures. When these measures are in place, the project owner shall repeat the noise survey.

Within 15 days of completion of the new survey, the project owner shall submit to the CPM a summary report of the new noise survey, performed as described above and showing compliance with this condition.

**NOISE-5** Following the project's attainment of a sustained output of 85% or greater of its rated capacity, the project owner shall conduct an occupational noise survey to identify any noise hazardous areas in the facility.

The survey shall be conducted by a qualified person in accordance with the provisions of Title 8, California Code of Regulations, sections 5095-5099 (Article 105) and Title 29, Code of Federal Regulations, section 1910.95. The survey results shall be used to determine the magnitude of employee noise exposure.

The project owner shall prepare a report of the survey results and, if necessary, identify proposed mitigation measures to be employed in order to comply with the applicable California and federal regulations.

**Verification:** Within 30 days after completing the survey, the project owner shall submit the noise survey report to the CPM. The project owner shall make the report available to OSHA and Cal-OSHA upon request.

## **CONSTRUCTION RESTRICTIONS**

**NOISE-6** Heavy equipment operation and noisy construction work relating to any project features shall be restricted to the times delineated below, unless a special permit has been issued by San Diego County:

Mondays through Fridays: 7:00 a.m. to 7:00 p.m.

Weekends and federal holidays: No Construction Allowed

Haul trucks and other engine-powered equipment shall be equipped with adequate mufflers. Haul trucks shall be operated in accordance with posted speed limits. Truck engine exhaust brake use shall be limited to emergencies.

**Verification:** Prior to ground disturbance, the project owner shall transmit to the CPM a statement acknowledging that the above restrictions will be observed throughout the construction of the project.

**Exhibit 1**  
**Noise Complaint Resolution Form**

Orange Grove Project (08-AFC-4)		
<b>NOISE COMPLAINT LOG NUMBER</b> _____		
Complainant's name and address:  		
Phone number: _____		
Date complaint received: _____ Time complaint received: _____		
Nature of noise complaint:  		
Definition of problem after investigation by plant personnel:  		
Date complainant first contacted: _____		
Initial noise levels at 3 feet from noise source _____	dBA	Date: _____
Initial noise levels at complainant's property: _____	dBA	Date: _____
Final noise levels at 3 feet from noise source: _____	dBA	Date: _____
Final noise levels at complainant's property: _____	dBA	Date: _____
Description of corrective measures taken:  		
Complainant's signature: _____		Date: _____
Approximate installed cost of corrective measures: \$ _____		
Date installation completed: _____		
Date first letter sent to complainant: _____		(copy attached)
Date final letter sent to complainant: _____		(copy attached)
This information is certified to be correct:  		
Plant Manager's Signature: _____		

Attach additional pages and supporting documentation, as required.

## REFERENCES

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County 2008 – County of San Diego Code of Regulatory Ordinances, Title 3, Public Safety.

OGE 2008a – OGE/S. Thome (tn46770) Application for Certification for Orange Grove Project (by Orange Grove Energy) dated 6/19/08. Submitted to Dockets on 6/19/08.

## NOISE APPENDIX A FUNDAMENTAL CONCEPTS OF COMMUNITY NOISE

To describe noise environments and to assess impacts on noise sensitive area, a frequency weighting measure, which simulates human perception, is customarily used. It has been found that A-weighting of sound intensities best reflects the human ear's reduced sensitivity to low frequencies and correlates well with human perceptions of the annoying aspects of noise. The A-weighted decibel scale (dBA) is cited in most noise criteria. Decibels are logarithmic units that conveniently compare the wide range of sound intensities to which the human ear is sensitive. **Noise Table A1** provides a description of technical terms related to noise.

Noise environments and consequences of human activities are usually well represented by an equivalent A-weighted sound level over a given time period ( $L_{eq}$ ), or by average day and night A-weighted sound levels with a nighttime weighting of 10 dBA ( $L_{dn}$ ). Noise levels are generally considered low when ambient levels are below 45 dBA, moderate in the 45 to 60 dBA range, and high above 60 dBA. Outdoor day-night sound levels vary over 50 dBA depending on the specific type of land use. Typical  $L_{dn}$  values might be 35 dBA for a wilderness area, 50 dBA for a small town or wooded residential area, 65 to 75 dBA for a major metropolis downtown (e.g., San Francisco), and 80 to 85 dBA near a freeway or airport. Although people often accept the higher levels associated with very noisy urban residential and residential-commercial zones, they nevertheless are considered to be levels of noise adverse to public health.

Various environments can be characterized by noise levels that are generally considered acceptable or unacceptable. Lower levels are expected in rural or suburban areas than what would be expected for commercial or industrial zones. Nighttime ambient levels in urban environments are about seven decibels lower than the corresponding average daytime levels. The day-to-night difference in rural areas away from roads and other human activity can be considerably less. Areas with full-time human occupation that are subject to nighttime noise, which does not decrease relative to daytime levels, are often considered objectionable. Noise levels above 45 dBA at night can result in the onset of sleep interference effects. At 70 dBA, sleep interference effects become considerable (Effects of Noise on People, U.S. Environmental Protection Agency, December 31, 1971).

In order to help the reader understand the concept of noise in decibels (dBA), **Noise Table A2** has been provided to illustrate common noises and their associated sound levels, in dBA.

**Noise Table A1**  
**Definition of Some Technical Terms Related to Noise**

Terms	Definitions
Decibel, dB	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).
Frequency, Hz	The number of complete pressure fluctuations per second above and below atmospheric pressure.
A-Weighted Sound Level, dBA	The sound pressure level in decibels as measured on a Sound Level Meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this testimony are A-weighted.
L <sub>10</sub> , L <sub>50</sub> , & L <sub>90</sub>	The A-weighted noise levels that are exceeded 10%, 50%, and 90% of the time, respectively, during the measurement period. L <sub>90</sub> is generally taken as the background noise level.
Equivalent Noise Level, L <sub>eq</sub>	The energy average A-weighted noise level during the Noise Level measurement period.
Community Noise Equivalent Level, CNEL	The average A-weighted noise level during a 24-hour day, obtained after addition of 4.8 decibels to levels in the evening from 7 p.m. to 10 p.m., and after addition of 10 decibels to sound levels in the night between 10 p.m. and 7 a.m.
Day-Night Level, L <sub>dn</sub> or DNL	The Average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10 p.m. and 7 a.m.
Ambient Noise Level	The composite of noise from all sources, near and far. The normal or existing level of environmental noise at a given location (often used for an existing or pre-project noise condition for comparison study).
Intrusive Noise	That noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level.
Pure Tone	A pure tone is defined by the Model Community Noise Control Ordinance as existing if the one-third octave band sound pressure level in the band with the tone exceeds the arithmetic average of the two contiguous bands by 5 decibels (dB) for center frequencies of 500 Hz and above, or by 8 dB for center frequencies between 160 Hz and 400 Hz, or by 15 dB for center frequencies less than or equal to 125 Hz.

Source: Guidelines for the Preparation and Content of Noise Elements of the General Plan, Model Community Noise Control Ordinance, California Department of Health Services 1976, 1977.

**Noise Table A2**  
**Typical Environmental and Industry Sound Levels**

<b>Noise Source (at distance)</b>	<b>A-Weighted Sound Level in Decibels (dBA)</b>	<b>Noise Environment</b>	<b>Subjective Impression</b>
Civil Defense Siren (100')	140-130		Pain Threshold
Jet Takeoff (200')	120		Very Loud
Very Loud Music	110	Rock Music Concert	
Pile Driver (50')	100		
Ambulance Siren (100')	90	Boiler Room	
Freight Cars (50')	85		
Pneumatic Drill (50')	80	Printing Press Kitchen with Garbage Disposal Running	Loud
Freeway (100')	70		Moderately Loud
Vacuum Cleaner (100')	60	Data Processing Center Department Store/Office	
Light Traffic (100')	50	Private Business Office	
Large Transformer (200')	40		Quiet
Soft Whisper (5')	30	Quiet Bedroom	
	20	Recording Studio	
	10		Threshold of Hearing

Source: Handbook of Noise Measurement, Arnold P.G. Peterson, 1980

### **Subjective Response to Noise**

The adverse effects of noise on people can be classified into three general categories:

- Subjective effects of annoyance, nuisance, dissatisfaction.
- Interference with activities such as speech, sleep, and learning.
- Physiological effects such as anxiety or hearing loss.

The sound levels associated with environmental noise, in almost every case, produce effects only in the first two categories. Workers in industrial plants can experience noise effects in the last category. There is no completely satisfactory way to measure the subjective effects of noise, or of the corresponding reactions of annoyance and dissatisfaction, primarily because of the wide variation in individual tolerance of noise.

One way to determine a person's subjective reaction to a new noise is to compare the level of the existing (background) noise, to which one has become accustomed, with the level of the new noise. In general, the more the level or the tonal variations of a new noise exceed the previously existing ambient noise level or tonal quality, the less acceptable the new noise will be, as judged by the exposed individual.

With regard to increases in A-weighted noise levels, knowledge of the following relationships can be helpful in understanding the significance of human exposure to noise.

1. Except under special conditions, a change in sound level of one dB cannot be perceived.
2. Outside of the laboratory, a three dB change is considered a barely noticeable difference.
3. A change in level of at least five dB is required before any noticeable change in community response would be expected.
4. A ten dB change is subjectively heard as an approximate doubling in loudness and almost always causes an adverse community response. (Kryter, Karl D., The Effects of Noise on Man, 1970).

### **Combination of Sound Levels**

People perceive both the level and frequency of sound in a non-linear way. A doubling of sound energy (for instance, from two identical automobiles passing simultaneously) creates a three dB increase (i.e., the resultant sound level is the sound level from a single passing automobile plus three dB). The rules for decibel addition used in community noise prediction are:

**Noise Table A3  
Addition of Decibel Values**

When two decibel values differ by:	Add the following amount to the larger value
0 to 1 dB	3 dB
2 to 3 dB	2 dB
4 to 9 dB	1 dB
10 dB or more	0
Figures in this table are accurate to $\pm 1$ dB.	

Source: Architectural Acoustics, M. David Egan, 1988

### **Sound and Distance**

Doubling the distance from a noise source reduces the sound pressure level by six dB.

Increasing the distance from a noise source 10 times reduces the sound pressure level by 20 dB.

### **Worker Protection**

OSHA noise regulations are designed to protect workers against the effects of noise exposure, and list permissible noise level exposure as a function of the amount of time to which the worker is exposed.

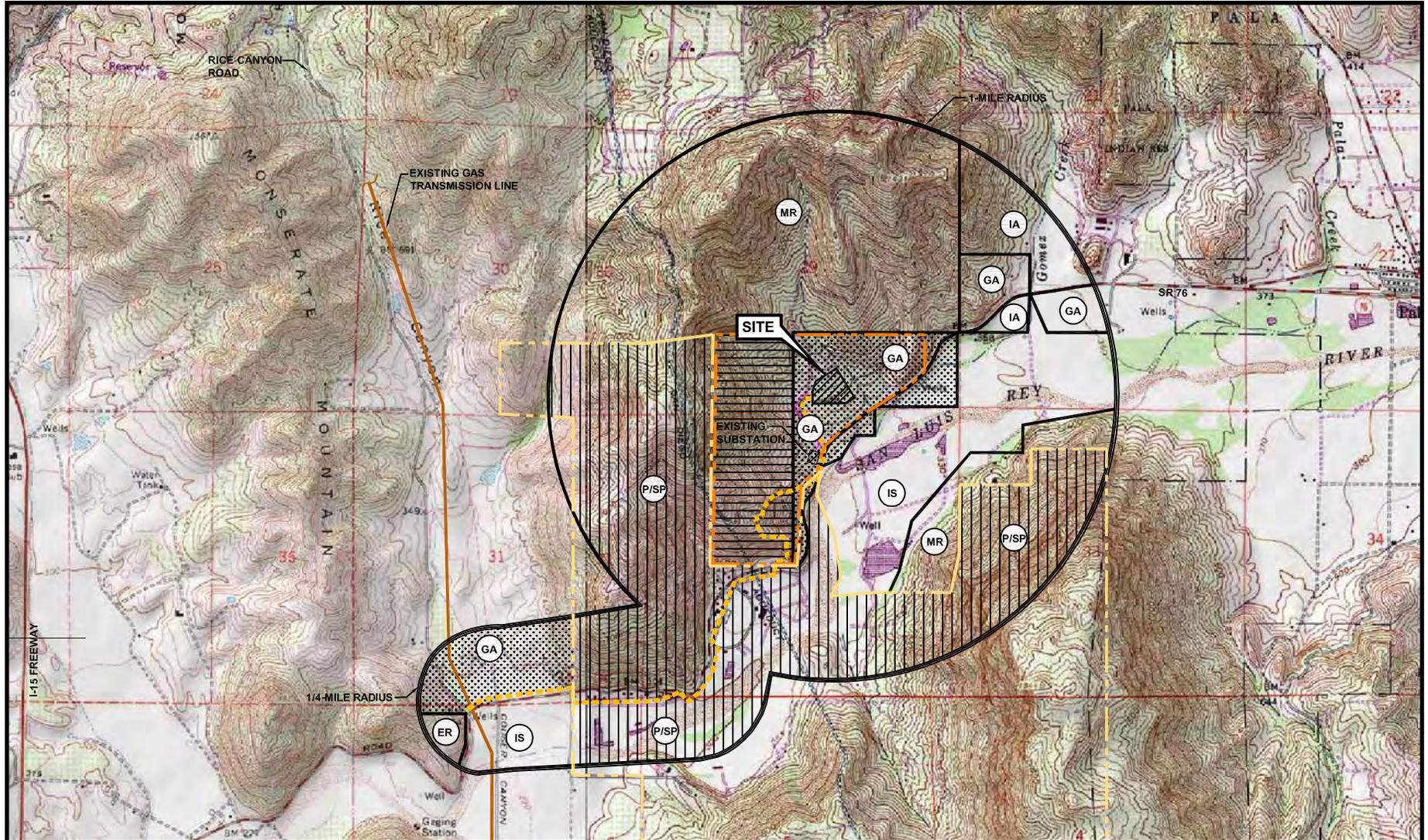
**Noise Table A4**  
**OSHA Worker Noise Exposure Standards**

Duration of Noise (Hrs/day)	A-Weighted Noise Level (dBA)
8.0	90
6.0	92
4.0	95
3.0	97
2.0	100
1.5	102
1.0	105
0.5	110
0.25	115

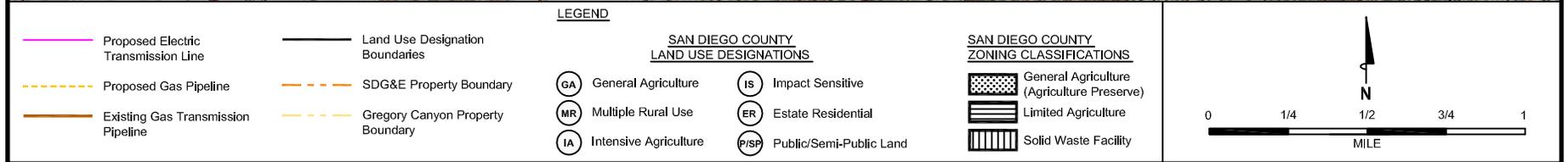
Source: 29 C.F.R. § 1910.

**NOISE AND VIBRATION - FIGURE 1**  
 Orange Grove Project - Land Use Designations and Zoning

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NOISE AND VIBRATION



**NOISE AND VIBRATION - FIGURE 2**

Orange Grove Project - Supplemental Ambient Measurement Location Map

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NOISE AND VIBRATION

