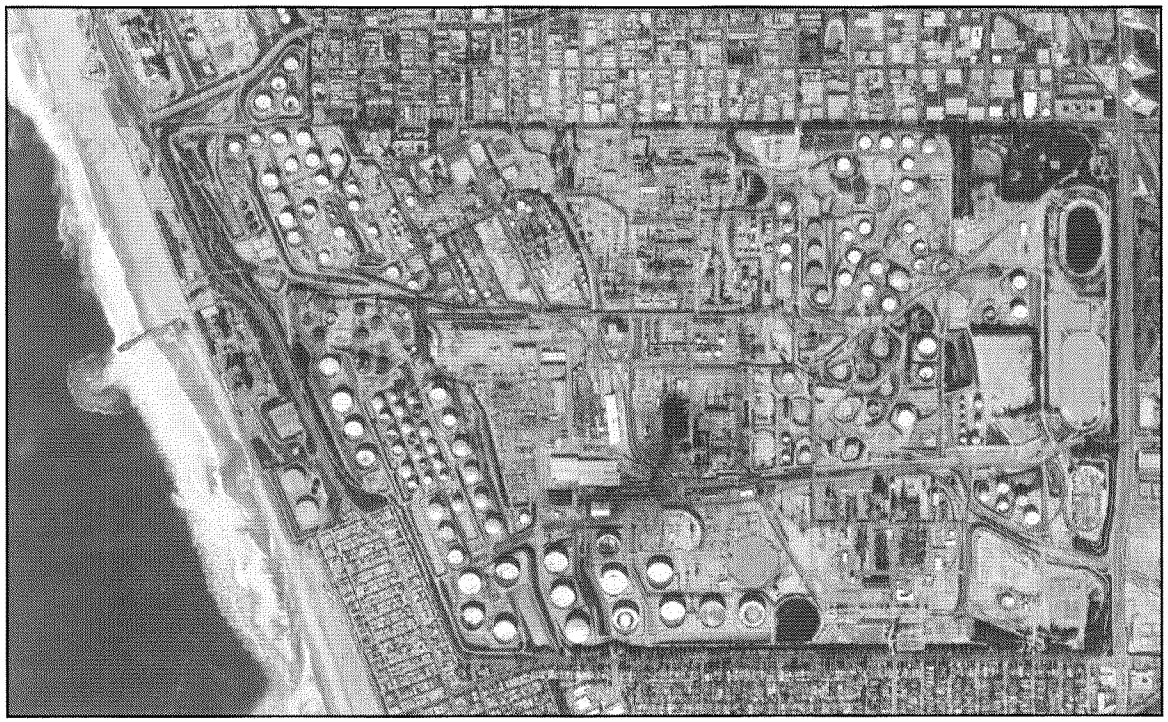
APPENDIX E

Noise Analysis

Navcon Engineering Report No. 71838a, Chevron El Segundo Refinery

Product Reliability and Optimization (PRO) Project

California Environmental Quality Act (CEQA) Noise Impact Assessment



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I. Administrative Information

- Project Location: Chevron Product Company, El Segundo Refinery
  324 West El Segundo Blvd., El Segundo, CA, 90245
- Project Name: Product Reliability and Optimization Project (PRO)
- Navcon Job No.: 71838, Chevron PRO Project Noise Study
- Navcon Engineers: Jim Steedman & Hans Forschner
- Service Contract: Chevron Contract 99001412, DRES 4676668

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II. Chevron Product Reliability and Optimization Project (PRO) Description

- Chevron Products Company is proposing modifications and additions to its El Segundo Refinery. The purpose of these modifications and additions is to increase the reliability and capacity of specific existing Refinery processing equipment.
- The Chevron Refinery property is bounded by the City of El Segundo to the North and the City of Manhattan Beach to the South. Residential communities are located to the North (El Segundo) and to the South-West and South (Manhattan Beach). Commercial areas are located to the North-East & East (El Segundo). El Segundo Power is located to the South-West. Refer to ***Aerial Photo 1***.

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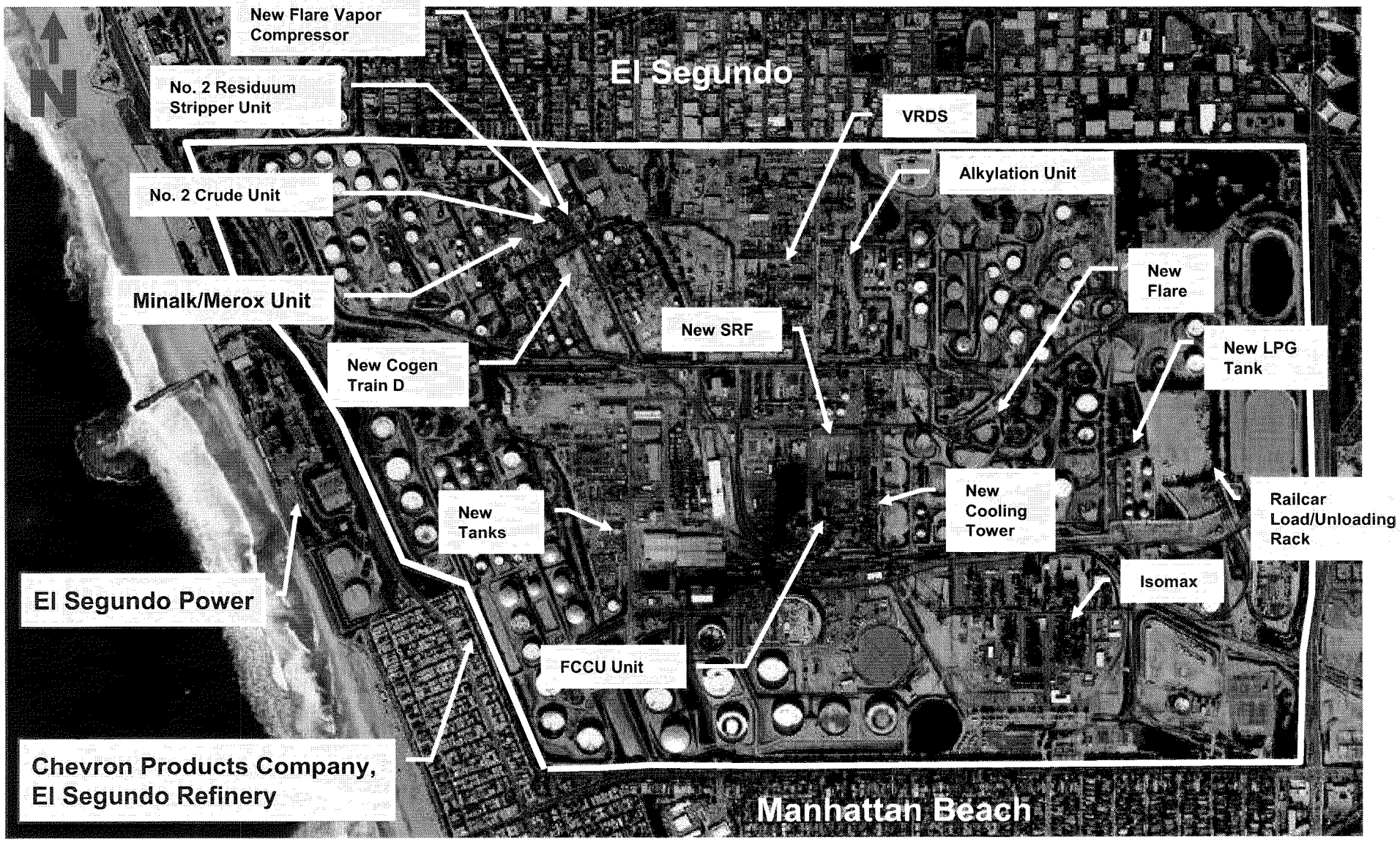
Aerial Photo 1, Site Plan with Principal Project Component Locations



III. Introduction

- This report summarizes the results of the Chevron PRO Project, *California Environmental Quality Act* (CEQA) Noise Impact Assessment.
- The principal objective was to asses the potential noise impact from the PRO Project in terms of CEQA Guidelines (refer to ***Section IV***).
- The principal tasks included: (**1**) an environmental noise survey to document current noise levels at the perimeter of the refinery (refer to ***Section V***), (**2**) the development of a three dimensional analytical noise model and prediction of the PRO Project noise levels (refer to ***Section VI***), and (**3**) the assessment of the PRO Project noise impact in terms of the Draft Los Angeles CEQA Thresholds Guidelines (refer to ***Section VII***).
- The noise study was conducted by Hans Forschner and Jim Steedman of Navcon Engineering.

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IV. Noise Impact Assessment Methodology

- The Chevron PRO noise assessment was made following standard methods and procedures accepted by the Air Quality Management District (AQMD). The noise impact is determined based upon net changes in the Community Noise Exposure Level (CNEL) due to the proposed project.
- The standard methods and procedures group noise-sensitive land uses and set ambient noise level limits according to the land use compatibility shown in ***Table 1***.
- The ambient noise levels are considered to be normally/conditionally acceptable, normally unacceptable, or clearly unacceptable based upon the CNEL.
- A project is considered to pose a significant impact on the community noise, if the operations cause the ambient noise level at the property line to either:
  - increase the CNEL by 5 dBA or more; or
  - increase the CNEL by 3 dBA and rise into either the normally unacceptable or clearly unacceptable category

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Table 1: Land Use Compatibility Categories & Noise Levels

Land Use	Ambient Community Noise Exposure Level (dBA CNEL)		
	Normally/Conditionally Acceptable	Normally Unacceptable	Clearly Unacceptable
Single-family, duplex, mobile homes, multi-family homes	50 - 70	70 - 75	Above 70
Schools, libraries, churches, hospitals, nursing homes, motels, hotels	50 - 70	70 - 80	Above 80
Auditoriums, concert halls, amphitheatres	50 - 70	(1)	Above 65
Sports arenas, outdoor spectator sports	50 - 75	(1)	Above 70
Playgrounds, neighborhood parks	50 - 70	67 - 75	Above 72
Golf courses, riding stables, water recreation, cemeteries	50 - 75	70 - 80	Above 80
Office buildings, business and professional commercial	50 - 77	Above 75	(1)
Industrial, manufacturing, utilities, and agriculture	50 - 80	Above 75	(1)

(1) No values identified.

V. *Environmental Noise Survey*

- Navcon conducted an environmental noise survey on October 5 - 9, 2007. The principal objective was to document the current ambient noise level at the refinery property line for the CEQA noise assessment.
- Five noise monitoring stations were used during the survey. They were located along the South, West & North perimeters of the refinery as shown in ***Aerial Photo 2***.
- Noise Monitoring Terminals (NMT) #1, #2 & #3 are transportable systems based upon Larson Davis Model 824 & 831 sound level analyzers.
  - *NMT #1* was located on the South-West berm close to Chevron Gate 22 as shown in ***Aerial Photo 2 & Photo Set 1***.
  - *NMT #2* was located on the West property line by Crest Drive & 45th Street, Manhattan Beach as shown in ***Aerial Photo 2 & Photo Set 2***.
  - *NMT #3* was located on the North property line close to the Administration Building as shown in ***Aerial Photo 2 and Photo Set 3***.

V. *Environmental Noise Survey (cont'd)*

- The refinery's Noise Monitoring & Early Warning System (NMEWS) microphones, NMEWS #1 & NMEWS #2, which have been in operation since 1990, were also used to document the current ambient noise environment (refer to ***Aerial Photo 2 and Photo Set 4***). The NMEWS monitors are based upon Bruel & Kjaer 4921 sound level meters interfaced to an Agilent Technologies VXI data acquisition system.
  - *NMEWS #1* is located on the South-Central side of the refinery, North of the Rosecrans berm.
  - *NMEWS #2* is located on the South-East side of the refinery, North of the Rosecrans berm by the electrical sub-station.

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V. *Environmental Noise Survey (cont'd)*

- All five noise monitors used during the environmental noise survey meet the American National Standards Institute (ANSI) S1.4, 1983 specification for Type I (Precision) sound level meters. Each monitor is calibrated on an annual basis in accordance with the National Institute of Standards Technology (NIST). The system sensitivities were checked prior to and following the noise monitoring survey using a NIST traceable Bruel & Kjaer pistonphone, Model 4228.
- The noise monitors were time synchronized and configured to record one second energy equivalent levels (Leq), hourly averaged sound pressure levels (L50), and the statistical noise parameters (Ln).
- The ambient noise level was assessed in terms of the Community Noise Exposure Level (CNEL). The CNEL is the averaged daily noise level with a 5 dB weighting factor applied to the level measured between 7 PM and 10 PM and a 10 dB weighting factor applied to the level measured between 10 PM and 7 AM.
- The current ambient CNEL values are summarized in ***Table 2***.

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Aerial Photo 2, Noise Monitoring Location Plan View

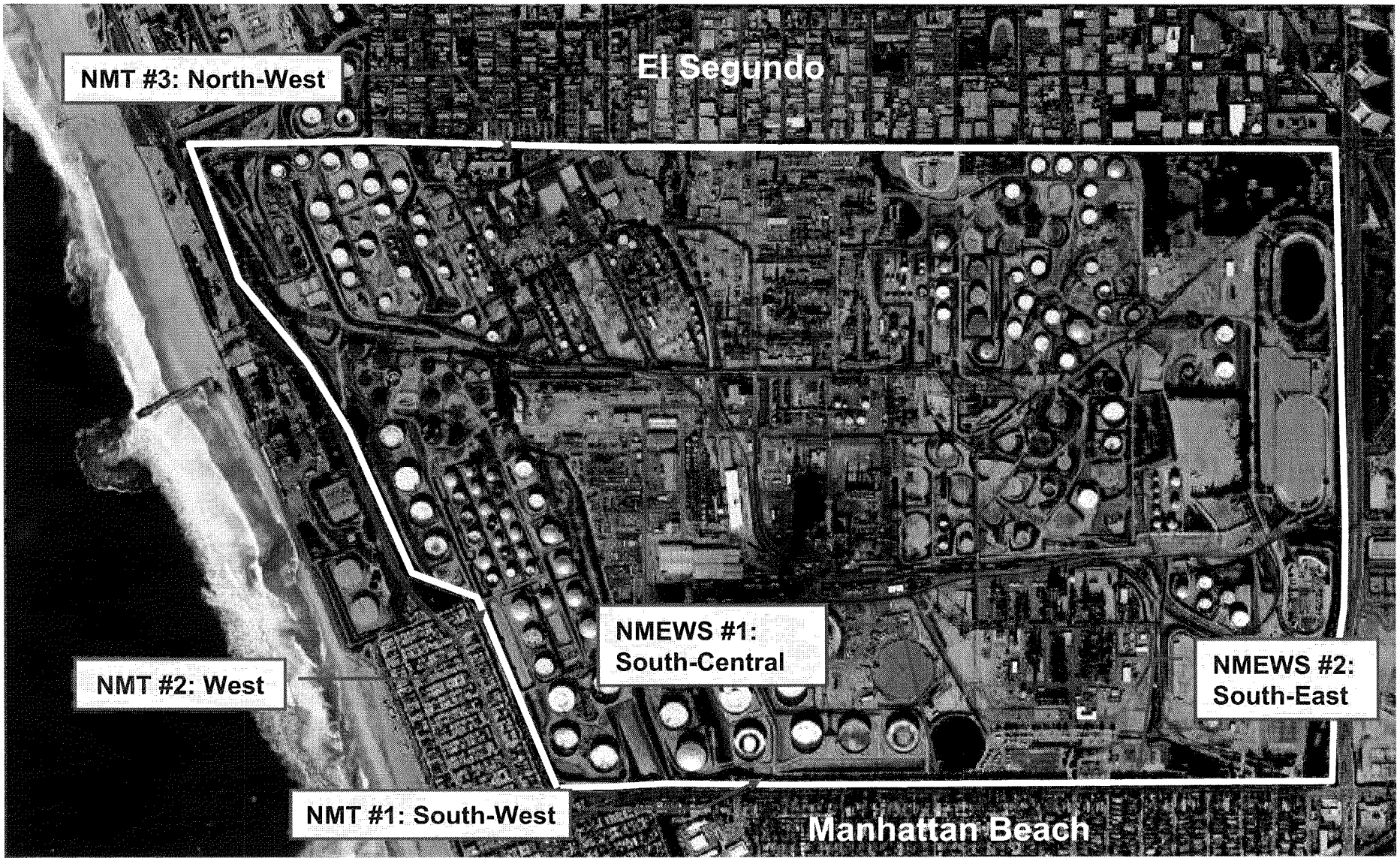
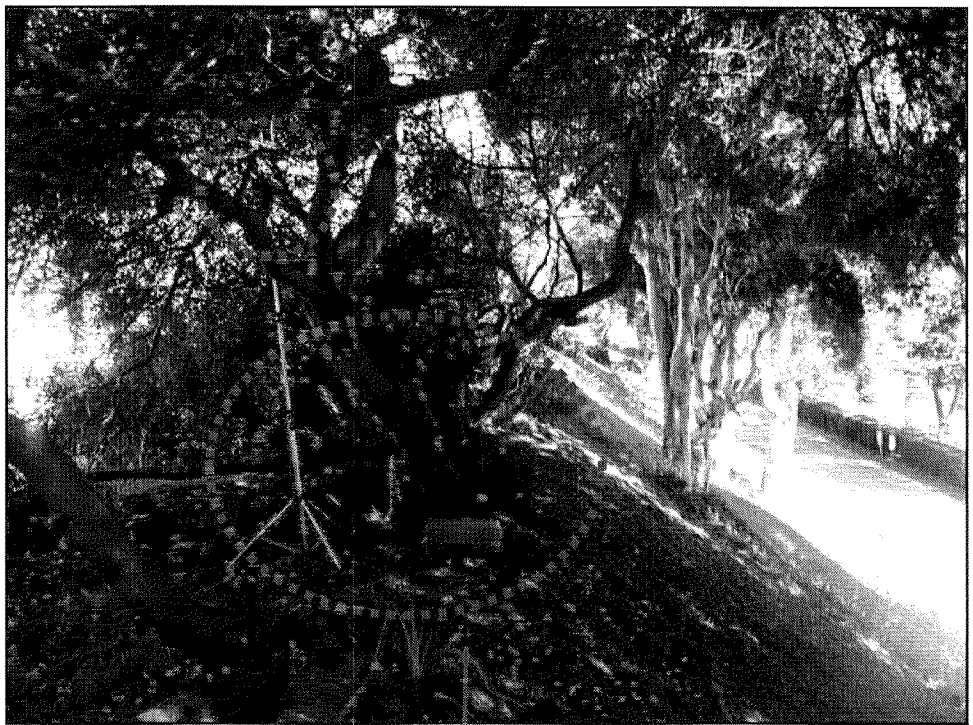


Photo Set 1, NMT #1 - South-West Property Line (Manhattan Beach)



NMT #1: Outdoor Microphone, Windscreen & Bird Spikes

NMT #1: Environmental Enclosure with Sound Level Analyzer & Tripod

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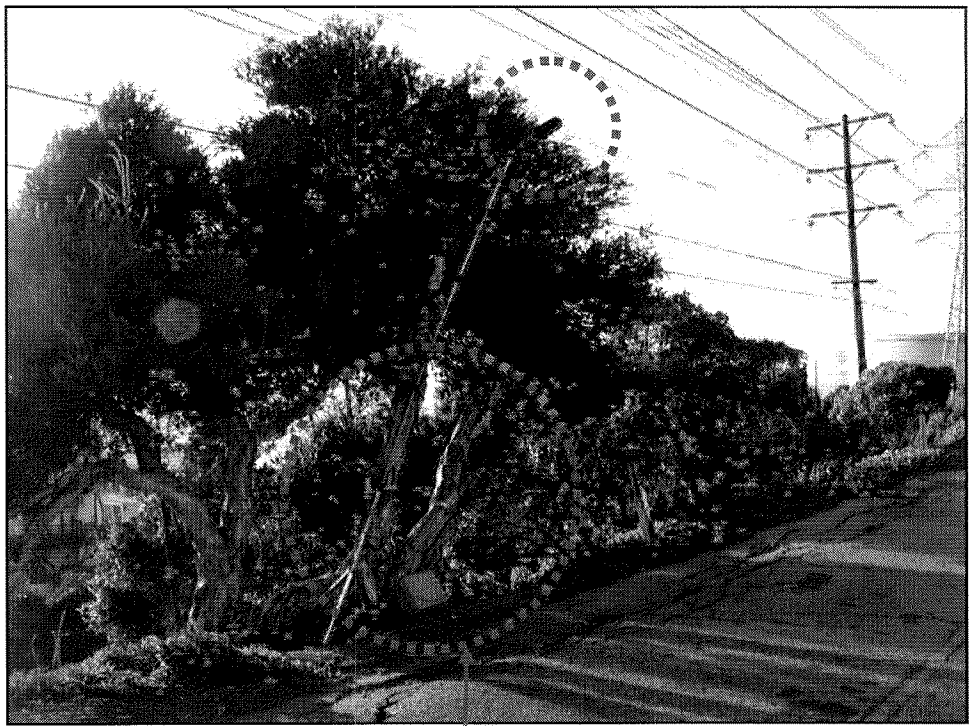
Photo Set 2, NMT #2 - West Property Line (Manhattan Beach)



NMT #2: Outdoor Microphone, Windscreen & Bird Spikes

NMT #2: Environmental Enclosure with Sound Level Analyzer & Tripod

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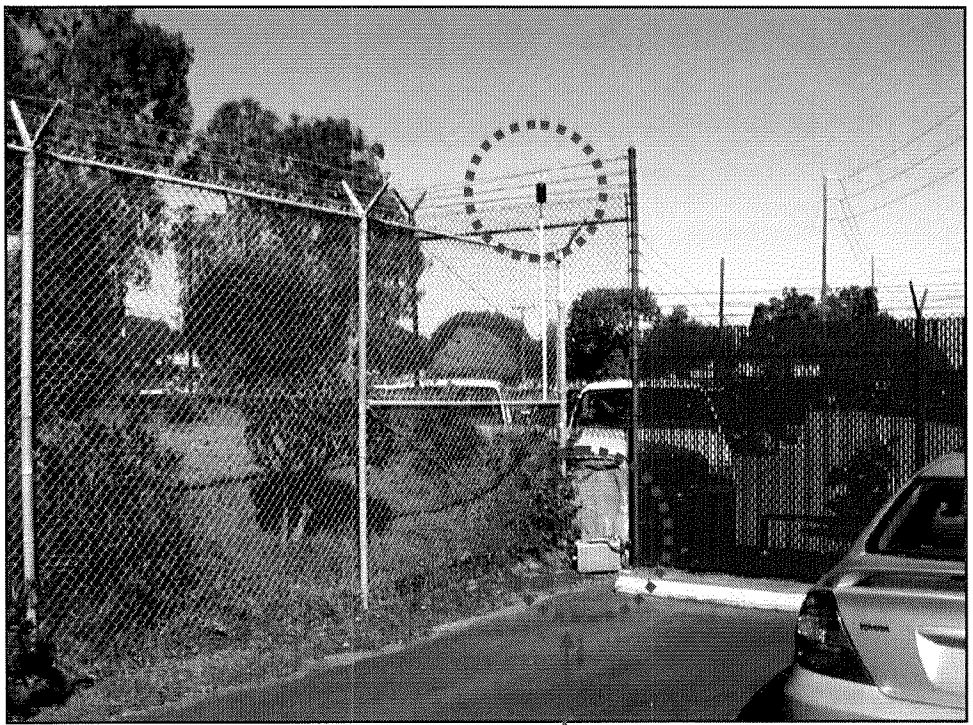
Photo Set 3, NMT #3 - North Property Line (El Segundo)



NMT #3: Outdoor Microphone, Windscreen & Bird Spikes

NMT #3: Environmental Enclosure with Sound Level Analyzer & Tripod

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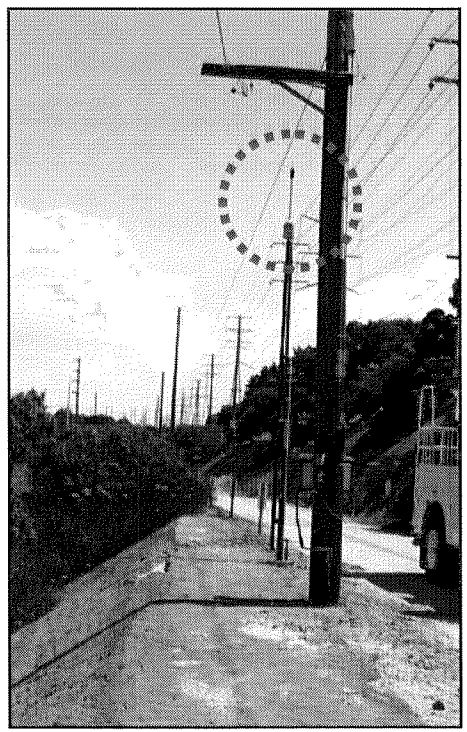
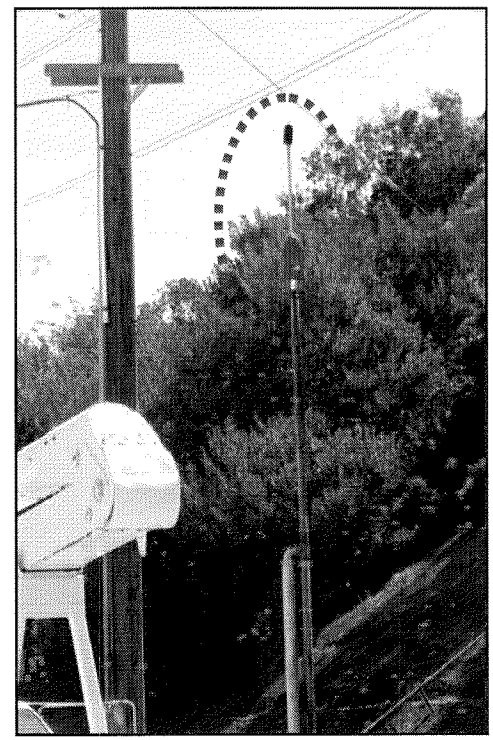
Photo 4, NMEWS #1 & NMEWS #2, South Property Line (Manhattan Beach)



NMEWS #1: South-Central
Property Line
Manhattan Beach



NMEWS #2: South-East
Property Line
Manhattan Beach

Table 2, CNEL – Current Ambient Noise Level

Date	NMT # 1 South-West Property Line	NMT # 2 West Property Line	NMT # 3 North-West Property Line	NMEWS # 1 South-Central Property Line	NMEWS # 2 South-East Property Line
5-Oct-07	63.7	61.9	68.7	68.0	63.8
6-Oct-07	64.2	61.7	68.8	69.1	63.9
7-Oct-07	65.3	65.5	69.7	69.1	64.3
8-Oct-07	63.5	60.4	68.9	69.2	63.8
9-Oct-07	63.4	66.7	69.1	68.2	63.8
Average	64.0	63.3	69.0	68.7	63.9
Max	65.3	66.7	69.7	69.2	64.3
Min	63.4	60.4	68.7	68.0	63.8
Stdev	0.8	2.7	0.4	0.6	0.2

The ambient property line background noise level CNEL ranges between 63 dBA and 70 dBA. The standard deviation ranges between 0.2 dB and 2.7 dB.

VI. Acoustical Model

- A three dimensional noise model of the PRO Project was created using the noise modeling software, SoundPLAN. The noise model geometry is presented in ***Graphics 1, 2 & 3***.
- The acoustical model parameters were as follows:
  - the ground was modeled with an absorption coefficient of 0.5.
  - the sides of the tanks, buildings, etc. were modeled as reflective surfaces and also as diffractive bodies (see the blue shaded areas).
  - the noise producing equipment were modeled as point, line & area sources (see the red shaded objects).
- The noise source sound power emission levels were estimated based upon the Chevron El Segundo Refinery Equipment Noise Specification which is 80 dBA to 85 dBA sound pressure level at 3 ft. from the face of the equipment. The spectral content was based on measurements recorded on similar equipment. The estimated sound power emission spectra are presented in ***Tables 3a – 3c***.

VI. Acoustical Model (cont'd)

- The PRO Project noise model predictions were made based upon the algorithms and procedures described in "*Environmental Noise from Industrial Plants. General Prediction Method, Danish Acoustical Laboratory, 1982. Report 32*".
- All significant noise sources to be installed as part of the PRO Project were considered to be operating simultaneously. Thus, the noise level predictions presented in this report are conservative and considered worst case. The vapory recovery flare was not included in the assessment since it will only be utilized during plant process upsets.
- The predicted CNEL contour map for the PRO Project (new sources only) is presented in ***Graphic 4***.

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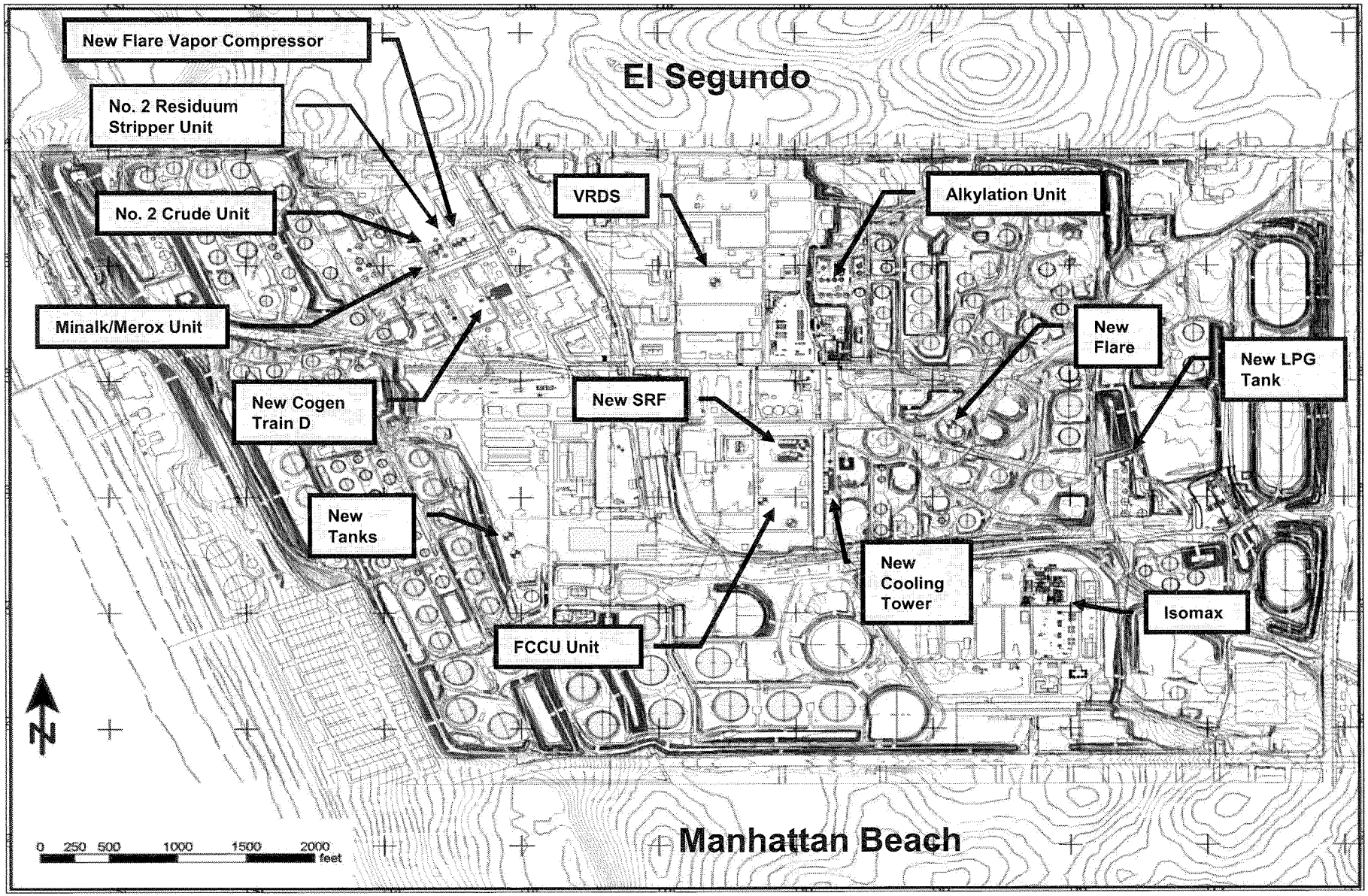
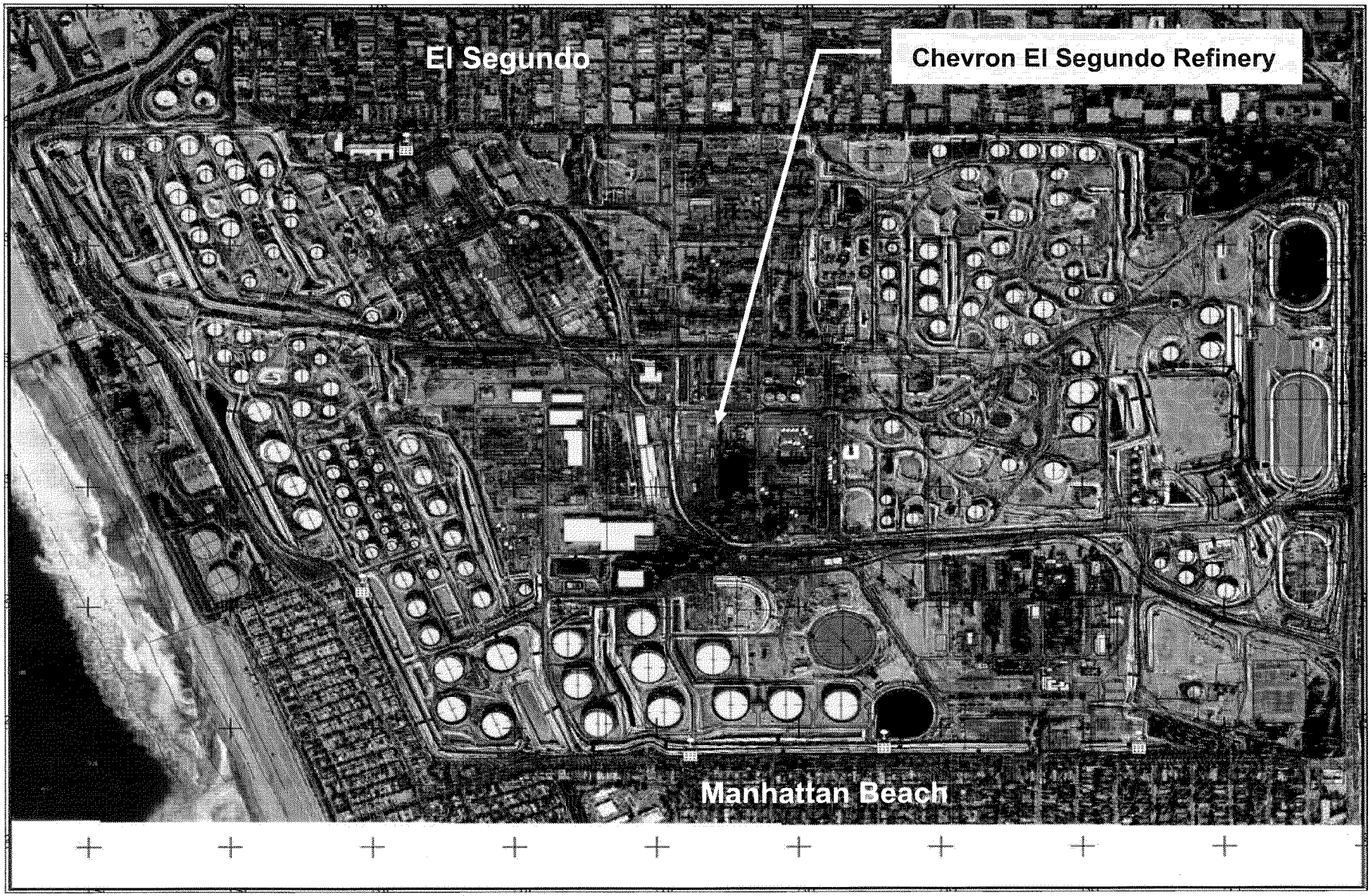
Graphic 1, Noise Model Geometry (2D View)



Graphic 2, Noise Model Geometry with Aerial Photo (2D View)



Graphic 3, Noise Model Geometry with Topographical Map (3D View)

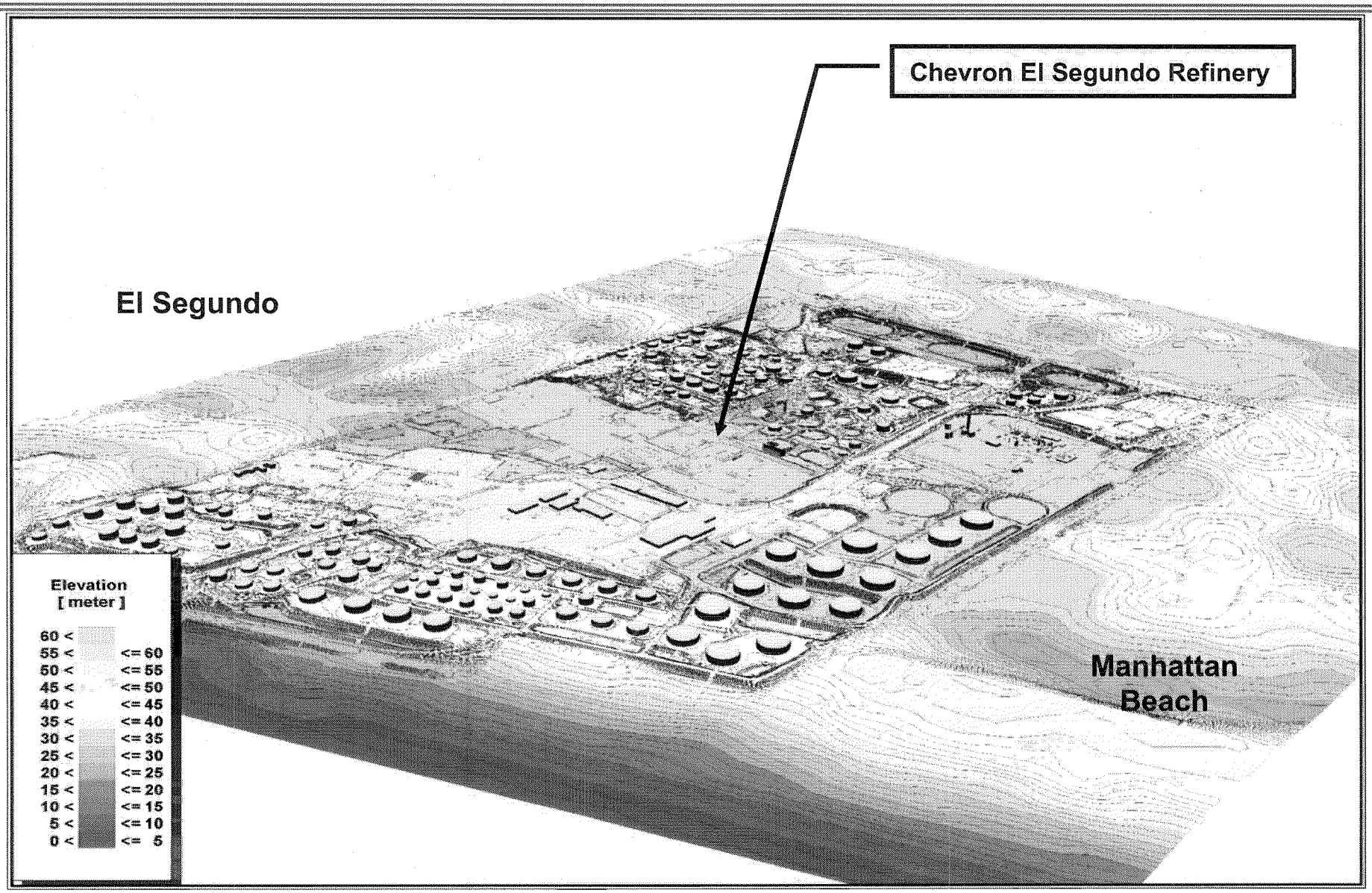


Table 3a, Sound Power Emission Levels

No. #	Source	Unit / Plant	Sound Power Level [dBA]								
			63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	OA
1	P-397 Flare Knockout Liquid Pump	2nd Crude	60	72	79	85	88	89	86	77	93
2	P-398 Flare Knockout Liquid Pump	2nd Crude	60	72	79	85	88	89	86	77	93
3	Cogen D Train	Cogen Train D	94	98	102	108	96	92	91	109	113
4	Cogen D-Train Stack	Cogen Train D	81	89	97	103	89	71	77	81	104
5	K-3701 / 3702 Gas Compressor	Cogen Train D	86	99	103	107	109	112	111	104	116
6	New Cooling Tower West	FCCU	93	101	101	98	104	100	101	90	109
7	P-5720 Depropanizer OH Pumps	FCCU	62	74	81	87	90	91	88	79	95
8	K-4450 Reciprocating Compressor	Flare Gas Vapor	90	93	104	96	95	106	103	95	110
9	P-4400 Water Pump	Flare Gas Vapor	62	74	81	87	90	91	88	79	95
10	P-4401 Flare Base Pump	Flare Gas Vapor	62	74	81	87	90	91	88	79	95
11	K-7301 Combustion Air Blower	SRU Unit	82	99	103	94	94	89	83	77	105
12	K-7302 Compressor	SRU Unit	82	99	103	94	94	89	83	77	105
13	P-7305 BFW Booster Pump	SRU Unit	62	74	81	87	90	91	88	79	95
14	P-7303 Sulfur Degassing Pump	SRU Unit	60	72	79	85	88	89	86	77	93

OA = Overall Sound Pressure Level **FCCU** = Fluid Catalytic Cracking Unit **SRU** = Sulfur Recovery Unit

Table 3b, Sound Power Emission Levels

No. #	Source	Unit / Plant	Sound Power Level [dBA]								
			63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	OA
15	E-730 G/H Overhead Condenser	Isomax	81	92	99	101	98	99	93	85	106
16	K & P-501 CKN High Pressure Feed	Isomax	73	82	91	97	103	108	99	91	110
17	K-940 H2 Booster Compressor	Isomax	92	96	107	99	98	108	105	95	112
18	P-700 CKN Feed Booster Pump	Isomax	62	74	81	87	90	91	88	79	95
19	P-710 Vacuum Colum Pump	Isomax	62	74	81	87	90	91	88	79	95
20	P-712 Vaccum Column Pump	Isomax	62	74	81	87	90	91	88	79	95
21	P-713 Diesel Product Pump	Isomax	62	74	81	87	90	91	88	79	95
22	P-733 Isosplitter Pump	Isomax	62	74	81	87	90	91	88	79	95
23	P-733A Isosplitter Pump	Isomax	62	74	81	87	90	91	88	79	95
24	P-733B Isosplitter Pump	Isomax	62	74	81	87	90	91	88	79	95
25	Ejector Vaccum Column C-730	Isomax	67	85	89	90	92	94	92	86	99
26	P-6801 Feed Pumps	SWS	62	74	81	87	90	91	88	79	95
27	P 6815 Bottoms Pump	SWS	62	74	81	87	90	91	88	79	95
28	P-302 Blend Pump	Tank 302	62	74	81	87	90	91	88	79	95

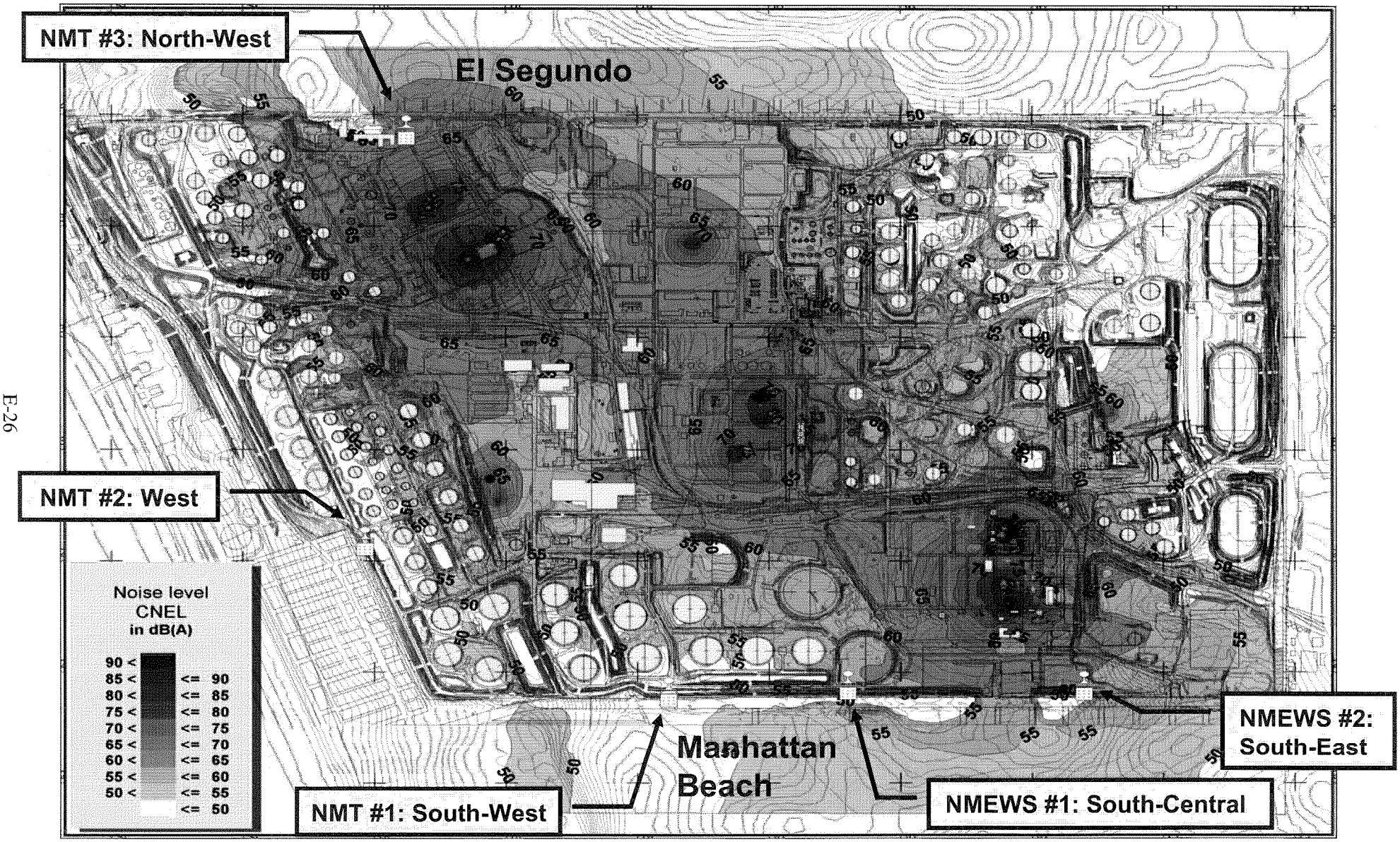
OA = Overall Sound Pressure Level **SWS** = Sour Water Stripper

Table 3c, Sound Power Emission Levels

			Sound Power Level [dBA]								
No. #	Source	Unit / Plant	63 Hz	125 Hz	250 Hz	500 Hz	1 kHz	2 kHz	4 kHz	8 kHz	OA
29	P-303 Blend Pump	Tank 303	62	74	81	87	90	91	88	79	95
30	P-722 Pump	Tank 722	60	72	79	85	88	89	86	77	93
31	K-6902 Booster Blower	TGU	82	99	103	94	94	89	83	83	105
32	K-10 Main Air Blower	TGU	84	101	105	96	96	91	85	83	107
33	K-6901 Combustion Air Blower	TGU	82	99	103	94	94	89	83	83	105
34	P-6902 Condenser Circ Pump	TGU	60	72	79	85	88	89	86	77	93
35	P-6902 Desuperheater Circ Pump	TGU	60	72	79	85	88	89	86	77	93
36	P-6903 Rich Amine Pump	TGU	60	72	79	85	88	89	86	77	93
37	P-6904 Wash Water Pump	TGU	60	72	79	85	88	89	86	77	93
38	P-6905 Lean Amine Pump	TGU	60	72	79	85	88	89	86	77	93
39	P-6906 Regenerator Reflux Pump	TGU	60	72	79	85	88	89	86	77	93
40	P-6908 Caustic Pump	TGU	60	72	79	85	88	89	86	77	93
41	K-1581 Sulfiding Recycle Compress	VRDS	85	88	99	91	90	101	98	83	105

OA = Overall Sound Pressure Level **TGU** = Tail Gas Unit **VRDS** = Vacuum Residuum Desulphurization Unit

Graphic 4, CNEL Contour Map (Predicted PRO Project New Sources Only)



VII. Noise Impact Assessment

- The current ambient CNEL was measured along the refinery's North, West, and South property line.
- A noise model was developed for the PRO Project and CNEL predictions made for all new equipment considered to be acoustically significant.
- Referring to ***Table 4***, the net change in CNEL along the refinery property line was computed by logarithmically adding the predicted PRO Project noise to the current ambient.
- The PRO Project is predicted to increase the current minimum ambient CNEL by less than 1.3 dB. Based on the criteria accepted by AQMD, the PRO Project will not represent a significant noise impact to the residential communities of El Segundo and Manhattan Beach.

Table 4, CNEL Noise Impact Assessment

	NMT # 1 South-West Property Line	NMT # 2 West Property Line	NMT # 3 North-West Property Line	NMEWS # 1 South-Central Property Line	NMEWS # 2 South-East Property Line
Measured Current Minimum Ambient CNEL	63.4	60.4	68.7	68.0	63.8
Predicted Pro Project CNEL	47.6	47.2	62.5	58.9	59.4
Summation: Current Ambient CNEL + Predicted PRO Project CNEL	63.5	60.6	69.7	68.5	65.1
NET Change in CNEL	**0.1**	**0.2**	**0.9**	**0.5**	**1.3**
Significant Noise Impact	**No**	**No**	**No**	**No**	**No**

Note: The noise impact was determined by (1) logarithmically adding the predicted PRO Project noise to the current measured ambient CNEL, (2) computing the NET change in the ambient CNEL, and (3) applying the impact criteria described in ***Section IV***.