7.5 NOISE

7.5 NOISE

In accordance with California Energy Commission (CEC) regulations, this section describes the existing noise environment on site and in the vicinity of the proposed San Gabriel Generating Station (SGGS), and assesses potential noise impacts associated with the proposed project. Noise-sensitive receptors that may be affected by noise are identified, as well as the laws, ordinances, regulations, and standards (LORS) that regulate noise levels from plant operations at those receptors. The following discussion describes the LORS, the fundamentals of acoustics, the results of a detailed site reconnaissance, sound level measurements, acoustical calculations, and assessment of potential noise impacts from construction and plant operations. Where appropriate, mitigation measures are proposed to reduce potential project-related noise impacts to acceptable levels.

7.5.1 Affected Environment

7.5.1.1 Fundamentals of Acoustics

Noise is generally defined as loud, unpleasant, unexpected, or undesired sound that is typically associated with human activity, and that interferes with or disrupts normal activities. Although exposure to high noise levels has been demonstrated to cause hearing loss, the principal human response to environmental noise is annoyance. The response of individuals to similar noise events is diverse and influenced by many factors, including the type of noise, the perceived importance of the noise and its appropriateness in the setting, the time of day and the type of activity during which the noise occurs, and the sensitivity of the individual.

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Sound is generally characterized by several variables, including frequency and amplitude. Frequency describes the sound's pitch and is measured in Hertz (Hz), while amplitude describes the sound's loudness and is measured in decibels (dB).

Sound from a tuning fork contains a single frequency (a pure tone), but most sounds heard in the environment do not consist of a single frequency but rather a broad band of many frequencies differing in sound level. The method commonly used to quantify environmental sounds consists of evaluating all frequencies of a sound according to a weighting system that reflects that human hearing is less sensitive at low frequencies and extremely high frequencies than at the mid-range frequencies. This is called "A" weighting, and the dB level measured is called the A-weighted sound level (dBA). In practice, the level of a noise source is conveniently measured using a sound level meter that includes a filter corresponding to the dBA curve. Unless specifically noted, the use of A weighting is always assumed with respect to environmental sound and community noise even if the notation is dB instead of dBA.

The amplitude of sound is measured using a logarithmic scale with units of dB. A sound level of 0 dBA is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. This threshold is the reference level against which the amplitude of other sounds is compared. Normal speech has a sound level of approximately 60 dBA. Sound levels above about 120 dBA begin to be felt inside the human ear as discomfort and eventually pain at still higher levels. The minimum change in the sound level of individual events that an average human ear can detect is about 1 to 2 dB. A 3 to 5 dB change is readily perceived. A change in sound level of about 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness.

Because of the logarithmic nature of the dB unit, sound levels cannot be added or subtracted directly and are somewhat cumbersome to handle mathematically. However, some simple rules are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. For example, 60 dB + 60 dB = 63 dB, and 80 dB + 80 dB = 83 dB. However, it requires about a 10 dB increase to double the perceived intensity of a sound.

As mentioned above, sound level is expressed by reference to a specified national/international standard. This report refers to two acoustical quantities: (1) sound pressure level (SPL), and (2) sound power level (PWL). In expressing sound pressure on a logarithmic scale, the sound pressure is compared to a reference value of 20 micropascals (μPa). In expressing sound power as a dB level, the standard reference sound power is 1 picowatt. These terms are different and should not be confused. SPL depends not only on the power of the source, but also on the distance from the source and on the acoustical characteristics of the space surrounding the source, while PWL is a measure of the inherent acoustic power radiated by the source.

Hertz is a measure of how many times each second the crest of a sound pressure wave passes a fixed point. For example, when a drummer beats a drum, the skin of the drum vibrates a number of times per second. When the drum skin vibrates 100 times per second it generates a sound pressure wave that is oscillating at 100 Hz, and this pressure oscillation is perceived by the ear/brain as a tonal pitch of 100 Hz. Sound frequencies between 20 and 20,000 Hz are within the range of sensitivity of the best human ear.

Although a dBA reading may adequately indicate the level of environmental noise at any instant in time, community noise levels vary continuously. Most ambient environmental noise includes a mixture of noise from nearby and distant sources that creates an ebb and flow of sound, including some identifiable sources plus a relatively steady background noise in which no particular source is identifiable. A single descriptor called the equivalent sound level (L_{eq}) is used to describe sound that is constant or changing in level. L_{eq} is the energy-mean dBA during a measured time interval. It is the "equivalent" constant sound level that would have to be produced by a given constant source to equal the acoustic energy contained in the fluctuating sound level measured during the interval. In addition to the energy-average level, it is often desirable to know the acoustic range of the noise source being measured. This is accomplished through the maximum L_{eq} (L_{max}) and minimum L_{eq} (L_{min}) indicators that represent the root-mean-square (RMS) maximum and minimum noise levels measured during the monitoring interval. The L_{min} value obtained for a particular monitoring location is often called the acoustic floor for that location.

To describe the time-varying character of environmental noise, the statistical or percentile noise descriptors L_{10}, L_{50}, and L_{90} may be used. They are the noise levels equaled or exceeded during 10 percent, 50 percent, and 90 percent of the measured time interval. Sound levels associated with the L_{10} typically describe transient or short-term events—half of the sounds during the measurement interval are softer than L_{50} and half are louder—while levels associated with the L_{90} describe the background noise conditions.

The day-night average sound level (L_{dn} or DNL) also represents the average sound level for a 24-hour day and is calculated by adding a 10-dB penalty only to sound levels during the night (10:00 p.m. to 7:00 a.m.). The L_{dn} is the descriptor of choice used by nearly all federal, state, and local agencies throughout the United States and is specified by the American National Standards Institute (ANSI) to define acceptable land use compatibility with respect to noise. Because of the time-of-day penalties associated with the L_{dn} descriptor, the L_{dn} dBA value for a continuously operating sound source during a 24-hour period will be numerically greater than the dBA value of the L_{eq}. Thus, for a continuously operating noise source producing a constant noise level operating for periods of 24 hours or more, the L_{dn} will be 6 dB higher than the L_{eq} value. For a sources operating intermittently, or continuously for less than 24 hours, the difference between L_{eq} and L_{dn} will be less than +6 dBA. To provide a frame of reference, common sound levels are presented in Table 7.5-1.

Table 7.5-1
Sound Levels of Typical Noise Sources and Noise Environments
(A-Weighted Sound Levels)

Noise Source (at Given Distance)	Scale of A-Weighted Sound Level in Decibels	Noise Environment	Human Judgment of Noise Loudness (Relative to a Reference Loudness of 70 Decibels*)
Military Jet Take-off with After-burner (50 feet)	140	Carrier Flight Deck	–
Civil Defense Siren (100 feet)	130	–	–
Commercial Jet Take-off (200 feet)	120	–	**Threshold of Pain** *32 times as loud
Pile Driver (50 feet)	110	Rock Music Concert	*16 times as loud
Ambulance Siren (100 feet) Newspaper Press (5 feet) Power Lawn Mower (3 feet)	100		**Very Loud** *8 times as loud
Motorcycle (25 feet) Propeller Plane Flyover (1,000 feet) Diesel Truck, 40 mph (50 feet)	90	Boiler Room Printing Press Plant	*4 times as loud
Garbage Disposal (3 feet)	80	High Urban Ambient Sound	*2 times as loud
Passenger Car, 65 mph (25 feet) Living Room Stereo (15 feet) Vacuum Cleaner (3 feet) Electronic Typewriter (10 feet)	70	–	**Moderately Loud** *70 decibels (Reference Loudness)
Normal Conversation (5 feet) Air Conditioning Unit (100 feet)	60	Data Processing Center Department Store	*1/2 as loud
Light Traffic (100 feet)	50	Private Business Office	*1/4 as loud
Bird Calls (distant)	40	Lower Limit of Urban Ambient Sound	**Quiet** *1/8 as loud
Soft Whisper (5 feet)	30	Quiet Bedroom	**Very Quiet**
	20	Recording Studio	
	10	–	**Extremely Quietly**
	0	–	**Threshold of Hearing**

Source: Compiled by URS Corporation from various published sources and widely-used references such as *The Handbook of Acoustical Measurements and Noise Control*, Third Edition, edited by C.M. Harris, 1991; *Federal Agency Review of Selected Airport Noise Analysis Issues*, 1992, Modified by The Louis Berger Group, Inc, 2004, and *Noise and Vibration Control*, Second Edition, edited by L.L. Beranek, 1988 Institute of Noise Control Engineering.

7.5.1.2 Use of Near Field Versus Far Field Noise Emission Specifications

Measured and predicted noise levels may be objectively described using appropriate units, several different types of sound descriptors, and secondary parameters where necessary to convey specific information. Selection of the scientifically correct description set is typically dictated by the purpose for measuring and/or predicting (modeling) the noise levels. The two most common reasons for quantifying levels are related to occupational noise exposure and to community noise exposure. While a single noise source (such as a fan motor or an entire power plant) may be of interest in both cases, the purpose for obtaining the noise level is different for each concern. Thus, the description set used to describe the noise must include purpose-specific characteristics of the noise (i.e., its absolute and relative level, duration, temporal pattern, spectrum uniformity, shape of radiation pattern), and, in some cases, the local or more distant characteristics of the propagation path and the physical environment.

In the case of occupational noise, the most important parameters are the absolute level of sound at the employee's ears during typical work tasks, the cumulative amount of sound energy to which a worker is exposed during a work shift, and the type of noise (relatively constant or "impulsive"). Because of the potential complexity of describing noise that might affect a worker, a short-cut criterion was developed to generally reduce the risk of adverse occupational noise exposure. This short-cut method is used to describe and/or limit potential noise levels near a machine (sometimes called the "operator's position") or in a defined acoustic environment (e.g., shop floor, vehicle cab, control room). "Near" is assumed to be 3 feet distant from the noise source in the vicinity of the worker's head (usually about 5 feet above local floor or ground). A location this close to a large noisy object is also in the object's acoustic near field and its sound pressure is subject to large fluctuations over small distances. The specification of a machine's sound level as less than, no more than, or equal to "85 dBA at 3 feet" is useful (when combined with quite a bit of other information) for the limited purpose of addressing occupational noise exposure. However, it is nearly useless for describing or modeling the community noise exposure caused by the machine.

With respect to community noise, much more acoustic information is required to accurately describe (measure and model) the noise exposure that may result from the identical noise source causing a worker exposure (plus the sum of all additional different sources). For example, assume the noise source is very large (typical of noisy machinery at power generating plants) and produces noise at a level of 85 dBA when measured at a nearby worker. What about the noise energy that is radiated by the other parts of the device that travels into an adjacent community? If the machine radiates noise uniformly per unit area (not likely), it is the overall surface area of the machine that determines the total amount of noise that will ultimately reach the community. Two machines with the same 85 dBA at three feet specification may be grossly different in size. If the machine does not radiate noise uniformly from its entire surface (almost always the case) then "85 dBA at three feet" is a meaningless piece of acoustical information at other than one or a few points around the machine.

Thus, for example, the far-field sound pressure level specification (e.g., x dBA at 400 feet) from one, a few, or large group of machines may be used to more accurately predict the sound pressure level of overall machine noise in the community for a range of distances from the machines. This is because measurements and prediction of noise level (in any given direction) in the noise source's acoustic far field (typically several hundred feet away for a very large source such as a power plant) are much more stable than near field measurements or specifications.

The best acoustic data to use for accurate community sound level modeling is the intrinsic sound power level of each major noise source in specific octave bands. This information describes the overall sound energy emission of the source regardless of its size, shape, or directivity, and takes into account the magnitude (level) and frequency (spectrum) of the noise emitted. The temporal component (often, but not always continuous for power plants) and the distance attenuation component may then be calculated separately to determine the far field noise level from each major source (and energy summed to provide the overall power plant noise level) at various points of interest (e.g., plant boundary, rest home, residences, school) within the surrounding area.

7.5.1.3 Proposed SGGS Project Site and Vicinity

The proposed project site is located on the northwest corner of the EGS facility on Etiwanda Avenue in Rancho Cucamonga, California. The proposed power plant will be almost entirely within the existing EGS property. The site is surrounded primarily by mixed-industrial and commercial land uses, with some interspersed residential housing units, and a busy arterial highway along its eastern boundary.

7.5.1.4 Ambient Noise Surveys

Environmental noise was measured at the SGGS site and at selected offsite locations on July 27 and 28, 2005. Noise level measurements were made within an approximate one mile radius of the proposed project site (the study area). The noise survey was conducted to evaluate current environmental noise conditions and to assess potential for project noise impacts on the surrounding community. The offsite locations represent residential receptors nearest to the SGGS site. The ambient noise surveys included both long-term (LT, 25-hour) automated and short-term (ST, up to 1-hour) manual measurements of existing ambient noise. General atmospheric conditions at the time of the sampling were: temperature of 74°F, 48.5 percent relative humidity, pressure at 28.68 inches mercury, little to no wind, 10 percent cloud cover, and no rain.

Figure 7.5-1 shows the locations where the ST and LT measurements were taken. During the survey, one LT and two ST measurements were conducted at three locations to acoustically describe the project site and its environs, and to determine the existing sound levels at potential noise-sensitive receptors.

The Community Noise Analyzer (CNA) at LT-1 was located northeast of the proposed project site, in the back yard of a single-family residence located due south of Whittram Avenue on Etiwanda Avenue on the west side of the street. This location represents the potentially most impacted noise receptor due to its proximity to the proposed plant. Noise sources during the measurement included faint traffic noise, overhead airplanes, crickets, and a sprinkler system. The CNA measured noise levels for contiguous 15-minute intervals during a 25-hour period (0900 hours April 26, 2006, to 1000 hours April 27, 2006).

7.5.1.5 Methods

As indicated above, the automated CNA measured average noise levels in contiguous 15 minute intervals during a 25-hour period. Shorter duration operator-attended noise measurements were conducted during nighttime hours at two locations (ST) to corroborate the results of the long-term monitoring and to allow for physical observations of the predominant local noise sources. ST measurements were made with Larson David Model 820 (Serial Number 1324), Type 1 Precision grade instruments operating in Sound Level Meter (SLM) mode The LT measurement was made with a Larson Davis Model 720 (Serial Number 0395), Type 2 Integrating SLM operating in CNA mode.

The sound measurement instruments meet the requirements of the ANSI Standard S1.4-1983 and the International Electrotechnical Commission Publications 804 and 651. The sound measuring instruments used for the survey were set on Slow time response using the A-weighted decibel (dBA) scale. A-weighting is used so that the instrument’s response is similar to human hearing, which is less sensitive to low and very high-pitched sounds. In all cases, the microphone height was 5 feet above the ground and the microphone was equipped with a windscreen. The SLM used for the short-term measurements was tripod mounted. Each sound-measuring instrument was programmed to record equivalent sound levels (L_{eq}), maximum and minimum sound levels (L_{max}, L_{min}), and statistical distributions of sound level (L_{10}, L_{50}, and L_{90}) for each measurement period.

Number 1238). The accuracy of the acoustical calibrator is maintained through a program established through the manufacturer and traceable to the National Institute of Standards and Technology. All field procedures were consistent with professional practice and ANSI standards for measuring environmental noise.

The stored hourly L_{eq} data from the CNA were downloaded to a personal computer for subsequent analysis. The overall noise environment in day-night average sound level (L_{dn}) was calculated for the long-term locations from the hourly L_{eq} dBA values. The 10-dB nighttime penalty integral to the L_{dn} noise descriptor was added to the hourly data for the hours between 10 p.m. and 7 a.m.

7.5.1.6 Results

A listing of the noise data on an hourly from the long-term measurement location is provided in Table 7.5-2. A listing of the noise data from short-term measurement locations is summarized in Table 7.5-3.

Table 7.5-2
Hourly Long-Term Results (Location LT-1)
(dBA)[1]

Start Time	L_{eq}	L_{min}	L_{max}	L_{10}	L_{50}	L_{90}
9:00	61	52	89	59	55	53
10:00	61	52	87	59	55	53
11:00	56	50	67	59	55	53
12:00	56	50	72	59	55	52
13:00	57	51	79	59	55	53
14:00	58	52	81	59	56	54
15:00	58	52	81	60	56	54
16:00	58	53	80	59	56	54
17:00	59	52	80	59	56	54
18:00	59	52	82	59	56	54
19:00	57	52	76	59	56	54
20:00	57	52	78	58	55	54
21:00	58	53	78	59	56	55
22:00	58	52	83	58	55	53
23:00	54	51	65	55	53	52
0:00	56	51	82	56	53	52
1:00	54	51	72	56	54	52
2:00	54	51	66	56	54	53
3:00	58	51	83	56	54	53
4:00	55	52	67	57	54	53
5:00	57	52	72	59	56	54
6:00	58	52	73	60	56	54
7:00	60	52	85	59	55	53
8:00	56	50	69	59	54	52
9:00	57	50	75	59	55	53

[1] Measured July 27 and 28, 2005

Table 7.5-3
Short-Term Measurement Data[1]

Measurement Identification	Time	L_{eq}	L_{min}	L_{max}	L_{10}	L_{50}	L_{90}
ST1	00:41-01:41	57	45	80	58	51	47
ST2	01:51 – 02:51	55	42	81	59	46	43

[1] Measured July 28, 2005.

7.5.1.7 Discussion

The ambient noise environments of the residential uses potentially affected by the proposed project are of primary interest because noise guidelines for residential land uses are typically the most restrictive. The nearest residential receptor is located 0.4 mile northeast of the proposed project site; more distant sensitive receptors are scattered around the site in all directions. At the SGGS site and in surrounding areas, ambient noise during the surveys included heavy traffic (including a high percentage of heavy trucks), industrial activity, birds, aircraft overflights, power line noise, rustling leaves, dogs barking, sprinkler systems, and crickets chirping. Ambient noise levels are dominated during all hours by activities associated with local automobile and heavy truck traffic.

7.5.2 Environmental Consequences

This section summarizes the noise impact analysis conducted for the proposed SGGS. Noise levels from the proposed project expected at noise-sensitive receptors in the study area, including the future facility boundaries, were modeled (predicted). The predicted noise levels were compared with existing ambient noise conditions and typical residential noise criteria to determine the potential for environmental noise impact as a consequence of construction and operation of the proposed project.

7.5.2.1 Modeled Operational Noise

The proposed power plant will have a combined cycle configuration of two Siemens 5000F gas combustion turbines, two heat recovery steam generators (HRSGs) equipped with duct burners, a steam turbine generator (STG), an air-cooled condenser (ACC) array, and associated auxiliary systems and equipment. Major noise-generating components would include combustion turbine generators (CTGs), an STG, compressors, ACCs, HRSGs, finned fan coolers, and transformers. The overall noise level generated by these components at offsite locations depends upon the physical layout of the facility and the noise control measures incorporated into the facility design. Onsite sound levels may be as high as 100 dBA in proximity to an individual noise source.

As part of the facility's design, specific noise control equipment will be incorporated that includes:

- Inlet air silencer (8 feet for up and over with lined elbow);
- Gas turbine – sound attenuated enclosure;
- Exhaust diffuser and duct – acoustical barrier; and
- Gas compressors – sound attenuated enclosure.

The incorporation of these noise control devices has been included in the formulation of equipment noise generation values and modeling of overall noise emission.

Cadna/A® was used to model the generation and propagation of noise from the proposed plant. Cadna/A is a three-dimensional software program for prediction and assessment of noise levels in the vicinity of industrial facilities and other noise sources. Cadna/A uses internationally recognized algorithms (ISO 9613-2) for the propagation of sound outdoors to calculate noise levels and presents the resultant noise levels in an easy to understand, graphically oriented format. The program allows for input of all pertinent features (such as terrain or structures) that affect noise, resulting in a highly accurate estimate of existing and future noise levels.

Cadna/A was used to create a virtual model of the planned facility and other existing nearby structures. Digital Terrain Modeling was used to account for elevation and terrain features, and aerial photographs were used to model the existing structures. Noise emission levels were input using octave band levels to accurately estimate noise propagation and attenuation effects. To ensure the validity of the results, the model was tested using previously measured and modeled noise data, and found to be consistent with both practice and theory.

All pieces of equipment that were deemed to be significant noise sources at the proposed facility were included in the baseline noise model. The facility will be a "base load" power plant, and was assumed to operate 24 hours per day. The set of modeled sources included turbines, generators, pumps, motors, main transformers, ACCs, HRSGs, and finned fan cooling towers. Small equipment items, such as pumps less than 25 horsepower, were excluded because they were considered insignificant noise sources. Nominal noise emissions levels from various sources were used for the modeling inputs. The source level data included data provided by the Applicant; limited vendor data, databases of previously modeled similar projects, and industry-standard estimated sound power values. Major buildings, tanks, and large equipment trains were included as barriers where appropriate. The Cadna/A model output predicted noise levels at several discrete locations and areas of equal noisiness around the proposed project site.

Attenuation due to spherical wave divergence, topographic features, barriers, and standard atmospheric absorption (70 percent relative humidity, 50°F) was included in the calculation of predicted noise levels. Attenuation due to wind or temperature gradients was not subtracted from the predicted levels to provide a conservative estimate of project sound levels.

Based on the above assumptions, the estimated sound levels (at the closest noise-sensitive receptors to the proposed equipment) are summarized in Table 7.5-4. The nearest noise sensitive receptor is LT-1, located approximately 0.4 mile northeast of the proposed SGGS. The plant's operational sound levels would only slightly increase LT-1's existing L_{dn} by 1 dBA; therefore, the resulting L_{dn} would be 64 dBA. All residences are located far enough away from the proposed project site, such that SGGS would have no appreciable effect on existing ambient noise levels. Figure 7.5-2 shows the area of a potential +5 dBA increase in noise levels. There are no residential land uses in this area.

Table 7.5-4
Change in Existing Sound Level with SGGS Project

Receptor	Distance from Source to Receptor	Existing Sound Level (L_{dn}, L_{eq}, L_{90}) [1]	Calculated Project Sound Level (L_{dn}, L_{eq}, L_{90})	Calculated Project Plus Existing (L_{dn}, L_{eq}, L_{90})	Change in Sound Level
LT-1	0.4 mile	63 dBA L_{dn} [2]	58, 51, 49 dBA	64, 58, 53 dBA	1 dBA
ST-1	2,000 feet	67, 57, 47 dBA	54, 47, 45 dBA	67, 66, 49 dBA	0 dBA
ST-2	3,200 feet	63, 61, 43 dBA	47, 41, 39 dBA	63, 55, 44 dBA	0 dBA

[1] L_{dn} for measurement locations ST-1 and ST-2 were estimated by Cadna/A.
[2] Refer to Table 7.5-2 for the existing measured hourly sound levels.

7.5.2.2 Tonal Noise

The CTGs, transformers, and combustion turbine inlet compressors produce tonal sounds. Because of the care taken in specifying the plant's engineering design features, no prominent tonal noise emissions will be propagated to the noise-sensitive receptors. For example, the generator enclosure and combustion turbine enclosure and inlet silencers will be designed to reduce the tonal emissions from these sources to levels below the general plant noise. In addition, the transformer tonal noise emission level will be below the broadband plant noise. Therefore, any equipment tonal emissions will not be distinctly audible at any offsite locations. During normal operations, the nature of noise from the proposed facility would be essentially continuous and broadband (no tones).

7.5.2.3 Occupational Noise Exposure

A review of major equipment near-field (very close to the source) noise emission data and general knowledge of machinery associated with power generation indicate that noise levels within the SGGS project site could reach 85 to 100 dBA within 3 feet of the equipment envelope. Because of these predicted site noise levels, the requirement for a hearing conservation program will be evaluated and employees working at the SGGS facility with exposure to noise sources will be identified. All areas within the SGGS facility where noise levels could be 85 dBA or greater will be delineated and posted "Noise Hazard Area – Hearing Protection Required."

7.5.2.4 Power Transmission

Noise sources associated with power transmission include occasional breaker operation in the switchyard, corona noise, and very low magnetostriction hum from the conductors. Breaker noise is considered impulsive in nature, lasting a very short duration and may occur only a few times per year. Corona noise is characterized as a buzz or hum and is usually worse when the conductors are wet, such as in rain or fog.

The Electric Power Research Institute (EPRI) has conducted noise tests and studies and has published reference material on transmission line noise. Consistent with all acoustic textbooks' discussion of propagation of noise from a line source, EPRI states that noise produced by a conductor decreases at a rate of 3 decibels per doubling of distance from the source. The EPRI Transmission Line Reference Book indicates that the audible noise from a typical 525-kilovolt (kV) line with two conductors per phase would likely be less than 40 dBA at a distance of 40 feet from the outside conductor at ground level. If only one conductor per phase is used, the noise level will be less. This level of noise is very likely to be inaudible with respect to existing levels of community noise.

7.5.2.5 Conclusion

Based on the above analysis, project noise levels during operation of the facility are not predicted to exceed recommended noise compatibility guidelines at any sensitive receptors.

7.5.2.6 Modeled Construction Noise

Construction of the proposed project is expected to take place for several months, with varying degrees of activity occurring during different phases of construction. Construction phases are expected to include:

- Excavation,
- Concrete pouring,
- Steel erection,
- Mechanical/electrical installation, and
- Cleanup.

Noise during construction of the SGGS should be typical of noise associated with industrial facility construction activities. Noise sources that are associated with most large industrial construction sites (including power plants) include air compressors, track hoes, backhoes, graders, bulldozers, scrapers, front-end loaders, cranes, hoists, generators, boom trucks, portable welders, and various heavy trucks and smaller vehicles. The exact noise levels are a complex function of variables such as the actual noise levels emitted from each major noise-emitting equipment, their location and orientation within the construction area, and their operation and load.

To realistically estimate the plant construction noise impacts, the composite noise levels listed in Table 3.1 of the *Power Plant Construction Noise Guide* (Guide) were used (Barnes et al., 1997). The composite noise levels are based on intensive noise monitoring during the construction of 15 actual power plants. The noise monitoring for the composite levels was done at locations selected to avoid undue excess attenuation from atmospheric conditions and terrain. The construction equipment was characterized as typical; it was neither unusually noisy nor quiet. The noise measurement data from the 15 power plants were normalized to consistent propagation conditions as follows: 59° Fahrenheit, 70 percent relative humidity, no wind or temperature gradients, flat terrain, and no soft ground (vegetation) losses. One important consideration in using these data is that the measurements are over 20 years old. Thus, they probably overestimate actual construction noise (there has been a trend towards quieter equipment in the intervening years). This same observation would be made if the U.S. EPA construction equipment or phases of construction noise level data were used because the EPA data were compiled in 1971. In spite of this consideration, these data are comprehensive and have the advantage of integrating significant variability to arrive at average impacts from construction. The estimated variability of the composite levels is ±3 dB for transient noise events, but is conservative overall.

For each phase of construction, the composite noise levels (defined in the *Guide*) provide long-term average L_{eq} at multiple distances from a hypothetical power plant construction site. These levels were then used to predict noise levels at the nearest residential use (LT-1), located northeast of the proposed plant site, using simple spherical divergence of the sound wave energy from the site to LT-1, which is approximately 0.4 mile. No additional excess attenuation due to vegetation, wind, atmospheric absorption, or temperature gradients was assumed. The results of the modeling are presented in Table 7.5-5. The results of modeling indicate that worst-case construction noise would be at or below existing noise levels at this location. Noise from SGGS construction would be lower at more distant noise-sensitive locations.

Table 7.5-5
Maximum Estimated Construction Noise Levels (dBA)

	Maximum Estimated Noise Levels at Nearest Sensitive Receptor and on site During Construction	
	LT-1 (0.4 Mile From Plant Construction Activity)	100 Feet From Construction Activity
Construction Phase	L_{eq}	L_{eq}
Excavation, site preparation	56	80
Concrete pouring	52	76
Steel erection	56	80
Mechanical, electrical	51	75
Clean-up	46	70

Periodically, some noises would be higher or lower than the levels presented here, but the overall sound levels should be lower because of excess attenuation and the trend toward quieter construction equipment in the intervening decade since the data were developed. These noise levels are based on data from normal workday construction only. When nighttime or weekend construction must occur, shifts are usually smaller and noise levels correspondingly lower. In the *Guide*, only one of 15 sites had evening construction activity. In that instance, the crew was about one-third the size of the daytime force and noise levels were about 4 dB lower.

In accordance with CEC Siting Regulation Appendix B (g) (4) (E), Occupational Safety and Health Administration (OSHA) regulations, 29 CFR 1910.95 and California Code of Regulations (CCR), Title 8, Section 5098, the potential occupational noise exposure to workers during construction of the facility was evaluated. A reference distance of 100 feet was used to evaluate onsite construction noise levels and their potential impact on workers. These noise levels are also presented in Table 7.5-5. These noise levels would vary significantly, depending on whether a worker is closer than 100 feet to a noise source or is personally conducting a noisy activity. Some site workers would be occasionally exposed to average noise levels above 85 dBA during construction and short-term exposures of 100 dBA or more could be expected. Thus, the construction contractor would have the legal responsibility for complying with the aforementioned federal and state regulations to protect workers from occupational noise hazards. Compliance would typically be achieved by implementing a combination of engineering controls, administrative controls, and personal protective equipment (PPE) use requirements.

No transmission line construction would occur because the proposed plant site is adjacent to an existing electrical substation.

7.5.2.7 Modeled Construction Traffic Noise

Construction traffic will be primarily from I-10 to northbound Etiwanda Avenue to the project site, or from I-15 to eastbound 4th Street to Etiwanda Avenue to the proposed project site. The maximum construction vehicle daily round trips is predicted to be 974 in August 2009.

Etiwanda Avenue

The existing traffic volume on Etiwanda Avenue is approximately 15,315 vehicles per day in the area adjacent to SGGS. The estimated 974 daily round trips due to construction vehicles would not measurably or perceptually increase noise on Etiwanda Avenue.

4th Street

The existing traffic volume on 4th Street between I-15 and Etiwanda Avenue is approximately 25,719 vehicles per day. The 974 daily round trips due to construction vehicles would not measurably or perceptually increase noise on 4th Street.

7.5.3 Cumulative Impacts

Past and current development in the project vicinity has resulted in a cumulatively significant increase in noise levels. Relevant future projects identified in Section 7.4.3 could further contribute to cumulative noise impacts. The proposed project would result in increases in noise levels, primarily within the plant boundary and westward in an area where no sensitive receptors are located or planned. Therefore, the proposed project's contribution to this impact would not be cumulatively considerable. The proposed project's cumulative impact would therefore be less than significant.

NOI-1: Noise Attenuation Measures. The proposed project design and implementation shall include appropriate noise attenuation measures adequate to ensure that the noise level produced by operation of the project will not exceed an hourly average exterior noise level of more than 47 dBA L_{eq} at any residence. No new pure tone components may be introduced. No single piece of equipment shall be allowed to stand out as a source of noise that draws legitimate complaints, as determined by the compliance project manager (CPM). Pressure relief valves shall be adequately muffled to preclude noise that draws legitimate complaints, as determined by the CPM.

Verification: Within 30 days of the proposed project first achieving a sustained output of 80 percent or greater of rated capacity, the Applicant shall conduct a 25-hour noise survey. The noise survey shall also include short-term measurement of one-third octave-band SPL to ensure that no new noise tones have been introduced. If the results from the operational noise survey indicate that pure tones are present, then additional noise control measures shall be implemented to eliminate the pure tones. Irrespective of the specific method used for determining the project's noise level, the character of the project's noise shall be evaluated at the nearest residence to determine the presence of tones or other dominant sources of project noise.

The measurement of proposed project noise for the purposes of demonstrating compliance with this Condition of Certification may be made at a location, acceptable to the CPM, closer to the project than the nearest residence (e.g., 400 feet from the project's acoustic center in the direction of residences) and this measured level is then mathematically extrapolated to determine the project's noise contribution at the nearest residence. If the results from the operational noise survey indicate that the project-only noise level exceeds 47 dBA, L_{eq} for any given hour at any residence, additional noise control measures shall be implemented to reduce noise to a level of compliance with this limit.

Within 30 days after completing the post-construction operational noise 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 noise control measures necessary to achieve compliance with the above listed noise limits, and a schedule, subject to CPM approval, for implementing these measures.

Within 30 days of completion of installation of these measures, the project owner shall submit to the CPM a summary report of a new noise survey, performed as described above and showing compliance with this condition.

7.5.4.2 Construction Noise

Construction of SGGS would temporarily elevate the noise levels in the surrounding community. Most often the sound levels would be moderate, with a few processes causing short-term, substantially elevated noise levels to occur. Because construction would be of a limited duration, will be conducted during daylight hours, and best practices for construction noise control will be implemented, no adverse construction noise effects are expected to occur in the surrounding community.

NOI-2: Construction Noise Measures. The project will implement the following measures during construction activities:

- Construction noise emission shall comply with all local LORS regarding hours of construction activity and permitted noise levels affecting adjacent uses.
- All construction equipment should be operated and maintained to minimize noise generation. Equipment and vehicles using internal combustion engines shall be

equipped with mufflers, air-inlet silencers where appropriate, and other shrouds or noise reducing features, in good operating condition that meet or exceed original factory specifications. Mobile or fixed “package equipment” shall be equipped with shrouds and noise control features that are readily available for that type of equipment.

- The use of noise-producing signals, including horns, whistles, electronic alarms, and sirens and bells, will be for safety warning purposes only.

- No construction-related public address, loudspeaker, or music system shall be audible at any adjacent noise-sensitive land use.

NOI-3: Implement Noise Complaint Process. The construction contractor shall implement a noise complaint process and hotline number for the surrounding community. The Applicant will have the responsibility and authority to receive and resolve noise complaints.

7.5.4.3 Onsite Occupational Noise Exposure

Noise levels within the SGGS site were modeled to be above 85 dBA within 50 feet of major noise-producing equipment. Employees working near the noise sources will participate in a facility-specific hearing conservation program if a program is necessary for compliance with OSHA regulations. In addition, specific plant areas will have noise surveys conducted after commissioning to determine where noise hazard warnings and personal hearing protection is necessary. With these project features in-place, no special mitigation measures will be required.

NOI-4: Occupational Noise Survey. Within 30 days of the proposed project first achieving a sustained output of 80 percent or greater of rated capacity, the Applicant shall conduct an occupational noise survey to verify modeled noise levels and to identify any additional noise hazard areas in the facility. The survey shall be conducted by a qualified person in accordance with the provisions of Title 8 CCR, Sections 5095-5099 (Article 105) and Title 29, CFR, Section 1910.95. The survey results shall be used to determine the magnitude of employee noise exposure. Areas above 85 dBA that may be accessed by any personnel shall be posted as high noise level areas. Hearing protectors shall be furnished and their use required in the posted areas.

The Applicant shall prepare a report of the survey results and, if necessary, identify proposed measures that will be employed to comply with the applicable state and federal regulations.

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

7.5.5 Permits Required and Permit Schedule

No noise-specific permits are required for construction of the SGGS project.

7.5.6 Laws, Ordinances, Regulations, and Standards

The following discussion addresses relevant LORS regarding noise emissions and exposure that are summarized in Table 7.5-6. Some of the LORS are not legally applicable to the SGGS because of the pre-emptive jurisdiction of the CEC in the certification process of power plants.

Table 7.5-6
Applicable Noise Laws, Ordinances, Regulations, and Standards

Agency	Laws, Ordinances, Regulations, and Standards	Applicability	AFC Section
Federal			
U.S. EPA	U.S. EPA Report 550/9-74-004. The U.S. EPA set this guideline as the level of environmental noise requisite to protect public health and welfare with an adequate margin of safety.	Not applicable by statute.	Section 7.5.6.1 discusses this guideline. As designed, the proposed project will comply with this guideline.
State			
CEC	The CEC uses their siting guidelines (CEC-140-2006-002) in combination with local noise regulations and standards to evaluate the significance of noise impacts through the comparison of existing ambient noise levels with the noise levels projected to result from a project.	This requirement is applicable to the control of operation noise from the proposed project. It evaluates noise increases of 5 dBA or greater in nearby noise sensitive areas.	Section 7.5.6.2 discusses conformance with this requirement. The proposed project has been designed to comply with this requirement.
Cal/OSHA	Occupational exposure to noise is regulated by Cal/OSHA in Title 8, Group 15, Article 105, Sections 5095 – 5100	This requirement is applicable to protect employees from significant noise exposure during a work period.	Section 7.5.6.2 discusses conformance with is requirement. The proposed project has been designed to comply with this requirement.
Local			
County of San Bernardino	The San Bernardino County Code, Title 8 Development Code, Division 7: General Design Standards, Chapter 9: Performance Standards	This requirement is applicable to noise generated during operation of the proposed project. Does not restrict the hours of day that construction is permitted.	Section 7.5.6.3 discusses this requirement. The proposed project has been planned to comply with this requirement.
City of Rancho Cucamonga	City of Ranch Cucamonga Municipal Code Section 17.08.080	This requirement is applicable to noise generated during operation of the proposed project. Does not restrict the hours of day that construction is permitted.	Section 7.5.6.3 discusses this requirement. The proposed project has been planned to comply with this requirement.
City of Fontana	City of Fontana Municipal Code Section 18-63(9)	This requirement is applicable to noise generated during operation of the proposed project. Does not restrict the hours of day that construction is permitted.	Section 7.5.6.3 discusses this requirement. The proposed project has been planned to comply with this requirement.
City of Ontario	City of Ontario Municipal Code Section 9-1.3305	This requirement is applicable to noise generated during operation of the proposed project. It also restricts the hours of the day that construction is permitted.	Section 7.5.6.3 discusses this requirement. The proposed project has been planned to comply with this requirement.

Notes:

Cal/OSHA = California Occupational Safety and Health Administration
CEC = California Energy Commission
DBA = A-weighted decibels
U.S. EPA = U.S. Environmental Protection Agency

7.5.6.1 Federal

A number of laws and guidelines at the federal level direct the consideration of a broad range of noise and vibration issues. Because the proposed project does not fall within the purview of the Federal Energy Regulatory Commission or require action by federal agencies, the proposed project is not directly subject to federal regulations (other than OSHA). Several of the more significant noise-related federal regulations and guidelines are provided below for information:

- National Environmental Policy Act (42 USC 4321, et seq.) (PL-91-190) (40 CFR § 1506.5)
- Noise Control Act of 1972 (42 USC 4910)
- U.S. EPA recommendations in "Information on Levels of Environmental Noise Requisite to Protect Health and Welfare with an Adequate Margin of Safety," NTIS 550\9-74-004, U.S. EPA, Washington, D.C., March 1974
- Federal Energy Regulatory Commission Guidelines on noise emissions from compressor stations, substations, and transmission lines (18 C.F.R 157.206(d)5)
- Federal Highway Administration (FHWA) Noise Abatement Procedures (23 CFR Part 772)
- Department of Housing and Urban Development (HUD) Environmental Standards (24 CFR Part 51)
- OSHA Occupational Noise Exposure; Hearing Conservation Amendment (FR 48 (46), 9738 – 9785 (1983).

The most relevant guidelines are provided by the U.S. EPA. In 1974, in response to a federal mandate, the U.S. EPA provided guidance in a document titled, *Information of Levels on Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (EPA 550/9-74-004). Guidance put forth in this document establishes a L_{dn} of 55 dBA as the requisite level, with an adequate margin of safety, for areas of outdoor uses including residences and recreation areas.

This document does not constitute U.S. EPA regulations or standards, but identifies safe levels of environmental noise exposure without consideration for achieving these levels or other potentially relevant considerations. It is intended to "provide State and Local governments as well as the Federal Government and the private sector with an informational point of departure for the purpose of decision making." These guidelines are not adopted or recommended by the State of California or any local jurisdiction. The agency is careful to stress that the recommendations contain a factor of safety and do not consider technical or economic feasibility issues, and therefore should not be construed as standards or regulations

7.5.6.2 State of California

The State of California provides regulation by adopted laws and guidance regarding noise emissions through the jurisdiction of state commissions. Regulation of noise emissions and noise exposure from power plants is provided via the CEC. The CEC provides siting guidelines (CEC, 2006: CEC-140-2006-002) to assist power plant operators with the evaluation of potential power plant locations. The siting guidelines specify that the potential noise impacts from power plant construction and operation be evaluated through the comparison of existing ambient noise levels with the noise levels projected to result from the project. This approach requires the determination of noise emissions from the proposed project and evaluation of noise exposure at specific receptor locations. In essence, this methodology ensures that power plants in California are sited with regard to the local noise environment. In general, the CEC considers that a project-related increase in environmental noise of 5 to 10 dBA or more at noise-sensitive receptors may be significant. An increase of 10 dBA or more is generally considered a significant impact.

Occupational exposure to noise is regulated by Cal/OSHA in Title 8, Group 15, Article 105, Sections 5095-5100. The standard stipulates that protection against the effects of noise exposure shall be provided when sound levels exceed 90 dBA over an 8-hour exposure period. Protection shall consist of feasible administrative or engineering controls. If such controls fail to reduce sound levels to within acceptable levels, personal protective equipment shall be provided and used to reduce exposure of the employee. Additionally, a Hearing Conservation Program must be instituted by the employers whenever employee noise exposure equals or exceeds the Action Level of an 8-hour time-weighted average (TWA) sound level of 85 dBA. The Hearing Conservation Program requirements consist of periodic area and personal noise monitoring, performance and evaluation of audiograms, provision of hearing protection, annual employee training, and record keeping. The CEC incorporates this regulation into its Conditions of Certification.

7.5.6.3 Local Noise Regulations

The proposed project is located within the existing EGS site in the Rancho Cucamonga city limits. This site is adjacent to an unincorporated area of San Bernardino County and is within 1.5 miles of the cities of Fontana and Ontario. Noise emissions from the proposed project could potentially impact sensitive uses located within each of these jurisdictions.

City of Rancho Cucamonga

The City of Ranch Cucamonga Municipal Code provides noise standards pertaining to noise abatement, residential districts, and industrial districts. Noise abatement standards are provided in Section 17.02.120 of the municipal code. These standards specify that noise levels cannot be raised above the following:

- Basic noise level for a cumulative period of not more than 15 minutes in any 1 hour,
- Basic noise level plus 5 dBA for a cumulative period of not more than 10 minutes in any 1 hour,
- Basic noise level plus 14 dBA for a cumulative period of not more than 5 minutes in any 1 hour, and
- Basic noise level plus 15 dBA at any time.

Noise standards for residential districts within the Rancho Cucamonga city limits are provided in Section 17.08.080 of the City's Municipal Code. These standards specify maximum interior and exterior noise limits in terms of dBA according to time of day. The maximum allowable exterior noise level for residential land uses is 60 dBA during the daytime (7:00 a.m. to 10:00 p.m.) and 55 dBA during the nighttime (10:00 p.m. to 7:00 a.m.). The maximum allowable interior noise level for residential land uses is 45 dBA during the daytime (7:00 a.m. to 10:00 p.m.) and 40 dBA during the nighttime (10:00 p.m. to 7:00 a.m.).

Noise standards for industrial districts within the City of Rancho Cucamonga are provided in Section 17.30.050 of the City's Municipal Code. Noise standards in this section of the Municipal Code specify maximum exterior cumulative noise exposure limits in terms of L_{dn}. Three classes of performance standards are provided and categorized as Class A, Class B, or Class C and are applied to specific areas based on land uses within the area. The Class A performance standard is the most restrictive. The maximum allowable exterior noise level for Class A is 65 dBA L_{dn}. Noise caused by motor vehicles is exempted from the Class A standard. The maximum noise level for the Class B performance standard is 75 L_{dn}. Noise caused by motor vehicles and trains are exempted from this standard. The maximum noise level for the Class C performance standard is 85 L_{dn}. Where a use is within 200 feet of residentially zoned land, the noise level at the residential property line shall not exceed 65 L_{dn}. The Class C performance standard also specifies that where a use occupies a lot abutting or separated by a street from a lot within the designated Class A or B performance standard or residential property, the performance standard of the abutting property shall apply at the common or facing lot line.

7.5.7 References

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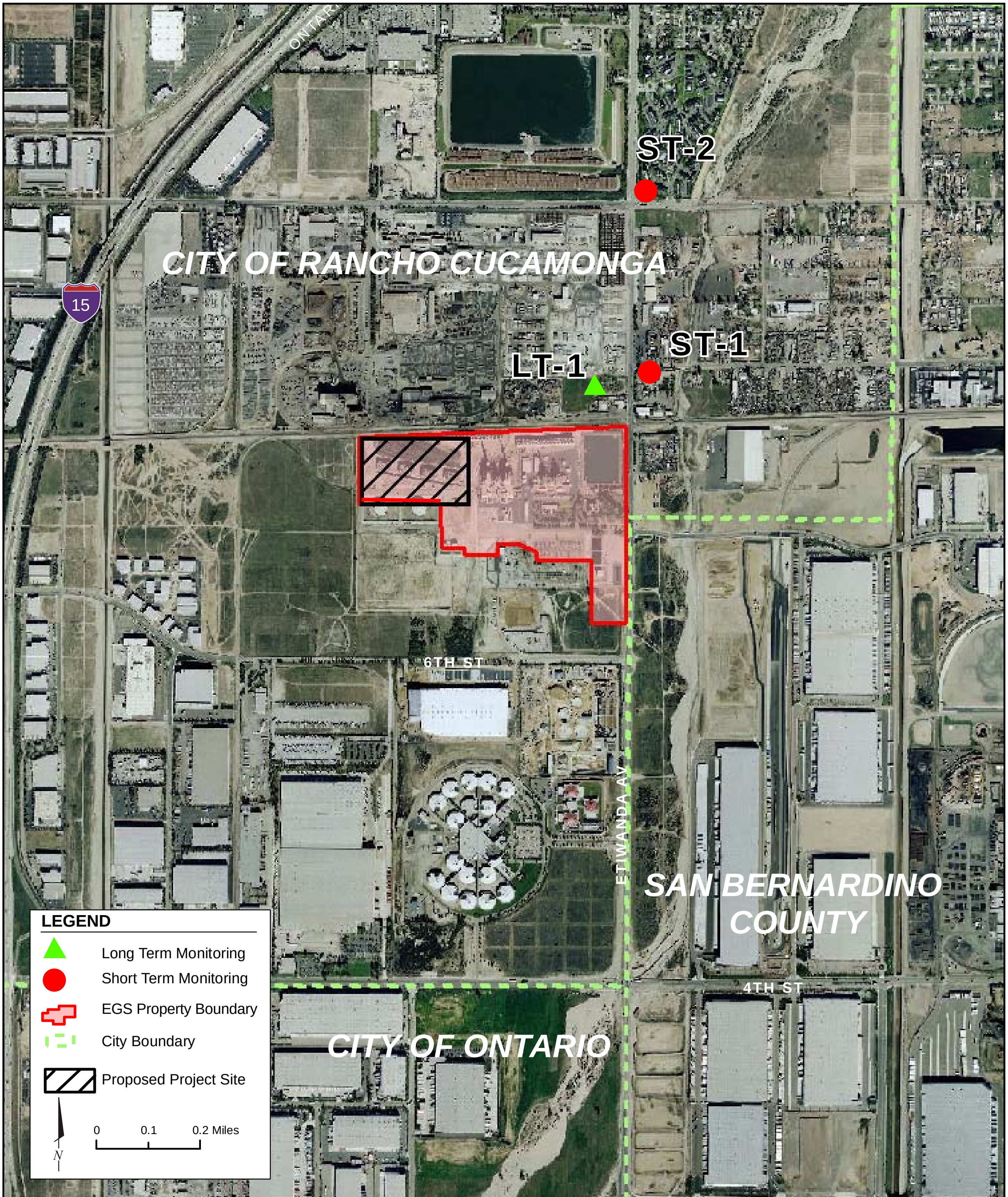


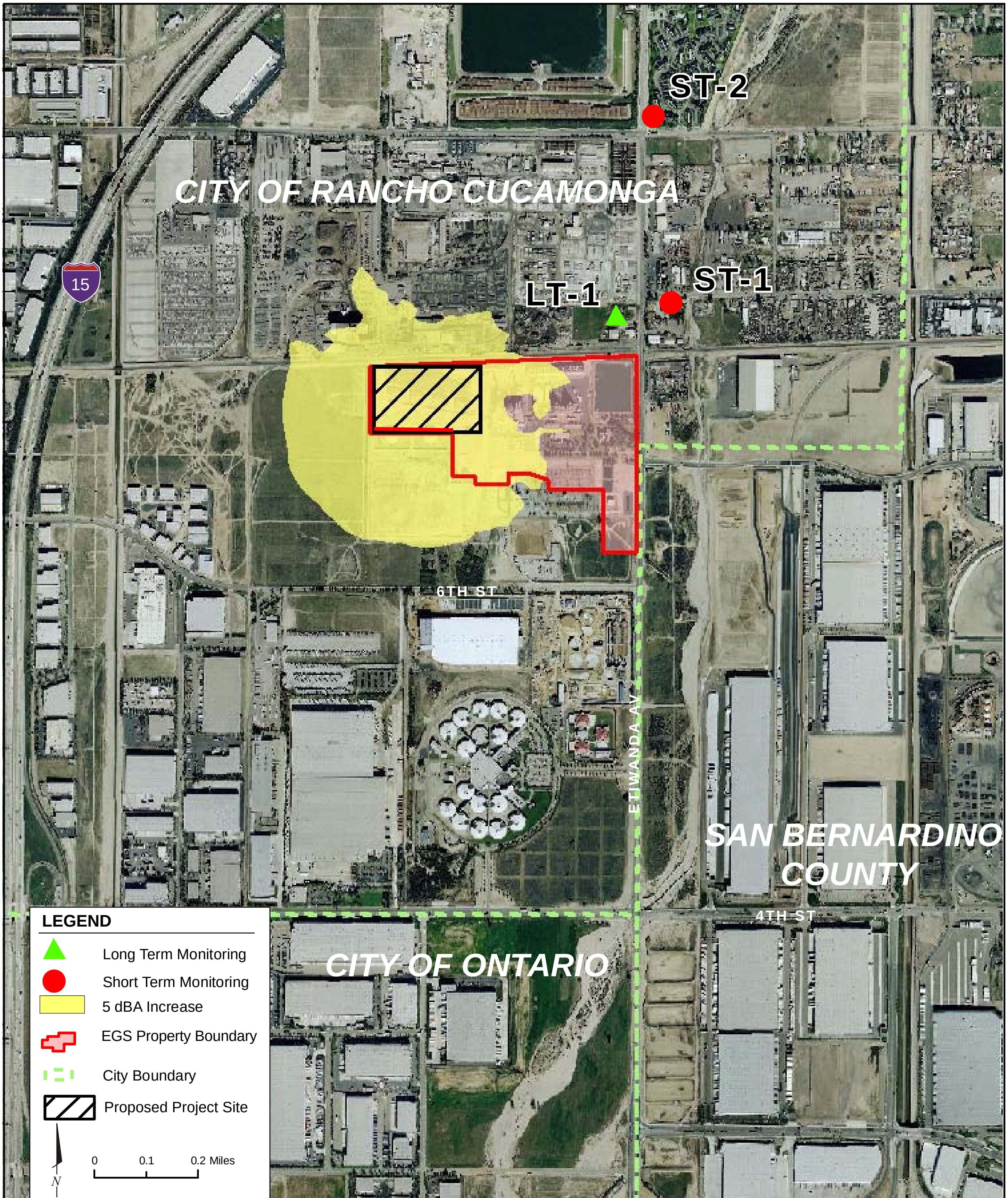
NOISE MONITORING LOCATIONS

April 2007
28067169

San Gabriel Generating Station
San Gabriel Power Generation, LLC
Rancho Cucamonga, California

URS

FIGURE 7.5-1



AREA OF POTENTIAL +5 dBA INCREASE

San Gabriel Generating Station
San Gabriel Power Generation, LLC
Rancho Cucamonga, California

April 2007
28067169

URS

FIGURE 7.5-2

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