Acoustical Analysis Report

for

Peaker Power Units – Etiwanda Substation

November 17, 2006
Revised December 14, 2006

Prepared for

Southern California Edison
Engineering and Technical Services
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By

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Summary

Southern California Edison contracted Veneklasen Associates (VA) to perform an acoustical study to help evaluate the impact to the community at the Etiwanda Substation site if a peaker unit and the required auxiliary equipment was added to the site.

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 proposed project site. With this model VA determined the equipment and the plant layout selected by GE will meet the existing noise guidelines at the Etiwanda Substation.

Project Site Description

The Etiwanda Substation is located within the interior boundary of the Reliant Energy Etiwanda Generating Station in the City of Rancho Cucamonga, California. The site is adjacent to and west of Etiwanda Avenue and north of 6th Street. The site is surrounded by industrial property land use ranging from steel processing plants to trucking and distribution warehousing facilities. The nearest residential area is located approximately 1 mile north of the site off Etiwanda Avenue at Arrow Highway. The I-15 Freeway is located approximately 1 mile west of the site. Figure 1 shows this project site. Figure 3 shows the equipment layout

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.

Section 17.30.050 “Performance Standards” of the City of Rancho Cucamonga Municipal Code states:

“The maximum allowable exterior noise level of any use shall not exceed 65 Ldn* as measured by any location on the lot occupied by such uses. Where a structure is occupied by more than one use, the noise level shall not be in excess of 60 Ldn as measured within the interior space of the neighboring establishment.”

Ambient Noise Conditions

VA performed noise measurements around the Etiwanda project site on July 15, 2004. Daytime ambient noise levels ranged from 61 dBA L_{50} to 47 dBA L_{50}. Because the ambient noise level is below the noise standard of the City of Rancho Cucamonga, 65 L_{dn} is the controlling noise limit.

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 levels at the projects' nearest property lines were calculated and are indicated in the table below.

Project Site	Calculated Sound Level at most Stringent Property Line	Local Noise Criteria	Ambient	Combination Ambient and Equipment	Pass/Fail
Daytime Operation	47 dBA	65 dBA L_{dn}	47 dBA	50 dBA	Pass
Nighttime Operation	47 dBA	65 dBA L_{dn}	45 dBA	49 dBA	Pass

Discussion of Results

Based on the sound levels provided and proposed layouts for the peaker equipment the Etiwanda Substation will meet the local noise ordinances without any additional mitigation. Should it be necessary for the equipment to operate in the nighttime hours it would also operate within the local noise limits.

Appendix

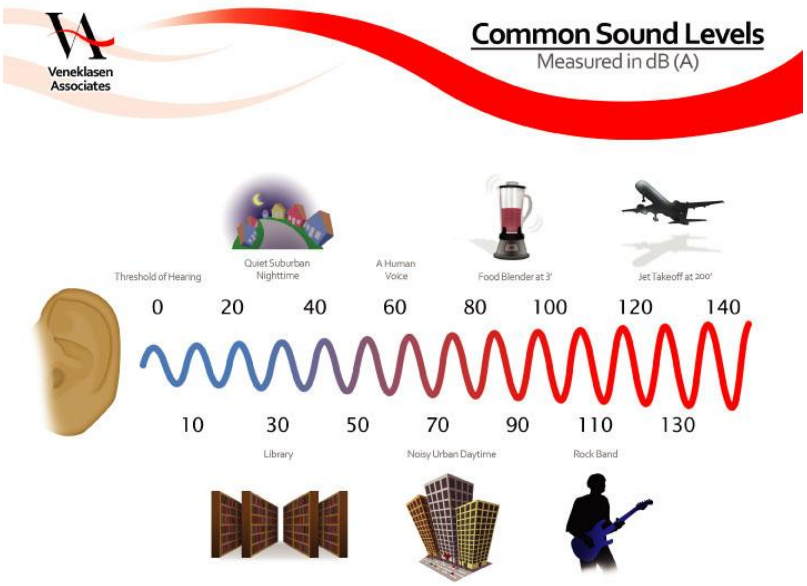
Equipment Sound Level Limits
(Based on Data Provided by the Equipment Manufacturer)

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
19. Air Compressors	85 dBA
22. Ammonia Forwarding and Storage System	85 dBA
27. Fuel Gas Compressor	95 dBA
30. Blackstart Generator	85 dBA

All other Equipment associated with the peaker unit is expected to generate noise levels below 60 dBA.

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.

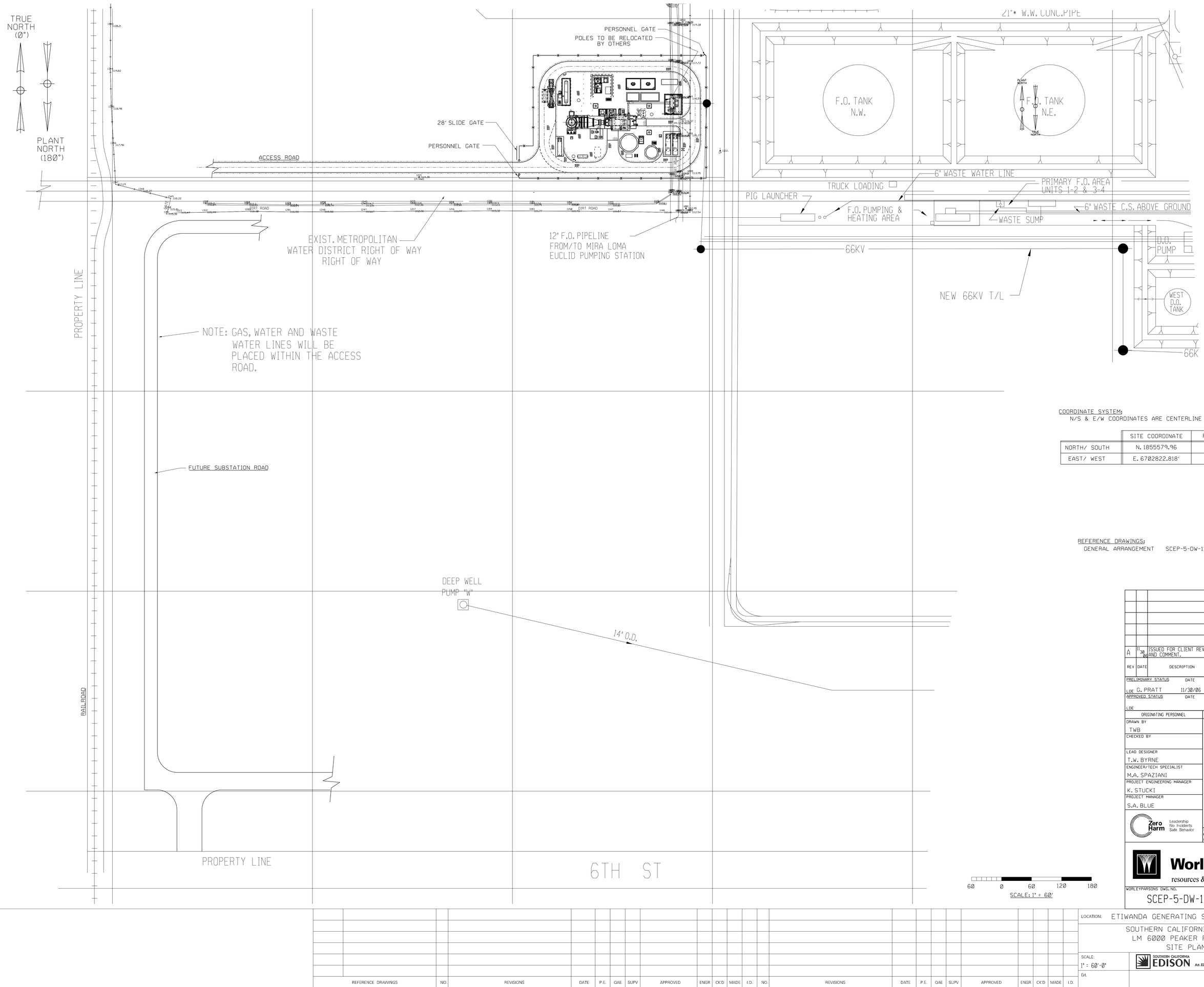
Acoustical Terminology

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 – ETIWANDA

FIGURE 2 CALCULATED NOISE CONTOURS

FIGURE 3 EQUIPMENT LAYOUT



REFERENCE DRAWINGS:
GENERAL ARRANGEMENT SCEP-5-DW-111-002-002

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

	SITE COORDINATE	PLANT COORDINATE
NORTH/ SOUTH	N. 1855579.96	N. 5000'-Ø"
EAST/ WEST	E. 6702822.818'	E. 10000'-Ø"

60 0 60 120 180
SCALE: 1" = 60'

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

PRELIMINARY STATUS DATE
LDE G. PRATT 11/30/06
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	
CHECKED BY:	
LEAD DESIGNER: T.W. BYRNE	
ENGINEER/TECH SPECIALIST: M.A. SPAZIANI	
PROJECT ENGINEERING MANAGER: K. STUCKI	
PROJECT MANAGER: S.A. BLUE	

Zero Harm Leadership No Incidents Safe Behavior

ORIGINALLY PREPARED UNDER THE RESPONSIBLE SUPERVISION OF
PE: _____ STATE: _____
LIC. NO.: _____ DATE: _____

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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: ETIWANDA GENERATING STATION (R.H.)
SOUTHERN CALIFORNIA EDISON
LM 6000 PEAKER PROJECT
SITE PLAN
SCALE: 1" = 60'-0"
SOUTHERN CALIFORNIA EDISON An EDISON INTERNATIONAL Company
DA.

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

DWG-FILE: SCEP-5-DW-111-002-001.dgn
DWG-DATE: 30-Nov-06 10:26