Health Risk Assessment (HRA) of Cogeneration Plant Operations at Hoag Memorial Hospital

Newport Beach, California

June 22, 2007

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Project No. 32409-46665-07-Documentation.LBR

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Section 1
Introduction

1.1 Background

Hoag Hospital is an existing facility located at One Hoag Drive in the City of Newport Beach. The approximately 38-acre site is generally bounded by Hospital Road to the north, West Coast Highway to the south, Newport Boulevard to the east, and residential development and Superior Avenue to the west. Sunset View Park is a linear/consolidated park that extends along much of the northern boundary of the Lower Campus and separates the hospital from the Villa Balboa and Seafaire condominiums. A site drawing and aerial map are attached in Appendices A and B, respectively.

The hospital cogeneration plant is located at the west end of the Lower Campus of Hoag Hospital property. It has three (3) currently permitted internal combustion engines (ICE) fueled by natural gas, one boiler (1) fueled by natural gas, and one (1) standby ICE fueled by diesel. Air quality Permits To Construct were obtained in 2003 from the South Coast Air Quality Management District (SCAQMD) for these existing units. In addition to the new cogeneration plant, there is also an existing utility plant located in the northwest corner of the Upper Campus which has five (5) diesel engine gensets, four (4) natural gas fueled boilers, and two (2) natural gas fueled heater/ chillers. The cogeneration plant has been designed to accommodate three (3) future cogeneration natural gas ICEs to meet anticipated power and heating demand in the future. Although not specifically known, this future demand date is expected to be after 2010. Relative to the cogeneration plant, the nearest commercial area is to the southwest approximately 500 feet away. The nearest K-12 school, Newport Heights Elementary School, is approximately 0.6 miles to the northeast of the facility. Three nursing homes are appromately 750 feet to the north of the facility. Residential locations are very close to both plants; specifically north of the cogeneration plant and west of the utility plant.

This technical report was developed to address health risk impacts associated with the three future cogeneration ICEs, as part of the Supplemental Environmental Impact Report (EIR) that has been prepared for Hoag Hospital. The health risk assessment was conducted following the Tier 4 Detailed Risk Assessment methods in South Coast Air Quality Management District's (SCAQMD's) Risk Assessment Procedures document[1]. As specified in those procedures, the California Air Resources Board's (ARB's) Hotspots Analysis and Report Program (HARP) model was used to calculate incremental and cumulative risks.

[1] SCAQMD "Risk Assessment Procedures for Rule 1401 and 212, Version 7.0," July 1, 2005.

1.2 Significance Thresholds

For this analysis, the project is assumed to be the installation and operation of the three future cogeneration ICEs. Therefore, the health risk assessment has been conducted in such a way that results are comparable to the following significance thresholds.

- Incremental project health risks associated with operation of the three future ICEs are compared to SCAQMD's California Environmental Quality Act (CEQA) thresholds[2]:
    - 10 per million cancer risk threshold[3]
    - Chronic non-cancer hazard index (HI) >= 1.0
    - Acute HI >= 1.0
- Cumulative hospital cogeneration and utility plant health risks are compared to SCAQMD Rule 1402 limits for facility-wide toxic air contaminant (TAC) emissions[4]:
    - 25 per million cancer risk threshold
    - Chronic non-cancer HI >= 3.0
    - Acute HI >= 3.0

[2] SCAQMD Air Quality Significance Thresholds, available at http://www.aqmd.gov/ceqa/hdbk.html .
[3] "Per million" means per million persons exposed to the toxic air contaminants being analyzed.
[4] SCAQMD Rule 1402 "Control of Toxic Air Contaminants from Existing Sources," Amended March 4, 2005.

Section 2
Equipment and Process Descriptions

The Lower Campus cogeneration plant has three existing ICEs fueled only by natural gas, one boiler fueled only by natural gas, and one standby ICE fueled only by diesel. There are also three future ICEs identical to the existing ones to be installed at much later date. The existing Upper Campus utility plant has five diesel generator sets, four natural gas boilers and two natural gas heater/chillers. The equipment descriptions are presented in the following Tables 2-1 through 2-4, and the manufacturer data sheets are attached in Appendix C.

Table 2-1
List of TAC Emitting Equipment in Hoag Hospital Cogeneration and Utility Plants

New/Existing	Location	Equipment Type	Fuel Type	No.
Proposed Project (New)	Cogeneration Plan	Internal Combustion Engine (ICE)	Natural Gas	3
Existing	Cogeneration Plant	Internal Combustion Engine (ICE)	Natural Gas	3
		Boiler	Natural Gas	1
		Standby ICE	Diesel	1
	Utility Plant	Standby ICE	Diesel	5
		Boiler	Natural Gas	4
		Heater/Chiller	Natural Gas	2
	Total Equipment			***19***

Source: CDM 2007.

Table 2-2
Natural Gas Cogeneration ICE Parameters (per unit)

Parameter	Value
Manufacturer	WAUKESHA
Engine Size	2080 BHP
Stack Height (Above ground)	46 ft
Stack Diameter	18 in
Exhaust Flowrate	5374 acfm
Exhaust Temperature	400 F
Fuel Consumption Rate	17640 cfh (natural gas)
Operation Schedule	24 hr/day, 365 days/yr

Source: CDM 2007.

Table 2-3
Natural Gas Boiler Parameters (SCAQMD permit application data)

Parameter	Value
Boiler Size	16 MMBtu/Hr
Stack Height (Above ground)	46/40ft [1]
Stack Diameter	26/12in [2]
Exhaust Flowrate	3719 acfm
Exhaust Temperature	200 F (assumed)
Fuel Consumption Rate	16000 cfh (natural gas)
Operation Schedule	24 hr/day, 365 days/yr

Source: CDM 2007.

[1] The boiler release height and diameter were measured at 46-ft and 26-in from available Cogen Plant drawing, and estimated at 40-ft and 12-in for boilers at Central Utility Plant from site walk.

Table 2-4
Existing Cogeneration Plant Diesel Standby ICE

Parameter	Value
Manufacturer	Caterpiller
Engine Size	400 ekW
Stack Height (Above ground)	12 ft
Stack Diameter	12 in
Exhaust Flowrate	3333.7 acfm
Exhaust Temperature	872 F
Fuel Consumption Rate	109.9 L/hr (diesel)
Operation Schedule	Test – 52hr/yr, Maintenance – 10hr/yr, Total 62 hr/yr

Source: CDM 2007.

Table 2-5
Existing Utility Plant Diesel Standby ICE

Parameter	Value
Manufacturer	Caterpiller
Engine Size	2518 bhp
Stack Height (Above ground)	40 ft
Stack Diameter	18 in
Exhaust Flowrate	15135.9 acfm
Exhaust Temperature	761.7 F
Fuel Consumption Rate	109.9 L/hr (diesel)
Operation Schedule	Test – 52hr/yr, Maintenance – 10hr/yr, Total 62 hr/yr

Source: CDM 2007.

Section 3
Emission Estimates

3.1 TACs Identification

CARB Speciation profiles can provide estimates of the chemical composition of VOC and PM emissions from different processes.In this analysis, most TAC emissions from natural gas fueled equipment were identified using the CARB source profiles and OEHHA TACs table. Natural gas PAH emission factors were obtained from SCAQMD and included in Appendix F. The following source profiles were downloaded from the CARB source profile database, as presented in Table 3-2. In each profile, a group of chemicals were given in terms of weight percentage based on total organic gases (TOG), which were converted to mass percent of VOC in order to use the permitted VOC emission rates by SCAQMD. The conversion was included in Appendix D. For equipment fueled by diesel, the diesel particulate matter was identified as the only carcinogenic TAC to represent diesel exhaust as recommended by OEHHA guidelines.

Table 3-1
CARB Source Profiles

Source Profile ID	Process/Source Type	Speciation from
719	ICE-reciprocating-natural gas	TOG
3	External combustion boiler - natural gas	TOG
818	Farm equipment - diesel - light & heavy	TOG

Source: CDM 2007.

3.2 TAC Emission Estimates

The non-PAH TAC emissions from natural gas fueled equipment were calculated using the TAC's weight percentage multiplied by the source VOC emissions, which were either the allowable emissions permitted by SCAQMD or manufacture test data. The PAH emissions were calculated using the fuel consumptions and emission factors from SCAQMD as attached in Appendix F. The detailed calculation worksheets were attached in Appendix H. For each of the cogeneration ICEs, the VOC emissions were calculated from the source testing data in SCAQMD permit document, i.e. 0.15g/bhp-hr for VOC emission as shown in Appendix G. The emission results were presented in Table 3-2a. The boiler VOC emission was calculated using the emission factor of 5.5 lb/MMcf, which was submitted in the existing boiler permit application to SCAQMD. The TAC emissions were summarized in Table 3-3a. The standby diesel engine emissions were calculated using the diesel emission factors provided in the technical data sheet from manufacturer, which are 0.11 g/bhp-hr and 0.062 g/bhp-hr respectively for HC and PM. The results were presented in Table 3-4. In emission calculations, it was assumed that there are no direct PM emissions from natural gas combustion, thus only the diesel equipment generated PM emissions. In addition, the

speciation factors of CARB profiles were based on TOG emission that should be converted to VOC speciation profile because either source testing or manufacturer's spec data only provides the VOC or NMHC emissions.

The PAH is an important group of TACs in VOC emissions, but detailed speciation of PAHs are not provided in CARB source profiles. The SCAQMD PAHs emission factors were used to calculate annual and hourly PAH emissions. For the natural gas ICEs, a control efficiency of 70 percent was assumed applicable to all PAHs, which was reported as NMHC control efficiency in the source testing report provided by the manufacturer. However, for the natural gas boiler, since there was not any control efficiency for any kinds of organic gas emissions indicated in the permit documents, the PAHs emissions were calculated without any control efficiency applied. The PAH emissions were summarized in Tables 3-2b and 3-3b, respectively, for the cogeneration ICEs and the boiler. For the diesel standby ICE, the PAH emissions were not calculated separately because diesel PM emission was assumed as the only TAC causing cancer risks.

Table 3-2a
Non-PAH TAC Emission Estimates for Each Natural Gas ICE
Using CARB Source Profile No. 719

CHEMICAL NAME (excluding PAHs)	CAS	Speciation Fraction	Each Engine	
			LBS/HR	LBS/YR
1,2,4-TRIMETHYLBENZENE {1,3,4-TRIMETHYLBENZENE}	95636	3.9705E-04	2.7573E-04	2.415
ACETALDEHYDE	75070	1.1911E-03	8.2716E-04	7.246
BENZENE	71432	4.3673E-03	3.0329E-03	26.568
BUTYRALDEHYDE	123728	7.9406E-04	5.5143E-04	4.831
CYCLOHEXANE	110827	3.9705E-04	2.7573E-04	2.415
ETHYLBENZENE	100414	3.9705E-04	2.7573E-04	2.415
ETHYLENE	74851	2.5013E-02	1.7370E-02	152.162
FORMALDEHYDE	50000	3.2160E-02	2.2333E-02	195.637
ISOMERS OF XYLENE	1210	7.9406E-04	5.5143E-04	4.831
M-XYLENE	108383	3.9705E-04	2.7573E-04	2.415
N-HEXANE	110543	7.9406E-04	5.5143E-04	4.831
O-XYLENE	95476	3.9705E-04	2.7573E-04	2.415
PROPYLENE	115071	6.7098E-02	4.6596E-02	408.181
TOLUENE	108883	1.5881E-03	1.1029E-03	9.661

Source: CDM 2007.

Table 3-2b
PAH Emission Estimates for Each Natural Gas ICE Using SCAQMD Emission Factors

TAC	CAS	SCAQMD EFs (lbs/MMcf)	LBS/HR[1]	LBS/YR[1]
PAHs	1151	0.0004	2.12E-06	1.85E-02

Source: SCAQMD, http://www.aqmd.gov/prdas/pdf/COMBEM2001.pdf.; CDM 2007.

[1] A 70 percent control efficiency applied to PAHs (assumed the same as for NMHC control from manufacturer's testing data)

Table 3-3a
Non-PAH TAC Emission Estimates for Natural Gas Boilers/Heaters Using CARB Source Profile No. 3

CHEMICAL NAME (excluding PAHs)	CAS	Speciation Fraction	LBS/HR	LBS/YR
FORMALDEHYDE	50000	0.1660	1.4606E-02	127.948
BENZENE	71432	0.0830	7.3029E-03	63.974
TOLUENE	108883	0.0415	3.6515E-03	31.987
CYCLOHEXANE	110827	0.0207	1.8257E-03	15.993
HEXANE	110543	0.0207	1.8257E-03	15.993

Source: CDM 2007.

Table 3-3b
PAH Emissions for Natural Gas Boilers/Heaters Using SCAQMD Emission Factors

Source	CAS	EFs (lbs/MMcf)	LBS/HR	LBS/YR
Cogeneration Plant Boiler	1151	0.0004	6.4E-06	5.61E-02
Utility Plant Boilers (each)	1151	0.0004	6.4E-06	5.62E-02
Utility Plant Heater/Chillers (each)	1151	0.0004	3.05E-06	2.67E-02

Source: CDM 2007.

Table 3-4
TAC Emission Estimates for Diesel Standby ICE
Using CARB Source Profile No. 818 (TOG) and 116 (PM)[1]

CHEMICAL NAME	CAS	Speciation Fraction	WEIGHT % of TOG	LBS/HR	LBS/YR
FORMALDEHYDE	50000	0.1471	14.714	0.0191	1.1847
BENZENE	71432	0.0200	2.000998	0.0026	0.1611
METHYL ETHYL KETONE (MEK) (2-BUTANONE)	78933	0.0148	1.476998	0.0019	0.1189
TOLUENE	108883	0.0147	1.473	0.0019	0.1186
M-XYLENE	108383	0.0061	0.611	0.0008	0.0492
O-XYLENE	95476	0.0034	0.335	0.0004	0.0270
P-XYLENE	106423	0.0010	0.095	0.0001	0.0076
STYRENE	100425	0.0006	0.058	0.0001	0.0047
METHYL ALCOHOL	67561	0.0003	0.03	0.00004	0.0024
VANADIUM	7440622	0.0055	0.55	0.0004	0.0250
Diesel PM	9901			7.320E-02	4.538

Source: CDM 2007.

[1] The speciated TACs were used for acute risk analysis only. For cancer risk, Diesel PM was the only TAC to represent the diesel exhaust in the analysis as recommended in Risk Assessment Procedures to Evaluate Particulate Emissions From Diesel-Fueled Engines, OEHHA Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments.

Section 4
Health Risk Analysis by HARP Modeling

HARP is software developed by CARB for HRA analysis under the OEHHA Guideline for Air Toxics Hot Spots Program. It basically comprises of three modules, i.e. emission inventory, dispersion modeling, and risk analysis. The emission inventory was developed by entering the emission estimates from the previous section. The dispersion modeling module needs the input of all source information, such as stack locations, heights, diameters, exhaust temperatures, flowrates, and dimensions of any on-site buildings close to any stacks, as well as receptor locations and terrain elevations. The output will be the ground concentrations of TACs at each receptor. The risk module will combine the emission rates and dispersion results to determine health risks for each receptor. The following sections will discuss in details to set up dispersion modeling inputs, and risk analysis using HARP Version 1.3.

4.1 Dispersion Module Setup

Two maps were used to help the setup of dispersion module, the site drawing from client and the aerial map downloaded from TerraServer as attached in Appendix D and E. The terrain file was downloaded as a DEM file from USGS website. The origin of facility UTM coordinates was determined at the hospital ER entrance from the download TerraServer aerial map. Then with site drawing, each source location was determined relative to the facility origin using the site map scale. The coordinates of the property line was determined by measuring some points on fenceline using site drawing scale. Since the hospital is located in an area with terrain changes, a DEM file, downloaded from USGS website was imported to determine the terrain elevation of the area. Stack dimensions and exhaust parameters were obtained from equipment spec sheets from manufacturers. Based on SCAQMD guideline on HRA for an area ranging between 25 and 100 acres, a minimum of 100-meter spacing was chosen for grid receptors outside property fenceline and a maximum of 75-meter spacing for grid receptors on fenceline. And the grid receptor system outside hospital property line was extended to 1200 meters on each direction from the facility origin. The meteorological data file was downloaded from SCAQMD website.

4.2 Risk Module Setup

The risk module combined the results of emission data and modeled TACs ground concentrations from the previous two modules, to calculate cancer, chronic and acute risks for all receptors on and outside fenceline. Except inhalation pathway, four other pathways were chosen in the analysis as recommended by OEHHA guideline, i.e. the home grown produce, the dermal, soil ingestion and mother's milk pathways. Since the closest residential receptor is immediately to the fenceline at the hospital northwest corner and residence normally has higher risks than workers at same location, the fenceline receptors were all modeled as residential area.

Section 5
Rules Evaluation

The applicable rules are SCAQMD rule 1401 and 1402 for toxic air emissions during operations of the cogeneration plant project. The rules require that for existing facilities the cumulative cancer risks should not exceed 25 per million, and cumulative HI for chronic non-cancer and acute risks should not exceed 3.0 for any target organ. The incremental project cancer risks should not exceed 10 per million, and incremental HI for chronic non-cancer and acute risks should not exceed 1.0 for any target organ. In addition, the cancer burden should not exceed 0.5 if individual cancer risks exceeds 1 per million.

Section 6
Analysis and Conclusions

The health impacts were evaluated for cancer, chronic and acute risks using HARP on 1239 receptors, including 10 sensitive receptors, 38 fenceline receptors, 625 grid receptors and 566 population census receptors. For the proposed future project with 3 natural gas ICEs, the modeled residential peak risks of cancer, chronic and acute impacts were found at the closest residential area just north of the cogeneration plant. The risk values are summarized in **Table 6-1**, and the residential peak cancer risk was calculated to be 5.7 per million which is lower than the SCAQMD CEQA threshold of 10 per million.

The cumulative impacts were also evaluated by modeling all existing and future equipment at both the utility plant and the cogeneration plant. The peak cumulative cancer risk was found about 20.6 in a million and also occurred at the receptor north of and nearest to the cogeneration plant. Note that the natural gas ICEs in the cogeneration plant are assumed to have oxidation catalysts, while all other existing boilers and heaters are not assumed to have add-on VOC or PAH controls. The new natural gas ICEs were modeled with 70% PAHs control efficiency, which was assumed same as the control efficiency for HC from manufacture test data.

The cumulative His for both non-cancer chronic and acute risks were modeled, and the risk results are lower than the HI thresholds of 1.0 at all receptors. In addition, the cancer burden was evaluated as required by Rules 1401 if the incremental cancer risks exceed 1 per million. A total of 566 census receptors were found in a circle area with a 2500-meter radius, and the highest cancer burden was determined at 0.005, which is far below SCAQMD's threshold of 0.5.

The breakdown of cumulative risk contributions by each chemical were provided for the peak risk receptors in **Tables 6-2** through **6-4**, for cancer, chronic non-cancer and acute risks, respectively. The main cancer risk drivers include the following four chemicals: PAHs, formaldehyde, benzene, and diesel PM. The proposed project incremental risk breakdown by chemical are presented in **Tables 6-5** through **6-7**, for cancer, chronic non-cancer, and acute risks respectively. Additional backup information and data are contained in Appendices E through L.

Table 6-1
Risks Summary from HARP Modeling

Risk Type	SCAQMD Threshold		Facility Cumulative Risks	Project Incremental Risks	Significant (Yes/No)	
	Cumulative	Increment			Cumulative	Increment
MICR (per million individuals)	25	10	20.6	5.6	No	No
HIC (chronic)	3.0	1.0	0.16	0.07	No	No
HIA (acute)	3.0	1.0	0.11	0.02	No	No

Source: CDM 2007.

Table 6-2
Facility Cumulative Cancer Risk Breakdown by TAC at the Peak Cancer Risk Receptor

CAS	Name	INHAL	DERM	SOIL	MOTHER	VEG	ORAL[1]	TOTAL	%
1151	PAHs-w/o	7.13E-08	2.37E-06	3.55E-07	0.00E+00	8.68E-06	1.14E-05	1.15E-05	56
50000	Formaldehyde	3.71E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.71E-06	18
71432	Benzene	3.44E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E-06	17
9901	DieselExhPM	1.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E-06	9
75070	Acetaldehyde	5.58E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.58E-08	0
91203	Naphthalene	3.63E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.63E-10	0
1210	Xylenes	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
74851	Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
95476	o-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
95636	1,2,4TriMeBenze	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
100414	Ethyl Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
108383	m-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
108883	Toluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
110543	Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
110827	Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
115071	Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
123728	Butyraldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
107028	Acrolein	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
1330207	XYLENES	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
67561	Methanol	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
78933	MEK	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
100425	Styrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
106423	p-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
7440622	Vanadium	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
Total by Pathway		9.18E-06	2.37E-06	3.55E-07	0.00E+00	8.68E-06	1.14E-05	**2.06E-05**	100

Source: CDM 2007.
[1] ORAL is the subtotal of non-INHAL risks.

Table 6-3
Facility Cumulative Chronic Risk Breakdown by TAC at the Peak Chronic Risk Receptor

CAS	NAME	CNS	DEVEL	ENDO	EYE	GILV	KIDN	REPRO	RESP	BLOOD	MAX
50000	Formaldehyde	0.00E+00	0.00E+00	0.00E+00	1.56E-01	0.00E+00	0.00E+00	0.00E+00	1.56E-01	0.00E+00	1.56E-01
107028	Acrolein	0.00E+00	0.00E+00	0.00E+00	3.74E-03	0.00E+00	0.00E+00	0.00E+00	3.74E-03	0.00E+00	3.74E-03
75070	Acetaldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.64E-03	0.00E+00	1.64E-03
71432	Benzene	1.52E-03	1.52E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-03	1.52E-03
9901	DieselExhPM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.16E-04	0.00E+00	9.16E-04
115071	Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.88E-04	0.00E+00	2.88E-04
108883	Toluene	1.28E-04	1.28E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-04	0.00E+00	1.28E-04
1210	Xylenes	1.39E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E-05	0.00E+00	1.39E-05
95476	o-Xylene	6.93E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.93E-06	0.00E+00	6.93E-06
108383	m-Xylene	6.93E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.93E-06	0.00E+00	6.93E-06
110543	Hexane	2.74E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.74E-06
100414	Ethyl Benzene	0.00E+00	2.71E-06	2.71E-06	0.00E+00	2.71E-06	2.71E-06	0.00E+00	0.00E+00	0.00E+00	2.71E-06
1330207	XYLENES	2.34E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.34E-06	0.00E+00	2.34E-06
91203	Naphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.92E-07	0.00E+00	8.92E-07
78933	MEK	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-08	0.00E+00	0.00E+00	1.52E-08
106423	p-Xylene	1.39E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E-09	0.00E+00	1.39E-09
100425	Styrene	6.62E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.62E-10
67561	Methanol	0.00E+00	7.71E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.71E-11
7440622	Vanadium	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1151	PAHs-w/o	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
110827	Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
95636	1,2,4TriMeBenze	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
123728	Butyraldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
74851	Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL by Organ		1.68E-03	1.65E-03	2.71E-06	1.60E-01	2.71E-06	2.71E-06	1.52E-08	1.63E-01	1.52E-03	**1.63E-01**

Source: CDM 2007.

Table 6-4
Facility Cumulative Acute Risks Breakdown by TACs at the Peak Acute Risk Receptor

CAS	NAME	CNS	DEVEL	EYE	IMMUN	REPRO	RESP	BLOOD	MAX
50000	Formaldehyde	0.00E+00	0.00E+00	7.88E-02	7.88E-02	0.00E+00	7.88E-02	0.00E+00	7.88E-02
107028	Acrolein	0.00E+00	0.00E+00	3.15E-02	0.00E+00	0.00E+00	3.15E-02	0.00E+00	3.15E-02
71432	Benzene	0.00E+00	8.23E-04	0.00E+00	8.23E-04	8.23E-04	0.00E+00	8.23E-04	8.23E-04
7440622	Vanadium	0.00E+00	0.00E+00	3.36E-04	0.00E+00	0.00E+00	3.36E-04	0.00E+00	3.36E-04
108883	Toluene	2.25E-05	2.25E-05	2.25E-05	0.00E+00	2.25E-05	2.25E-05	0.00E+00	2.25E-05
78933	MEK	0.00E+00	0.00E+00	9.32E-06	0.00E+00	0.00E+00	9.32E-06	0.00E+00	9.32E-06
1210	Xylenes	0.00E+00	0.00E+00	4.69E-06	0.00E+00	0.00E+00	4.69E-06	0.00E+00	4.69E-06
108383	m-Xylene	0.00E+00	0.00E+00	4.64E-06	0.00E+00	0.00E+00	4.64E-06	0.00E+00	4.64E-06
95476	o-Xylene	0.00E+00	0.00E+00	3.57E-06	0.00E+00	0.00E+00	3.57E-06	0.00E+00	3.57E-06
1330207	XYLENES	0.00E+00	0.00E+00	1.98E-06	0.00E+00	0.00E+00	1.98E-06	0.00E+00	1.98E-06
106423	p-Xylene	0.00E+00	0.00E+00	3.82E-07	0.00E+00	0.00E+00	3.82E-07	0.00E+00	3.82E-07
100425	Styrene	0.00E+00	0.00E+00	2.40E-07	0.00E+00	0.00E+00	2.40E-07	0.00E+00	2.40E-07
67561	Methanol	9.01E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.01E-08
9901	DieselExhPM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1151	PAHs-w/o	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
75070	Acetaldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
91203	Naphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
100414	Ethyl Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
110543	Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
110827	Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
115071	Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
95636	1,2,4TriMeBenze	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
123728	Butyraldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
74851	Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL by Organ		2.26E-05	8.45E-04	1.11E-01	7.96E-02	8.45E-04	1.11E-01	8.23E-04	**1.11E-01**

Source: CDM 2007.

Table 6-5
Proposed Project Incremental Cancer Risk Breakdown by TAC
at the Peak Cancer Risk Receptor

CAS	NAME	INHAL	DERM	SOIL	MOTHER	VEG	ORAL[1]	TOTAL	%
1151	PAHs-w/o	1.87E-08	6.21E-07	9.31E-08	0.00E+00	2.27E-06	2.99E-06	3.01E-06	54
50000	Formaldehyde	1.54E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-06	28
71432	Benzene	9.98E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.98E-07	18
75070	Acetaldehyde	2.72E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.72E-08	0
1210	Xylenes	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
74851	Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
95476	o-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
95636	1,2,4TriMeBenze	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
100414	Ethyl Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
108383	m-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
108883	Toluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
110543	Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
110827	Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
115071	Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
123728	Butyraldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
86737	Fluorene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
Total by Pathway		2.59E-06	6.21E-07	9.31E-08	0.00E+00	2.27E-06	2.99E-06	**5.58E-06**	100

Source: CDM 2007.

[1] ORAL is the subtotal of non-INHAL risks.

Table 6-6
Proposed Project Incremental Chronic Risks Breakdown by TAC at the Peak Chronic Risk Receptor

CAS	NAME	CNS	DEVEL	ENDO	EYE	GILV	KIDN	RESP	BLOOD	MAX	%
50000	Formaldehyde	0.00E+00	0.00E+00	0.00E+00	6.50E-02	0.00E+00	0.00E+00	6.50E-02	0.00E+00	6.50E-02	98
75070	Acetaldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.03E-04	0.00E+00	8.03E-04	1
71432	Benzene	4.41E-04	4.41E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.41E-04	4.41E-04	1
115071	Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-04	0.00E+00	1.36E-04	0
108883	Toluene	3.21E-05	3.21E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.21E-05	0.00E+00	3.21E-05	0
1210	Xylenes	6.88E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.88E-06	0.00E+00	6.88E-06	0
95476	o-Xylene	3.44E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E-06	0.00E+00	3.44E-06	0
108383	m-Xylene	3.44E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E-06	0.00E+00	3.44E-06	0
100414	Ethyl Benzene	0.00E+00	1.20E-06	1.20E-06	0.00E+00	1.20E-06	1.20E-06	0.00E+00	0.00E+00	1.20E-06	0
110543	Hexane	6.88E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.88E-07	0
1151	PAHs-w/o	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
74851	Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
95636	1,2,4TriMeBenze	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
110827	Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
123728	Butyraldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
86737	Fluorene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0
TOTAL		4.88E-04	4.75E-04	1.20E-06	6.50E-02	1.20E-06	1.20E-06	6.60E-02	4.41E-04	**6.60E-02**	100

Source: CDM 2007.

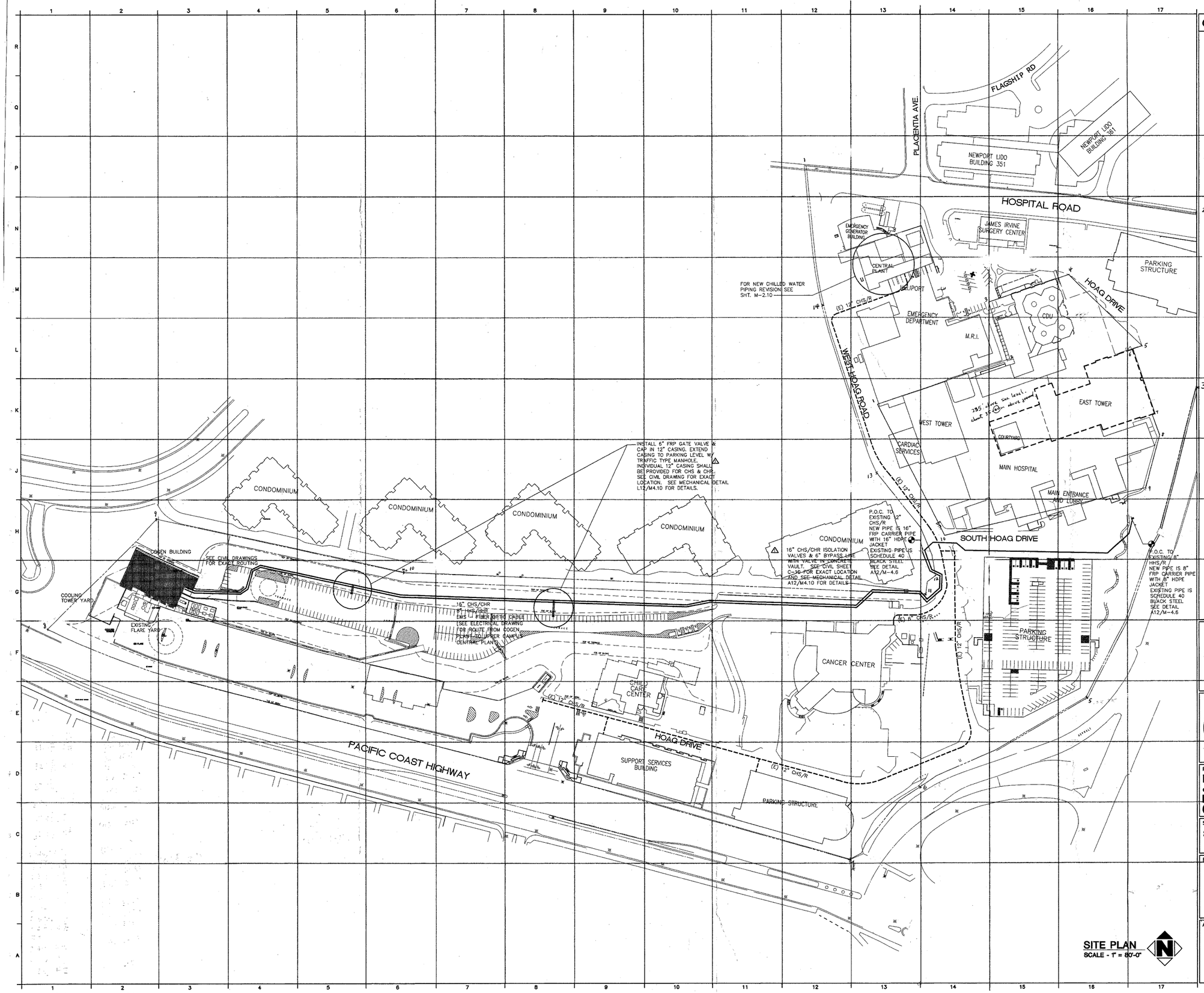
Table 6-7
Proposed Project Incremental Acute Risk Breakdown by TACs at the Peak Acute Risk Receptor

CAS	NAME	CNS	DEVEL	EYE	IMMUN	REPRO	RESP	BLOOD	MAX
50000	Formaldehyde	0.00E+00	0.00E+00	2.22E-02	2.22E-02	0.00E+00	2.22E-02	0.00E+00	2.22E-02
71432	Benzene	0.00E+00	1.46E-04	0.00E+00	1.46E-04	1.46E-04	0.00E+00	1.46E-04	1.46E-04
108883	Toluene	2.78E-06	2.78E-06	2.78E-06	0.00E+00	2.78E-06	2.78E-06	0.00E+00	2.78E-06
1210	Xylenes	0.00E+00	0.00E+00	2.34E-06	0.00E+00	0.00E+00	2.34E-06	0.00E+00	2.34E-06
95476	o-Xylene	0.00E+00	0.00E+00	1.17E-06	0.00E+00	0.00E+00	1.17E-06	0.00E+00	1.17E-06
108383	m-Xylene	0.00E+00	0.00E+00	1.17E-06	0.00E+00	0.00E+00	1.17E-06	0.00E+00	1.17E-06
1151	PAHs-w/o	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
74851	Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
75070	Acetaldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
95636	1,2,4TriMeBenze	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
100414	Ethyl Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
110543	Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
110827	Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
115071	Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
123728	Butyraldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
86737	Fluorene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
TOTAL by Organ		2.78E-06	1.48E-04	2.22E-02	2.23E-02	1.48E-04	2.22E-02	1.46E-04	**2.23E-02**

Source: CDM 2007.

Appendix A
Site Drawing

GENERAL NOTES



SITE PLAN
SCALE - 1" = 80'-0"

REGISTERED PROFESSIONAL ENGINEER ROBERT OKAJIMA M29915 06/30/04 MECHANICAL STATE OF CALIFORNIA

JLH JL HENGSTLER ASSOCIATES
MECHANICAL & ELECTRICAL ENGINEERS
100 S. ANAHEIM BLVD. #150, ANAHEIM, CA. 92805
(714) 490-5555 FAX: (714) 490-5560
E-mail: info@jlhengineers.com

LICENSED ARCHITECT NEIL A. RINELLA 23302 REN. 3-31-05 STATE OF CALIFORNIA

TAYLOR & ASSOCIATES
2220 NORTH UNIVERSITY DRIVE
NEWPORT BEACH, CALIFORNIA 92660
~~949.574.1325~~ ~~FAX: 949.574.1330~~
ARCHITECTURE AND INTERIOR DESIGN

PROJECT:
HOAG MEMORIAL PRESBYTERIAN
ONE HOAG DRIVE, NEWPORT BEACH, CA, 92658-6100
LOWER CAMPUS - CENTRAL PLANT (COGEN BUILDING)

SHEET TITLE:
SITE PLAN - MECHANICAL UTILITIES

REVISIONS/SUBMITTALS:	DATE:
1 OSHPD RESUBMITTAL	07/15/03

PROJECT NUMBER: 1542.20
PROJECT ARCHITECT: N. RINELLA
DRAWN BY: T. OKAJIMA
AGENCY SUBMITTAL DATE:
ISSUED FOR BIDS:
ISSUED FOR CONSTRUCTION:
SCALE: 1" = 80'-0"

AGENCY APPROVALS:
REVIEWED IN ACCORDANCE WITH THE REQUIREMENTS OF T24, CCR
NOV 10 2003
Office of Statewide Health Planning & Development Facilities Development Division

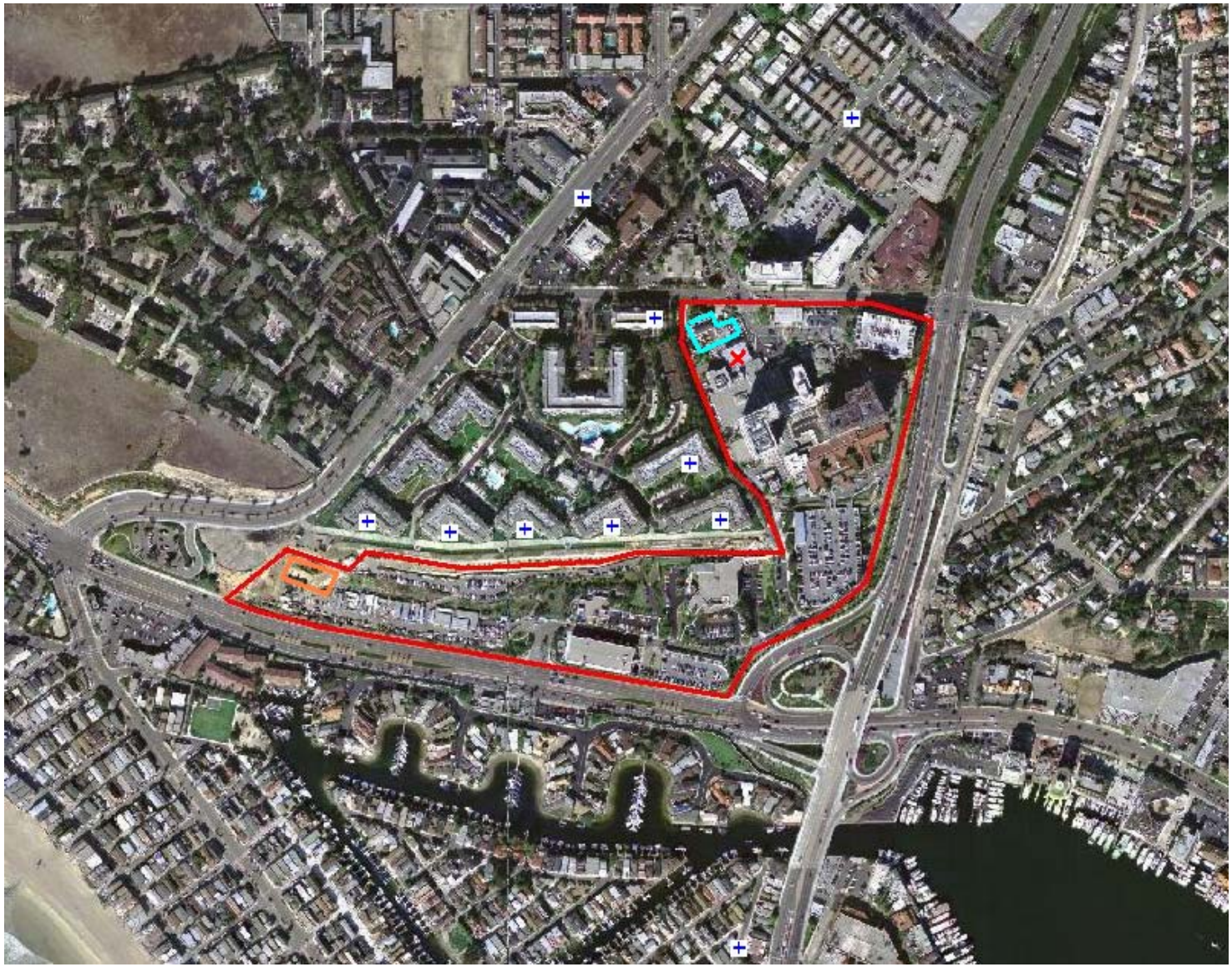
PROJECT: HOAG MEMORIAL HOSPITAL PRESBYTERIAN LOWER CAMPUS - CENTRAL PLANT

SHEET NUMBER: M-1.1

11-11-03 FOR CONSTRUCTION

F:\3300\3300.015.05\MEP\M-1.1.DWG DATE PLOTTED: 07/16/03 TIME PLOTTED: 11:31

Appendix B
Aerial Map


Hoag Hospital
Hospital Property line
Sensitive Receptor
Cogen Plant
Central Utility Plant

Appendix C
Equipment Manufacturer Data

DRESSER Waukesha

SAA No. 2003- 14A

CERTIFICATION OF ENGINEERING APPROVAL

Are Special Codes or Equipment Required for this Approval? Y

List: Code 1102: Hot Water Cooling System - 235°F JW
Code 1130: Breather System Modification
WPS Code 1105/1105A: Engomatic Control System Required

Engineering Approval:

Ignition Timing 21 °BTDC Carb Setting (Lambda or MAFR) 0.38% CO

When operating per the site conditions listed with a commercial quality natural gas consisting of 93% Methane by volume, WKI(TM) = 91, and 900 Btu/ft3 SLHV, WED approves a continuous rating of 2080 BHP @1200 RPM with 8% overload allowed 2hrs/24hrs.

For the site conditions listed and per the above stated fuel with the engine operating at 2080 BHP @1200 RPM, the following heat rejection and emissions are guaranteed to be:

BSFC:(Btu/bhp-hr)	7910±4%
Induction Air:(SCFM)	3151±6%
Exhaust Flow:(lb/hr)	14026±6%
Exhaust Temp:(°F)	1201±50°
Heat To:(Btu/hr x1000)	
Jacket Water:	4678±6%
Lube Oil:	725±6%
Intercooler:	519±6%
Total Exhaust:	4435±6%
Radiation:	801±25%
Emissions Not To Exceed:	
*NOx:(g/bhp-hr)	13.0
CO:(g/bhp-hr)	9.0
NMHC:(g/bhp-hr)	0.50

* NOx emission at absolute humidity of 75 grains H2O/lb dry air.

Fuel must conform to WED "Gaseous Fuel Specification" S7884-7.

Signed: Jayson Ewald Date: 01/28/2003

Signed: Mark Schreiner Date: 01/28/2003

EMISSION CONTROL EQUIPMENT SPECIFICATION
380 Lapp Road, Malvern, P A 19355
Tel: 610.971.3100 Fax: 610.971.3116

DTE ENERGY

Project: Hoag Hospital

Jck Cole

Date	6/25/2003
Quote No.	463-3-059
Email:	colem@dteenergy.com
Phone:	562-377-3062
Fax:	562-377-3061

ENGINE DATA	Rich Burn
Engine Mfg:	Waukesha
Engine Model:	P9390GSI
Bhp:	2080
RPM:	1200
Load:	100%
Fuel:	Natural Gas
Temp into Catalyst, °F:	1201
Operating Hours, hrs/yr:	8760

ENGINE PREFORMANCE	
Exhaust Flow, acfm:	9910
Exhaust Flow, scfm:	3102
Exhaust Flow, scfh:	186148
Exhaust Flow, lb/hr:	14033
Exhaust MW:	28.6

TYPICAL (Rich Burn)	MW		
Ar, vol %:	39.9		-
N2, vol %:	28.0		79.70
O2, vol %:	32.0		0.30
H2O, vol%:	18.0		10.00
CO2, vol %:	44.0		10.00

EMISSIONS DATA	PRE	POST	% Reduction
NOx as NO2, g/Bhp-hr:	13.00	0.15	98.8%
NOx as NO2, lb/hr:	59.62	0.69	
NOx as NO2, tons/yr:	261.15	3.01	
NOx as NO2, ppmv:	2,643.28	30.50	
x as NO2, ppmvd @ 15% O2:	842.54	9.72	
CO, g/Bhp-hr:	9.00	0.60	93.3%
CO, lb/hr:	41.28	2.75	
CO, tons/yr:	180.80	12.05	
CO, ppmv:	3,006.37	200.42	
CO, ppmvd @ 15% O2:	958.27	63.88	
THC as CH4, g/Bhp-hr:	2.00	0.15	92.5%
THC as CH4, lb/hr:	9.17	0.69	
THC as CH4, tons/yr:	40.18	3.01	
THC as CH4, ppmv:	1,169.14	87.69	
THC as CH4, ppmvd @ 15% O2:	372.66	27.95	
NMHC as CH4, g/Bhp-hr:	0.50	0.15	70.0%
NMHC as CH4, lb/hr:	2.29	0.69	
NMHC as CH4, tons/yr:	10.04	3.01	
NMHC as CH4, ppmv:	292.29	87.69	
NMHC as CH4, ppmvd @ 15% O2:	93.17	27.95	

SCOPE OF SUPPLY	DualOx 2020 CC18-1A2
Exhaust Line Size, (inches)	18
Attenuation type	None
Length, approx (inches)...C	72
Width, approx (inches)...A	48
Height: approx (inches)...B	52
Weight, estimated (pounds)	1700
Housing:	Carbon
Element(s) (23x24inches)	4
Back Pressure estimated (inches H2O)	3
Net Price:(each)	$29,256.50
Delivery: ARO	6-8 Weeks

V. Kammerer, Engine Industries Sales Manager...281-353-2500..fax: 281-288-4550..email: kammew@jmusa.com

...ers and valid for 30 days from date of quote, FOB point of Manufacture, excludes any applicable duties and taxes. Terms, net 30 days from date of invoice as offered under Jm's General Terms and Conditions. Warranty 13 months from date of shipment or 12 months from date of start-up. Written notice required. Maximum service temperature 1350 degree F. Minimum operating temperature 850 degrees F.

Data above calculated from engine manufacturers data corresponding to catalyst converter settings. A slightly rich to stoichiometric air fuel ratio is required (Oxygen content in exhaust of 0.25% - 0.75%) oxygen sensor millivolts approximately 700 to 800, or Lambda of 0.97 to 0.99)

Table / Engine Rich burn

JM

Johnson Matthey

TECHNICAL DATA

Open Generator Set - - 1800 rpm/60 Hz/480 Volts	DM6221	
Package Performance		
Genset Power rating with fan	400 ekW	
Genset Power rating @ 0.8 pf	500 kVA	
Fuel Consumption		
100% load with fan	109.9 L/hr	29.0 Gal/hr
75% load with fan	80.6 L/hr	21.3 Gal/hr
50% load with fan	56.0 L/hr	14.8 Gal/hr
Cooling System		
Air flow restriction (system)	0.12 kPa	0.48 in. water
Engine Coolant capacity with radiator/exp. tank	54.5 L	14.4 Gal
Engine coolant capacity	20.8 L	5.5 Gal
Radiator coolant capacity	33.7 L	8.9 Gal
Exhaust System		
Combustion air inlet flow rate	36.3 m³/min	1281.9 cfm
Exhaust stack gas temperature	466.5 Deg C	872 Deg F
Exhaust gas flow rate	94.4 m³/min	3333.7 cfm
Exhaust flange size (internal diameter)	152,4 mm	6.0 in
Exhaust system backpressure (maximum allowable)	6.7 kPa	26.9 in. water
Heat Rejection		
Heat rejection to coolant (total)	149 kW	8474 Btu/min
Heat rejection to exhaust (total)	399 kW	22691 Btu/min
Heat rejection to atmosphere from engine	74 kW	4208 Btu/min
Heat rejection to atmosphere from generator	27.28 kW	1551.41 Btu/min
Alternator		
Motor starting capability @ 30% voltage dip	765 skVA	
Frame	498	
Temperature Rise	130 Deg C	266 Deg F
Lube System		
Sump refill with filter	38.0 L	10.0 Gal
Emissions		
Nox g/hp-hr (not to exceed)	5.46 g/bhp-hr	
CO g/hp-hr (not to exceed)	.32 g/bhp-hr	
HC g/hp-hr (not to exceed)	.11 g/bhp-hr	
PM g/hp-hr (not to exceed)	.062 g/bhp-hr	

Ambient capability at 200 m (660 ft) above sea level. For ambient capability at other altitudes, consult your Caterpillar dealer. Air flow restriction (system) is added to existing restriction from factory.
Generator temperature rise is based on a 40° C (104° F) ambient per NEMA MG1-32.
Emissions data measurements are consistent with those described in EPA CFR 40 Part 89 Subpart D & E and ISO8178-1 for measuring HC, CO, PM, NOx. Data shown is based on steady state operating conditions of 77 deg F, 28.42 in HG and number 2 diesel fuel with 35 deg API and LHV of 18,390 Btu/lb.

| Diesel |

Appendix D
CARB Speciation Profile

ORGPROF	SAROAD	ORGFRAC	TOGTHC	CAS		
3	43105	0.01	1.036		ISOMERS OF HEXANE	External combustion boiler - natural gas
3	43122	0.09	1.036		ISOMERS OF PENTANE	External combustion boiler - natural gas
3	43201	0.56	1.036	74828	METHANE	External combustion boiler - natural gas
3	43204	0.04	1.036	74986	PROPANE	External combustion boiler - natural gas
3	43212	0.09	1.036	106978	N-BUTANE	External combustion boiler - natural gas
3	43220	0.06	1.036	109660	N-PENTANE	External combustion boiler - natural gas
3	43248	0.01	1.036	110827	CYCLOHEXANE	External combustion boiler - natural gas
3	43502	0.08	1.036	50000	FORMALDEHYDE	External combustion boiler - natural gas
3	45201	0.04	1.036	71432	BENZENE	External combustion boiler - natural gas
3	45202	0.02	1.036	108883	TOLUENE	External combustion boiler - natural gas

ORGPROF	SAROAD	ORGFRAC	TOGTHC	CAS		
719	43105	0.0002	0.99		ISOMERS OF HEXANE	ICE-reciprocating-natural gas
719	43106	0.0004	0.99		ISOMERS OF HEPTANE	ICE-reciprocating-natural gas
719	43107	0.0002	0.99		ISOMERS OF OCTANE	ICE-reciprocating-natural gas
719	43108	0.0001	0.99		ISOMERS OF NONANE	ICE-reciprocating-natural gas
719	43109	0.0002	0.99		ISOMERS OF DECANE	ICE-reciprocating-natural gas
719	43120	0.0026	0.99		ISOMERS OF BUTENE	ICE-reciprocating-natural gas
719	43122	0.0013	0.99		ISOMERS OF PENTANE	ICE-reciprocating-natural gas
719	43201	0.7663998	0.99	74828	METHANE	ICE-reciprocating-natural gas
719	43202	0.1399	0.99	74840	ETHANE	ICE-reciprocating-natural gas
719	43203	0.0063	0.99	74851	ETHYLENE	ICE-reciprocating-natural gas
719	43204	0.0291	0.99	74986	PROPANE	ICE-reciprocating-natural gas
719	43205	0.0169	0.99	115071	PROPYLENE	ICE-reciprocating-natural gas
719	43206	0.0032	0.99	74862	ACETYLENE	ICE-reciprocating-natural gas
719	43212	0.01	0.99	106978	N-BUTANE	ICE-reciprocating-natural gas
719	43213	0.0001	0.99	106989	1-BUTENE	ICE-reciprocating-natural gas
719	43214	0.0043	0.99	75285	ISOBUTANE	ICE-reciprocating-natural gas
719	43215	0.0002	0.99	115117	ISOBUTYLENE	ICE-reciprocating-natural gas
719	43216	0.0013	0.99	624646	TRANS-2-BUTENE	ICE-reciprocating-natural gas
719	43217	0.0002	0.99	590181	CIS-2-BUTENE	ICE-reciprocating-natural gas
719	43220	0.0013	0.99	109660	N-PENTANE	ICE-reciprocating-natural gas
719	43224	0.0001	0.99	109671	1-PENTENE	ICE-reciprocating-natural gas
719	43226	0.0001	0.99	646048	TRANS-2-PENTENE	ICE-reciprocating-natural gas
719	43228	0.0001	0.99	513359	2-METHYL-2-BUTENE	ICE-reciprocating-natural gas
719	43230	0.0002	0.99	96140	3-METHYLPENTANE	ICE-reciprocating-natural gas
719	43231	0.0002	0.99	110543	N-HEXANE	ICE-reciprocating-natural gas
719	43232	0.0002	0.99	142825	N-HEPTANE	ICE-reciprocating-natural gas
719	43233	0.0002	0.99	111659	N-OCTANE	ICE-reciprocating-natural gas
719	43235	0.0001	0.99	111842	N-NONANE	ICE-reciprocating-natural gas
719	43238	0.0001	0.99	124185	N-DECANE	ICE-reciprocating-natural gas
719	43242	0.0002	0.99	287923	CYCLOPENTANE	ICE-reciprocating-natural gas
719	43248	0.0001	0.99	110827	CYCLOHEXANE	ICE-reciprocating-natural gas
719	43261	0.0002	0.99	108872	METHYLCYCLOHEXANE	ICE-reciprocating-natural gas
719	43262	0.0004	0.99	96377	METHYLCYCLOPENTANE	ICE-reciprocating-natural gas
719	43265	0.0001	0.99	111660	1-OCTENE	ICE-reciprocating-natural gas
719	43267	0.0001	0.99	124118	1-NONENE	ICE-reciprocating-natural gas
719	43271	0.0001	0.99	108087	2,4-DIMETHYLPENTANE	ICE-reciprocating-natural gas
719	43291	0.0001	0.99	75832	2,2-DIMETHYLBUTANE	ICE-reciprocating-natural gas
719	43295	0.0001	0.99	589344	3-METHYLHEXANE	ICE-reciprocating-natural gas
719	43298	0.0002	0.99	589811	3-METHYLHEPTANE	ICE-reciprocating-natural gas
719	43502	0.0081	0.99	50000	FORMALDEHYDE	ICE-reciprocating-natural gas
719	43503	0.0003	0.99	75070	ACETALDEHYDE	ICE-reciprocating-natural gas
719	43510	0.0002	0.99	123728	BUTYRALDEHYDE	ICE-reciprocating-natural gas
719	45102	0.0002	0.99	1330207	ISOMERS OF XYLENE	ICE-reciprocating-natural gas
719	45201	0.0011	0.99	71432	BENZENE	ICE-reciprocating-natural gas
719	45202	0.0004	0.99	108883	TOLUENE	ICE-reciprocating-natural gas
719	45203	0.0001	0.99	100414	ETHYLBENZENE	ICE-reciprocating-natural gas
719	45204	0.0001	0.99	95476	O-XYLENE	ICE-reciprocating-natural gas
719	45205	0.0001	0.99	108383	M-XYLENE	ICE-reciprocating-natural gas
719	45207	0.0002	0.99	108678	1,3,5-TRIMETHYLBENZENE	ICE-reciprocating-natural gas
719	45208	0.0001	0.99	95636	1,2,4-TRIMETHYLBENZENE	ICE-reciprocating-natural gas
719	45225	0.0001	0.99	526738	1,2,3-TRIMETHYLBENZENE	ICE-reciprocating-natural gas
719	45248	0.0001	0.99		C10 DIALKYL BENZENES	ICE-reciprocating-natural gas
719	98005	0.0001	0.99	592767	1-HEPTENE	ICE-reciprocating-natural gas
719	98039	0.0002	0.99		C10 INTERNAL ALKENES	ICE-reciprocating-natural gas
719	98040	0.0002	0.99	763291	2-METHYL-1-PENTENE	ICE-reciprocating-natural gas
719	98042	0.0004	0.99		C9 INTERNAL ALKENES	ICE-reciprocating-natural gas
719	98049	0.0001	0.99		C9 AROMATICS	ICE-reciprocating-natural gas
719	99912	0.0001	0.99	620144	1-METHYL-3-ETHYLBENZE	ICE-reciprocating-natural gas
719	99915	0.0001	0.99	611143	1-METHYL-2-ETHYLBENZE	ICE-reciprocating-natural gas

ORGPROF	SAROAD	ORGFRAC	TOGTHC	CAS		
818	43201	0.04084	1.438	74828	METHANE	Farm equipment - diesel - light & heavy - (
818	43202	0.00565	1.438	74840	ETHANE	Farm equipment - diesel - light & heavy - (
818	43203	0.14377	1.438	74851	ETHYLENE	Farm equipment - diesel - light & heavy - (
818	43204	0.00185	1.438	74986	PROPANE	Farm equipment - diesel - light & heavy - (
818	43205	0.02597	1.438	115071	PROPYLENE	Farm equipment - diesel - light & heavy - (
818	43206	0.04254	1.438	74862	ACETYLENE	Farm equipment - diesel - light & heavy - (
818	43208	0.00466	1.438	463490	1,2-PROPADIENE	Farm equipment - diesel - light & heavy - (
818	43212	0.00104	1.438	106978	N-BUTANE	Farm equipment - diesel - light & heavy - (
818	43213	0.00666	1.438	106989	1-BUTENE	Farm equipment - diesel - light & heavy - (
818	43214	0.01222	1.438	75285	ISOBUTANE	Farm equipment - diesel - light & heavy - (
818	43215	0.00922	1.438	115117	ISOBUTYLENE	Farm equipment - diesel - light & heavy - (
818	43216	0.00195	1.438	624646	TRANS-2-BUTENE	Farm equipment - diesel - light & heavy - (
818	43217	0.00094	1.438	590181	CIS-2-BUTENE	Farm equipment - diesel - light & heavy - (
818	43218	0.0019	1.438	106990	1,3-BUTADIENE	Farm equipment - diesel - light & heavy - (
818	43220	0.00175	1.438	109660	N-PENTANE	Farm equipment - diesel - light & heavy - (
818	43224	0.00324	1.438	109671	1-PENTENE	Farm equipment - diesel - light & heavy - (
818	43226	0.0004	1.438	646048	TRANS-2-PENTENE	Farm equipment - diesel - light & heavy - (
818	43227	0.0003	1.438	627203	CIS-2-PENTENE	Farm equipment - diesel - light & heavy - (
818	43229	0.00392	1.438	107835	2-METHYLPENTANE	Farm equipment - diesel - light & heavy - (
818	43230	0.00115	1.438	96140	3-METHYLPENTANE	Farm equipment - diesel - light & heavy - (
818	43231	0.00157	1.438	110543	N-HEXANE	Farm equipment - diesel - light & heavy - (
818	43232	0.00068	1.438	142825	N-HEPTANE	Farm equipment - diesel - light & heavy - (
818	43233	0.0014	1.438	111659	N-OCTANE	Farm equipment - diesel - light & heavy - (
818	43234	0.00028	1.438	563780	2,3-DIMETHYL-1-BUTENE	Farm equipment - diesel - light & heavy - (
818	43235	0.0023	1.438	111842	N-NONANE	Farm equipment - diesel - light & heavy - (
818	43238	0.00529	1.438	124185	N-DECANE	Farm equipment - diesel - light & heavy - (
818	43241	0.00261	1.438	1120214	N-UNDECANE	Farm equipment - diesel - light & heavy - (
818	43242	0.00012	1.438	287923	CYCLOPENTANE	Farm equipment - diesel - light & heavy - (
818	43248	0.00026	1.438	110827	CYCLOHEXANE	Farm equipment - diesel - light & heavy - (
818	43261	0.00068	1.438	108872	METHYLCYCLOHEXANE	Farm equipment - diesel - light & heavy - (
818	43262	0.00149	1.438	96377	METHYLCYCLOPENTANE	Farm equipment - diesel - light & heavy - (
818	43264	0.00107	1.438	108941	CYCLOHEXANONE	Farm equipment - diesel - light & heavy - (
818	43271	0.00019	1.438	108087	2,4-DIMETHYLPENTANE	Farm equipment - diesel - light & heavy - (
818	43274	0.00073	1.438	565593	2,3-DIMETHYLPENTANE	Farm equipment - diesel - light & heavy - (
818	43275	0.00115	1.438	591764	2-METHYLHEXANE	Farm equipment - diesel - light & heavy - (
818	43276	0.00298	1.438	540841	2,2,4-TRIMETHYLPENTANE	Farm equipment - diesel - light & heavy - (
818	43277	0.00036	1.438	589435	2,4-DIMETHYLHEXANE	Farm equipment - diesel - light & heavy - (
818	43279	0.00015	1.438	565753	2,3,4-TRIMETHYLPENTANE	Farm equipment - diesel - light & heavy - (
818	43291	0.00061	1.438	75832	2,2-DIMETHYLBUTANE	Farm equipment - diesel - light & heavy - (
818	43295	0.00348	1.438	589344	3-METHYLHEXANE	Farm equipment - diesel - light & heavy - (
818	43301	0.0003	1.438	67561	METHYL ALCOHOL	Farm equipment - diesel - light & heavy - (
818	43302	0.00009	1.438	64175	ETHYL ALCOHOL	Farm equipment - diesel - light & heavy - (
818	43502	0.14714	1.438	50000	FORMALDEHYDE	Farm equipment - diesel - light & heavy - (
818	43503	0.07353	1.438	75070	ACETALDEHYDE	Farm equipment - diesel - light & heavy - (
818	43504	0.0097	1.438	123386	PROPIONALDEHYDE	Farm equipment - diesel - light & heavy - (
818	43510	0.01868	1.438	123728	BUTYRALDEHYDE	Farm equipment - diesel - light & heavy - (
818	43512	0.0011	1.438		C5 ALDEHYDE	Farm equipment - diesel - light & heavy - (
818	43551	0.07507	1.438	67641	ACETONE	Farm equipment - diesel - light & heavy - (
818	43552	0.01477	1.438	78933	METHYL ETHYL KETONE (	Farm equipment - diesel - light & heavy - (
818	43559	0.00899	1.438	591786	METHYL N-BUTYL KETONE	Farm equipment - diesel - light & heavy - (
818	45105	0.00127	1.438		ISOMERS OF BUTYLBENZI	Farm equipment - diesel - light & heavy - (
818	45106	0.00135	1.438		ISOMERS OF DIETHYLBEN	Farm equipment - diesel - light & heavy - (
818	45201	0.02001	1.438	71432	BENZENE	Farm equipment - diesel - light & heavy - (
818	45202	0.01473	1.438	108883	TOLUENE	Farm equipment - diesel - light & heavy - (
818	45203	0.00305	1.438	100414	ETHYLBENZENE	Farm equipment - diesel - light & heavy - (
818	45204	0.00335	1.438	95476	O-XYLENE	Farm equipment - diesel - light & heavy - (
818	45205	0.00611	1.438	108383	M-XYLENE	Farm equipment - diesel - light & heavy - (
818	45206	0.00095	1.438	106423	P-XYLENE	Farm equipment - diesel - light & heavy - (
818	45207	0.00194	1.438	108678	1,3,5-TRIMETHYLBENZENE	Farm equipment - diesel - light & heavy - (
818	45208	0.0053	1.438	95636	1,2,4-TRIMETHYLBENZENE	Farm equipment - diesel - light & heavy - (
818	45209	0.00122	1.438	103651	N-PROPYLBENZENE	Farm equipment - diesel - light & heavy - (
818	45215	0.00006	1.438	98066	T-BUTYLBENZENE	Farm equipment - diesel - light & heavy - (
818	45220	0.00058	1.438	100425	STYRENE	Farm equipment - diesel - light & heavy - (
818	45225	0.0012	1.438	526738	1,2,3-TRIMETHYLBENZENE	Farm equipment - diesel - light & heavy - (
818	45234	0.00051	1.438	135988	(1-METHYLPROPYL)BENZE	Farm equipment - diesel - light & heavy - (
818	45235	0.00126	1.438	538932	(2-METHYLPROPYL)BENZE	Farm equipment - diesel - light & heavy - (
818	45501	0.00699	1.438	100527	BENZALDEHYDE	Farm equipment - diesel - light & heavy - (
818	90081	0.00061	1.438		ETHYLHEXANE	Farm equipment - diesel - light & heavy - (
818	98020	0.00047	1.438	637503	B-METHYLSTYRENE	Farm equipment - diesel - light & heavy - (
818	98043	0.00015	1.438	98828	ISOPROPYLBENZENE (CU	Farm equipment - diesel - light & heavy - (
818	98044	0.00188	1.438	496117	INDAN	Farm equipment - diesel - light & heavy - (
818	98046	0.00085	1.438	91203	NAPHTHALENE	Farm equipment - diesel - light & heavy - (
818	98049	0.00497	1.438		C9 AROMATICS	Farm equipment - diesel - light & heavy - (
818	98050	0.00079	1.438		C10 AROMATICS	Farm equipment - diesel - light & heavy - (
818	98078	0.01749	1.438		ALKENE KETONE	Farm equipment - diesel - light & heavy - (
818	98095	0.03799	1.438		C6 ALDEHYDES	Farm equipment - diesel - light & heavy - (
818	98132	0.00602	1.438	78784	ISOPENTANE	Farm equipment - diesel - light & heavy - (
818	98139	0.00011	1.438	584941	2,3-DIMETHYLHEXANE	Farm equipment - diesel - light & heavy - (
818	98140	0.00057	1.438	592278	2-METHYLHEPTANE	Farm equipment - diesel - light & heavy - (
818	98154	0.00086	1.438	135013	1,2-DIETHYLBENZENE (OR	Farm equipment - diesel - light & heavy - (
818	98169	0.0282	1.438	558372	3,3-DIMETHYL-1-BUTENE	Farm equipment - diesel - light & heavy - (
818	99912	0.00247	1.438	620144	1-METHYL-3-ETHYLBENZE	Farm equipment - diesel - light & heavy - (
818	99915	0.00138	1.438	611143	1-METHYL-2-ETHYLBENZE	Farm equipment - diesel - light & heavy - (
818	99999	0.13862	1.438		UNIDENTIFIED	Farm equipment - diesel - light & heavy - (

PM PROFIL	CHEMICA	SPECIE	CAS	SAROAD	WEIGHT % of PM TOTAL	WEIGHT % of PM 10		WEIGHT % of PM 2.5	
116	CALCIUM	CA	7440702	12111		5	5	5	STAT. I.C. ENGINE
116	ELEM CAF	C(E)	7440440	12116		4	4	4	STAT. I.C. ENGINE
116	IRON	FE	7439896	12126		0.55	0.55	0.55	STAT. I.C. ENGINE
116	SILICON	SI	7440213	12165		0.55	0.55	0.55	STAT. I.C. ENGINE
116	SULFATE	SO4	14808798	12403		15	15	15	STAT. I.C. ENGINE
116	VANADIU	V	7440622	12164		0.55	0.55	0.55	STAT. I.C. ENGINE
116	OTHER	OTHER	99999	12999		74.35	74.35	74.35	STAT. I.C. ENGINE

Appendix E
OEHHA TACs Table

Substance ®	Chemical▼ Abstract Service Number (CAS)	Noncancer Effects						Cancer Risk				
		Acute Inhalation REL ($\mu g/m^3$)	Date * Value Reviewed [Added]	Chronic Inhalation REL ($\mu g/m^3$)	Date * Value Reviewed [Added]	Chronic Oral REL (mg/kg/d)	Date * Value Reviewed [Added]	Inhalation Cancer Potency Factor $(mg/kg-d)^{-1}$	Date * Value Reviewed [Added]	Oral Slope Factor $(mg/kg-d)^{-1}$	Date * Value Reviewed [Added]	M* W A F
ACETALDEHYDE	75-07-0			9.0E+00	5/93			1.0E-02	4/99 [5/93]			1
ACETAMIDE	60-35-5							7.0E-02	4/99			1
ACROLEIN	107-02-8	1.9E-01	4/99	6.0E-02	1/01							--
ACRYLAMIDE	79-06-1							4.5E+00	4/99 [7/90]			1
ACRYLIC ACID	79-10-7	6.0E+03	4/99									--
ACRYLONITRILE	107-13-1			5.0E+00	12/01			1.0E+00	4/99 [1/91]			1
ALLYL CHLORIDE	107-05-1							2.1E-02	4/99			1
2-AMINOANTHRAQUINONE	117-79-3							3.3E-02	4/99			1
AMMONIA	7664-41-7	3.2E+03	4/99	2.0E+02	2/00							--
ANILINE	62-53-3							5.7E-03	4/99			1
Antimony Compounds	*7440-36-0*											--
ANTIMONY TRIOXIDE	1309-64-4											--
ARSENIC AND COMPOUNDS (INORGANIC) TAC ♣	7440-38-2 1016 [1015]	1.9E-01 AveP	4/99	3.0E-02	1/01	3.0E-04	10/00	1.2E+01 TAC	7/90	1.5E+00	10/00	1
ARSINE	7784-42-1	1.6E+02	4/99									--
ASBESTOS TAC ⌘	1332-21-4							1.9E-04 TAC⌘	3/86			333.33 ⌘
BENZENE TAC	71-43-2	1.3E+03 AveP	4/99	6.0E+01	2/00			1.0E-01 TAC	1/85			1
BENZIDINE (AND ITS SALTS) *values also apply to:*	92-87-5							5.0E+02	4/99 [1/91]			1
Benzidine based dyes	*1020*							*5.0E+02*	*4/99 [1/91]*			*1*
Direct Black 38	*1937-37-7*							*5.0E+02*	*4/99 [1/91]*			*1*
Direct Blue 6	*2602-46-2*							*5.0E+02*	*4/99 [1/91]*			*1*
Direct Brown 95 (technical grade)	*16071-86-6*							*5.0E+02*	*4/99 [1/91]*			*1*
BENZYL CHLORIDE	100-44-7	4E+02	4/99					1.7E-01	4/99			1
BERYLLIUM AND COMPOUNDS ♣	7440-41-7 [1021]			7.0E-03	12/01	2.0E-03	12/01	8.4E+00	4/99 [7/90]			1
BIS(2-CHLOROETHYL)ETHER (Dichloroethyl ether)	111-44-4							2.5E+00	4/99			1
BIS(CHLOROMETHYL)ETHER	542-88-1							4.6E+01	4/99 [1/91]			1
1,3-BUTADIENE TAC	106-99-0			2.0E+01	1/01			6.0E-01 TAC	7/92			1

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APPENDIX L - TABLE 1
OEHHA/ARB APPROVED HEALTH VALUES FOR USE IN HOT SPOT FACILITY RISK ASSESSMENTS ®

Substance ®	Chemical▼ Abstract Service Number (CAS)	Noncancer Effects						Cancer Risk				
		Acute Inhalation REL ($\mu g/m^3$)	Date • Value Reviewed [Added]	Chronic Inhalation REL ($\mu g/m^3$)	Date • Value Reviewed [Added]	Chronic Oral REL (mg/kg/d)	Date • Value Reviewed [Added]	Inhalation Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date • Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date • Value Reviewed [Added]	M• W A F
CADMIUM AND COMPOUNDS TAC ♣	7440-43-9 [1045]			2.0E-02	1/01	5.0E-04	10/00	1.5E+01 TAC	1/87			1
CARBON DISULFIDE	75-15-0	6.2E+03 AveP	4/99	8.0E+02 RfC								--
CARBON MONOXIDE	630-08-0	2.3E+04	4/99									--
CARBON TETRACHLORIDE TAC (Tetrachloromethane)	56-23-5	1.9E+03 AveP	4/99	4.0E+01	1/01			1.5E-01 TAC	9/87			1
CHLORINATED PARAFFINS	108171-26-2							8.9E-02	4/99			1
CHLORINE	7782-50-5	2.1E+02	4/99	2.0E-01	2/00							--
CHLORINE DIOXIDE	10049-04-4			6.0E-01	1/01							--
4-CHLORO-O-PHENYLENEDIAMINE	95-83-0							1.6E-02	4/99			1
CHLOROBENZENE	108-90-7			1.0E+03	1/01							--
CHLORODIFLUOROMETHANE ... (see Fluorocarbons)												
CHLOROFORM TAC	67-66-3	1.5E+02 AveP	4/99	3.0E+02	4/00			1.9E-02 TAC	12/90			1
Chlorophenols	*1060*											--
PENTACHLOROPHENOL	87-86-5							1.8E-02	4/99			1
2,4,6-TRICHLOROPHENOL	88-06-2							7.0E-02	4/99 [1/91]			1
CHLOROPICRIN	76-06-2	2.9E+01	4/99	4.0E-01	12/01							--
CHLOROPRENE	126-99-8											--
p-CHLORO-o-TOLUIDINE	95-69-2							2.7E-01	4/99			1
CHROMIUM 6+ TAC ♣ *values also apply to:*	18540-29-9			2.0E-01	1/01	2.0E-02	10/00	5.1E+02 TAC	1/86			1
Barium chromate♣	*10294-40-3*			*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*5.1E+02* TAC	*1/86*			*0.2053*
Calcium chromate♣	*13765-19-0*			*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*5.1E+02* TAC	*1/86*			*0.3332*
Lead chromate♣	*7758-97-6*			*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*5.1E+02* TAC	*1/86*			*0.1609*
Sodium dichromate♣	*10588-01-9*			*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*5.1E+02* TAC	*1/86*			*0.397*
Strontium chromate♣	*7789-06-2*			*2.0E-01*	*1/01*	*2.0E-02*	*10/00*	*5.1E+02* TAC	*1/86*			*0.2554*
CHROMIUM TRIOXIDE ♣ (as chromic acid mist)	1333-82-0			2.0E-03	1/01	2.0E-02	10/00	5.1E+02 TAC	1/86			0.52
COPPER AND COMPOUNDS	7440-50-8 [1067]	1.0E+02	4/99									--
p-CRESIDINE	120-71-8							1.5E-01	4/99			1
CRESOLS (mixtures of)	1319-77-3			6.0E+02	1/01							--
m-CRESOL	108-39-4			6.0E+02	1/01							--

APPENDIX L - TABLE 1
OEHHA/ARB APPROVED HEALTH VALUES FOR USE IN HOT SPOT FACILITY RISK ASSESSMENTS [Φ]

Substance [®]	Chemical▼ Abstract Service Number (CAS)	Noncancer Effects						Cancer Risk				
		Acute Inhalation REL ($\mu g/m^3$)	Date * Value Reviewed [Added]	Chronic Inhalation REL ($\mu g/m^3$)	Date * Value Reviewed [Added]	Chronic Oral REL (mg/kg/d)	Date * Value Reviewed [Added]	Inhalation Cancer Potency Factor $(mg/kg-d)^{-1}$	Date * Value Reviewed [Added]	Oral Slope Factor $(mg/kg-d)^{-1}$	Date * Value Reviewed [Added]	M* W A F
ETHYLENE DICHLORIDE TAC (1,2-Dichloroethane)	107-06-2			4.0E+02	1/01			7.2E-02 TAC	9/85			1
ETHYLENE GLYCOL	107-21-1			4.0E+02	4/00							--
ETHYLENE GLYCOL BUTYL ETHER … (see Glycol ethers)												
ETHYLENE OXIDE TAC (1,2-Epoxyethane)	75-21-8			3.0E+01	1/01			3.1E-01 TAC	11/87			1
ETHYLENE THIOUREA	96-45-7							4.5E-02	4/99			1
Fluorides	*1101*	*2.4E+02*	*4/99*	*1.3E+01*	*8/03*	4.0E-2	8/03					--
HYDROGEN FLUORIDE (Hydrofluoric acid)	7664-39-3	2.4E+02	4/99	1.4E+01	8/031	4.0E-2						--
FORMALDEHYDE TAC	50-00-0	9.4E+01	4/99	3.0E+00	2/00			2.1E-02 TAC	3/92			1
GASOLINE VAPORS	1110											--
GLUTARALDEHYDE	111-30-8			8.0E-02	1/01							--
GLYCOL ETHERS	1115											
ETHYLENE GLYCOL MONOBUTYL ETHER – EGBE	111-76-2	1.4E+04	4/99									--
ETHYLENE GLYCOL MONOETHYL ETHER – EGEE	110-80-5	3.7E+02 AveP	4/99[1/92]	7.0E+01	2/00							--
ETHYLENE GLYCOL MONOETHYL ETHER ACETATE – EGEEA	111-15-9	1.4E+02 AveP	4/99	3.0E+02	2/00							--
ETHYLENE GLYCOL MONOMETHYL ETHER – EGME	109-86-4	9.3E+01 AveP	4/99	6.0E+01	2/00							--
ETHYLENE GLYCOL MONOMETHYL ETHER ACETATE – EGMEA	110-49-6			9.0E+01	2/00							--
HEXACHLOROBENZENE	118-74-1							1.8E+00	4/99 [1/91]			1
HEXACHLOROCYCLOHEXANES (mixed or technical grade)	608-73-1 1120							4.0E+00	4/99 [1/91]	4.0E+00	10/00 [1/92]	1
Alpha-HEXACHLOROCYCLOHEXANE	319-84-6							4.0E+00	4/99 [1/91]	4.0E+00	10/00 [1/92]	1
beta- HEXACHLOROCYCLOHEXANE	319-85-7							4.0E+00	4/99 [1/91]	4.0E+00	10/00 [1/92]	1
Gamma-HEXACHLOROCYCLOHEXANE (Lindane)	58-89-9							1.1E+00	4/99	1.1E+00	10/00	1

APPENDIX L - TABLE 1
OEHHA/ARB APPROVED HEALTH VALUES FOR USE IN HOT SPOT FACILITY RISK ASSESSMENTS [Φ]

Substance [Φ]	Chemical▼ Abstract Service Number (CAS)	Noncancer Effects						Cancer Risk				
		Acute Inhalation REL ($\mu g/m^3$)	Date • Value Reviewed [Added]	Chronic Inhalation REL ($\mu g/m^3$)	Date • Value Reviewed [Added]	Chronic Oral REL (mg/kg/d)	Date • Value Reviewed [Added]	Inhalation Cancer Potency Factor $(mg/kg-d)^{-1}$	Date • Value Reviewed [Added]	Oral Slope Factor $(mg/kg-d)^{-1}$	Date • Value Reviewed [Added]	M• W A F
n-HEXANE	110-54-3			7.0E+03	4/00							--
HYDRAZINE	302-01-2			2.0E-01	1/01			1.7E+01	4/99 [7/90]			1
HYDROCHLORIC ACID (Hydrogen chloride)	7647-01-0	2.1E+03	4/99	9.0E+00	2/00							--
HYDROGEN BROMIDE … (see Bromine & Compounds)												
HYDROGEN CYANIDE … (see Cyanide & Compounds)												
HYDROGEN FLUORIDE … (see Fluorides)												
HYDROGEN SELENIDE … (see Selenium & Compounds)												
HYDROGEN SULFIDE	7783-06-4	4.2E+01	4/99[7/90]	1.0E+01	4/00							--
ISOPHORONE	78-59-1			2.0E+03	12/01							--
ISOPROPYL ALCOHOL (Isopropanol)	67-63-0	3.2E+03	4/99	7.0E+03	2/00							--
LEAD AND COMPOUNDS[TAC] * ♣ (inorganic) *values also apply to:*	7439-92-1 1128 [1130]							4.2E-02 TAC	4/97	8.5E-03	10/00	1
Lead acetate♣	*301-04-2*							*4.2E-02* TAC	*4/97*	*8.5E-03*	*10/00*	*0.637*
Lead phosphate♣	*7446-27-7*							*4.2E-02* TAC	*4/97*	*8.5E-03*	*10/00*	*0.7659*
Lead subacetate♣	*1335-32-6*							*4.2E-02* TAC	*4/97*	*8.5E-03*	*10/00*	*0.7696*
LINDANE ... (see gamma-Hexachlorocyclohexane)												
MALEIC ANHYDRIDE	108-31-6			7.0E-01	12/01							--
MANGANESE AND COMPOUNDS	7439-96-5 [1132]			2.0E-01	4/00							--
MERCURY AND COMPOUNDS (INORGANIC)	7439-97-6 [1133]	1.8E+00	4/99	9.0^{E}-02	2/00	3.0E-04	10/00 [1/92]					--
Mercuric chloride	*7487-94-7*	*1.8E+00*	*4/99*	*9.0E-02*	*2/00*	*3.0E-04*	*10/00 [1/92]*					--
MERCURY AND COMPOUNDS (ORGANIC) *values also apply to:*	N/A											
METHYL MERCURY	593-74-8											--
METHANOL	67-56-1	2.8E+04	4/99	4.0E+03	4/00							--
METHYL BROMIDE (Bromomethane)	74-83-9	3.9E+03	4/99	5.0E+00	2/00							--
METHYL tertiary-BUTYL ETHER	1634-04-4			8.0E+03	2/00			9.1E-04	11/99			1
METHYL CHLOROFORM (1,1,1-Trichloroethane)	71-55-6	6.8E+04	4/99	1.0E+03	2/00							--

APPENDIX L - TABLE 1
OEHHA/ARB APPROVED HEALTH VALUES FOR USE IN HOT SPOT FACILITY RISK ASSESSMENTS ◆

Substance ◆	Chemical▼ Abstract Service Number (CAS)	Noncancer Effects						Cancer Risk				
		Acute Inhalation REL ($\mu g/m^3$)	Date • Value Reviewed [Added]	Chronic Inhalation REL ($\mu g/m^3$)	Date • Value Reviewed [Added]	Chronic Oral REL (mg/kg/d)	Date • Value Reviewed [Added]	Inhalation Cancer Potency Factor $(mg/kg-d)^{-1}$	Date • Value Reviewed [Added]	Oral Slope Factor $(mg/kg-d)^{-1}$	Date • Value Reviewed [Added]	M• W A F
METHYL ETHYL KETONE (2-Butanone)	78-93-3	1.3E+04	4/99									--
METHYL ISOCYANATE	624-83-9			1.0E+00	12/01							--
METHYL MERCURY ... (see Mercury & Compounds)												
METHYL METHACRYLATE	80-62-6											--
4,4'-METHYLENE BIS (2-CHLOROANILINE) (MOCA)	101-14-4							1.5E+00	4/99			1
METHYLENE CHLORIDE TAC (Dichloromethane)	75-09-2	1.4E+04	4/99	4.0^{R}+02	2/00			3.5E-03 TAC	7/89			1
4,4'-METHYLENE DIANILINE (AND ITS DICHLORIDE)	101-77-9			2.0^{R}+01	12/01			1.6E+00	4/99	1.6E+00	10/00	1
METHYLENE DIPHENYL ISOCYANATE	101-68-8			7.0E-01	1/01							--
MICHLER'S KETONE (4,4'-Bis(dimethylamino)benzophenone)	90-94-8							8.6E-01	4/99			1
N-NITROSO-n-BUTYLAMINE	924-16-3							1.1E+01	4/99 [1/92]			1
N-NITROSODI-n-PROPYLAMINE	621-64-7							7.0E+00	4/99 [1/91]			1
N-NITROSODIETHYLAMINE	55-18-5							3.6E+01	4/99 [1/91]			1
N-NITROSODIMETHYLAMINE	62-75-9							1.6E+01	4/99 [1/91]			1
N-NITROSODIPHENYLAMINE	86-30-6							9.0E-03	4/99			1
N-NITROSO-N-METHYLETHYLAMINE	10595-95-6							2.2E+01	4/99 [7/90]			1
N-NITROSOMORPHOLINE	59-89-2							6.7E+00	4/99 [7/92]			1
N-NITROSOPIPERIDINE	100-75-4							9.4E+00	4/99 [7/92]			1
N-NITROSOPYRROLIDINE	930-55-2							2.1E+00	4/99 [7/90]			1
NAPHTHALENE ... (see Polycyclic aromatic hydrocarbons)												
NICKEL AND COMPOUNDS TAC ♣ *values also apply to:*	7440-02-0 [1145]	6.0E+00	4/99	5.0E-02	2/00	5.0E-02	10/00	9.1E-01 TAC	8/91			1
Nickel acetate•	*373-02-4*	*6.0E+00*	*4/99*	*5.0E-02*	*2/00*	*5.0E-02*	*10/00*	*9.1E-01* TAC	*8/91*			*0.3321*
Nickel carbonate•	*3333-39-3*	*6.0E+00*	*4/99*	*5.0E-02*	*2/00*	*5.0E-02*	*10/00*	*9.1E-01* TAC	*8/91*			*0.4945*
Nickel carbonyl•	*13463-39-3*	*6.0E+00*	*4/99*	*5.0E-02*	*2/00*	*5.0E-02*	*10/00*	*9.1E-01* TAC	*8/91*			*0.3438*
Nickel hydroxide•	*12054-48-7*	*6.0E+00*	*4/99*	*5.0E-02*	*2/00*	*5.0E-02*	*10/00*	*9.1E-01* TAC	*8/91*			*0.6332*

APPENDIX L - TABLE 1
OEHHA/ARB APPROVED HEALTH VALUES FOR USE IN HOT SPOT FACILITY RISK ASSESSMENTS ◆

Substance ◆	Chemical▼ Abstract Service Number (CAS)	Noncancer Effects						Cancer Risk				
		Acute Inhalation REL ($\mu g/m^3$)	Date * Value Reviewed [Added]	Chronic Inhalation REL ($\mu g/m^3$)	Date * Value Reviewed [Added]	Chronic Oral REL (mg/kg/d)	Date * Value Reviewed [Added]	Inhalation Cancer Potency Factor $(mg/kg-d)^{-1}$	Date * Value Reviewed [Added]	Oral Slope Factor $(mg/kg-d)^{-1}$	Date * Value Reviewed [Added]	M◆ W A F
Nickelocene◆	*1271-28-9*	*6.0E+00*	*4/99*	*5.0E-02*	*2/00*	*5.0E-02*	*10/00*	*9.1E-01* TAC	*8/91*			*0.4937*
NICKEL OXIDE◆	1313-99-1	6.0E+00	4/99	1.0E-01	2/00	5.0E-02	10/00	9.1E-01 TAC	8/91			0.7859
Nickel refinery dust from the pyrometallurgical process	*1146*	*6.0E+00*	*4/99*	*5.0E-02*	*2/00*	*5.0E-02*	*10/00*	*9.1E-01* TAC	*8/91*			*1*
Nickel subsulfide◆	*12035-72-2*	*6.0E+00*	*4/99*	*5.0E-02*	*2/00*	*5.0E-02*	*10/00*	*9.1E-01* TAC	*8/91*			*0.2443*
NITRIC ACID	7697-37-2	8.6E+01	4/99									--
NITROGEN DIOXIDE	10102-44-0	4.7E+02	4/99[1/92]									--
2-NITROPROPANE	79-46-9											--
p-NITROSODIPHENYLAMINE	156-10-5							2.2E-02	4/99			1
OZONE	10028-15-6	1.8E+02	4/99[1/92]									--
PARTICULATE EMISSIONS FROM DIESEL-FUELED ENGINES[TAC] ■	9901			5.0E+00 TAC	8/98			1.1E+00 TAC	8/98			1
PENTACHLOROPHENOL ... (see Chlorophenols)												
PERCHLOROETHYLENE[TAC] (Tetrachloroethylene)	127-18-4	2.0E+04	4/99	3.5E+01 TAC	10/91			2.1E-02 TAC	10/91			1
PHENOL	108-95-2	5.8E+03	4/99	2.0E+02	4/00							--
PHOSGENE	75-44-5	4.0E+00	4/99									--
PHOSPHINE	7803-51-2			8.0E-01	9/02							--
PHOSPHORIC ACID	7664-38-2			7.0E+00	2/00							--
PHTHALIC ANHYDRIDE	85-44-9			2.0E+01	1/01							--
PCB (POLYCHLORINATED BIPHENYLS-unspeciated mixture) [lowest risk] *	1336-36-3							7.0E-02	2/02	7.0E-02	2/02	1
PCB (POLYCHLORINATED BIPHENYLS-unspeciated mixture) [low risk]*	1336-36-3							4.0E-01	2/02	4.0E-01	2/02	1
PCB (POLYCHLORINATED BIPHENYLS - unspeciated mixture) [high risk] *	1336-36-3							2.0E+00	2/02	2.0E+00	2/02	1
PCB (POLYCHLORINATED BIPHENYLS (speciated)∇												
3,3',4,4'-TETRACHLOROBIPHENYL (77)	35298-13-3			4.0E-01	8/03	1.0E-04	8/03	1.3E+01	8/03	1.3E+01	8/03	
3,4,4',5-TETRACHLOROBIPHENYL (81)	70362-50-4			4.0E-01	8/03	1.0E-04	8/03	1.3E+01	8/03	1.3E+01	8/03	
2,3,3',4,4'- PENTACHLOROBIPHENYL (105)	32598-14-4			4.0E-01	8/03	1.0E-04	8/03	1.3E+01	8/03	1.3E+01	8/03	
2,3,4,4'5-PENTACHLOROBIPHENYL (114)	74472-37-0			8.0E-02	8/03	2.0E-05	8/03	6.5E+01	8/03	6.5E+01	8/03	
2,3'4,4',5- PENTACHLOROBIPHENYL (118)	31508-00-6			4.0E-01	8/03	1.0E-04	8/03	1.3E+01	8/03	1.3E+01	8/03	

APPENDIX L - TABLE 1
OEHHA/ARB APPROVED HEALTH VALUES FOR USE IN HOT SPOT FACILITY RISK ASSESSMENTS [1]

Substance [2]	Chemical[3] Abstract Service Number (CAS)	Noncancer Effects						Cancer Risk				
		Acute Inhalation REL ($\mu g/m^3$)	Date * Value Reviewed [Added]	Chronic Inhalation REL ($\mu g/m^3$)	Date * Value Reviewed [Added]	Chronic Oral REL (mg/kg/d)	Date * Value Reviewed [Added]	Inhalation Cancer Potency Factor $(mg/kg-d)^{-1}$	Date * Value Reviewed [Added]	Oral Slope Factor $(mg/kg-d)^{-1}$	Date * Value Reviewed [Added]	M* W A F
2',3,4,4',5- PENTACHLOROBIPHENYL (123)	65510-44-3			4.0E-01	8/03	1.0E –04	8/03	1.3E +01	8/03	1.3E +01	8/03	
3,3',4,4',5- PENTACHLOROBIPHENYL (126)	57465-28-8			4.0E-04	8/03	1.0E –07	8/03	1.3E +04	8/03	1.3E +04	8/03	
2,3,3',4,4',5-HEXACHLOROBIPHENYL (156)	38380-08-4			8.0E-02	8/03	2.0E –05	8/03	6.5E +01	8/03	6.5E +01	8/03	
2,3,3',4,4',5'-HEXACHLOROBIPHENYL (157)	69782-90-7			8.0E-02	8/03	2.0E –05	8/03	6.5E +01	8/03	6.5E +01	8/03	
2,3',4,4',5,5'-HEXACHLOROBIPHENYL (167)	52663-72-6			4.0E-00	8/03	1.0E –03	8/03	1.3E +00	8/03	1.3E +00	8/03	
3,3',4,4'5,5'- HEXACHLOROBIPHENYL (169)	32774-16-6			4.0E-03	8/03	1.0E –06	8/03	1.3E +03	8/03	1.3E +03	8/03	
2,3,3'4,4',5,5'- HEPTACHLOROBIPHENYL (189)	39635-31-9			4.0E-01	8/03	1.0 E-04	8/03	1.3E +01	8/03	1.3E +01	8/03	
POLYCHLORINATED DIBENZO-*P*-DIOXINS (PCDD) (AS 2,3,7,8-PCDD EQUIVALENT)[TAC •]	1085 1086											
2,3,7,8-TETRACHLORODIBENZO-*P*-DIOXIN[TAC]	1746-01-6			4.0E-05	2/00	1.0E-08	10/00	1.3E+05 TAC	8/86	1.3E+05 TAC	8/86	1
1,2,3,7,8-PENTACHLORODIBENZO-*P*-DIOXIN	40321-76-4			8.0E-05	2/00	2.0E-08	10/00	1.3E+05	4/99	1.3E+05	10/00	1
1,2,3,4,7,8-HEXACHLORODIBENZO-*P*-DIOXIN	39227-28-6			4.0E-04	2/00	1.0E-07	10/00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,6,7,8-HEXACHLORODIBENZO-*P*-DIOXIN	57653-85-7			4.0E-04	2/00	1.0E-07	10/00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,7,8,9-HEXACHLORODIBENZO-*P*-DIOXIN	19408-74-3			4.0E-04	2/00	1.0E-07	10/00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,4,6,7,8-HEPTACHLORODIBENZO-*P*-DIOXIN	35822-46-9			4.0E-03	2/00	1.0E-06	10/00	1.3E+03	4/99	1.3E+03	10/00	1
1,2,3,4,6,7,8,9-OCTACHLORODIBENZO-*P*-DIOXIN	3268-87-9			4.0E-02	2/00	1.0E-05	10/00	1.3E+01	4/99	1.3E+01	10/00	1
POLYCHLORINATED DIBENZOFURANS (AS 2,3,7,8-PCDD EQUIVALENT) (PCDF) [TAC •]	1080											
2,3,7,8-TETRACHLORODIBENZOFURAN	5120-73-19			4.0E-04	2/00	1.0E-07	10/00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,7,8-PENTACHLORODIBENZOFURAN	57117-41-6			8.0E-04	2/00	2.0E-07	10/00	6.5E+03	4/99	6.5E+03	10/00	1
2,3,4,7,8-PENTACHLORODIBENZOFURAN	57117-31-4			8.0E-05	2/00	2.0E-08	10/00	6.5E+04	4/99	6.5E+04	10/00	1
1,2,3,4,7,8-HEXACHLORODIBENZOFURAN	70648-26-9			4.0E-04	2/00	1.0E-07	10/00	1.3E+04	4/99	1.3E+04	10/00	1

APPENDIX L - TABLE 1
OEHHA/ARB APPROVED HEALTH VALUES FOR USE IN HOT SPOT FACILITY RISK ASSESSMENTS [1]

Substance [2]	Chemical[3] Abstract Service Number (CAS)	Noncancer Effects						Cancer Risk				
		Acute Inhalation REL ($\mu g/m^3$)	Date * Value Reviewed [Added]	Chronic Inhalation REL ($\mu g/m^3$)	Date * Value Reviewed [Added]	Chronic Oral REL (mg/kg/d)	Date * Value Reviewed [Added]	Inhalation Cancer Potency Factor $(mg/kg-d)^{-1}$	Date * Value Reviewed [Added]	Oral Slope Factor $(mg/kg-d)^{-1}$	Date * Value Reviewed [Added]	M* W A F
1,2,3,6,7,8-HEXACHLORODIBENZOFURAN	57117-44-9			4.0E-04	2/00	1.0E-07	10/00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,7,8,9-HEXACHLORODIBENZOFURAN	72918-21-9			4.0E-04	2/00	1.0E-07	10/00	1.3E+04	4/99	1.3E+04	10/00	1
2,3,4,6,7,8-HEXACHLORODIBENZOFURAN	60851-34-5			4.0E-04	2/00	1.0E-07	10/00	1.3E+04	4/99	1.3E+04	10/00	1
1,2,3,4,6,7,8-HEPTACHLORODIBENZOFURAN	67562-39-4			4.0E-03	2/00	1.0E-06	10/00	1.3E+03	4/99	1.3E+03	10/00	1
1,2,3,4,7,8,9-HEPTACHLORODIBENZOFURAN	55673-89-7			4.0E-03	2/00	1.0E-06	10/00	1.3E+03	4/99	1.3E+03	10/00	1
1,2,3,4,6,7,8,9-OCTACHLORODIBENZOFURAN	39001-02-0			4.0E-02	2/00	1.0E-05	10/00	1.3E+01	4/99	1.3E+01	10/00	1
POLYCYCLIC AROMATIC HYDROCARBON (PAH)	1150 1151											
BENZ(A)ANTHRACENE*	56-55-3							3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
BENZO(A)PYRENE*	50-32-8							3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
BENZO(B)FLUORANTHENE*	205-99-2							3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
BENZO(J)FLUORANTHENE*	205-82-3							3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
BENZO(K)FLUORANTHENE*	207-08-9							3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
CHRYSENE*	218-01-9							3.9E-02	4/99 [4/94]	1.2E-01	10/00 [4/94]	1
DIBENZ(A,H)ACRIDINE*	226-36-8							3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
DIBENZ(A,H)ANTHRACENE*	53-70-3							4.1E+00	4/99 [4/94]	4.1E+00	10/00 [4/94]	1
DIBENZ(A,J)ACRIDINE*	224-42-0							3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
DIBENZO(A,E)PYRENE*	192-65-4							3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
DIBENZO(A,H)PYRENE*	189-64-0							3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1

APPENDIX L - TABLE 1
OEHHA/ARB APPROVED HEALTH VALUES FOR USE IN HOT SPOT FACILITY RISK ASSESSMENTS ®

Substance ®	Chemical▼ Abstract Service Number (CAS)	Noncancer Effects						Cancer Risk				
		Acute Inhalation REL ($\mu g/m^3$)	Date • Value Reviewed [Added]	Chronic Inhalation REL ($\mu g/m^3$)	Date • Value Reviewed [Added]	Chronic Oral REL (mg/kg/d)	Date • Value Reviewed [Added]	Inhalation Cancer Potency Factor $(mg/kg-d)^{-1}$	Date • Value Reviewed [Added]	Oral Slope Factor $(mg/kg-d)^{-1}$	Date • Value Reviewed [Added]	M• W A F
DIBENZO(A,I)PYRENE•	189-55-9							3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1
DIBENZO(A,L)PYRENE•	191-30-0							3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1
7H-DIBENZO(C,G)CARBAZOLE•	194-59-2							3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
7,12-DIMETHYLBENZ(A)ANTHRACENE•	57-97-6							2.5E+02	4/99 [4/94]	2.5E+02	10/00 [4/94]	1
1,6-DINITROPYRENE•	42397-64-8							3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1
1,8-DINITROPYRENE•	42397-65-9							3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
INDENO(1,2,3-C,D)PYRENE•	193-39-5							3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
3-METHYLCHOLANTHRENE•	56-49-5							2.2E+01	4/99 [4/94]	2.2E+01	10/00 [4/94]	1
5-METHYLCHRYSENE•	3697-24-3							3.9E+00	4/99 [4/94]	1.2E+01	10/00 [4/94]	1
NAPHTHALENE	91-20-3			9.0E+00	4/00							--
5-NITROACENAPHTHENE•	602-87-9							1.3E-01	4/99 [4/94]	1.3E-01	10/00 [4/94]	1
6-NITROCHRYSENE•	7496-02-8							3.9E+01	4/99 [4/94]	1.2E+02	10/00 [4/94]	1
2-NITROFLUORENE•	607-57-8							3.9E-02	4/99 [4/94]	1.2E-01	10/00 [4/94]	1
1-NITROPYRENE•	5522-43-0							3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
4-NITROPYRENE•	57835-92-4							3.9E-01	4/99 [4/94]	1.2E+00	10/00 [4/94]	1
POTASSIUM BROMATE.... ... (see Bromine & Compounds)												
1,3-PROPANE SULTONE	1120-71-4							2.4E+00	4/99			1
PROPYLENE (PROPENE)	115-07-1			3.0E+03	4/00							--
PROPYLENE GLYCOL MONOMETHYL ETHER	107-98-2			7.0E+03	2/00							--
PROPYLENE OXIDE	75-56-9	3.1E+03	4/99	3.0E+01	2/00			1.3E-02	4/99 [7/90]			1
SELENIUM AND COMPOUNDS	7782-49-2 [1170]			2.0E+01	12/01							--
HYDROGEN SELENIDE	7783-07-5	5.0E+00	4/99									--
Selenium sulfide	*7446-34-6*			*2.0E+01*	*12/01*							--
SODIUM HYDROXIDE	1310-73-2	8.0E+00	4/99	4.8E+00	7/90							--

APPENDIX L - TABLE 1
OEHHA/ARB APPROVED HEALTH VALUES FOR USE IN HOT SPOT FACILITY RISK ASSESSMENTS ®

Substance ®	Chemical▼ Abstract Service Number (CAS)	Noncancer Effects						Cancer Risk				
		Acute Inhalation REL ($\mu g/m^3$)	Date * Value Reviewed [Added]	Chronic Inhalation REL ($\mu g/m^3$)	Date * Value Reviewed [Added]	Chronic Oral REL (mg/kg/d)	Date * Value Reviewed [Added]	Inhalation Cancer Potency Factor $(mg/kg\text{-}d)^{-1}$	Date * Value Reviewed [Added]	Oral Slope Factor $(mg/kg\text{-}d)^{-1}$	Date * Value Reviewed [Added]	M* W A F
STYRENE	100-42-5	2.1E+04	4/99	9.0E+02	4/00							--
SULFATES	9960	1.2E+02	4/99	2.5E+01	1/92							--
SULFUR DIOXIDE	7446-09-5	6.6E+02	4/99[1/92]	6.6E+02	1/92							--
SULFURIC ACID AND OLEUM	7664-93-9	1.2E+02	4/99	*1.0E+00*	*12/01*							--
SULFURIC ACID	*7664-93-9*	*1.2E+02*	*4/99*	1.0E+00	12/01							--
SULFUR TRIOXIDE	*7446-71-9*	*1.2E+02*	*4/99*									--
OLEUM	*8014-95-7*	*1.2E+02*	*4/99*	*1.0E+00*	*12/01*							--
1,1,2,2-TETRACHLOROETHANE	79-34-5							2.0E-01	4/99			1
TETRACHLOROPHENOLS ... (see Chlorophenols)												
2,4,5-TRICHLOROPHENOL ... (see Chlorophenols)												
2,4,6-TRICHLOROPHENOL ... (see Chlorophenols)												
THIOACETAMIDE	62-55-5							6.1E+00	4/99			1
TOLUENE	108-88-3	3.7E+04	4/99	3.0E+02	4/00							--
Toluene diisocyantates	*26471-62-5 1204*			*7.0E-02*	*1/01*			*3.9E-02*	*4/99*			*1*
TOLUENE-2,4-DIISOCYANATE	584-84-9			7.0E-02	1/01			3.9E-02	4/99			1
TOLUENE-2,6-DIISOCYANATE	91-08-7			7.0E-02	1/01			3.9E-02	4/99			1
1,1,2-TRICHLOROETHANE (Vinyl trichloride)	79-00-5							5.7E-02	4/99			1
TRICHLOROETHYLENE[TAC]	79-01-6			6.0E+02	4/00			7.0E-03 TAC	10/90			1
TRIETHYLAMINE	121-44-8	2.8E+03	4/99	2.0^{R}+02	9/02							--
URETHANE (Ethyl carbamate)	51-79-6							1.0E+00	4/99 [7/90]			1
Vanadium Compounds	*N/A*											
Vanadium (fume or dust)	*7440-62-2*	*3.0E+01*	*4/99*									--
VANADIUM PENTOXIDE	1314-62-1	3.0E+01	4/99									--
VINYL ACETATE	108-05-4			2.0E+02	12/01							--
VINYL CHLORIDE[TAC] (Chloroethylene)	75-01-4	1.8E+05	4/99					2.7E-01 TAC	12/90			1
VINYLIDENE CHLORIDE (1,1-Dichloroethylene)	75-35-4			7.0E+01	1/01							--

APPENDIX L - TABLE 1
OEHHA/ARB APPROVED HEALTH VALUES FOR USE IN HOT SPOT FACILITY RISK ASSESSMENTS ①

Substance ②	Chemical▼ Abstract Service Number (CAS)	Noncancer Effects						Cancer Risk				
		Acute Inhalation REL ($\mu g/m^3$)	Date • Value Reviewed [Added]	Chronic Inhalation REL ($\mu g/m^3$)	Date • Value Reviewed [Added]	Chronic Oral REL (mg/kg/d)	Date • Value Reviewed [Added]	Inhalation Cancer Potency Factor $(mg/kg-d)^{-1}$	Date • Value Reviewed [Added]	Oral Slope Factor $(mg/kg-d)^{-1}$	Date • Value Reviewed [Added]	M• W A F
XYLENES (mixed isomers)	1330-20-7 1210	2.2E+04	4/99	7.0E+02	4/00							--
m-XYLENE	108-38-3	2.2E+04	4/99	7.0E+02	4/00							--
o-XYLENE	95-47-6	2.2E+04	4/99	7.0E+02	4/00							--
p-XYLENE	106-42-3	2.2E+04	4/99	7.0E+02	4/00							--

Appendix F
Emission Estimates for Existing New and Old Equipment

CARB Speciation Method

VOC (lbs/day) 50 3 engines (permit)

VOC (g/s) 0.2627 Control Eff. (%) 70 [1]

Gas Consumption (scf/hr) 17640 per engine

ICE-NG

CHEMICAL NAME (excluding PAHs)	CAS	ROG/VOC Speciation Fraction	ROG/VOC Emission Rate (g/s)	Each Engine LBS/HR	Each Engine LBS/YR
1,2,4-TRIMETHYLBENZENE	95636	3.9705E-04	1.0432E-04	2.7573E-04	2.415
ACETALDEHYDE	75070	1.1911E-03	3.1294E-04	8.2716E-04	7.246
BENZENE	71432	4.3673E-03	1.1474E-03	3.0329E-03	26.568
BUTYRALDEHYDE	123728	7.9406E-04	2.0862E-04	5.5143E-04	4.831
CYCLOHEXANE	110827	3.9705E-04	1.0432E-04	2.7573E-04	2.415
ETHYLBENZENE	100414	3.9705E-04	1.0432E-04	2.7573E-04	2.415
ETHYLENE	74851	2.5013E-02	6.5717E-03	1.7370E-02	152.162
FORMALDEHYDE	50000	3.2160E-02	8.4493E-03	2.2333E-02	195.637
ISOMERS OF XYLENE	1210	7.9406E-04	2.0862E-04	5.5143E-04	4.831
M-XYLENE	108383	3.9705E-04	1.0432E-04	2.7573E-04	2.415
N-HEXANE	110543	7.9406E-04	2.0862E-04	5.5143E-04	4.831
O-XYLENE	95476	3.9705E-04	1.0432E-04	2.7573E-04	2.415
PROPYLENE	115071	6.7098E-02	1.7629E-02	4.6596E-02	408.181
TOLUENE	108883	1.5881E-03	4.1725E-04	1.1029E-03	9.661

70% NMHC control efficiency applied to PAHs (assumed same as the testing for NMHC)

PAHs	CAS	EF (lbs/MMcf)	Controlled LBS/HR	Controlled LBS/YR
PAHs	1151	0.0004	2.12E-06	1.85E-02

SCAQMD Efs http://www.aqmd.gov/prdas/pdf/COMBEM2001.pdf

BOILER-NG

AQMD Backup data for Boiler on Page 9

Parameters			
Size	16	MMBtu/hr	
Fuel Consumption	16000	cfh	
Operating Scenario	Ave.	Max.	
Load	100%	100%	
Hour/day	24	24	
Days/Week	7	7	
Days/Year	365	365	
Days/Month	30	30	
Emission Factors	Uncontrolled	Controlled	
CO	50	50	ppm
NOx	9	9	ppm
PM10	7.6	7.6	lb/mmcf
ROG	**5.5**	**5.5**	lb/mmcf
SOx	0.8	0.8	lb/mmcf

ROG Emission Rates	
LBS/HR	LBS/YR
0.09	770.88

CHEMICAL NAME	CAS	Speciation Fraction	LBS/HR	LBS/YR
FORMALDEHYDE	50000	0.1660	1.4606E-02	127.948
BENZENE	71432	0.0830	7.3029E-03	63.974
TOLUENE	108883	0.0415	3.6515E-03	31.987
ISOMERS OF HEXANE	110543	0.0207	1.8257E-03	15.993
CYCLOHEXANE	110827	0.0207	1.8257E-03	15.993
ISOMERS OF PENTANE	NA	0.1867	1.6432E-02	143.941
N-BUTANE	NA	0.1867	1.6432E-02	143.941
N-PENTANE	NA	0.1245	1.0954E-02	95.961
PROPANE	NA	0.0830	7.3029E-03	63.974

Note: CAS with NA means this chemical is not listed as a TAC in HARP database.

CHEMICAL NAME	CAS	Efs(lb/mmcf)	LBS/HR	LBS/YR
Acetaldehyde	75070	0.0031	4.9600E-05	0.434
Acrolein	107028	0.0027	4.3200E-05	0.378
Propylene	115071	0.53	8.4800E-03	74.285
Naphthalene	91203	0.0003	4.8000E-06	0.042
Xylenes	1330207	0.0197	3.1520E-04	2.761
Ethylbenzene	100414	0.0069	1.1040E-04	0.967

If chemical is
the Efs from A

Control efficiency 70%

PAHs	CAS	EF (lbs/MMcf)	LBS/HR	LBS/YR
PAHs	1151	0.0004	1.92E-06	1.68E-02

SCAQMD Efs http://www.aqmd.gov/prdas/pdf/COMBEM2001.pdf

Standby Diesel Engine

Size	400	ekW	536	bhp-hr
Operation	62	hr/yr	1-hr test/wk + 10-hr Maint/yr	
Exhaust	3334	acfm		
Release Height/Diameter	12	ft	1	ft
Fuel Consumption (100% Load	29	gal/hr		
Emission factors (Caterpillar Technical Data)				
Nox	5.46	g/bhp-hr		
CO	0.32	g/bhp-hr	LBS/HR	LBS/YR
HC	0.11	g/bhp-hr	0.130	8.052
PM	0.062	g/bhp-hr		

TACs

	CAS	EF(g/bhp-hr)	lb/hr	lb/yr
Diesel PM	9901	6.20E-02	7.320E-02	4.538

Other HC having Chronic and Acute impacts from CARB Speciation Profile 818

CHEMICAL NAME	CAS	Speciation Fraction	WEIGHT % of TOG	LBS/HR	LBS/YR
FORMALDEHYDE	50000	0.1471	14.714	0.0191	1.1847
BENZENE	71432	0.0200	2.000998	0.0026	0.1611
METHYL ETHYL KETONE (ME	78933	0.0148	1.476998	0.0019	0.1189
TOLUENE	108883	0.0147	1.473	0.0019	0.1186
M-XYLENE	108383	0.0061	0.611	0.0008	0.0492
O-XYLENE	95476	0.0034	0.335	0.0004	0.0270
P-XYLENE	106423	0.0010	0.095	0.0001	0.0076
STYRENE	100425	0.0006	0.058	0.0001	0.0047
METHYL ALCOHOL	67561	0.0003	0.03	0.00004	0.0024

Other metal PM having Acute impacts from CARB PM Speciation Profile 116

			PM10/2.5		
VANADIUM	7440622	0.0055	0.55	0.0004	0.0250

PAHs' Ef from SCAQMD-http://www.aqmd.gov/prdas/pdf/COMBEM2001.pdf

	(lb/1000 gal)	LBS/HR	LBS/YR
PAHs	0.0559	0.0016211	0.1005082

CARB Speciation Method

BOILER-NG

AQMD Backup data for Boiler on Page 9

Parameters			
Size	16.6	MMBtu/hr	
Fuel Consumption	16000	cfh	
Operating Scenario	Ave.	Max.	
Load	100%	100%	
Hour/day	24	24	
Days/Week	7	7	
Days/Year	365	365	
Days/Month	30	30	
Emission Factors	Uncontrolled	Controlled	
CO	50	50	ppm
NOx	9	9	ppm
PM10	7.6	7.6	lb/mmcf
ROG	**5.5**	**5.5**	lb/mmcf
SOx	0.8	0.8	lb/mmcf

ROG Emission Rates	
LBS/HR	LBS/YR
0.09	770.88

CHEMICAL NAME	CAS	Speciation Fraction	LBS/HR	LBS/YR
FORMALDEHYDE	50000	0.1660	1.4606E-02	127.948
BENZENE	71432	0.0830	7.3029E-03	63.974
TOLUENE	108883	0.0415	3.6515E-03	31.987
ISOMERS OF HEXANE	110543	0.0207	1.8257E-03	15.993
CYCLOHEXANE	110827	0.0207	1.8257E-03	15.993
ISOMERS OF PENTANE	NA	0.1867	1.6432E-02	143.941
N-BUTANE	NA	0.1867	1.6432E-02	143.941
N-PENTANE	NA	0.1245	1.0954E-02	95.961
PROPANE	NA	0.0830	7.3029E-03	63.974

CARB VOC Source Profile ID#3

Note: CAS with NA means this chemical is not listed as a TAC in HARP database.

CHEMICAL NAME	CAS	Efs(lb/mmcf)	LBS/HR	LBS/YR
Acetaldehyde	75070	0.0031	4.9600E-05	0.434
Acrolein	107028	0.0027	4.3200E-05	0.378
Propylene	115071	0.53	8.4800E-03	74.285
Naphthalene	91203	0.0003	4.8000E-06	0.042
Xylenes	1330207	0.0197	3.1520E-04	2.761
Ethylbenzene	100414	0.0069	1.1040E-04	0.967

If chemical is not available in source profile,
the Efs from AQMD backup data were used.

No control efficiency applied for the Boiler's PAHs.

PAHs	CAS	EF (lbs/MMcf)	LBS/HR	LBS/YR
PAHs	1151	4.00E-04	6.40E-06	5.61E-02

CATEF Heater emission factor of PAHs, Boiler's not available.

SCAQMD Efs http://www.aqmd.gov/prdas/pdf/COMBEM2001.pdf

Standby Diesel Engine

Size		ekW	2018	bhp-hr
Operation	62	hr/yr		
Exhaust	15135.9	acfm		
Release Height/Diameter	12	ft	1	ft
Fuel Consumption (100% Load	138.9	gal/hr		
Emission factors (Caterpillar Technical Data)				
Nox	5.39	g/bhp-hr		
CO	0.29	g/bhp-hr	LBS/HR	LBS/YR
HC	0.11	g/bhp-hr	0.489	30.314
PM	0.026	g/bhp-hr		

TACs

	CAS	EF(g/bhp-hr)	lb/hr	lb/yr
Diesel PM	9901	2.60E-02	1.156E-01	7.165

http://www.cat.com/cda/components/fullArticle/?m=39280&x=7&id=215813&languageId=7 Rating 2000

Other HC having Chronic and Acute impacts from CARB Speciation Profile 818

CHEMICAL NAME	CAS	Speciation Fraction	WEIGHT % of TOG	LBS/HR	LBS/YR
FORMALDEHYDE	50000	0.1471	14.714	0.0719	4.4605
BENZENE	71432	0.0200	2.000998	0.0098	0.6066
METHYL ETHYL KETONE (ME	78933	0.0148	1.476998	0.0072	0.4477
TOLUENE	108883	0.0147	1.473	0.0072	0.4465
M-XYLENE	108383	0.0061	0.611	0.0030	0.1852
O-XYLENE	95476	0.0034	0.335	0.0016	0.1016
P-XYLENE	106423	0.0010	0.095	0.0005	0.0288
STYRENE	100425	0.0006	0.058	0.0003	0.0176
METHYL ALCOHOL	67561	0.0003	0.03	0.00015	0.0091
Other metal PM having Acute impacts from CARB PM Speciation Profile 116					
			PM10/2.5		
VANADIUM	7440622	0.0055	0.55	0.0006	0.0394

PAHs' Ef from SCAQMD-http://www.aqmd.gov/prdas/pdf/COMBEM2001.pdf

	(lb/1000 gal)	LBS/HR	LBS/YR
PAHs	0.0559	0.0077645	0.48139962

Heater/Chiller

AQMD Backup data for Boiler on Page 11

Parameters			
Size	7.623	MMBtu/hr	
Fuel Consumption	7623	cfh	
Operating Scenario	Ave.	Max.	
Load	100%	100%	
Hour/day	24	24	
Days/Week	7	7	
Days/Year	365	365	
Days/Month	30	30	
Emission Factors	Uncontrolled	Controlled	
CO	50	50	ppm
NOx	9	9	ppm
PM10	7.6	7.6	lb/mmcf
ROG	**5.5**	**5.5**	lb/mmcf
SOx	0.8	0.8	lb/mmcf

ROG Emission Rates	
LBS/HR	LBS/YR
0.09	770.88

CHEMICAL NAME	CAS	Speciation Fraction	LBS/HR	LBS/YR
FORMALDEHYDE	50000	0.1660	6.96E-03	60.959
BENZENE	71432	0.0830	3.48E-03	30.479
TOLUENE	108883	0.0415	1.74E-03	15.240
ISOMERS OF HEXANE	110543	0.0207	8.70E-04	7.620
CYCLOHEXANE	110827	0.0207	8.70E-04	7.620
ISOMERS OF PENTANE	NA	0.1867	7.83E-03	68.579
N-BUTANE	NA	0.1867	7.83E-03	68.579
N-PENTANE	NA	0.1245	5.22E-03	45.719
PROPANE	NA	0.0830	3.48E-03	30.479

CHEMICAL NAME	CAS	Efs(lb/mmcf)	LBS/HR	LBS/YR
Acetaldehyde	75070	0.0031	2.3631E-05	0.207
Acrolein	107028	0.0027	2.0582E-05	0.180
Propylene	115071	0.53	4.0402E-03	35.392
Naphthelene	91203	0.0003	2.2869E-06	0.020
Xylenes	1330207	0.0197	1.5017E-04	1.316
Ethylbenzene	100414	0.0069	5.2599E-05	0.461

If chemical is not available in source profile, the Efs from AQMD backup data were used.

No control efficiency applied for the Boiler's PAHs.

PAHs	CAS	EF (lbs/MMcf)	LBS/HR	LBS/YR
PAHs	1151	4.00E-04	3.05E-06	2.67E-02

SCAQMD Efs http://www.aqmd.gov/prdas/pdf/COMBEM2001.pdf

Appendix G
Permit Document for Existing Equipment

(These documents are on file at the City of Newport Beach Planning Department)

Appendix H
SCAQMD PAH Emission Factors

VENTURA COUNTY AIR POLLUTION CONTROL DISTRICT
669 County Square Drive, Ventura CA 93003 805/ 645-1401 FAX 805/ 645-1444 www.vcapcd.org

AB 2588 COMBUSTION EMISSION FACTORS

Emission factors for combustion of natural gas and diesel fuel were developed for use in AB 2588 emission inventory reports in 1990 and updated in 1991, 1992 and 1995. These factors have been updated again based on new data available from the USEPA (1) (10).

These emission factors are to be used where source testing or fuel analysis are not required by the AB 2588 Criteria and Guidelines Regulations, Appendix D. The factors are divided into external combustion sources (boilers, heaters, flares) and internal combustion sources (engines, turbines). Natural gas combustion factors are further divided into a number of sub-categories, based on equipment size and type.

If better source specific data such as manufacturer's data, source tests, or fuel analysis is available, it should be used rather than these emission factors.

Natural Gas Combustion Factors

Natural gas combustion factors were developed for listed substances identified by the California Air Resources Board (CARB) as significant components of natural gas combustion emissions (2) and for some federal HAPs.

In the past, the VCAPCD has included emission factors for natural gas fired internal combustion equipment in this document. In 2000, the USEPA published air toxics emission factors for natural gas fired turbines and engines. For natural gas fired internal combustion equipment, the emission factors from the USEPA publication AP-42 (1) should be used.

For natural gas fired turbines, emission factors from Table 3.1-3 of AP-42, dated April 2000 should be used. For natural gas fired internal combustion engines, emission factors from Tables 3.2-1, 3.2-2, and 3.2-3 of AP-42, dated August 2000, as applicable, should be used.

Natural Gas Fired External Combustion Equipment

	<10 MMBTUh	10-100 MMBTUh	>100 MMBTUh	flare
Pollutant	Emissions (lb/MMcf)			
benzene	0.0080	0.0058	0.0017	0.159
formaldehyde	0.0170	0.0123	0.0036	1.169
PAH's (including naphthalene)	0.0004	0.0004	0.0004	0.014
naphthalene	0.0003	0.0003	0.0003	0.011
acetaldehyde	0.0043	0.0031	0.0009	0.043
acrolein	0.0027	0.0027	0.0008	0.010
propylene	0.7310	0.5300	0.01553	2.440
toluene	0.0366	0.0265	0.0078	0.058
xylenes	0.0272	0.0197	0.0058	0.029
ethyl benzene	0.0095	0.0069	0.0020	1.444
hexane	0.0063	0.0046	0.0013	0.029

External combustion equipment includes boilers, heaters, and steam generators.

Derivation of Factors

The emission factors for boilers, heaters, and steam generators were based on the results of source tests performed mostly on units rated at between 10 and 100 million BTU per hour. The following test data was used: benzene (3) (6) (16) (19); formaldehyde (3) (6) (19); PAH, naphthalene, toluene, xylenes, ethyl benzene (16) (19); acetaldehyde, acrolein, and propylene (19); and hexane (20).

The test results listed above were used directly to determine the emission factors for boilers, heaters, and steam generators with heat input ratings of 10-100 MMBTU/hr. For units <10 MMBTU/hr and >100 MMBTU/hr, were calculated by scaling the factors for 10-100 MMBTU/hr equipment by the ratios of their TOC emission factors (7).

For flares, the factors were developed by applying the CARB species profiles (8) to the USEPA TOC emission factor for flares (1). The internal combustion species profile was used as CARB stated that they had very little confidence in the external combustion profile, and they use only the internal combustion profile (9). Information on acrolein was not contained in the species profile used. It was therefore assumed that the ratio of acrolein to formaldehyde is the same for flares as for turbines. The PAH emission factor is from EPA (10)

Diesel Combustion Factors

Diesel (#1, #2 fuel oil) combustion factors were developed for listed substances identified by the CARB as significant components of diesel fuel combustion emissions (2) and for federal HAPs for which data was available.

Diesel Combustion Factors

	external combustion	internal combustion
Pollutant	Emissions (lb/1000 gal)	
benzene	0.0044	0.1863
formaldehyde	0.3506	1.7261
PAH's (including naphthalene)	0.0498	0.0559
naphthalene	0.0053	0.0197
acetaldehyde	0.3506	0.7833
acrolein	0.3506	0.0339
1,3-butadiene	0.0148	0.2174
chlorobenzene	0.0002	0.0002
dioxins	ND	ND
furans	ND	ND
propylene	0.0100	0.4670
hexane	0.0035	0.0269
toluene	0.0044	0.1054
xylenes	0.0016	0.0424
ethyl benzene	0.0002	0.0109
hydrogen chloride	0.1863	0.1863
arsenic	0.0016	0.0016
beryllium	ND	ND
cadmium	0.0015	0.0015
total chromium	0.0006	0.0006
hexavalent chromium	0.0001	0.0001
copper	0.0041	0.0041
lead	0.0083	0.0083
manganese	0.0031	0.0031
mercury	0.0020	0.0020
nickel	0.0039	0.0039
selenium	0.0022	0.0022
zinc	0.0224	0.0224

ND - not detected

Derivation of Factors

For external combustion equipment, formaldehyde, PAH, and naphthalene emission factors for were developed using source test data (17). Based on information from CARB it was assumed that acetaldehyde and acrolein emissions would be the same as formaldehyde (14). Emission factors for toluene, xylenes, propylene, ethyl benzene, and hexane were based on USEPA emission factors for total organic compounds and CARB species profile (8) for substances identified by CARB as significant.

For internal combustion engines, emission factors for formaldehyde, PAH's, naphthalene, and metals were based on source testing (4), (5), (6), (18). Benzene, acetaldehyde, acrolein, toluene and xylenes emission factors were based on sources (4), (5), and (18). Propylene factors were based on source tests (4) and (5). 1,3-butadiene was based on (4). Ethyl benzene and hexane emission factors were based on (18).

For all oil combustion equipment, emission factors for chlorobenzene, hydrogen chloride, and metals were based on stack testing and fuel analyses (4), (5), (6), (12), (13), (18). It was assumed that 99.9% of the chlorine contained in the fuel was converted to hydrogen chloride (15), with the remainder converted to chlorobenzene. 5% of the chromium in the fuel samples was assumed to be emitted as hexavalent chromium (15).

Dioxins (PCDD's), furans (PCDF's), and beryllium were identified as potentially significant components of diesel combustion exhaust (2). However, the only test results for diesel combustion found (11) reported "not detected" for dioxins and furans. Beryllium has not been detected in any of the diesel fuel analyses reviewed (4), (5), (6), (12), (13), (18). For emission inventory reporting purposes, facilities should report these compounds on for PRO using an emission estimation code of "99" and writing "ND" for the emissions.

References

(1) USEPA, Compilation of Air Pollutant Emission Factors, Volume I, Fifth Edition, AP-42, January 1995, and Supplement F, 2000

(2) Gary Agid, California Air Resources Board, Letter to Air Pollution Control District, September 12, 1989

(3) CARNOT, Emission Inventory Testing at Southern California Edison Company Long Beach Auxiliary Boiler, May 1990

(4) CARNOT, Emissions of Air Toxic Species: Test Conducted Under AB 2588 for the Western States Petroleum Association, May 1990

(5) South Coast Environmental, Compliance Report: Hydraulic Dredge "Ollie Riedel", Report Number T1238C, March 8, 1991

(6) ENSR Consulting and Engineering, Western States Petroleum Association, Pooled Source Report: Oil and Gas Production Combustion Sources, Fresno and Ventura Counties, California, Document Number 7230-007-700, January 1991

(7) Ventura County Air Pollution Control District, Emission Factors and Calculation Procedures, July 1985

(8) State of California Air Resources Board, Identification of Volatile Organic Compound Species Profiles, August 1991, as updated November 29, 2000, profiles 504 and 719

(9) Paul Allen, California Air Resources Board, Telephone conversation, February 1, 1990

(10) United States Environmental Protection Agency, Locating and Estimating Air Emissions From Sources of Polycyclic Organic Matter, EPA-454/R-98-014, July 1998

(11) United States Environmental Protection Agency, Toxic Air Pollutant Emission Factors-A Compilation for Selected Air Toxic Compounds and Sources, EPA-450/2-88-006a, October 1988

(12) BTC Environmental, Inc., Ventura Port District Dredge: Air Toxics Emissions Retesting, January 29, 1991

(13) Shell Western E & P, Emission Inventory Report for Ventura Avenue Field, June 11, 1990

(14) Muriel Strand, California Air Resources Board, Telephone conversation, February 6, 1990

(15) State of California Air Resources Board, Technical Guidance Document to the Criteria and Guidelines Regulation for AB 2588, August 1989

(16) Shell Western E&P, Emission Measurements for Speciated PAH's and BTXE Compounds on a Gas fired Turbine and Steam Generator, June 24-27, 1991

(17) Marine Corps Base Camp Pendleton, California: Draft Final Air Toxics Emissions Inventory Report, May 1, 1991

(18) Entropy Environmentalists, Inc., Pooled Source Testing of a Rig Diesel-Fired Internal Combustion Engine, conducted for Western States Petroleum Association, July 29-31, 1992

(19) Radian Corporation, Source Test Report for the Texaco Heater Treater, the Mobil Steam Generator, and the SWEPI Gas Turbine in the San Joaquin Valley Unified Air Pollution Control District, September 1992

(20) AIRx Testing, Emissions Testing OLS Energu Natural Gas Fired Turbine, and Two Auxiliary Boilers, Job Number 22030, April 21, 1994

Appendix I
Cumulative Risk Summary

Chem	CAS			Source	Stk #
1	9901	DieselExhPM	Diesel engine exhaust, particulate matter	existing ICE #1	104
2	50000	Formaldehyde	Formaldehyde	existing ICE #2	105
3	67561	Methanol	Methanol	existing ICE #3	106
4	71432	Benzene	Benzene	existing new boiler	107
5	78933	MEK	Methyl ethyl ketone {2-Butanone}	existing new diesel Genset	108
6	95476	o-Xylene	o-Xylene	existing old diesel Genset #1	109
7	100425	Styrene	Styrene	existing old diesel Genset #2	110
8	106423	p-Xylene	p-Xylene	existing old diesel Genset #3	111
9	108383	m-Xylene	m-Xylene	existing old diesel Genset #4	112
10	108883	Toluene	Toluene	existing old diesel Genset #5	113
11	7440622	Vanadium	Vanadium (fume or dust)	existing old boiler #1	114
12	1151	PAHs-w/o	PAHs, total, w/o individ. components reported [Tr	existing old boiler #2	115
13	75070	Acetaldehyde	Acetaldehyde	existing old boiler #3	116
14	91203	Naphthalene	Naphthalene	existing old boiler #4	117
15	100414	Ethyl Benzene	Ethyl benzene	existing old chiller #1	118
16	107028	Acrolein	Acrolein	existing old chiller #2	119
17	110543	Hexane	Hexane	future ICE #1	120
18	110827	Cyclohexane	Cyclohexane	future ICE #2	121
19	115071	Propylene	Propylene	future ICE #3	122
20	1330207	XYLENES	XYLENES (mixed xylenes)		
21	95636	1,2,4TriMeBenze	1,2,4-Trimethylbenzene		
22	123728	Butyraldehyde	Butyraldehyde		
23	74851	Ethylene	Ethylene		
24	1210	Xylenes	Xylenes (mixed)		

AVERAGE CHRONIC HI, RECEPTOR 664

CAS	Name	INHAL	DERM	SOIL	MOTHER	VEG	ORAL	TOTAL	%
1151	PAHs-w/o	7.13E-08	2.37E-06	3.55E-07	0.00E+00	8.68E-06	1.14E-05	1.15E-05	0.56
50000	Formaldeh	3.71E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.71E-06	0.18
71432	Benzene	3.44E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E-06	0.17
9901	DieselExhF	1.90E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.90E-06	0.09
75070	Acetaldehy	5.58E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.58E-08	0.00
91203	Naphthaler	3.63E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.63E-10	0.00
1210	Xylenes	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
74851	Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
95476	o-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
95636	1,2,4TriMe	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
100414	Ethyl Benz	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
108383	m-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
108883	Toluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
110543	Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
110827	Cyclohexar	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
115071	Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
123728	Butyraldeh	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
107028	Acrolein	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
1330207	XYLENES	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
67561	Methanol	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
78933	MEK	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
100425	Styrene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
106423	p-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
7440622	Vanadium	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
Total		9.18E-06	2.37E-06	3.55E-07	0.00E+00	8.68E-06	1.14E-05	2.06E-05	1.00

AVERAGE CHRONIC HI, RECEPTOR 664

CAS	NAME	CNS	DEVEL	ENDO	EYE	GILV	KIDN	REPRO	RESP	BLOOD	MAX
50000	Formaldehyde	0.00E+00	0.00E+00	0.00E+00	1.56E-01	0.00E+00	0.00E+00	0.00E+00	1.56E-01	0.00E+00	1.56E-01
107028	Acrolein	0.00E+00	0.00E+00	0.00E+00	3.74E-03	0.00E+00	0.00E+00	0.00E+00	3.74E-03	0.00E+00	3.74E-03
75070	Acetaldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.64E-03	0.00E+00	1.64E-03
71432	Benzene	1.52E-03	1.52E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-03	1.52E-03
9901	DieselExhPM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.16E-04	0.00E+00	9.16E-04
115071	Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.88E-04	0.00E+00	2.88E-04
108883	Toluene	1.28E-04	1.28E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.28E-04	0.00E+00	1.28E-04
1210	Xylenes	1.39E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E-05	0.00E+00	1.39E-05
95476	o-Xylene	6.93E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.93E-06	0.00E+00	6.93E-06
108383	m-Xylene	6.93E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.93E-06	0.00E+00	6.93E-06
110543	Hexane	2.74E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.74E-06
100414	Ethyl Benzene	0.00E+00	2.71E-06	2.71E-06	0.00E+00	2.71E-06	2.71E-06	0.00E+00	0.00E+00	0.00E+00	2.71E-06
1330207	XYLENES	2.34E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.34E-06	0.00E+00	2.34E-06
91203	Naphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.92E-07	0.00E+00	8.92E-07
78933	MEK	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.52E-08	0.00E+00	0.00E+00	1.52E-08
106423	p-Xylene	1.39E-09	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.39E-09	0.00E+00	1.39E-09
100425	Styrene	6.62E-10	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.62E-10
67561	Methanol	0.00E+00	7.71E-11	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.71E-11
7440622	Vanadium	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
1151	PAHs-w/o	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
110827	Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
95636	1,2,4TriMeBenze	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
123728	Butyraldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
74851	Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Total		1.68E-03	1.65E-03	2.71E-06	1.60E-01	2.71E-06	2.71E-06	1.52E-08	1.63E-01	1.52E-03	1.63E-01

ACUTE HI, RECEPTOR 664

CAS	NAME	CNS	DEVEL	EYE	IMMUN	REPRO	RESP	BLOOD	MAX	%
50000	ormaldehyc	0.00E+00	0.00E+00	7.88E-02	7.88E-02	0.00E+00	7.88E-02	0.00E+00	7.88E-02	0.71
107028	Acrolein	0.00E+00	0.00E+00	3.15E-02	0.00E+00	0.00E+00	3.15E-02	0.00E+00	3.15E-02	0.28
71432	Benzene	0.00E+00	8.23E-04	0.00E+00	8.23E-04	8.23E-04	0.00E+00	8.23E-04	8.23E-04	0.01
7440622	Vanadium	0.00E+00	0.00E+00	3.36E-04	0.00E+00	0.00E+00	3.36E-04	0.00E+00	3.36E-04	0.00
108883	Toluene	2.25E-05	2.25E-05	2.25E-05	0.00E+00	2.25E-05	2.25E-05	0.00E+00	2.25E-05	0.00
78933	MEK	0.00E+00	0.00E+00	9.32E-06	0.00E+00	0.00E+00	9.32E-06	0.00E+00	9.32E-06	0.00
1210	Xylenes	0.00E+00	0.00E+00	4.69E-06	0.00E+00	0.00E+00	4.69E-06	0.00E+00	4.69E-06	0.00
108383	m-Xylene	0.00E+00	0.00E+00	4.64E-06	0.00E+00	0.00E+00	4.64E-06	0.00E+00	4.64E-06	0.00
95476	o-Xylene	0.00E+00	0.00E+00	3.57E-06	0.00E+00	0.00E+00	3.57E-06	0.00E+00	3.57E-06	0.00
1330207	XYLENES	0.00E+00	0.00E+00	1.98E-06	0.00E+00	0.00E+00	1.98E-06	0.00E+00	1.98E-06	0.00
106423	p-Xylene	0.00E+00	0.00E+00	3.82E-07	0.00E+00	0.00E+00	3.82E-07	0.00E+00	3.82E-07	0.00
100425	Styrene	0.00E+00	0.00E+00	2.40E-07	0.00E+00	0.00E+00	2.40E-07	0.00E+00	2.40E-07	0.00
67561	Methanol	9.01E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.01E-08	0.00
9901	DieselExhPM	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
1151	PAHs-w/o	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
75070	Acetaldehyd	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
91203	Naphthalene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
100414	thyl Benzer	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
110543	Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
110827	Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
115071	Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
95636	,4TriMeBer	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
123728	utyraldehyc	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
74851	Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
Total		2.26E-05	8.45E-04	1.11E-01	7.96E-02	8.45E-04	1.11E-01	8.23E-04	1.11E-01	1.00

Cancer Risk by Source

SRC	INHAL	DERM	SOIL	MOTHER	VEG	ORAL	TOTAL	%
existing new boiler	1.40E-06	7.59E-07	1.14E-07	0.00E+00	2.78E-06	3.65E-06	5.05E-06	0.245
future ICE #1	8.75E-07	2.10E-07	3.15E-08	0.00E+00	7.69E-07	1.01E-06	1.89E-06	0.092
future ICE #2	8.72E-07	2.09E-07	3.14E-08	0.00E+00	7.66E-07	1.01E-06	1.88E-06	0.091
future ICE #3	8.74E-07	2.10E-07	3.14E-08	0.00E+00	7.68E-07	1.01E-06	1.88E-06	0.091
existing ICE #3	8.69E-07	2.09E-07	3.13E-08	0.00E+00	7.64E-07	1.00E-06	1.87E-06	0.091
existing ICE #1	8.58E-07	2.06E-07	3.09E-08	0.00E+00	7.54E-07	9.91E-07	1.85E-06	0.090
existing ICE #2	8.60E-07	2.07E-07	3.09E-08	0.00E+00	7.56E-07	9.93E-07	1.85E-06	0.090
existing new diesel Genset	1.80E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.80E-06	0.087
existing old boiler #1	1.33E-07	7.20E-08	1.08E-08	0.00E+00	2.64E-07	3.46E-07	4.79E-07	0.023
existing old boiler #2	1.31E-07	7.13E-08	1.07E-08	0.00E+00	2.61E-07	3.43E-07	4.74E-07	0.023
existing old boiler #3	1.30E-07	7.04E-08	1.06E-08	0.00E+00	2.58E-07	3.39E-07	4.69E-07	0.023
existing old boiler #4	1.27E-07	6.92E-08	1.04E-08	0.00E+00	2.53E-07	3.33E-07	4.60E-07	0.022
existing old chiller #1	7.25E-08	3.93E-08	5.89E-09	0.00E+00	1.44E-07	1.89E-07	2.61E-07	0.013
existing old chiller #2	7.19E-08	3.90E-08	5.84E-09	0.00E+00	1.43E-07	1.87E-07	2.59E-07	0.013
existing old diesel Genset #5	2.08E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.08E-08	0.001
existing old diesel Genset #4	2.07E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.07E-08	0.001
existing old diesel Genset #3	2.05E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.05E-08	0.001
existing old diesel Genset #2	2.04E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.04E-08	0.001
existing old diesel Genset #1	2.02E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.02E-08	0.001
Total	9.18E-06	2.37E-06	3.55E-07	0.00E+00	8.68E-06	1.14E-05	2.06E-05	1.000

Receptor 664 Run 618 without PAH control on existing new boiler

Source Group	Cancer Risk	Contribution
Existing Old	2.50E-06	12%
Existing New	1.24E-05	60%
Baseline	1.49E-05	73%
Future	5.65E-06	27%
Facility Cumulative	2.06E-05	100%

		Total	%
Cogen Plant	Existing Equip.	1.24E-05	6.03E-01
	Future Equip.	5.65E-06	2.74E-01
Central Plant	Existing Equip.	2.50E-06	
Total		2.06E-05	

Chronic Non-Cancer Risk by Source

NAME	CNS	DEVEL	ENDO	EYE	GILV	KIDN	REPRO	RESP	BLOOD		%
future ICE #1	1.65E-04	1.61E-04	4.07E-07	2.20E-02	4.07E-07	4.07E-07	0.00E+00	2.23E-02	1.49E-04	2.23E-02	0.1368
future ICE #3	1.65E-04	1.60E-04	4.07E-07	2.20E-02	4.07E-07	4.07E-07	0.00E+00	2.23E-02	1.49E-04	2.23E-02	0.1368
existing ICE #3	1.64E-04	1.60E-04	4.04E-07	2.18E-02	4.04E-07	4.04E-07	0.00E+00	2.22E-02	1.48E-04	2.22E-02	0.1362
future ICE #2	1.64E-04	1.60E-04	4.06E-07	2.19E-02	4.06E-07	4.06E-07	0.00E+00	2.22E-02	1.49E-04	2.22E-02	0.1362
existing ICE #1	1.62E-04	1.57E-04	3.99E-07	2.16E-02	3.99E-07	3.99E-07	0.00E+00	2.19E-02	1.46E-04	2.19E-02	0.1344
existing ICE #2	1.62E-04	1.58E-04	4.00E-07	2.16E-02	4.00E-07	4.00E-07	0.00E+00	2.19E-02	1.47E-04	2.19E-02	0.1344
existing new boiler	4.75E-04	4.72E-04	1.95E-07	1.97E-02	1.95E-07	1.95E-07	0.00E+00	1.98E-02	4.29E-04	1.98E-02	0.1215
existing old boiler #1	4.49E-05	4.47E-05	1.84E-08	1.87E-03	1.84E-08	1.84E-08	0.00E+00	1.87E-03	4.06E-05	1.87E-03	0.0115
existing old boiler #2	4.45E-05	4.42E-05	1.82E-08	1.85E-03	1.82E-08	1.82E-08	0.00E+00	1.85E-03	4.02E-05	1.85E-03	0.0113
existing old boiler #3	4.39E-05	4.37E-05	1.80E-08	1.82E-03	1.80E-08	1.80E-08	0.00E+00	1.83E-03	3.97E-05	1.83E-03	0.0112
existing old boiler #4	4.31E-05	4.29E-05	1.77E-08	1.79E-03	1.77E-08	1.77E-08	0.00E+00	1.80E-03	3.90E-05	1.80E-03	0.0110
existing old chiller #1	2.45E-05	2.44E-05	1.01E-08	1.02E-03	1.01E-08	1.01E-08	0.00E+00	1.02E-03	2.22E-05	1.02E-03	0.0063
existing old chiller #2	2.43E-05	2.42E-05	9.98E-09	1.01E-03	9.98E-09	9.98E-09	0.00E+00	1.01E-03	2.20E-05	1.01E-03	0.0062
existing new diesel Genset	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.67E-04	0.00E+00	8.67E-04	0.0053
existing old diesel Genset #5	8.30E-08	7.98E-08	0.00E+00	1.02E-05	0.00E+00	0.00E+00	3.08E-09	2.01E-05	6.96E-08	2.01E-05	0.0001
existing old diesel Genset #4	8.24E-08	7.92E-08	0.00E+00	1.02E-05	0.00E+00	0.00E+00	3.06E-09	2.00E-05	6.90E-08	2.00E-05	0.0001
existing old diesel Genset #3	8.18E-08	7.86E-08	0.00E+00	1.01E-05	0.00E+00	0.00E+00	3.03E-09	1.98E-05	6.85E-08	1.98E-05	0.0001
existing old diesel Genset #2	8.12E-08	7.80E-08	0.00E+00	1.00E-05	0.00E+00	0.00E+00	3.01E-09	1.96E-05	6.80E-08	1.96E-05	0.0001
existing old diesel Genset #1	8.04E-08	7.73E-08	0.00E+00	9.91E-06	0.00E+00	0.00E+00	2.98E-09	1.95E-05	6.74E-08	1.95E-05	0.0001
Total	1.68E-03	1.65E-03	2.71E-06	1.60E-01	2.71E-06	2.71E-06	1.52E-08	1.63E-01	1.52E-03	1.63E-01	1.0000

Receptor 664 Run 618 without PAH control on existing new boiler

Source Group	Chronic Risk	Contribution
Existing Old	1.03E-02	6%
Existing New	8.58E-02	53%
Baseline	9.61E-02	59%
Future	6.68E-02	41%
Facility Cumulative	1.63E-01	100%

Acute Risk by Source

NAME	CNS	DEVEL	EYE	IMMUN	REPRO	RESP	BLOOD	MAX	%
existing new boiler	4.16E-06	1.67E-04	1.61E-02	6.70E-03	1.67E-04	1.61E-02	1.63E-04	1.61E-02	0.15
existing ICE #1	9.35E-07	5.01E-05	7.44E-03	7.49E-03	5.01E-05	7.44E-03	4.91E-05	7.49E-03	0.07
future ICE #2	9.34E-07	5.01E-05	7.45E-03	7.49E-03	5.01E-05	7.45E-03	4.91E-05	7.49E-03	0.07
future ICE #3	9.29E-07	5.41E-05	7.41E-03	7.46E-03	5.41E-05	7.41E-03	5.32E-05	7.46E-03	0.07
future ICE #1	9.28E-07	4.64E-05	7.40E-03	7.44E-03	4.64E-05	7.40E-03	4.55E-05	7.44E-03	0.07
existing ICE #2	9.26E-07	4.99E-05	7.38E-03	7.43E-03	4.99E-05	7.38E-03	4.90E-05	7.43E-03	0.07
existing ICE #3	9.24E-07	4.83E-05	7.35E-03	7.40E-03	4.83E-05	7.35E-03	4.74E-05	7.40E-03	0.07
existing old boiler #1	1.88E-06	6.02E-05	7.30E-03	3.02E-03	6.02E-05	7.30E-03	5.83E-05	7.30E-03	0.07
existing old boiler #2	1.86E-06	5.96E-05	7.22E-03	2.99E-03	5.96E-05	7.22E-03	5.77E-05	7.22E-03	0.07
existing old boiler #3	1.84E-06	5.89E-05	7.12E-03	2.95E-03	5.89E-05	7.12E-03	5.70E-05	7.12E-03	0.06
existing old boiler #4	1.80E-06	5.77E-05	6.97E-03	2.88E-03	5.77E-05	6.97E-03	5.59E-05	6.97E-03	0.06
existing old chiller #1	1.06E-06	3.29E-05	4.13E-03	1.71E-03	3.29E-05	4.13E-03	3.19E-05	4.13E-03	0.04
existing old chiller #2	1.06E-06	3.26E-05	4.10E-03	1.69E-03	3.26E-05	4.10E-03	3.16E-05	4.10E-03	0.04
existing old diesel Genset #5	6.95E-07	1.59E-05	2.73E-03	2.67E-03	1.59E-05	2.73E-03	1.52E-05	2.73E-03	0.02
existing old diesel Genset #4	6.84E-07	1.57E-05	2.69E-03	2.63E-03	1.57E-05	2.69E-03	1.50E-05	2.69E-03	0.02
existing old diesel Genset #3	6.74E-07	1.54E-05	2.65E-03	2.59E-03	1.54E-05	2.65E-03	1.48E-05	2.65E-03	0.02
existing old diesel Genset #2	6.62E-07	1.52E-05	2.60E-03	2.55E-03	1.52E-05	2.60E-03	1.46E-05	2.60E-03	0.02
existing old diesel Genset #1	6.49E-07	1.50E-05	2.55E-03	2.50E-03	1.50E-05	2.55E-03	1.43E-05	2.55E-03	0.02
existing new diesel Genset	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
Total	2.26E-05	8.45E-04	1.11E-01	7.96E-02	8.45E-04	1.11E-01	8.23E-04	1.11E-01	1.00

Source Group	Acute Risk	Contribution
Existing Old	5.01E-02	45%
Existing New	3.84E-02	35%
Baseline	8.85E-02	80%
Future	2.24E-02	20%
Facility Cumulative	1.11E-01	100%

Appendix J
Proposed Project Incremental Risk Summary

Chem	CAS	NAME	
1	1151	PAHs-w/o	PAHs, total, w/o individ. components reported [Treated as B(a)P for HRA]
2	1210	Xylenes	Xylenes (mixed)
3	50000	Formaldehyde	Formaldehyde
4	71432	Benzene	Benzene
5	74851	Ethylene	Ethylene
6	75070	Acetaldehyde	Acetaldehyde
7	95476	o-Xylene	o-Xylene
8	95636	1,2,4TriMeBenze	1,2,4-Trimethylbenzene
9	100414	Ethyl Benzene	Ethyl benzene
10	108383	m-Xylene	m-Xylene
11	108883	Toluene	Toluene
12	110543	Hexane	Hexane
13	110827	Cyclohexane	Cyclohexane
14	115071	Propylene	Propylene
15	123728	Butyraldehyde	Butyraldehyde
16	86737	Fluorene	Fluorene

Cancer Risk by TAC									
CAS	NAME	INHAL	DERM	SOIL	MOTHER	VEG	ORAL	TOTAL	%
1151	PAHs-w/o	1.87E-08	6.21E-07	9.31E-08	0.00E+00	2.27E-06	2.99E-06	3.01E-06	0.54
50000	Formaldehyde	1.54E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.54E-06	0.28
71432	Benzene	9.98E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	9.98E-07	0.18
75070	Acetaldehyde	2.72E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.72E-08	0.00
1210	Xylenes	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
74851	Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
95476	o-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
95636	1,2,4TriMeBenze	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
100414	Ethyl Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
108383	m-Xylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
108883	Toluene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
110543	Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
110827	Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
115071	Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
123728	Butyraldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
86737	Fluorene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
TOTAL		2.59E-06	6.21E-07	9.31E-08	0.00E+00	2.27E-06	2.99E-06	5.58E-06	1.00

Chronic Non-Cancer Risk by TAC											
CAS	NAME	CNS	DEVEL	ENDO	EYE	GILV	KIDN	RESP	BLOOD	MAX	%
50000	Formaldehyde	0.00E+00	0.00E+00	0.00E+00	6.50E-02	0.00E+00	0.00E+00	6.50E-02	0.00E+00	6.50E-02	0.98
75070	Acetaldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	8.03E-04	0.00E+00	8.03E-04	0.01
71432	Benzene	4.41E-04	4.41E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.41E-04	4.41E-04	0.01
115071	Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.36E-04	0.00E+00	1.36E-04	0.00
108883	Toluene	3.21E-05	3.21E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.21E-05	0.00E+00	3.21E-05	0.00
1210	Xylenes	6.88E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.88E-06	0.00E+00	6.88E-06	0.00
95476	o-Xylene	3.44E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E-06	0.00E+00	3.44E-06	0.00
108383	m-Xylene	3.44E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.44E-06	0.00E+00	3.44E-06	0.00
100414	Ethyl Benzene	0.00E+00	1.20E-06	1.20E-06	0.00E+00	1.20E-06	1.20E-06	0.00E+00	0.00E+00	1.20E-06	0.00
110543	Hexane	6.88E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.88E-07	0.00
1151	PAHs-w/o	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
74851	Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
95636	1,2,4TriMeBenze	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
110827	Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
123728	Butyraldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
86737	Fluorene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00
TOTAL		4.88E-04	4.75E-04	1.20E-06	6.50E-02	1.20E-06	1.20E-06	6.60E-02	4.41E-04	6.60E-02	1.00

Acute Risk by TAC										
CAS	NAME	CNS	DEVEL	EYE	IMMUN	REPRO	RESP	BLOOD	MAX	%
50000	Formaldehyde	0.00E+00	0.00E+00	2.22E-02	2.22E-02	0.00E+00	2.22E-02	0.00E+00	2.22E-02	0.996
71432	Benzene	0.00E+00	1.46E-04	0.00E+00	1.46E-04	1.46E-04	0.00E+00	1.46E-04	1.46E-04	0.007
108883	Toluene	2.78E-06	2.78E-06	2.78E-06	0.00E+00	2.78E-06	2.78E-06	0.00E+00	2.78E-06	0.000
1210	Xylenes	0.00E+00	0.00E+00	2.34E-06	0.00E+00	0.00E+00	2.34E-06	0.00E+00	2.34E-06	0.000
95476	o-Xylene	0.00E+00	0.00E+00	1.17E-06	0.00E+00	0.00E+00	1.17E-06	0.00E+00	1.17E-06	0.000
108383	m-Xylene	0.00E+00	0.00E+00	1.17E-06	0.00E+00	0.00E+00	1.17E-06	0.00E+00	1.17E-06	0.000
1151	PAHs-w/o	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000
74851	Ethylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000
75070	Acetaldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000
95636	1,2,4TriMeBenze	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000
100414	Ethyl Benzene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000
110543	Hexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000
110827	Cyclohexane	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000
115071	Propylene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000
123728	Butyraldehyde	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000
86737	Fluorene	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.000
TOTAL		2.78E-06	1.48E-04	2.22E-02	2.23E-02	1.48E-04	2.22E-02	1.46E-04	2.23E-02	1.000

Cancer Risk by Source

RECEPTOR 664

SRC_NAME	INHAL	DERM	SOIL	MOTHER	VEG	ORAL(SubTotal)	TOTAL	%
Future ICE #1	8.58E-07	2.06E-07	3.09E-08	0.00E+00	7.54E-07	9.91E-07	1.85E-06	0.33
Future ICE #2	8.60E-07	2.07E-07	3.09E-08	0.00E+00	7.56E-07	9.93E-07	1.85E-06	0.33
Future ICE #3	8.69E-07	2.09E-07	3.13E-08	0.00E+00	7.64E-07	1.00E-06	1.87E-06	0.34
Total	2.59E-06	6.21E-07	9.31E-08	0.00E+00	2.27E-06	2.99E-06	5.58E-06	1.00

Chronic Non-Cancer Risk by Source									
RECEPTOR 664									
SRC_NAME	DEVEL	ENDO	EYE	GILV	KIDN	RESP	BLOOD	MAX	%
Future ICE #1	1.57E-04	3.99E-07	2.16E-02	3.99E-07	3.99E-07	2.19E-02	1.46E-04	2.19E-02	0.33
Future ICE #2	1.58E-04	4.00E-07	2.16E-02	4.00E-07	4.00E-07	2.19E-02	1.47E-04	2.19E-02	0.33
Future ICE #3	1.60E-04	4.04E-07	2.18E-02	4.04E-07	4.04E-07	2.22E-02	1.48E-04	2.22E-02	0.34
Total	4.75E-04	1.20E-06	6.50E-02	1.20E-06	1.20E-06	6.60E-02	4.41E-04	6.60E-02	1.00

Acute Risk by Source

RECEPTOR 664

SRC_NAME	CNS	DEVEL	EYE	IMMUN	REPRO	RESP	BLOOD	MAX	%
Future ICE #1	9.35E-07	5.01E-05	7.44E-03	7.49E-03	5.01E-05	7.44E-03	4.91E-05	7.49E-03	0.34
Future ICE #2	9.26E-07	4.99E-05	7.38E-03	7.43E-03	4.99E-05	7.38E-03	4.90E-05	7.43E-03	0.33
Future ICE #3	9.24E-07	4.83E-05	7.35E-03	7.40E-03	4.83E-05	7.35E-03	4.74E-05	7.40E-03	0.33
Total	2.78E-06	1.48E-04	2.22E-02	2.23E-02	1.48E-04	2.22E-02	1.46E-04	2.23E-02	1.00

Appendix K
HARP Modeled Output Files for Facility Cumulative Cancer, Chronic and Acute Risks

(These documents are on file at the City of Newport Beach Planning Department)

Appendix L
HARP Modeled Output Files for Incremental Cancer, Chronic and Acute Risks by Facility

(These documents are on file at the

City of Newport Beach Planning Department)