Veneklasen Associates
Consultants in Acoustics & Audio-Visual Design

Acoustical Analysis Report

for

Peaker Power Unit – Center Substation

November 9, 2006
Revised December 14, 2006

Prepared for

Southern California Edison
Engineering and Technical Services
300 No. Lone Hill Avenue
San Dimas, California 91773

By

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Summary

Southern California Edison contracted Veneklasen Associates (VA) to perform an acoustical study to determine the acoustical impact of including a peaker unit and the required auxiliary equipment at the Center Substation. VA performed acoustical measurements at the project site to determine the existing ambient noise level.

Using the sound information provided by GE, VA developed a computer model to compare the predicted noise levels with the local noise criteria for the Center Substation. With this model VA determined the equipment and the plant layout selected by GE will meet the existing noise criteria.

Project Site Description

Figure 1 shows the Center Substation project site. Center is located within the City of Norwalk, California near the intersection of the 605 Freeway and Firestone Boulevard. The 605 Freeway is on the east boundary line, a commercial nursery is located to the north and west, and beyond the nursery to the west is the San Gabriel River. A commercial fun zone is located adjacent to the southern property line with Firestone Boulevard beyond. South of Firestone Boulevard is a large shopping center and west of the San Gabriel River is a car dealership and large park recreational center.

Figure 3 shows the proposed equipment layout for the project site.

Noise Criteria

It is understood that the peaker unit is expected to only operate during daytime hours when peak loads are required (typically between 1:00PM and 9:00PM). As a result VA used the daytime hours (between 7:00AM and 10:00PM) to evaluate compliance with the local noise ordinances.

The applicable noise standards are contained within the City of Norwalk Noise Ordinance. The Ordinance allows a noise source to be in compliance until it exceeds the presumed or measured ambient by 5 dBA. The noise limits for the commercial areas around the Center Substation is the assumed ambient of 60 dBA anytime of the day or night at commercial land uses plus 5 dBA for an adjusted limit of 65 dBA. The presumed ambient at residential property lines is 55 dBA during the daytime hours.

The measured ambient at the closest residential property line was 60 dBA, which is greater then the presumed ambient. Thus, the measured ambient becomes the controlling number. The Noise Ordinance states the noise level cannot exceed “the ambient noise level at the property line of any residential land…by more than five decibels”. Thus the noise limit at this property line is 65 dBA during the daytime.

Should it be necessary to have the equipment run during nighttime hours, the presumed ambient would become 45 dBA. The interpolated nighttime ambient at the closest property line is 56 dBA. Therefore the equipment cannot exceed 61 dBA at this location.

Ambient Noise Conditions

In December 2003 noise measurements were performed at various locations at the project’s property line with a Bruel and Kjaer model 2230 type I precision sound level meter. All A-weighted noise measurements are reported in dB re $2x10^{-5}$ $N/M^{2,}$ and are referenced to L_{50} or average noise level. The sound level meter was calibrated both prior to and after the measurements were made. The daytime noise measurements ranged from a maximum L_{50} of 63 dBA to minimum of 53 dBA. Thus the noise standard of 65 dBA identified in the Norwalk Noise Ordinances is the limiting criteria for the commercial property lines.

Additional noise surveys were conducted on November 13, 2006 to evaluate the noise conditions at the residences to the east. The noise level at measurement location 5 in figure 1 was measured at 60 dBA. The noise level at location 6 was

measured at 67 dBA. Thus the maximum allowable noise level at the residential property line is 65 dBA with the equipment running.
In order to evaluate the nighttime noise levels at the residential area VA performed noise measurements at location 6 on November 30, 2006 at 2:00AM. Location 6 was chosen because it provided similar shielding to the freeway as Location 5 but was easily accessible in the early morning hours. Ambient noise levels between 2:00AM and 2:30AM ranged from 56-57 dBA.

Expected Operation Parameters

The equipment noise levels were provided by General Electric based on the equipment selection and operating conditions and are reported in the attached appendix. As shown in the attached site layout, Figure 3, the proposed layout included a 10' sound wall around the Gas Compressor Discharge Cooler, the Fuel Gas Compressor Skid, and the fuel gas regulators. VA assumed the sound wall would be constructed with materials having an STC value greater then STC 32. Acceptable construction materials include CMU, or modular acoustical panels equal to Phoenix-E type Sono-Con Class 1-E or IAC model NoiseShield Regular.

Veneklasen Associates understands typical hours where all the new equipment would be operating will be between 1:00PM and 9:00PM.

Computer Noise Model

In order to predict future noise conditions at the project site, VA developed a 3D computer model of the project site utilizing LIMA noise modeling software developed by Stapelfeldt Ingenieurgesellschaft and distributed by Bruel & Kjaer. The software utilizes the ISO standard 9613-2 "Acoustics – Attenuation of Sound During Propagation Outdoors" to evaluate the expected future noise conditions.

Computer Model Results

The expected noise level at the nearest property line as indicated in figure 1 was calculated and is indicated in the table below.

	Calculated Sound Level at most Stringent Property Line	Local Noise Limit	Ambient	Combination Ambient and Equipment	Pass/Fail
Daytime	57 dBA	65 dBA	60 dBA	62 dBA	Pass
Nighttime	57 dBA	60 dBA	56 dBA	60 dBA	Pass

Figure 2 attached shows the noise contours expected to be generated by the proposed equipment.

Discussion of Results

Based on the sound levels provided and proposed layouts for the peaker equipment the local noise ordinances will be met without any additional mitigation regardless if the equipment operates during daytime and nighttime hours.

Appendix

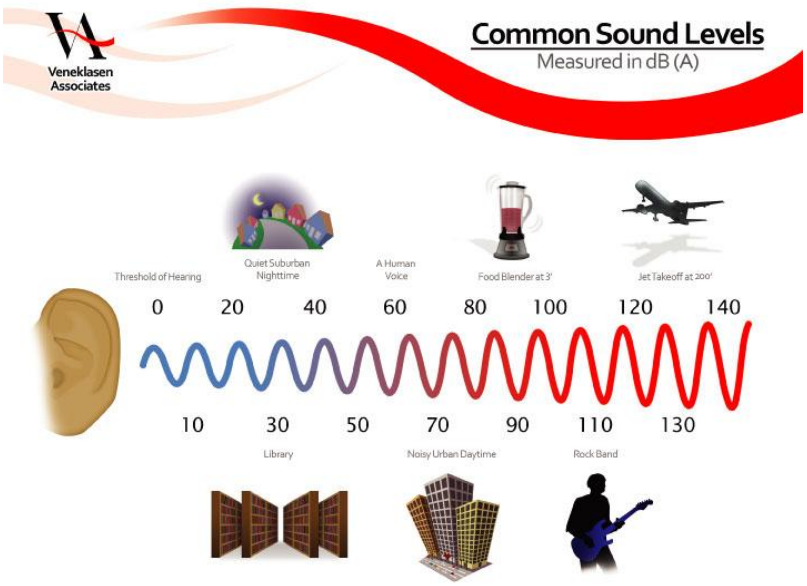
Equipment Sound Level Limits
(Based on Data Provided by the Equipment Manufacturer)

Equipment	Maximum Sound Pressure Level @ 3’
1. Combustion Turbine Generator	85 dBA
Exhaust Stack	85 dBA
2. SCR	85 dBA
5. CTG Air/Oil Cooler	85 dBA
13. 13.8 Kv/4.16 KV Transformer	60 dBA
14. 13.8/480V Transformer	60 dBA
15. GSU Transformer	70 dBA
18. Gas Compressors Discharge Cooler	85 dBA
19. Air Compressors	85 dBA
22. Ammonia Forwarding and Storage System	85 dBA
27. Fuel Gas Compressor	95 dBA
30. Blackstart Generator	85 dBA
41. Fuel Gas Regulators	85 dBA

- All other Equipment associated with the peaker unit is expected to generate noise levels below 60 dBA at 3’.
- Should any equipment exceed the values indicated in this table, additional mitigation to reduce the noise level will be required.

A Brief Introduction to Environmental Acoustics

Sound is the physical phenomenon of complex minute variations of atmospheric pressure. Because of the range of sound pressure level detectable by the human ear, sound pressure level (SPL) is represented on a logarithmic scale known as decibels (dB). A sound level of 0 dB is approximately the threshold of human hearing and is usually not audible, even under extremely quiet (laboratory-type) listening conditions. A SPL of 120 dB begins to be felt inside the ear as discomfort and pain at approximately 140 dB. Because decibels are logarithmic, they cannot be added or subtracted linearly. Instead, it is necessary to add the values logarithmically. For example, if two sound sources each produce 100 dB, when they are operated together they will produce 103 dB, not 200 dB. Four 100 dB sources operating together again double the sound energy, resulting in a total SPL of 106 dB, and so on. In addition, if one source is 10dB louder than another, the two sources operating together will produce the same SPL as if the louder source were operating alone. Thus, a 100 dB source plus an 80 dB source produce 100 dB when operating together. Two useful rules to remember when comparing SPLs are: (1) most people perceive a 10 dB increase in SPL between two noise events to be about a doubling of loudness, and (2) changes in SPL of less than about 3 dB between two events are not detected by typical humans. The table below reports some typical noise levels for reference:



Frequency, or pitch, is a physical characteristic of sound and is expressed in units of cycles per second or hertz (Hz). The normal frequency range of hearing for most people extends from about 20 to 20k Hz. The human ear is more sensitive to middle and high frequencies, especially when the noise levels are quieter. As the noise levels get louder, the human ear starts to hear the frequency spectrum more evenly. To accommodate for this phenomenon a weighting system to evaluate how loud a noise level is to a human was developed. The frequency weighting called “A” weighting is typically used for quieter noise levels which de-emphasizes the low frequency components of the sound in a manner similar to the response of a human ear.

Sound levels vary with time. For example, the sound increases as an aircraft approaches, then falls and blends into the ambient or background as the aircraft recedes into the distance. Because of this variation, it is often convenient to describe a particular noise "event" by its highest or maximum sound level (Lmax). Note Lmax describes only one dimension of an event; it provides no information on the cumulative noise exposure generated by a sound source. In fact, two events with identical Lmax may produce very different total exposures. One may be of very short duration, while the other may be much longer.

For the evaluation of community noise effects of long term noise sources such as traffic, aircraft, or mechanical equipment the Day-Night Average Sound Level (DNL) and Community Noise Equivalent Level (CNEL) are used. DNL averages sound levels at a location over a complete 24-hour period, with a 10-decibel adjustment added to those noise events occurring between 10:00 p.m. and 7:00 a.m. (local time) the following morning. The 10:00 p.m. to 7:00 a.m. period is defined as nighttime (or night) and the 7:00 a.m. to 10:00 p.m. period is defined as daytime (or day). The CNEL metric is similar to the DNL metric in that it produces a penalty

for the nighttime hours, but it also includes an evening hour penalty adjustment. Thus ambient noise measured between 7:00 a.m. and 7:00 p.m. has no penalty; a +5 dB adjustment must be made to noise measured between 7:00 p.m. and 10:00 p.m. and a 10+ dB penalty is added to noise measured between 10:00 p.m. and 7:00 a.m.

Sound from a point source propagates similar to the waves caused by throwing a stone into a pond. At the initial point of the disturbance the energy is strongest and dissipated over a small surface area. As the wave moves outward away from the initial point of disturbance, the circumference of the wave increases. Neglecting friction, the total energy remains the same but it is distributed over a greater surface area. Therefore for any specific point at the wave even though the total energy hasn't changed, the energy is less as the distance from the source increases. Under typical conditions the reduction in noise level is 6 dB per doubling of distance.

Acoustical Terminology

deciBel	A unit for 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. deciBels are denoted "dB".
A-weighted sound pressure level	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 response of the human ear and gives good correlation with subjective reactions to noise. A-weighted deciBels are denoted "dBA" or "dB(A)".
Equivalent Sound Level	The sound level containing the same total energy as a time-varying signal over a given sample period. Equivalent sound level, denoted "L_{eq}" is typically computed over 1, 8 and 24-hour sample periods.
The Day-Night Level	Denoted "L_{dn}", the Day-Night Level is calculated by averaging equivalent sound levels recorded over a 24-hour period after the addition of a ten deciBel weighting to sound levels measured at night, between 10:00 p.m. and 7:00 a.m.
Percentile level	Denoted L_n, percentile level indicates the time-average sound level that is exceeded for "n" percent of the total measurement period. Unless otherwise stated, A-weighting is understood. *Example: L_{90} indicates the average sound pressure level that was exceeded 90% of the measurement period.*

FIGURE 1 – CENTER

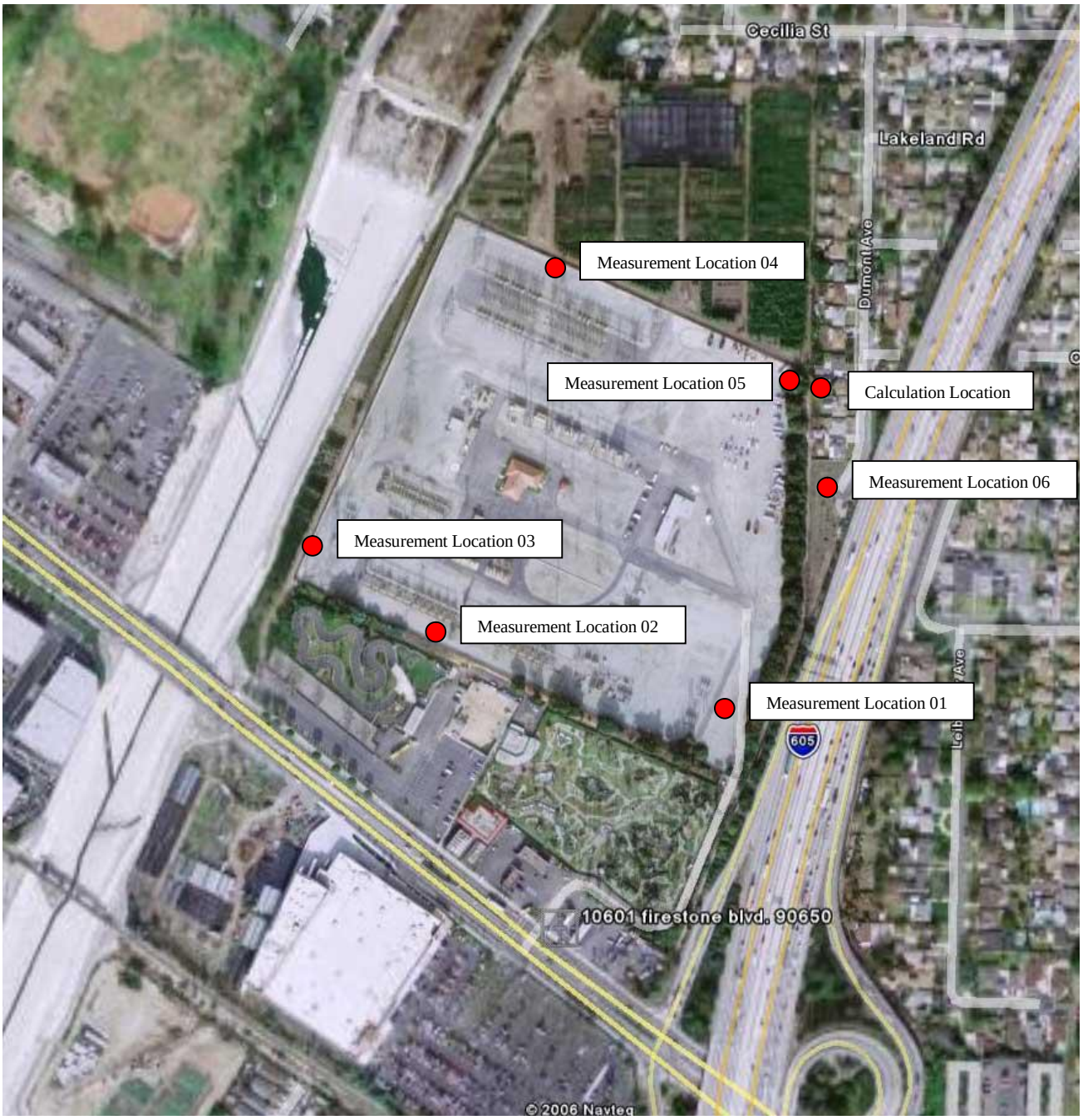


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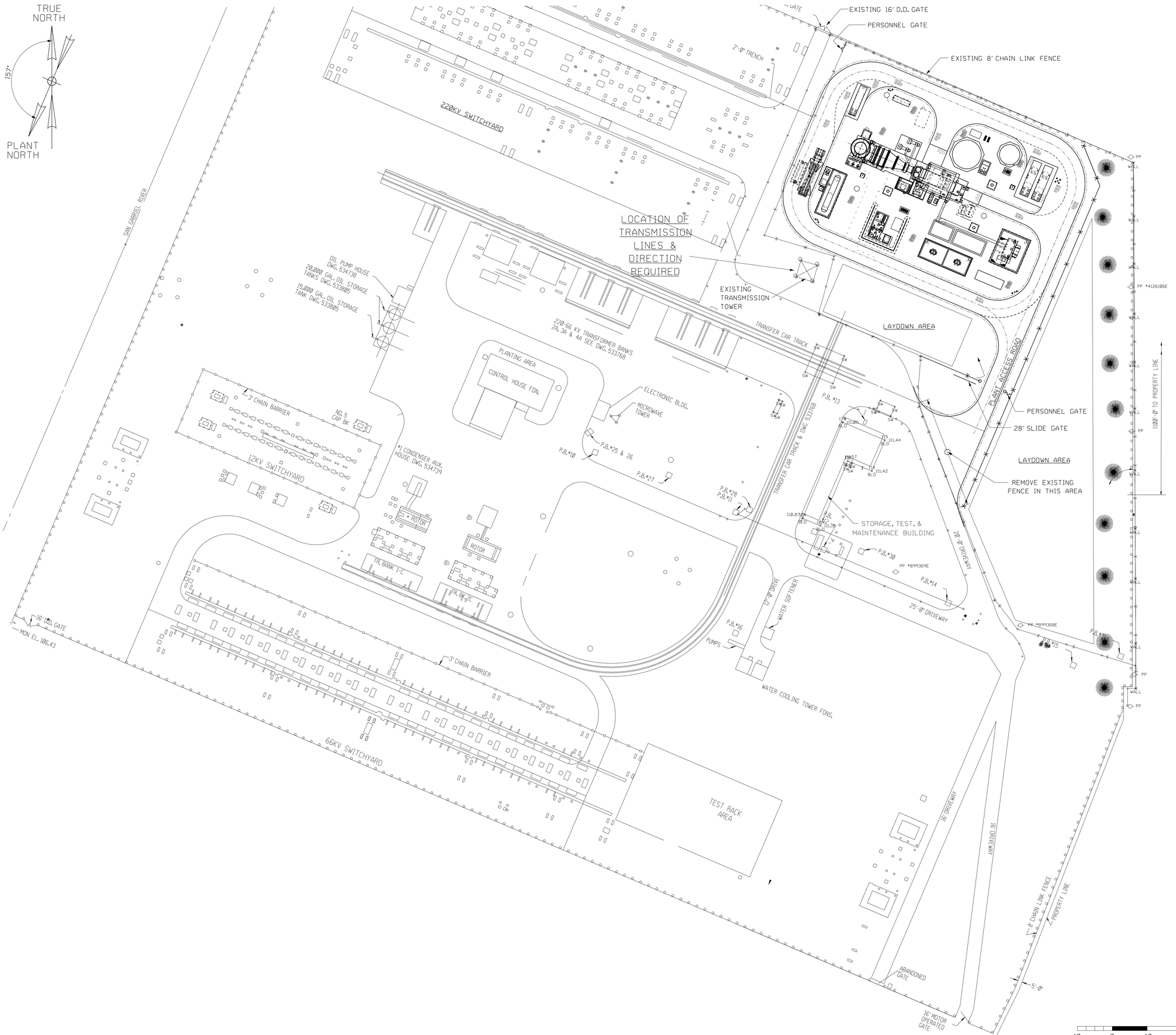
FIGURE 2 CALCULATED NOISE CONTOURS

FIGURE 3 EQUIPMENT LAYOUT



COORDINATE SYSTEM;
N/S & E/W COORDINATES ARE CENTERLINE OF STACK

	SITE COORDINATE	PLANT COORDINATE
NORTH/ SOUTH	N. 1796813.5'	N. 5000'-0"
EAST/ WEST	E. 6529922.346	E. 10000'-0"

REFERENCE DRAWINGS;
GENERAL ARRANGEMENT SCEP-4-DW-111-002-002

REV	DATE	DESCRIPTION	DRAWN	CHECKED	LEAD DESIGNER	ENGINEER/ TECH SPEC.	LEAD DISC. ENGINEER	PROJECT ENGINEER MANAGER	PROJECT MANAGER
A	11 30 06	ISSUED FOR CLIENT REVIEW AND COMMENT.	TWB		TWB	MAS	MAS	KS	SAB

PRELIMINARY STATUS — DATE 11/30/06 — LDE G. PRATT — REPRESENTS GENERAL DESIGN CONCEPTS BASED ON ASSUMPTIONS. REVIEWED NOT CHECKED.

APPROVED STATUS — DATE — LDE — REPRESENTS REVIEWED AND APPROVED DESIGN, ANY PORTION MARKED "HOLD" RETAINS PRELIMINARY STATUS.

ORIGINATING PERSONNEL	PROFESSIONAL ENGINEER'S SEAL
DRAWN BY: TWB	ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF REG. _____ STATE _____ LIC. NO. _____ DATE _____
CHECKED BY:	
LEAD DESIGNER: T.W. BYRNE	
ENGINEER/TECH SPECIALIST: M.A. SPAZIANI	
PROJECT ENGINEERING MANAGER: K. STUCKI	
PROJECT MANAGER: S.A. BLUE	

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REFERENCE DRAWINGS	NO.	REVISIONS	DATE	P.E.	QAE	SUPV	APPROVED	ENGR	CK'D	MADE	I.D.	NO.	REVISIONS	DATE	P.E.	QAE	SUPV	APPROVED	ENGR	CK'D	MADE	I.D.

LOCATION: CENTER SUBSTATION (L.H.)

SOUTHERN CALIFORNIA EDISON
LM 6000 PEAKER PROJECT
SITE PLAN

SCALE: 1" = 40'-0" — SOUTHERN CALIFORNIA EDISON An EDISON INTERNATIONAL Company

D/L

FAC | PIPING | I & C | ELECT | MECH | CIVIL | STRUC

DWG-FILE: SCEP-4-DW-111-002-001.dgn
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