8.1 Air Quality

The proposed project consists of the installation and operation of 10 Wärtsilä 18V50DF 16 megawatt (MW) natural gas-fired reciprocating engine-generators at Pacific Gas and Electric's (PG&E's) existing Humboldt Bay Power Plant near Eureka, Humboldt County, California. The Humboldt Bay Repowering Project (HBRP) will replace the existing steam boiler Units 1 and 2 and the existing peaking turbines (Mobile Emergency Power Plants [MEPPs]) 2 and 3, which will be shut down once the new units have been commissioned. The nominal plant output after repowering will be 163 MW.

This section of the Application for Certification (AFC) describes existing air quality conditions, maximum potential impacts from the HBRP, and mitigation measures that keep these impacts below thresholds of significance. The project will use the latest, most efficient generating technology to generate electricity in a manner that will provide the operational flexibility required for the local area's electrical demand while minimizing the amount of fuel needed, emissions of criteria pollutants, and potential effects on ambient air quality.

Other beneficial environmental aspects of the project that minimize adverse air quality impacts include the following:

- Clean-burning fuels
- Selective catalytic reduction (SCR) to minimize oxides of nitrogen (NOx) emissions
- Oxidation catalysts to reduce emissions of carbon monoxide (CO) and hazardous air pollutants
- Appropriately sized stacks to reduce ground-level concentrations of exhaust constituents

This section presents the methodology and results of the air quality analyses performed to assess potential impacts associated with air emissions from the project. Potential public health risks posed by emissions of non-criteria pollutants are addressed in Section 8.9 (Public Health).

Section 8.1.1 describes the affected environment. Section 8.1.2 examines the potential environmental consequences of the project. Section 8.1.3 discusses cumulative impacts. Section 8.1.4 describes mitigation measures. Section 8.1.5 presents applicable laws, ordinances, regulations, and standards (LORS). Section 8.1.6 presents agency contacts, and Section 8.1.7 presents permit requirements and schedules. Section 8.1.8 contains references cited or consulted in preparing this section.

8.1.1 Affected Environment

8.1.1.1 Geography and Topography

The project will be 3 miles southwest of the city of Eureka. The township of King Salmon is located to the west, adjacent to the site location. PG&E owns 143 acres of land area along the mainland shore of Humboldt Bay. PG&E also owns the intertidal areas extending approximately 500 feet into Humboldt Bay from this land area.

The terrain in the vicinity of the Humboldt Bay Power Plant rises rapidly from the bay on the north side to an elevation of approximately 69 feet mean lower low water (MLLW) at Buhne Point peninsula. Terrain to the north and east of the site is generally flat. To the south and east, the terrain rises rapidly, forming Humboldt Hill, which reaches an elevation of over 500 feet within 2 miles of the project and is the site of several small neighborhoods. Humboldt County is mostly mountainous except for the level plain that surrounds Humboldt Bay. The coastal hills surrounding Humboldt Bay begin with Patrick's Point, 30 miles to the north, then extend to the southeast, then to the southwest, ending in Cape Mendocino, 23 miles from the site. The tops of these hills range from 1,500 to 2,500 feet, with the highest point (Kings Peak) reaching 4,087 feet, 40 miles directly south of Eureka. These hills greatly modify the rainfall and temperatures of the region by creating a rain shadow and sheltering the region from the brunt of the heavier rainfall and temperature extremes. Figure 8.1-1 shows elevations and topography within 6 miles of the project site.

The project site is in the North Coast Unified Air Quality Management District (NCUAQMD), which in turn is part of the North Coast Air Basin.

8.1.1.2 Climate and Meteorology

The climate of the greater Humboldt Bay region, including Eureka and the immediate coastal strip where the project site is located, is characterized as Mediterranean. Summers have little or no rainfall and low overcast and fog are frequently observed. Winters are wet, with frequent passage of Pacific storms, and temperatures are mild.

The overall climate at the project site is dominated by the semi-permanent eastern Pacific high pressure system centered off the coast of California. This high pressure system is centered between the 140° west (W) and 150° W meridians, and oscillates in a north-south direction. Its position governs California's weather. In the summer, the high pressure system moves to its northernmost position, which results in strong northwesterly flows and negligible precipitation.

In the winter, the high pressure system moves southwestward toward Hawaii, which allows storms originating in the Gulf of Alaska to reach northern California, bringing wind and rain. As winter storms move in from the Pacific and Gulf of Alaska, the prefrontal winds are generally from the southeast to southwest. Over the Humboldt Bay area, the hills generally deflect these winds south to southeast. After frontal passage, the winds are generally from the north to northwest. During the rainy season, generally November through March, Eureka receives 75 percent of its average rainfall, with most of the rain falling during December and January. The average annual rainfall over the 100-year period of record is 38.87 inches. This is one of the lowest averages in northwest California and is caused by a rain shadow due to the surrounding hills and minimal uplifting along the immediate west-facing beaches. PM_{10} and $PM_{2.5}$ (particulate matter with aerodynamic diameter less than or equal to 10 and 2.5 microns, respectively) levels are highest during the late fall and winter. Colder, more stagnant conditions during this time of the year are conducive to the buildup of PM, including the formation of secondary ammonium nitrate. In addition, increased emissions from residential fireplaces and wood stoves during this time of year contribute to increased direct particulate emissions.

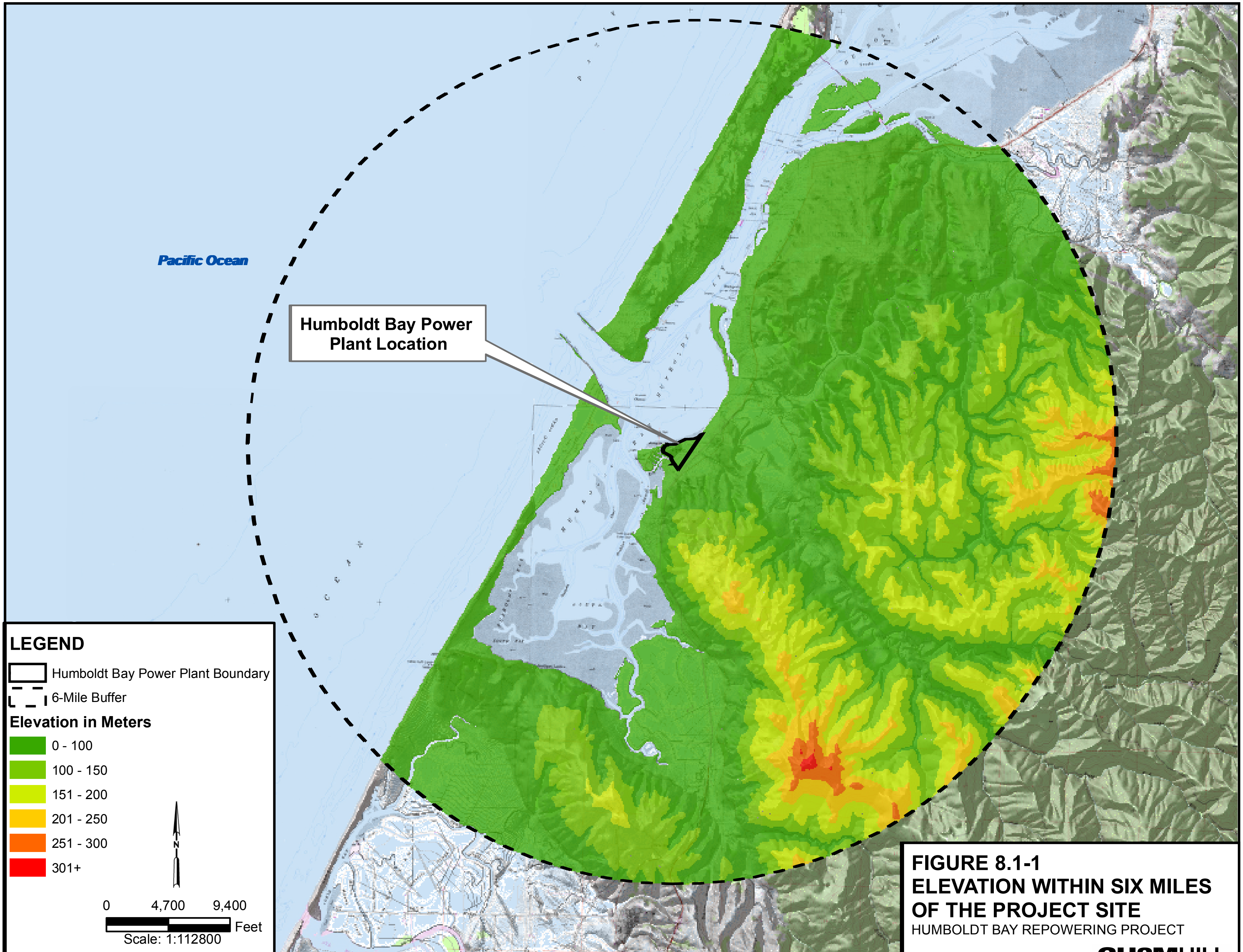

FIGURE 8.1-1
ELEVATION WITHIN SIX MILES OF THE PROJECT SITE
HUMBOLDT BAY REPOWERING PROJECT
CH2MHILL

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The average annual temperature is 52 degrees Fahrenheit (°F). The average July temperature is 56°F; winter temperatures average 48°F in January.[1]

Air quality is determined primarily by the type and amount of pollutants emitted into the atmosphere, the topography of the air basin, and local meteorological conditions. The predominant winds in California are shown in Figures 8.1B-1A through 8.1B-1D, Appendix 8.1B. As indicated in the figures, winds in California generally are light and easterly in the winter, but strong and westerly in the spring, summer, and fall.

Quarterly wind roses and wind frequency distribution tables are provided in Appendix 8.1. Wind patterns at the project site can be seen in Figures 8.1B-2A through 8.1B-6E, which show quarterly and annual wind roses for meteorological data collected at the Woodley Island meteorological station during 2001 through 2005. The annual wind rose for 2005 is shown as Figure 8.1-2. The wind roses show that the winds are variable, with up to 25 percent calm conditions, and on an annual basis, predominantly from the north and south. Winds are predominantly from the north and south during the first quarter, from the north during the second quarter, and from the south during the fourth quarter. Northwesterly and westerly winds appear during the third quarter but are mostly absent during the other quarters.

The mixing heights of the area are affected by the eastern Pacific high pressure system and marine influences. Often, the base of the inversion is found at the top of a layer of marine air, because the marine environment is cooler. Smith et al. (1984) reported that at Oakland, the nearest representative upper-level meteorological station (located 235 miles southeast of the project site), 50th percentile morning mixing heights for the period 1979-1980 were on the order of 1,770 feet (530 to 550 meters) in summer and fall, and 3,600 to 3,900 feet (1,100 to 1,200 meters) in winter and spring. The 50th percentile afternoon mixing heights ranged from 2,150 to 3,030 feet (660 to 925 meters) in summer and fall and over 3,900 feet (over 1,200 meters) in winter and spring. Such mixing heights provide generally favorable conditions for the dispersion of pollutants. Inland areas, where marine influence is weaker, often experience strong ground-based inversions during cold weather periods. These inversions, which inhibit dispersion of low-lying sources of air pollution such as cars and trucks and can result in high pollutant concentrations, are largely absent in coastal areas such as Eureka.

8.1.1.3 Criteria Pollutants and Air Quality Trends

8.1.1.3.1 State and National Ambient Air Quality Standards

The U.S. Environmental Protection Agency (USEPA) has established national ambient air quality standards (NAAQS) for ozone, nitrogen dioxide (NO_2), CO, sulfur dioxide (SO_2), PM_{10}, $PM_{2.5}$, and airborne lead. Areas with air pollution levels above these standards can be considered “nonattainment areas” subject to planning and pollution control requirements that are more stringent than standard requirements.

In addition, the California Air Resources Board (CARB) has established standards for ozone, CO, NO_2, SO_2, sulfates, PM_{10}, airborne lead, hydrogen sulfide, and vinyl chloride at levels designed to protect the most sensitive members of the population, particularly children, the elderly, and people who suffer from lung or heart diseases.

Both state and national air quality standards consist of two parts: an allowable concentration of a pollutant, and an averaging time over which the concentration is to be measured.

[1] Eureka, CA NWS

Allowable concentrations are based on the results of studies of the effects of the pollutants on human health, crops and vegetation, and, in some cases, damage to paint and other materials. The averaging times are based on whether the damage caused by the pollutant is more likely to occur during exposures to a high concentration for a short time (1 hour, for instance), or to a relatively lower average concentration over a longer period (8 hours, 24 hours, or 1 month). For some pollutants there is more than one air quality standard, reflecting both short-term and long-term effects. Table 8.1-1 presents the NAAQS and California ambient air quality standards for selected pollutants. The California standards are generally set at concentrations much lower than the federal standards and in some cases have shorter averaging periods.

TABLE 8.1-1
Ambient Air Quality Standards

Pollutant	Averaging Time	California	National
Ozone	1 hour	0.09 ppm	—
	8 hours	0.070 ppm	0.08 ppm (3-year average of annual 4th-highest daily maximum)
Carbon Monoxide	8 hours	9.0 ppm	9 ppm
	1 hour	20 ppm	35 ppm
Nitrogen Dioxide	Annual Average	0.030 ppm	0.053 ppm
	1 hour	0.18 ppm	–
Sulfur Dioxide	Annual Average	–	80 µg/m³ (0.03 ppm)
	24 hours	0.04 ppm (105 µg/m³)	365 µg/m³ (0.14 ppm)
	3 hours	–	1,300[a] µg/m³ (0.5 ppm)
	1 hour	0.25 ppm	–
Suspended Particulate Matter (10 Micron)	Annual Arithmetic Mean	20 µg/m³	
	24 hours	50 µg/m³	150 µg/m³
Suspended Particulate Matter (2.5 Micron)	Annual Arithmetic Mean	12 µg/m³	15 µg/m³ (3-year average)
	24 hours	–	35 µg/m³ (3-year average of 98th percentiles)
Sulfates	24 hours	25 µg/m³	–
Lead	30 days	1.5 µg/m³	–
	Calendar Quarter	–	1.5 µg/m³
Hydrogen Sulfide	1 hours	0.03 ppm	–
Vinyl Chloride	24 hours	0.010 ppm	–
Visibility Reducing Particles	8 hours (10am to 6pm PST)	In sufficient amount to produce an extinction coefficient of 0.23 per kilometer due to particles when the relative humidity is less than 70 percent.	–

Notes:
[a] This is a national secondary standard, which is designed to protect public welfare.
ppm = parts per million
µg/m³ = micrograms per cubic meter

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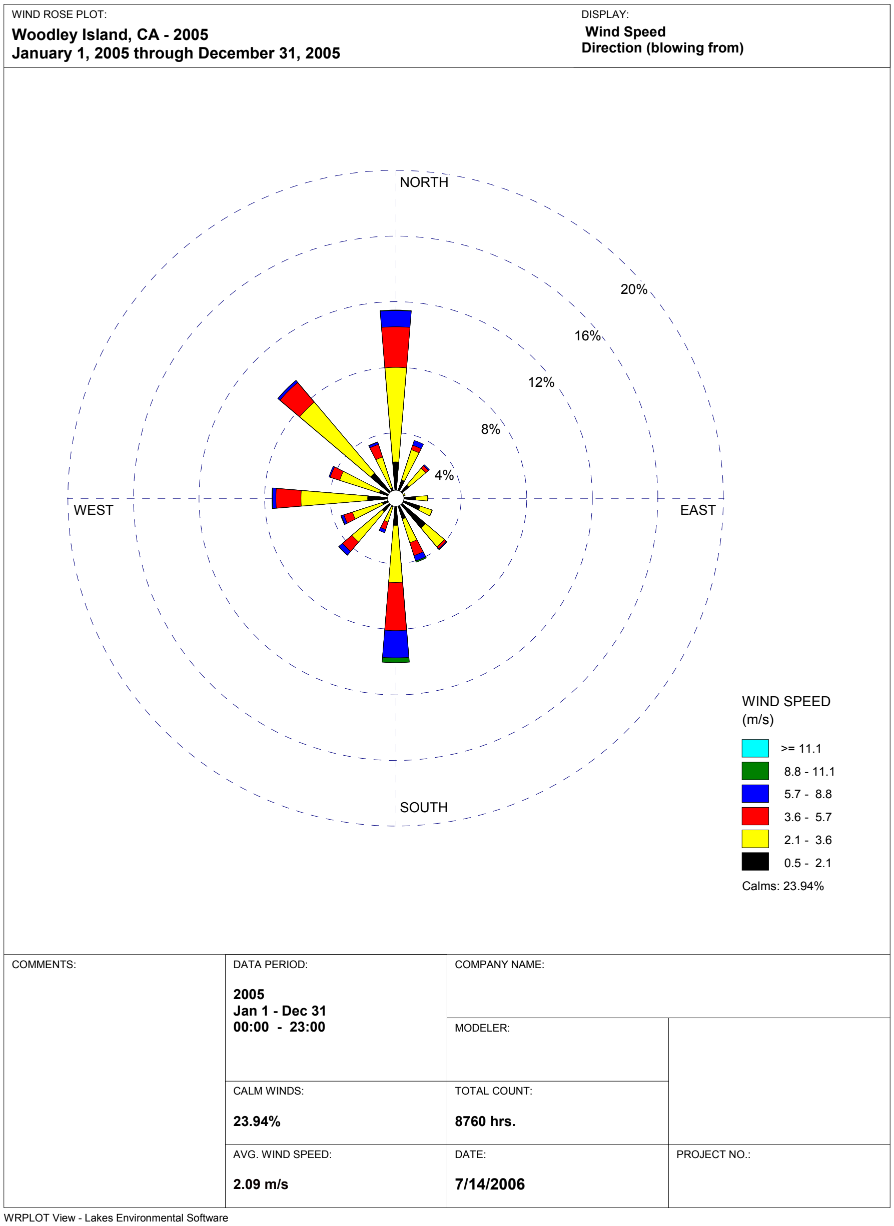

FIGURE 8.1-2
2005 Annual Wind Rose, Woodley Island, CA

8.1.1.3.2 Ambient Monitoring Stations

To characterize existing air quality at the project site, ambient air quality readings were taken from nearby air monitoring stations in Eureka and at Trinidad Head, as well as more distant stations in Willits, Ukiah, and San Francisco. [2][3] The Eureka station, which is 6 miles northeast of the project site, is operated by the NCUAQMD. This station was chosen because of its proximity to the project site. The Eureka station collects data only for particulate matter.[4] The Trinidad Head station, approximately 24 miles north of the project site, is operated by the National Oceanic and Atmospheric Administration (NOAA) as a special project site and measures surface ozone concentrations. This station has been in operation only since April 2002; therefore, the Willits and Ukiah station data were also used because they are the closest stations in the North Coast Air Basin that measure long-term ozone, NO_2, and CO levels. Willits is 90 miles to the south of Eureka, and 30 miles inland. Ukiah is 110 miles to the south of Eureka, and 30 miles inland. For each gaseous pollutant, data for both stations are provided. For each pollutant, the data set from the station with the highest maximum relevant concentration was used for the impact analysis. The Arkansas Street station in San Francisco is the closest station on the Pacific coast that measures SO_2. San Francisco is 210 miles south of Eureka. The limited data available for Ukiah and Willits are also presented for comparison.

All ambient air quality data presented in this section were taken from CARB, USEPA, and NOAA publications and data sources.

The NCUAQMD's attainment status is "nonattainment" for the state 24-hour and annual PM_{10} ambient air quality standards. NCUAQMD's status for all other pollutants is either "attainment" or "unclassified."

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8.1.1.3.3 Ozone

Ozone is generated by a complex series of chemical reactions between reactive organic compounds (ROC) and NOx in the presence of ultraviolet radiation. Ambient ozone concentrations tend to follow a seasonal pattern: higher in the summertime and lower in the wintertime. The general area lacks most of the conditions that lead to the formation of ozone: persistent temperature inversions, clear skies, mountain ranges that trap the air mass, and exhaust emissions from millions of vehicles and stationary sources. Because the area lacks these conditions, ozone levels are not currently monitored by local or state air regulatory agencies in the vicinity of the project. Based upon ambient air measurements at stations in the southern part of the basin, the North Coast Air Basin is classified as an attainment area for ozone.

Ozone data have been collected closer to the project site by other agencies and in previous years. NOAA began collecting surface ozone data in 2002 as part of its Earth System Research Laboratory (ESRL) Global Monitoring Division (GMD). NOAA states that "[m]uch of the time the site experiences baseline conditions, but it also allows for the monitoring of regionally influenced air, affected mainly by forested lands, but to a lesser extent, air having

[2] A more extensive discussion of why the data from these stations are considered to be representative of air quality in the vicinity of the proposed project is provided in Section 8.1.5.2.1.1.

[3] The ozone tables and charts in this section have been updated with 2006 data. Updated 2006 data for the other pollutants is presented in Table 8.1-25.

[4] The District established a second monitoring station in Eureka in December 2006 that monitors gaseous pollutants. However, there is not enough data available from that monitor to establish trends so those data are not included here.

a small urban influence."[5] Ozone was also monitored in Eureka from late 1990 through early 1992 and in Redwood National Park (about 42 miles north of the project site) through mid-1995. All of the data collected at these locations show higher ozone concentrations in the winter months, rather than the summer months. Because the higher ozone concentrations occur in the absence of conditions that would cause the formation of photochemical ozone, this indicates that the ozone in the Eureka area is not primarily photochemical but is mostly natural background or, under certain conditions, is related to stratospheric ozone intrusion.

Table 8.1-2 shows the annual maximum hourly ozone levels recorded at the Willits and Ukiah monitoring stations during the period 1997-2006, and at the Trinidad Head monitoring station during the period 2002-2006. No exceedances of the state and federal standards have been observed during this period. Maximum ozone concentrations at the Willits and Ukiah stations usually are recorded during the summer months; maximum concentrations at Trinidad Head are generally observed during the winter and spring.

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TABLE 8.1-2
Ozone Levels at the Willits Monitoring Station, 1997-2006 (ppm)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Highest 1-Hour Average	0.065	0.070	0.066	0.054	0.062	0.086	0.090	0.060	0.067	0.058
Highest 8-Hour Average	0.058	0.059	0.059	0.046	0.047	0.057	0.055	0.048	0.050	0.052
Ozone Levels at the Ukiah Monitoring Station, 1997-2006 (ppm)										
Highest 1-Hour Average	0.071	0.090	0.079	0.071	0.070	0.092	0.078	0.070	0.088	0.081
Highest 8-Hour Average	0.061	0.071	0.069	0.059	0.055	0.072	0.066	0.056	0.060	0.069
Ozone Levels at Trinidad Head, 2002-2006 (ppm)										
Highest 1-Hour Average	*	*	*	*	*	0.052	0.064	0.063	0.057	0.066
Highest 8-Hour Average	*	*	*	*	*	0.050	0.060	0.058	0.055	*

Notes:
Source: California Air Quality Data, California Air Resources Board website; USEPA AIRData website; NOAA website.
* There were insufficient (or no) data available to determine the value.

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The long-term trends of maximum 1-hour ozone readings are shown in Figure 8.1-3 for the Willits, Ukiah, and Trinidad Head monitoring stations. The data show that the state and federal ozone air quality standards have not been exceeded in the area in the past 10 years. Trends of maximum and 3-year average of the 4th highest daily concentrations of 8-hour average ozone readings at the Willits and Ukiah stations are shown in Figure 8.1-4. These levels are well below the federal 8-hour average standard. USEPA has designated the North Coast Air Basin as an attainment area for the 1-hour federal standard; CARB has requested an initial designation of attainment for the North Coast Air Basin for the 8-hour federal ozone standard.

[5] NOAA ESRL GMD Trinidad Head monitoring website, http://www.cmdl.noaa.gov/obop/thd.

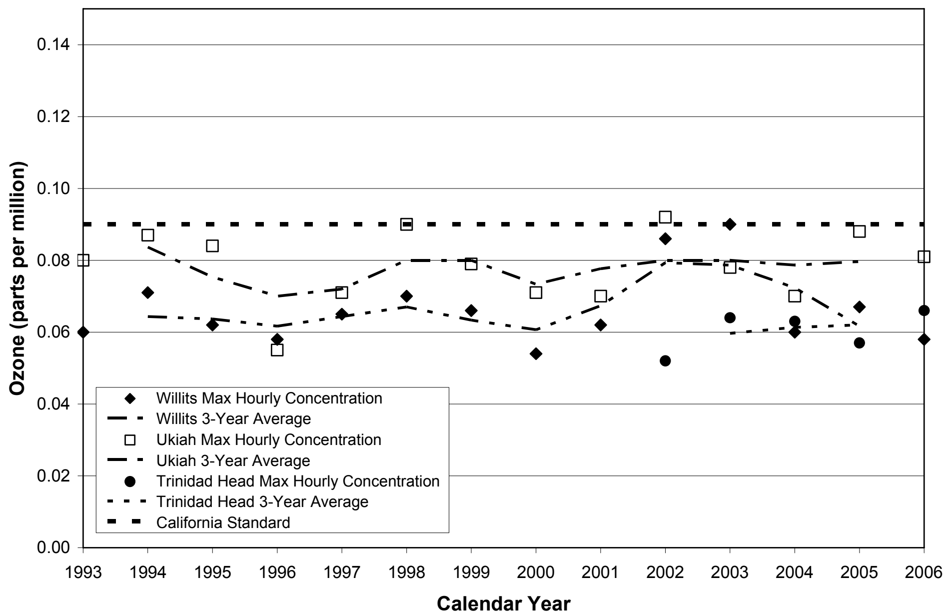

FIGURE 8.1-3
Maximum 1-hour Ozone Levels: Willits, Ukiah and Trinidad Head: 1993-2006

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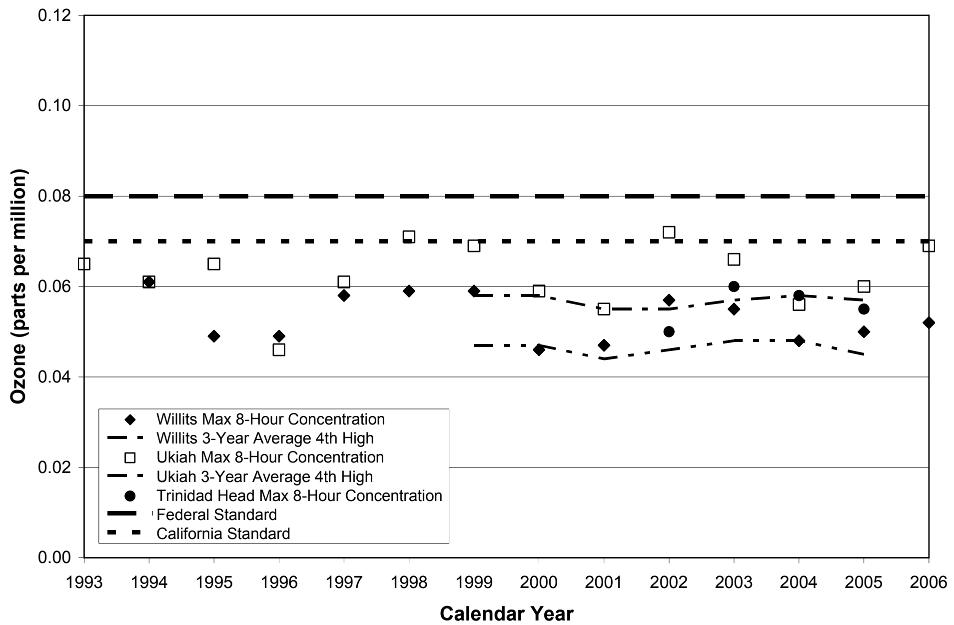

FIGURE 8.1-4
Maximum 8-hour Ozone Levels: Willits, Ukiah and Trinidad Head, 1993-2006

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8.1.1.3.4 Nitrogen Dioxide

Atmospheric NO_2 is formed primarily from reactions between nitric oxide (NO) and oxygen or ozone. NO is formed during high temperature combustion processes, when the nitrogen and oxygen in the combustion air combine. Although NO is much less harmful than NO_2, it can be converted to NO_2 in the atmosphere within a matter of hours, or even minutes, under certain conditions. For purposes of state and federal air quality planning, the NCUAQMD is in attainment for NO_2.

Table 8.1-3 shows the long-term trend of maximum 1-hour NO_2 levels recorded at the Willits and Ukiah stations, as well as the annual average level for each of those years. During this period there has not been a single violation of either the state 1-hour standard or the NAAQS of 0.053 ppm (annual average).

TABLE 8.1-3
Nitrogen Dioxide Levels, Willits Station, 1995-2005 (ppm)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Highest 1-Hour Average	0.030	0.061	0.052	0.056	0.035	0.044	0.080	0.053	0.036	0.028
Annual Average (NAAQS = 0.053 ppm)	*	*	0.010	0.008	0.007	0.007	0.008	0.009	0.008	0.008
Nitrogen Dioxide Levels, Ukiah Station, 1995-2005 (ppm)										
Highest 1-Hour Average	0.044	0.049	0.052	0.066	0.042	0.052	0.038	0.042	0.037	0.037
Annual Average (NAAQS = 0.053 ppm)	*	0.010	0.009	0.010	0.011	0.010	0.010	0.009	0.009	0.008

Notes:
Source: California Air Quality Data, California Air Resources Board website; USEPA AIRData website.
* There were insufficient (or no) data available to determine the value.

Figure 8.1-5 shows the historical trend of maximum 1-hour NO_2 levels at the Willits and Ukiah stations. The NO_2 levels are approximately one-third of the state standard.

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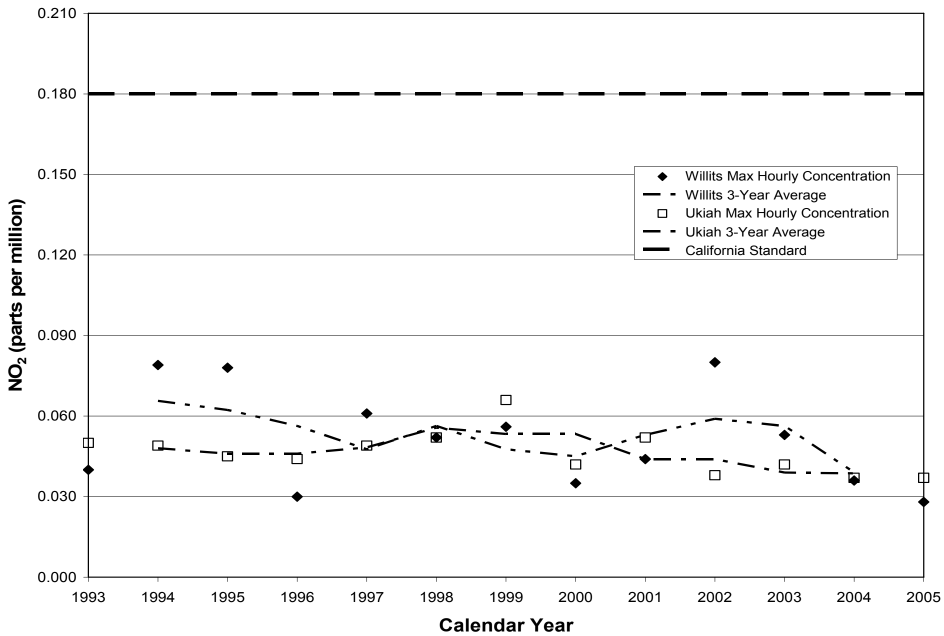

FIGURE 8.1-5
Maximum Hourly NO_2 Levels: Willits and Ukiah, 1993-2005

8.1.1.3.5 Carbon Monoxide

CO is a product of inefficient combustion, principally from automobiles and other mobile sources of pollution. In many areas of California, CO emissions from wood-burning stoves and fireplaces can also be measurable contributors to ambient CO levels. Industrial sources typically contribute less than 10 percent of ambient CO levels. Peak CO levels occur typically during winter months, due to a combination of higher emission rates and calm weather conditions with strong, ground-based inversions. Based upon ambient air quality monitoring, the North Coast Air Basin is classified as being in attainment for CO.

Table 8.1-4 shows the California and federal air quality standards for CO, and the maximum 1- and 8-hour average levels recorded at the Willits and Ukiah monitoring stations during the period 1996-2005.

TABLE 8.1-4
Carbon Monoxide Levels in Willits, 1996-2005 (ppm)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Highest 1-hour average	3.0	7.4	3.7	2.9	2.0	2.9	2.0	5.3	1.8	1.7
Highest 8-hour average	1.55	3.04	2.06	1.82	1.47	1.42	1.3	1.59	1.17	1.05
Carbon Monoxide Levels in Ukiah, 1996-2005 (ppm)										
Highest 1-hour average	4.8	4.6	4.8	5.2	4.4	4.0	3.1	4.8	2.3	2.6
Highest 8-hour average	2.72	3.21	3.46	3.66	2.57	2.34	2.55	2.18	1.78	1.51

Source: California Air Quality Data, California Air Resources Board website; USEPA AIRData website.

Trends of maximum 1- and 8-hour average CO concentrations are shown in Figures 8.1-6 and 8.1-7, which show that maximum ambient CO levels at the Willits and Ukiah monitoring station have been well below the state standards for many years.

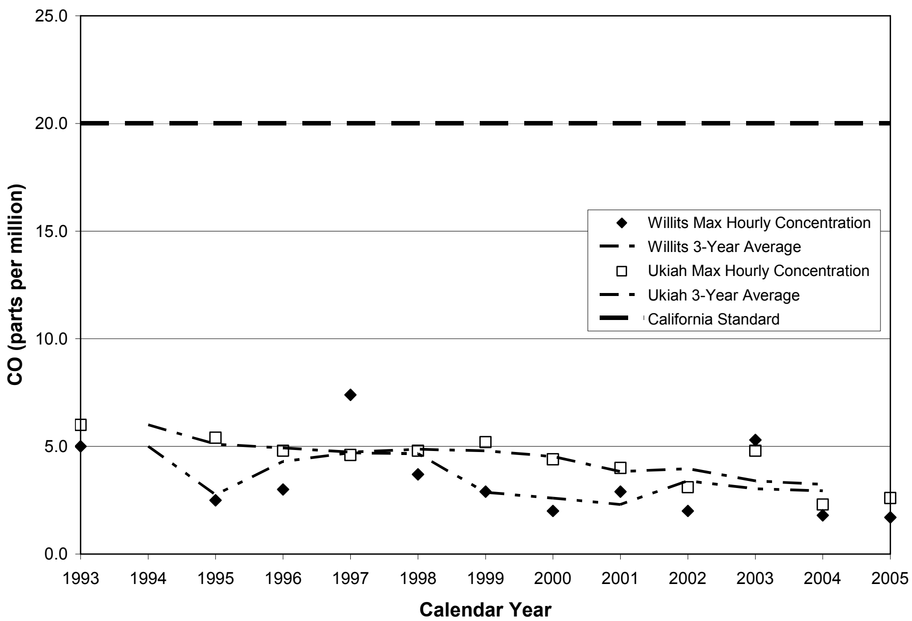

FIGURE 8.1-6
Maximum 1-Hour Average CO Levels: Willits & Ukiah, 1993-2005

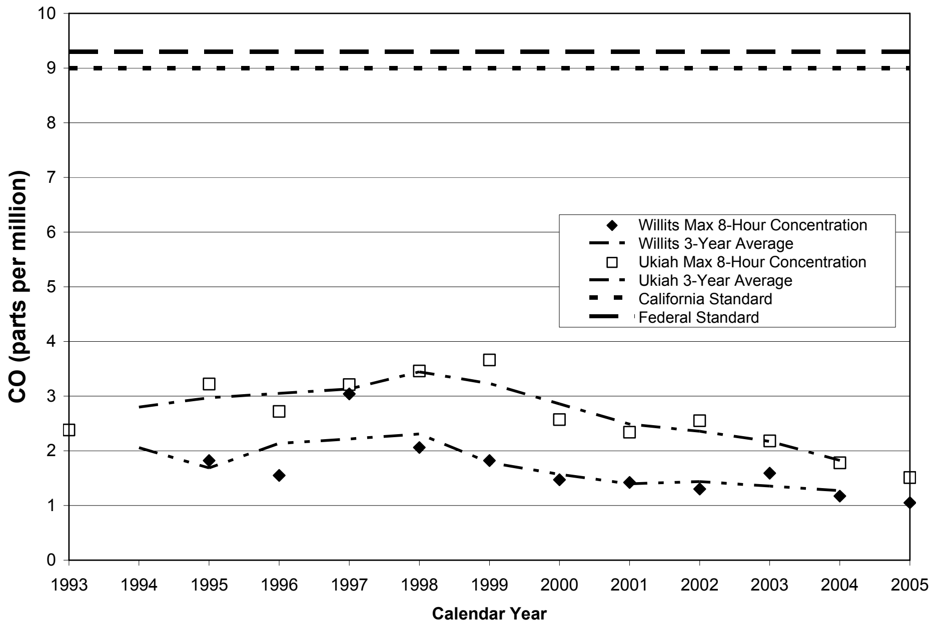

FIGURE 8.1-7
Maximum 8-Hour Average CO Levels: Willits and Ukiah, 1993-2005

8.1.1.3.6 Sulfur Dioxide

SO_2 is produced when any sulfur-containing fuel is burned. It is also emitted by chemical plants that treat or refine sulfur or sulfur-containing chemicals. Natural gas contains negligible sulfur, while fuel oils contain larger amounts. Peak concentrations of SO_2 occur at different times of the year in different parts of California, depending on local fuel characteristics, weather, and topography. The North Coast Air Basin is considered to be in attainment for SO_2 for purposes of state and federal air quality planning.

Table 8.1-5 presents the state air quality standard for SO_2 and the maximum levels recorded from 1996 through 2005 in Willits and Ukiah. The federal 24-hour average standard is 0.14 ppm; during the period shown, the average SO_2 levels measured at the Willits station have been less than one-tenth of the federal standard. Figure 8.1-8 shows that for several years the maximum 24-hour SO_2 levels at San Francisco typically have been less than one-third of the state standard.

TABLE 8.1-5
Sulfur Dioxide Levels in San Francisco (ppm)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Highest 24-Hour Average	0.008	0.007	0.005	0.007	0.008	0.008	0.007	0.007	0.008	0.007
Annual Average	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002	0.002	0.002

Sulfur Dioxide Levels in Mendocino County (ppm)

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Highest 24-Hour Average	0.006	0.001	0.002	*	*	*	*	*	*	*
Annual Average	0.001	0.000	0.001	*	*	*	*	*	*	*

Source: California Air Quality Data, California Air Resources Board website; USEPA AIRData website.

Note: 1992 and 1993 data are from Ukiah; 1994 data are from Willits. No other SO_2 monitoring data are available from the North Coast Air Basin.

* No data collected.

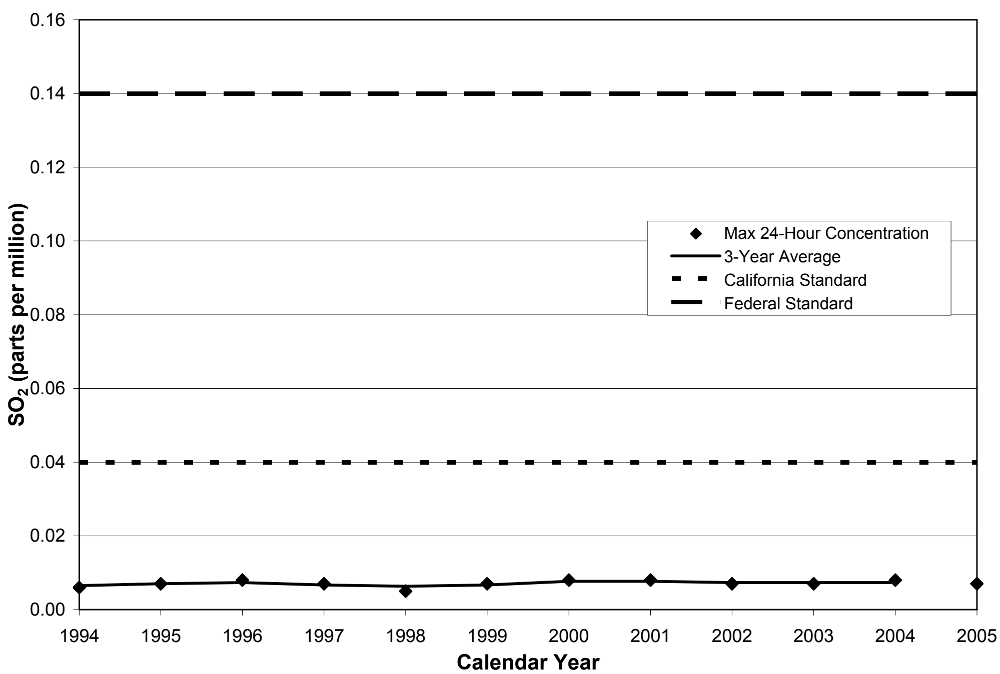

FIGURE 8.1-8
Maximum 24-Hour Average SO_2 Levels: San Francisco Arkansas Street, 1994-2005

8.1.1.3.7 Particulate Sulfates

Particulate sulfates are the product of further oxidation of SO_2. The NCUAQMD is in attainment of the state standard for sulfates (24-hour average < 25 μg/m^3). There is no federal standard for sulfates.

No sulfate monitoring has been performed in the North Coast Air Basin in over 10 years.

Although no chemical composition data are available, based on similarities with the San Francisco Bay Area and northern Sacramento Valley air basins, CARB estimates that secondary ammonium nitrate and sulfate comprise approximately 30 percent of North Coast's $PM_{2.5}$. Based on speciation of $PM_{2.5}$ in the Bay Area, as much as one-third of the secondary particulate could be sulfate. Based on these estimates, as much as 10 percent of $PM_{2.5}$ could be sulfate.

The highest 24-hour $PM_{2.5}$ level measured in Eureka in the last 10 years was 36.9 μg/m^3. Sulfate levels in Eureka are therefore likely to be below 4 μg/m^3, far below the state standard of 25 μg/m^3.

8.1.1.3.8 Particulates (PM_{10} and $PM_{2.5}$)

Particulates in the air are caused by a combination of wind-blown fugitive dust; particles emitted from combustion sources and manufacturing processes; and organic, sulfate, and nitrate aerosols formed in the air from emitted hydrocarbons, sulfur oxides, and nitrogen oxides. In 1984, CARB adopted standards for PM_{10} and phased out the total suspended particulate (TSP) standards that had been in effect previously. PM_{10} standards were substituted for TSP standards because PM_{10} corresponds to the size range of particulates that can be inhaled into the lungs and therefore is a better measure to use in assessing potential health effects. In 1987, USEPA also replaced national TSP standards with PM_{10} standards. The North Coast Air Basin is in attainment of the federal PM_{10} standards but exceeds the state standards.

PM_{10} and $PM_{2.5}$ levels are highest during the late fall and winter. Colder, more stagnant conditions during this time of the year are conducive to the buildup of PM, including the formation of secondary ammonium nitrate. In addition, increased activity from residential wood combustion may also occur.

Table 8.1-6 shows the federal and state air quality standards for PM_{10}, maximum levels recorded at the Eureka Health Department monitoring station during 1996-2005, and geometric and arithmetic annual averages for the same period. The maximum 24-hour PM_{10} levels exceed the state standard, and the federal standard has not been exceeded during the past 10 years. The annual average PM_{10} levels have remained below the federal standards throughout the 10-year period. The federal annual PM_{10} standard was rescinded effective December 18, 2006.

TABLE 8.1-6
PM_{10} Levels in Eureka, Health Dept Station, 1996-2005 (µg/m³)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Highest 24-Hour Average	87	56	45	60	53	67	38	71	64	71
Annual Arithmetic Mean (State Standard = 20 µg/m³)[a]	19.0	21.0	15.9	19.9	21.8	21.3	[b]	[b]	[b]	[b]
(Federal Standard = 50 µg/m³)[c]	18.4	21.2	14.8	19.2	20.9	20.8	18.5	21	20.7	22
Estimated Number of Days Exceeding:										
State Standard (50 µg/m³, 24-hour)	12	6	0	13	6	13	0	3	2	1
Federal Standard (150 µg/m³, 24-hour)	0	0	0	0	0	0	0	0	0	0

Notes:

Source: California Air Quality Data, California Air Resources Board website; USEPA AIRData website.

[a] State statistics are based on California approved samplers; national statistics are based on samplers using federal reference or equivalent methods.

[b] There were insufficient (or no) data available to determine the value.

[c] Federal annual average standard was rescinded in December 2006.

The trend of maximum 24-hour average PM_{10} levels is plotted in Figure 8.1-9, and the trend of expected violations of the state 24-hour standard of 50 µg/m³ is plotted in Figure 8.1-10. Note that since PM_{10} is measured only once every 6 days, expected violation days are six times the number of measured violations. The trend of maximum annual average PM_{10} readings and the California and federal standards are shown in Figure 8.1-11. Annual average PM_{10} concentrations are well below the old federal standard, but remain close to the state standard of 20 µg/m³.

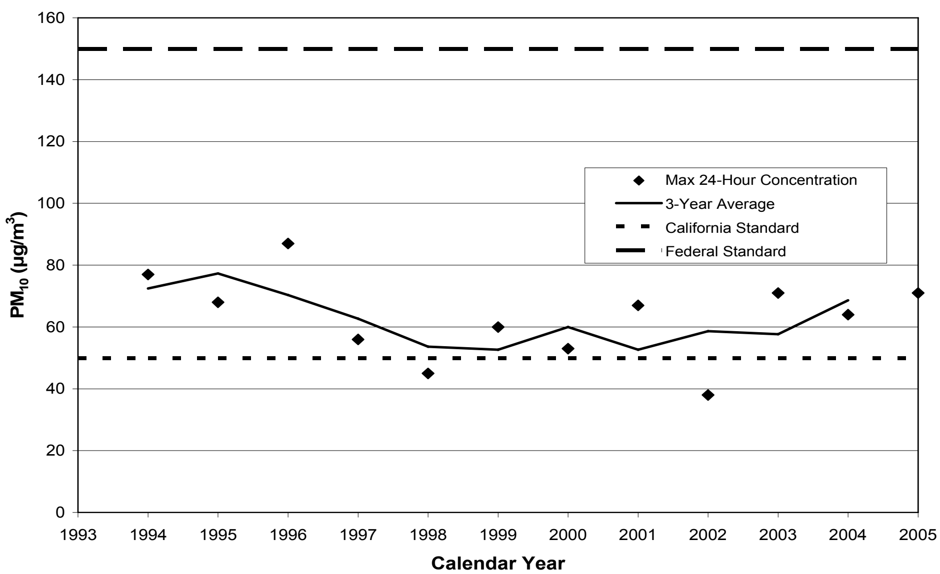

FIGURE 8.1-9
Maximum 24-Hour Average PM_{10} Levels: Eureka, 1993-2005

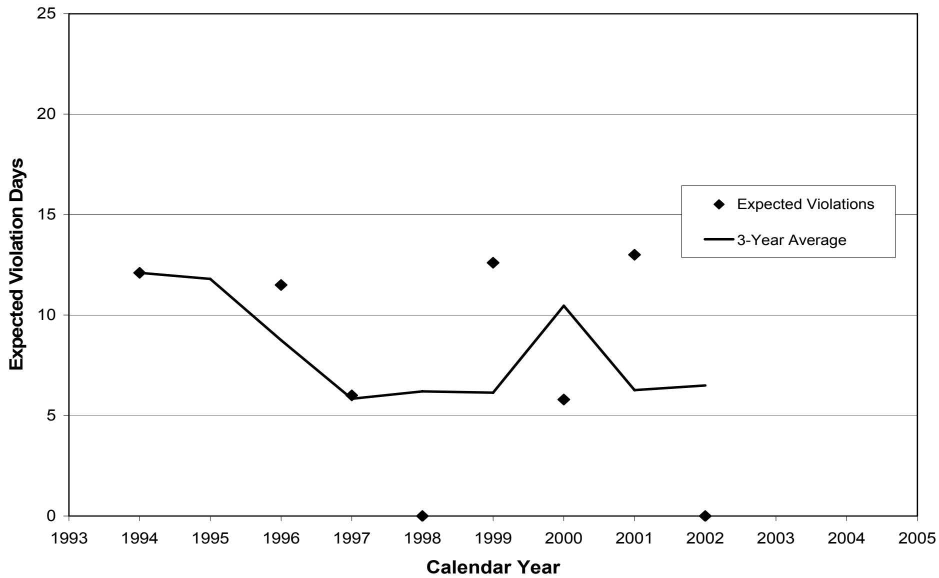

FIGURE 8.1-10
Expected Violations of the California 24-Hour PM_{10} Standards (50 µg/m³): Eureka, 1993-2005

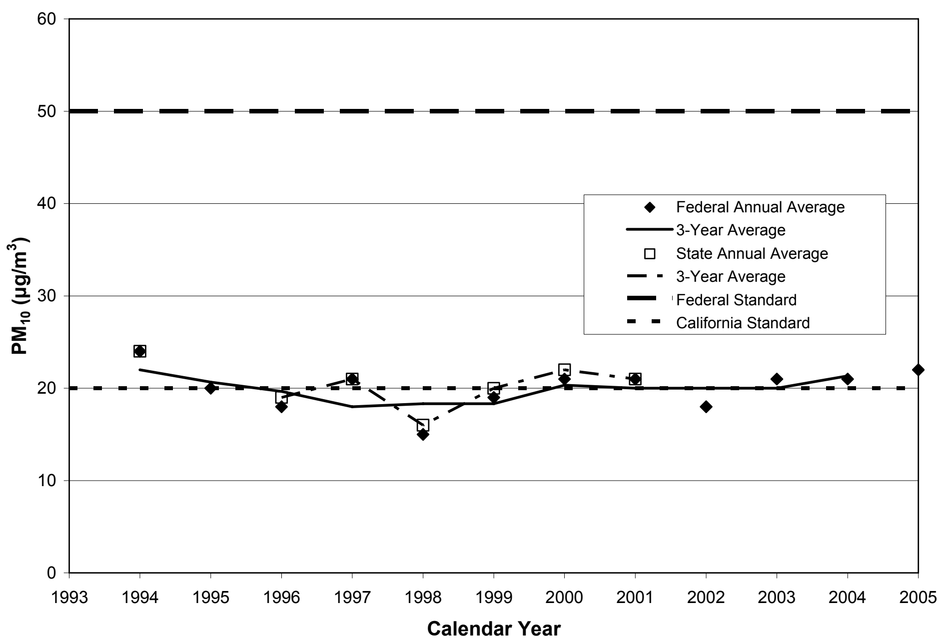

FIGURE 8.1-11
Annual Average PM_{10} Levels: Eureka, 1993-2005

The NAAQS for particulates were revised by USEPA with new standards that went into effect on September 16, 1997; two new $PM_{2.5}$ standards were added at that time. In June 2002, CARB established a new annual average standard for $PM_{2.5}$. USEPA revised the federal 24-hour average standard in December 2006. $PM_{2.5}$ data have been collected at the Eureka monitoring station since 1999, and are presented below.

Table 8.1-7 shows the state and federal air quality standards for $PM_{2.5}$, maximum levels recorded at the Eureka monitoring station during 1999-2005, and 3-year averages for the same period. The 24-hour average concentrations have not exceeded the federal standard during the monitoring period. Annual average $PM_{2.5}$ levels have not exceeded the state or federal standards. The North Coast Air Basin is unclassified for the state $PM_{2.5}$ standard and is unclassified for the federal $PM_{2.5}$ standard, although the state has requested that USEPA designate the North Coast Air Basin as being in attainment.

TABLE 8.1-7
$PM_{2.5}$ Levels in Eureka, Health Dept Station, 1996-2005 (μg/m³)

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Highest 24-Hour Average	–	–	–	36.9	24.0	32.6	23.7	36.1	25.6	31.8
Number of Days Exceeding:										
Federal Standard (35 μg/m³, 24-hour)	–	–	–	0	0	0	0	0	0	0
98th Percentile	–	–	–	27.7	21.5	29	22.6	35	23.1	32
3-yr Average, 98th Percentile	–	–	–	*	*	*	*	*	*	*
Annual Arithmetic Mean (Federal Std = 15 μg/m³)	–	–	–	9.1	9.2	9.4	7.9	8.2	8.1	9.1
3-yr Annual Average (State Std = 12 μg/m³)	–	–	–	–	–	9	9	--	--	–

Note:
Source: California Air Quality Data, California Air Resources Board website; USEPA AIRData website.

* There were insufficient (or no) data available to determine the value.

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Maximum annual $PM_{2.5}$ levels are plotted in Figure 8.1-12. The trend of maximum 24-hour average $PM_{2.5}$ levels is plotted in Figure 8.1-13.

8.1.1.3.9 Airborne Lead

The majority of lead in the air results from the combustion of fuels that contain lead. Twenty-five years ago, motor vehicle gasolines contained relatively large amounts of lead compounds used as octane-rating improvers, and ambient lead levels were relatively high. Beginning with the 1975 model year, new automobiles began to be equipped with exhaust catalysts, which were poisoned by the exhaust products of leaded gasoline. Thus, unleaded gasoline became the required fuel for an increasing fraction of new vehicles, and the phaseout of leaded gasoline began. As a result, ambient lead levels decreased dramatically. The North Coast Air Basin has been in attainment of state and federal airborne lead levels for air quality planning purposes for a number of years.

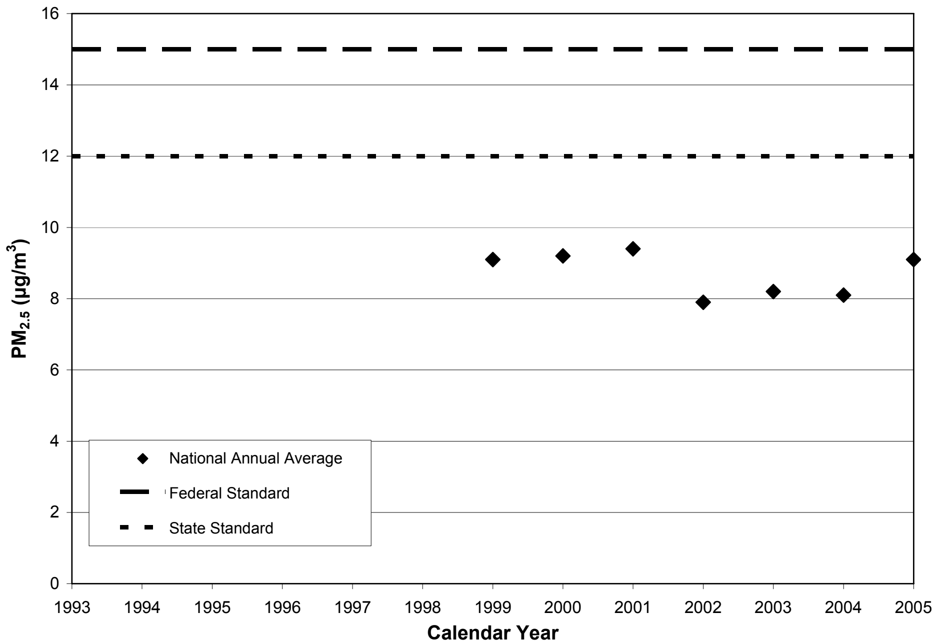

FIGURE 8.1-12
Annual Arithmetic Mean $PM_{2.5}$ Levels: Eureka, 1999-2005

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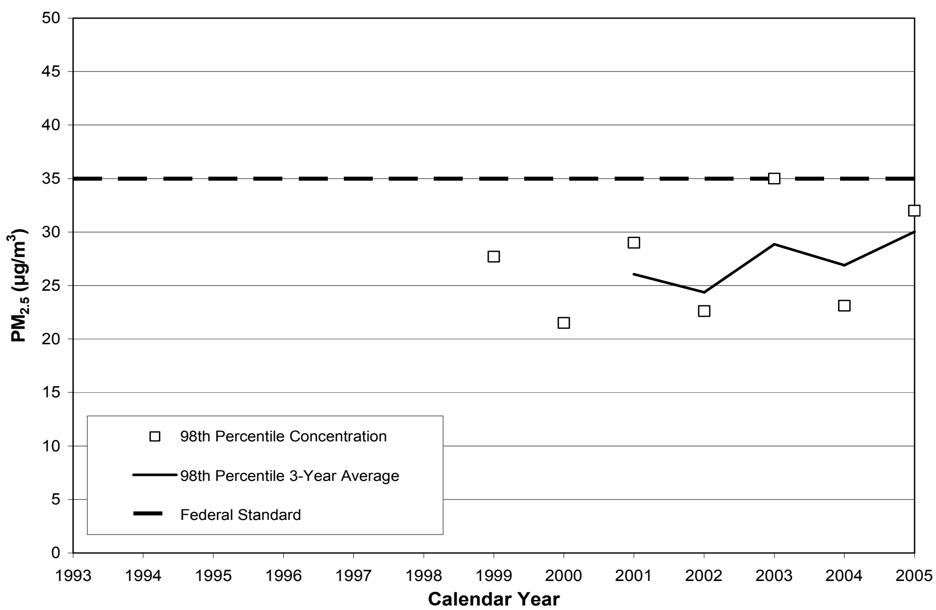

FIGURE 8.1-13
98th Percentile 24-Hour Average $PM_{2.5}$ Levels: Eureka, 1994-2005

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Table 8.1-8 lists the federal air quality standard for airborne lead and the levels reported at the Fort Bragg station between 1980 and 1987. Fort Bragg is on the California coast 90 miles south of Eureka. This site was selected because it was the closest station with lead monitoring data. Note that the data are for maximum daily levels, while the standard is a quarterly average. The elimination of airborne lead as a health issue is one of the great environmental success stories. Maximum levels are well below the federal standard.[6]

TABLE 8.1-8
Airborne Lead Levels in Fort Bragg, 1980-1987 (μg/m³)

	1980	1981	1982	1983	1984	1985	1986	1987
Highest daily average	0.11	0.12	0.76	0.17	0.11	0.08	0.08	0.04
Number of Days Exceeding:								
Federal Standard (1.5 μg/m³, quarterly)	0	0	0	0	0	0	0	0

8.1.2 Environmental Consequences

This section discusses the environmental consequences of the construction and operation of the HBRP with respect to air quality. It describes the methodology for modeling the project's air emissions and presents an analysis of air quality impacts from operation and construction. This section also discusses the screening-level human health risk assessment described in greater detail in Section 8.9, Public Health, and discusses specialized modeling analyses that include fumigation modeling, modeling of engine startups and shutdowns, engine commissioning, and cumulative impacts.

8.1.2.1 Significance Criteria

The criteria used to determine the significance of project-related air quality impacts are as suggested in Appendix G, Environmental Checklist Form, of the California Environmental Quality Act (CEQA) (Public Resources Code Sections 21000 et seq.). Project-related impacts are determined to be significant if they:

- Conflict with or obstruct implementation of the applicable air quality plan;
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation;
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors); or
- Expose sensitive receptors to substantial pollutant concentrations.

[6] CARB no longer reports summary lead statistics on its website.

8.1.2.2 Overview of the Analytical Approach to Estimating Facility Impacts

The proposed project is subject to NCUAQMD Rule 110, which contains the District's New Source Review (NSR) and Prevention of Significant Deterioration (PSD) permitting requirements. The project is also subject to Rules 1-200(c) and 1-220, adopted March 14, 1984, and approved by USEPA as part of the State Implementation Plan (SIP). These older rules constitute the District's federally delegated PSD program. As discussed in Section 8.1.5.2.1.1 of this application, the District has been delegated the authority to perform PSD review in accordance with the requirements of the 1984 rules. The District's review of compliance with the 1984 SIP-approved PSD rule is referred to here as "federal PSD review" to distinguish it from the District's review of compliance with its current NSR/PSD requirements.[7]

The District NSR/PSD rule requires that best available control technology (BACT) be used, emission offsets be provided, and an air quality impact analysis be performed. Similarly, the federal PSD regulation requires the use of BACT and various analyses of the air quality impacts of the proposed project. Ambient air quality impact analyses have been conducted to satisfy both sets of regulatory requirements, as well as CEC requirements, for criteria pollutants (NOx, SO_2, CO, ROC, and $PM_{10}/PM_{2.5}$) and noncriteria pollutants, during project construction and operation. The applicability of the District regulatory requirements and facility compliance with these requirements are based on facility emission levels and ambient air quality impact analyses.

Maximum pollutant emission rates and ambient impacts of the project have been evaluated to determine compliance with District and federal regulations. The new emissions sources at the HBRP include 10 Wärtsilä 18V50DF reciprocating internal combustion engines, an emergency diesel generator, and a diesel fire pump engine. Each reciprocating engine will be equipped with an SCR system for NOx control and an oxidation catalyst for control of CO. Emissions control systems will be fully operational during all operations except startups and shutdowns. Maximum annual emissions are based on operation of the reciprocating engines at maximum firing rates and include the expected maximum number of startups that may occur in a year. Each reciprocating engine startup will result in transient emission rates until steady-state operation for the engine and its emission control systems is achieved.

The two existing electric utility steam generating units and the two peaking combustion turbines at Humboldt Bay Power Plant will be shut down following commissioning of the new units.

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The following sections describe the emission sources that have been evaluated, the results of the ambient impact analyses, and the evaluation of facility compliance with the applicable air quality regulations.

[7] Although the District enforces its current PSD rule for major sources as defined in 40 CFR 52.21, this rule has not been approved by EPA as the basis for PSD program delegation. Therefore an applicant for a new major source or major modification that is subject to PSD review must also comply with the requirements of the District's 1984 SIP-approved PSD rules.

8.1.2.2.1 Existing Facility

The existing Humboldt Bay Power Plant consists of two electric utility steam boilers (Units 1 and 2) and two peaking combustion turbines (MEPPs 2 and 3).[8] All four units will be shut down once the new engines are operational, resulting in emissions reductions. Emissions reductions must be calculated for District NSR/PSD, federal PSD and CEQA purposes. All three approaches use a 2-year period of operation as the basis for determining emissions from the existing sources. While the regulations allow the use of any representative 2-year period within the preceding 5 to 10 years, PG&E believes that the 2-year period immediately preceding the date the AFC was filed—September 29, 2004 through September 28, 2006—is the period consistent with regulatory guidance and most reasonably representative of normal historical operation for NSR and PSD purposes. The District has accepted this period as the baseline period for emissions calculations, consistent with the requirements of the District and federal PSD rules.

Quarterly and annual emissions of NOx and SO_2 from Boiler Units 1 and 2 are based on emissions reported under USEPA's Acid Rain program for 2004-2006. Quarterly and annual emissions of CO, ROC, and PM_{10} are based on quarterly fuel use and standard emission factors and correspond to emissions as reported to the NCUAQMD for the period.

For the federal PSD analysis, the potential to emit for the proposed HBRP must be compared with the actual emissions from the existing units.[9] Calculation of actual emissions during the baseline period is shown in detail in Appendix 8.1, Table 8.1A-1. Actual historical emissions for Units 1 and 2 and MEPPs 2 and 3 are summarized in Table 8.1-9.

TABLE 8.1-9
Emission Reductions from Shutdown of Existing Generating Equipment at Humboldt Bay Power Plant

	Emissions, tons per year				
	NOx	SO_2	CO	ROC	PM_{10}
Unit 1	464.2	0.8	53.4	11.6	10.1
Unit 2	432.8	28.0	55.0	11.9	12.3
MEPP 2	19.3	0.6	2.0	0.5	2.5
MEPP 3	20.4	0.6	1.9	0.5	2.4
Total	936.8	30.0	112.3	24.5	27.4

Note: Totals in all tables may not add directly because figures are rounded.

8.1.2.2.2 New Equipment

The proposed new units are Wärtsilä 18V50DF 16 MW natural gas-fired reciprocating engine-generators. The reciprocating engines will be fueled primarily with natural gas and will use a small amount of diesel as a pilot injection fuel; this mode of operation is referred to as "natural gas mode." These dual-fuel reciprocating engines will also be able to use liquid fuel as an emergency backup fuel; this mode of operation is referred to as "diesel

[8] MEPP Unit 1 is a PG&E-owned unit that has been operated at the Contra Costa Power Plant and in Fort Bragg. MEPP 1 is currently being stored at Humboldt Bay Power Plant but there are no plans to permit the unit for operation there.

[9] Because HBRP is considered a reconstructed source under District rules, the emissions reductions from the shutdown of the existing Humboldt Bay Power Plant units are treated as offsets for District NSR purposes. See Section 8.1.5.2.3.1.

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mode." For the purpose of operating the HBRP in diesel mode, "emergency" means a shortage of natural gas supplies or transportation capacity sufficient to trigger the curtailment of natural gas to PG&E "interruptible" natural gas customers, or that would trigger such a curtailment but for the operation of one or more HBRP units on liquid fuel.[10] Post-combustion air pollution controls will consist of SCR for NOx control and oxidation catalysts for CO control. Any or all of the reciprocating engines may be operated up to 24 hours per day, 7 days per week, with total plantwide heat input not to exceed the equivalent of 6,497 full-load engine hours per year, which is equivalent to a 70 percent annual average capacity factor.[11] Each reciprocating engine will be limited to 50 hours per year of operation in diesel mode for testing and maintenance purposes to ensure its availability during emergency situations. Specifications for the new reciprocating engines are summarized in Table 8.1-10. Additional information regarding the Wärtsilä reciprocating engines is contained in Appendix 8.1A, Tables 8.1A-2 and 8.1A-3.

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TABLE 8.1-10
New Wärtsilä 18V50DF Reciprocating Engine Design Specifications

Manufacturer:	Wärtsilä
Model:	18V50DF
Primary Fuel:	Natural gas
Backup Fuel:	CARB diesel
Design Ambient Temperature*:	67.5°F
Nominal Heat Input Rate (HHV):	143.9 MMBtu/hr natural gas plus 0.79 MMBtu/hr pilot fuel (natural gas mode) OR 148.9 MMBtu/hr emergency backup diesel fuel (diesel mode)
Nominal Power Generation Rate:	16 MW
Nominal Exhaust Temperature:	728°F
Exhaust Flow Rate:	121,502 acfm
Exhaust O_2 Concentration, dry volume:	11.58%
Exhaust CO_2 Concentration, dry volume:	5.32%
Exhaust Moisture Content, wet volume:	9.42%
Emission Controls:	Lean burn technology and SCR (6 ppmv NOx @ 15% O_2, primary fuel) Oxidation Catalyst (13 ppmv CO @ 15% O_2, primary fuel)

Note:
* Average-temperature scenario.
MMBtu/hr = million British thermal units per hour
acfm = actual cubic feet per minute

Typical natural gas and CARB diesel fuel analyses are summarized in Tables 8.1-11A and 8.1-11B, respectively.

[10] The regulatory definition of "emergency" from the Diesel ATCM is shown in Section 8.1.5.2.2.2.

[11] This 70 percent capacity factor is used as the basis for emissions calculations but is not intended to be applied as an operating limit. Emissions will be limited through a combination of heat input and emissions limits.

TABLE 8.1-11A
Nominal Fuel Properties—Natural Gas

Component Analysis		Chemical Analysis	
Component	**Average Concentration, Volume**	**Constituent**	**Percent by Weight**
CH_4	95.64%	C	73.03 %
C_2H_6	2.32%	H	23.98 %
C_3H_8	0.25%	N	1.72 %
C_4H_{10}	0.07%	O	1.28 %
C_5H_{12}	0.02%	S	<1 gr/100 scf
N_2	1.03%	Higher Heating Value	1021 Btu/scf 22,941 Btu/lb
CO_2	0.67%		
S	<0.00%		

Note:
scf = standard cubic feet

TABLE 8.1-11B
Nominal Fuel Properties— CARB Diesel

Parameter	Specification
Gravity, deg API	30 min
Aromatics, %	10 max
Flash Point, °F	140 min
Cetane No	40 min
Sulfur, ppm	15 max
Ash, wt %	0.01 max
Higher Heating Value	136,903 Btu/gal 19,692 Btu/lb

The emergency diesel generator and diesel fire pump engine will be constructed adjacent to the reciprocating engines. Specifications for the emergency generator are shown in Table 8.1-12; specifications for the diesel fire pump engine are shown in Table 8.1-13.

TABLE 8.1-12
Emergency Diesel Engine Generator Specifications

Parameter	Value
Manufacturer	Caterpillar or equivalent
Model	DM8149 or equivalent
Fuel	CARB diesel
Engine Output, kw	350
Engine Output, bhp	469
Heat Input, MMBtu/hr (HHV)	4.0
Heat Input, gal/hr	29.1
Operating hours per year*	50

Note:
* Allowable hours per year for testing and maintenance.

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TABLE 8.1-13
Emergency Diesel Fire Pump Engine Specifications

Parameter	Value
Manufacturer	Clarke
Model	JU6H-UF50
Fuel	CARB diesel
Engine Output, kw	157
Engine Output, bhp	210
Heat Input, MMBtu/hr (HHV)	1.68
Heat Input, gal/hr	12.3
Operating hours per year*	50

Note:
* Allowable hours per year for testing and maintenance.

8.1.2.2.3 Facility Operations

New Wärtsilä Reciprocating Internal Combustion Engines

Wärtsilä provided engine performance specifications for natural gas and diesel modes for three temperature scenarios: high temperature (87°F), average temperature (67.5°F), and low temperature (21°F). The low-temperature scenario was used to characterize maximum emissions because it has the highest hourly heat input and emission rates. Maximum daily operations are based on full-load operation of 10 reciprocating engines for 24 hours with some restrictions on liquid fuel use and emissions (see Section 8.1.2.3.3). Maximum annual emissions are based on full-load operation of each engine for the equivalent of 6,497 full-load engine hours per year. Heat input limits, as summarized in Table 8.1-14, were established to provide the basis for the calculation of project and facility emissions. Values shown in bold are proposed permit conditions.

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TABLE 8.1-14
Wärtsilä 18V50DF Fuel Use

	Heat Input, MMBtu (HHV)		
	Hourly	**Daily**	**Annual[a]**
Each Reciprocating Engine			
Natural gas	143.9	3,454	927,450
Diesel pilot fuel	0.8	19	5,100
Backup diesel fuel	148.9	3,574	7,450
Total Heat Input	148.9 MMBtu/hr	3,574 MMBtu/day	940,000 MMBtu/yr
Total, 10 Reciprocating Engines			
Natural gas	1439	34,536	9,274,500
Diesel pilot fuel	7.9	190	51,000
Backup diesel fuel	1489	35,736	74,500
Proposed Limits	**1489 MMBtu/hr total heat input (total, 10 engines)**	**35,736 MMBtu/day total heat input (total, 10 engines)**	**9,400,000 MMBtu/yr total heat input (total, 10 engines)** **125,500 MMBtu/yr diesel heat input for non-emergency operation (total, 10 engines)** **50 hours/yr (per engine) of non-emergency operation on diesel fuel**

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Note:

[a] The quantity of backup diesel fuel reflects the state regulatory limit of 50 hours per year per unit for non-emergency (testing and maintenance) operations plus diesel pilot fuel for natural gas combustion.

New Emergency Diesel Engine Generator and Diesel Fire Pump Engine

The emergency diesel engine generator will operate under emergency conditions to power basic plant utilities during a power outage. The diesel fire pump engine would also operate in case of power outage during a fire when the main electric fire water pump is not available. The engines may be operated up to 50 hours per year for testing and maintenance activities.

8.1.2.3 Emissions Assessment: Criteria Pollutants

Criteria pollutants emitted from the reciprocating engines and the emergency equipment include NOx, sulfur dioxide (SO_2), CO, ROC and fine particulate matter (PM_{10})[12]. This section of the application presents calculated emissions from the new equipment.

The reciprocating engines and emergency equipment also will emit trace levels of toxic air contaminants (TACs), including ammonia. This section presents the maximum TAC emissions from the proposed new units. Tables containing the detailed TAC emission calculations are included in Appendix 8.1A.

12All of the particulate matter emitted from the reciprocating engines is assumed to be less than 2.5 microns in diameter. All references to PM_{10} include $PM_{2.5}$ as well.

8.1.2.3.1 Criteria Pollutant Emissions: Reciprocating Engines

Proposed maximum emissions from the 18V50DF reciprocating engines were estimated on an hourly, daily, and annual basis based on expected daily operation and proposed annual operating limitations.

Emissions During Normal Operations

Emissions of NOx, CO, and ROC were calculated from emission limits (in ppmv @ 15 percent O_2) and the exhaust flow rates. The NOx emission limit reflects the application of SCR. The ROC emission limit reflects the use of good combustion practices. The CO emission limit reflects the expected performance of the oxidation catalyst. Maximum emissions were based on the exhaust rates associated with the heat input rates for each fuel shown in Table 8.1-14.

SO_2 emissions were calculated from the heat input (in MMBtu) and an SO_2 emission factor (in lb/MMBtu). Short-term SO_2 emissions during natural gas firing were calculated based on the maximum allowable fuel sulfur content of 1 grain per 100 standard cubic feet (scf), while annual average SO_2 emissions were calculated from the maximum annual average sulfur content of 0.33 grain per 100 scf. SO_2 emissions during emergency diesel firing were calculated based on the maximum allowable diesel fuel sulfur content of 15 ppmw. Maximum SO_2 emissions were calculated using the heat input rates in Table 8.1-14.

Maximum hourly PM_{10} emissions were obtained from the manufacturer's guarantees for these units. $PM_{2.5}$ emissions were determined based on the assumption that all particulate matter emissions are less than 2.5 microns in size.

Maximum emission rates for the 18V50DF reciprocating engines are summarized in Table 8.1-15. The BACT analysis upon which the emission factors are based is presented in Appendix 8.1E and summarized in Section 8.1.5.2.1.1.

TABLE 8.1-15
Maximum Emission Rates—Each Reciprocating Engine

Pollutant	ppmv @ 15% O_2	lb/MMBtu	lb/hr
Natural Gas Mode (Natural Gas Firing with Pilot Diesel Injection)			
NOx	6.0[a]	0.022	3.1
SO_2[b]	0.55	0.0028	0.4
CO	13.0[a]	0.029	4.1
ROC	28.0[a]	0.035	5.1
$PM_{10}/PM_{2.5}$[c]	n/a	n/a	3.6
Diesel Mode (Backup CARB Diesel Fuel Firing)			
NOx	35.0	0.134	19.6
SO_2[d]	0.40	0.0016	0.22
CO	20.0	0.047	6.9
ROC	40.0	0.053	7.9
$PM_{10}/PM_{2.5}$[c]	n/a	n/a	10.8

Notes:
[a] NOx, CO, ROC and PM_{10} emission rates exclude startups and shutdowns (see Table 8.1-16).
[b] Based on maximum natural gas sulfur content of 1 gr/100 scf. See text.
[c] Includes front and back half.
[d] Based on a maximum CARB diesel content of 15 ppmw.

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Emissions During Startup and Shutdown

Each Wärtsilä reciprocating engine will reach steady state conditions and the emission control systems will reach their full abatement efficiency within 30 minutes of startup. Maximum emission rates expected to occur during a startup or shutdown are estimated based on vendor data and are shown in Table 8.1-16. Hourly startup emission rates are calculated assuming 30 minutes of startup and 30 minutes of full-load operation. SO_2 and PM_{10} emissions are not included in this table because emissions of these pollutants will not be higher during startup than during baseload facility operation.

TABLE 8.1-16
Reciprocating Engine Startup Emission Rates

	NOx	CO	ROC
Natural gas mode startup, lb/start	22	22	15.4
Natural gas mode startup, lb/hour	23.6	24.1	17.9
Diesel mode startup, lb/start	154	22	13.2
Diesel mode startup, lb/hour	164	25.4	17.2

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The Applicant is proposing two permit conditions related to NOx emissions during startup. The first condition would limit NOx emissions during any hour to 392 pounds, and would apply during normal plant operations, including startup, shutdown, and maintenance and testing of the Wärtsilä engines on liquid fuel as well as on operation in natural gas mode.

This limit is expected to be adequate under most operating conditions, as it will allow simultaneous startups of all 10 engines in natural gas mode as well as simultaneous startups of up to 2 engines in diesel mode while the other engines are in operation.[13] The engines will be started up on natural gas most of the time, and startups on liquid fuel for testing and maintenance can be coordinated to ensure compliance with this hourly emission limit.

Under emergency conditions, such as a natural gas curtailment or other failure of the natural gas supply, it might be necessary to start up several engines at one time on liquid fuel. Under these circumstances, the second permit condition would provide a higher hourly NOx limit of 676 pounds, which would apply only during emergency conditions, as defined in the permit. The notification and reporting condition in the permit that apply to emergency operations, as defined, would also apply during emergency startups.

Compliance with both limits will be enforced through the continuous NOx emissions monitors.

8.1.2.3.2 Criteria Pollutants: Emergency Equipment

Maximum emissions from the emergency diesel engine generator and the diesel fire pump engine are based on manufacturers' guaranteed emission rates for these units. Guaranteed emission rates and calculated hourly emissions for these units are shown in Appendix 8.1A, Tables 8.1A-3 and 8.1A-4.

8.1.2.3.3 Criteria Pollutant Emissions Summary for the New Equipment

Maximum facility emissions are shown in Table 8.1-17. The emission calculations are based on the reciprocating engine emission rates shown in Tables 8.1-15 and 8.1-16, the fuel use limitations in Table 8.1-14, and the following assumptions:

- Each reciprocating engine may operate up to 24 hours per day.
- Combined daily PM_{10} emissions from the Wärtsilä engines will be limited on any day when one or more engines operate in diesel mode for any period of time. This limit is discussed below.
- Each reciprocating engine may have up to 3 startups per day, with a total of 3 hours of startup/shutdown activity for each reciprocating engine.
- All 10 reciprocating engines could be required to start up simultaneously, with a limit of 392 lb/hr of NOx emissions in any hour.[14]
- Under emergency conditions,[15] a limit of 676 lb/hr of NOx would apply.
- Each reciprocating engine may have a total of 365 hours per year of startup/shutdown activity.
- Total annual fuel use by all 10 reciprocating engines will be limited to the equivalent of 6,497 full-load hours per engine per year for the facility.[16]

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13 An engine can switch from natural gas mode to Diesel mode without shutting down and starting up. The startup emission rates in Table 8.1-16 apply only to starting up an engine that has not previously been in operation.

14 This emission limit is proposed as a permit condition. NOx emissions during engine startup on liquid fuel will be managed to maintain compliance with this limit.

15 See Section 8.1.5.2.2.2 for the definition of emergency operating conditions.

TABLE 8.1-17
Emissions from New Equipment

Emissions/Equipment	NOx	SO_2[d]	CO	ROC	PM_{10}
Maximum Hourly Emissions					
Reciprocating Engines[a]	392[e]	4.0	254.6	179.5	108.0
Black Start Generator	2.7	<0.01	0.5	0.31	0.05
Fire Pump Engine[b]	—	—	—	—	—
Total, pounds per hour	**394.7**	**4.0**	**255.1**	**179.8**	**108.1**
Maximum Daily Emissions					
Reciprocating Engines[a]	9,101.3	96.7	2,219.1	2,205.4	2,203.0
Black Start Generator[b]	2.69	<0.01	0.5	0.31	0.05
Fire Pump Engine[b]	2.27	<0.01	0.3	0.23	0.06
Total, pounds per day	**9,106.3**	**96.7**	**2,219.9**	**2,206.0**	**2,203.1**
Maximum Annual Emissions, tons per year (tpy)					
Reciprocating Engines[c]	174.2	4.4	171.0	188.9	118.7
Black Start Generator[c]	0.1	<0.1	<0.1	<0.1	<0.1
Fire Pump Engine[c]	0.1	<0.1	<0.1	<0.1	<0.1
Total, tons per year	**174.3**	**4.4**	**171.0**	**188.9**	**118.7**

Notes:

[a] Maximum hourly reciprocating engine emissions include 30 minutes of startup and 30 minutes of operation on emergency backup fuel. Maximum daily reciprocating engine emissions include 3 30-minute startups and 24 hours of operation on emergency backup fuel.

[b] Black start generator and fire pump engine will not be tested during the same hour or on the same day. Black start generator has higher hourly emissions so emissions from that unit are used to calculate maximum project hourly emissions. Maximum daily emissions from the emergency generator reflect 45 minutes of operation for testing or maintenance. Maximum daily emissions from the fire pump engine reflect 1 hour of operation for testing or maintenance.

[c] Maximum annual emissions reflect 50 hours per year per reciprocating engine on emergency backup fuel and 50 hours per year of testing and maintenance operation for the black start generator and fire pump engine, as limited by the Airborne Toxic Control Measures (ATCMs) (see Section 8.1.5.2.2.2).

[d] SO_2 emissions based on natural gas sulfur content of 1 gr/100 scf for all averaging periods except annual. Annual SO_2 emissions based on maximum annual average sulfur content of 0.33 gr/100 scf.

[e] NOx limit during emergency operating conditions would be 676 lb/hr.

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16 As discussed above, this limit was used in calculating emissions but is not intended to be imposed as an operating limit. Emissions will be limited by limits on fuel use, as monitored through fuel meters, and emissions, as monitored by CEMS and calculated from source test results.

18 An analysis of the applicability of the ATCM to the reciprocating engines is presented in Section 8.1.5.2.2.2.

- Annual emissions from the facility include 50 hours of operation per engine per year in diesel mode, the maximum allowed for emergency engines under the Air Toxics Control Measure for Stationary Diesel Engines (CCR Title 17, Section 93115). The ATCM, which applies to the reciprocating engines during backup diesel operation[18], limits non-emergency operation of new stationary emergency standby compression ignition engines to 50 hours per year.

Detailed calculations are shown in Appendix 8.1A, Table 8.1A-6.

Total daily PM_{10} emissions from the Wärtsilä engines are proposed to be limited by three separate conditions. The first limit of 864 lb/day is the potential to emit for 10 engines in natural gas mode. Compliance with this limit, which will apply on any day when the Wärtsilä engines are operated only in natural gas mode, will be determined using the manufacturer's guaranteed emission rate of 3.6 lb/hr and actual hours of operation in natural gas mode. The second limit, 2203 lb/day, is the potential to emit for the 10 engines when operated in natural gas or diesel mode. Compliance with the second limit, which would apply on any day when one or more engines are operated in diesel mode for any period of time, will be determined using the manufacturer's guaranteed emission rates of 3.6 lb/hr for natural gas mode and 10.8 lb/hr for diesel mode, and actual hours of operation in natural gas and diesel mode, respectively.

The third limit, 1542 lb/day, reflects the maximum expected emissions from the engines on any day when one or more engines are operated in diesel mode. Compliance with this third limit will be determined using District-approved emission factors derived from source test data that reflect the actual performance of the engines and emission control systems, and the actual quantity of fuel consumed by each engine in each mode.

The daily PM_{10} emissions shown in Table 8.1-17 reflect the second limit, the potential to emit based on the manufacturer's guaranteed emission rate. Annual PM_{10} emissions for regulatory applicability, including offsets and mitigation requirements, are also calculated using the manufacturer's guaranteed emission rates.

8.1.2.3.4 Net Changes in Criteria Pollutant Emissions for the Repowering Project

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Net emissions changes as a result of the project are calculated on an annual basis for federal PSD purposes. These calculations are shown in Table 8.1-18. Because HBRP is considered a new source under District rules (see Section 8.1.5.2.3.1), the emissions reductions from the shutdown of Humboldt Bay Power Plant are treated as offsets for District NSR. The applicability of PSD to a project is based on the difference between the post-modification potential to emit (i.e., the maximum possible emissions allowed under the proposed permit) and the existing facility's actual emissions. As discussed in Section 8.1.2.2.1, the baseline period for emissions from the existing facility is the 24-month period immediately preceding the filing of the AFC: September 29, 2004, through September 28, 2006.

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Because a facility rarely operates at its full capacity for an entire year, the "net emissions increase" calculated by the actual-to-potential calculation may be much larger than the actual emission increase.

TABLE 8.1-18
Net Emissions Changes for the Repowering Project

Emissions, tons per year	NOx	SO_2	CO	ROC	PM_{10}
Potential to Emit, New Units	174.3	4.4	171.0	188.9	118.7
Reduction, Shutdown of Existing Units	936.8	30.0	112.3	24.5	27.4
Net Increase (Reduction)	**(789.5)**	**(25.6)**	**68.7**	**164.4**	**91.3**

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8.1.2.4 Construction Emissions

Emissions due to the construction phase of the project have been estimated, including an assessment of emissions from vehicle and equipment exhaust and the fugitive dust generated from material handling. A detailed analysis of the emissions and ambient impacts is included in Appendix 8.1D. Construction emissions mitigation and/or control techniques proposed for use at the HBRP site include but are not limited to the following:

- Operational measures, such as limiting time spent with the engine idling by shutting down equipment when not in use;
- Regular preventive maintenance to prevent emission increases due to engine problems;
- Use of low sulfur and low aromatic fuel meeting California standards for motor vehicle diesel fuel; and
- Use of low-emitting gas and diesel engines meeting state and federal emissions standards for construction equipment, including but not limited to catalytic converter systems and particulate filter systems.

The following mitigation measures are proposed to control fugitive dust emissions during construction of the project:

- Use either water application or chemical dust suppressant application to control dust emissions from onsite unpaved road travel and unpaved parking areas;
- Use vacuum sweeping and/or water flushing of paved road surface to remove buildup of loose material to control dust emissions from travel on the paved access road (including adjacent public streets impacted by construction activities) and paved parking areas;
- Cover all trucks hauling soil, sand, and other loose materials or require all trucks to maintain at least two feet of freeboard;
- Limit traffic speeds on all unpaved site areas to 15 mph;
- Install sandbags or other erosion control measures to prevent silt runoff to roadways;
- Replant vegetation in disturbed areas as quickly as possible;
- Use wheel washers or wash off tires of all trucks exiting construction site; and
- Mitigate fugitive dust emissions from wind erosion of areas disturbed from construction activities (including storage piles) by application of either water or chemical dust suppressant.

The HBRP construction site impacts are not unusual in comparison to most construction sites. Construction sites that use good dust suppression techniques and low-emitting vehicles typically do not cause violations of air quality standards.

8.1.2.5 Emissions Assessment: Toxic Air Contaminants

Noncriteria pollutants are compounds that have been identified as pollutants that pose a significant health hazard. Nine of these pollutants are regulated under the federal New Source Review program: lead, asbestos, beryllium, mercury, fluorides, sulfuric acid mist, hydrogen sulfide, total reduced sulfur, and reduced sulfur compounds.[19] In addition to these nine compounds, the federal Clean Air Act lists 189 substances as potential hazardous air pollutants (Clean Air Act Sec. 112(b)(1). The NCUAQMD incorporates the CARB Airborne Toxic Control Measures (ATCMs) in its Regulation III (Toxic Air Contaminant Control). Any pollutant that may be emitted from the HBRP and is on the federal New Source Review list, the federal Clean Air Act list, and/or the District toxic air contaminant list has been evaluated as part of the AFC.

8.1.2.5.1 Toxic Air Contaminant Emissions: Wärtsilä Reciprocating Engines

Maximum hourly and annual TAC emissions were estimated for the proposed Wärtsilä reciprocating engines during natural gas firing based on the heat input rate (in MMBtu/hr and MMBtu/yr), emission factors (in lb/MMBtu), and the nominal higher heating value of 1021 Btu/scf. Hourly and annual emissions were based on the heat input rates shown in Table 8.1-14. The ammonia emission factor was derived from an ammonia slip limit of 10 ppmv @ 15 percent O_2. Other emission factors were obtained from AP-42 (Table 3.2-2, 7/00) and from the California Air Resources Board's CATEF database for lean-burn reciprocating IC engines, with a control efficiency of 40% from the oxidation catalysts applied for all organic TACs except formaldehyde.[20] As discussed in Section 8.1.5.2.1.3, the new engines will also be required to comply with the Reciprocating Internal Combustion Engine (RICE) Maximum Achievable Control Technology (MACT) (40 CFR Part 63, Subpart ZZZZ), which limits the emissions of formaldehyde for new compression ignition reciprocating engines or, alternatively, requires 70 percent control of CO emissions.[21] TAC emissions are summarized in Table 8.1-19. Detailed emissions calculations, including emission factors, are provided in Appendix 8.1A, Table 8.1A-8.

[19] These pollutants are regulated under federal and state air quality programs; however, they are evaluated as noncriteria pollutants by the California Energy Commission.

[20] Sources: BAAQMD PDOC for the Eastshore Energy Center, April 30, 2007; CEC PSA for Eastshore Energy Center, August 17, 2007. Formaldehyde emission factor provided by vendor reflects oxidation catalyst control.

[21] Oxidation catalyst efficiency in controlling CO emissions is used as a surrogate for efficiency in controlling formaldehyde emissions and other HAPs that are the subject of the MACT rule. See Section 8.1.5.2.3.

TABLE 8.1-19
Maximum Proposed TAC Emissions for the New Equipment

Compound	Maximum Emissions: Hourly (lb/hr) Natural Gas Mode[a,g]	Maximum Emissions: Hourly (lb/hr) Diesel Mode	Maximum Emissions: Annual (tpy)
10 Wärtsilä Reciprocating Engines			
Ammonia[b]	19.3	21.1	62.8
Propylene	4.6	2.5	14.7
Hazardous Air Pollutants			
Acetaldehyde	0.4	0.02	1.4
Acrolein	0.05	0.01	0.2
Benzene	0.2	0.7	0.6
1,3-Butadiene	0.3	--	1.0
Diesel Particulate Matter[c,d]	--	55.6	1.4[f]
Ethylbenzene	0.1	--	0.2
Formaldehyde	3.3	0.1	10.7
Hexane	1.0	--	3.1
Naphthalene	0.02	0.1	0.1
PAHs[e]	$1.8x10^{-5}$	$4.1x10^{-5}$	$4.9x10^{-5}$
Toluene	0.2	0.2	0.6
Xylene	0.5	0.2	1.8
Diesel Emergency Generator			
Diesel Particulate Matter[c]	--	0.25	$6.2x10^{-3}$ [f]
Diesel Fire Pump Engine			
Diesel Particulate Matter[c]	--	0.06	$1.6x10^{-3}$ [f]
Total Hazardous Air Pollutants (HAPs) (excluding DPM)			**19.7**

Notes:

[a] Obtained from AP-42 and CATEF database for natural gas-fired lean-burn IC engines. See Appendix 8.1A, Table 8.1A-8.

[b] Based on an exhaust NH_3 limit of 10 ppmvd @ 15% O_2.

[c] In accordance with CARB policy, DPM is to be used as a surrogate for all TAC emissions from diesel IC engines. At CEC staff's request, individual constituents of diesel exhaust are also evaluated for acute health impacts in Sections 8.1.2.9 (Screening Health Risk Assessment) and 8.9 (Public Health).

[d] DPM portion of total PM_{10} emissions is front half only as defined in the ATCM and is limited to 0.15 gm/kw-hr.

[e] Carcinogenic PAHs only; naphthalene is considered separately.

[f] Annual DPM emissions calculation based on 50 hours per year of allowable operation for testing and maintenance per the ATCM.

[g] Natural gas mode firing includes pilot diesel injection.

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Annual DPM emissions are calculated based on the 50 hours per year of allowable operation on diesel fuel for testing and maintenance and on the 0.15 gm/kw-hr (0.11 gm/bhp-hr) limit for stationary compression ignition engines measured in accordance with the requirements of the NSPS (see Section 8.1.5.2.1.2). In accordance with CARB policy, DPM is used as a surrogate for diesel reciprocating engine TACs for chronic and cancer health risks.

Deleted: Maximum hourly and annual TAC emissions from the reciprocating engines during backup diesel fuel firing are equivalent to maximum hourly and annual diesel particulate matter (DPM) emissions from these units.

8.1.2.5.2 Toxic Air Contaminant Emissions: New Emergency Equipment

Maximum hourly and annual TAC emissions from the diesel-fueled emergency equipment are equivalent to maximum hourly and annual diesel particulate matter emissions from these units. In accordance with CARB policy, DPM is used as a surrogate for diesel reciprocating engine TACs. TACs from the new emergency engines are also shown in Table 8.1-19.

8.1.2.6 Air Quality Impact Analysis

NCUAQMD Rule 110 requires the Applicant to provide ambient air quality modeling analyses and other impact assessments. An ambient air quality impact assessment is also required for PSD review and by the CEC for CEQA review. These analyses are presented in this section.

8.1.2.6.1 Air Quality Modeling Methodology

An assessment of impacts from the HBRP on ambient air quality has been conducted using USEPA-approved air quality dispersion models. These models are based on various mathematical descriptions of atmospheric diffusion and dispersion processes in which a pollutant source impact can be calculated over a given area.

Figure 8.1B-7 in Appendix 8.1B shows the building layout used in the modeling analysis. Since the new equipment will operate for some undetermined period of time with the existing Humboldt Bay Power Plant generating equipment in place, the modeling analysis included the existing structures to account for any potential influences from those structures. The impact analysis was used to determine the worst-case ground-level impacts of the new reciprocating engines. The results were compared with established state and federal ambient air quality standards and PSD significance levels. If the standards are not exceeded then it is assumed that, in the operation of the facility, no exceedances are expected under any conditions. In accordance with the air quality impact analysis guidelines developed by USEPA (40 CFR Part 51, Appendix W: Guideline on Air Quality Models) and CARB (Reference Document for California Statewide Modeling Guideline, April 1989), the ground-level impact analysis includes the following assessments:

- Impacts in simple, intermediate, and complex terrain;
- Aerodynamic effects (downwash) due to nearby building(s) and structures;
- Impacts from inversion breakup (fumigation); and
- Impacts from shoreline fumigation conditions.

Simple, intermediate, and complex terrain impacts were assessed for all meteorological conditions that would limit the amount of final plume rise. Plume impaction on elevated terrain, such as on the slope of a nearby hill, can cause high ground-level concentrations, especially under stable atmospheric conditions. Another dispersion condition that can cause high ground-level pollutant concentrations is caused by building downwash. Building downwash can occur when wind speeds are high and a building or structure is in close proximity to the emission stack. This can result in building wake effects where the plume is drawn down toward the ground by the lower pressure region that exists in the lee side (downwind) of the building or structure.

Fumigation conditions occur when the plume is emitted into a low-lying layer of stable air (inversion) that then becomes unstable, resulting in a rapid mixing of pollutants towards the ground. The low mixing height that results from this condition allows little diffusion of the stack plume before it is carried downwind to the ground. Although fumigation conditions rarely last as long as an hour, relatively high ground-level concentrations may be reached during that period. Fumigation tends to occur under clear skies and light winds, and is more prevalent in the summer. Because land surfaces tend to both heat and cool more rapidly than water, shoreline fumigation tends to occur on sunny days when the denser cooler air over water displaces the warmer, lighter air over land. During an inland sea breeze, the unstable air over land gradually increases in depth with inland distance. The boundary between the stable air over the water and the unstable air over the land and the wind speed determine if the plume will loop down before much dispersion of the pollutants has occurred.

The basic model equation used in this analysis assumes that the concentrations of emissions within a plume can be characterized by a Gaussian distribution about the centerline of the plume. Concentrations at any location downwind of a point source such as a stack can be determined from the following equation:

$$C(x,y,z,H) = \left(\frac{Q}{2\pi\sigma_y\sigma_z u}\right) * \left(e^{-1/2\left(y/\sigma_y\right)^2}\right) * \left[\left\{e^{-1/2(z-H/\sigma_z)^2}\right\} + \left\{e^{-1/2(z+H/\sigma_z)^2}\right\}\right]$$

where

- C = the concentration in the air of the substance or pollutant in question
- Q = the pollutant emission rate
- σ_y,σ_z = the horizontal and vertical dispersion coefficients, respectively, at downwind distance x
- u = the wind speed at the height of the plume center
- x,y,z = the variables that define the 3-dimensional Cartesian coordinate system used; the downwind, crosswind, and vertical distances from the base of the stack
- H = the height of the plume above the stack base (the sum of the height of the stack and the vertical distance that the plume rises due to the momentum and/or buoyancy of the plume)

Gaussian dispersion models are approved by USEPA for regulatory use and are based on conservative assumptions (i.e., the models tend to overpredict actual impacts by assuming steady-state conditions, no pollutant loss through conservation of mass, no chemical reactions, etc.). The USEPA models were used to determine if ambient air quality standards would be exceeded, and whether a more accurate and sophisticated modeling procedure would be warranted to make the impact determination. The following sections describe:

- Screening modeling procedures
- Refined air quality impact analysis
- Existing ambient pollutant concentrations and preconstruction monitoring
- Results of the ambient air quality modeling analyses
- PSD increment consumption

8.1.2.6.1.1 AERMOD

The screening and refined air quality impact analyses were performed using the American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) modeling system, also known as AERMOD (version 06341). The AERMOD modeling system incorporates a steady-state, multiple-source, Gaussian dispersion model designed for use with stack emission sources situated in terrain where ground elevations can exceed the stack heights of the emission sources (i.e. complex terrain).[22] The model is capable of estimating concentrations for a wide range of averaging times (from 1 hour to 1 year).

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Inputs required by the AERMOD model include the following:

- Model options
- Meteorological data
- Source data
- Receptor data

Model options refer to user selections that account for conditions specific to the area being modeled or to the emissions source that needs to be examined. Examples of model options include use of site-specific vertical profiles of wind speed and temperature; consideration of stack and building wake effects; and time-dependent exponential decay of pollutants. The model supplies recommended default options for the user for some of these parameters.

AERMOD uses hourly meteorological data to characterize plume dispersion. The representativeness of the data is dependent on the proximity of the meteorological monitoring site to the area under consideration, the complexity of the terrain, the exposure of the meteorological monitoring site, and the period of time during which the data are collected. The meteorological data used in this analysis were collected at the Woodley Island NWS monitoring station about 5 miles northeast of project site. This data set was selected to be representative of meteorological conditions at the project site and to meet the requirements of the USEPA "On-Site Meteorological Program Guidance for Regulatory Model Applications" (EPA-450/4-87-013, August 1995). The analysis used surface meteorological data collected between 2001 and 2005. There is no nearby location where satisfactory upper air data are gathered for the purpose of determining mixing heights and other surface boundary layer parameters. The nearest NWS sounding station is Medford, Oregon, which is 185 km (115 miles) away. That location is inland, and is not characteristic of either the meteorological data or project sites. Although the NWS station at Oakland Airport is farther from the site than Medford (378 km, or 235 miles away), it is in a comparable coastal location to the project site, so the upper air data collected there are representative of upper air conditions at the site.

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[22] AERMOD was adopted as a guideline model by USEPA as a replacement for ISCST3. AERMOD incorporates an improved downwash algorithm as compared to ISCST3 (Federal Register, November 9, 2005; Volume 70, Number 216, Pages 68218-68261).

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Therefore, Oakland sounding data were used for determining mixing heights and other surface boundary layer parameters.

The AERMET meteorological preprocessor was used to prepare the meteorological data for AERMOD. AERMET requires location-specific surface characteristics to construct realistic planetary boundary layer (PBL) similarity profiles. Values for surface roughness (z_o), Albedo (r), and Bowen ratio (B_o) must be selected for wind direction sectors. In accordance with EPA guidance,[23] since the HBRP was determined to be a rural source using rural NWS data, the value of z_o for each sector was selected to reflect the meteorological station site. Source site values were used for B_o and r. The sectors and the values of z_o, B_o and r used in creating the AERMOD meteorological data set are shown in Table 8.1-20. The sectors are illustrated in Appendix 8.1B, Figure 8.1B-8.

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TABLE 8.1-20

Location-Specific Surface Characteristics Used in AERMET

Wind Direction Sector, Deg.	Land Use: Met Station	Land Use: Project Site	Surface Roughness, z_o[a]	Albedo, r[b]	Bowen Ratio, B_o[b]
0-37	Water	Water	0.001	0.14	0.1
37-90	Water	Grassland	0.001	0.2	0.6
90-125	Desert shrubland	Grassland	0.0725[c]	0.2	0.6
125-200	Residential	Coniferous Forest	0.6	0.12	0.4
200-230	Residential	Water	0.6	0.14	0.1
230-330	Swamp	Water	0.05	0.14	0.1
330-0	Water	Water	0.001	0.14	0.1

Notes:

[a] All values for surface roughness parameters except desert shrubland taken from Roland B Stull, "An Introduction to Boundary Layer Meteorology," Chapter 9 (Similarity Theory), p. 380, 1988.

[b] All values for Albedo and Bowen ratio taken from USEPA, "User's Guide for the AERMOD Meteorological Preprocessor (AERMET)," EPA-454/B-03-002, November 2004.

[c] Value for desert shrubland surface roughness based on the default option of AERMET VIEW by Lakes Environmental, Inc.

The required emission source data inputs to AERMOD include source locations, source elevations, stack heights, stack diameters, stack exit temperatures and velocities, and emission rates. The source locations are specified for a Cartesian (x,y) coordinate system where x and y are distances east and north in meters, respectively. The Cartesian coordinate system used is the Universal Transverse Mercator Projection (UTM). The stack height that can be used in the model is limited by federal and NCUAQMD Good Engineering Practice (GEP) stack height restrictions, discussed in more detail below. In addition, AERMOD requires nearby building dimension data to calculate the impacts of building downwash.

[23] USEPA, "AERMOD Implementation Guide," September 27, 2005. http://www.epa.gov/scram001/7thconf/aermod.

8.1.2.6.1.3 CTDMPLUS

The USEPA- approved CTSCREEN (version number 94111) and CTDMPLUS (version number 93228) models were used for refined modeling of impacts in complex terrain. The CTDMPLUS model is a refined point-source Gaussian air quality model for use in all stability conditions for complex terrain applications; CTSCREEN is the screening mode version of CTDMPLUS. Because CTDMPLUS/CTSCREEN accounts for the dimensional nature of the plume and terrain interaction, the model requires digitized terrain of the nearby topography. The digitization of terrain was accomplished by the terrain preprocessors, FITCON and HCRIT. The wind direction used in CTDMPLUS is based on the source-terrain geometry, resulting in computation of the highest impacts likely to occur. Other meteorological variables are derived from possible combinations of a set of predetermined values. CTSCREEN provides maximum concentration estimates that are similar to, but on the conservative side of, those that would be calculated from the CTDMPLUS model, which employs representative meteorological data.

CTSCREEN and CTDMPLUS are appropriate for the following applications:

- Elevated point sources;
- Terrain elevations above stack top elevation;
- Rural or urban areas; and
- 1 hour to annual averaging time periods.[25]

The terrain data required by the CTSCREEN and CTDMPLUS models were created by digitizing terrain contours at periodic intervals. A sufficient number of points were selected to define the basic shape of each contour. All digitized points were input to the preprocessor programs FITCON and HCRIT, and a terrain file was generated for use in the CTSCREEN and CTDMPLUS models.

CTDMPLUS requires an extensive suite of meteorological data composed not only of wind speed, direction, and temperature, but also of horizontal and vertical wind direction standard deviations (sigma theta and sigma phi, respectively) as well as vertical wind speed standard deviation (sigma w). The data set directed by the NCUAQMD for use in modeling the project, derived from measurements taken at Woodley Island, does not include these non-standard measurements.

Conservative values for these standard deviation parameters were developed that are consistent with the available meteorological data and were used to prepare a meteorological data set that is usable in CTDMPLUS and yields conservative (i.e., high) ground-level concentrations.

The following meteorological parameters are needed for CTDMPLUS and were taken directly from the AERMET files:

- Observed mixing height, provided as the height of the convective or planetary boundary layer (PBL);

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[25] CTSCREEN and CTDMPLUS produce one-hour average values which are converted to longer-term averages using published EPA default conversion factors. There is no published conversion factor for the 8-hour averaging period, so a conversion factor of 0.5 was used, as recommended by EPA Region 9 Regional Meteorologist Scott Bohning.

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- Calculated mixing height, provided as the height of the mechanical, or surface, boundary layer (SBL);
- Friction velocity (USTAR);
- Monin-Obukhov length (L); and
- Roughness length (Z_O).

The remaining standard deviations (sigma values) are not available from AERMOD and must be obtained from the ISCST3 files. Stability classes determined by MPRM[26] or PCRAMMET[27] from the measured Woodley Island meteorological data were used to select the most conservative values from the ranges recommended in EPA's Meteorological Monitoring Guidance document, as listed in Table 8.1-21[28]

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TABLE 8.1-21

Sigma Values for Use in CTDMPLUS Modeling

Stability Category	**Sigma Phi (σ_Φ)/ Regulatory Range (degrees)**	**Sigma Theta (σ_θ)/ Regulatory Range (degrees)**
A	11.5	22.5
B	10.0 – 11.5	17.5 – 22.5
C	7.8 – 10.0	12.5 – 17.5
D	5.0 – 7.8	7.5 – 12.5
E	2.4 – 5.0	3.8 – 7.5
F	< 2.4	< 3.8

The most conservative values (that is, the values that produce the highest modeled impacts) for sigma theta and sigma phi within each range were determined by conducting a sensitivity analysis for all combinations of stack conditions to be modeled using CTDMPLUS and receptor locations for which CTDMPLUS could be used (that is, receptors above stack height). The sensitivity analysis used the upper and lower values of each range for each stability category. For example, for stability category D, four combinations were evaluated as follows:

26 The Meteorological Processor for Regulatory Models

27 EPA meteorological preprocessor

28 Tables 6-8a and 6-9a in Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-005, US EPA Office of Air and Radiation, Office of Air Quality Planning and Standards, February 2000.

σ_Φ	σ_θ
5.0	7.5
5.0	12.5
7.8	7.5
7.8	12.5

For stability category A, maximum values for sigma phi and sigma theta of 15.0 and 27.0, respectively, were evaluated. For stability category F, minimum values for sigma phi and sigma theta of 1.0 and 2.0, respectively, were evaluated. For the sensitivity analysis, five hills surrounding the project site (shown in the figure in Attachment 8.1B-2) and stack parameters for eight operating cases (full load and part load, gas and liquid fuel operation) were evaluated. Four different combinations of the standard deviation parameters were used for each analysis:

- Bottom of both sigma theta and sigma phi ranges
- Bottom of sigma theta range; top of sigma phi range
- Top of sigma theta range; bottom of sigma phi range
- Top of both sigma theta and sigma phi ranges

The results of the sensitivity analysis showed that while other combinations of parameters sometimes produce higher intermediate results, the project maxima are always associated with the lowest values for the two dispersion parameters. Based on these results, the lowest values for the two dispersion parameters were used in the final CTDMPLUS modeling analyses.[29]

Sigma-w was estimated by multiplying sigma-phi (after conversion from degrees to radians) by the horizontal wind speed.

8.1.2.6.3 Source Data

For the refined modeling analyses, AERMOD was used to model impacts in terrain at all receptors and CTSCREEN and CTDMPLUS were used to refine the analyses for impacts in terrain above stack top. For both models, each Wärtsilä engine stack was modeled as an individual point source.

For the purposes of modeling, a stack height beyond what is required by Good Engineering Practices is not allowed (NCUAQMD Rule 110, Section 7.2). However, this requirement does not place a limit on the actual constructed height of a stack. GEP as used in modeling analyses is the height necessary to ensure that emissions from the stack do not result in excessive concentrations of any air pollutant in the immediate vicinity of the source as a result of atmospheric downwash, eddies, or wakes that may be created by the source itself, nearby structures, or nearby terrain obstacles. In addition, the GEP stack height modeling restriction assures that any required regulatory control measure is not compromised by the effect of that portion of the stack that exceeds the GEP height. The USEPA guidance

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Deleted: because of their proximity (the 5 individual stacks in each group are within approximately 1 diameter of each other) each cluster of 5 Wärtsilä engine stacks was modeled as a single equivalent stack with exhaust temperature and velocity equal to that of the individual stacks and diameter calculated as the square root of the sum of the squares of the individual stacks. Therefore the 2 clusters of five 1.62 meter diameter stacks were modeled as 2 equivalent stacks, each having a diameter of:¶
$[(1.62)^2 + (1.62)^2 + (1.62)^2 + (1.62)^2 + (1.62)^2]^{1/2} = 3.62$ meters

29 The results of this sensitivity analysis have been provided to the District under separate cover.

("Guideline for Determination of Good Engineering Practice Stack Height," Revised 6/85) for determining GEP stack height indicates that GEP is the lesser of 65 meters or H_g, where H_g is calculated as follows:

$$H_g = H + 1.5L$$

where

H_g = Good Engineering Practice stack height, measured from the ground-level elevation at the base of the stack

H = height of nearby structure(s) measured from the ground-level elevation at the base of the stack

L = lesser dimension, height or maximum projected width, of nearby structure(s)

In using this equation, the guidance document indicates that both the height and width of the structure are determined from the frontal area of the structure, projected onto a plane perpendicular to the direction of the wind. For the HBRP, the nearest influencing structure is the top of the engine hall, which is 44.8 feet above ground level. Therefore, GEP stack height is 2.5 times that height, or 112 feet. The proposed stack height of 100 feet will not exceed GEP stack height, so the full physical stack height may be used in the modeling analysis.

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For regulatory applications, a building is considered sufficiently close to a stack to cause wake effects when the downwind distance between the stack and the nearest part of the building is less than or equal to five times the lesser of the height or the projected width of the building. Building dimensions for the buildings analyzed as downwash structures were obtained from plot plans. The building dimensions were analyzed using the Lakes Environmental Building Profile Input Program (BPIP) to calculate 36 wind-direction-specific building heights and projected building widths for use in building wake calculations. The building dimensions used in the GEP analysis are shown in Appendix 8.1B, Table 8.1B-1. As many of the existing power plant structures will remain in place for some period of time following the startup of the new reciprocating engines, those structures are reflected in the downwash analysis.

8.1.2.6.4 Screening Procedures for the HBRP Reciprocating Engines

To ensure the impacts analyzed were for maximum emission levels and worst-case dispersion conditions, a screening procedure was used to determine the inputs to the impact modeling for the new generating units. The screening procedure analyzed the reciprocating engine operating conditions that would result in the maximum impacts on a pollutant-specific basis. The operating conditions examined in this screening analysis, along with their exhaust and emission characteristics, are shown in Appendix 8.1B, Table 8.1B-3. These operating conditions represent reciprocating engine operation at maximum and minimum ambient operating temperatures (87°F and 21°F), and at 100 percent, 75 percent and minimum (50 percent) loads on natural gas and emergency backup diesel fuels. The low-load operating cases (2G, 6G, 2D and 6D) were not evaluated for 24-hour or annual average impacts, and the mid-load cases (3G, 4G, 3D, 4D) were not evaluated for annual average impacts, because these operating cases are not expected to persist for more than a few hours

Deleted: 8.1.2.6.2 Impacts from the Existing Humboldt Bay Power Plant Generating Units¶
Ambient impacts from the existing Humboldt Bay Power Plant generating units were modeled using actual emissions, operating, and fuel use data. For the 1-, 3- and 8-hour averaging periods, it was assumed that all four units were operating at full load. For the 24-hour averaging period, it was assumed that the two boilers were operating at full load and that each MEPP was operating at 50 percent load. Average historical emission rates over the past 2 years were used for the annual averaging period. Emission rates and stack parameters used in evaluating the air quality impacts from the existing generating units are shown in Table 8.1B-2, Appendix 8.1B. Maximum modeled impacts are summarized in Table 8.1-21.¶
TABLE 8.1-21¶
Maximum Modeled Impacts from Existing Generating Units at Humboldt Bay Power Plant ... [9]

at any time. The 24-hour average PM_{10} impacts were modeled using the 1542 lb/day limit discussed in Section 8.1.2.3.2.

Ambient impacts for each of the operating cases were modeled using USEPA's AERMOD model and five years of on-site meteorological data, as described above. The results of the unit impact analysis are presented in Appendix 8.1B, Table 8.1B-4. The analysis showed that for most pollutants and averaging periods, modeled impacts were highest under full load operating conditions, while 24-hour average PM_{10} impacts were highest under part load conditions.

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8.1.2.7 Results of the Ambient Air Quality Modeling Analysis

8.1.2.7.1 Refined Air Quality Impact Analysis

The stack parameters and emission rates used to model impacts from the Wärtsilä reciprocating engines and emergency equipment are shown in Appendix 8.1B, Table 8.1B-5. The unit impact/screening and refined analyses included simple, intermediate, and complex terrain. Terrain features were taken from USGS DEM data and 7.5-minute quadrangle maps of the area including Eureka, Cannibal Island, Fields Landing, McWhinney Creek, and Arcata South.

The model receptor grids were derived from 30-meter DEM data. The CEC guidance cited above was used to locate receptors. Twenty-five-meter refined receptor grids were used in areas where the coarse grid analyses indicated modeled maxima for each site plan would be located. In general, the CEC staff recommends extending the 25-meter fine grid to a distance of 1 km from the location of the coarse grid maximum for each pollutant and averaging period. For this analysis, and after discussion with the CEC staff, the extent of the AERMOD fine grids was reduced to a distance of two coarse grid spacings from the coarse grid maxima. Modeled concentrations at the edges of each fine grid were examined to ensure that the maxima were captured on these grids. Maps showing the layout of each receptor grid around the site plan are presented in Figures 8.1B-9A, 9B and 9C, Appendix 8.1B.

As discussed above, the refined modeling used CTSCREEN and CTDMPLUS to examine maximum impacts in the complex terrain surrounding the facility. The CTSCREEN coarse grids covered the terrain above stack top elevation nearest the facility, where the maximum complex terrain impacts from the initial AERMOD modeling analysis were shown to be located. The coarse grid resolution is 153 m by 153 m, extending 2.9 km in each direction to cover Humboldt Hill. Each CTSCREEN fine grid has a resolution of 25 m by 25 m and extends 500 m in each direction from the location of the CTSCREEN coarse grid maximum impacts. For CTDMPLUS, the coarse grid resolution is 250 m by 250 m, covering the entirety of each of five identified hills. The CTDMPLUS fine grid has a resolution of 25 m by 25 m and extends 400 m in each direction from the location of the CTDMPLUS coarse grid maximum 1-hr impact.

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The higher of the impact in flat terrain (below stack base, from AERMOD) or in elevated terrain (above stack top from CTSCREEN or CTDMPLUS) is reported as the maximum modeled impact for each pollutant and averaging period. The CTSCREEN and CTDMPLUS receptor grids are shown in Figure 8.1B-9D, Appendix 8.1D.

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Both normal and emergency operations were modeled for the engines. Normal operation reflects routine natural gas operation of the Wärtsilä reciprocating engines with up to 50 hours per year of testing and maintenance operation per engine on diesel fuel. Emergency

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operation reflects worst-case daily operation of the Wärtsilä reciprocating engines on liquid fuel for short-term averaging periods (24 hours and less).

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8.1.2.7.2 Inversion Breakup Fumigation Modeling

Inversion breakup fumigation occurs when a stable layer of air lies a short distance above the release point of a plume and unstable air lies below. Under these conditions, an exhaust plume may be drawn to the ground, causing high ground-level pollutant concentrations. Although fumigation conditions rarely last as long as 1 hour, relatively high ground-level concentrations may be reached during that time. For this analysis, fumigation was assumed to occur for up to 90 minutes, per USEPA guidance.

The SCREEN3 model was used to evaluate maximum ground-level concentrations for short-term averaging periods (24 hours or less). Although this modeling analysis is not required by District regulation, guidance from USEPA[30] was followed in evaluating fumigation impacts. Since SCREEN3 is a single-source model, a single engine was modeled and the results multiplied by 10. The maximum fumigation impact from this analysis, which is shown in more detail in Appendix 8.1B, Table 8.1B-6, showed that impacts under fumigation conditions are expected to be lower than the maximum concentrations calculated by AERMOD under downwash conditions. Fumigation impacts for the reciprocating engines occurred approximately 7 km to 9 km from the facility, depending upon engine load (the AERMOD maximum 1-hour impact occurs about 1 km from the engine stacks). Inversion breakup impacts are shown in Table 8.1-22 below.

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30 USEPA-454/R-92-019, "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised."

TABLE 8.1-22
Results of the Specialized Modeling Analyses (Total Impacts for 10 Engines)

Pollutant	Averaging Period	Modeled Concentration (µg/m^3): Startup, Normal Conditions[a]	Startup, Liquid Fuel[b]	Inversion Breakup Fumigation[e]	Shoreline Fumigation[e]
NO_2	1 hour[d]	229.7	338	74.1	224.6
SO_2	1 hour	[c]	[c]	1.5	10.7
	3 hours	[c]	[c]	1.2	5.3
	24 hours	[c]	[c]	0.5	0.7
CO	1 hour	2,055	[b]	25.8	179.5
	8 hours	[f]	[f]	14.1	34.3
PM_{10}	24 hours	[c]	[c]	8.7	12.9

Notes:

[a] Modeled using the maximum hourly NOx and CO emission rates in Table 8.1-17.

[b] Modeled using the higher hourly NOx emission limit, which would apply only under emergency conditions. See discussion in Section 8.1.2.3.3 and 8.1.2.7.4 as well as definition of emergency conditions in Section 8.1.5.2.2.2.

[c] Not applicable, because emissions are not elevated above normal levels during startup.

[d] Ozone limited using highest hourly ozone concentration at Ukiah during 2001-2005.

[e] These analyses are for short-term phenomena and are evaluated only for short-term averaging periods. PM_{10} impacts reflect 1542 lb/day limit.

[f] Not applicable, because startup emissions are included in the 8-hour and longer-term modeling.

8.1.2.7.3 Shoreline Fumigation Modeling

Shoreline fumigation modeling is used to determine the impacts as a result of over-water plume dispersion. Because land surfaces tend to both heat and cool more rapidly than water, shoreline fumigation tends to occur on sunny days when the denser cooler air over water displaces the warmer, lighter air over land. During an inland sea breeze, the unstable air over land gradually increases in depth with inland distance. The boundary between the stable air over the water and the unstable air over the land and the wind speed determine if the plume will loop down before much dispersion of the pollutants has occurred.

SCREEN3 can examine sources within 3,000 meters of a large body of water, and was used to calculate the maximum shoreline fumigation impact. The model uses a stable onshore flow and a wind speed of 2.5 meters per second; the maximum ground-level shoreline fumigation concentration is assumed by the model to occur where the top of the stable plume intersects the top of the well-mixed thermal inversion boundary layer (TIBL). The SCREEN3 default TIBL height of 6 was used to determine facility impacts due to shoreline fumigation, which is assumed to occur for up to 90 minutes. The shoreline fumigation modeling analysis is shown in more detail in Table 8.1B-7, Appendix 8.1B.

Shoreline fumigation impacts for the reciprocating engines were predicted to occur at a distance of approximately 0.5 km from the engine stacks (the AERMOD maximum 1-hour impact occurs about 1 km from the engine stacks). Shoreline fumigation impacts are

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summarized along with inversion breakup fumigation impacts and impacts during startup in Table 8.1-22.

8.1.2.7.4 Engine Startup

Short-term ambient impacts from the facility during engine startup may be higher than impacts during normal operation because emission control systems are not fully operational during some part of the initial startup period. Therefore, facility impacts were also evaluated during the startup of all 10 engines simultaneously to evaluate short-term impacts under worst-case startup emissions. Although engines will typically be started up on natural gas, under emergency operating conditions it could be necessary to start up some of the engines on diesel fuel.[31] Emission rates expected during startups were provided by Wärtsilä and were presented in Table 8.1-16. Engine exhaust parameters for 50 percent load operation on natural gas (Case 2G) and diesel (Case 6D) were used to characterize engine exhaust during startup, because those operating cases produced the highest modeled impacts in the engine screening analysis. CO and NOx emission rates from Table 8.1-17 were used for the modeling analysis. Startup impacts were evaluated for the 1-hour averaging period; startup impacts are included in the modeling of 8-hour average CO impacts under normal operating conditions. The emission rates and stack parameters used are shown in Table 8.1B-8, Appendix 8.1B. Startup impacts were modeled using AERMOD and complex terrain impacts were refined using CTSCREEN. The results of the analysis are summarized in Table 8.1-22.

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8.1.2.7.5 Ozone Limiting

For AERMOD, one-hour NO_2 impacts were modeled using AERMOD_PVMRM. AERMOD_PVMRM uses hourly ozone data to perform ozone-limiting calculations on individual plumes on an hour-by-hour basis. Concurrent ozone data collected at the nearest representative monitoring station, Ukiah, were used for this analysis.[32] CTSCREEN and CTDMPLUS do not include built-in ozone-limiting options. Concentrations modeled using CTSCREEN were ozone corrected using the highest hourly ozone reading during each year of the 5-year period. Annual NOx impacts were converted to NO_2 using the EPA-guidance Ambient Ratio Method and the nationwide default conversion rate of 0.75.

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8.1.2.7.6 Engine Commissioning

The commissioning period begins when the engines are prepared for first fire and ends upon successful completion of initial performance testing. There are several high emissions scenarios possible during commissioning. The first is the period prior to SCR system and oxidation catalyst installation, when the engines are being tuned. Under this scenario, NOx emissions would be high because the NOx emissions control system would not be functioning and because the engines would not be tuned for optimum performance. CO emissions would also be high because engine performance would not be optimized and the CO emissions control system would not be functioning. The second high emissions scenario may occur when the engines have been tuned but the SCR and oxidation catalyst installation is not complete. Since the control system installation would not be complete,

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31 See definition of emergency conditions in Section 8.1.5.2.2.2.

32 Ukiah hourly ozone data were selected instead of data from Willits because monitored hourly concentrations in Ukiah were generally higher than those in Willits. Contemporaneous Willits ozone data were used to fill in missing hours in the Ukiah data set. A discussion of why the Ukiah and Willits ozone data are representative of ozone at the project site is provided in Section 8.1.5.2.1.1.

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NOx and CO levels would again be high. Wärtsilä expects to perform initial commissioning activities on 5 engines at a time, for between 30 and 60 days. Performance and emission testing would follow, requiring an additional 45 to 90 days. Commissioning activities and expected emissions are shown in more detail in Table 8.1B-10, Appendix 8.1B.

The existing Humboldt Bay Power Plant generating units will be in operation during the commissioning of the HBRP engines. An assessment of the air quality impacts of this combined operation will be included in the cumulative impacts analysis, as discussed in the protocol provided in Appendix 8.1F.

Air quality impacts during the commissioning period were determined using the emission rates in Table 8.1B-10 and the screening modeling results in Table 8.1B-4. One-hour average NO_2 impacts during commissioning were modeled using AERMOD PVMRM and concurrent Ukiah ozone data. The CTSCREEN model was used to evaluate refined impacts in complex terrain. Modeled impacts are shown in Table 8.1-23.

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TABLE 8.1-23

Ambient Impacts During Initial Commissioning

	Maximum Modeled Impact During Commissioning, µg/m³			
Operating Mode	**NO_2, 1-hr avg[a]**	**CO, 1-hr avg**	**CO, 8-hr avg**	**PM_{10}, 24-hr avg**
Test run and tuning	222.3	1,025	435.9	13.8
Alignment	233.3	1,247	266.2	3.7
SCR tuning on liquid fuel	177.1	176.1	74.8	13.7

Note:

[a] Modeled using AERMOD PVMRM and CTSCREEN and hourly ozone data from Ukiah.

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8.1.2.8 Total Facility Impacts

The maximum facility impacts calculated from the modeling analyses described above are summarized in Table 8.1-24. The highest modeled short-term impacts are expected to occur under startup and shoreline fumigation conditions.

Although EPA guidance (71 FR 6727) provides that compliance with the federal $PM_{2.5}$ NAAQS should be evaluated using the PM_{10} NAAQS and not modeled directly, at the request of the District, compliance with both the federal 24-hour average AAQS and the state and federal annual average AAQS for $PM_{2.5}$ have been addressed based on $PM_{2.5}$ for non-PSD purposes. $PM_{2.5}$ impacts are discussed separately below.

TABLE 8.1-24
Results of the Ambient Air Quality Modeling Analysis

		Modeled Concentration (µg/m3)			
Pollutant	**Averaging Time**	**Normal Operation[a]**	**Emergency Operation[b]**	**Startup**	**Shoreline Fumigation**
NO_2	1-hour	174.7[c]	209.1[i]	229.7[d]	224.6
	Annual	2.5	n/a	--[e]	--[f]
SO_2	1-hour	25.4	--[g]	--[h]	10.7
	3-hour	18.3	--[g]	--[h]	5.3
	24-hour	3.7	--[g]	--[h]	0.7
	Annual	0.1	n/a	--[h]	--[f]
CO	1-hour	264.1	492.2[i]	1,925[d]	179.5
	8-hour	n/a	242.3	--[d]	34.2
PM_{10}	24-hour	18.7	34.1	--[h]	12.9
	Annual	3.1	n/a	--[h]	--[f]

Notes:

[a] Wartsila generators operating on natural gas for short-term averaging periods; 50 hrs/yr of liquid fuel firing for annual averaging period.

[b] Wartsila generators operating on emergency backup diesel fuel for short-term averaging periods.

[c] Includes emergency black start generator and fire pump engine testing. Black start generator limited to 45 minutes of operation for testing and maintenance in any hour.

[d] Startup on natural gas fuel.

[e] Not applicable, because startup emissions are included in the 8-hour and longer-term ("Normal Operation") modeling.

[f] Not applicable, because shoreline fumigation is a short-term phenomenon and as such is evaluated only for short-term averaging periods.

[g] Short-term SO_2 concentrations are highest during natural gas firing, because 1 gr/100 scf natural gas fuel sulfur content is higher than 15 ppm CARB diesel fuel sulfur limit.

[h] Not applicable, because emissions are not elevated above normal levels during startup.

[I] Excludes emergency equipment.

To determine a project's air quality impacts, the modeled concentrations are added to the highest reported background ambient air concentrations and then compared to the applicable ambient air quality standards. The modeled concentrations have already been presented in earlier tables. The highest reported background ambient concentrations are listed in Table 8.1-25. More detailed discussions of why the data collected at these stations are representative of ambient concentrations in the vicinity of the project are provided in Sections 8.1.1.3.2 and 8.1.5.2.1.1.

Table 8.1-25 presents the highest reported concentrations of NOx, CO, SO_2, and PM_{10} recorded between 2004 and 2006 from the Willits, Ukiah, and Eureka monitoring stations.

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TABLE 8.1-25
Maximum Background Concentrations, 2004-2006 (µg/m³)

Pollutant	Averaging Time	2004	2005	2006
NO_2	1-hour, Willits	67.7	52.6	75.2
	1-hour, Ukiah	69.6	69.6	73.3
	annual, Willits	15.1	15.1	17.0
	annual, Ukiah	17.0	15.1	15.1
SO_2[a]	1-hour, SF	114.4	49.4	65.0
	3-hour, SF	70.2	33.8	39.0
	24-hour, SF	21.0	18.4	15.3
	Annual, SF	5.3	5.3	5.8
CO	1-hour, Willits	2250	2125	2375
	1-hour, Ukiah	2875	3250	2750
	8-hour, Willits	1300	1167	1211
	8-hour, Ukiah	1978	1678	1800
PM_{10}[b]	24-Hour	64	71	72.2
	Annual	20.7	13.6	21.1

Notes:

[a] SO_2 background data collected at San Francisco Arkansas Street.

[b] PM_{10} data collected at Eureka I Street.

8.1.2.8.1 Normal and Emergency Operations

Maximum ground-level impacts due to operation of the HBRP are shown together with the ambient air quality standards in Table 8.1-26. The impacts shown in Table 8.1-26 reflect typical facility operation in natural gas mode, with operation of the emergency equipment (black start generator and fire pump engine) and of the Wärtsilä reciprocating engines in diesel mode only for allowable testing and maintenance hours (50 hours per year). The ambient air quality modeling results are extremely conservative and are designed to overpredict ambient concentrations because they evaluate impacts under a combination of worst-case conditions that are unlikely to occur simultaneously. The modeling combines the highest allowable emission rates with the most extreme meteorological conditions and the equipment operating load conditions that result in the highest ambient impact; therefore, it is extremely unlikely that the ambient concentrations predicted by the models will ever actually be realized. However, this analysis demonstrates that even under these combinations of conditions that overpredict impacts, the HBRP will not cause or contribute to violations of any state or federal air quality standards, with the exception of the state PM_{10} standards. For this pollutant, existing concentrations already exceed the state standards.

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TABLE 8.1-26
Modeled Maximum Impacts

Pollutant	Averaging Time	Maximum Facility Impact (μg/m³)	Background (μg/m³)	Total Impact (μg/m³)	State Standard (μg/m³)	Federal Standard (μg/m³)
NO_2	1-hour, natural gas mode	174.7	75.2	250	338	–
	1-hour, diesel mode	209.1	75.2	284	338	--
	Annual[a]	2.5	17.0	20	56	100
SO_2[c]	1-hour	25.4	114.4	140	650	–
	3-hour	18.3	70.2	88	–	1300
	24-hour	3.7	21.0	25	109	365
	Annual[a]	0.1	5.8	5.9	–	80
CO	1-hour, natural gas mode	264.1	3,250	3,514	23,000	40,000
	1-hour, diesel mode	492.2	3,250	3,742	23,000	40,000
	8-hour, diesel mode[b]	242.2	1,978	2,220	10,000	10,000
PM_{10}	24-hour, natural gas mode	18.7	72.2	91	50	150
	24-hour, diesel mode	34.1	72.2	106	50	150
	Annual[a]	3.1	21.1	24.2	20	50

Notes:

[a] Operation in natural gas mode with up to 50 hours per year per engine of operation in diesel mode for testing and maintenance.

[b] All reciprocating engines operating on liquid fuel; includes one 1-hour startup.

[c] SO_2 emissions on natural gas are higher than SO_2 emissions on diesel fuel, so modeled SO_2 impacts for emergency operations are lower than for normal operation and are not shown.

8.1.2.8.2 Impacts During Startup and Commissioning

Maximum modeled 1-hour average NO_2 and CO impacts during startup are summarized in Table 8.1-27. One-hour average NO_2 and CO impacts during commissioning are lower than impacts during startup, as shown in Table 8.1-23. SO_2 and PM_{10} impacts are not higher during startup or commissioning activities than during normal and emergency engine operation, so these pollutants are not included here.

Deleted: Maximum ground-level impacts due to operation of the HBRP are shown together with the ambient air quality standards in Tables 8.1-26 and 8.1-27. The impacts shown in Table 8.1-26 reflect typical facility operation, with operation of the emergency equipment (black start generator and fire pump engine) and of the Wärtsilä reciprocating engines on liquid backup fuel only for allowable testing and maintenance hours (50 hours per year). Table 8.1-26 shows maximum modeled impacts under reasonably foreseeable worst case conditions, with maximum anticipated op ... [31]

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TABLE 8.1-27
Modeled Maximum Impacts During Startup Activities

Pollutant	Averaging Time	Maximum Facility Impact (µg/m³)	Background (µg/m³)	Total Impact (µg/m³)	State Standard (µg/m³)	Federal Standard (µg/m³)
NO_2	1-hour, startup[a]	261.8	75.2	337	338	–
	1-hour, emergency startup[b]	338.0	--	338	338	--
CO	1-hour, startup	2,054.8	3,250	5,305	23,000	40,000

Notes:
[a] Operation in compliance with 392 lb/hr limit.
[b] Operation in compliance with 676 lb/hr limit.

8.1.2.8.3 Compliance with the Federal $PM_{2.5}$ Standards

As discussed above, the USEPA has indicated in several policy documents that modeling techniques for $PM_{2.5}$ have not yet been developed, so compliance with the federal $PM_{2.5}$ standards should be demonstrated through compliance with the PM_{10} standards. However, for this project the CARB and District staffs requested a demonstration, through modeling, that the proposed project would not cause a violation of the federal $PM_{2.5}$ standards.

Compliance with the federal 24-hour average $PM_{2.5}$ standard was demonstrated by combining modeled 24-hour average concentrations for each day with contemporaneous (with the meteorological data) 24-hour average $PM_{2.5}$ concentrations from the Eureka monitor for each day during the 4-year modeling period (2001 through 2004[33]). Since $PM_{2.5}$ measurements are taken on a once-in-six-day basis, each $PM_{2.5}$ measurement was presumed to represent the day of measurement and each subsequent day until a new monitored concentration was collected. Missing data (beyond these 5-day gaps) were filled in by interpolation using data from the monitoring days immediately preceding and following the missing data point. Compliance with the standard is calculated as the 98th percentile of 24-hour $PM_{2.5}$ concentrations in a year, averaged over three years.

To calculate the 98th percentile 24-hour $PM_{2.5}$ concentration from 365 daily values, the following formula was used:

$$P_{0.98y} = X_{[i+1]}$$

where:

$P_{0.98y}$ = 98th percentile value for year y

$X_{[i+1]}$ = the (i+1)th number in the ordered series of numbers

i = the integer part of the product of 0.98 and n

The three year average 24-hour 98th percentile is calculated by averaging 98th percentile annual values obtained for three consecutive years.

33 No monitored $PM_{2.5}$ concentrations are available for the Eureka monitoring station between June 27 and November 27, 2005. Because of this large amount of missing data, 2005 was not included in the evaluation of $PM_{2.5}$ impacts.

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Solving for P on an annual basis produces:

0.98 x 365 = 357.7 == i+1 = 358[34]

which corresponds to the 8th highest value for each year.

A step-by-step description of the procedure is as follows:

- Perform refined modeling for two operating cases (natural gas mode and diesel mode) that produced highest concentration in screening step, using AERMOD for all receptors and CTDMPLUS for receptors above stack top elevation, and 4 years of Woodley Island meteorological data[35]. Obtain the highest modeled concentration for each receptor for each 24-hour period.
- Select the highest modeled concentrations for each calendar day for the gas and diesel cases.
- Add the modeled concentration for each day to the monitored background value from the Eureka monitor for the corresponding day.
- Select the 98th percentile value (8th highest total concentration) for each year. Calculate the three-year average for 2001 through 2003 and for 2002 through 2004. Compare the higher of the two averages with the ambient air quality standard, 35 µg/m³. If the three-year average of the 98th percentile values is less than the standard, compliance with the NAAQS has been demonstrated.

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Tables showing the background values and the maximum modeled $PM_{2.5}$ concentrations for each calendar day are provided in Appendix B. The 98th percentile modeling results and the 3-year averages are summarized in Table 8.1-28.

The 3-year average 98th percentile total 24-hour average $PM_{2.5}$ concentration for natural gas mode operation is 30.6 µg/m³, while the 3-year average 98th percentile total 24-hour average $PM_{2.5}$ concentration for diesel mode operation is 33.8 µg/m³. Both concentrations are below the federal standard of 35 µg/m³.

34 For a leap year, the 98th percentile value is the 359th sample, which is also the 8th highest value.

35 Because there are so many $PM_{2.5}$ readings missing during the 2005 calendar year, CARB has determined that 2005 is not a valid year for calculating statistics and for determining attainment. For this reason, 2005 data were not included in the assessment of compliance with the $PM_{2.5}$ standard.

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TABLE 8.1-28

Results of the 24-Hour Average $PM_{2.5}$ Ambient Air Quality Modeling Analysis

Calendar Year	Natural Gas Mode			Diesel Mode		
	Modeled Conc., µg/m^3	Background Conc., µg/m^3	98th Percentile Total Conc., µg/m^3	Modeled Conc., µg/m^3	Background Conc., µg/m^3	98th Percentile Total Conc., µg/m^3
2001	3.23	29.00	32.23	9.98	25.00	34.98
2002	2.67	15.25	17.92	14.04	15.25	29.29
2003	1.32	34.70	36.02	2.42	34.70	37.12
2004	18.75	7.80	26.55	29.38	4.80	34.18
Avg., 01-03			30.57			33.80
Avg., 02-04			28.67			31.93
Higher Average of the 98th Percentile Values			30.6			33.8

8.1.2.9 Screening Health Risk Assessment

The screening health risk assessment (SHRA) was conducted to determine expected impacts on public health of the noncriteria pollutant emissions from the facility. The SHRA was conducted in accordance with the California Office of Environmental Health Hazard Assessment (OEHHA)/CARB Risk Assessment Guidelines (August 2003). The SHRA estimated the offsite cancer risk to the maximally exposed individual (MEI), as well as indicated any adverse effects of non-carcinogenic compound emissions. The CARB/OEHHA Health Risk Assessment computer program was used to evaluate multipathway exposure to toxic substances. Because of the conservatism (overprediction) built into the established risk analysis methodology, the actual risks will be lower than those estimated.

A health risk assessment requires the following information:

- Unit risk factors (or carcinogenic potency values) for any carcinogenic substances that may be emitted
- Noncancer Reference Exposure levels (RELs) for determining non-carcinogenic health impacts
- One-hour and annual average emission rates for each substance of concern
- The modeled maximum offsite concentration of each of the pollutants emitted.

Pollutant-specific unit risk factors are the estimated probability of a person contracting cancer as a result of constant exposure to an ambient concentration of 1 µg/m^3 over a 70-year lifetime. The SHRA uses unit risk factors specified by the OEHHA and implemented in CARB's Hotspots Analysis and Reporting Program (HARP). The cancer risk for each pollutant emitted is the product of the unit risk factor and the modeled concentration. All of the pollutant cancer risks are assumed to be additive.

An evaluation of the potential noncancer health effects from long-term (chronic) and short-term (acute) exposures has also been included in the SHRA. Many of the carcinogenic compounds are also associated with noncancer health effects and are therefore included in the determination of both cancer and noncancer effects. RELs are used as indicators of potential adverse health effects. RELs are generally based on the most sensitive adverse health effect reported and are designed to protect the most sensitive individuals. However, exceeding the REL does not automatically indicate a health impact. The OEHHA reference exposure levels were used to determine any adverse health effects from noncarcinogenic compounds. A hazard index for each noncancer pollutant is then determined by the ratio of the pollutant annual average concentration to its respective REL for a chronic evaluation. The individual indices are summed to determine the overall hazard index for the project. Because noncancer compounds do not target the same system or organ, this sum is considered conservative. The same procedure is used for the acute evaluation.

The HBRP SHRA results are compared with the established risk management procedures for the determination of acceptability. The established risk management criteria include those listed below.

- If the potential increased cancer risk is less than 1 in 1 million, the facility risk is considered not significant.
- If the potential increased cancer risk is greater than 1 in 1 million but less than 10 in 1 million and Toxics-Best Available Control Technology (TBACT) has been applied to reduce risks, the facility risk is considered acceptable.
- If the potential increased cancer risk is greater than 10 in 1 million and there are mitigating circumstances that, in the judgment of a regulatory agency, outweigh the risk, the risk is considered acceptable.
- For noncancer effects, total hazard indices of one or less are considered not significant.
- For a hazard index greater than 1, OEHHA and the reviewing agency conduct a more refined review of the analysis and determine whether the impact is acceptable.

The SHRA includes the noncriteria pollutants listed above in Table 8.1-19. The receptor grid described earlier for criteria pollutant modeling was used for the SHRA. The SHRA results for the HBRP are presented in Table 8.1-29, and the detailed calculations are provided in Appendix 8.1C. The locations of the maximum modeled risks are shown in Figure 8.1C-1.

TABLE 8.1-29
Screening Health Risk Assessment Results

Cancer Risk to Maximally Exposed Individual:	8.6 in 1 million
Maximum Cancer Risk to Residents:	8.6 in 1 million
Maximum Cancer Risk to Workers:	1.3 in 1 million
Acute Health Hazard Index, Natural Gas Mode Operation:	0.56
Acute Health Hazard Index, Diesel Mode Operation:	0.09
Chronic Health Hazard Index:	0.09

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The SHRA results indicate that the acute and chronic hazard indices are well below 1.0, so are not significant. The cancer risk to a maximally exposed individual is 8.6 in 1 million, well below the 10 in 1 million level. The generating units and emergency equipment comply with TBACT because their DPM emission rates will comply with the DPM limits of the ATCM, so this cancer risk is considered to be acceptable. The SHRA results indicate that, overall, the HBRP will not pose a significant health risk at any location.

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To better place these estimated risks into perspective, it is important to note that the risk assessment methods used to transform emissions into health risk estimates involve a series of conservative assumptions. In this case "conservative" means that a particular assumption is selected or stated in a manner that deliberately overstates the magnitude of health impacts potentially associated with exposure to a chemical substance. Examples of conservative assumptions include the following:

- Selecting meteorological conditions that produce the highest concentration in air when modeling emissions;
- Estimating risks based on potential exposure to an individual who is assumed to be located continuously (24 hours/day, 365 days/year, for a 70-year lifetime) at the one point where the highest pollutant concentrations will be found; and
- Calculating the excess lifetime cancer risk associated with this highly unlikely scenario by statistically extrapolating to humans the maximum cancer incidence as observed from a laboratory study using the most sensitive animal species.

When using such estimates to evaluate the risks potentially associated with these emissions, it should be remembered that the actual risks are very likely to be much lower than projected in the risk assessment. The actual risks are highly unlikely to ever approach or exceed the risks projected in the risk assessment.

The risk assessment is discussed in more detail in Section 8.9, Public Health.

8.1.2.10 Construction Impacts Analysis

Emissions due to the construction phase of the project have been estimated, including an assessment of emissions from vehicle and equipment exhaust and the fugitive dust generated from material handling. A dispersion modeling analysis was conducted based on these emissions. A detailed analysis of the emissions and ambient impacts is included in these emissions. A detailed analysis of the emissions and ambient impacts is included in Appendix 8.1D. The results of the analysis indicate that the maximum construction impacts will be below the state and federal standards for all the criteria pollutants emitted. The best available emission control techniques will be used. The HBRP construction site impacts are not unusual in comparison to most construction sites; construction sites that use good dust suppression techniques and low-emitting vehicles typically do not cause violations of air quality standards.

Impacts from exposure to DPM generated during project construction have also been evaluated. The carcinogenic risk due to exposure to DPM during construction activities is expected to be between approximately 5 and 42 in 1 million.[36] Although the high end of these risk estimates exceeds the significance level of 10 in 1 million, the area in which the risk may exceed 10 in 1 million extends barely beyond the freeway east of the Humboldt Bay Power Plant and does not include any residences, schools, or other potentially sensitive receptors.

The results of this risk screening analysis are presented in more detail in Appendix 8.1D.

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8.1.3 Cumulative Air Quality Impacts Analysis

An analysis of potential cumulative air quality impacts that may result from the HBRP and other reasonably foreseeable projects is generally required when project impacts are significant. The cumulative air quality impacts analysis presented in Appendix 8.1F demonstrates that the project is not expected to cause any local or regional cumulative air quality impacts.

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8.1.4 Mitigation

In addition to implementing BACT, District Rule 110 requires the HBRP to provide full emission offsets (emissions reduction credits, or ERCs) for net increases in any nonattainment pollutants or their precursors. Because the NCUAQMD is a nonattainment area for the state PM_{10} standard, HBRP must offset increases in NOx, SO_2 and ROC as well as PM_{10}, as all of these pollutants are considered to be precursors to PM_{10}. Maximum hourly, daily, quarterly, and annual emissions from HBRP are based on expected operation of the HBRP, as discussed in Section 8.1.2.2 and presented in Appendix 8.1A.

Offsets must be provided on a quarterly basis. Because HBRP is considered a reconstructed facility (see Section 8.1.5.2.3.1), offsets must be provided for emissions from the reconstructed facility which exceed 25 tpy, as shown in Table 8.1-30. Mitigation for project emissions will be provided through the shutdown of the existing generating units and through acquisition of ERCs as delineated in Appendix 8.1G. The shutdown of the existing generating units will result in a large net reduction in NOx emissions, and increases in SO_2, CO, ROC, and PM_{10}. Offsets are not generally required for CO, provided an ambient air quality impact analysis demonstrates that the CO emissions from the facility will not cause or contribute to a violation of any CO standard. This demonstration was made in Section

36 The lower end of the cancer risk shown here was determined based on an exposure period that reflects the actual construction period, which is consistent with how cancer risk assessments have been carried out for previous AFCs. However, at the request of CARB staff, cancer risk during construction was also evaluated based on a 9-year exposure period, resulting in a high-end cancer risk of 42 in one million. See Appendix 8.1D.

8.1.2.7. The excess NOx reductions will be used to offset the increases in ROC and PM_{10}, as all three pollutants are precursors to PM_{10}.

TABLE 8.1-30
Net Emissions Increases and Required Offsets, tpy

Pollutant	HBRP Annual Emissions, District NSR Rule, tpy	Offset Threshold, tpy	Offsets Required
NOx	174.3	25	Yes
SO_2	4.4	25	No
ROC	188.9	25	Yes
PM_{10}	118.7	25	Yes

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The quarterly offset calculation and the analysis supporting the interpollutant offset ratios used for NOx to ROC and NOx to PM_{10} are included as Appendix 8.1G.

Table 8.1-31 shows the net emissions increases for HBRP as calculated under CEQA. Mitigation for the net increases in ROC and PM_{10} is provided by the large net reduction in NO_x emissions, which results in overall net reductions in ozone and PM_{10} precursor emissions. This calculation is provided in Appendix 8.1G.

TABLE 8.1-31
CEQA Mitigation Requirements for HBRP

Pollutant	HBRP Annual Emissions for CEQA	Reductions from Shutdown of Humboldt Bay Power Plant	Net Emissions Increase (Decrease)	Net Change in Emissions of Ozone Precursors[a]	Net Change in Emissions of PM_{10} Precursors[b]
NO_x	174.3	936.8	(762.5)	(598.1)	(532.4)
SO_2	4.4	30.0	(25.6)		
ROC	188.9	24.5	164.4		
PM_{10}	118.7	27.4	91.3		

Notes:
[a] Ozone precursors are NO_x and ROC.
[b] PM_{10} precursors are NO_x, SO_2, ROC, and PM_{10}.

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Rule 110 requires project denial if SO_2, NO_2, PM_{10}, or CO air quality modeling results indicate emissions will interfere with the attainment or maintenance of the applicable ambient air quality standards or will exceed PSD increments. The modeling analyses show that facility emissions will not interfere with the attainment or maintenance of the applicable air quality standards.

8.1.5 Laws, Ordinances, Regulations and Standards

This section provides a detailed discussion of LORS applicable to air quality for the HBRP. It begins with a description of the NAAQS. It then describes, in succession, the federal, state, and local LORS, respectively. Finally, this section includes an analysis of the HBRP's compliance with federal, state, and local LORS.

8.1.5.1 Applicable LORS

8.1.5.1.1 Federal LORS

The USEPA implements and enforces the requirements of many of the federal environmental laws. USEPA Region IX, in San Francisco, administers federal USEPA programs in California.

The Federal Clean Air Act, as most recently amended in 1990, provides USEPA with the legal authority to regulate air pollution from stationary sources such as the HBRP. USEPA has promulgated the following stationary source regulatory programs to implement the requirements of the Clean Air Act:

- Prevention of Significant Deterioration;
- New Source Review;
- Title IV: Acid Deposition Control;
- Title V: Operating Permits;
- Standards of Performance for New Stationary Sources (NSPS);
- National Emission Standards for Hazardous Air Pollutants (NESHAP); and
- Compliance Assurance Monitoring (CAM) Rule.

Prevention of Significant Deterioration Program

Authority: Clean Air Act §160-169A, 42 USC §7470-7491; 40 CFR Parts 51 and 52

Requirements: Requires PSD review and facility permitting for construction of new or modified major stationary sources of air pollution. PSD review applies with respect to attainment pollutants for which ambient concentrations are lower than the corresponding NAAQS. The following federal requirements apply on a pollutant-by-pollutant basis, depending on facility emission rates.

- Emissions must be controlled using BACT.
- Air quality impacts in combination with other increment-consuming sources must not exceed maximum allowable incremental increases for SO_2, PM_{10}, and NOx.
- Air quality impacts of all sources in the area plus ambient pollutant background levels cannot exceed NAAQS.
- Pre- and/or post-construction air quality monitoring may be required.
- The air quality impacts on soils, vegetation, and nearby PSD Class I areas (specific national parks and wilderness areas) must be evaluated. (Note: HBRP is located in a Class II area.)

PSD review jurisdiction had been delegated to the NCUAQMD for all attainment pollutants.

Administering Agency: USEPA Region IX.

New Source Review

Authority: Clean Air Act §171-193, 42 USC §7501 et seq.; 40 CFR Parts 51 and 52

Requirement: Requires NSR facility permitting for construction or modification of specified stationary sources. New source review applies with respect to nonattainment pollutants for which ambient concentration levels are higher than the corresponding NAAQS. The following federal requirements apply on a pollutant-by-pollutant basis, depending on facility emission rates.

- Emissions must be controlled to the lowest achievable emission rate (LAER).
- Sufficient offsetting emissions reductions must be obtained following the requirements in the regulations to continue reasonable further progress toward attainment of applicable NAAQS.
- The owner or operator of the new facility has demonstrated that major stationary sources owned or operated by the same entity in California are in compliance or on schedule for compliance with applicable emissions limitations in this rule.
- The administrator must find that the implementation plan has been adequately implemented.
- An analysis of alternatives must show that the benefits of the proposed source significantly outweigh any environmental and social costs.

The North Coast Air Basin is in attainment with all federal ambient air quality standards. Federal NSR therefore does not apply.

Acid Rain Program
Authority: Clean Air Act §401 (Title IV), 42 USC §7651

Requirement: Requires the reduction of the adverse effects of acid deposition through reductions in emissions of sulfur dioxide and nitrogen oxides. NCUAQMD has received delegation authority to implement Title IV. The proposed generating units at HBRP are rated at less than 25 MW each and will use ultralow sulfur fuel (less than 0.05 wt percent sulfur) and therefore are not subject to the acid rain program. A New Unit Exemption form must be filed for each generating unit.

Administering Agency: NCUAQMD, with USEPA Region IX oversight.

Title V Operating Permits Program
Authority: Clean Air Act §501 (Title V), 42 USC §7661

Requirements: Establishes comprehensive operating permit program for major stationary sources. NCUAQMD has received delegation authority for this program.

Administering Agency: NCUAQMD, with USEPA Region IX oversight.

National Standards of Performance for New Stationary Sources
Authority: Clean Air Act §111, 42 USC §7411; 40 CFR Part 60

Requirements: Establishes national standards of performance for new stationary sources. These standards are enforced at the local level with USEPA oversight. The reciprocating engines used for this project will be subject to Subpart IIII.

Administering Agency: NCUAQMD, with USEPA Region IX oversight.

National Emission Standards for Hazardous Air Pollutants
Authority: Clean Air Act §112, 42 USC §7412

Requirements: Establishes national emission standards for hazardous air pollutants. The reciprocating engines used for this project will be subject to Subpart ZZZZ. These standards are enforced at the local level with USEPA oversight.

Administering Agency: NCUAQMD, with USEPA Region IX oversight.

Compliance Assurance Monitoring Rule
Authority: Clean Air Act § 501 (Title V), 42 USC §7414; 40 CFR Part 64

Purpose: Requires facilities to monitor the operation and maintenance of emissions control systems and report any control system malfunctions to the appropriate regulatory agency. If an emissions control system is not working properly, the CAM rule also requires a facility to take action to correct the control system malfunction. The CAM rule applies to emissions units with uncontrolled potential to emit levels greater than applicable major source thresholds. However, emission control systems governed by Title V operating permits requiring continuous compliance determination methods are exempt from the CAM rule. Since the project will be issued a Title V permit requiring the installation and operation of continuous emissions monitoring systems, the project will qualify for this exemption from the requirements of the CAM rule. Consequently, the CAM rule will not be further addressed.

Administering Agency: NCUAQMD, with USEPA Region IX oversight.

Administering Agency: USEPA Region IX.

8.1.5.1.2 State LORS
Nuisance Regulation
Authority: CA Health & Safety Code §41700

Requirements: Provides that "no person shall discharge from any source whatsoever such quantities of air contaminants or other material which causes injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public or which endanger the comfort, repose, health, or safety of any such persons or the public, or which cause, or have a natural tendency to cause injury or damage to business or property."

Administering Agency: NCUAQMD and CARB

Toxic "Hot Spots" Act
Authority: H& SC §44300-44384; 17 CCR §93300-93347

Requirements: Requires preparation and biennial updating of inventory of facility emissions of hazardous substances listed by CARB, in accordance with CARB's regulatory guidelines. Risk assessments are to be prepared by facilities required to submit emissions inventories according to local priorities.

Administering Agency: NCUAQMD and CARB

CEC and CARB Memorandum of Understanding
Authority: CA Pub. Res. Code §25523(a); 20 CCR §1752, 1752.5, 2300-2309 and Div. 2, Chap. 5, Art. 1, Appendix B, Part (k)

Requirements: Provides for the inclusion of requirements in the CEC's decision on an application for certification to assure protection of environmental quality; application is required to include information concerning air quality protection.

Administering Agency: California Energy Commission

8.1.5.1.3 Local LORS

District Regulations and Policies
Authority: CA Health & Safety Code §40001

Requirements: Prohibit emissions and other discharges (such as smoke and odors) from specific sources of air pollution in excess of specified levels.

Administering Agency: NCUAQMD, with CARB oversight.

8.1.5.2 Conformance of Facility

As addressed in this section, HBRP is designed, and will be constructed and operated, in accordance with all relevant federal, state, and local requirements and policies concerning protection of air quality.

8.1.5.2.1 Consistency with Federal Requirements

The NCUAQMD has been delegated authority by the USEPA to implement and enforce most federal requirements that may be applicable to the repowering project, including the new source performance standards and prevention of significant deterioration regulations. Compliance with the District regulations ensures compliance and consistency with the corresponding federal requirements as well. Following the shutdown of the existing steam boilers, the HBRP will no longer be subject to the Federal Acid Rain requirements (Title IV) as the new Wärtsilä engines are rated at less than 25 MW each and use ultralow sulfur fuel (sulfur content less than 0.05 wt percent), and therefore are not acid rain units. A New Unit Exemption form will be filed for each new generating unit and a Retired Unit Exemption form will be filed for each existing unit when the Humboldt Bay Power Plant units are retired. HBRP will obtain an amended District Title V permit that includes applicable requirements for the repowered power plant and eliminates the existing Title IV Acid Rain provisions.

8.1.5.2.1.1 Federal Prevention of Significant Deterioration Program

USEPA has promulgated PSD regulations for areas that are in compliance with national ambient air quality standards (40 CFR 52.21). The PSD program allows new sources of air pollution to be constructed, or existing sources to be modified, while preserving the existing ambient air quality levels, protecting public health and welfare, and protecting Class I areas (e.g., specific national parks and wilderness areas). USEPA has delegated the authority to implement the PSD program to various California air pollution control districts, including the NCUAQMD where HBRP is located (40 CFR 52.21[u]). The NCUAQMD will be responsible for issuing the PSD permit for the proposed project. The District's SIP-approved

PSD rule is Rule 1-220 (adopted March 14, 1984), and the requirements of this rule will govern the District's federal PSD review process.

Although issuance of the PSD permit has been delegated to the NCUAQMD, the protection of Class I areas is still the responsibility of the Federal Land Managers (FLMs). The required assessment of project impacts on visibility, acid deposition, and air quality in the Class I areas within 100 km of HBRP was prepared and submitted to the FLMs in accordance with a protocol that was submitted to the FLMs on July 18, 2006.[37] The assessment will be revised as necessary in response to FLM comments.

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The five principal areas of the federal PSD program are as follows:

- Applicability;
- Best available control technology;
- Pre-construction monitoring;
- Increments analysis; and
- Air quality impact analysis.

Each of these elements of the program is discussed individually below.

Applicability

The PSD program was established to allow emission increases (increments of consumption) that do not result in significant deterioration of ambient air quality in areas where criteria pollutants have not exceeded NAAQS. The federal PSD requirements apply on a pollutant-specific basis to any project that is a new major stationary source or a major modification to an existing stationary source. (These terms are defined in federal regulations.) (40 CFR 52.21) The determination of applicability is based on evaluating the emissions changes associated with the proposed project in addition to all other emissions changes at the same location since the applicable PSD baseline dates (40 CFR 52.21).

For the purposes of determining applicability of the PSD program requirements, the following regulatory procedure is used:

- Emissions from the existing Humboldt Bay Power Plant are compared with major source thresholds to determine whether the existing facility is a major source. This comparison is made in Table 8.1-32.
- Emissions increases from the project are compared with regulatory significance thresholds to determine whether the increases are significant. If the emissions increases exceed the significant emissions thresholds, the proposed modification may be subject to PSD review. The comparison in Table 8.1-33 indicates that the increases in ROC and PM_{10} emissions will be significant.
- Contemporaneous emissions increases and decreases at the facility are then included in the netting calculation to determine the net emissions changes at the facility. The net emissions changes are compared with the PSD significance levels in Table 8.1-34. Since there are no contemporaneous increases and decreases that need to be considered in this calculation, the increases and the net increases are the same for the proposed project.

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37 The nearby Class I areas and the relevant FLMs are Redwood National Park (National Park Service) and Marble Mountain and Yolla Bolly Wilderness Areas (US Forest Service).

Since the proposed project will result in significant net emissions increases in ROC and PM_{10}, the project is subject to PSD review.

TABLE 8.1-32
Humboldt Bay Power Plant Emissions and PSD Major Source Thresholds

Pollutant	Humboldt Bay Power Plant Emissions (tpy)	PSD Major Source Thresholds (tpy)	Major?
NOx	936.8	250	Yes
SO_2	30.0	250	No
CO	112.3	250	No
ROC	24.5	250	No
PM_{10}	27.4	250	No

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TABLE 8.1-33
Emissions Increases and PSD Significant Emissions Levels

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Pollutant	Project Emissions Increases (tpy)[a]	PSD Significance Thresholds (tpy)	Significant?
NOx	(762.5)	40	Yes
SO_2	(25.6)	40	No
ROC	164.4	40	Yes
CO	58.7	100	No
PM_{10}	91.3	15	Yes

Note:
[a] Includes 10 Wärtsilä reciprocating engines, emergency generator and fire pump engine.

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TABLE 8.1-34
Net Emission Increases and Significant Emissions Levels

Pollutant	Facility Net Increase (tpy)	PSD Significance Levels (tpy)	Are Increases Significant?
NOx	(762.5)	40	No
SO_2	(25.6)	40	No
ROC	164.4	40	Yes
CO	58.7	100	No
PM_{10}	91.3	15	Yes

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- If an ambient impact analysis is required, the analysis is first used to determine if the impact levels are significant. The determination of significance is based on whether the impacts exceed regulatory significance levels (40 CFR 51.165) shown in Table 8.1-35. If the significance levels are not exceeded, no further analysis is required.

TABLE 8.1-35
PSD Significant Impact Levels (SILs)

Pollutant	Averaging Time	Significant Impact Levels	Maximum Allowable Class II Increments
PM_{10}	24-Hour	5 µg/m^3	30 µg/m^3
	Annual	1 µg/m^3	17 µg/m^3

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The calculation of net emission increases was shown in Table 8.1-18 above. Table 8.1-32 shows that the existing Humboldt Bay Power Plant is a major source under the PSD regulations. Table 8.1-33 shows that the net increases of ROC and PM_{10} from the project are above the PSD significance thresholds, so the project is subject to PSD review for these pollutants.

Deleted: s that emissions from HBRP will be significant, so the project will be a major modification to an existing major source and thus subject to PSD review. Table 8.1-33 above shows

If the significant impact levels (SILs) are exceeded, an analysis is required to demonstrate that the allowable increments will not be exceeded, on a pollutant-specific basis. Increments are the maximum increases in concentration that are allowed to occur above the baseline concentration. These PSD increments are also shown in Table 8.1-35. There are no SILs or increments for ROC.

Best Available Control Technology

BACT is defined in 40 CFR 52.21(j) as:

> "an emissions limitation…based on the maximum degree of reduction for each pollutant subject to regulation under the Clean Air Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant…"

A top-down BACT analysis is required for each pollutant subject to PSD review: that is, ROC and PM_{10}. The required top-down BACT analysis is provided in Appendix 8.1E, and concludes that BACT for the proposed project is as shown in Table 8.1-36.

TABLE 8.1-36
BACT Required Under Federal PSD for the HBRP

Pollutant	Controlled Emission Rate	Control Technique
ROC	28 ppmc[a] (primary fuel)	good combustion practices
PM_{10}	3.6 lb/hr (primary fuel) (0.04 gr/dscf)	natural gas fuel with CARB diesel fuel backup; good combustion practices

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Note:
[a] ppmc: parts per million by volume, dry, corrected to 15% O_2

Preconstruction Monitoring

To ensure that the impacts from the HBRP will not cause or contribute to a violation of an ambient air quality standard or an exceedance of a PSD increment, an analysis of the existing air quality in the project area is necessary. If a source is subject to PSD review, PSD regulations generally require preconstruction ambient air quality monitoring data for the purposes of establishing background pollutant concentrations in the impact area (42 CFR 52.21(m)). However, a facility may be exempted from this requirement if the predicted air quality impacts of the facility do not exceed the *de minimis* levels listed in Table 8.1-37.

TABLE 8.1-37
PSD Preconstruction Monitoring Exemption Levels

Pollutant	Averaging Period	De minimis Level
Ozone[a]	n/a	100 tpy of ROC
PM_{10}	24-hr average	10 µg/m^3

Note:
[a] No *de minimis* air quality level is provided for ozone. However, any net increase of 100 tons per year or more of volatile organic compounds subject to PSD is considered significant and may be subject to preconstruction monitoring requirements for ozone.

There is no ambient preconstruction monitoring threshold for ozone impacts because Gaussian plume models are not suited to evaluating ambient impacts from individual stationary sources. Therefore, USEPA has established a ROC emissions threshold as a surrogate for determining the significance of project emissions on ambient ozone levels. As shown in Table 8.1-38, the net increase in ROC emissions exceeds the 100-tpy significant increase threshold for potential ozone impacts and the 24-hour average PM_{10} impacts exceed the ambient concentration threshold, so the preconstruction monitoring requirement for these pollutants must be addressed in more detail.

TABLE 8.1-38
Evaluation Of Preconstruction Monitoring Requirements

Pollutant	Averaging Time	Exemption Concentration (µg/m^3)	Maximum Modeled Concentration (µg/m^3)		Exceed Monitoring Threshold?
			Natural Gas Mode	Diesel Mode	
Ozone	n/a	100 tpy of ROCs	164.4 tpy of ROCs	n/a	yes
PM_{10}	24-hr	10	18.7	34.1	yes

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The purpose of the preconstruction monitoring requirement is to ensure that background concentrations are adequately characterized to ensure that the national ambient air quality standards are protected. With the District's approval, a facility may rely on air quality monitoring data collected at District monitoring stations to satisfy the requirement for preconstruction monitoring. In such a case, in accordance with Section 2.4 of the USEPA PSD guideline, the last 3 years of ambient monitoring data may be used if they are representative of the area's air quality where the maximum impacts occur due to the proposed source.

The background data need not be collected on site, as long as the data are representative of the air quality in the subject area (40 CFR 51, Appendix W, Section 9.2). Three criteria are applied in determining whether the background data are representative: (1) location, (2) data quality, and (3) data currentness.[38] These criteria are defined as follows:

- **Location:** The measured data must be representative of the areas where the maximum concentration occurs for the proposed stationary source, existing sources, and a combination of the proposed and existing sources.
- **Data quality:** Data must be collected and equipment must be operated in accordance with the requirements of 40 CFR Part 58, Appendices A and B, and PSD monitoring guidance.
- **Currentness:** The data are current if they have been collected within the preceding 3 years and they are representative of existing conditions.

All of the data used in this analysis meet the requirements of Appendices A and B of 40 CFR Part 58, and thus all meet the criterion for data quality. All of the data have been collected within the preceding 3 years, and thus all meet the criterion for currentness. The location and overall representativeness of the data are discussed further below.

Ozone/ROCs

If ozone concentrations were near the ambient air quality standard, the construction and operation of a new major source of ROCs could theoretically result in a violation of the standard, because ROCs are precursors to ozone. The Applicant believes, however, that there are adequate ozone data from the project area to demonstrate that current ozone levels there are extremely low and that the operation of the proposed project will not cause the violation of state or federal ozone standards.

As discussed above, ozone concentrations are currently monitored at Ukiah and Willits, which are inland locations in Mendocino County (North Coast Air Basin). These ozone monitors are used to characterize ozone air quality in the air basin and are the basis for the NCAB's designation as an attainment area for both state and federal ozone standards.

Ozone was monitored in the Redwood National Park, about 40 miles north of Eureka, until mid-1995. Ozone concentrations were monitored in Eureka from mid-1990 to mid-1992. A comparison of these measured concentrations with contemporaneous ozone measurements at Willits and Ukiah demonstrates that ozone concentrations in Eureka are expected to be

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[38] Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), USEPA, 1987.

significantly lower than concentrations monitored in Willits and Ukiah. The contemporaneous monitoring results are shown in Table 8.1-39.

TABLE 8.1-39
Comparison of Regional Ozone Concentrations

Location	Maximum Modeled Ozone Concentration, ppm (Month)				
	1991	1992	1993	1994	1995
1-Hour Average					
Eureka	0.050 (Feb)	0.040 (Feb)	n/a	n/a	n/a
Redwood National Park	0.050 (Jan)	0.064 (Feb)	0.050 (Feb)	0.051 (Mar)	0.052 (Mar)
Willits	n/a	n/a	0.060 (Jul)	0.071 (Jul)	0.062 (Jul)
Ukiah	n/a	0.060 (Oct)	0.080 (Oct)	0.087 (Sep)	0.085 (Jul)
8-Hour Average					
Eureka	0.042 (Feb)	0.040 (Feb)	n/a	n/a	n/a
Redwood National Park	0.048 (May)	0.060 (Feb)	0.050 (Feb)	0.048 (Mar)	0.048 (Mar)
Willits	n/a	n/a	0.050 (Oct)	0.061 (Jul)	0.049 (Jul)
Ukiah	n/a	0.043 (Oct)	0.065 (Sep)	0.061 (Sep)	0.065 (Jul)

These monitoring data also show that the highest ozone concentrations were recorded along the coast (that is, at Eureka and Redwood National Park) during the winter months, when the weather tends to be overcast and rainy and there is little ultraviolet radiation available for photochemical activity. Because the formation of ozone from ROC and NOx is a photochemical reaction, the presence of ozone in the absence of ultraviolet radiation suggests that the ozone in these areas is mostly background ozone from natural sources, which is in the range of 0.015 to 0.035 ppm, with a maximum of about 0.040 ppm.[39]

Ozone data are also collected by the NOAA, Earth Systems Research Laboratory (ESRL) Global Monitoring Division at Trinidad Head, about 22 miles north of the project site. This monitoring project has been in operation since April 2002.[40] The ozone data from Trinidad Head also indicate that the highest ozone concentrations occur in the spring (February through May), and that ozone levels in the project area are not much higher than background levels. The Trinidad Head ozone data were compared with the Ukiah and Willits data in Table 8.1-2 and in Figures 8.1-3 and 8.1-4 and are reproduced here as Table 8.1-40.

[39] CARB, "Review of the California Ambient Air Quality Standard for Ozone," October 2005 Revision, p. 4-12, October 27, 2005.

[40] NOAA ESRL Global Monitoring Division Website, surface ozone data for Trinidad Head Observatory (THD), 2003-2005, downloaded from http://www.cmdl.noaa.gov/infodata/ftpdata.html.

TABLE 8.1-40
Ozone Levels in the Vicinity of the Proposed Project (ppm)

	2002	2003	2004	2005	NAAQS
Highest 1-Hour Average	0.052	0.064	0.063	0.057	0.12
Highest 8-Hour Average	0.050	0.060	0.058	0.055	0.08

Note:
Ozone levels monitored by NOAA at Trinidad Head.

The Applicant believes that the existing, current data that are collected nearby are adequate to demonstrate that the ozone concentrations in the project area are extremely low and are mostly natural background rather than photochemical ozone. In addition, the ROC emissions increase from the HBRP will be completely offset by reductions in NOx from the shutdown of the existing Humboldt Bay Power Plant generating equipment, and NOx is also an ozone precursor. As a result, ozone levels in Eureka would not be expected to increase due to an increase in ROC emissions as a result of the proposed project, and we do not believe that preconstruction monitoring for ozone is necessary to ensure that the proposed project will not cause violations of the federal ozone standards.

PM_{10}

Ambient PM_{10} and $PM_{2.5}$ data are collected at the Eureka I Street monitoring station. This monitoring station is located approximately 5 miles northeast of the project site. The ambient pollution levels monitored at the I Street monitoring station reflect concentrations in the vicinity of the project, and thus meet the criterion for location.

The area in which modeling shows that PM_{10} impacts from the project will exceed the preconstruction monitoring threshold is shown in Appendix 8.1B, Figure 8.1B-11C. Based on the geography and meteorology of the area, it is highly unlikely that there are sources other than HBRP and the Humboldt Bay Power Plant that would cause a localized influence in that area that would not be represented in the ambient monitored concentrations in Eureka. Therefore, the Applicant believes that the existing, current PM_{10} data that are collected nearby are adequate to characterize PM_{10} concentrations in the study area and that no additional ambient monitoring is necessary to ensure that the proposed project will not cause violations of the federal PM_{10} standards.

Deleted: This area is adjacent to and immediately south of the power plant, with the impacts driven by strong northerly winds. As discussed earlier, a large part of the maximum modeled PM_{10} impact is due to an unusual 24-hour period of extreme meteorological conditions. The area in which the preconstruction monitoring threshold is exceeded even smaller when that unusual meteorological condition is eliminated, as shown in Appendix 8.1B, Figure 8.1B-11D.

PSD Increment Consumption

The maximum modeled impacts from the HBRP facility are compared with the PM_{10} significance levels in Table 8.1-41. These comparisons show that the maximum modeled PM_{10} impacts from the proposed project exceed the significance levels.

TABLE 8.1-41
Comparison of Maximum Modeled Impacts and PSD Significant Impact Levels

Pollutant	Averaging Time	Maximum Modeled Impacts (µg/m³)	Significant Impact Level (µg/m³)	Significant?
PM_{10}	24-hour, Natural Gas Mode	18.7	5	yes
	24-hour, Diesel Mode	34.1	5	yes
	Annual	3.1	1	yes

The project's impact area is the geographical area in which the proposed project is predicted to have a significant ambient impact. Appendix 8.1B, Figure 8.1B-11E shows the area in the vicinity of the plant where the SILs are exceeded.

The ambient air quality impacts analysis provided in Section 8.1.2.7 is compared with the allowable increments in Table 8.1-42 to demonstrate that the highest second-highest (H2H, for the 24-hour averaging period) and highest (for the annual averaging period) modeled PM_{10} impacts from the project will not exceed the Class II increments.

TABLE 8.1-42
Comparison of Maximum Modeled Impacts and PSD Class II Increments

Pollutant	Averaging Time	Modeled Impacts (µg/m³)	Class II Increment (µg/m³)
PM_{10}	24-hour, Natural Gas Mode	15.5	30
	24-hour, Diesel Mode	28.1	30
	Annual	3.1	17

The PM_{10} increments analysis will be provided as a separate, supplemental report.

Air Quality Impacts Analysis

An ambient air quality impacts analysis for PM_{10} was provided in Section 8.1.2.7.

8.1.5.2.1.2 Federal New Source Performance Standards

The Standards of Performance for New Stationary Sources are source-specific federal regulations, limiting the allowable emissions of criteria pollutants (i.e., those that have a national ambient air quality standard). These regulations apply to certain sources depending on the equipment size, process rate, and/or the date of construction, modification, or reconstruction of the affected facility. Recordkeeping, reporting, and monitoring requirements are usually necessary for the regulated pollutants from each subject source; the reports must be regularly submitted to the reviewing agency (40 CFR 60.4). This program has been delegated by USEPA to the NCUAQMD.

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Deleted: As discussed earlier, a large part of the maximum modeled PM_{10} impact is due to an unusual 24-hour period of extreme meteorological conditions. The area in which the SILs are exceeded is even smaller when that unusual meteorological condition is eliminated, as shown in Appendix 8.1B, Figure 8.1B-11F.

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Deleted: Table 8.1-42 shows the combined modeled impacts of HBRP with the reductions from the shutdown of the Humboldt Bay Power Plant generating units.

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Deleted: ¶ TABLE 8.1-42 ¶ Comparison of Combined Modeled Impacts of HBRP and Humboldt Bay Power Plant and PSD Class II Increments ... [43]

Applicability to Wärtsilä Reciprocating Engines

Subpart IIII, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines (40 CFR §60.4200 et seq.), became effective July 11, 2006. The new NSPS sets NOx, PM_{10}, and, for some engines, CO and NMHC standards for compression ignition engines installed or modified after July 11, 2005.

The NSPS defines "compression ignition" as follows:

> "Compression ignition means relating to a type of stationary internal combustion engine that is not a spark ignition engine."

The engines meet the definition of "spark ignition" engines, which are not covered by the regulation. Section 60.4219 of the regulation defines "spark ignition" as follows:

> "Spark ignition means relating to a gasoline, natural gas, or liquefied petroleum gas fueled engine or any other type of engine with a spark plug (or other sparking device) and with operating characteristics significantly similar to the theoretical Otto combustion cycle. Spark ignition engines usually use a throttle to regulate intake air flow to control power during normal operation. Dual-fuel engines in which a liquid fuel (typically diesel fuel) is used for CI and gaseous fuel (typically natural gas) is used as the primary fuel at an annual average ratio of less than 2 parts diesel fuel to 100 parts total fuel on an energy equivalent basis are spark ignition engines."

When operated in natural gas mode for prime power generation, the ratio of diesel fuel to total fuel is less than 1 part per 100 parts on an energy equivalent basis (0.79 MMBtu/hr diesel fuel to 144.7 MMBtu/hr of total fuel), and the Wärtsilä reciprocating engines would qualify as spark ignition engines. However, when potential emergency operation in diesel mode is considered, the annual average ratio of diesel fuel to total fuel could exceed the 2 parts diesel fuel per 100 parts total fuel ratio. Because the new Wärtsilä reciprocating engines meet the definition of compression ignition engines in this regulation when operating in diesel mode, they are subject to the NSPS requirements.

The new reciprocating engines have a displacement of more than 30 liters per cylinder, and are subject to the following requirements:

- Reduce NOx emissions by 90 percent or more OR limit the NOx emissions in the exhaust to 1.6 gm/kw-hr (1.2 gm/bhp-hr); and
- Reduce particulate matter emissions by 60 percent or more OR limit the emissions of PM in the exhaust to 0.15 g/kw-hr (0.11 g/bhp-hr) at full load; and
- Use fuel with a sulfur content not to exceed 500 ppm.

As shown in Table 8.1A-3, NOx emissions from the engines in diesel mode will range from 0.53 to 0.56 gm/kw-hr, well below the 1.6 gm/kw-hr limit of the NSPS. For purposes of the NSPS, particulate matter is defined as filterable PM only, excluding condensibles (Table 7 to Subpart IIII).[41] Filterable PM emissions from the engines in diesel mode, shown as DPM in Table 8.1A-3, will meet the 0.15 gm/kw-hr limit at full load. Finally, the liquid fuel used in

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[41] The test method for demonstrating compliance with the PM limit of the NSPS, EPA Method 5, is the same for both the NSPS and the ATCM (discussed in Section 8.1.5.2.2.2). Because the purpose of the ATCM is to regulate Diesel particulate matter, the filterable fraction of the PM is referred to in Table 8.1A-3 as DPM.

the engines will be CARB diesel fuel with a sulfur content not to exceed 15 ppm, well below the 500 ppm limit that applies to engines of this size.

Applicability to Black Start Generator and Fire Pump Engine

Both the black start generator and the emergency diesel fire pump engine will be subject to the NSPS. For engines in this size range, the NSPS requires manufacturers to provide engines that are certified to meet the NSPS emission standards. HBRP will assure compliance with the emission limitations of the NSPS by purchasing certified engines for these applications.

The NSPS also requires engines in this size range to use fuel with a sulfur content not to exceed 15 ppm. The emergency engines will comply with this requirement by using only CARB diesel fuel.

8.1.5.2.1.3 National Emissions Standards for Hazardous Air Pollutants

The NESHAPs are either source-specific or pollutant-specific regulations, limiting the allowable emissions of hazardous air pollutants from the affected sources (40 CFR 61). Unlike criteria air pollutants, hazardous air pollutants do not have a national ambient air quality standard but have been identified by USEPA as causing or contributing to the adverse health effects of air pollution.

Administration of the hazardous air pollutants program has been delegated to the NCUAQMD, as described in Section 8.1.5.1.1 (40 CFR 61.04).

NESHAP Subpart ZZZZ—National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines (40 CFR §63.6580 et seq.) applies to stationary reciprocating engines above 500 hp located at major sources of hazardous air pollutants (HAPs). Based on current estimates of TACs from the Wärtsilä reciprocating engines (see Table 8.1-20), annual emissions of formaldehyde may exceed 10 tpy and total HAP emissions from the facility are approximately 25 tpy, so the facility is expected to be a major source of HAPs. Therefore, the Wärtsilä natural-gas-fired engine/generator sets that comprise this project must comply with the applicable requirements of Subpart ZZZZ. For the purposes of the NESHAP, the engines to be used in this project meet the definition of "compression ignition engine:"

> "*Compression ignition engine* means any stationary RICE [reciprocating internal combustion engine] in which a high boiling point liquid fuel injected into the combustion chamber ignites when the air charge has been compressed to a temperature sufficiently high for auto-ignition, including diesel engines, dual-fuel engines, and engines that are not spark ignition."

The proposed engines are dual-fuel engines and do not meet the definition of "spark ignition" in this regulation:

> "*Spark ignition engine* means a type of engine in which a compressed air/fuel mixture is ignited by a timed electric spark generated by a spark plug."

New compression ignition engines are required by the NSPS to meet one of the following performance standards:

- Reduce CO emissions by 70 percent or more; or

- Limit concentration of formaldehyde in the exhaust to 580 ppbvd or less at 15 percent O_2.

HBRP will use oxidation catalysts on the Wärtsilä reciprocating engines to meet the requirements of the NESHAP, and will install and operate a CO CEMS. HBRP will comply with the testing, monitoring and recordkeeping requirements of Subpart ZZZZ by continuously monitoring CO and CO_2 or O_2 at both the inlet and outlet of the oxidation catalysts.

Although Subpart ZZZZ does not apply to the black start generator or the fire pump engine because both are below 500 hp, USEPA has proposed to amend Subpart ZZZZ[42] to cover engines below 500 hp located at major sources of HAPs. The proposed amendment would require stationary compression ignition engines such as the black start generator and the fire pump engine to comply with the requirements of 40 CFR 60 Subpart IIII. Compliance with this requirement is discussed in Section 8.1.5.2.1.2 above.

8.1.5.2.1.4 Federal Clean Air Act Amendments of 1990

In November 1990, substantial revisions and updates to the federal Clean Air Act were signed into law. This complex enactment addresses a number of areas that could be relevant to the proposed HBRP, such as more extensive permitting requirements and new USEPA mandates and deadlines for developing rules to control air toxic emissions. The most significant of the new provisions applicable to this project is the Title V operating permit program.

Title V—Operating Permits

This title establishes a comprehensive operating permit program for major stationary sources (42 USC §7661 et seq.). Under the Title V program, a single permit is required that includes a listing of all the stationary sources, applicable regulations, requirements, and compliance determination.

The NCUAQMD’s Title V Program (Rules 501-504) has been approved by USEPA. Consequently, the NCUAQMD has received delegation to implement the Title V program. The NCUAQMD Title V permit programs applicable to this project are summarized below.

8.1.5.2.2 Consistency with State Requirements

State law sets up local air pollution control districts and air quality management districts with the principal responsibility for regulating emissions from stationary sources. As discussed above, the HBRP is under the local jurisdiction of the NCUAQMD, and compliance with NCUAQMD regulations will ensure compliance with most state air quality requirements.

8.1.5.2.2.1 California Clean Air Act

AB 2595, the California Clean Air Act (CAA) was enacted by the California Legislature and became law in January 1989. The CAA requires the local air pollution control districts to attain and maintain both the federal and state ambient air quality standards at the “earliest practicable date.” The CAA contains several milestones for local districts and the CARB. The NCUAQMD was required to submit to the CARB an air quality plan, with updates as

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[42] Federal Register Vol. 71, No. 112, Monday June 12, 2006, p. 33804 et seq.

necessary, defining the program for meeting the required emission reduction milestones in the North Coast.

Air quality plans must demonstrate attainment of the state ambient air quality standards and must result in a 5 percent annual reduction in emissions of nonattainment pollutants (PM_{10} and its precursors) in a given district (H&SC §40914). A local district may adopt additional stationary source control measures or transportation control measures, revise existing source-specific or new source review rules, or expand its vehicle inspection and maintenance program (H&SC §40918) as part of the plan. District air quality plans specify the development and adoption of more stringent regulations to achieve the requirements of the Act. The applicable regulations that will apply to HBRP are included in the discussion of NCUAQMD prohibitory rules in Section 8.1.5.2.3.2.

8.1.5.2.2.2 Airborne Toxic Control Measure for Stationary Compression Ignition Engines

In 2004, CARB adopted an ATCM[43] to reduce DPM and criteria pollutant emissions from stationary diesel-fueled compression ignition engines. The ATCM categorizes stationary diesel engines as either new or in-use, and as either prime or emergency. New emergency engines must meet a DPM emission limit of 0.15 g/bhp-hr upon installation. New prime engines must meet a DPM emission limit of 0.01 g/bhp-hr. The proposed HBRP will utilize multiple, dual-fueled reciprocating engines combusting primarily natural gas (over 99 percent of heat input), along with less than 1 percent diesel fuel to facilitate detonation. This natural gas mode would be the normal operating mode for the engines. During curtailments or interruptions of natural gas supply to the facility, one or more of the engines may operate on 100 percent CARB diesel fuel (in diesel mode) for limited periods of time to maintain local area grid reliability. As discussed in more detail below, the applicability of the ATCM is applied to each of two "virtual engines" that comprise each physical engine: a gas-fired pilot injection engine operating under the theoretical Otto cycle to produce prime power, and a diesel-fired engine operating under the theoretical diesel cycle to produce power under emergency situations.

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Applicability of ATCM to Wärtsilä Engines in Natural Gas Operating Mode

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The emission limits of the ATCM apply to engines that are classified as being both "diesel-fueled" and "compression ignition." As discussed above, in the recently adopted federal New Source Performance Standard for Compression Ignition Engines, USEPA uses a threshold of 2 percent energy input from diesel fuel to distinguish between "spark ignition" engines, which are exempt from the NSPS, and "compression ignition" engines, which are subject to the NSPS.

> "Compression ignition means relating to a type of stationary internal combustion engine that is not a spark ignition engine."

> "Spark ignition means relating to a gasoline, natural gas, or liquefied petroleum gas fueled engine or any other type of engine with a spark plug (or other sparking device) and with operating characteristics significantly similar to the theoretical Otto combustion cycle. Spark ignition engines usually use a throttle to regulate intake air flow to control power during normal operation. Dual-fuel engines in which a liquid fuel (typically diesel fuel) is used for CI

[43] CCR Title 17, Section 93115.

> and gaseous fuel (typically natural gas) is used as the primary fuel at an annual average ratio of less than 2 parts diesel fuel to 100 parts total fuel on an energy equivalent basis are spark ignition engines."[44]

When the engines are operated in natural gas mode, they clearly qualify as "spark ignition" and not "compression ignition" engines. The term "compression ignition" is defined in Section (d)(11) of the ATCM as "…operating characteristics significantly similar to the theoretical diesel combustion cycle. The regulation of power by controlling fuel supply in lieu of a throttle is indicative of a compression ignition engine." These two criteria in the definition of "compression ignition" in the ATCM are discussed separately below.

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1) "…Operating Characteristics Significantly Similar to the Theoretical Diesel Combustion Cycle"

   The theoretical Diesel and Otto cycles are distinguished by the conditions that occur in the cylinder when the fuel is being combusted. During combustion, the chemical energy of the fuel is converted to heat by the exothermic oxidation of hydrocarbons with air. This is known as the "heat addition" phase, which occurs while the piston is at, or close to, top dead center (TDC) between the compression stroke and the power stroke. In the theoretical Diesel cycle, while combustion (heat addition) is occurring, the pressure in the cylinder remains constant while the volume of the cylinder increases due to movement of the piston. This is known as isobaric expansion. In the theoretical Otto cycle, when combustion (heat addition) occurs, the pressure in the cylinder increases while the volume remains constant. Because the diesel pilot injection engine uses 99 percent natural gas, which is well-mixed with air in the combustion chamber at the time of ignition, the combustion characteristics are significantly similar to the theoretical Otto cycle, and are fundamentally different from the theoretical Diesel cycle. Well-mixed conditions create rapid combustion and a rapid increase in cylinder pressure in a virtually isovolumetric process. For this reason, when operating in pilot injection mode, the HBRP engines do not meet the ATCM's definition of compression ignition and therefore are not subject to the ATCM's requirements.

2) "Regulation of power by controlling fuel supply in lieu of a throttle is indicative of a compression ignition."

   Another distinction between the Diesel and Otto cycles is that the Diesel cycle has a much slower rate of combustion compared to the Otto cycle. In traditional diesel-fueled engines, the liquid fuel is atomized and injected into the cylinder containing compressed air. The hot air vaporizes the droplets and oxidizes the resulting gaseous hydrocarbons. The rate of combustion is limited by the rate at which the fuel is injected. Engine power output is controlled by adjusting the amount of fuel that is injected into the cylinder while the amount of air remains essentially constant (per cylinder charge). Due to the kinetics of the system, combustion occurs much more slowly while work is being performed on the cylinder than in an Otto cycle engine.

[44] 40 CFR 60.4216.

In traditional Otto cycle engines, the fuel is either gaseous or a volatile liquid (gasoline). The fuel is injected during the compression stroke and forms a near homogenous gaseous mixture with combustion air. The mixture is detonated by a spark plug or other means and combustion occurs rapidly. Power is controlled by limiting or "choking" the amount of combustion air, in addition to varying the quantity of fuel.

Although the Wärtsilä engines regulate power mostly by controlling fuel supply, they operate under the theoretical Otto cycle, not the Diesel cycle, during natural gas mode. The ATCM's statement that air throttling indicates compression ignition is evidence that CARB did not consider the Wartsila dual-fuel technology at issue here when developing the ATCM. Another example of a technology for which air throttling is not a definitive characteristic is the new BMW 7-series automobile, which uses a gasoline-fueled, spark-ignited engine which does not use air throttling during normal operation, yet operates under the theoretical Otto cycle.[45]

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In conclusion, when the engines are operated in natural gas mode for prime power production, they are not subject to the ATCM because in this mode they do not operate as compression ignition engines, as they do when they operate in diesel mode and are used on an emergency basis.

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Applicability of ATCM to Wärtsilä Engines Operating in Diesel Mode

As discussed above, the proposed engines would operate on 100 percent CARB diesel during periods when natural gas service to the facility is curtailed or interrupted. Also as discussed above, the ATCM contains separate emission limits for prime and emergency standby engines. To qualify for the emergency standby limits, an engine must meet the two criteria of Section (d)(24):

- The engine is installed for the primary purpose of providing electrical power or mechanical work during an emergency use and is not the source of primary power at the facility; and
- The engine is operated to provide electrical power or mechanical work during an emergency use or during other limited circumstances.

The first criterion requires that the engine be installed primarily to operate in cases where the loss of electricity or natural gas supply is beyond the reasonable control of the owner or operator. The loss of power or natural gas supply cannot be the result of a contractual obligation with a third party.

The ATCM does not appear to anticipate the possibility that the serving electric utility uses an emergency standby engine to provide power to the electric grid. However, the fact that 100 percent diesel operation of the proposed engines would occur only during a qualifying emergency use is sufficient to conclude that the emergency standby engine limits apply during this mode of operation.

The CARB staff has concurred in this interpretation. Therefore, when operating in diesel mode, the Wärtsilä engines will be required to comply with the PM limit of 0.15 gm/hp-hr

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45 With BMW's Valvetronic engine control system, a traditional throttle is employed only under "limp home" mode.

over the ISO 8178 D1 cycle.[46] The ATCM limit applies only to filterable PM, and the HBRP reciprocating engines will comply with this limit during emergency liquid fuel firing. As required by the ATCM, each reciprocating engine will be limited to 50 hours per year of operation in diesel mode for testing and maintenance purposes.

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Emergency use is defined as follows:

Providing electrical power or mechanical work during any of the following events and subject to the following conditions:

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a. The failure or loss of all or part of normal electrical power service or normal natural gas supply to the facility:

1. Which is caused by any reason other than the enforcement of a contractual obligation the owner or operator has with a third party or any other party; and

2. Which is demonstrated by the owner or operator to the district APCO's satisfaction to have been beyond the reasonable control of the owner or operator;

b. The failure of a facility's internal power distribution system:

1. Which is caused by any reason other than the enforcement of a contractual obligation the owner or operator has with a third party or any other party; and

2. Which is demonstrated by the owner or operator to the district APCO's satisfaction to have been beyond the reasonable control of the owner or operator;

c. The pumping of water for fire suppression or protection.

Emergency operation cannot be related to fuel pricing (i.e., units will not be switched to diesel fuel operation simply because gas prices are higher than diesel prices). Emergency operation can be due to a curtailment of natural gas supply to the plant (either partial or total).

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Further, natural gas curtailments will be required to meet the following criteria:

a. The curtailment must be directed by a regulatory agency, or automatically implemented by PG&E in accordance with procedures approved by a regulatory agency; and

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b. Notice must be given to the District within 24 hours of when the plant receives notification of an anticipated curtailment that would result in the operation of one or more units in diesel mode.

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Black Start Generator and Fire Pump Engine

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The black start generator and diesel fire pump engine are also subject to the ATCM requirements for new emergency engines. As required by the ATCM, PM emissions will not exceed 0.15 gm/hp-hr, and each reciprocating engine will be limited to 50 hours of operation on liquid fuel per year for testing and maintenance purposes.

46 The ISO 8178 D1 cycle is a weighted average of emissions at 100%, 75%, and 50% loads.

8.1.5.2.3 Consistency with Local Requirements: North Coast Air Quality Management District

8.1.5.2.3.1 NCUAQMD New Source Review Requirements

NCUAQMD Rule 110, New Source Review, requires that a pre-construction review be conducted for all proposed new or modified sources of air pollution. New Source Review contains three principal elements:

- BACT;
- Emissions offsets; and
- Air quality impact analysis.

Under the District definitions in Rule 110, HBRP is considered a reconstructed source. The Humboldt Bay Power Plant is a source undergoing physical modification. The fixed capital cost of the new components at HBRP is estimated at $250 million. The fixed capital cost of a comparable new stationary source—that is, replacing the Humboldt Bay Power Plant boilers and gas turbines with comparable new units—is estimated as approximately $377 million. Since the fixed capital cost of the new components exceeds 50 percent of the fixed capital cost of the new stationary source, HBRP meets the §4.22 definition of a reconstructed source. In accordance with §4.15, HBRP is treated as a new stationary source rather than a modification, so NSR requirements apply as for new sources.

BACT is required for any new emissions unit that results in an increase in emissions of any criteria pollutant and that has a potential to emit in excess of levels specified in Rule 110 §5.1 (shown in Table 8.1-43). As shown in Table 8.1-17, the daily emissions from the proposed Wärtsilä reciprocating engines will exceed these levels, so the engines are subject to BACT requirements for all pollutants. The BACT analysis is included as Appendix 8.1E.

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TABLE 8.1-43
NCUAQMD Thresholds for BACT

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Pollutant	BACT Threshold (lb/day)
Asbestos	0.030
Beryllium	0.002
CO	500
Fluorides	15
Hydrogen Sulfide	50
Lead	3.2
Mercury	0.5
NOx	50
PM_{10}	80
ROC	50
Reduced sulfur compounds	50
Sulfur oxides	80
Sulfuric acid mist	35
Total reduced sulfur compounds	50
Vinyl chloride	5

Rule 110 §5.2 further requires that new sources at facilities with a potential to emit more than 25 tons per year of a nonattainment pollutant or its precursors must offset at least the portion of the potential to emit that exceeds 25 tpy. NCUAQMD is nonattainment for the state PM_{10} standard, and the HBRP has a potential to emit more than 25 tpy of PM_{10} and its precursors NOx and ROC. Offsets will therefore be required for these three pollutants. Offsets are not required for SO_2 because the emissions for this pollutant are less than 25 tpy. Offsets are not required for CO if the Applicant demonstrates through ambient air quality modeling that the CO emissions from a proposed project will not cause or contribute to a violation of the air quality standards. The required analysis was provided in Section 8.1.2.7.

The required offsets for the project are being provided through a combination of onsite reductions, offsite ERCs, and interpollutant offsets. Compliance with the offset requirement is discussed in detail in Appendix 8.1G.

An air quality impact analysis is required to demonstrate that the project will not cause a violation or interfere with the maintenance of any ambient air quality standards or applicable increments. The required air quality impact analysis to demonstrate compliance with ambient air quality standards was provided in Section 8.1.2.8, Table 8.1-26.

Finally, the District may impose appropriate monitoring requirements to ensure compliance. The Applicant expects that the District will impose requirements for continuous monitoring of NOx and CO emissions from the Wärtsilä reciprocating engines and of fuel use and operating hours for the Wärtsilä reciprocating engines, the black start generator, and the fire pump engine.

Rule 110 §9 specifies procedures for review and standards for approval of Authorities to Construct power plants within the District. The District must conduct a Determination of Compliance review as part of the CEC certification process. The District considers the AFC to be the equivalent of an application for an Authority to Construct.

The NCUAQMD recently amended its PSD rule. Although the PSD rule has not been approved by USEPA to replace the existing SIP-approved rule, the requirements of the new rule must also be complied with. Under the NCUAQMD PSD program (Rule 110, Section 11), a separate air quality analysis must be submitted for each regulated pollutant that will be emitted in a significant amount from the new major stationary source. The existing Humboldt Bay Power Plant was shown to be an existing major stationary source in Table 8.1-32. The calculation of emissions from the proposed HBRP for District NSR was shown in Table 8.1-17. Emissions from the proposed project are compared with PSD significance thresholds in Table 8.1-44.

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Compliance with this requirement has been demonstrated in the discussion of compliance with federal PSD (Section 8.1.5.2.1.1).[47]

[47] For the purposes of the District's PSD rule, the source is treated as a reconstructed (new) source; this is in contrast with the treatment of the project under the SIP-approved PSD program, under which the project is treated as a modification to an existing stationary source.

TABLE 8.1-44
Emissions from New Equipment for District PSD

Pollutant	HBRP Emissions, tpy	PSD Significant Emission Levels, tpy	Significant?
NOx	174.3	40	Yes
SO_x	4.4	40	No
CO	171.0	100	Yes
ROC	188.9	40	Yes
PM_{10}	118.7	15	Yes

The source must also demonstrate that it will not cause the violation of any Class II increments. The ambient air quality impacts analysis provided in Section 8.1.2.5 is compared with the allowable Class II NO_2 increment in Table 8.1-45 to demonstrate that the maximum modeled annual average NO_2 impact from the project will not exceed the Class II increments. Compliance with the Class II PM_{10} increments is shown in Table 8.1-45.

TABLE 8.1-45
Comparison of Maximum Modeled Annual Average NO_2 Impact and PSD Class II Increment

Pollutant	Averaging Time	Maximum Modeled Impacts (µg/m^3)	Class II Increment (µg/m^3)
NO_2	Annual	2.5	25

8.1.5.2.3.2 Other NCUAQMD Regulatory Requirements

The NCUQMD has developed regulations limiting emissions from specific sources. These regulations are collectively known as "prohibitory rules," because they prohibit the construction or operation of a source of pollution that would violate specific emission limits.

The general prohibitory rules of the NCUAQMD applicable to the HBRP are as follows.

Rule 104 §1.1—Public Nuisance
Prohibits emissions in quantities that adversely affect public health, other businesses, or property. The analyses provided in this application demonstrate that the proposed facility will comply with this rule.

Rule 104 §2.1—Visible Emissions
Limits the visible emissions from the project to no darker than No. 2 when compared to a Ringelmann Chart for a period or periods aggregating more than 3 minutes in any hour. The analyses provided in this application indicate that the engines proposed for use in this project will be controlled to extremely low emission levels and will use clean fuels. Therefore, no exceedances of the visible emissions limitations are expected.

Rule 104 §3.1—Particulate Matter and Visible Emissions
Particulate emission concentrations cannot exceed 0.20 grains per dry standard cubic foot of exhaust gas volume. The grain loading concentrations shown in Tables 8.1A-2 and 8.1A-3 of Appendix 8.1A show that the engines will easily comply with this limitation.

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TABLE 8.1-46 ¶
Comparison of Combined Modeled Annual Average NO_2 Impacts of HBRP and Humboldt Bay Power Plant with PSD Class II Increment ... [44]

Rule 104 §4.0—Fugitive Dust Emissions

This rule requires the use of reasonable precautions to prevent particulate matter from becoming airborne. Relevant examples include the use of water or chemicals to control dust in demolition, construction, and grading operations (§4.2.4). As discussed in Section 8.1.2.4, mitigation measures will be used during construction and grading operations to minimize dust emissions.

Rule 104 §5.0—Sulfur Dioxide

This rule limits stationary source emissions of sulfur dioxide to less than 1,000 ppm. The SO_2 emissions concentrations shown in Tables 8.1A-2 and 8.1A-3 of Appendix 8.1A show that the engines will easily comply with this limitation.

Rule 303—Hexavalent Chromium Emissions From Cooling Towers

NCUAQMD has adopted by reference Air Toxics Control Measures adopted by the California Air Resources Board. NCUAQMD Rule 303 (Section 93103, Subchapter 7.5, Chapter 1, Part III, Titles 17 and 26, Code of California Regulations) limits hexavalent chromium emissions from cooling towers by eliminating the use of chromium-based chemicals. This regulation is not applicable to the proposed project because no wet cooling towers will be utilized.

8.1.5.2.3.3 NCUAQMD Title V Program

NCUAQMD Rules 501-504—Title V

These rules implement the operating permit requirements of Title V of the federal Clean Air Act. The rules apply to major facilities, Phase II acid rain facilities, subject solid waste incinerator facilities, and any facility listed by USEPA as requiring a Title V permit. The HBRP will be required to obtain an amended Title V permit prior to commencing operation. HBRP will comply with this requirement by submitting an application for an amended Title V permit at least 12 months before the expected date of first fire for the engines.

The NCUAQMD has adopted by reference the federal Title IV (Acid Rain) Regulation and is now responsible for implementing the program through the Title V operating permit program. Under Title IV, a project must comply with maximum operating emissions levels for SO_2 and NOx and is required to install and operate continuous monitoring systems for SO_2, NOx, and CO_2 emissions. Extensive recordkeeping and reporting requirements are also part of the acid rain program. The existing Humboldt Bay Power Plant boilers are subject to the requirements of the acid rain program. However, since the new engines that will replace the boilers are rated at less than 25 MW each, these new units will not be subject to acid rain program requirements.

All applicable LORS are summarized in Table 8.1-46.

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TABLE 8.1-46
Laws, Ordinances, Regulations, Standards (LORS), and Permits for Protection of Air Quality

LORS	Purpose	Regulating Agency	Permit or Approval	Schedule and Status of Permit	Conformance (Section; Page)
Federal					
Clean Air Act (CAA) §160-169A and implementing regulations, Title 42 United States Code (USC) §7470-7491 (42 USC 7470-7491), Title 40 Code of Federal Regulations (CFR) Parts 51 & 52 (40 CFR 51 & 52) (Prevention of Significant Deterioration Program)	Requires prevention of significant deterioration (PSD) review and facility permitting for construction of new or modified major stationary sources of air pollution. PSD review applies to pollutants for which ambient concentrations are lower than NAAQS.	NCUAQMD with USEPA oversight	After project review, issues Authority to Construct (ATC) with conditions limiting emissions.	Agency approval to be obtained before start of construction.	8.1.5.2.1.1, Appendices 8.1E and 8.1G; pp. 65-74
CAA §171-193, 42 USC §7501 et seq. (New Source Review)	Requires new source review (NSR) facility permitting for construction or modification of specified stationary sources. NSR applies to pollutants for which ambient concentration levels are higher than NAAQS.	NCUAQMD with USEPA oversight	After project review, issues ATC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	8.1.5.2.3.1, Appendices 8.1E and 8.1G; pp. 82-84
CAA §401 (Title IV), 42 USC §7651 (Acid Rain Program)	Requires reductions in NO_x and SO_2 emissions.	NCUAQMD with USEPA oversight	Issues Acid Rain permit after review of application.	Application to be made within 12 months of start of facility operation; HBRP not subject to this program.	8.1.5.1.1; p. 63
CAA §501 (Title V), 42 USC §7661 (Federal Operating Permits Program)	Establishes comprehensive permit program for major stationary sources.	NCUAQMD with USEPA oversight	Issues amended Title V permit after review of application.	Application for amendment to be made at least 12 months prior to start of facility operation.	8.1.5.2.3.3; p. 86
CAA §111, 42 USC §7411, 40 CFR Part 60 (New Source Performance Standards [NSPS])	Establishes national standards of performance for new stationary sources.	NCUAQMD with USEPA oversight	After project review, issues ATC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	8.1.5.2.1.3; pp. 75-76
CAA §112, 42 USC §7412, 40 CFR Part 63 (NESHAP)	Establishes national emission standards for hazardous air pollutants.	NCUAQMD with USEPA oversight	After project review, issues ATC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	8.1.5.2.1.3; p. 77
State					
California Health & Safety Code (H&SC) §41700 (Nuisance Regulation)	Outlaws discharge of such quantities of air contaminants that cause injury, detriment, nuisance, or annoyance.	NCUAQMD with CARB oversight	After project review, issues Final Determination of Compliance (FDOC) with conditions limiting emissions.	Agency approval to be obtained before start of construction.	8.1.5.2.2; p. 64
H&SC §44300-44384; California Code of Regulations (CCR) §93300-93347 (Toxic "Hot Spots" Act)	Requires preparation and biennial updating of facility emission inventory of hazardous substances; risk assessments.	NCUAQMD with CARB oversight	After project review, issues Final Determination of Compliance (FDOC) with conditions limiting emissions.	SHRA submitted before start of construction.	8.1.2.8, 8.1.5.2.2.2, Appendix 8.1C; pp. 57-58, 64
California Public Resources Code §25523(a); 20 CCR §1752, 2300-2309 (CEC & CARB Memorandum of Understanding)	Requires that CEC's decision on AFC include requirements to assure protection of environmental quality; AFC required to address air quality protection.	CEC	After project review, issues Final Determination of Compliance (FDOC) with conditions limiting emissions.	CEC approval of AFC, including all conditions contained in FDOC, to be obtained before start of construction.	8.1.5.1.2; p. 64
Local					
NCUAQMD Rule 104 §1.1 (Public Nuisance)	Prohibits emissions in quantities that adversely affect public health, other businesses, or property.	NCUAQMD with CARB oversight	After project review, issues Final Determination of Compliance (FDOC) with conditions limiting emissions.	Agency approval to be obtained before start of construction.	8.1.5.2.3.2; p. 85
NCUAQMD Rule 110 (New Source Review and Prevention of Significant Deterioration)	NSR and PSD: Requires that preconstruction review be conducted for all proposed new or modified sources of air pollution, including BACT, emissions offsets, and air quality impact analysis.	NCUAQMD with CARB oversight	After project review, issues Final Determination of Compliance (FDOC) with conditions limiting emissions.	Agency approval to be obtained before start of construction.	8.1.5.2.3.1, Appendices 8.1C and 8.1G; pp. 82-84
NCUAQMD Rules 501-504 (Title V)	Implements operating permits requirements of CAA Title V	NCUAQMD with USEPA oversight	Issues amended Title V permit after review of application.	Application for amendment to be made at least 12 months of start of facility operation.	8.1.5.2.4; p. 86
NCUAQMD Rules 501-504 (Title IV)	Acid rain regulations of CAA Title IV.	NCUAQMD with USEPA oversight	Title IV requirements incorporated into Title V permit after review of application	Application to be submitted 2 years before start of facility operation. HBRP not subject to this program.	8.1.5.1.1; p. 63

TABLE 8.1-46
Laws, Ordinances, Regulations, Standards (LORS), and Permits for Protection of Air Quality

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LORS	Purpose	Regulating Agency	Permit or Approval	Schedule and Status of Permit	Conformance (Section; Page)
NCUAQMD Rule 104 §2.1 (Visible Emissions)	Limits visible emissions to no darker than Ringelmann No. 2 for periods greater than 3 minutes in any hour.	NCUAQMD with CARB oversight	After project review, issues Final Determination of Compliance (FDOC) with conditions limiting emissions.	Agency approval to be obtained before start of construction.	8.1.5.2.3.2; p. 85
NCUAQMD Rule 104 §3.1 (Particulate Matter)	Limits PM emissions to less than 0.20 gr/dscf.	NCUAQMD with CARB oversight	After project review, issues Final Determination of Compliance (FDOC) with conditions limiting emissions.	Agency approval to be obtained before start of construction.	8.1.5.2.3.2; p. 85
NCUAQMD Rule 104 §5.0 (Sulfur Dioxide)	Limits SO_2 emissions to <1,000 ppm	NCUAQMD with CARB oversight	After project review, issues ATC with conditions limiting emissions.	Agency approval to be obtained before start of construction.	8.1.5.2.3.2; p. 85

8.1.6 Agencies Involved and Agency Contacts

The USEPA has responsibility for enforcing, on a national basis, the requirements of many of the country's environmental and hazardous waste laws. California is under the jurisdiction of USEPA Region IX, located in San Francisco. Region IX is responsible for the local administration of USEPA programs for California, Arizona, Nevada, Hawaii, and certain Pacific trust territories. USEPA's activities relative to the California air pollution control program focus principally on reviewing California's submittals for the SIP. The SIP is required by the federal Clean Air Act to demonstrate how all areas of the state will meet the national ambient air quality standards within the federally specified deadlines.

The California Air Resources Board was created in 1968 by the Mulford-Carrell Air Resources Act, through the merger of two other state agencies. CARB's primary responsibilities are to develop, adopt, implement, and enforce the state's motor vehicle pollution control program; to administer and coordinate the state's air pollution research program; to adopt and update as necessary the state's ambient air quality standards; to review the operations of the local air pollution control districts; and to review and coordinate preparation of the SIP for achievement of the federal ambient air quality standards.

When the state's air pollution statutes were reorganized in the mid-1960s, local air pollution control districts (APCDs) were required to be established in each county of the state. There are three types of districts: county, regional, and unified. In addition, special air quality management districts (AQMDs), with more comprehensive authority over non-vehicular sources as well as transportation and other regional planning responsibilities, have been established by the Legislature for several regions in California. The NCUAQMD is a unified air district established pursuant to Section 40150 of the Health and Safety Code.

Air pollution control districts and air quality management districts in California have principal responsibility for developing plans for meeting the state and federal ambient air quality standards; for developing control measures for non-vehicular sources of air pollution necessary to achieve and maintain both state and federal air quality standards; for implementing permit programs established for the construction, modification, and operation of sources of air pollution; for enforcing air pollution statutes and regulations governing non-vehicular sources; and for developing employer-based trip reduction programs.

Each level of government has adopted specific regulations that limit emissions from stationary combustion sources, several of which are applicable to this project. The other air agencies having permitting authority for this project are shown in Table 8.1-47. The applicable federal LORS and compliance with these requirements are discussed in more detail in the following sections. The NCUAQMD will review the AFC, filed with the CEC, as if it were an application for a District permit. It will provide the CEC with a Determination of Compliance, which provides the CEC with information on what the facility must do in order to be in compliance with air quality requirements. Additionally, the NCUAQMD is responsible for issuance of the federal Operating (Title V) permit. An application for the federal permit will be submitted in a timely fashion.

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TABLE 8.1-47
Air Quality Agencies

Agency	Authority	Contact
USEPA Region IX	Oversight of permit issuance, enforcement	Gerardo Rios, Chief Permits Office USEPA Region IX 75 Hawthorne Street San Francisco, CA 94105 (415) 744-1259
California Air Resources Board	Regulatory oversight	Mike Tollstrup, Chief Project Assessment Branch California Air Resources Board 2020 L Street Sacramento, CA 95814 (916) 322-6026
North Coast Unified Air Quality Management District	Permit issuance, enforcement	Jason Davis, Permit Services Division Manager North Coast Unified Air Quality Management District 2300 Myrtle Ave Eureka, CA 95501 (707) 443-3093

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8.1.7 Permits and Permit Schedule

The Permit to Construct permit is required in accordance with NCUAQMD Rule 110. A complete application for a "Permit to Construct" will be filed with the NCUAQMD within 1 week (5-7 working days) of the HBRP AFC filing.

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Maximum Annual Emissions for Federal PSD and CEQA Compliance, tpy					
Reciprocating Engines[d]	263.1	4.7	181.2	198.8	182.8
Black Start Generator[d]	0.4	<0.1	0.1	<0.1	<0.1
Fire Pump Engine[d]	0.2	<0.1	<0.1	<0.1	<0.1
Total, tons per year	**263.7**	**4.7**	**181.3**	**198.8**	**182.8**

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8.1.2.6.2 Impacts from the Existing Humboldt Bay Power Plant Generating Units

Ambient impacts from the existing Humboldt Bay Power Plant generating units were modeled using actual emissions, operating, and fuel use data. For the 1-, 3- and 8-hour averaging periods, it was assumed that all four units were operating at full load. For the 24-hour averaging period, it was assumed that the two boilers were operating at full load and that each MEPP was operating at 50 percent load. Average historical emission rates over the past 2 years were used for the annual averaging period. Emission rates and stack parameters used in evaluating the air quality impacts from the existing generating units are shown in Table 8.1B-2, Appendix 8.1B. Maximum modeled impacts are summarized in Table 8.1-21.

TABLE 8.1-21
Maximum Modeled Impacts from Existing Generating Units at Humboldt Bay Power Plant

Pollutant	Averaging Time	Modeled Concentration (µg/m^3)
NO_2	1-hour Annual	267.3[a] 9.1[b]
SO_2	1-hour 3-hour 24-hour Annual	10.0 7.0 2.6 0.04
CO	1-hour 8-hour	110.3 55.1

$PM_{2.5}/PM_{10}$	24-hour Annual	7.8 0.3

Notes:

[a] 1-hour average NO_x modeled using CTSCREEN; ozone limiting performed using highest 1-hour ozone concentration during 2003-2005 from Ukiah.

[b] Annual average NO2 calculated from modeled NO_x using ARM and default 75% conversion factor.

8.1.2.6.3 Screening Procedures for the HBRP Reciprocating Engines

To ensure the impacts analyzed were for maximum emission levels and worst-case dispersion conditions, a screening procedure was used to determine the inputs to the impact modeling for the new generating units. The screening procedure analyzed the reciprocating engine operating conditions that would result in the maximum impacts on a pollutant-specific basis. The operating conditions examined in this screening analysis, along with their exhaust and emission characteristics, are shown in Appendix 8.1B, Table 8.1B-3. These operating conditions represent reciprocating engine operation at maximum and minimum ambient operating temperatures (87°F and 21°F), and at 100 percent, 75 percent and minimum (50 percent) loads on natural gas and emergency backup diesel fuels.

Ambient impacts for each of the 12 operating cases were modeled using USEPA's AERMOD model and 5 years of onsite meteorological data, as described above. The results of the unit impact analysis are presented in Appendix 8.1B, Table 8.1B-4. The analysis showed that for most pollutants and averaging period, modeled impacts were highest under full load operating conditions, while PM_{10} and annual average impacts were highest under minimum load conditions.

8.1.2.7 Results of the Ambient Air Quality Modeling Analysis

8.1.2.7.1 Refined Air Quality Impact Analysis

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2.3

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0.03

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7
0.03

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51.3
37.6

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55.8[i]
37.6

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843.2[j]
—[d]

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61.6
11.8

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—[g]
—[g]

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8.9
—[f]

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; 800 hrs/yr of liquid fuel firing for annual averaging period

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Max. hourly NO_2 during

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Typical natural gas startup of 10 engines has maximum impact of 198.1 μg/m^3.

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[j]. Startup on liquid fuel. Typical natural gas startup of 10 engines has maximum impact of 786.1μg/m^3. [k]. [l]
When the 24-hour period of extreme meteorological conditions is eliminated from the met data set, the maximum modeled 24-hour average PM_{10} concentration during normal operation is reduced to 14.6 μg/m^3. See text.

[l]. When the 24-hour period of extreme meteorological conditions is eliminated from the met data set, the maximum modeled 24-hour average PM_{10} concentration during emergency operation is reduced to 13.7 μg/m^3. See text.

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As discussed earlier, 5 years of meteorological data were used to evaluate the ambient impacts of the project. Results obtained using the 2004 met data set were consistently significantly higher than results from the other met data years. A closer examination of the 2004 met data set revealed that there was a 24-hour period during that year (November 3, 2004) during which the winds blew from the north at high speed for most of the 24-hour period. That combination created extreme downwash conditions, bringing the exhaust plumes to ground quickly and with very little dilution, and causing relatively high ground-level concentrations at the plant boundary. Comparing the persistence of the wind speed and direction to those of other days indicated that this day was highly unusual. When that day is eliminated, the maximum modeled 24-hour average PM_{10} concentrations drop by almost one-third. That the meteorological conditions on a single day could have such a large effect on the modeling results emphasizes the overly conservative and overpredictive nature of this analysis.

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$PM_{2.5}$[b]	24-Hour[c]	**35**	23	32
	Annual	8.2	8.1	**9.1**

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[c] 24-hour average $PM_{2.5}$ value shown is 98th percentile value as that is the basis of the ambient air quality standard.

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on liquid backup fuel

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Table 8.1-26 shows maximum modeled impacts under reasonably foreseeable worst case conditions, with maximum anticipated operation of the emergency units: 200 hours per year for the black start generator and fire pump engine.

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Maximum ground-level impacts due to operation of the HBRP are shown together with the ambient air quality standards in Tables 8.1-26 and 8.1-27. The impacts shown in Table 8.1-26 reflect typical facility operation, with operation of the emergency equipment (black start generator and fire pump engine) and of the Wärtsilä reciprocating engines on liquid backup fuel only for allowable testing and maintenance hours (50 hours per year). Table 8.1-26 shows maximum modeled impacts under reasonably foreseeable worst case conditions, with maximum anticipated operation of the units under emergency conditions: 800 hours per year of emergency diesel operation for the Wärtsilä reciprocating engines and 200 hours per year for the black start generator and fire pump engine. The ambient air quality modeling results are extremely conservative and are designed to overpredict ambient concentrations because they evaluate impacts under a combination of worst-case conditions that are unlikely to occur simultaneously. The modeling combines the highest allowable emission rates with the most extreme meteorological conditions and the equipment operating load conditions that result in the highest ambient impact. Therefore it is extremely unlikely that the ambient concentrations predicted by the models will ever actually be realized. However, this analysis demonstrates that even under these combinations of conditions that overpredict impacts, the HBRP will not cause or contribute to violations of any state or federal air quality standards, with the exception of the state PM_{10} standards. For this pollutant, existing concentrations already exceed the state standards.

TABLE 8.1-26

Modeled Maximum Impacts, Normal Facility Operations[a]

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Annual

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198.1
1.3

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99.6

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298[b]
18

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470
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118
73
22

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2.3

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7
0.03

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786.1
37.6

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6,625
2,422

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7,411

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Annual[2]

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21.7[c]

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71
20.7

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93
22

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$PM_{2.5}$	24-Hour	21.7[c]	35	57	–	65
	Annual	1.2	9.1	10	12	15

Notes:

[a] Normal operations reflect operation on natural gas fuel with up to 50 hours per year per engine of operation on liquid fuel for testing and maintenance.

[b]. Includes startup. Under normal operating conditions, total impact will be 119 μg/m^3.

[c] When the extreme 24-hour period of extreme meteorological conditions is eliminated from the met data set, the highest modeled concentration drops to 14.6 μg/m^3. See text.

TABLE 8.1-27

Modeled Maximum Impacts, Maximum Expected Emergency Facility Operation[a]

Pollutant	Averaging Time	Maximum Facility Impact (μg/m^3)	Background (μg/m^3)	Total Impact (μg/m^3)	State Standard (μg/m^3)	Federal Standard (μg/m^3)
NO_2	1-hour	262.8	99.6	362	470	–
	Annual	1.9	17.0	19	–	100
SO_2	1-hour	2.0	114.4	116	650	–
	3-hour	1.0	70.2	71	–	1,300
	24-hour	0.7	21.0	22	109	365
	Annual	0.03	5.3	5	–	80
CO	1-hour	843.2	6,625	7,468	23,000	40,000
	8-hour	37.6	2,422	2,460	10,000	10,000
PM_{10}	24-hour	18.6[b]	71	90	50	150
	Annual[2]	1.4	20.7	22	20	50
$PM_{2.5}$	24-Hour	18.6[b]	35	54	–	65
	Annual	1.4	9.1	11	12	15

Notes:

[a] Emergency operations reflect worst-case conditions, including all reciprocating engines starting up and operating on liquid fuel for a 24-hour period, as well as 800 hours per year per engine of emergency operation on liquid fuel.

[b] When the extreme 24-hour period of extreme meteorological conditions is eliminated from the met data set, the highest modeled concentration drops to 13.7 μg/m³. See text.

8.1.2.9 Screening Health Risk Assessment

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Normal operations reflect o

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fuel with

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on liquid fuel

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TABLE 8.1-42
Comparison of Combined Modeled Impacts of HBRP and Humboldt Bay Power Plant and PSD Class II Increments

Pollutant	Averaging Time	Maximum Modeled Impacts (μg/m³)[a]	Class II Increment (μg/m³)
PM_{10}	24-Hour, Normal Operation	21.7	30
	24-hour, Emergency Operation	18.6	30
	Annual	1.14	17

HBRP will consult with the District staff to determine the appropriate baseline date for the PM_{10} increments analysis and to identify other increment-consuming and increment-expanding sources that need to be included in t

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TABLE 8.1-46
Comparison of Combined Modeled Annual Average NO_2 Impacts of HBRP and Humboldt Bay Power Plant with PSD Class II Increment

Pollutant	Averaging Time	Maximum Modeled Impacts (μg/m³)	Class II Increment (μg/m³)
NO_2	Annual	0.3	25

APPENDIX 8.1A

Emissions and Operating Parameters

APPENDIX 8.1A

Emissions and Operating Parameters

The following tables are provided in this appendix:

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Deleted: Detailed Calculations for Maximum Hourly, Daily, and Annual Criteria Pollutant Emissions for Federal PSD and CEQA

Table 8.1A-1
HBRP
Baseline Updated March 07 to include Humboldt Bay Power Plant emissions through September 28, 2006

Quarterly Emissions, tons

	HB 1					HB 2					MEPP 2					MEPP 3				
	NOx	**SO2**	**CO**	**ROC**	**PM-10**	**NOx**	**SO2**	**CO**	**ROC**	**PM-10**	**NOx**	**SO2**	**CO**	**ROC**	**PM-10**	**NOx**	**SO2**	**CO**	**ROC**	**PM-10**
Q3 2004 (1)	1.46	0.00	0.21	0.05	0.04	1.45	0.00	0.22	0.05	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Q4 2004	121.12	0.19	12.35	2.69	2.35	105.53	0.19	12.54	2.73	2.38	2.53	0.19	0.30	0.08	0.38	0.04	0.00	0.00	0.00	0.01
Q1 2005	114.90	0.20	12.79	2.78	2.43	92.67	0.19	12.54	2.73	2.38	1.68	0.08	0.20	0.05	0.25	0.26	0.01	0.02	0.01	0.03
Q2 2005	99.37	0.17	10.86	2.36	2.06	85.52	0.16	10.40	2.26	1.98	9.01	0.45	1.07	0.28	1.36	11.42	0.45	1.07	0.28	1.36
Q3 2005	128.23	0.23	14.85	3.23	2.82	98.32	0.21	13.78	3.00	2.62	1.70	0.09	0.20	0.05	0.26	2.35	0.09	0.22	0.06	0.28
Q4 2005	148.99	0.24	15.93	3.46	3.03	142.25	0.27	17.94	3.90	3.41	2.02	0.10	0.24	0.06	0.31	12.71	0.50	1.19	0.31	1.51
Q1 2006	128.18	0.24	16.04	3.49	3.05	125.92	0.25	16.63	3.62	3.16	2.39	0.03	0.21	0.05	0.27	2.53	0.03	0.24	0.06	0.30
Q2 2006	97.43	0.17	11.08	2.41	2.11	87.49	0.18	11.76	2.56	2.23	11.82	0.13	1.05	0.27	1.34	7.07	0.08	0.66	0.17	0.84
Q3 2006 (2)	88.82	0.19	12.59	2.74	2.39	126.55	54.46	14.27	3.02	6.45	7.38	0.08	0.66	0.17	0.83	4.44	0.05	0.42	0.11	0.53

Notes: 1. Sept 29-30, 2004
2. Sept 1-28, 2006

Unit-specific Quarterly Averages, September 29, 2004 -- September 28, 2006

	HB 1					HB 2					MEPP 2					MEPP 3				
	NOx	**SO2**	**CO**	**ROC**	**PM-10**	**NOx**	**SO2**	**CO**	**ROC**	**PM-10**	**NOx**	**SO2**	**CO**	**ROC**	**PM-10**	**NOx**	**SO2**	**CO**	**ROC**	**PM-10**
Q1	121.54	0.22	14.42	3.14	2.74	109.30	0.22	14.59	3.17	2.77	2.04	0.06	0.21	0.05	0.26	1.39	0.02	0.13	0.03	0.17
Q2	98.40	0.17	10.97	2.39	2.08	86.51	0.17	11.08	2.41	2.10	10.41	0.29	1.06	0.27	1.35	9.25	0.27	0.86	0.22	1.10
Q3	109.25	0.21	13.83	3.01	2.63	113.16	27.34	14.13	3.03	4.56	4.54	0.08	0.43	0.11	0.55	3.40	0.07	0.32	0.08	0.40
Q4	135.05	0.22	14.14	3.08	2.69	123.89	0.23	15.24	3.31	2.90	2.27	0.15	0.27	0.07	0.34	6.38	0.25	0.60	0.15	0.76

Facilitywide Quarterly Averages, September 29, 2004 -- September 28, 2006

	NOx	**SO2**	**CO**	**ROC**	**PM-10**
Q1	234.27	0.52	29.34	6.40	5.94
Q2	204.56	0.90	23.97	5.29	6.64
Q3	230.35	27.70	28.71	6.23	8.13
Q4	267.59	0.85	30.25	6.61	6.68
Total	936.77	29.97	112.27	24.54	27.39

Table 8.1A-2
HBRP
Emissions and Operating Parameters for Wärtsilä Reciprocating Engines
Natural Gas Firing
PM10 em rate rev 8/13/07

Case	1) Hot Base	2) Hot Low	3) Hot Mid	4) Cold Mid	5) Cold Base	6) Cold Low
Engine Load, kW	16929	8634	12697	12825	17100	8550
Engine Load, bhp	22,702	11,578	17,027	17,198	22,931	11,466
Ambient Temp, F	87	87	87	21	21	21
Engine Load	100	50	75	75	100	50
Heat input, MMBtu/hr (HHV)	142.5	80.97	111.5	112.4	143.9	81.7
Stack flow, lb/hr	221,535	125,074	174,122	174,981	222,353	125,891
Stack flow, acfm	118,586	71,806	99,082	99,509	120,764	73,619
Stack temp, F	735	796	787	776	723	796
Stack exhaust, vol %						
O2 (dry)	11.50%	11.50%	11.60%	11.66%	11.56%	11.67%
CO2 (dry)	5.37%	5.37%	5.31%	5.28%	5.33%	5.27%
H2O	9.52%	9.52%	9.43%	9.31%	9.40%	9.30%
Emissions						
NOx, ppmvd @ 15% O2	6.0	6.0	6.0	6.0	6.0	6.0
NOx, lb/hr	3.10	1.76	2.43	2.45	3.13	1.78
NOx, lb/MMBtu	0.0218	0.0218	0.0218	0.0218	0.0218	0.0218
SO2, ppmvd @ 15% O2	0.55	0.55	0.55	0.55	0.55	0.55
SO2, lb/hr	0.40	0.23	0.31	0.31	0.40	0.23
SO2, lb/MMBtu	0.0028	0.0028	0.0028	0.0028	0.0028	0.0028
CO, ppmvd @ 15% O2	13.0	13.0	13.0	13.0	13.0	13.0
CO, lb/hr	4.09	2.33	3.20	3.23	4.13	2.35
CO, lb/MMBtu	0.0287	0.0287	0.0287	0.0287	0.0287	0.0287
ROC, ppmvd @ 15% O2	28	28	28	28	28	28
ROC, lb/hr	5.05	2.87	3.95	3.98	5.10	2.90
ROC, lb/MMBtu	0.0354	0.0355	0.0355	0.0355	0.0354	0.0355
PM10, lb/hr	***3.6***	***3.6***	***3.6***	***3.6***	***3.6***	***3.6***
PM10, lb/MMBtu	***0.0253***	***0.0445***	***0.0323***	***0.0320***	***0.0250***	***0.0441***
PM10, gr/dscf	***0.00937***	***0.01649***	***0.01186***	***0.01168***	***0.00922***	***0.01605***
PM10, g/bhp-hr	***0.07193***	***0.14104***	***0.09591***	***0.09495***	***0.07121***	***0.14242***
NH3, ppmvd@15% O2	10.0	10.0	10.0	10.0	10.0	10.0
NH3, lb/hr	1.92	1.09	1.50	1.51	1.93	1.10

Table 8.1A-3
HBRP
Emissions and Operating Parameters for Wärtsilä Reciprocating Engines
Emergency Diesel Firing

Case	1) Hot Base	2) Hot Low	3) Hot Mid	4) Cold Mid	5) Cold Base	6) Cold Low
Engine Output, kW	17,100	8,550	12,825	12,825	17,100	8,550
Engine Output, bhp	22,931	11,466	17,198	17,198	22,931	11,466
Ambient Temp, F	87	87	87	21	21	21
Engine Load	100	50	75	75	100	50
Heat input, MMBtu/hr (HHV)	148.9	79.0	114.0	113.7	148.6	78.9
Stack flow, lb/hr	261,115	152,383	214,289	229,369	280,163	163,495
Stack flow, acfm	134,544	81,291	109,381	110,290	135,556	79,589
Stack temp, F	684	697	660	592	616	619
Stack exhaust, vol %						
O2 (dry)	12.34%	13.24%	12.93%	13.63%	13.05%	13.82%
CO2 (dry)	6.40%	5.73%	5.96%	5.45%	5.87%	5.30%
H2O	7.85%	7.34%	7.52%	5.89%	5.12%	4.66%
Emissions						
NOx, ppmvd @ 15% O2	35.0	35.0	35.0	35.0	35.0	35.0
NOx, lb/hr	19.92	10.57	15.25	15.21	19.87	10.55
NOx, lb/MMBtu	0.134	0.134	0.134	0.134	0.134	0.134
NOx, gm/kw-hr	0.53	0.56	0.54	0.54	0.53	0.56
SO2, ppmvd @ 15% O2	0.40	0.38	0.38	0.35	0.37	0.36
SO2, lb/hr	0.22	0.12	0.17	0.17	0.22	0.12
SO2, lb/MMBtu	0.0015	0.0016	0.0015	0.0015	0.0015	0.0016
CO, ppmvd @ 15% O2	20.0	20.0	20.0	20.0	20.0	20.0
CO, lb/hr	6.93	3.68	5.31	5.29	6.91	3.67
CO, lb/MMBtu	0.047	0.047	0.047	0.047	0.047	0.047
ROC, ppmvd @ 15% O2	40	40	40	40	40	40
ROC, lb/hr	7.94	4.21	6.08	6.06	7.92	4.21
ROC, lb/MMBtu	0.0533	0.0533	0.0533	0.0533	0.0533	0.0533
PM10, lb/hr	10.8	10.8	10.8	10.8	10.8	10.8
PM10, lb/MMBtu	0.0725	0.1367	0.0947	0.0950	0.0727	0.1369
PM10, gr/dscf	0.02330	0.03931	0.02834	0.02594	0.02141	0.03640
PM10, g/bhp-hr	0.21	0.43	0.28	0.28	0.21	0.43
DPM, lb/hr	5.56	--	--	--	5.56	--
DPM, g/kw-hr	0.15	--	--	--	0.15	--
NH3, ppmvd@15% O2	10.0	10.0	10.0	10.0	10.0	10.0
NH3, lb/hr	2.11	1.12	1.61	1.61	2.10	1.12

Table 8.1A-4
HBRP
Emergency Generator Performance and Emissions
Rev 8/07

Engine		
Manufacturer		***Caterpillar***
Model		***DM8149***
Capacity	kW	350
	bhp	469
Fuel		Diesel
Fuel Consumption (HHV)	Btu/bhp-hr	8,491
Fuel Consumption	gal/hr	***29.1***
Exhaust Flow	acfm	***3,366***
Stack Velocity	ft/sec	285.67
Exhaust Temperature	deg. F	***925.9***
Exhaust Pipe Diameter	in	***6***
Number of Exhaust Pipes		1
Exhaust Stack Height	ft	***10.00***
Operating Profile		
Annual operation	hrs	50
Emissions		
NOx	g/bhp-hr	***3.47***
CO	g/bhp-hr	***0.63***
ROC (non-methane HC)	g/bhp-hr	***0.4***
PM10	g/bhp-hr	***0.05***
NOx	lb/hr	3.59
CO	lb/hr	0.65
ROC	lb/hr	0.41
PM10	lb/hr	0.05
	gr/scf	0.00384
SO2	lb/hr	0.0061

Diesel fuel	6.95	lb/gal
	136,903	Btu/gal

Table 8.1A-5
HBRP
Diesel Fire Pump Performance and Emissions

Engine		
Fire Pump Mfr		Clarke
Engine Mfr		John Deere
Model		JU6H-UF50
Useable Horsepower	hp	210
Speed	rpm	2100
Fuel		CA Diesel
Specific Gravity		0.825
Fuel Sulfur Content	wt %	0.0015%
Fuel Consumption	gph	12.3
	Btu/bhp-hr	8,019
Exhaust Flow	acfm	1204
Stack Velocity	ft/sec	13.7
Exhaust Temperature	deg. F	1050
Exhaust Pipe Diameter	in	5
Exhaust Stack Height	ft	40
Pump		
Speed	rpm	2100
Capacity	gpm	2500
Discharge Pressure	psig	
Pump Efficiency	%	
Brake Horsepower	bhp	210.0
Operating Profile		
Annual Operation	hrs	50
Emissions		
NOx	g/bhp-hr	4.9
CO	g/bhp-hr	0.59
ROC	g/bhp-hr	0.5
PM10	g/bhp-hr	0.14
NOx	lb/hr	2.27
CO	lb/hr	0.27
ROC	lb/hr	0.23
PM10	lb/hr	0.06
	gr/scf	0.01680
SO2	lb/hr	0.0026

Table 8.1A-6
HBRP
Detailed Calculations for Maximum Hourly, Daily, and Annual Criteria Pollutant Emissions
Rev. 8/07
Operating and Emissions Assumptions

Equipment	Base Load max. hour	hrs/day	hrs/Q1	hrs/Q2	hrs/Q3	hrs/Q4	hrs/yr
ICE, NG, baseload hours per engine	0	0	1512	1528	1546	1546	6132
ICE, Diesel, baseload hours per engine	0	21	0	0	0	0	0
ICE, NG startups per engine	0	0	78	79	79	79	315
ICE, Diesel startups per engine	1	3	12	12	13	13	50
Black Start Generator, hours	0.75	0.75	12	12	13	13	50
Fire Pump Engine, hours	0	1	12	12	13	13	50

	NOx		SOx (1)		CO		ROC		PM10	
Equipment	Base Load lb/hr	Startup (2) lb/hr	Base Load lb/hr	Annual lb/hr	Base Load lb/hr	Startup (2) lb/hr	Base Load lb/hr	Startup (2) lb/hr	Base Load lb/hr	Startup lb/hr
ICE, NG, baseload	3.13	--	0.403	0.13	4.13	--	5.10	--	***3.60***	--
ICE, Diesel, baseload	19.92	--	0.219	0.22	6.93	--	7.94	--	10.80	--
ICE, NG startups	--	23.6	--	--	--	24.07	--	17.9	--	***3.60***
ICE, Diesel startups	--	164.0	--	--	--	25.46	--	17.2	--	10.80

Table 8.1A-6 (cont'd)
Rev. 8/07
Emissions Calculations

Equipment	NOx Emissions Max lb/hr	Max lb/day	Max lb/Q1	Max lb/Q2	Max lb/Q3	Max lb/Q4	Total tons/yr
ICE, NG, baseload, per engine	0.00	0.00	4,736.2	4,788.4	4,843.7	4,843.7	9.61
ICE, Diesel, baseload, per engine	0.0	418.3	0.0	0.0	0.0	0.0	0.00
ICE, startups, per engine	164.0	491.9	3,805.7	3,829.3	3,993.2	3,993.2	7.81
ICE Max, 10 engines	***392.0***	9,101.3	85,419	86,176	88,369	88,369	174.2
Black Start Generator	2.69	2.69	43.1	43.1	46.7	46.7	0.09
Fire Pump Engine	0.00	2.27	27.2	27.2	29.5	29.5	0.06
Project Total	***394.7***	9,106.3	85,489	86,247	88,446	88,446	174.3
	lb/hr	lb/day	lb/Q1	lb/Q2	lb/Q3	lb/Q4	tons/yr

Equipment	SOx Emissions Max lb/hr	Max lb/day	Max lb/Q1	Max lb/Q2	Max lb/Q3	Max lb/Q4	Total tons/yr
ICE, NG, baseload	0.0	8.5	609.1	615.8	622.9	622.9	0.4
ICE, Diesel, baseload	0.0	0.0	0.0	0.0	0.0	0.0	0.0
ICE, startups	0.4	1.2	34.1	34.5	34.7	34.7	2.66E-02
ICE Total, 10 engines	4.0	96.7	6,431	6,503	6,576	6,576	4.4
Black Start Generator	0.00	0.00	0.07	0.07	0.08	0.08	1.52E-04
Fire Pump Engine	0.00	0.00	0.03	0.03	0.03	0.03	6.41E-05
Total	4.0	96.7	6,431	6,503	6,576	6,576	4.4
	lb/hr	lb/day	lb/Q1	lb/Q2	lb/Q3	lb/Q4	tons/yr

Equipment	CO Emissions Max lb/hr	Max lb/day	Max lb/Q1	Max lb/Q2	Max lb/Q3	Max lb/Q4	Total tons/yr
ICE, NG, baseload	0.0	0.0	6,247.8	6,316.7	6,389.7	6,389.7	13
ICE, Diesel, baseload	0.0	145.5	0.0	0.0	0.0	0.0	0
ICE, startups	25.5	76.4	2,182.8	2,206.8	2,232.3	2,232.3	4
ICE Total, 10 engines	254.6	2,219.1	84,306	85,236	86,220	86,220	171.0
Black Start Generator	0.5	0.5	7.8	7.8	8.5	8.5	0.0
Fire Pump Engine	0.0	0.3	3.3	3.3	3.6	3.6	0.0
Total	255.1	2219.9	84,317	85,247	86,232	86,232	171.0
	lb/hr	lb/day	lb/Q1	lb/Q2	lb/Q3	lb/Q4	tons/yr

Equipment	ROC Emissions Max lb/hr	Max lb/day	Max lb/Q1	Max lb/Q2	Max lb/Q3	Max lb/Q4	Total tons/yr
ICE, NG, baseload	0.0	0.0	7,707.6	7,792.6	7,882.6	7,882.6	16
ICE, Diesel, baseload	0.0	166.7	0.0	0.0	0.0	0.0	0
ICE, startups	***17.9***	***53.8***	1,606.1	1,624.0	1,641.2	1,641.2	3
ICE Total, 10 engines	***179.5***	***2,205.4***	93,137	94,166	95,238	95,238	188.9
Black Start Generator	***0.31***	0.31	4.96	4.96	5.38	5.38	1.03E-02
Fire Pump Engine	***0.00***	0.23	2.78	2.78	3.01	3.01	5.79E-03
Total	***179.8***	***2,206.0***	93,145	94,174	95,247	95,247	188.9
	lb/hr	lb/day	lb/Q1	lb/Q2	lb/Q3	lb/Q4	tons/yr

Equipment	PM10 Emissions Max lb/hr	Max lb/day	Max lb/Q1	Max lb/Q2	Max lb/Q3	Max lb/Q4	Total tons/yr
ICE, NG, baseload	0.0	0.0	***5442.0***	***5502.0***	***5565.6***	***5565.6***	***11.04***
ICE, Diesel, baseload	0.0	226.8	0.0	0.0	0.0	0.0	0
ICE, startups	10.8	32.4	410.4	414	424.8	424.8	0.84
ICE Total, 10 engines	108.0	***2,203.0***	***58,524***	***59,160***	***59,904***	***59,904***	***118.7***
Black Start Generator	***0.00***	0.04	0.63	0.63	0.69	0.69	1.32E-03
Fire Pump Engine	***0.06***	0.06	0.78	0.78	0.84	0.84	1.62E-03
Total	108.1	***2,203.1***	***58,526***	***59,161***	***59,905***	***59,905***	***118.7***
	lb/hr	lb/day	lb/Q1	lb/Q2	lb/Q3	lb/Q4	tons/yr

Table 8.1A-8
HBRP
Annual and Maximum Hourly Non-Criteria Pollutant Emissions for Wärtsilä Reciprocating Engines
Rev 8/07

Pollutant	Natural Gas Emission Factor (1) lb/MMscf	Controlled Natural Gas Em Factor (2) lb/MMscf	Diesel Emission Factor (3) lb/Mgal	Controlled Diesel Em Factor (2) lb/Mgal	Maximum Hourly Emissions per Engine, lb/hr (5)		ICE Total Annual Emissions (7) tpy
					Nat Gas Firing (5)	Diesel Firing (6)	
Ammonia	(4)	n/a	(4)	n/a	1.93	2.11	62.84
Propylene	5.38E+00	3.23E+00	3.85E-01	2.31E-01	0.46	0.25	14.67
Hazardous Air Pollutants							
Acetaldehyde	5.29E-01	3.17E-01	3.47E-03	2.08E-03	0.04	2.26E-03	1.44
Acrolein	5.90E-02	3.54E-02	1.07E-03	6.42E-04	4.99E-03	6.98E-04	0.16
Benzene	2.18E-01	1.31E-01	1.01E-01	6.06E-02	0.02	6.59E-02	0.60
1,3-Butadiene	3.67E-01	2.20E-01	--	--	0.03	--	1.00
Diesel PM (8)	--		--	--	--	5.56	1.39
Ethylbenzene	7.11E-02	4.27E-02	--	--	0.01	--	0.19
Formaldehyde	2.36	inc	1.32E-02	inc	0.33	1.44E-02	10.70
Hexane	1.13E+00	6.80E-01	--	--	0.10	--	3.09
Naphthalene	2.51E-02	1.51E-02	1.63E-02	9.78E-03	2.22E-03	1.06E-02	0.07
PAHs (as B(a)P) (9)	1.71E-05	1.03E-05	6.21E-05	3.73E-05	1.81E-06	4.05E-05	4.89E-05
Toluene	2.39E-01	1.43E-01	3.74E-02	2.24E-02	2.04E-02	2.44E-02	0.65
Xylene	6.46E-01	3.88E-01	2.68E-02	1.61E-02	5.48E-02	1.75E-02	1.76
Total HAPs (excluding Diesel PM) =							19.66

Notes:

(1) All factors except hexane and formaldehyde are CATEF mean values for natural gas-fired IC engines. Hexane is from AP-42 Table 3.2-2; formaldehyde is based on vendor data.

(2) 40% control efficiency for oxidation catalyst applied for all TACs except formaldehyde. Source: BAAQMD PDOC for Eastshore Energy Center, April 30, 2007. Formaldehyde emission factor provided by vendor reflects ox cat control.

(3) All factors are CATEF mean values for large Diesel engines (SCC 20200102).

(4) Based on 10 ppm ammonia slip from SCR system.

(5) Based on maximum ICE firing rate of 143.9 MMBtu/hr and fuel HHV of 1,021.1 Btu/scf of natural gas and 0.79 MMBtu/hr and fuel HHV of 136,903 Btu/gal for pilot Diesel fuel

0.14088	MMscf/hr natural gas
0.01	Mgal/hr Diesel fuel

(6) Based on maximum ICE firing rate of 148.9 MMBtu/hr and fuel HHV of 136,903 Btu/gal for Diesel fuel

1.09	Mgal/hr Diesel fuel

(7) Based on maximum ICE firing rate (from (3)) for 6447 hrs/yr on natural gas and pilot Diesel fuel.

908.3	MMscf/yr of natural gas
7.0	Mgal/yr Diesel fuel

(8) Based on 50 hrs/yr of backup Diesel fuel operation; Front half only, per ATCM.

(9) Emission factors for individual PAHs weighted by cancer risk relative to B(a)P and summed to obtain overall B(a)P equivalent emission rate for HRA.

	Mean EF		PEF Equiv.	PEF-Weighted EF	
	Nat Gas	Diesel		Nat Gas	Diesel
PAHs (as B(a)P)					
Benzo(a)anthracene	5.88E-05	5.03E-05	0.1	5.88E-06	5.03E-06
Benzo(a)pyrene	2.70E-06	1.81E-05	1	2.70E-06	1.81E-05
Benzo(b)fluoranthrene	4.09E-05	7.96E-05	0.1	4.09E-06	7.96E-06
Benzo(k)fluoranthrene	7.83E-06	1.56E-05	0.1	7.83E-07	1.56E-06
Chrysene	1.43E-05	1.06E-04	0.01	1.43E-07	1.06E-06
Dibenz(a,h)anthracene	2.70E-06	2.43E-05	1.05	2.84E-06	2.55E-05
Indeno(1,2,3-cd)pyrene	7.17E-06	2.89E-05	0.1	7.17E-07	2.89E-06

Table 8.1A-9
Humboldt Bay Power Plant
Fuel Use During the Baseline Period: Humboldt Bay Power Plant
Rev 08/07

		HB 1					HB 2					MEPP 2					MEPP 3				
Year	Month	MMCF Gas Fuel	Eq. Bbl Gas Fuel	A Bbl Oil Fuel	Eq. Bbl Oil Fuel	MMBtu Fuel	MMCF Gas Fuel	Eq. Bbl Gas Fuel	A Bbl Oil Fuel	Eq. Bbl Oil Fuel	MMBtu Fuel	MMCF Gas Fuel	Eq. Bbl Gas Fuel	A Bbl Oil Fuel	Eq. Bbl Oil Fuel	MMBtu Fuel	MMCF Gas Fuel	Eq. Bbl Gas Fuel	A Bbl Oil Fuel	Eq. Bbl Oil Fuel	MMBtu Fuel
2004	Sept 29-30	10.5	1,710.8	0.0	0.0	10,692.6	11.0	1,786.9	0.0	0.0	11,168.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	October	162.7	26,496.0	0.0	0.0	165,599.8	170.6	27,783.3	0.0	0.0	173,645.5	0.0	0.0	257.0	237.8	1,486.0	0.0	0.0	0.0	0.0	0.0
	November	226.2	36,921.8	0.0	0.0	230,761.0	227.1	37,061.3	0.0	0.0	231,633.1	0.0	0.0	693.0	643.0	4,018.8	0.0	0.0	34.0	31.5	196.7
	December	228.5	37,422.6	0.0	0.0	233,891.2	229.6	37,596.3	0.0	0.0	234,976.9	0.0	0.0	1,214.0	1,127.6	7,047.7	0.0	0.0	0.0	0.0	0.0
2005	January	240.6	39,253.9	0.0	0.0	245,336.6	239.0	39,001.1	0.0	0.0	243,757.0	0.0	0.0	1,007.0	933.8	5,836.4	0.0	0.0	10.0	10.0	62.4
	February	189.5	30,969.1	0.0	0.0	193,556.7	193.1	31,564.7	0.0	0.0	197,279.5	0.0	0.0	41.0	38.0	237.8	0.0	0.0	82.0	77.0	481.4
	March	209.6	34,187.2	0.0	0.0	213,669.7	195.1	31,835.3	0.0	0.0	198,970.8	0.0	0.0	391.0	362.0	2,262.5	0.0	0.0	81.0	76.2	476.1
	April	46.0	7,460.0	0.0	0.0	46,625.1	313.4	51,104.9	0.0	0.0	319,405.9	0.0	0.0	4,444.0	4,114.7	25,717.1	0.0	0.0	3,643.0	3,374.6	21,091.4
	May	296.8	48,160.9	0.0	0.0	301,005.9	78.1	12,743.7	0.0	0.0	79,648.4	0.0	0.0	2,375.0	2,200.7	13,754.6	0.0	0.0	3,490.0	3,228.5	20,178.0
	June	200.0	32,734.9	0.0	0.0	204,593.3	128.4	20,952.9	0.0	0.0	130,955.6	0.0	0.0	905.0	837.9	5,237.0	0.0	0.0	548.0	508.2	3,176.0
	July	241.8	39,383.3	0.0	0.0	246,145.5	184.8	30,093.0	0.0	0.0	188,081.2	0.0	0.0	455.0	422.6	2,641.1	0.0	0.0	150.0	140.5	878.1
	August	306.5	49,999.6	0.0	0.0	312,497.4	304.2	49,731.8	0.0	0.0	310,823.6	0.0	0.0	957.0	886.8	5,542.5	0.0	0.0	1,383.0	1,281.3	8,008.1
	Sept 1-28	176.6	28,895.5	0.0	0.0	180,597.2	182.2	29,811.5	0.0	0.0	186,321.9	0.0	0.0	44.0	41.2	257.7	0.0	0.0	46.0	43.1	269.5
	Sept 29-30	17.8	2,904.5	0.0	0.0	18,153.2	17.8	2,914.6	0.0	0.0	18,216.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	October	300.6	49,088.8	0.0	0.0	306,804.7	305.5	49,900.5	0.0	0.0	311,878.0	0.0	0.0	178.0	166.2	1,039.0	0.0	0.0	1,152.0	1,070.4	6,689.8
	November	278.9	45,509.0	0.0	0.0	284,431.0	292.9	47,772.9	0.0	0.0	298,580.4	0.0	0.0	163.0	152.1	950.9	0.0	0.0	3,680.0	3,405.9	21,287.0
	December	217.0	35,454.0	0.0	0.0	221,587.6	298.5	48,719.9	0.0	0.0	304,499.1	0.0	0.0	1,385.0	1,284.0	8,025.1	0.0	0.0	3,714.0	3,437.3	21,483.2
2006	January	301.6	49,071.2	0.0	0.0	306,694.9	309.7	50,399.5	0.0	0.0	314,996.9	0.0	0.0	1,330.0	1,234.2	7,713.4	0.0	0.0	1,343.0	1,244.7	7,779.4
	February	227.0	36,917.5	0.0	0.0	230,734.1	235.9	38,363.5	0.0	0.0	239,771.6	0.0	0.0	30.0	27.8	173.6	0.0	0.0	37.0	34.8	217.7
	March	273.6	44,583.8	0.0	0.0	278,648.9	286.0	46,595.8	0.0	0.0	291,223.8	0.0	0.0	166.0	154.6	966.4	0.0	0.0	315.0	292.5	1,827.9
	April	58.9	9,604.3	0.0	0.0	60,027.1	362.1	58,972.5	0.0	0.0	368,578.2	0.0	0.0	7,007.0	6,478.9	40,493.0	0.0	0.0	4,510.0	4,174.5	26,090.7
	May	219.3	35,793.8	0.0	0.0	223,711.3	176.7	28,836.0	0.0	0.0	180,225.2	0.0	0.0	217.0	202.2	1,263.6	0.0	0.0	47.0	43.8	273.9
	June	275.8	45,466.5	0.0	0.0	284,165.3	49.3	8,051.8	0.0	0.0	50,323.7	0.0	0.0	345.0	323.7	2,022.9	0.0	0.0	195.0	181.9	1,136.8
	July	213.5	34,998.4	0.0	0.0	218,739.7	210.8	34,526.0	0.0	0.0	215,787.3	0.0	0.0	29.0	27.3	170.9	0.0	0.0	437.0	416.8	2,604.8
	August	226.0	36,765.3	0.0	0.0	229,783.1	272.7	44,349.7	1,458.2	1,444.1	286,211.3	0.0	0.0	3,412.0	3,156.6	19,729.0	0.0	0.0	1,942.0	1,798.5	11,240.7
	Sept 1-28	190.1	30,947.2	0.0	0.0	193,420.1	167.4	27,245.2	10,468.7	10,330.2	234,845.7	0.0	0.0	1,287.0	1,192.0	7,450.1	0.0	0.0	594.0	551.9	3,449.3
	Sept 29-30	9.3	1,514.5	0.0	0.0	9,465.5	9.9	1,616.2	0.0	0.0	10,100.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	October	212.2	34,659.9	0.0	0.0	216,624.1	132.5	21,684.8	0.0	0.0	135,529.8	0.0	0.0	717.0	666.9	4,167.9	0.0	0.0	336.0	311.0	1,944.0
	November	266.7	43,468.5	0.0	0.0	271,678.1	199.2	32,446.3	0.0	0.0	202,789.6	0.0	0.0	1,326.0	1,228.0	7,675.1	0.0	0.0	2,535.0	2,344.5	14,653.0
	December	245.8	40,223.9	154.1	147.2	252,318.9	308.8	50,523.1	2,860.4	2,788.9	333,200.2	0.0	0.0	2,127.0	1,975.9	12,349.7	0.0	0.0	2,717.0	2,517.1	15,731.8
	2005 Total	2,535.3	413,595.5	0.0	0.0	2,584,971.8	2,456.5	401,066.8	0.0	0.0	2,506,667.3	0.0	0.0	12,783.0	11,846.3	74,039.2	0.0	0.0	9,467.0	8,770.9	54,817.9
	2006 Total	2,800.1	457,104.2	0.0	0.0	2,856,901.1	2,985.1	486,647.7	11,926.9	11,774.3	3,115,137.5	0.0	0.0	15,549.0	14,399.7	89,997.9	0.0	0.0	17,966.0	16,653.0	104,081.2

APPENDIX 8.1B

Modeling Analysis

APPENDIX 8.1B

Modeling Analysis

The following tables and figures are provided in this appendix:

Deleted: 1-Hour Average NOx Impacts

Deleted: 24-Hour Average PM_{10} Impacts

Deleted: Annual Average PM_{10} Impacts

TABLE 8.1B-1
Dimensions of On-Site Structures
HBRP and Humboldt Bay Power Plant

Feature	Height (feet)	Length (feet)	Width (feet)	Diameter (feet)
HBRP New Structures				
Wartsila ICEs				
Tier 1 (emission control systems and ducting)	27.0	169.1	284.8	--
Tier 2 (engine hall)	38.6	90.0	284.8	--
Tier 3 (engine hall vents)	44.8	16.1	110.2	--
Oil Water Tank	13.1	--	--	11.5
Clean Lube Oil Tank	19.0	--	--	16.4
Used Lube Oil Tank	18.4	--	--	11.5
Ammonia Tanks (2)	34.0	--	--	13.5
Fire Water Tank	32.0	--	--	30
Fire Pump Engine Enclosure	10.3	23.0	19.7	--
Oil Water Separator	13.8	13.1	44.3	--
Sludge Tank	21.9	--	--	11.5
Diesel Tank	40.0	--	--	51.9
Workshop/Control Room	21.9	40	120	--
Humboldt Bay Power Plant Existing Structures				
Power Building (Units 1 and 2)				
Tier 1 (Operating level)	15.0	84.0	66.0	--
Tier 2	18.8			--
Tier 3	27.0			--
Tier 4	70.0	57.0	28.0	--
Unit 3 Power Building	48.3	150.0	100.0	--
Admin. Annex	15.0	100.0	35.0	--
Rad Waste Pre-Engr Building	34.0	96.0	44.0	--
MEPPS Sound Enclosures	16.4	59.3	17.0	--
MEPPS Air Intake Structures	32.4		17.0	--
MEPPS Air Start Bldg	12.0	52.0	24.0	--
Fuel Storage Tanks (2)	48.0	--	--	15.0
Fuel Service Tanks (2)	24.0	--	--	24.0
Light Oil Tank	24.0	--	--	25.0
Relay Bldg	13.3	31.7	16.0	--
Fresh Water Tank	42.0	--	--	36.0
Distilled Water Tanks (4)	24.0	--	--	15.0
Tanks A and B (2)	48.3	--	--	100

Table 8.1B-2
HBRP
Emission Rates and Stack Parameters for Modeling Existing Humboldt Bay Power Plant Generating Units
Rev 8/07

	Stack Diam, m	Stack Height, m	Exh Temp, Deg K	Exhaust Flow, m3/s	Exhaust Velocity, m/s	PM10 Emission Rates, g/s
24-Hour Averaging Period, Full Load, Gas Firing in Boilers						
Boiler 1	3.150	36.576	408.000	110.07	14.128	0.600
Boiler 2	3.150	36.576	408.000	110.07	14.128	0.600
MEPP2	3.767	6.528	723.000	256.67	23.026	1.745
MEPP3	3.767	6.528	723.000	256.67	23.026	1.745
24-Hour Averaging Period, Part Load, Gas Firing in Boilers						
Boiler 1	3.150	36.576	408.000	96.86	12.432	0.528
Boiler 2	3.150	36.576	408.000	96.86	12.432	0.528
MEPP2	3.767	6.528	723.000	256.67	23.026	1.745
MEPP3	3.767	6.528	723.000	256.67	23.026	1.745
24-Hour Averaging Period, Full Load, Oil Firing in Boilers						
Boiler 1	3.150	36.576	422.500	106.16	13.626	8.274
Boiler 2	3.150	36.576	422.500	106.16	13.626	8.720
MEPP2	3.767	6.528	723.000	256.67	23.026	1.745
MEPP3	3.767	6.528	723.000	256.67	23.026	1.745
24-Hour Averaging Period, Part Load, Oil Firing in Boilers						
Boiler 1	3.150	36.576	422.500	93.42	11.991	7.281
Boiler 2	3.150	36.576	422.500	93.42	11.991	7.673
MEPP2	3.767	6.528	723.000	256.67	23.026	1.745
MEPP3	3.767	6.528	723.000	256.67	23.026	1.745
Annual Averaging Period						
Boiler 1	3.150	36.576	408.000	88.06	11.302	0.292
Boiler 2	3.150	36.576	408.000	88.06	11.302	0.355
MEPP2	3.767	6.528	723.000	256.67	23.026	0.072
MEPP3	3.767	6.528	723.000	256.67	23.026	0.070

Table 8.1B-3
HBRP
Emissions and Stack Parameters for Screening Modeling
Rev 8/07

Turbine Case	Load/ Ambient Temp	Stack Diam (m)	Stack Ht (m)	Exhaust Temp (deg K)	Exhaust Velocity (m/s)
1G	full/87	1.620	30.480	663.556	27.152
2G	low/87	1.620	30.480	697.444	16.441
3G	mid/87	1.620	30.480	692.444	22.686
4G	mid/21	1.620	30.480	686.333	22.784
5G	full/21	1.620	30.480	656.889	27.651
6G	low/21	1.620	30.480	697.444	16.856
1D	full/87	1.620	30.480	635.222	30.806
2D	low/87	1.620	30.480	642.444	18.613
3D	mid/87	1.620	30.480	621.889	25.044
4D	mid/21	1.620	30.480	584.111	25.252
5D	full/21	1.620	30.480	597.444	31.037
6D	low/21	1.620	30.480	599.111	18.223

Note: PM10 emission rate for Diesel mode cases reflect 1542 lb/day PM

Table 8.1B-4
HBRP
Results of the Screening Analysis for the Wärtsilä Reciprocating Engines
Revised 08/07

Screening Modeling Results (ug/m3 per 1.0 g/s, each engine)					
Operating	**AERMOD Results**				
Case	1-hr	3-hr	8-hr	24-hr*	annual
1G	501.91	361.21	214.35	72.59	6.71
2G	635.42	467.08	260.98	n/a	n/a
3G	549.37	381.47	233.73	79.24	n/a
4G	549.98	381.70	233.97	79.33	n/a
5G	499.85	359.51	212.86	72.08	6.66
6G	629.75	461.10	258.45	n/a	n/a
1D	481.18	345.04	200.74	67.95	6.32
2D	620.80	451.16	254.57	n/a	n/a
3D	545.77	379.96	231.97	78.63	n/a
4D	559.54	385.17	237.56	80.56	n/a
5D	492.80	353.73	207.78	70.35	6.52
6D	640.12	471.66	262.62	n/a	n/a

Emission Rates for Screening Modeling (g/s per engine)							
Operating	NOx		SO2		CO	PM10	
Case	1-hr	annual	short-term	annual	all	24-hr	annual
1G	0.391	0.501	0.050	0.013	0.516	0.454	0.342
2G	0.222	0.501	0.029	0.013	0.293	0.454	0.342
3G	0.306	0.501	0.039	0.013	0.404	0.454	0.342
4G	0.308	0.501	0.040	0.013	0.407	0.454	0.342
5G	0.395	0.501	0.051	0.013	0.521	0.454	0.342
6G	0.224	0.501	0.029	0.013	0.296	0.454	0.342
1D	2.510	n/a	0.027	n/a	0.873	***0.810***	n/a
2D	1.332	n/a	0.016	n/a	0.463	***0.810***	n/a
3D	1.921	n/a	0.021	n/a	0.668	***0.810***	n/a
4D	1.917	n/a	0.022	n/a	0.667	***0.810***	n/a
5D	2.504	n/a	0.028	n/a	0.871	***0.810***	n/a
6D	1.330	n/a	0.016	n/a	0.463	***0.810***	n/a

	Load/	**Modeled Impacts, ug/m3, by Pollutant and Averaging Period**									
Operating	**Ambient**	NOx		SO2				CO		PM10	
Case	**Temp**	1-hr	Annual	1-hr	3-hr	24-hr	Annual	1-hr	8-hr	24-hr	Annual
1G	full/87	196.30	**3.361**	25.245	18.168	3.651	**0.0845**	258.96	110.59	32.93	**2.292**
2G	low/87	141.25	n/a	18.156	13.346	n/a	n/a	186.33	76.53	n/a	n/a
3G	mid/87	168.10	n/a	21.612	15.007	3.117	n/a	221.76	94.35	35.95	n/a
4G	mid/21	169.62	n/a	21.807	15.135	3.145	n/a	223.76	95.19	**35.98**	n/a
5G	full/21	**197.32**	3.339	**25.376**	**18.251**	**3.659**	0.0840	**260.30**	**110.85**	32.70	2.277
6G	low/21	141.22	n/a	18.152	13.291	n/a	n/a	186.30	76.46	n/a	n/a
1D	full/87	1207.53	n/a	13.177	9.449	1.861	n/a	420.12	175.26	55.02	n/a
2D	low/87	826.60	n/a	9.658	7.019	n/a	n/a	287.59	117.93	n/a	n/a
3D	mid/87	1048.59	n/a	11.690	8.138	1.684	n/a	364.82	155.06	63.67	n/a
4D	mid/21	1072.38	n/a	12.080	8.315	1.739	n/a	373.10	158.40	**65.23**	n/a
5D	full/21	**1233.97**	n/a	13.622	9.778	1.944	n/a	**429.32**	**181.01**	56.96	n/a
6D	low/21	851.15	n/a	10.046	7.402	n/a	n/a	296.13	121.49	n/a	n/a

Table 8.1B-5
HBRP
Emission Rates and Stack Parameters for HBRP
Rev 08/07

	Stack Diam, m	Stack Height, m	Exh Temp, Deg K	Exhaust Flow, m3/s	Exhaust Velocity, m/s	Emission Rates, g/s			
						NOx	SO2	CO	PM10
One-Hour Averaging Period: NOx and CO, emergency Diesel backup operation (Case 5D)									
ICE 1	1.620	30.480	597.444	63.98	31.037	2.504	2.764E-02	0.871	--
ICE 2	1.620	30.480	597.444	63.98	31.037	2.504	2.764E-02	0.871	--
ICE 3	1.620	30.480	597.444	63.98	31.037	2.504	2.764E-02	0.871	--
ICE 4	1.620	30.480	597.444	63.98	31.037	2.504	2.764E-02	0.871	--
ICE 5	1.620	30.480	597.444	63.98	31.037	2.504	2.764E-02	0.871	--
ICE 6	1.620	30.480	597.444	63.98	31.037	2.504	2.764E-02	0.871	--
ICE 7	1.620	30.480	597.444	63.98	31.037	2.504	2.764E-02	0.871	--
ICE 8	1.620	30.480	597.444	63.98	31.037	2.504	2.764E-02	0.871	--
ICE 9	1.620	30.480	597.444	63.98	31.037	2.504	2.764E-02	0.871	--
ICE 10	1.620	30.480	597.444	63.98	31.037	2.504	2.764E-02	0.871	--
Emergency Gen.	0.152	3.048	769.611	1.588	87.073	--	--	--	--
Fire Pump Engine	0.127	12.192	838.556	0.568	44.856	--	--	--	--
One-Hour Averaging Period: Normal Operation (Case 5G)									
ICE 1	1.620	30.480	656.889	56.99	27.651	0.395	5.077E-02	0.521	--
ICE 2	1.620	30.480	656.889	56.99	27.651	0.395	5.077E-02	0.521	--
ICE 3	1.620	30.480	656.889	56.99	27.651	0.395	5.077E-02	0.521	--
ICE 4	1.620	30.480	656.889	56.99	27.651	0.395	5.077E-02	0.521	--
ICE 5	1.620	30.480	656.889	56.99	27.651	0.395	5.077E-02	0.521	--
ICE 6	1.620	30.480	656.889	56.99	27.651	0.395	5.077E-02	0.521	--
ICE 7	1.620	30.480	656.889	56.99	27.651	0.395	5.077E-02	0.521	--
ICE 8	1.620	30.480	656.889	56.99	27.651	0.395	5.077E-02	0.521	--
ICE 9	1.620	30.480	656.889	56.99	27.651	0.395	5.077E-02	0.521	--
ICE 10	1.620	30.480	656.889	56.99	27.651	0.395	5.077E-02	0.521	--
Emergency Gen.	0.152	3.048	769.611	1.59	87.07	0.339	7.647E-04	8.210E-02	--
Fire Pump Engine	0.127	12.192	838.556	0.57	44.856	0.286	3.231E-04	3.442E-02	--
Three-Hour Averaging Period (Case 5G)									
ICE 1	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 2	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 3	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 4	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 5	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 6	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 7	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 8	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 9	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 10	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
Emergency Gen.	0.152	3.048	769.611	1.59	87.073	--	2.549E-04	--	--
Fire Pump Engine	0.127	12.192	838.556	0.57	44.856	--	1.077E-04	--	--
Eight-Hour Averaging Period, emergency Diesel backup operation (includes one startup) (Case 5D)									
ICE 1	1.620	30.480	597.444	63.98	31.037	--	--	1.165	--
ICE 2	1.620	30.480	597.444	63.98	31.037	--	--	1.165	--
ICE 3	1.620	30.480	597.444	63.98	31.037	--	--	1.165	--
ICE 4	1.620	30.480	597.444	63.98	31.037	--	--	1.165	--
ICE 5	1.620	30.480	597.444	63.98	31.037	--	--	1.165	--
ICE 6	1.620	30.480	597.444	63.98	31.037	--	--	1.165	--
ICE 7	1.620	30.480	597.444	63.98	31.037	--	--	1.165	--
ICE 8	1.620	30.480	597.444	63.98	31.037	--	--	1.165	--
ICE 9	1.620	30.480	597.444	63.98	31.037	--	--	1.165	--
ICE 10	1.620	30.480	597.444	63.98	31.037	--	--	1.165	--
Emergency Gen.	0.152	3.048	769.611	1.59	87.073	--	--	1.026E-02	--
Fire Pump Engine	0.127	12.192	838.556	0.57	44.856	--	--	4.302E-03	--

Table 8.1B-5 (cont'd)

	Stack Diam, m	Stack Height, m	Exh Temp, Deg K	Exhaust Flow, m3/s	Exhaust Velocity, m/s	Emission Rates, g/s			
						NOx	SO2	CO	PM10
24-Hour Averaging Period: SO2 (Case 5G)									
ICE 1	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 2	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 3	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 4	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 5	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 6	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 7	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 8	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 9	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
ICE 10	1.620	30.480	656.889	56.99	27.651	--	5.077E-02	--	--
Emergency Gen.	0.152	3.048	769.611	1.59	87.073	--	3.186E-05	--	--
Fire Pump Engine	0.127	12.192	838.556	0.57	44.856	--	1.346E-05	--	--
24-Hour Averaging Period: PM10, emergency Diesel backup operation (Case 4D)									
ICE 1	1.620	30.480	584.111	52.05	25.252	--	--	--	***0.4818***
ICE 2	1.620	30.480	584.111	52.05	25.252	--	--	--	***0.4818***
ICE 3	1.620	30.480	584.111	52.05	25.252	--	--	--	***0.4818***
ICE 4	1.620	30.480	584.111	52.05	25.252	--	--	--	***0.4818***
ICE 5	1.620	30.480	584.111	52.05	25.252	--	--	--	***0.4818***
ICE 6	1.620	30.480	584.111	52.05	25.252	--	--	--	***0.4818***
ICE 7	1.620	30.480	584.111	52.05	25.252	--	--	--	***0.4818***
ICE 8	1.620	30.480	584.111	52.05	25.252	--	--	--	***0.4818***
ICE 9	1.620	30.480	584.111	52.05	25.252	--	--	--	***0.4818***
ICE 10	1.620	30.480	584.111	52.05	25.252	--	--	--	***0.4818***
Emergency Gen.	0.152	3.048	769.611	1.59	87.073	--	--	--	--
Fire Pump Engine	0.127	12.192	838.556	0.57	44.856	--	--	--	--
24-Hour Averaging Period: PM10, normal operation (Case 4G)									
ICE 1	1.620	30.480	686.333	46.96	22.784	--	--	--	***4.536E-01***
ICE 2	1.620	30.480	686.333	46.96	22.784	--	--	--	***4.536E-01***
ICE 3	1.620	30.480	686.333	46.96	22.784	--	--	--	***4.536E-01***
ICE 4	1.620	30.480	686.333	46.96	22.784	--	--	--	***4.536E-01***
ICE 5	1.620	30.480	686.333	46.96	22.784	--	--	--	***4.536E-01***
ICE 6	1.620	30.480	686.333	46.96	22.784	--	--	--	***4.536E-01***
ICE 7	1.620	30.480	686.333	46.96	22.784	--	--	--	***4.536E-01***
ICE 8	1.620	30.480	686.333	46.96	22.784	--	--	--	***4.536E-01***
ICE 9	1.620	30.480	686.333	46.96	22.784	--	--	--	***4.536E-01***
ICE 10	1.620	30.480	686.333	46.96	22.784	--	--	--	***4.536E-01***
Emergency Gen.	0.152	3.048	769.611	1.59	87.073	--	--	--	2.769E-04
Fire Pump Engine	0.127	12.192	838.556	0.57	44.856	--	--	--	3.403E-04
Annual Averaging Period (Case 1G)									
ICE 1	1.620	30.480	663.556	55.97	27.152	5.010E-01	1.260E-02	--	***3.393E-01***
ICE 2	1.620	30.480	663.556	55.97	27.152	5.010E-01	1.260E-02	--	***3.393E-01***
ICE 3	1.620	30.480	663.556	55.97	27.152	5.010E-01	1.260E-02	--	***3.393E-01***
ICE 4	1.620	30.480	663.556	55.97	27.152	5.010E-01	1.260E-02	--	***3.393E-01***
ICE 5	1.620	30.480	663.556	55.97	27.152	5.010E-01	1.260E-02	--	***3.393E-01***
ICE 6	1.620	30.480	663.556	55.97	27.152	5.010E-01	1.260E-02	--	***3.393E-01***
ICE 7	1.620	30.480	663.556	55.97	27.152	5.010E-01	1.260E-02	--	***3.393E-01***
ICE 8	1.620	30.480	663.556	55.97	27.152	5.010E-01	1.260E-02	--	***3.393E-01***
ICE 9	1.620	30.480	663.556	55.97	27.152	5.010E-01	1.260E-02	--	***3.393E-01***
ICE 10	1.620	30.480	663.556	55.97	27.152	5.010E-01	1.260E-02	--	***3.393E-01***
Emergency Gen.	0.152	3.048	769.611	1.59	87.073	2.581E-03	4.365E-06	--	3.794E-05
Fire Pump Engine	0.127	12.192	838.556	0.57	44.856	1.631E-03	1.844E-06	--	4.661E-05

Table 8.1B-6
HBRP
Calculation of Inversion Fumigation Impacts from the ICEs
Rev 8/07
ICE Emission Rates, g/s per engine

Case	NOx	SO2	CO	PM10
1G	0.391	0.050	0.516	0.454
2G	0.222	0.029	0.293	0.454
3G	0.306	0.039	0.404	0.454
4G	0.308	0.040	0.407	0.454
5G	0.395	0.051	0.521	0.454
6G	0.224	0.029	0.296	0.454
1D	2.510	0.027	0.873	***0.810***
2D	1.332	0.016	0.463	***0.810***
3D	1.921	0.021	0.668	***0.810***
4D	1.917	0.022	0.667	***0.810***
5D	2.504	0.028	0.871	***0.810***
6D	1.330	0.016	0.463	***0.810***

Inversion Breakup Modeling Results from SCREEN3

Case	Unit Impacts, ug/m3 per g/s	Maximum One-Hour Avg Impacts, ug/m3, 10 engines				Distance to Maximum (m)
		NOx	SO2	CO	PM10	
1G	3.045	11.9093	1.5316	15.7104	13.8121	8,363
2G	4.134	9.1897	1.1812	12.1228	18.7518	6,674
3G	3.355	10.2661	1.3198	13.5428	15.2183	7,786
4G	3.36	10.3627	1.3323	13.6702	15.2410	7,777
5G	3.024	11.9378	1.5352	15.7480	13.7169	8,405
6G	4.065	9.1160	1.1717	12.0255	18.4388	6,758
1D	2.867	71.9485	0.7851	25.0319	23.2134	8,742
2D	3.97	52.8610	0.6176	18.3911	32.1441	6,878
3D	3.329	63.9599	0.7130	22.2526	26.9541	7,831
4D	3.442	65.9673	0.7431	22.9510	27.8690	7,640
5D	2.960	74.1179	0.8182	25.7867	23.9664	8,538
6D	4.201	55.8592	0.6593	19.4342	34.0145	6,596

Table B-6 (cont'd)

Flat Terrain Modeling Results from SCREEN3

Case	Unit Impacts, ug/m3 per g/s	Maximum One-Hour Avg Impacts, ug/m3, 10 engines NOx	SO2	CO	PM10	Distance to Maximum (m)
1G	2.211	8.6474	1.1121	11.4075	10.0291	1,100
2G	3.393	7.5425	0.9695	9.9498	15.3906	926
3G	2.547	7.7937	1.0020	10.2812	11.5532	1,012
4G	2.553	7.8738	1.0123	10.3869	11.5804	1,011
5G	2.192	8.6533	1.1128	11.4152	9.9429	1,100
6G	3.318	7.4408	0.9564	9.8157	15.0504	932
1D	2.147	53.8798	0.5880	18.7456	17.3837	946
2D	3.216	42.8214	0.5003	14.8982	26.0392	941
3D	2.519	48.3974	0.5395	16.8381	20.3957	1,016
4D	2.64	50.5967	0.5699	17.6033	21.3754	1,001
5D	2.163	54.1612	0.5979	18.8434	17.5133	944
6D	3.465	46.0728	0.5438	16.0294	28.0553	920

Adjust unit impacts for longer averaging periods to account for 90-minute duration of fumigation

Case	1-hr unit	3-hr unit	8-hr unit	24-hr unit
1G	3.045	2.6280	2.3674	2.2631
2G	4.134	3.7635	3.5319	3.4393
3G	3.355	2.9510	2.6985	2.5975
4G	3.360	2.9565	2.7043	2.6034
5G	3.024	2.6080	2.3480	2.2440
6G	4.065	3.6915	3.4581	3.3647
1D	2.867	2.5070	2.2820	2.1920
2D	3.970	3.5930	3.3574	3.2631
3D	3.329	2.9240	2.6709	2.5696
4D	3.442	3.0410	2.7904	2.6901
5D	2.960	2.5615	2.3124	2.2128
6D	4.201	3.8330	3.6030	3.5110

Table B-6 (cont'd)

Calculation of Fumigation Impacts from 10 Wartsila Reciprocating Engines

Case/Avg Period	NOx	SO2	CO	PM10
One-Hour				
1G	11.9093	1.5316	15.7104	-
2G	9.1897	1.1812	12.1228	-
3G	10.2661	1.3198	13.5428	-
4G	10.3627	1.3323	13.6702	-
5G	11.9378	**1.5352**	15.7480	-
6G	9.1160	1.1717	12.0255	-
1D	71.9485	0.7851	25.0319	-
2D	52.8610	0.6176	18.3911	-
3D	63.9599	0.7130	22.2526	-
4D	65.9673	0.7431	22.9510	-
5D	**74.1179**	0.8182	**25.7867**	-
6D	55.8592	0.6593	19.4342	-
3 Hours				
1G	-	1.1896	-	-
2G	-	0.9678	-	-
3G	-	1.0448	-	-
4G	-	1.0551	-	-
5G	-	**1.1916**	-	-
6G	-	0.9576	-	-
1D	-	0.6179	-	-
2D	-	0.5031	-	-
3D	-	0.5637	-	-
4D	-	0.5909	-	-
5D	-	0.6372	-	-
6D	-	0.5414	-	-
8 Hours				
1G	-	-	8.5500	-
2G	-	-	7.2501	-
3G	-	-	7.6249	-
4G	-	-	7.7018	-
5G	-	-	8.5593	-
6G	-	-	7.1610	-
1D	-	-	13.9470	-
2D	-	-	10.8872	-
3D	-	-	12.4973	-
4D	-	-	13.0242	-
5D	-	-	**14.1017**	-
6D	-	-	11.6675	-
24 Hours				
1G	-	**0.4553**	-	4.1062
2G	-	n/a	-	n/a
3G	-	0.4087	-	4.7129
4G	-	0.4129	-	4.7237
5G	-	0.4557	-	4.0715
6G	-	n/a	-	n/a
1D	-	0.2401	-	7.0992
2D	-	n/a	-	n/a
3D	-	0.2202	-	8.3223
4D	-	0.2323	-	**8.7125**
5D	-	0.2447	-	7.1666
6D	-	n/a	-	n/a

NOTES TO TABLE 8.1B-6

INVERSION BREAKUP FUMIGATION ANALYSIS

Inversion breakup fumigation is generally a short-term phenomenon and was evaluated here as persisting for up to 90 minutes. SCREEN3 was used to model 1-hour unit impacts from the engines under 2.5 m/s winds and F stability (for fumigation impacts) and under all meteorological conditions (shown in the table as "Inversion Breakup Modeling Results from SCREEN3"). Since SCREEN3 is a single-source model, each SCREEN3 run evaluated the impacts of 1 engine with an emission rate of 1.0 g/s per engine and SCREEN3 results are in units of µg/m^3 per 1.0 g/s.

For longer-term averaging periods, impacts were calculated using the highest modeled impact from SCREEN3 for the corresponding averaging period. A sample calculation for 24-hour average PM_{10} for Case 1G is as follows:

- For 1 engines, Case 1G, 1-hour average unit impact under inversion breakup conditions = 3.045 µg/m3 per 1.0 g/s
- For 1 engine, Case 1, max. 1-hour average unit impact from SCREEN3 = 2.211 µg/m3 per 1.0 g/s
- For a single engine, the appropriate unit impact for the 24-hour averaging period is calculated as 1.5 hours of inversion breakup fumigation plus 22.5 hours of operation under typical conditions (from SCREEN3): [(1.5 * 3.045 µg/m3 per g/s) + (22.5 * 2.211 µg/m3 per g/s)] ÷ 24 hrs = 2.263 µg/m^3 per g/s
- For 10 engines with an emission rate of 0.454 g/s each, the total 24-hour average PM_{10} impact under inversion breakup fumigation conditions is: 2.263 µg/m^3 per g/s * 0.454 g/s per engine* 0.4 [persistence factor for converting 1-hour average screening impact into 24-hour average concentration] * 10 engines = 4.106 µg/m^3

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Table 8.1B-7
HBRP
Calculation of Shoreline Fumigation Impacts from the Wärtsilä Reciprocating Engines
Rev 08/07
ICE Emission Rates, g/s per engine

Case	NOx	SO2	CO	PM10
1G	0.391	0.050	0.516	0.454
2G	0.222	0.029	0.293	0.454
3G	0.306	0.039	0.404	0.454
4G	0.308	0.040	0.407	0.454
5G	0.395	0.051	0.521	0.454
6G	0.224	0.029	0.296	0.454
1D	2.510	0.027	0.873	0.810
2D	1.332	0.016	0.463	0.810
3D	1.921	0.021	0.668	0.810
4D	1.917	0.022	0.667	0.810
5D	2.504	0.028	0.871	0.810
6D	1.330	0.016	0.463	0.810

Shoreline Fumigation Breakup Modeling Results from SCREEN3

	Impacts,	Maximum One-Hour Avg Impacts, ug/m3, 10 engines				Distance to
Case	ug/m3 per g/s	NO2 (1)	SO2	CO	PM10	Maximum (m)
1G	21.22	82.99	10.67	109.48	96.25	564
2G	29.07	64.62	8.31	85.25	131.86	391
3G	23.48	71.85	9.24	94.78	106.51	503
4G	23.52	72.54	9.33	95.69	106.69	502
5G	21.07	83.18	10.70	109.73	95.57	568
6G	28.59	64.11	8.24	84.58	129.68	399
1D	19.93	222.98	5.46	174.01	161.37	603
2D	27.93	210.15	4.35	129.39	226.14	410
3D	23.29	217.71	4.99	155.68	188.57	508
4D	24.12	219.19	5.21	160.83	195.29	488
5D	20.61	224.57	5.70	179.55	166.87	582
6D	29.53	212.22	4.63	136.61	239.10	383

Note 1: NO2 concentrations were ozone limited using highest ozone reading at Ukiah for the 5-year period.

Table 8.1B-7 (cont'd)

Flat Terrain Modeling Results from SCREEN3

Case	Impacts, ug/m3 per g/s	Maximum One-Hour Avg Impacts, ug/m3, 10 engines				Distance to Maximum (m)
		NOx	SO2	CO	PM10	
1G	2.211	8.6474	1.1121	11.4075	10.0291	1,100
2G	3.393	7.5425	0.9695	9.9498	15.3906	926
3G	2.547	7.7937	1.0020	10.2812	11.5532	1,012
4G	2.553	7.8738	1.0123	10.3869	11.5804	1,011
5G	2.192	8.6533	1.1128	11.4152	9.9429	1,100
6G	3.318	7.4408	0.9564	9.8157	15.0504	932
1D	2.147	53.8798	0.5880	18.7456	17.3837	946
2D	3.216	42.8214	0.5003	14.8982	26.0392	941
3D	2.519	48.3974	0.5395	16.8381	20.3957	1,016
4D	2.640	50.5967	0.5699	17.6033	21.3754	1,001
5D	2.163	54.1612	0.5979	18.8434	17.5133	944
6D	3.465	46.0728	0.5438	16.0294	28.0553	920

Adjust unit impacts for longer averaging periods to account for 90-minute duration of fumigation (ug/m3 per g/s)

Case	1-hr unit	3-hr unit	8-hr unit	24-hr unit
1G	21.2200	11.7155	5.7752	3.3991
2G	29.0700	16.2315	8.2074	4.9978
3G	23.4800	13.0135	6.4719	3.8553
4G	23.5200	13.0365	6.4843	3.8634
5G	21.0700	11.6310	5.7316	3.3719
6G	28.5900	15.9540	8.0565	4.8975
1D	19.9300	11.0385	5.4813	3.2584
2D	27.9300	15.5730	7.8499	4.7606
3D	23.2900	12.9045	6.4136	3.8172
4D	24.1200	13.3800	6.6675	3.9825
5D	20.6100	11.3865	5.6218	3.3159
6D	29.5300	16.4975	8.3522	5.0941

Table 8.1B-7 (cont'd)

Calculation of Shoreline Fumigation Impacts from 10 Engines

Case/Avg Period	NO2	SO2	CO	PM10
One-Hour				
1G	82.9933	10.6731	109.4827	-
2G	64.6212	8.3063	85.2467	-
3G	71.8476	9.2369	94.7795	-
4G	72.5390	9.3259	95.6916	-
5G	83.1775	**10.6967**	109.7257	-
6G	64.1144	8.2407	84.5782	-
1D	222.9751	5.4578	174.0098	-
2D	210.1491	4.3451	129.3863	-
3D	217.7069	4.9884	155.6810	-
4D	219.1870	5.2071	160.8302	-
5D	**224.5671**	5.6968	**179.5485**	-
6D	212.2250	4.6343	136.6084	-
3 Hours				
1G	-	5.3033	-	-
2G	-	4.1741	-	-
3G	-	4.6075	-	-
4G	-	4.6522	-	-
5G	-	**5.3143**	-	-
6G	-	4.1387	-	-
1D	-	2.7206	-	-
2D	-	2.1804	-	-
3D	-	2.4876	-	-
4D	-	2.5997	-	-
5D	-	2.8326	-	-
6D	-	2.3301	-	-
8 Hours				
1G	-	-	20.8576	-
2G	-	-	16.8476	-
3G	-	-	18.2873	-
4G	-	-	18.4671	-
5G	-	-	20.8939	-
6G	-	-	16.6836	-
1D	-	-	33.5003	-
2D	-	-	25.4553	-
3D	-	-	30.0098	-
4D	-	-	31.1208	-
5D	-	-	**34.2830**	-
6D	-	-	27.0466	-
24 Hours				
1G	-	**0.6839**	-	6.1673
2G	-	n/a	-	n/a
3G	-	0.6067	-	6.9951
4G	-	0.6128	-	7.0098
5G	-	0.6847	-	6.1179
6G	-	n/a	-	n/a
1D	-	0.3569	-	10.5531
2D	-	n/a	-	n/a
3D	-	0.3270	-	12.3627
4D	-	0.3439	-	**12.8981**
5D	-	0.3666	-	10.7393
6D	-	n/a	-	n/a

NOTES TO TABLE 8.1B-7

SHORELINE FUMIGATION ANALYSIS

Shoreline fumigation was modeled for the engines using the default SCREEN3 TIBL factor of 6 at a distance to shoreline of 196 meters. As for inversion breakup fumigation, shoreline fumigation conditions were assumed to persist for up to 90 minutes. For longer-term averaging periods, impacts were calculated using the highest modeled impact from SCREEN3 for the corresponding averaging period. Since SCREEN3 is a single-source model, each SCREEN3 run evaluated the impacts of 1 engine with an emission rate of 1.0 g/s per engine and SCREEN3 results are in units of µg/m^3 per 1.0 g/s.

A sample calculation for 8-hour average CO for Case 3G follows.

- For 1 engine, Case 3G, 1-hour average unit impact under shoreline fumigation conditions = 23.48 µg/m3 per g/s
- For 1 engine, Case 3G, max. 1-hour average unit impact from SCREEN3 = 2.547 µg/m3 per g/s
- For a single engine, 8-hour unit impact is calculated as 90 minutes of shoreline fumigation plus 22.5 hours of operation under typical conditions (from SCREEN3): [(1.5 * 23.48 µg/m3 per g/s) + (6.5 * 2.547 µg/m3 per g/s)] ÷ 8 hrs = 6.472 µg/m^3 per g/s
- For 10 engines with an emission rate of 0.404 g/s, the total 8-hour average CO impact under shoreline fumigation conditions is: 6.472 µg/m^3 per g/s * 0.404 g/s per engine* 0.7 [persistence factor for converting 1-hour average screening impact into 8-hour average concentration] * 10 engines = 18.29 µg/m^3

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Table 8.1B-8
HBRP
Emission Rates and Stack Parameters for Modeling Startup Impacts
Assume all reciprocating engines in startup
Rev 8/07

	Stack Diam, m	Stack Height, m	Exh Temp, Deg K	Exhaust Flow, m3/s	Exhaust Velocity, m/s	Em Rates, g/s	
						NOx	CO
Natural Gas Startup (Case 2D)							
Each Reciprocating Engine	1.62	30.48	697.4	33.9	16.441	2.97	3.03
Diesel Startup (Case 6D) (50% load, 30 minutes)							
Each Reciprocating Engine	1.62	30.48	599.1	37.6	18.223	7.34	3.21
Diesel Startup (Case 5D) (full load, 30 minutes)							
Each Reciprocating Engine	1.62	30.48	597.4	64.0	31.037	2.50	n/a

Table 8.1B-9
HBRP
Commissioning Emissions for the Wärtsilä Reciprocating Engines

Operating Mode	Hours of Operation per Engine During Activity Prd	Activity Duration, days	Average Engine Load, %	Consumed Natural Gas, scft	Consumed Diesel, gal	Total Hourly Emissions (lbs/hr) NOx	CO	ROC	PM10
Protection relay tests	3	1	100	39,948	0	323.3	197.1	86.6	24.5
Test run and tuning	50	3	75	436,847	0	242.5	147.9	65.0	18.4
Crankshaft and generator coupling adjustments	4	1	100	46,597	0	323.3	197.2	86.6	24.5
SCR tuning, Natural Gas	8	1	75	69,895	0	11.2	14.8	18.2	18.4
SCR tuning, Diesel Fuel	8	1	75	0	31,443	71.7	25.0	28.5	40.5

Notes:
1. Commissioning schedule, engine load and emissions estimate provided by Wärtsilä. Schedule calls for natural gas operation during commissioning activities except for SCR tuning on Diesel fuel.
2. Each group of 5 engines will be commissioned simultaneously. Emissions shown reflect 5 engines in operation.
3. Activities shown do not include zero-emission (no fuel consumption) or fully controlled (reliability and emissions testing) commissioning activities. Cumulative time for initial commissioning is expected to be 15 to 30 days for each group of 5 engines, or up to 60 days total. Performance and emissions testing will occur for a period of 45 to 90 days following completion of initial conditioning.

Table 8.1B-10
HBRP
Emission Rates and Stack Parameters for Modeling Commissioning Impacts
Rev 08/07

Operating Mode	Hours of Operation per Engine During Activity Prd	Activity Duration, days	Hours of Operation per Day in Mode	Average Engine Load, %	Total Hourly Emissions (lbs/hr) (5 engines in operation) NOx	CO	PM10
Test run and tuning	50	3	18	75	242.5	147.9	18.4
Alignment	4	1	4	100	323.3	197.2	24.5
SCR tuning on Diesel	8	1	8	75	71.7	25.0	40.5

Operating Mode	Emission Rate for Avg Prd, g/s, EACH, 5 engines				Unit Impact Modeling Result, ug/m3 per g/s, 10 engines			Operating Case (from Table 8.1B-4)
	NOx 1 hr	CO 1 hr	CO 8 hr	PM10 24 hr	1 hr avg	8 hr avg	24 hr avg	
Test run and tuning	6.11	3.73	3.73	0.35	549.98	233.97	79.33	Case 4G
Alignment	8.15	4.97	2.48	0.103	501.91	214.35	72.59	Case 1G
SCR tuning on Diesel	1.81	0.63	0.63	0.34	559.54	237.56	80.56	Case 4D

Modeling Parameters for 1-hour Average NO2 Impacts: 5 engines, EACH

	Stack Diam (m)	Stack Ht (m)	Exhaust Temp (deg K)	Exh Velocity (m/s)	NOx Em, g/s per engine	Stack Diam (ft)	Stack Ht (ft)	Exhaust Temp (deg F)	Flow Rate (acfm)
Test run and tuning	1.620	30.480	686.333	22.784	6.111	5.32	100.0	776.0	99,509
Alignment	1.620	30.480	663.556	27.152	8.148	5.32	100.0	735.0	118,586
SCR tuning on Diesel	1.620	30.480	584.111	25.252	1.807	5.32	100.0	592.0	110,290

Operating Mode	Max. Modeled Impact During Commissioning, ug/m3			
	NO2 1 hr ozone lmtd	CO 1 hr	CO 8 hr	PM10 24 hr
Test run and tuning	222.3	1024.6	435.9	13.8
Alignment	233.3	1246.8	266.2	3.7
SCR tuning on Diesel	177.1	176.1	74.8	13.7

Table 8.1B-11A
Ozone Limiting Calculation for CTSCREEN Results
HBRP Normal Operations

1-hour average NO2, Diesel mode										
	conc, ppm					conc, ug/m3				
Pollutant	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
Max 1-hr NOx	0.192	0.192	0.192	0.192	0.192	361.0	361.0	361.0	361.0	361.0
Max 1-hr ozone	0.07	0.092	0.078	0.07	0.088					
Max 1-hr NO2	0.089	0.111	0.097	0.089	0.107	167.7	209.1	182.7	167.7	201.5

Table 8.1B-11B
Ozone Limiting Calculation for CTSCREEN Results
HBRP Commissioning Activities

Test Run										
	conc, ppm					conc, ug/m3				
Pollutant	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
Max 1-hr NOx	0.262	0.262	0.262	0.262	0.262	493.0	493.0	493.0	493.0	493.0
Max 1-hr ozone	0.07	0.092	0.078	0.07	0.088					
Max 1-hr NO2	0.096	0.118	0.104	0.096	0.114	180.9	222.3	195.9	180.9	214.7

Alignment										
	conc, ppm					conc, ug/m3				
Pollutant	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
Max 1-hr NOx	0.321	0.321	0.321	0.321	0.321	603.4	603.4	603.4	603.4	603.4
Max 1-hr ozone	0.07	0.092	0.078	0.07	0.088					
Max 1-hr NO2	0.102	0.124	0.110	0.102	0.120	191.9	233.3	207.0	191.9	225.8

Table 8.1B-11C
Ozone Limiting Calculation for CTSCREEN Results
HBRP Startup

Natural Gas only

Pollutant	conc, ppm 2001	2002	2003	2004	2005	conc, ug/m3 2001	2002	2003	2004	2005
Max 1-hr NOx	0.302	0.302	0.302	0.302	0.302	567.4	567.4	567.4	567.4	567.4
Max 1-hr ozone	0.07	0.092	0.078	0.07	0.088					
Max 1-hr NO2	0.100	0.122	0.108	0.100	0.118	188.3	229.7	203.4	188.3	222.2

Diesel-- normal conditions

Pollutant	conc, ppm 2001	2002	2003	2004	2005	conc, ug/m3 2001	2002	2003	2004	2005
Max 1-hr NOx	0.755	0.755	0.755	0.755	0.755	1420.0	1420.0	1420.0	1420.0	1420.0
Max 1-hr ozone	0.07	0.092	0.078	0.07	0.088					
Max 1-hr NO2	0.146	0.168	0.154	0.146	0.164	273.6	315.0	288.6	273.6	307.4

Diesel-- full load

Pollutant	conc, ppm 2001	2002	2003	2004	2005	conc, ug/m3 2001	2002	2003	2004	2005
Max 1-hr NOx	0.189	0.189	0.189	0.189	0.189	356.1	356.1	356.1	356.1	356.1
Max 1-hr ozone	0.07	0.092	0.078	0.07	0.088					
Max 1-hr NO2	0.089	0.111	0.097	0.089	0.107	167.2	208.6	182.3	167.2	201.1
Average						220.4	261.8	235.4	220.4	254.2

Diesel-- Emergency only

Pollutant	conc, ppm 2001	2002	2003	2004	2005	conc, ug/m3 2001	2002	2003	2004	2005
Max 1-hr NOx	0.878	0.878	0.878	0.878	0.878	1650.2	1650.2	1650.2	1650.2	1650.2
Max 1-hr ozone	0.07	0.092	0.078	0.07	0.088					
Max 1-hr NO2	0.158	0.180	0.166	0.158	0.176	296.6	338.0	311.7	296.6	330.5

Table 8.1B-11D
Ozone Limiting Calculation for CTSCREEN Results
HBRP Shoreline Fumigation

	conc, ppm					conc, ug/m3				
Pollutant	2001	2002	2003	2004	2005	2001	2002	2003	2004	2005
Max 1-hr NOx	0.209	0.209	0.209	0.209	0.209	392.6	392.6	392.6	392.6	392.6
Max 1-hr ozone	0.07	0.092	0.078	0.07	0.088					
Max 1-hr NO2	0.091	0.113	0.099	0.091	0.109	170.9	212.2	185.9	170.9	204.7

Table 8.1B-12
HBRP
PM2.5 24-Hour Average Modeling Results

	HBRP, AERMOD Flat Terrain		HBRP, CTDMPLUS		MAX (AERMOD/CTDMPLUS)		Measured	Total Impact	
Date	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Background	Diesel Mode	Nat. Gas Mode
1/1/2001	1.31E-01	7.12E-02	7.87778	4.36556	7.88	4.37	21.9	29.78	26.27
1/2/2001	1.78E-01	9.76E-02	0.05086	0.00489	0.18	0.10	21.9	22.08	22.00
1/3/2001	1.89E+00	1.03E+00	2.56561	0.75454	2.57	1.03	21.9	24.47	22.93
1/4/2001	1.77E+00	9.65E-01	2.46722	0.29956	2.47	0.96	21.9	24.37	22.86
1/5/2001	7.56E-01	4.19E-01	1.95153	1.02411	1.95	1.02	21.9	23.85	22.92
1/6/2001	2.46E+00	1.35E+00	2.44222	0.96111	2.46	1.35	21.9	24.36	23.25
1/7/2001	8.99E+00	4.99E+00	0.55455	0.12941	8.99	4.99	9.9	18.89	14.89
1/8/2001	8.38E-01	4.60E-01	1.72486	0.84887	1.72	0.85	9.9	11.62	10.75
1/9/2001	5.03E+00	2.80E+00	0.47833	0.23908	5.03	2.80	9.9	14.93	12.70
1/10/2001	3.83E+00	2.11E+00	0.08554	0.0464	3.83	2.11	9.9	13.73	12.01
1/11/2001	6.51E-01	3.56E-01	4.44928	2.43424	4.45	2.43	9.9	14.35	12.33
1/12/2001	1.07E+00	5.88E-01	10.27159	5.49788	10.27	5.50	9.9	20.17	15.40
1/13/2001	5.34E-01	2.97E-01	0.69528	0.17495	0.70	0.30	18.7	19.35	18.95
1/14/2001	1.46E+00	8.02E-01	1.53194	0.84183	1.53	0.84	18.7	20.18	19.49
1/15/2001	1.11E+00	6.05E-01	0.00000	0.00000	1.11	0.61	18.7	19.76	19.26
1/16/2001	6.79E-01	3.77E-01	2.39778	0.00381	2.40	0.38	18.7	21.05	19.03
1/17/2001	4.63E-01	2.56E-01	2.27389	0.74056	2.27	0.74	27.4	29.67	28.14
1/18/2001	5.93E-01	3.27E-01	1.46722	0.17523	1.47	0.33	27.4	28.87	27.73
1/19/2001	7.73E-01	4.30E-01	2.65567	1.45556	2.66	1.46	27.4	30.06	28.86
1/20/2001	4.54E+00	2.52E+00	0.03792	0.02138	4.54	2.52	27.4	31.94	29.92
1/21/2001	9.98E-01	5.55E-01	6.26022	3.33278	6.26	3.33	27.4	33.66	30.73
1/22/2001	1.91E+00	1.06E+00	1.4275	0.46589	1.91	1.06	27.4	29.31	28.46
1/23/2001	5.96E+00	3.29E+00	0.566	0.31028	5.96	3.29	27.4	33.36	30.69
1/24/2001	1.39E+00	7.65E-01	4.38667	2.41778	4.39	2.42	27.4	31.79	29.82
1/25/2001	9.98E+00	5.50E+00	0.00007	0	9.98	5.50	25.0	34.98	30.50
1/26/2001	3.82E+00	2.10E+00	0.03191	0	3.82	2.10	25.0	28.82	27.10
1/27/2001	2.64E+00	1.46E+00	0.66455	0.37618	2.64	1.46	25.0	27.64	26.46
1/28/2001	8.26E-01	4.57E-01	1.70489	0.40894	1.70	0.46	25.0	26.70	25.46
1/29/2001	9.78E-01	5.40E-01	4.93195	2.71974	4.93	2.72	25.0	29.93	27.72
1/30/2001	2.64E-02	2.40E-02	2.67111	1.44302	2.67	1.44	25.0	27.67	26.44
1/31/2001	1.38E-01	7.59E-02	1.50678	0.83118	1.51	0.83	29.0	30.51	29.83
2/1/2001	2.71E-01	1.48E-01	1.41167	0.29312	1.41	0.29	29.0	30.41	29.29
2/2/2001	1.06E+00	5.74E-01	4.76598	2.33189	4.77	2.33	29.0	33.77	31.33
2/3/2001	9.76E-01	5.37E-01	0	0	0.98	0.54	29.0	29.98	29.54
2/4/2001	2.46E+00	1.34E+00	5.93324	3.23275	5.93	3.23	29.0	34.93	32.23
2/5/2001	7.05E-01	3.90E-01	12.09638	7.01696	12.10	7.02	29.0	41.10	36.02
2/6/2001	2.16E+00	1.19E+00	15.69632	8.17595	15.70	8.18	4.3	20.00	12.48
2/7/2001	1.84E+00	1.01E+00	3.89385	2.11174	3.89	2.11	4.3	8.19	6.41
2/8/2001	1.16E+00	6.40E-01	0.55778	0	1.16	0.64	4.3	5.46	4.94
2/9/2001	1.82E+00	9.90E-01	0.00305	0.00179	1.82	0.99	4.3	6.12	5.29
2/10/2001	1.63E+00	9.11E-01	0.65763	0.1773	1.63	0.91	4.3	5.93	5.21
2/11/2001	3.52E+00	1.97E+00	0.0117	0.00672	3.52	1.97	4.3	7.82	6.27
2/12/2001	1.31E+00	7.19E-01	0.99278	0.53717	1.31	0.72	23.5	24.81	24.22
2/13/2001	1.46E+00	8.01E-01	3.42924	1.87139	3.43	1.87	23.5	26.93	25.37
2/14/2001	1.12E+00	6.11E-01	0.17856	0.00417	1.12	0.61	23.5	24.62	24.11
2/15/2001	5.10E+00	2.84E+00	0.75182	0.41286	5.10	2.84	23.5	28.60	26.34
2/16/2001	4.54E+00	2.47E+00	0.00001	0.00001	4.54	2.47	23.5	28.04	25.97
2/17/2001	3.43E+00	1.88E+00	0.35787	0.09339	3.43	1.88	23.5	26.93	25.38
2/18/2001	1.78E+00	9.98E-01	0.17467	0.07933	1.78	1.00	8.3	10.08	9.30
2/19/2001	7.47E+00	4.13E+00	0.00019	0.00011	7.47	4.13	8.3	15.77	12.43
2/20/2001	8.41E+00	4.62E+00	0.00039	0.00007	8.41	4.62	8.3	16.71	12.92
2/21/2001	4.69E+00	2.58E+00	0.21089	0.00032	4.69	2.58	8.3	12.99	10.88
2/22/2001	2.84E+00	1.56E+00	0.39711	0.09661	2.84	1.56	8.3	11.14	9.86
2/23/2001	1.72E+00	9.50E-01	2.89111	1.63278	2.89	1.63	8.3	11.19	9.93
2/24/2001	3.86E+00	2.16E+00	8.00948	4.38143	8.01	4.38	3.8	11.81	8.18
2/25/2001	1.10E+00	6.07E-01	4.58167	2.57589	4.58	2.58	3.8	8.38	6.38
2/26/2001	1.71E+00	9.39E-01	1.42	0.77167	1.71	0.94	3.8	5.51	4.74
2/27/2001	6.42E-01	3.52E-01	4.2286	1.30261	4.23	1.30	3.8	8.03	5.10
2/28/2001	6.86E-01	3.78E-01	1.99498	1.02724	1.99	1.03	3.8	5.79	4.83
3/1/2001	5.67E+00	3.15E+00	3.14182	1.73182	5.67	3.15	3.8	9.47	6.95
3/2/2001	1.99E+00	1.10E+00	10.40449	5.68808	10.40	5.69	4.7	15.05	10.34
3/3/2001	8.67E-01	4.83E-01	2.48889	0.80722	2.49	0.81	4.7	7.14	5.46
3/4/2001	4.11E+00	2.28E+00	3.42087	1.85304	4.11	2.28	4.7	8.76	6.93
3/5/2001	1.26E+00	6.84E-01	7.86667	4.34725	7.87	4.35	4.7	12.52	9.00
3/6/2001	1.23E+00	6.72E-01	2.57889	1.44889	2.58	1.45	4.7	7.23	6.10
3/7/2001	9.17E-01	5.04E-01	7.20234	3.85545	7.20	3.86	4.7	11.85	8.51
3/8/2001	3.04E+00	1.67E+00	19.19967	9.4368	19.20	9.44	5.5	24.70	14.94
3/9/2001	2.14E+00	1.19E+00	9.53062	5.35283	9.53	5.35	5.5	15.03	10.85
3/10/2001	3.57E+00	1.97E+00	10.15734	4.35549	10.16	4.36	5.5	15.66	9.86
3/11/2001	3.27E+00	1.82E+00	12.15563	5.73408	12.16	5.73	5.5	17.66	11.23
3/12/2001	1.11E+00	6.17E-01	0.44772	0.11588	1.11	0.62	5.5	6.61	6.12
3/13/2001	1.31E+00	7.20E-01	5.63618	3.15635	5.64	3.16	5.5	11.14	8.66
3/14/2001	1.37E+00	7.56E-01	1.10556	0.59223	1.37	0.76	8.9	10.27	9.66
3/15/2001	7.21E-01	3.94E-01	7.10817	3.78526	7.11	3.79	8.9	16.01	12.69
3/16/2001	9.38E-01	5.14E-01	3.25075	1.63029	3.25	1.63	8.9	12.15	10.53
3/17/2001	1.23E+00	6.75E-01	1.80033	0.15578	1.80	0.67	8.9	10.70	9.57
3/18/2001	2.01E+00	1.11E+00	1.80723	0.99446	2.01	1.11	8.9	10.91	10.01
3/19/2001	7.56E-01	4.17E-01	4.77092	2.23083	4.77	2.23	8.9	13.67	11.13
3/20/2001	1.21E+00	6.69E-01	6.62222	3.66389	6.62	3.66	11.6	18.22	15.26
3/21/2001	1.61E+00	8.94E-01	2.46508	0.76538	2.47	0.89	11.6	14.07	12.49
3/22/2001	7.20E-01	3.95E-01	8.66575	4.82513	8.67	4.83	11.6	20.27	16.43
3/23/2001	5.47E-01	3.01E-01	7.35017	3.49	7.35	3.49	11.6	18.95	15.09
3/24/2001	6.91E+00	3.80E+00	0.28709	0.13275	6.91	3.80	11.6	18.51	15.40
3/25/2001	9.45E-01	5.22E-01	8.26955	4.83189	8.27	4.83	11.6	19.87	16.43
3/26/2001	1.74E+00	9.58E-01	10.3653	5.68529	10.37	5.69	12.9	23.27	18.59
3/27/2001	5.56E-01	3.09E-01	3.02444	1.66444	3.02	1.66	12.9	15.92	14.56
3/28/2001	6.10E-01	3.39E-01	5.40755	3.03895	5.41	3.04	12.9	18.31	15.94
3/29/2001	1.90E+00	1.05E+00	16.99978	9.29317	17.00	9.29	12.9	29.90	22.19
3/30/2001	1.12E+00	6.21E-01	7.91861	4.36116	7.92	4.36	12.9	20.82	17.26
3/31/2001	1.09E+00	6.04E-01	29.76078	16.35254	29.76	16.35	12.9	42.66	29.25
4/1/2001	1.54E+00	8.47E-01	15.00822	8.38306	15.01	8.38	3.5	18.51	11.88
4/2/2001	1.82E+00	1.00E+00	0.94406	0.51572	1.82	1.00	3.5	5.32	4.50

Date	HBRP, AERMOD Flat Terrain		HBRP, CTDMPLUS		MAX (AERMOD/CTDMPLUS)		Measured	Total Impact	
	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Background	Diesel Mode	Nat. Gas Mode
4/3/2001	1.97E+00	1.09E+00	0	0.00005	1.97	1.09	3.5	5.47	4.59
4/4/2001	2.94E+00	1.62E+00	2.63445	1.44773	2.94	1.62	3.5	6.44	5.12
4/5/2001	2.06E+00	1.13E+00	0.27833	0.15544	2.06	1.13	3.5	5.56	4.63
4/6/2001	1.06E+00	5.88E-01	7.23889	4.00056	7.24	4.00	3.5	10.74	7.50
4/7/2001	2.06E+00	1.14E+00	2.28789	1.26722	2.29	1.27	5.6	7.89	6.87
4/8/2001	3.05E+00	1.76E+00	2.60295	0.18382	3.05	1.76	5.6	8.65	7.36
4/9/2001	3.95E+00	2.19E+00	6.34659	3.49639	6.35	3.50	5.6	11.95	9.10
4/10/2001	5.41E-01	3.00E-01	0.60667	0.33211	0.61	0.33	5.6	6.21	5.93
4/11/2001	3.58E+00	1.98E+00	2.25933	0.93843	3.58	1.98	5.6	9.18	7.58
4/12/2001	7.22E-01	4.56E-01	1.93401	1.06065	1.93	1.06	5.6	7.53	6.66
4/13/2001	2.69E+00	1.49E+00	1.82111	0.98606	2.69	1.49	6.8	9.49	8.29
4/14/2001	2.50E+00	1.47E+00	2.74167	1.11776	2.74	1.47	6.8	9.54	8.27
4/15/2001	3.22E+00	1.79E+00	0.46554	0.15576	3.22	1.79	6.8	10.02	8.59
4/16/2001	6.22E+00	3.47E+00	0.23845	0.01998	6.22	3.47	6.8	13.02	10.27
4/17/2001	3.93E+00	2.19E+00	0.54739	0.07218	3.93	2.19	6.8	10.73	8.99
4/18/2001	9.26E-01	5.10E-01	6.0739	3.35172	6.07	3.35	6.8	12.87	10.15
4/19/2001	1.99E+00	1.10E+00	0.58013	0.17403	1.99	1.10	6.5	8.49	7.60
4/20/2001	1.47E+00	8.19E-01	0.8515	0.48956	1.47	0.82	6.5	7.97	7.32
4/21/2001	1.96E+00	1.09E+00	4.85709	2.66114	4.86	2.66	6.5	11.36	9.16
4/22/2001	1.19E+00	6.56E-01	7.84744	4.05605	7.85	4.06	6.5	14.35	10.56
4/23/2001	3.44E+00	1.91E+00	13.15944	7.30919	13.16	7.31	6.5	19.66	13.81
4/24/2001	2.18E+00	1.21E+00	22.53251	12.47625	22.53	12.48	6.5	29.03	18.98
4/25/2001	9.96E-01	5.47E-01	7.34129	4.11066	7.34	4.11	3.4	10.74	7.51
4/26/2001	1.06E+00	5.77E-01	7.98467	4.05598	7.98	4.06	3.4	11.38	7.46
4/27/2001	1.84E+00	1.03E+00	2.00237	0.49489	2.00	1.03	3.4	5.40	4.43
4/28/2001	2.86E+00	1.58E+00	4.00389	2.23056	4.00	2.23	3.4	7.40	5.63
4/29/2001	1.29E+00	7.08E-01	0.75495	0.22994	1.29	0.71	3.4	4.69	4.11
4/30/2001	9.13E-01	5.41E-01	3.38289	1.8769	3.38	1.88	3.4	6.78	5.28
5/1/2001	5.44E+00	3.02E+00	9.15108	4.8411	9.15	4.84	8.9	18.05	13.74
5/2/2001	4.68E+00	2.59E+00	5.67803	2.91437	5.68	2.91	8.9	14.58	11.81
5/3/2001	2.47E+00	1.36E+00	2.42444	1.32222	2.47	1.36	8.9	11.37	10.26
5/4/2001	2.50E+00	1.39E+00	5.37306	2.9675	5.37	2.97	8.9	14.27	11.87
5/5/2001	2.24E+00	1.24E+00	3.7643	1.8703	3.76	1.87	8.9	12.66	10.77
5/6/2001	2.12E+00	1.17E+00	0.00572	0.00329	2.12	1.17	8.9	11.02	10.07
5/7/2001	2.78E+00	1.54E+00	9.78	5.33222	9.78	5.33	8.5	18.28	13.83
5/8/2001	2.01E+00	1.09E+00	8.69643	4.76619	8.70	4.77	8.5	17.20	13.27
5/9/2001	8.29E-01	4.58E-01	19.35112	10.92896	19.35	10.93	8.5	27.85	19.43
5/10/2001	1.93E+00	1.06E+00	1.46706	0.83033	1.93	1.06	8.5	10.43	9.56
5/11/2001	2.73E+00	1.51E+00	5.71173	0.86436	5.71	1.51	8.5	14.21	10.01
5/12/2001	1.03E+00	5.58E-01	9.15268	5.03876	9.15	5.04	8.5	17.65	13.54
5/13/2001	4.07E+00	2.25E+00	3.4451	1.87326	4.07	2.25	6.4	10.47	8.65
5/14/2001	2.86E+00	1.58E+00	0.0004	0.00023	2.86	1.58	6.4	9.26	7.98
5/15/2001	2.91E+00	1.60E+00	3.10571	1.71579	3.11	1.72	6.4	9.51	8.12
5/16/2001	3.85E+00	2.12E+00	18.67054	10.33815	18.67	10.34	6.4	25.07	16.74
5/17/2001	2.57E+00	1.42E+00	3.59016	1.52067	3.59	1.52	6.4	9.99	7.92
5/18/2001	1.52E+00	8.38E-01	3.14328	0.40648	3.14	0.84	6.4	9.54	7.24
5/19/2001	2.12E+00	1.17E+00	2.33527	0.64981	2.34	1.17	11.6	13.94	12.77
5/20/2001	3.38E+00	1.86E+00	3.29167	1.41389	3.38	1.86	11.6	14.98	13.46
5/21/2001	2.09E+00	1.15E+00	2.67204	0.80099	2.67	1.15	11.6	14.27	12.75
5/22/2001	1.71E+00	9.35E-01	3.42737	0.88504	3.43	0.94	11.6	15.03	12.54
5/23/2001	1.41E+00	7.64E-01	11.1118	6.17383	11.11	6.17	11.6	22.71	17.77
5/24/2001	7.35E-01	4.02E-01	10.75667	6.04556	10.76	6.05	11.6	22.36	17.65
5/25/2001	1.30E+00	7.21E-01	1.83053	1.00071	1.83	1.00	9.8	11.63	10.80
5/26/2001	1.53E+00	8.40E-01	1.70187	0.94209	1.70	0.94	9.8	11.50	10.74
5/27/2001	2.36E+00	1.30E+00	1.71	0.97044	2.36	1.30	9.8	12.16	11.10
5/28/2001	1.20E+00	6.59E-01	7.24796	3.7846	7.25	3.78	9.8	17.05	13.58
5/29/2001	2.09E+00	1.15E+00	9.92521	5.39858	9.93	5.40	9.8	19.73	15.20
5/30/2001	1.25E+00	6.91E-01	6.34778	2.69833	6.35	2.70	9.8	16.15	12.50
5/31/2001	8.87E-01	4.82E-01	4.78393	2.32778	4.78	2.33	14.3	19.08	16.63
6/1/2001	1.46E+00	8.01E-01	17.70878	9.77069	17.71	9.77	14.3	32.01	24.07
6/2/2001	3.57E+00	1.97E+00	9.44762	5.19119	9.45	5.19	14.3	23.75	19.49
6/3/2001	3.21E+00	1.78E+00	6.28905	3.46589	6.29	3.47	14.3	20.59	17.77
6/4/2001	2.10E+00	1.15E+00	9.21852	4.90001	9.22	4.90	14.3	23.52	19.20
6/5/2001	2.05E+00	1.22E+00	1.73284	0.28313	2.05	1.22	14.3	16.35	15.52
6/6/2001	1.99E+00	1.09E+00	7.37583	4.06819	7.38	4.07	3.7	11.08	7.77
6/7/2001	1.62E+00	8.89E-01	2.12111	1.16256	2.12	1.16	3.7	5.82	4.86
6/8/2001	2.74E+00	1.51E+00	7.34721	4.12056	7.35	4.12	3.7	11.05	7.82
6/9/2001	2.02E+00	1.11E+00	5.69253	3.17062	5.69	3.17	3.7	9.39	6.87
6/10/2001	2.79E+00	1.54E+00	2.75683	0.86222	2.79	1.54	3.7	6.49	5.24
6/11/2001	1.48E+00	8.03E-01	13.19773	7.27142	13.20	7.27	3.7	16.90	10.97
6/12/2001	2.77E+00	1.53E+00	23.25981	12.85234	23.26	12.85	4.8	28.01	17.60
6/13/2001	2.26E+00	1.25E+00	5.18394	2.86778	5.18	2.87	4.8	9.93	7.62
6/14/2001	2.26E+00	1.24E+00	11.24983	5.91989	11.25	5.92	4.8	16.00	10.67
6/15/2001	2.00E+00	1.10E+00	7.34638	4.05954	7.35	4.06	4.8	12.10	8.81
6/16/2001	2.78E+00	1.53E+00	8.46667	4.72	8.47	4.72	4.8	13.22	9.47
6/17/2001	2.60E+00	1.42E+00	2.73556	1.19	2.74	1.42	4.8	7.49	6.17
6/18/2001	2.22E+00	1.21E+00	4.95167	2.79	4.95	2.79	5.8	10.75	8.59
6/19/2001	2.29E+00	1.25E+00	0.71778	0.26189	2.29	1.25	5.8	8.09	7.05
6/20/2001	2.19E+00	1.20E+00	0.80356	0.44556	2.19	1.20	5.8	7.99	7.00
6/21/2001	1.71E+00	9.48E-01	15.93889	8.84787	15.94	8.85	5.8	21.74	14.65
6/22/2001	2.20E+00	1.24E+00	7.87526	3.85002	7.88	3.85	5.8	13.68	9.65
6/23/2001	1.55E+00	8.52E-01	9.4332	5.14461	9.43	5.14	5.8	15.23	10.94
6/24/2001	2.58E+00	1.42E+00	5.52173	3.04671	5.52	3.05	4.3	9.82	7.35
6/25/2001	1.23E+00	6.78E-01	7.7693	4.28025	7.77	4.28	4.3	12.07	8.58
6/26/2001	1.21E+01	6.66E+00	0.00032	0.00018	12.07	6.66	4.3	16.37	10.96
6/27/2001	4.49E+00	2.51E+00	6.61379	2.19855	6.61	2.51	4.3	10.91	6.81
6/28/2001	1.10E+00	5.98E-01	14.29401	7.923	14.29	7.92	4.3	18.59	12.22
6/29/2001	1.97E+00	1.09E+00	10.13796	5.55177	10.14	5.55	4.3	14.44	9.85
6/30/2001	2.01E+00	1.12E+00	15.95239	8.81135	15.95	8.81	3.5	19.45	12.31
7/1/2001	2.43E+00	1.34E+00	7.22223	4.05794	7.22	4.06	3.5	10.72	7.56
7/2/2001	1.67E+00	9.24E-01	0.53161	0.29258	1.67	0.92	3.5	5.17	4.42
7/3/2001	1.72E+00	9.46E-01	6.38866	3.53818	6.39	3.54	3.5	9.89	7.04
7/4/2001	1.17E+00	6.46E-01	7.81706	4.31678	7.82	4.32	3.5	11.32	7.82
7/5/2001	1.17E+00	6.39E-01	0.43183	0.17789	1.17	0.64	3.5	4.67	4.14
7/6/2001	1.45E+00	7.98E-01	2.5848	0.6814	2.58	0.80	9.9	12.48	10.70
7/7/2001	1.34E+00	7.37E-01	4.87952	2.65755	4.88	2.66	9.9	14.78	12.56
7/8/2001	1.28E+00	6.98E-01	1.6035	0.88067	1.60	0.88	9.9	11.50	10.78

	HBRP, AERMOD Flat Terrain		HBRP, CTDMPLUS		MAX (AERMOD/CTDMPLUS)		Measured	Total Impact	
Date	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Background	Diesel Mode	Nat. Gas Mode
7/9/2001	2.70E+00	1.48E+00	4.78886	2.65693	4.79	2.66	9.9	14.69	12.56
7/10/2001	2.12E+00	1.16E+00	1.92885	0.61863	2.12	1.16	9.9	12.02	11.06
7/11/2001	1.40E+00	7.61E-01	6.81667	3.75444	6.82	3.75	9.9	16.72	13.65
7/12/2001	1.20E+00	6.67E-01	7.91623	4.24828	7.92	4.25	5.2	13.12	9.45
7/13/2001	1.12E+00	6.18E-01	6.45903	3.62922	6.46	3.63	5.2	11.66	8.83
7/14/2001	9.51E-01	5.19E-01	5.88351	3.22775	5.88	3.23	5.2	11.08	8.43
7/15/2001	2.08E+00	1.15E+00	6.62026	3.48585	6.62	3.49	5.2	11.82	8.69
7/16/2001	2.81E+00	1.55E+00	9.4967	5.20201	9.50	5.20	5.2	14.70	10.40
7/17/2001	2.35E+00	1.29E+00	6.19381	3.3722	6.19	3.37	5.2	11.39	8.57
7/18/2001	2.34E+00	1.30E+00	10.41778	5.85722	10.42	5.86	4.2	14.62	10.06
7/19/2001	1.08E+00	5.96E-01	6.60233	3.70421	6.60	3.70	4.2	10.80	7.90
7/20/2001	1.29E+00	7.09E-01	9.45	5.18635	9.45	5.19	4.2	13.65	9.39
7/21/2001	2.71E+00	1.51E+00	13.32787	7.30063	13.33	7.30	4.2	17.53	11.50
7/22/2001	1.10E+00	5.96E-01	3.00003	1.62099	3.00	1.62	4.2	7.20	5.82
7/23/2001	1.75E+00	9.63E-01	3.89978	2.16222	3.90	2.16	4.2	8.10	6.36
7/24/2001	2.03E+00	1.12E+00	1.78149	0.49604	2.03	1.12	10.0	12.03	11.12
7/25/2001	1.96E+00	1.08E+00	1.42945	0.78838	1.96	1.08	10.0	11.96	11.08
7/26/2001	3.03E+00	1.67E+00	1.56213	0.39172	3.03	1.67	10.0	13.03	11.67
7/27/2001	1.46E+00	8.07E-01	9.39401	5.17831	9.39	5.18	10.0	19.39	15.18
7/28/2001	2.93E+00	1.63E+00	1.11741	0.64444	2.93	1.63	10.0	12.93	11.63
7/29/2001	1.36E+00	7.48E-01	1.20408	0.40117	1.36	0.75	10.0	11.36	10.75
7/30/2001	1.01E+00	5.52E-01	10.27782	5.63962	10.28	5.64	2.7	12.98	8.34
7/31/2001	1.63E+00	8.88E-01	7.3513	4.11183	7.35	4.11	2.7	10.05	6.81
8/1/2001	2.15E+00	1.18E+00	13.74811	7.61033	13.75	7.61	2.7	16.45	10.31
8/2/2001	6.26E-01	3.46E-01	13.25739	7.15406	13.26	7.15	2.7	15.96	9.85
8/3/2001	2.63E+00	1.45E+00	5.84047	3.23556	5.84	3.24	2.7	8.54	5.94
8/4/2001	1.28E+00	7.03E-01	1.97757	1.10097	1.98	1.10	2.7	4.68	3.80
8/5/2001	3.35E+00	1.84E+00	0	0	3.35	1.84	3.8	7.15	5.64
8/6/2001	1.73E+00	9.59E-01	12.13833	6.62333	12.14	6.62	3.8	15.94	10.42
8/7/2001	9.32E-01	5.04E-01	6.88417	3.59516	6.88	3.60	3.8	10.68	7.40
8/8/2001	1.32E+00	7.19E-01	6.09843	3.4117	6.10	3.41	3.8	9.90	7.21
8/9/2001	1.29E+00	7.03E-01	0.98167	0.52796	1.29	0.70	3.8	5.09	4.50
8/10/2001	6.27E-01	3.45E-01	14.56577	8.04731	14.57	8.05	3.8	18.37	11.85
8/11/2001	5.46E-01	3.04E-01	17.90647	10.04458	17.91	10.04	5.7	23.61	15.74
8/12/2001	7.58E-01	4.12E-01	7.07682	4.16143	7.08	4.16	5.7	12.78	9.86
8/13/2001	1.35E+00	7.35E-01	12.30897	6.74711	12.31	6.75	5.7	18.01	12.45
8/14/2001	5.97E-01	3.27E-01	10.52359	5.76895	10.52	5.77	5.7	16.22	11.47
8/15/2001	7.25E-01	3.95E-01	9.66189	5.29619	9.66	5.30	5.7	15.36	11.00
8/16/2001	6.35E-01	3.44E-01	15.38583	8.59969	15.39	8.60	5.7	21.09	14.30
8/17/2001	1.67E+00	9.19E-01	10.7009	6.00836	10.70	6.01	4.2	14.90	10.21
8/18/2001	1.40E+00	7.74E-01	5.51778	3.04667	5.52	3.05	4.2	9.72	7.25
8/19/2001	8.58E-01	4.69E-01	6.7961	3.7102	6.80	3.71	4.2	11.00	7.91
8/20/2001	7.38E-01	4.07E-01	3.74942	2.11672	3.75	2.12	4.2	7.95	6.32
8/21/2001	3.14E+00	1.73E+00	2.42389	1.34723	3.14	1.73	4.2	7.34	5.93
8/22/2001	4.14E+00	2.30E+00	0.63118	0.15146	4.14	2.30	4.2	8.34	6.50
8/23/2001	1.47E+00	8.10E-01	5.61227	3.14167	5.61	3.14	7.2	12.81	10.34
8/24/2001	7.67E-01	4.27E-01	8.78023	4.89571	8.78	4.90	7.2	15.98	12.10
8/25/2001	1.11E+00	6.16E-01	9.2	5.03833	9.20	5.04	7.2	16.40	12.24
8/26/2001	1.41E+00	7.84E-01	11.9517	6.60952	11.95	6.61	7.2	19.15	13.81
8/27/2001	1.39E+00	7.70E-01	12.10791	6.57521	12.11	6.58	7.2	19.31	13.78
8/28/2001	6.83E-01	3.74E-01	8.89178	5.01667	8.89	5.02	7.2	16.09	12.22
8/29/2001	7.96E-01	4.44E-01	4.69325	2.53187	4.69	2.53	3.8	8.49	6.33
8/30/2001	8.81E-01	4.71E-01	3.24996	0.99361	3.25	0.99	3.8	7.05	4.79
8/31/2001	9.20E-01	5.00E-01	15.909	8.7595	15.91	8.76	3.8	19.71	12.56
9/1/2001	2.09E+00	1.15E+00	4.06874	2.19629	4.07	2.20	3.8	7.87	6.00
9/2/2001	2.16E+00	1.19E+00	4.15283	2.15222	4.15	2.15	3.8	7.95	5.95
9/3/2001	2.09E+00	1.15E+00	8.81667	4.83611	8.82	4.84	3.8	12.62	8.64
9/4/2001	1.99E+00	1.11E+00	12.43404	6.97887	12.43	6.98	4.5	16.93	11.48
9/5/2001	2.37E+00	1.30E+00	8.45831	4.66757	8.46	4.67	4.5	12.96	9.17
9/6/2001	1.36E+00	7.41E-01	0	0	1.36	0.74	4.5	5.86	5.24
9/7/2001	2.45E+00	1.35E+00	2.48299	0.92645	2.48	1.35	4.5	6.98	5.85
9/8/2001	6.16E-01	3.42E-01	10.32539	5.80314	10.33	5.80	4.5	14.83	10.30
9/9/2001	7.77E-01	4.28E-01	12.22658	6.84417	12.23	6.84	4.5	16.73	11.34
9/10/2001	6.82E-01	3.76E-01	6.86803	3.85056	6.87	3.85	5.5	12.37	9.35
9/11/2001	6.27E-01	3.48E-01	8.93042	4.11409	8.93	4.11	5.5	14.43	9.61
9/12/2001	8.56E-01	4.67E-01	0.60983	0.14489	0.86	0.47	5.5	6.36	5.97
9/13/2001	5.59E-01	3.03E-01	6.72238	3.70724	6.72	3.71	5.5	12.22	9.21
9/14/2001	9.55E-01	5.22E-01	4.79492	2.20989	4.79	2.21	5.5	10.29	7.71
9/15/2001	1.50E+00	8.32E-01	8.25	4.555	8.25	4.56	5.5	13.75	10.06
9/16/2001	6.17E-01	3.39E-01	3.46048	1.51374	3.46	1.51	4.1	7.56	5.61
9/17/2001	9.91E-01	5.49E-01	9.048	4.97322	9.05	4.97	4.1	13.15	9.07
9/18/2001	1.15E+00	6.36E-01	1.01389	0.289	1.15	0.64	4.1	5.25	4.74
9/19/2001	1.55E+00	8.51E-01	8.95555	4.91944	8.96	4.92	4.1	13.06	9.02
9/20/2001	9.76E-01	5.44E-01	3.12695	1.41421	3.13	1.41	4.1	7.23	5.51
9/21/2001	1.20E+00	6.59E-01	0.82254	0.42372	1.20	0.66	4.1	5.30	4.76
9/22/2001	1.95E+00	1.06E+00	2.55	1.20778	2.55	1.21	6.5	9.05	7.71
9/23/2001	1.44E+00	8.00E-01	2.61396	1.47949	2.61	1.48	6.5	9.11	7.98
9/24/2001	9.78E-01	5.35E-01	1.905	1.04333	1.91	1.04	6.5	8.41	7.54
9/25/2001	3.64E+00	2.01E+00	2.96122	1.14	3.64	2.01	6.5	10.14	8.51
9/26/2001	7.73E-01	4.28E-01	4.44932	2.37052	4.45	2.37	6.5	10.95	8.87
9/27/2001	1.27E+00	7.00E-01	0.94517	0.51233	1.27	0.70	6.5	7.77	7.20
9/28/2001	9.53E-01	5.20E-01	2.77333	0.77057	2.77	0.77	7.5	10.27	8.27
9/29/2001	2.22E+00	1.22E+00	0	0	2.22	1.22	7.5	9.72	8.72
9/30/2001	1.45E+00	8.05E-01	0.06178	0	1.45	0.81	7.5	8.95	8.31
10/1/2001	1.17E+00	6.44E-01	4.02511	2.21089	4.03	2.21	7.5	11.53	9.71
10/2/2001	1.99E+00	1.08E+00	1.5	0.85056	1.99	1.08	7.5	9.49	8.58
10/3/2001	1.30E+00	7.06E-01	0.89778	0.16844	1.30	0.71	7.5	8.80	8.21
10/4/2001	1.91E+00	1.06E+00	0.76695	0.26843	1.91	1.06	7.8	9.71	8.86
10/5/2001	1.36E+00	7.50E-01	6.38459	3.55978	6.38	3.56	7.8	14.18	11.36
10/6/2001	1.08E+00	5.91E-01	5.66765	3.21778	5.67	3.22	7.8	13.47	11.02
10/7/2001	1.12E+00	6.20E-01	1.61004	0.75898	1.61	0.76	7.8	9.41	8.56
10/8/2001	1.78E+00	9.84E-01	3.30333	1.81778	3.30	1.82	7.4	10.70	9.22
10/9/2001	1.57E+00	8.60E-01	2.88278	0.61798	2.88	0.86	7.4	10.28	8.26
10/10/2001	8.07E-01	4.49E-01	2.43944	1.35333	2.44	1.35	7.4	9.84	8.75
10/11/2001	2.08E+00	1.15E+00	8.8767	4.75803	8.88	4.76	5.3	14.18	10.06
10/12/2001	1.38E+00	7.54E-01	0.92111	0.49778	1.38	0.75	5.3	6.68	6.05
10/13/2001	1.12E+00	6.17E-01	0.18417	0.10166	1.12	0.62	5.3	6.42	5.92

Date	HBRP, AERMOD Flat Terrain Diesel Mode	HBRP, AERMOD Flat Terrain Nat. Gas Mode	HBRP, CTDMPLUS Diesel Mode	HBRP, CTDMPLUS Nat. Gas Mode	MAX (AERMOD/CTDMPLUS) Diesel Mode	MAX (AERMOD/CTDMPLUS) Nat. Gas Mode	Measured Background	Total Impact Diesel Mode	Total Impact Nat. Gas Mode
10/14/2001	1.24E+00	6.84E-01	0.69278	0.06461	1.24	0.68	5.3	6.54	5.98
10/15/2001	1.04E+00	5.69E-01	1.49482	0.18539	1.49	0.57	5.3	6.79	5.87
10/16/2001	5.29E-01	2.92E-01	3.65067	2.052	3.65	2.05	11.8	15.45	13.85
10/17/2001	1.07E+00	5.89E-01	3.27161	1.88136	3.27	1.88	11.8	15.07	13.68
10/18/2001	8.04E-01	4.38E-01	1.385	0.3825	1.39	0.44	11.8	13.19	12.24
10/19/2001	9.05E-01	5.00E-01	1.47444	0.81333	1.47	0.81	11.8	13.27	12.61
10/20/2001	8.41E-01	4.56E-01	3.79013	0.77249	3.79	0.77	11.8	15.59	12.57
10/21/2001	6.20E-01	3.43E-01	0.31872	0.17611	0.62	0.34	11.8	12.42	12.14
10/22/2001	6.38E-01	3.46E-01	3.54944	1.93222	3.55	1.93	8.5	12.05	10.43
10/23/2001	1.39E+00	7.59E-01	5.04961	2.75739	5.05	2.76	8.5	13.55	11.26
10/24/2001	1.94E+00	1.08E+00	1.31778	0.33177	1.94	1.08	8.5	10.44	9.58
10/25/2001	1.00E+00	5.55E-01	7.42833	4.00778	7.43	4.01	8.5	15.93	12.51
10/26/2001	1.08E+00	6.01E-01	9.9962	5.63487	10.00	5.63	8.5	18.50	14.13
10/27/2001	5.82E-01	3.22E-01	9.50035	5.21889	9.50	5.22	8.5	18.00	13.72
10/28/2001	8.14E-01	4.50E-01	10.1979	5.35889	10.20	5.36	9.6	19.80	14.96
10/29/2001	2.80E+00	1.55E+00	0.50628	0.27544	2.80	1.55	9.6	12.40	11.15
10/30/2001	5.79E+00	3.16E+00	1.14556	0.61444	5.79	3.16	9.6	15.39	12.76
10/31/2001	1.11E+00	5.96E-01	1.64244	0.45661	1.64	0.60	9.6	11.24	10.20
11/1/2001	8.94E-01	4.90E-01	5.16778	2.89389	5.17	2.89	9.6	14.77	12.49
11/2/2001	1.48E+00	8.17E-01	6.14436	3.34624	6.14	3.35	9.6	15.74	12.95
11/3/2001	2.03E+00	1.12E+00	0.92352	0.51153	2.03	1.12	9.3	11.33	10.42
11/4/2001	1.63E+00	8.97E-01	2.32278	0.21633	2.32	0.90	9.3	11.62	10.20
11/5/2001	1.22E+00	6.75E-01	9.38282	5.21512	9.38	5.22	9.3	18.68	14.52
11/6/2001	1.01E+00	5.54E-01	9.2668	5.08235	9.27	5.08	9.3	18.57	14.38
11/7/2001	5.78E-01	3.15E-01	0	0	0.58	0.31	9.3	9.88	9.61
11/8/2001	8.27E-01	4.57E-01	1.10556	0	1.11	0.46	9.3	10.41	9.76
11/9/2001	1.06E+00	5.83E-01	0.55228	0.00106	1.06	0.58	32.6	33.66	33.18
11/10/2001	1.34E+00	7.40E-01	3.55867	1.71056	3.56	1.71	32.6	36.16	34.31
11/11/2001	1.21E+01	6.68E+00	2.11455	0.635	12.05	6.68	32.6	44.65	39.28
11/12/2001	3.29E+00	1.84E+00	1.01524	0.33891	3.29	1.84	32.6	35.89	34.44
11/13/2001	9.48E+00	5.17E+00	0	0	9.48	5.17	32.6	42.08	37.77
11/14/2001	3.64E+00	1.99E+00	0.00109	0	3.64	1.99	32.6	36.24	34.59
11/15/2001	9.53E+00	5.20E+00	1.31955	0.75364	9.53	5.20	18.1	27.58	23.25
11/16/2001	8.30E-01	4.56E-01	12.32032	6.68852	12.32	6.69	18.1	30.37	24.74
11/17/2001	7.58E-01	4.21E-01	0	0	0.76	0.42	18.1	18.81	18.47
11/18/2001	7.23E+00	3.93E+00	2.17391	0.63127	7.23	3.93	18.1	25.28	21.98
11/19/2001	8.62E+00	4.79E+00	0.03258	0.01817	8.62	4.79	18.1	26.67	22.84
11/20/2001	2.19E+00	1.20E+00	0.70442	0.18333	2.19	1.20	18.1	20.24	19.25
11/21/2001	5.62E+00	3.07E+00	0.66425	0.08908	5.62	3.07	3.5	9.12	6.57
11/22/2001	5.41E-01	2.92E-01	0.74311	0.22368	0.74	0.29	3.5	4.24	3.79
11/23/2001	6.78E-01	3.74E-01	1.45944	0.80111	1.46	0.80	3.5	4.96	4.30
11/24/2001	1.54E+00	8.47E-01	11.88263	6.55191	11.88	6.55	3.5	15.38	10.05
11/25/2001	8.53E-01	4.60E-01	3.72429	2.03857	3.72	2.04	3.5	7.22	5.54
11/26/2001	5.69E-01	3.10E-01	1.26444	0.67833	1.26	0.68	3.5	4.76	4.18
11/27/2001	9.52E-01	5.19E-01	3.55389	0.28901	3.55	0.52	19.1	22.65	19.62
11/28/2001	1.32E+01	7.27E+00	0	0	13.16	7.27	19.1	32.26	26.37
11/29/2001	1.10E+00	6.07E-01	3.88817	2.06123	3.89	2.06	19.1	22.99	21.16
11/30/2001	5.93E+00	3.26E+00	0.00001	0.00001	5.93	3.26	19.1	25.03	22.36
12/1/2001	4.75E+00	2.60E+00	0.68257	0.13669	4.75	2.60	19.1	23.85	21.70
12/2/2001	1.20E+01	6.60E+00	0.20678	0.09721	12.01	6.60	19.1	31.11	25.70
12/3/2001	1.50E+00	8.26E-01	9.25957	4.9273	9.26	4.93	12.6	21.86	17.53
12/4/2001	1.52E+00	8.30E-01	1.52722	0.84	1.53	0.84	12.6	14.13	13.44
12/5/2001	1.78E+00	9.68E-01	0.41961	0.23328	1.78	0.97	12.6	14.38	13.57
12/6/2001	7.94E-01	4.39E-01	6.16667	3.32944	6.17	3.33	12.6	18.77	15.93
12/7/2001	9.22E-01	5.12E-01	6.80556	3.7	6.81	3.70	12.6	19.41	16.30
12/8/2001	1.14E+00	6.30E-01	1.06222	0.28906	1.14	0.63	12.6	13.74	13.23
12/9/2001	2.51E+00	1.39E+00	9.82942	5.20923	9.83	5.21	4.3	14.13	9.51
12/10/2001	6.04E-01	3.33E-01	5.54531	3.03257	5.55	3.03	4.3	9.85	7.33
12/11/2001	8.14E-01	4.47E-01	0.16544	0.09139	0.81	0.45	4.3	5.11	4.75
12/12/2001	6.06E-01	3.37E-01	6.93667	2.38951	6.94	2.39	4.3	11.24	6.69
12/13/2001	5.24E+00	2.89E+00	2.06668	1.12186	5.24	2.89	4.3	9.54	7.19
12/14/2001	8.26E-01	4.54E-01	7.18742	5.2866	7.19	5.29	4.3	11.49	9.59
12/15/2001	1.90E+00	1.03E+00	0	0	1.90	1.03	4.0	5.90	5.03
12/16/2001	6.24E+00	3.43E+00	1.81217	1.00391	6.24	3.43	4.0	10.24	7.43
12/17/2001	1.05E+00	5.74E-01	5.75	3.23889	5.75	3.24	4.0	9.75	7.24
12/18/2001	6.12E+00	3.38E+00	3.54429	2.01909	6.12	3.38	4.0	10.12	7.38
12/19/2001	5.20E+00	2.84E+00	2.34524	0.67977	5.20	2.84	4.0	9.20	6.84
12/20/2001	7.23E-01	3.99E-01	8.31156	4.61309	8.31	4.61	4.0	12.31	8.61
12/21/2001	5.86E+00	3.22E+00	0.00098	0.00056	5.86	3.22	7.3	13.16	10.52
12/22/2001	4.29E+00	2.36E+00	0.99182	0.46087	4.29	2.36	7.3	11.59	9.66
12/23/2001	7.02E-01	3.87E-01	0.07406	0.04089	0.70	0.39	7.3	8.00	7.69
12/24/2001	4.19E+00	2.28E+00	0.03302	0.01826	4.19	2.28	7.3	11.49	9.58
12/25/2001	1.89E+00	1.05E+00	2.58056	1.45	2.58	1.45	7.3	9.88	8.75
12/26/2001	3.83E+00	2.13E+00	9.04762	4.97143	9.05	4.97	7.3	16.35	12.27
12/27/2001	6.51E+00	3.62E+00	0.25485	0.04984	6.51	3.62	11.5	18.01	15.12
12/28/2001	6.98E-01	3.84E-01	2.42056	0.79278	2.42	0.79	11.5	13.92	12.29
12/29/2001	8.12E-01	4.47E-01	2.41434	0.48838	2.41	0.49	11.5	13.91	11.99
12/30/2001	3.56E+00	1.97E+00	1.48429	0.82952	3.56	1.97	11.5	15.06	13.47
12/31/2001	3.69E+00	2.04E+00	1.18111	0.34878	3.69	2.04	11.5	15.19	13.54
8th highest value								34.98	32.23

Date	HBRP, AERMOD Flat Terrain Diesel Mode	HBRP, AERMOD Flat Terrain Nat. Gas Mode	HBRP, CTDMPLUS Diesel Mode	HBRP, CTDMPLUS Nat. Gas Mode	MAX (AERMOD/CTDMPLUS) Diesel Mode	MAX (AERMOD/CTDMPLUS) Nat. Gas Mode	Measured Background	Total Impact Diesel Mode	Total Impact Nat. Gas Mode
1/1/2002	1.42E+01	7.79E+00	0	0.00001	14.18	7.79	11.5	25.68	19.29
1/2/2002	1.49E+00	8.16E-01	0.6443	0.23072	1.49	0.82	12.1	13.59	12.92
1/3/2002	6.04E-01	3.34E-01	1.95997	1.09683	1.96	1.10	12.1	14.06	13.20
1/4/2002	5.28E+00	2.87E+00	1.61444	0.88778	5.28	2.87	12.1	17.38	14.97
1/5/2002	7.26E+00	4.00E+00	0.0006	0.00015	7.26	4.00	12.1	19.36	16.10
1/6/2002	1.15E+01	6.31E+00	0.00161	0	11.53	6.31	12.1	23.63	18.41
1/7/2002	1.15E+01	6.28E+00	0.15878	0.08661	11.47	6.28	12.1	23.57	18.38
1/8/2002	8.36E-01	4.61E-01	9.01943	4.96509	9.02	4.97	9.7	18.72	14.67
1/9/2002	3.51E-01	1.95E-01	13.82612	7.71495	13.83	7.71	9.7	23.53	17.41
1/10/2002	6.46E-01	3.55E-01	2.95267	1.48722	2.95	1.49	9.7	12.65	11.19
1/11/2002	7.82E-01	4.36E-01	1.38928	0.71337	1.39	0.71	9.7	11.09	10.41
1/12/2002	1.41E+00	7.80E-01	5.13752	2.95799	5.14	2.96	9.7	14.84	12.66
1/13/2002	1.01E+00	5.63E-01	14.26319	7.82868	14.26	7.83	9.7	23.96	17.53
1/14/2002	9.32E-01	5.10E-01	0.45783	2.07102	0.93	2.07	4.3	5.23	6.37
1/15/2002	2.34E+00	1.29E+00	4.35833	2.37502	4.36	2.38	4.3	8.66	6.68
1/16/2002	3.85E-01	2.11E-01	1.53035	0.7587	1.53	0.76	4.3	5.83	5.06
1/17/2002	1.08E+00	5.93E-01	3.95261	2.20812	3.95	2.21	4.3	8.25	6.51
1/18/2002	1.13E+00	6.24E-01	1.09361	0.59067	1.13	0.62	4.3	5.43	4.92
1/19/2002	1.41E+00	7.72E-01	5.89704	3.22796	5.90	3.23	4.3	10.20	7.53
1/20/2002	2.09E+00	1.16E+00	0.00157	0.00087	2.09	1.16	6.7	8.79	7.86
1/21/2002	1.59E+00	8.76E-01	1.93274	1.06719	1.93	1.07	6.7	8.63	7.77
1/22/2002	8.14E-01	4.52E-01	0.6815	0.21017	0.81	0.45	6.7	7.51	7.15
1/23/2002	1.25E+00	6.93E-01	1.33062	0.74333	1.33	0.74	6.7	8.03	7.44
1/24/2002	8.52E-01	4.72E-01	0.68485	0.20033	0.85	0.47	6.7	7.55	7.17
1/25/2002	8.84E+00	4.86E+00	1.77412	1.02021	8.84	4.86	6.7	15.54	11.56
1/26/2002	8.51E-01	4.64E-01	1.46393	0.59894	1.46	0.60	5.1	6.56	5.70
1/27/2002	8.53E-01	4.72E-01	3.34556	1.88611	3.35	1.89	5.1	8.45	6.99
1/28/2002	1.18E+00	6.47E-01	0.57167	0.24589	1.18	0.65	5.1	6.28	5.75
1/29/2002	1.32E+00	7.26E-01	0.26239	0.14417	1.32	0.73	5.1	6.42	5.83
1/30/2002	6.28E-01	3.48E-01	2.69333	1.48111	2.69	1.48	5.1	7.79	6.58
1/31/2002	2.37E+00	1.31E+00	0.41606	0.11561	2.37	1.31	5.1	7.47	6.41
2/1/2002	1.46E+00	8.17E-01	0.00024	0.00014	1.46	0.82	11.3	12.76	12.12
2/2/2002	1.94E+00	1.07E+00	1.29795	0.38867	1.94	1.07	11.3	13.24	12.37
2/3/2002	3.93E-01	2.18E-01	1.71778	0.94889	1.72	0.95	11.3	13.02	12.25
2/4/2002	8.70E-01	4.79E-01	4.41372	2.41824	4.41	2.42	11.3	15.71	13.72
2/5/2002	8.03E-01	4.46E-01	2.0428	1.11779	2.04	1.12	11.3	13.34	12.42
2/6/2002	7.58E+00	4.19E+00	0.91682	0.50318	7.58	4.19	11.3	18.88	15.49
2/7/2002	4.11E+00	2.28E+00	1.78318	0.99347	4.11	2.28	4.0	8.11	6.28
2/8/2002	9.43E-01	5.18E-01	0.60944	0.00108	0.94	0.52	4.0	4.94	4.52
2/9/2002	8.54E-01	4.68E-01	0.92	0.50572	0.92	0.51	4.0	4.92	4.51
2/10/2002	1.82E+00	1.00E+00	0.13489	0.00007	1.82	1.00	4.0	5.82	5.00
2/11/2002	5.74E+00	3.17E+00	2.495	1.36611	5.74	3.17	4.0	9.74	7.17
2/12/2002	1.01E+00	5.59E-01	2.57485	1.41373	2.57	1.41	4.0	6.57	5.41
2/13/2002	7.86E-01	4.37E-01	8.51276	4.57926	8.51	4.58	14.0	22.51	18.58
2/14/2002	7.45E-01	4.08E-01	6.43333	3.51111	6.43	3.51	14.0	20.43	17.51
2/15/2002	3.62E+00	2.02E+00	1.37222	0.75	3.62	2.02	14.0	17.62	16.02
2/16/2002	2.11E+00	1.18E+00	11.04628	6.32728	11.05	6.33	14.0	25.05	20.33
2/17/2002	7.11E-01	3.86E-01	2.8701	1.50067	2.87	1.50	14.0	16.87	15.50
2/18/2002	1.04E+01	5.75E+00	1.46579	0.80538	10.39	5.75	14.0	24.39	19.75
2/19/2002	2.47E+00	1.36E+00	0.29829	0.0775	2.47	1.36	2.4	4.87	3.76
2/20/2002	7.30E-01	3.98E-01	0.82151	0.20608	0.82	0.40	2.4	3.22	2.80
2/21/2002	9.75E-01	5.38E-01	2.43833	1.36778	2.44	1.37	2.4	4.84	3.77
2/22/2002	5.69E+00	3.13E+00	0.54467	0.08461	5.69	3.13	2.4	8.09	5.53
2/23/2002	5.12E+00	2.79E+00	2.14093	1.14274	5.12	2.79	2.4	7.52	5.19
2/24/2002	5.17E-01	2.86E-01	2.9999	1.65095	3.00	1.65	2.4	5.40	4.05
2/25/2002	2.10E+00	1.16E+00	0.72233	0.07194	2.10	1.16	9.9	12.00	11.06
2/26/2002	7.04E-01	3.91E-01	1.19778	0.65444	1.20	0.65	9.9	11.10	10.55
2/27/2002	1.06E+00	5.85E-01	17.94318	9.94557	17.94	9.95	9.9	27.84	19.85
2/28/2002	6.26E-01	3.52E-01	13.31359	7.30169	13.31	7.30	9.9	23.21	17.20
3/1/2002	3.14E+00	1.74E+00	2.27	2.50626	3.14	2.51	9.9	13.04	12.41
3/2/2002	1.43E+00	7.87E-01	0	0	1.43	0.79	9.9	11.33	10.69
3/3/2002	2.28E+00	1.26E+00	0	0	2.28	1.26	13.5	15.78	14.76
3/4/2002	1.05E+00	5.79E-01	1.38178	0.69833	1.38	0.70	13.5	14.88	14.20
3/5/2002	3.03E+00	1.69E+00	0.3421	0.08506	3.03	1.69	13.5	16.53	15.19
3/6/2002	2.36E+00	1.31E+00	0.71208	0.39304	2.36	1.31	13.5	15.86	14.81
3/7/2002	1.54E+00	8.54E-01	3.38397	1.7165	3.38	1.72	13.5	16.88	15.22
3/8/2002	2.26E+00	1.25E+00	2.16	1.19722	2.26	1.25	13.5	15.76	14.75
3/9/2002	4.96E+00	2.76E+00	2.01762	1.11571	4.96	2.76	5.3	10.26	8.06
3/10/2002	3.17E+00	1.78E+00	0.0002	0.00001	3.17	1.78	5.3	8.47	7.08
3/11/2002	2.76E+00	1.54E+00	1.26378	0.70406	2.76	1.54	5.3	8.06	6.84
3/12/2002	1.88E+00	1.06E+00	4.41054	2.40242	4.41	2.40	5.3	9.71	7.70
3/13/2002	1.23E+00	6.86E-01	0.27144	0.15178	1.23	0.69	5.3	6.53	5.99
3/14/2002	2.21E+00	1.22E+00	0.24449	0.13899	2.21	1.22	5.3	7.51	6.52
3/15/2002	1.75E+00	9.68E-01	3.06794	1.66911	3.07	1.67	7.1	10.17	8.77
3/16/2002	8.69E-01	4.80E-01	0.44556	0.24789	0.87	0.48	7.1	7.97	7.58
3/17/2002	1.17E+00	6.48E-01	1.74056	0.95341	1.74	0.95	7.1	8.84	8.05
3/18/2002	2.01E+00	1.10E+00	1.56889	0.83667	2.01	1.10	7.1	9.11	8.20
3/19/2002	1.96E+00	1.09E+00	4.14111	0.73056	4.14	1.09	7.1	11.24	8.19
3/20/2002	1.79E+00	9.88E-01	0.16094	0.08872	1.79	0.99	7.1	8.89	8.09
3/21/2002	1.24E-01	8.17E-02	7.05192	3.90468	7.05	3.90	9.3	16.35	13.20
3/22/2002	3.29E+00	1.81E+00	0.52524	0.28548	3.29	1.81	9.3	12.59	11.11
3/23/2002	1.85E+00	1.14E+00	6.33333	3.4919	6.33	3.49	9.3	15.63	12.79
3/24/2002	1.44E+00	8.00E-01	6.07717	3.09222	6.08	3.09	9.3	15.38	12.39
3/25/2002	2.36E+00	1.30E+00	4.25222	2.35778	4.25	2.36	9.3	13.55	11.66
3/26/2002	2.12E+00	1.17E+00	2.82375	1.60798	2.82	1.61	9.3	12.12	10.91
3/27/2002	1.88E+00	1.04E+00	1.69307	1.35783	1.88	1.36	7.8	9.68	9.16
3/28/2002	1.89E+00	1.04E+00	9.1328	4.96585	9.13	4.97	7.8	16.93	12.77
3/29/2002	2.07E+00	1.14E+00	11.59132	6.27039	11.59	6.27	7.8	19.39	14.07
3/30/2002	1.53E+00	8.44E-01	13.7446	7.51897	13.74	7.52	7.8	21.54	15.32
3/31/2002	2.01E+00	1.11E+00	2.75851	1.4141	2.76	1.41	7.8	10.56	9.21
4/1/2002	1.38E+00	7.54E-01	0.36511	0.19733	1.38	0.75	7.8	9.18	8.55
4/2/2002	5.86E+00	3.26E+00	1.68612	0.70611	5.86	3.26	9.4	15.26	12.66

Date	HBRP, AERMOD Flat Terrain Diesel Mode	HBRP, AERMOD Flat Terrain Nat. Gas Mode	HBRP, CTDMPLUS Diesel Mode	HBRP, CTDMPLUS Nat. Gas Mode	MAX (AERMOD/CTDMPLUS) Diesel Mode	MAX (AERMOD/CTDMPLUS) Nat. Gas Mode	Measured Background	Total Impact Diesel Mode	Total Impact Nat. Gas Mode
4/3/2002	8.45E-01	4.69E-01	8.7229	4.87467	8.72	4.87	9.4	18.12	14.27
4/4/2002	9.10E-01	5.09E-01	15.71783	8.31956	15.72	8.32	9.4	25.12	17.72
4/5/2002	1.24E+00	6.85E-01	0.81911	0.25089	1.24	0.69	9.4	10.64	10.09
4/6/2002	1.71E+00	9.42E-01	3.34631	1.48522	3.35	1.49	9.4	12.75	10.89
4/7/2002	1.94E+00	1.08E+00	3.24895	1.78221	3.25	1.78	9.4	12.65	11.18
4/8/2002	2.22E+00	1.22E+00	1.97638	1.07329	2.22	1.22	6.0	8.22	7.22
4/9/2002	2.85E+00	1.57E+00	1.33842	0.69271	2.85	1.57	6.0	8.85	7.57
4/10/2002	1.62E+00	8.87E-01	1.55007	0.84883	1.62	0.89	6.0	7.62	6.89
4/11/2002	1.92E+00	1.06E+00	2.53206	1.37073	2.53	1.37	6.0	8.53	7.37
4/12/2002	8.81E-01	4.88E-01	8.35289	4.54249	8.35	4.54	6.0	14.35	10.54
4/13/2002	9.94E-01	5.45E-01	2.3231	1.26034	2.32	1.26	6.0	8.32	7.26
4/14/2002	7.14E-01	3.91E-01	5.7645	2.95957	5.76	2.96	3.0	8.76	5.96
4/15/2002	2.38E+00	1.32E+00	3.36767	1.814	3.37	1.81	3.0	6.37	4.81
4/16/2002	3.25E+00	1.81E+00	7.12222	3.90444	7.12	3.90	3.0	10.12	6.90
4/17/2002	1.83E+00	1.01E+00	6.46176	3.57818	6.46	3.58	3.0	9.46	6.58
4/18/2002	2.43E+00	1.34E+00	0.76057	0.41276	2.43	1.34	3.0	5.43	4.34
4/19/2002	2.66E+00	1.47E+00	10.8704	5.96643	10.87	5.97	3.0	13.87	8.97
4/20/2002	2.14E+00	1.18E+00	8.51667	4.69889	8.52	4.70	9.2	17.72	13.90
4/21/2002	2.09E+00	1.15E+00	7.59444	4.195	7.59	4.20	9.2	16.79	13.40
4/22/2002	1.70E+00	9.42E-01	4.76333	2.61444	4.76	2.61	9.2	13.96	11.81
4/23/2002	2.72E+00	1.49E+00	1.93389	1.05778	2.72	1.49	9.2	11.92	10.69
4/24/2002	1.56E+00	8.62E-01	0.76111	0.21206	1.56	0.86	9.2	10.76	10.06
4/25/2002	1.70E+00	9.45E-01	4.59148	2.5151	4.59	2.52	9.2	13.79	11.72
4/26/2002	1.44E+00	8.07E-01	22.83903	13.46962	22.84	13.47	5.0	27.84	18.47
4/27/2002	2.87E+00	1.59E+00	10.79657	5.94902	10.80	5.95	5.0	15.80	10.95
4/28/2002	3.42E+00	1.89E+00	0	0	3.42	1.89	5.0	8.42	6.89
4/29/2002	2.20E+00	1.21E+00	1.63555	0.90439	2.20	1.21	5.0	7.20	6.21
4/30/2002	9.61E-01	5.28E-01	19.56439	10.70695	19.56	10.71	5.0	24.56	15.71
5/1/2002	8.61E-01	4.71E-01	6.9241	3.86082	6.92	3.86	5.0	11.92	8.86
5/2/2002	8.96E-01	4.94E-01	15.78314	8.78931	15.78	8.79	4.9	20.68	13.69
5/3/2002	2.69E+00	1.49E+00	8.96228	4.9468	8.96	4.95	4.9	13.86	9.85
5/4/2002	2.37E+00	1.31E+00	10.97222	6.00944	10.97	6.01	4.9	15.87	10.91
5/5/2002	1.39E+00	7.75E-01	10.30938	5.6626	10.31	5.66	4.9	15.21	10.56
5/6/2002	1.74E+00	9.64E-01	9.48755	5.19848	9.49	5.20	4.9	14.39	10.10
5/7/2002	4.80E+00	2.67E+00	11.58537	6.50369	11.59	6.50	4.9	16.49	11.40
5/8/2002	1.10E+00	6.06E-01	8.78333	4.84261	8.78	4.84	6.3	15.08	11.14
5/9/2002	1.84E+00	1.03E+00	11.17363	6.16933	11.17	6.17	6.3	17.47	12.47
5/10/2002	3.42E+00	1.89E+00	5.67708	3.09806	5.68	3.10	6.3	11.98	9.40
5/11/2002	1.48E+00	8.11E-01	3.53944	1.97444	3.54	1.97	6.3	9.84	8.27
5/12/2002	1.71E+00	9.40E-01	10.3272	5.67678	10.33	5.68	6.3	16.63	11.98
5/13/2002	2.65E+00	1.46E+00	17.47252	9.70743	17.47	9.71	6.3	23.77	16.01
5/14/2002	2.73E+00	1.52E+00	4.87423	2.68349	4.87	2.68	5.0	9.87	7.68
5/15/2002	1.87E+00	1.03E+00	7.27498	3.78822	7.27	3.79	5.0	12.27	8.79
5/16/2002	1.64E+00	9.10E-01	5.95	3.33835	5.95	3.34	5.0	10.95	8.34
5/17/2002	1.66E+00	9.13E-01	10.50189	5.56459	10.50	5.56	5.0	15.50	10.56
5/18/2002	2.30E+00	1.27E+00	6.07687	3.42285	6.08	3.42	5.0	11.08	8.42
5/19/2002	7.86E+00	4.35E+00	0.22452	0.00563	7.86	4.35	5.0	12.86	9.35
5/20/2002	6.42E+00	3.59E+00	0.24972	0.13039	6.42	3.59	1.9	8.32	5.49
5/21/2002	2.44E+00	1.35E+00	3.00122	1.64553	3.00	1.65	1.9	4.90	3.55
5/22/2002	4.41E+00	2.43E+00	4.67208	2.57333	4.67	2.57	1.9	6.57	4.47
5/23/2002	1.92E+00	1.06E+00	1.25222	0.68333	1.92	1.06	1.9	3.82	2.96
5/24/2002	1.81E+00	9.78E-01	1.83111	1.04444	1.83	1.04	1.9	3.73	2.94
5/25/2002	2.00E+00	1.12E+00	6.93972	3.84735	6.94	3.85	1.9	8.84	5.75
5/26/2002	9.33E-01	5.08E-01	0.64889	0.3555	0.93	0.51	4.4	5.33	4.91
5/27/2002	1.77E+00	9.73E-01	1.63141	0.84169	1.77	0.97	4.4	6.17	5.37
5/28/2002	5.81E+00	3.22E+00	4.95556	2.71409	5.81	3.22	4.4	10.21	7.62
5/29/2002	6.56E-01	3.54E-01	7.23013	3.42624	7.23	3.43	4.4	11.63	7.83
5/30/2002	9.87E-01	5.42E-01	6.38509	3.50693	6.39	3.51	4.4	10.79	7.91
5/31/2002	2.27E+00	1.25E+00	9.38489	5.25723	9.38	5.26	4.4	13.78	9.66
6/1/2002	1.38E+00	7.58E-01	8.99011	5.00298	8.99	5.00	6.8	15.79	11.80
6/2/2002	2.04E+00	1.12E+00	9.60783	5.3545	9.61	5.35	6.8	16.41	12.15
6/3/2002	2.05E+00	1.13E+00	6.14813	3.39327	6.15	3.39	6.8	12.95	10.19
6/4/2002	1.81E+00	1.00E+00	18.45463	9.63411	18.45	9.63	6.8	25.25	16.43
6/5/2002	1.70E+00	9.47E-01	23.14833	12.49548	23.15	12.50	6.8	29.95	19.30
6/6/2002	1.96E+00	1.08E+00	8.49248	4.58984	8.49	4.59	6.8	15.29	11.39
6/7/2002	3.45E+00	1.91E+00	8.32017	4.54152	8.32	4.54	6.1	14.42	10.64
6/8/2002	2.82E+00	1.56E+00	5.76983	3.97209	5.77	3.97	6.1	11.87	10.07
6/9/2002	3.49E+00	1.93E+00	11.1382	6.13384	11.14	6.13	6.1	17.24	12.23
6/10/2002	1.87E+00	1.03E+00	10.06249	5.39361	10.06	5.39	6.1	16.16	11.49
6/11/2002	2.43E+00	1.34E+00	3.07328	1.72256	3.07	1.72	6.1	9.17	7.82
6/12/2002	1.35E+00	7.35E-01	2.46124	1.3939	2.46	1.39	6.1	8.56	7.49
6/13/2002	1.05E+00	5.84E-01	6.39183	3.44056	6.39	3.44	2.6	8.99	6.04
6/14/2002	1.54E+00	8.52E-01	8.20282	4.52765	8.20	4.53	2.6	10.80	7.13
6/15/2002	2.71E+00	1.49E+00	0.79989	0.00044	2.71	1.49	2.6	5.31	4.09
6/16/2002	2.12E+00	1.16E+00	0.65722	0	2.12	1.16	2.6	4.72	3.76
6/17/2002	2.31E+00	1.27E+00	0.99043	0.1811	2.31	1.27	2.6	4.91	3.87
6/18/2002	2.62E-01	1.42E-01	24.18768	13.27115	24.19	13.27	2.6	26.79	15.87
6/19/2002	1.22E+00	6.80E-01	8.86194	4.87022	8.86	4.87	5.0	13.86	9.87
6/20/2002	8.55E-01	4.70E-01	6.99155	3.93087	6.99	3.93	5.0	11.99	8.93
6/21/2002	1.02E+00	5.68E-01	18.03874	9.20706	18.04	9.21	5.0	23.04	14.21
6/22/2002	1.21E+00	6.68E-01	6.65951	3.73004	6.66	3.73	5.0	11.66	8.73
6/23/2002	1.98E+00	1.10E+00	8.8459	4.75551	8.85	4.76	5.0	13.85	9.76
6/24/2002	1.05E+00	5.83E-01	8.52741	4.32729	8.53	4.33	5.0	13.53	9.33
6/25/2002	1.49E+00	8.22E-01	2.37683	1.31954	2.38	1.32	3.5	5.88	4.82
6/26/2002	2.17E+00	1.20E+00	2.77309	1.56868	2.77	1.57	3.5	6.27	5.07
6/27/2002	9.94E-01	5.40E-01	10.59396	5.82204	10.59	5.82	3.5	14.09	9.32
6/28/2002	4.10E+00	2.26E+00	1.41222	0.79833	4.10	2.26	3.5	7.60	5.76
6/29/2002	1.57E+00	8.59E-01	3.60449	2.04666	3.60	2.05	3.5	7.10	5.55
6/30/2002	1.72E+00	9.43E-01	6.5957	3.66391	6.60	3.66	3.5	10.10	7.16
7/1/2002	1.86E+00	1.02E+00	6.82194	3.63333	6.82	3.63	7.0	13.82	10.63
7/2/2002	1.67E+00	9.13E-01	5.41389	3.00506	5.41	3.01	7.0	12.41	10.01
7/3/2002	2.69E+00	1.48E+00	6.84773	3.68795	6.85	3.69	7.0	13.85	10.69
7/4/2002	2.07E+00	1.15E+00	14.61012	8.06426	14.61	8.06	7.0	21.61	15.06
7/5/2002	1.58E+00	8.74E-01	6.63614	3.68701	6.64	3.69	7.0	13.64	10.69
7/6/2002	8.77E-01	4.86E-01	7.50131	4.19281	7.50	4.19	7.0	14.50	11.19
7/7/2002	1.59E+00	8.69E-01	0.255	0.0558	1.59	0.87	5.0	6.59	5.87
7/8/2002	2.18E+00	1.18E+00	8.79722	4.92833	8.80	4.93	5.0	13.80	9.93

Date	HBRP, AERMOD Flat Terrain		HBRP, CTDMPLUS		MAX (AERMOD/CTDMPLUS)		Measured	Total Impact	
	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Background	Diesel Mode	Nat. Gas Mode
7/9/2002	1.90E+00	1.03E+00	2.22389	1.21222	2.22	1.21	5.0	7.22	6.21
7/10/2002	1.43E+00	7.90E-01	4.13511	2.20156	4.14	2.20	5.0	9.14	7.20
7/11/2002	1.12E+00	6.21E-01	2.45056	1.35222	2.45	1.35	5.0	7.45	6.35
7/12/2002	2.86E+00	1.59E+00	1.42569	0.83694	2.86	1.59	5.0	7.86	6.59
7/13/2002	5.63E-01	3.09E-01	10.97886	5.94861	10.98	5.95	8.9	19.88	14.85
7/14/2002	2.55E+00	1.40E+00	1.68667	0.92833	2.55	1.40	8.9	11.45	10.30
7/15/2002	2.03E+00	1.12E+00	3.03788	1.59627	3.04	1.60	8.9	11.94	10.50
7/16/2002	1.48E+00	8.29E-01	15.4008	8.55125	15.40	8.55	8.9	24.30	17.45
7/17/2002	1.37E+00	7.55E-01	8.10057	4.55971	8.10	4.56	8.9	17.00	13.46
7/18/2002	1.46E+00	8.15E-01	12.18507	6.59234	12.19	6.59	8.9	21.09	15.49
7/19/2002	9.18E-01	5.07E-01	9.50003	5.20517	9.50	5.21	3.5	13.00	8.71
7/20/2002	1.47E+00	8.07E-01	11.84608	6.45155	11.85	6.45	3.5	15.35	9.95
7/21/2002	1.07E+00	5.89E-01	2.61258	1.33279	2.61	1.33	3.5	6.11	4.83
7/22/2002	1.08E+00	5.81E-01	6.06611	3.40611	6.07	3.41	3.5	9.57	6.91
7/23/2002	8.69E-01	4.78E-01	3.77237	2.05322	3.77	2.05	3.5	7.27	5.55
7/24/2002	2.23E+00	1.22E+00	2.28776	1.24357	2.29	1.24	3.5	5.79	4.74
7/25/2002	6.99E-01	3.79E-01	9.48574	5.18729	9.49	5.19	4.4	13.89	9.59
7/26/2002	1.75E+00	9.62E-01	10.84196	5.8279	10.84	5.83	4.4	15.24	10.23
7/27/2002	2.27E+00	1.25E+00	4.62422	2.63241	4.62	2.63	4.4	9.02	7.03
7/28/2002	3.21E+00	1.76E+00	3.48773	1.93955	3.49	1.94	4.4	7.89	6.34
7/29/2002	7.10E-01	3.87E-01	4.94535	2.7346	4.95	2.73	4.4	9.35	7.13
7/30/2002	1.69E+00	9.32E-01	13.05606	6.98232	13.06	6.98	4.4	17.46	11.38
7/31/2002	3.97E+00	2.20E+00	2.43419	1.40105	3.97	2.20	5.1	9.07	7.30
8/1/2002	8.22E-01	4.44E-01	2.31782	1.30836	2.32	1.31	5.1	7.42	6.41
8/2/2002	2.06E+00	1.13E+00	1.80233	0.99633	2.06	1.13	5.1	7.16	6.23
8/3/2002	8.67E-01	4.75E-01	7.61434	4.15386	7.61	4.15	5.1	12.71	9.25
8/4/2002	2.47E+00	1.37E+00	2.24233	1.26757	2.47	1.37	5.1	7.57	6.47
8/5/2002	2.72E+00	1.50E+00	8.51613	4.76034	8.52	4.76	5.1	13.62	9.86
8/6/2002	2.64E+00	1.46E+00	3.37606	1.83834	3.38	1.84	4.1	7.48	5.94
8/7/2002	1.56E+00	8.59E-01	2.42314	1.32727	2.42	1.33	4.1	6.52	5.43
8/8/2002	1.96E+00	1.07E+00	1.25389	0.68778	1.96	1.07	4.1	6.06	5.17
8/9/2002	1.25E+00	6.72E-01	1.96556	0.5652	1.97	0.67	4.1	6.07	4.77
8/10/2002	1.23E+00	6.68E-01	9.59778	5.26033	9.60	5.26	4.1	13.70	9.36
8/11/2002	3.98E+00	2.17E+00	2.38356	1.30722	3.98	2.17	4.1	8.08	6.27
8/12/2002	3.21E+00	1.77E+00	0.72134	0.3598	3.21	1.77	8.5	11.71	10.27
8/13/2002	1.54E+00	8.38E-01	12.26761	6.76897	12.27	6.77	8.5	20.77	15.27
8/14/2002	9.92E-01	5.53E-01	8.78727	4.84351	8.79	4.84	8.5	17.29	13.34
8/15/2002	2.19E+00	1.20E+00	3.88569	2.09437	3.89	2.09	8.5	12.39	10.59
8/16/2002	2.57E+00	1.42E+00	4.97665	2.66948	4.98	2.67	8.5	13.48	11.17
8/17/2002	7.74E-01	4.28E-01	1.73726	0.98574	1.74	0.99	8.5	10.24	9.49
8/18/2002	1.07E+00	5.95E-01	4.88005	2.70337	4.88	2.70	18.7	23.58	21.40
8/19/2002	1.01E+00	5.61E-01	4.09222	2.25111	4.09	2.25	18.7	22.79	20.95
8/20/2002	1.81E+00	9.93E-01	6.11558	3.33974	6.12	3.34	18.7	24.82	22.04
8/21/2002	1.77E+00	9.68E-01	8.13706	4.21841	8.14	4.22	18.7	26.84	22.92
8/22/2002	7.87E-01	4.36E-01	0.67527	0.37381	0.79	0.44	18.7	19.49	19.14
8/23/2002	1.63E-02	1.33E-02	3.50472	1.921	3.50	1.92	18.7	22.20	20.62
8/24/2002	1.19E+00	6.51E-01	6.92433	3.87706	6.92	3.88	2.5	9.42	6.38
8/25/2002	8.14E-01	4.50E-01	13.95887	7.63217	13.96	7.63	2.5	16.46	10.13
8/26/2002	1.57E+00	8.73E-01	4.29756	2.3475	4.30	2.35	2.5	6.80	4.85
8/27/2002	1.54E+00	8.52E-01	1.27416	0.69667	1.54	0.85	2.5	4.04	3.35
8/28/2002	9.55E-01	5.17E-01	0.78389	0.24628	0.96	0.52	2.5	3.46	3.02
8/29/2002	5.11E-01	2.79E-01	2.92569	1.51502	2.93	1.52	2.5	5.43	4.02
8/30/2002	8.10E-01	4.46E-01	2.93597	1.52	2.94	1.52	8.7	11.64	10.22
8/31/2002	2.29E+00	1.25E+00	1.39074	0.76121	2.29	1.25	8.7	10.99	9.95
9/1/2002	1.86E+00	1.02E+00	6.66667	3.69833	6.67	3.70	8.7	15.37	12.40
9/2/2002	1.60E+00	8.64E-01	2.47056	1.35111	2.47	1.35	8.7	11.17	10.05
9/3/2002	1.35E+00	7.47E-01	5.15117	2.59111	5.15	2.59	8.7	13.85	11.29
9/4/2002	1.27E+00	6.98E-01	1.71111	0.96389	1.71	0.96	8.7	10.41	9.66
9/5/2002	2.36E+00	1.28E+00	2.32194	1.26629	2.36	1.28	5.8	8.16	7.08
9/6/2002	3.13E-02	1.75E-02	6.92583	3.80635	6.93	3.81	5.8	12.73	9.61
9/7/2002	1.69E+00	9.32E-01	8.2	4.52845	8.20	4.53	5.8	14.00	10.33
9/8/2002	1.54E+00	8.42E-01	0.75889	0.00001	1.54	0.84	5.8	7.34	6.64
9/9/2002	1.18E+00	6.55E-01	6.05278	3.04167	6.05	3.04	5.8	11.85	8.84
9/10/2002	9.65E-01	5.15E-01	4.68191	2.56238	4.68	2.56	5.8	10.48	8.36
9/11/2002	2.96E+00	1.64E+00	9.10646	5.00495	9.11	5.00	5.6	14.71	10.60
9/12/2002	6.06E-01	3.33E-01	7.5155	4.03278	7.52	4.03	5.6	13.12	9.63
9/13/2002	8.98E-01	4.87E-01	1.95407	0.99283	1.95	0.99	5.6	7.55	6.59
9/14/2002	1.38E+00	7.55E-01	3.42	1.93389	3.42	1.93	5.6	9.02	7.53
9/15/2002	1.30E+00	7.21E-01	2.41167	1.32613	2.41	1.33	5.6	8.01	6.93
9/16/2002	1.83E+00	9.85E-01	2.62778	0	2.63	0.99	5.6	8.23	6.59
9/17/2002	7.44E-01	4.00E-01	0.25778	0.05811	0.74	0.40	7.5	8.24	7.90
9/18/2002	2.26E+00	1.24E+00	9.08804	5.02406	9.09	5.02	7.5	16.59	12.52
9/19/2002	1.85E+00	1.02E+00	2.56944	1.41	2.57	1.41	7.5	10.07	8.91
9/20/2002	2.81E+00	1.55E+00	5.66111	3.05611	5.66	3.06	7.5	13.16	10.56
9/21/2002	2.02E+00	1.10E+00	5.1432	2.81875	5.14	2.82	7.5	12.64	10.32
9/22/2002	1.48E+00	8.17E-01	6.13306	2.94833	6.13	2.95	7.5	13.63	10.45
9/23/2002	4.31E+00	2.39E+00	1.45	0.79444	4.31	2.39	9.1	13.41	11.49
9/24/2002	1.39E+00	7.74E-01	5.43669	2.98389	5.44	2.98	9.1	14.54	12.08
9/25/2002	1.62E+00	8.95E-01	2.75706	1.56889	2.76	1.57	9.1	11.86	10.67
9/26/2002	6.34E-01	3.44E-01	4.77	2.575	4.77	2.58	9.1	13.87	11.68
9/27/2002	1.20E+00	6.59E-01	7.6	4.19556	7.60	4.20	9.1	16.70	13.30
9/28/2002	5.92E-01	3.23E-01	2.09491	1.0303	2.09	1.03	9.1	11.19	10.13
9/29/2002	1.11E+00	6.10E-01	12.3635	6.74169	12.36	6.74	5.1	17.46	11.84
9/30/2002	2.16E+00	1.20E+00	1.82444	0.97923	2.16	1.20	5.1	7.26	6.30
10/1/2002	1.56E+00	8.61E-01	5.38556	2.94425	5.39	2.94	5.1	10.49	8.04
10/2/2002	2.20E+00	1.22E+00	9.67778	5.34611	9.68	5.35	5.1	14.78	10.45
10/3/2002	1.40E+00	7.76E-01	3.06778	1.75056	3.07	1.75	5.1	8.17	6.85
10/4/2002	1.31E+00	7.29E-01	19.43718	10.86722	19.44	10.87	5.1	24.54	15.97
10/5/2002	1.49E+00	8.16E-01	8.34422	4.5485	8.34	4.55	7.1	15.44	11.65
10/6/2002	2.38E+00	1.29E+00	0.188	0.09578	2.38	1.29	7.1	9.48	8.39
10/7/2002	8.44E-01	4.67E-01	2.42056	1.325	2.42	1.33	7.1	9.52	8.43
10/8/2002	1.44E+00	7.91E-01	0.49217	0.27067	1.44	0.79	7.1	8.54	7.89
10/9/2002	1.40E+00	7.57E-01	0	0	1.40	0.76	7.1	8.50	7.86
10/10/2002	8.46E-01	4.69E-01	9.45002	5.17333	9.45	5.17	7.1	16.55	12.27
10/11/2002	1.08E+00	6.00E-01	1.43722	0.79278	1.44	0.79	10.6	12.04	11.39
10/12/2002	7.44E-01	4.01E-01	0	0	0.74	0.40	10.6	11.34	11.00
10/13/2002	8.86E-01	4.89E-01	1.47889	0.81222	1.48	0.81	10.6	12.08	11.41

	HBRP, AERMOD Flat Terrain		HBRP, CTDMPLUS		MAX (AERMOD/CTDMPLUS)		Measured	Total Impact	
Date	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Background	Diesel Mode	Nat. Gas Mode
10/14/2002	1.36E+00	7.46E-01	4.64992	2.53278	4.65	2.53	10.6	15.25	13.13
10/15/2002	4.48E-01	2.42E-01	3.62333	1.74987	3.62	1.75	10.6	14.22	12.35
10/16/2002	6.75E-01	3.66E-01	2.16244	1.09046	2.16	1.09	10.6	12.76	11.69
10/17/2002	6.91E-01	3.78E-01	0.35861	0.19667	0.69	0.38	8.7	9.39	9.08
10/18/2002	1.12E+00	6.14E-01	2.26222	1.22778	2.26	1.23	8.7	10.96	9.93
10/19/2002	4.78E-01	2.57E-01	9.25013	5.08923	9.25	5.09	8.7	17.95	13.79
10/20/2002	5.57E-01	3.08E-01	9.1604	5.03956	9.16	5.04	8.7	17.86	13.74
10/21/2002	2.13E+00	1.19E+00	3.78623	1.69044	3.79	1.69	8.7	12.49	10.39
10/22/2002	2.74E-01	1.50E-01	1.2717	0.69694	1.27	0.70	8.7	9.97	9.40
10/23/2002	8.86E-01	4.88E-01	0.94856	0.53383	0.95	0.53	6.6	7.55	7.13
10/24/2002	6.31E-01	3.47E-01	0.38208	0.11122	0.63	0.35	6.6	7.23	6.95
10/25/2002	1.09E+00	5.91E-01	1.75944	0.96944	1.76	0.97	6.6	8.36	7.57
10/26/2002	1.89E-02	1.41E-02	0.15728	0.09006	0.16	0.09	6.6	6.76	6.69
10/27/2002	7.07E-01	3.96E-01	0.04178	0.02383	0.71	0.40	6.6	7.31	7.00
10/28/2002	1.84E+00	1.02E+00	0.46206	0.25244	1.84	1.02	6.6	8.44	7.62
10/29/2002	1.19E+00	6.51E-01	9.12222	5.01056	9.12	5.01	8.6	17.72	13.61
10/30/2002	1.32E+00	7.33E-01	1.05667	0.58111	1.32	0.73	8.6	9.92	9.33
10/31/2002	1.47E+00	8.14E-01	0.00992	0.0055	1.47	0.81	8.6	10.07	9.41
11/1/2002	8.59E-01	4.65E-01	2.92011	1.61389	2.92	1.61	8.6	11.52	10.21
11/2/2002	3.43E+00	1.90E+00	0.88167	0	3.43	1.90	8.6	12.03	10.50
11/3/2002	7.06E-01	3.79E-01	2.78389	1.56056	2.78	1.56	8.6	11.38	10.16
11/4/2002	1.00E+00	5.54E-01	2.29528	1.24453	2.30	1.24	12.0	14.30	13.24
11/5/2002	3.01E+00	1.65E+00	0.66296	0.069	3.01	1.65	12.0	15.01	13.65
11/6/2002	9.34E+00	5.17E+00	0.16594	0.09111	9.34	5.17	12.0	21.34	17.17
11/7/2002	9.32E+00	5.16E+00	0.2048	0.02196	9.32	5.16	12.0	21.32	17.16
11/8/2002	1.59E+00	8.57E-01	0.21538	0.01079	1.59	0.86	12.0	13.59	12.86
11/9/2002	2.17E+00	1.20E+00	0.42387	0.0305	2.17	1.20	12.0	14.17	13.20
11/10/2002	1.92E+00	1.06E+00	2.48413	1.33222	2.48	1.33	8.1	10.58	9.43
11/11/2002	1.66E+00	9.09E-01	1.84301	1.02056	1.84	1.02	8.1	9.94	9.12
11/12/2002	3.12E+00	1.70E+00	7.31278	4.05578	7.31	4.06	8.1	15.41	12.16
11/13/2002	1.01E+00	5.61E-01	2.90194	1.61589	2.90	1.62	8.1	11.00	9.72
11/14/2002	1.61E+00	8.90E-01	0.45306	0.24661	1.61	0.89	8.1	9.71	8.99
11/15/2002	1.44E+00	7.86E-01	1.46044	0.80327	1.46	0.80	8.1	9.56	8.90
11/16/2002	2.88E+00	1.59E+00	1.0519	0.57715	2.88	1.59	17.7	20.58	19.29
11/17/2002	7.28E-01	4.03E-01	5.59444	3.05889	5.59	3.06	17.7	23.29	20.76
11/18/2002	9.75E-01	5.43E-01	2.51	1.36778	2.51	1.37	17.7	20.21	19.07
11/19/2002	8.86E-01	4.83E-01	1.26	0.68889	1.26	0.69	17.7	18.96	18.39
11/20/2002	1.05E+00	5.79E-01	0.69944	0.39256	1.05	0.58	17.7	18.75	18.28
11/21/2002	1.39E+00	7.60E-01	1.32278	0.72056	1.39	0.76	17.7	19.09	18.46
11/22/2002	1.59E+00	8.80E-01	2.43111	1.32889	2.43	1.33	13.1	15.53	14.43
11/23/2002	1.07E+00	5.95E-01	0.58222	0.31322	1.07	0.59	13.1	14.17	13.69
11/24/2002	5.40E-01	3.00E-01	12.51259	5.71907	12.51	5.72	13.1	25.61	18.82
11/25/2002	9.51E-01	5.23E-01	2.51722	1.38556	2.52	1.39	13.1	15.62	14.49
11/26/2002	4.02E-01	2.19E-01	6.92778	3.78167	6.93	3.78	13.1	20.03	16.88
11/27/2002	9.00E-01	5.00E-01	2.64944	1.45611	2.65	1.46	13.1	15.75	14.56
11/28/2002	1.16E+00	6.35E-01	0.00073	0.00041	1.16	0.64	22.6	23.76	23.24
11/29/2002	1.27E+00	7.03E-01	0	0	1.27	0.70	22.6	23.87	23.30
11/30/2002	1.56E+00	8.65E-01	0	0	1.56	0.86	22.6	24.16	23.46
12/1/2002	9.24E-01	5.13E-01	0	0	0.92	0.51	22.6	23.52	23.11
12/2/2002	1.13E+00	6.25E-01	1.03556	0.59	1.13	0.62	22.6	23.73	23.22
12/3/2002	1.20E+00	6.57E-01	1.14111	0.62556	1.20	0.66	22.6	23.80	23.26
12/4/2002	2.66E+00	1.47E+00	5.56111	3.09889	5.56	3.10	6.8	12.36	9.90
12/5/2002	1.06E+00	5.83E-01	1.2472	0.66889	1.25	0.67	6.8	8.05	7.47
12/6/2002	7.88E-01	4.35E-01	2.39	1.30944	2.39	1.31	6.8	9.19	8.11
12/7/2002	6.50E-01	3.60E-01	2.54778	1.39444	2.55	1.39	6.8	9.35	8.19
12/8/2002	2.02E+00	1.10E+00	6.03333	3.36167	6.03	3.36	6.8	12.83	10.16
12/9/2002	4.44E+00	2.45E+00	0.85348	0.46592	4.44	2.45	6.8	11.24	9.25
12/10/2002	1.65E+00	9.16E-01	0.00147	0	1.65	0.92	15.3	16.90	16.17
12/11/2002	4.14E+00	2.24E+00	0.00066	0	4.14	2.24	15.3	19.39	17.49
12/12/2002	1.49E+01	8.19E+00	0.00024	0	14.89	8.19	15.3	30.14	23.44
12/13/2002	7.01E+00	3.85E+00	1.03909	0.565	7.01	3.85	15.3	22.26	19.10
12/14/2002	1.42E+01	7.84E+00	0.00007	0.00001	14.24	7.84	15.3	29.49	23.09
12/15/2002	1.40E+01	7.77E+00	0.00001	0.00001	14.04	7.77	15.3	29.29	23.02
12/16/2002	4.27E+00	2.40E+00	1.1128	0.59948	4.27	2.40	15.3	19.52	17.65
12/17/2002	1.00E+00	5.62E-01	3.30091	1.78045	3.30	1.78	15.3	18.55	17.03
12/18/2002	9.03E+00	5.02E+00	0	0.00001	9.03	5.02	15.3	24.28	20.27
12/19/2002	1.48E+01	8.20E+00	0.00194	0	14.78	8.20	15.3	30.03	23.45
12/20/2002	4.85E+00	2.67E+00	0.54701	0.09553	4.85	2.67	15.3	20.10	17.92
12/21/2002	5.67E-01	3.06E-01	0.46556	0.00017	0.57	0.31	15.3	15.82	15.56
12/22/2002	7.11E-01	3.91E-01	0.23667	0	0.71	0.39	23.7	24.41	24.09
12/23/2002	9.52E-01	5.25E-01	0	0	0.95	0.52	23.7	24.65	24.22
12/24/2002	2.02E+00	1.11E+00	0.51239	0.18891	2.02	1.11	23.7	25.72	24.81
12/25/2002	1.34E+01	7.38E+00	0.0073	0.00411	13.38	7.38	23.7	37.08	31.08
12/26/2002	1.12E+01	6.14E+00	0.0172	0.00002	11.17	6.14	23.7	34.87	29.84
12/27/2002	4.29E+00	2.34E+00	5.88899	3.5341	5.89	3.53	23.7	29.59	27.23
12/28/2002	1.75E+00	9.53E-01	0.11239	0.00067	1.75	0.95	3.2	4.95	4.15
12/29/2002	4.48E+00	2.46E+00	0.20329	0.04597	4.48	2.46	3.2	7.68	5.66
12/30/2002	1.69E+01	9.36E+00	0.00001	0.00001	16.92	9.36	3.2	20.12	12.56
12/31/2002	1.93E+00	1.05E+00	1.67113	0.93773	1.93	1.05	3.2	5.13	4.25
8th highest value								29.29	23.45

Date	HBRP, AERMOD Flat Terrain		HBRP, CTDMPLUS		MAX (AERMOD/CTDMPLUS)		Measured	Total Impact	
	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Background	Diesel Mode	Nat. Gas Mode
1/1/2003	4.78E+00	2.61E+00	0.56	0.30705	4.78	2.61	3.2	7.98	5.81
1/2/2003	1.30E+01	7.17E+00	0.00016	0.00001	13.05	7.17	3.2	16.25	10.37
1/3/2003	1.24E+00	6.77E-01	2.71556	1.50611	2.72	1.51	7.2	9.92	8.71
1/4/2003	6.08E+00	3.35E+00	2.49906	1.22889	6.08	3.35	7.2	13.28	10.55
1/5/2003	2.82E+00	1.57E+00	0.26372	0.14389	2.82	1.57	7.2	10.02	8.77
1/6/2003	2.88E-01	1.56E-01	0	0	0.29	0.16	7.2	7.49	7.36
1/7/2003	1.33E+00	7.21E-01	0	0	1.33	0.72	7.2	8.53	7.92
1/8/2003	7.09E-01	3.89E-01	1.39944	0.76778	1.40	0.77	7.2	8.60	7.97
1/9/2003	3.20E+00	1.78E+00	1.22222	0.66778	3.20	1.78	11.2	14.40	12.98
1/10/2003	2.50E+00	1.34E+00	0.96739	0.52739	2.50	1.34	11.2	13.70	12.54
1/11/2003	8.04E+00	4.38E+00	0.00004	0	8.04	4.38	11.2	19.24	15.58
1/12/2003	1.01E+01	5.55E+00	0.00031	0	10.14	5.55	11.2	21.34	16.75
1/13/2003	6.68E-03	5.74E-03	1.81667	0.99778	1.82	1.00	11.2	13.02	12.20
1/14/2003	4.83E-01	2.69E-01	3.12871	1.711	3.13	1.71	11.2	14.33	12.91
1/15/2003	9.32E-01	5.18E-01	2.477	1.40918	2.48	1.41	3.6	6.08	5.01
1/16/2003	1.31E+00	7.27E-01	1.63778	0.00259	1.64	0.73	3.6	5.24	4.33
1/17/2003	2.75E+00	1.52E+00	0	0	2.75	1.52	3.6	6.35	5.12
1/18/2003	3.93E+00	2.17E+00	1.54389	0.84778	3.93	2.17	3.6	7.53	5.77
1/19/2003	1.27E+00	7.03E-01	1.82486	1.01782	1.82	1.02	3.6	5.42	4.62
1/20/2003	1.03E+00	5.73E-01	1.39889	0.79056	1.40	0.79	3.6	5.00	4.39
1/21/2003	6.12E+00	3.37E+00	0.00653	0.00035	6.12	3.37	1.6	7.72	4.97
1/22/2003	8.37E+00	4.61E+00	0.26721	0.09861	8.37	4.61	1.6	9.97	6.21
1/23/2003	9.51E-01	5.16E-01	0.29539	0.16211	0.95	0.52	1.6	2.55	2.12
1/24/2003	2.76E+00	1.52E+00	0	0	2.76	1.52	1.6	4.36	3.12
1/25/2003	5.63E-01	3.12E-01	2.54134	1.3818	2.54	1.38	1.6	4.14	2.98
1/26/2003	1.01E+00	5.59E-01	3.48452	1.90144	3.48	1.90	1.6	5.08	3.50
1/27/2003	6.94E-01	3.83E-01	8.49322	4.88188	8.49	4.88	3.8	12.29	8.68
1/28/2003	1.19E+00	6.48E-01	2.95944	1.61667	2.96	1.62	3.8	6.76	5.42
1/29/2003	4.19E-01	2.24E-01	2.64311	1.44889	2.64	1.45	3.8	6.44	5.25
1/30/2003	8.82E-01	4.75E-01	4.95624	2.6502	4.96	2.65	3.8	8.76	6.45
1/31/2003	4.32E-01	2.34E-01	0.91138	0.38817	0.91	0.39	3.8	4.71	4.19
2/1/2003	1.03E+00	5.63E-01	9.45303	5.40538	9.45	5.41	3.8	13.25	9.21
2/2/2003	1.17E+00	6.44E-01	4.61877	2.4088	4.62	2.41	20.0	24.57	22.36
2/3/2003	1.35E+00	7.42E-01	6.80122	3.70457	6.80	3.70	20.0	26.75	23.65
2/4/2003	1.28E+00	7.04E-01	2.65222	1.45778	2.65	1.46	20.0	22.60	21.41
2/5/2003	9.86E-01	5.47E-01	1.4501	0.79672	1.45	0.80	20.0	21.40	20.75
2/6/2003	6.86E-01	3.78E-01	0.01089	0.00604	0.69	0.38	20.0	20.64	20.33
2/7/2003	8.00E-01	4.33E-01	1.19056	0.65556	1.19	0.66	20.0	21.14	20.61
2/8/2003	8.04E-01	4.44E-01	0	0	0.80	0.44	36.1	36.90	36.54
2/9/2003	1.40E+00	7.76E-01	0.45028	0	1.40	0.78	36.1	37.50	36.88
2/10/2003	1.07E+00	5.94E-01	0	0.00021	1.07	0.59	36.1	37.17	36.69
2/11/2003	2.52E+00	1.39E+00	2.32833	1.31333	2.52	1.39	36.1	38.62	37.49
2/12/2003	4.11E-01	2.28E-01	1.47444	0.81	1.47	0.81	36.1	37.57	36.91
2/13/2003	3.85E-02	2.47E-02	10.40072	5.70478	10.40	5.70	36.1	46.50	41.80
2/14/2003	1.77E+00	9.78E-01	0.90206	0.45206	1.77	0.98	7.1	8.87	8.08
2/15/2003	6.57E+00	3.59E+00	0.10445	0.05691	6.57	3.59	7.1	13.67	10.69
2/16/2003	5.00E+00	2.75E+00	0.26046	0.06287	5.00	2.75	7.1	12.10	9.85
2/17/2003	8.83E-01	4.80E-01	0.26978	0.06194	0.88	0.48	7.1	7.98	7.58
2/18/2003	2.28E+00	1.25E+00	0.13172	0.06655	2.28	1.25	7.1	9.38	8.35
2/19/2003	7.72E-01	4.18E-01	3.01826	1.6617	3.02	1.66	7.1	10.12	8.76
2/20/2003	1.10E+00	6.07E-01	1.37556	0.40439	1.38	0.61	10.4	11.78	11.01
2/21/2003	8.22E-01	4.57E-01	2.80075	1.57691	2.80	1.58	10.4	13.20	11.98
2/22/2003	1.03E-01	5.69E-02	5.24814	2.86912	5.25	2.87	10.4	15.65	13.27
2/23/2003	1.03E+00	5.69E-01	0	0	1.03	0.57	10.4	11.43	10.97
2/24/2003	1.10E+00	6.07E-01	7.46398	4.11583	7.46	4.12	10.4	17.86	14.52
2/25/2003	9.93E-01	5.45E-01	3.40172	1.92989	3.40	1.93	10.4	13.80	12.33
2/26/2003	6.42E-01	3.49E-01	0.48539	0.1896	0.64	0.35	7.3	7.94	7.65
2/27/2003	1.78E+00	9.83E-01	0.68167	0.37589	1.78	0.98	7.3	9.08	8.28
2/28/2003	2.01E+00	1.10E+00	4.57002	2.53183	4.57	2.53	7.3	11.87	9.83
3/1/2003	1.64E+00	9.00E-01	0.67959	0.38175	1.64	0.90	7.3	8.94	8.20
3/2/2003	1.00E+00	5.47E-01	8.03809	4.47586	8.04	4.48	7.3	15.34	11.78
3/3/2003	1.83E+00	1.01E+00	0.96231	0.51951	1.83	1.01	7.3	9.13	8.31
3/4/2003	1.86E+00	1.03E+00	1.09709	0.59764	1.86	1.03	7.3	9.16	8.33
3/5/2003	1.81E+00	1.00E+00	5.65611	3.10661	5.66	3.11	7.3	12.96	10.41
3/6/2003	6.41E-01	3.52E-01	4.27659	2.39781	4.28	2.40	7.3	11.58	9.70
3/7/2003	1.08E+00	6.84E-01	1.58203	0.47656	1.58	0.68	7.3	8.88	7.98
3/8/2003	2.76E+00	1.53E+00	1.78161	0.92333	2.76	1.53	7.3	10.06	8.83
3/9/2003	7.28E+00	3.98E+00	0.53739	0.29013	7.28	3.98	7.3	14.58	11.28
3/10/2003	7.78E-01	4.29E-01	1.36325	0.63937	1.36	0.64	4.2	5.56	4.84
3/11/2003	1.85E+00	1.02E+00	5.35374	2.89404	5.35	2.89	4.2	9.55	7.09
3/12/2003	1.10E+01	6.13E+00	2.1368	1.23106	11.04	6.13	1.5	12.54	7.63
3/13/2003	7.25E+00	4.04E+00	0.24104	0.00237	7.25	4.04	1.5	8.75	5.54
3/14/2003	1.09E+01	6.05E+00	0.00177	0.00001	10.89	6.05	1.5	12.39	7.55
3/15/2003	2.87E+00	1.61E+00	0.32414	0.15773	2.87	1.61	1.5	4.37	3.11
3/16/2003	2.49E+00	1.38E+00	2.86786	0.28294	2.87	1.38	5.2	8.07	6.58
3/17/2003	2.44E+00	1.35E+00	2.61389	1.43	2.61	1.43	5.2	7.81	6.63
3/18/2003	1.27E+00	6.99E-01	0.44822	0.02676	1.27	0.70	5.2	6.47	5.90
3/19/2003	7.10E+00	3.95E+00	0.3015	0.1668	7.10	3.95	5.2	12.30	9.15
3/20/2003	1.51E+00	8.30E-01	0.62378	0.23544	1.51	0.83	5.2	6.71	6.03
3/21/2003	2.95E+00	1.63E+00	0.41829	0.10089	2.95	1.63	5.2	8.15	6.83
3/22/2003	2.46E+00	1.36E+00	0.36094	0.19978	2.46	1.36	13.3	15.76	14.66
3/23/2003	4.30E+00	2.38E+00	5.55464	3.34713	5.55	3.35	13.3	18.85	16.65
3/24/2003	1.63E+00	8.97E-01	1.44127	0.79332	1.63	0.90	13.3	14.93	14.20
3/25/2003	3.62E+00	2.01E+00	0.28856	0.15728	3.62	2.01	13.3	16.92	15.31
3/26/2003	9.93E-01	5.45E-01	7.47505	4.07389	7.48	4.07	13.3	20.78	17.37
3/27/2003	2.47E+00	1.36E+00	1.17225	0.63279	2.47	1.36	13.3	15.77	14.66
3/28/2003	1.23E+00	6.75E-01	0.62222	0.00348	1.23	0.67	7.4	8.63	8.07
3/29/2003	8.99E-01	4.87E-01	0	0	0.90	0.49	7.4	8.30	7.89
3/30/2003	1.33E+00	7.27E-01	2.06334	1.13445	2.06	1.13	7.4	9.46	8.53
3/31/2003	1.29E+00	7.15E-01	8.48728	4.74025	8.49	4.74	7.4	15.89	12.14
4/1/2003	2.28E+00	1.27E+00	3.71667	2.09333	3.72	2.09	7.4	11.12	9.49
4/2/2003	1.63E+00	8.86E-01	5.23	2.905	5.23	2.91	7.4	12.63	10.31

Date	HBRP, AERMOD Flat Terrain Diesel Mode	HBRP, AERMOD Flat Terrain Nat. Gas Mode	HBRP, CTDMPLUS Diesel Mode	HBRP, CTDMPLUS Nat. Gas Mode	MAX (AERMOD/CTDMPLUS) Diesel Mode	MAX (AERMOD/CTDMPLUS) Nat. Gas Mode	Measured Background	Total Impact Diesel Mode	Total Impact Nat. Gas Mode
4/3/2003	4.29E+00	2.40E+00	0.25257	0.09877	4.29	2.40	2.5	6.79	4.90
4/4/2003	1.59E+00	8.90E-01	4.28479	2.39907	4.28	2.40	2.5	6.78	4.90
4/5/2003	1.00E+00	5.44E-01	0.26433	0.05833	1.00	0.54	2.5	3.50	3.04
4/6/2003	1.50E+00	8.25E-01	1.03731	0.30511	1.50	0.83	2.5	4.00	3.33
4/7/2003	1.02E+00	5.50E-01	2.58367	1.245	2.58	1.25	2.5	5.08	3.75
4/8/2003	5.36E+00	3.00E+00	5.415	2.945	5.42	3.00	2.5	7.92	5.50
4/9/2003	1.38E+00	7.56E-01	16.41411	8.77111	16.41	8.77	5.8	22.21	14.57
4/10/2003	1.76E+00	9.61E-01	1.33706	0.29225	1.76	0.96	5.8	7.56	6.76
4/11/2003	1.75E+00	9.60E-01	2.725	1.51056	2.73	1.51	5.8	8.53	7.31
4/12/2003	5.77E+00	3.18E+00	0.04787	0.02665	5.77	3.18	5.8	11.57	8.98
4/13/2003	2.38E+00	1.34E+00	0.36067	0.13828	2.38	1.34	5.8	8.18	7.14
4/14/2003	2.56E+00	1.41E+00	0.18911	0.10523	2.56	1.41	5.8	8.36	7.21
4/15/2003	2.46E+00	1.36E+00	0.26677	0.0571	2.46	1.36	3.4	5.86	4.76
4/16/2003	3.57E+00	1.98E+00	0.6258	0.07542	3.57	1.98	3.4	6.97	5.38
4/17/2003	1.41E+00	7.86E-01	6.59643	3.68444	6.60	3.68	3.4	10.00	7.08
4/18/2003	2.46E+00	1.36E+00	2.17495	1.16096	2.46	1.36	3.4	5.86	4.76
4/19/2003	2.40E+00	1.32E+00	0.28848	0.00033	2.40	1.32	3.4	5.80	4.72
4/20/2003	2.20E+00	1.21E+00	1.3233	0.7118	2.20	1.21	3.4	5.60	4.61
4/21/2003	1.70E+00	9.42E-01	8.62947	4.78001	8.63	4.78	3.1	11.73	7.88
4/22/2003	1.25E+00	6.89E-01	10.18097	5.63088	10.18	5.63	3.1	13.28	8.73
4/23/2003	8.01E+00	4.47E+00	0.67183	0.36541	8.01	4.47	3.1	11.11	7.57
4/24/2003	3.13E+00	1.73E+00	0.38247	0.12069	3.13	1.73	3.1	6.23	4.83
4/25/2003	7.50E+00	4.14E+00	0.31059	0.09426	7.50	4.14	3.1	10.60	7.24
4/26/2003	2.69E+00	1.51E+00	0.07017	0.00663	2.69	1.51	3.1	5.79	4.61
4/27/2003	6.81E+00	3.75E+00	0.01094	0.0061	6.81	3.75	2.7	9.51	6.45
4/28/2003	6.01E+00	3.31E+00	0	0	6.01	3.31	2.7	8.71	6.01
4/29/2003	5.28E+00	2.90E+00	0.45761	0.15258	5.28	2.90	2.7	7.98	5.60
4/30/2003	3.75E+00	2.07E+00	0.302	0.12294	3.75	2.07	3.5	7.25	5.57
5/1/2003	1.64E+00	9.02E-01	0.66167	0.16172	1.64	0.90	3.5	5.14	4.40
5/2/2003	1.15E+00	6.30E-01	2.91556	0	2.92	0.63	3.5	6.42	4.13
5/3/2003	1.14E+00	6.26E-01	1.97847	1.09732	1.98	1.10	6.7	8.68	7.80
5/4/2003	1.53E+00	8.42E-01	4.85389	2.63611	4.85	2.64	6.7	11.55	9.34
5/5/2003	2.57E+00	1.42E+00	4.55556	2.52278	4.56	2.52	6.7	11.26	9.22
5/6/2003	1.05E+00	5.75E-01	1.37167	0.76333	1.37	0.76	6.7	8.07	7.46
5/7/2003	2.12E+00	1.18E+00	14.37665	7.8714	14.38	7.87	6.7	21.08	14.57
5/8/2003	3.00E+00	1.66E+00	5.47033	2.98404	5.47	2.98	6.7	12.17	9.68
5/9/2003	8.16E-01	4.51E-01	1.04667	0	1.05	0.45	3.8	4.85	4.25
5/10/2003	1.15E-01	7.98E-02	3.82372	2.17805	3.82	2.18	3.8	7.62	5.98
5/11/2003	2.76E+00	1.53E+00	16.47691	9.08916	16.48	9.09	3.8	20.28	12.89
5/12/2003	3.08E+00	1.70E+00	9.41504	5.1769	9.42	5.18	3.8	13.22	8.98
5/13/2003	1.50E+00	8.25E-01	0.23633	0.09617	1.50	0.82	3.8	5.30	4.62
5/14/2003	2.21E+00	1.22E+00	15.87353	8.72638	15.87	8.73	3.8	19.67	12.53
5/15/2003	2.94E+00	1.63E+00	6.08967	2.92222	6.09	2.92	4.4	10.44	7.27
5/16/2003	1.80E-01	9.84E-02	4.05445	2.1997	4.05	2.20	4.4	8.40	6.55
5/17/2003	2.93E+00	1.63E+00	11.38123	6.54887	11.38	6.55	4.4	15.73	10.90
5/18/2003	3.22E+00	1.78E+00	5.1864	2.81895	5.19	2.82	4.4	9.54	7.17
5/19/2003	2.23E+00	1.23E+00	1.8455	1.03289	2.23	1.23	4.4	6.58	5.58
5/20/2003	1.24E-01	6.58E-02	5.44439	2.82014	5.44	2.82	4.4	9.79	7.17
5/21/2003	1.14E-01	6.20E-02	9.26838	5.08196	9.27	5.08	4.9	14.17	9.98
5/22/2003	1.72E+00	9.45E-01	8.38611	4.63611	8.39	4.64	4.9	13.29	9.54
5/23/2003	4.44E-02	3.29E-02	10.29267	5.50333	10.29	5.50	4.9	15.19	10.40
5/24/2003	2.38E+00	1.31E+00	3.33083	1.85752	3.33	1.86	4.9	8.23	6.76
5/25/2003	6.91E-01	3.77E-01	2.41278	1.33283	2.41	1.33	4.9	7.31	6.23
5/26/2003	3.27E+00	1.80E+00	3.86389	2.10278	3.86	2.10	4.9	8.76	7.00
5/27/2003	2.60E+00	1.43E+00	5.185	2.75278	5.19	2.75	5.8	10.99	8.55
5/28/2003	1.60E+00	8.86E-01	1.80111	1.02889	1.80	1.03	5.8	7.60	6.83
5/29/2003	8.86E-01	4.92E-01	1.11726	0.61502	1.12	0.62	5.8	6.92	6.42
5/30/2003	9.28E-01	5.07E-01	6.336	3.5358	6.34	3.54	5.8	12.14	9.34
5/31/2003	1.33E+00	7.45E-01	13.40609	7.36688	13.41	7.37	5.8	19.21	13.17
6/1/2003	2.11E+00	1.16E+00	9.31563	4.83506	9.32	4.84	5.8	15.12	10.64
6/2/2003	1.48E+00	8.16E-01	6.71672	3.71823	6.72	3.72	15.5	22.22	19.22
6/3/2003	2.30E+00	1.26E+00	0.35561	0.13611	2.30	1.26	15.5	17.80	16.76
6/4/2003	9.85E-01	5.42E-01	4.43214	2.48669	4.43	2.49	15.5	19.93	17.99
6/5/2003	3.27E-02	2.23E-02	10.79717	5.87417	10.80	5.87	15.5	26.30	21.37
6/6/2003	1.14E+00	6.24E-01	12.26636	6.76251	12.27	6.76	15.5	27.77	22.26
6/7/2003	9.91E-01	5.43E-01	19.7535	10.85746	19.75	10.86	15.5	35.25	26.36
6/8/2003	9.41E-01	5.13E-01	6.14015	3.39453	6.14	3.39	10.3	16.39	13.64
6/9/2003	2.39E+00	1.32E+00	11.28613	6.00384	11.29	6.00	10.3	21.54	16.25
6/10/2003	1.66E+00	9.15E-01	9.63489	5.26503	9.63	5.27	10.3	19.88	15.52
6/11/2003	7.67E-01	4.20E-01	12.94508	6.48392	12.95	6.48	10.3	23.20	16.73
6/12/2003	1.10E+00	6.05E-01	16.08113	8.62815	16.08	8.63	10.3	26.33	18.88
6/13/2003	2.16E+00	1.18E+00	11.57567	5.89304	11.58	5.89	10.3	21.83	16.14
6/14/2003	2.85E+00	1.57E+00	23.42222	12.84722	23.42	12.85	10.3	33.67	23.10
6/15/2003	2.01E+00	1.11E+00	9.50453	5.22005	9.50	5.22	10.3	19.75	15.47
6/16/2003	1.39E+00	7.56E-01	12.64554	6.37689	12.65	6.38	10.3	22.90	16.63
6/17/2003	1.03E+00	5.69E-01	12.27248	6.76727	12.27	6.77	10.3	22.52	17.02
6/18/2003	8.56E-01	4.77E-01	4.26876	2.41181	4.27	2.41	10.3	14.52	12.66
6/19/2003	1.60E+00	8.92E-01	18.83422	10.3267	18.83	10.33	10.3	29.08	20.58
6/20/2003	3.11E+00	1.71E+00	33.21056	18.30722	33.21	18.31	10.3	43.46	28.56
6/21/2003	2.47E+00	1.37E+00	18.96611	10.399	18.97	10.40	10.3	29.22	20.65
6/22/2003	2.37E+00	1.31E+00	5.29258	2.89558	5.29	2.90	10.3	15.54	13.15
6/23/2003	2.57E+00	1.42E+00	9.09499	4.99261	9.09	4.99	10.3	19.34	15.24
6/24/2003	3.56E+00	1.98E+00	3.1652	1.72393	3.56	1.98	10.3	13.81	12.23
6/25/2003	1.55E+00	8.40E-01	0.86539	0.3375	1.55	0.84	10.3	11.80	11.09
6/26/2003	1.60E+00	8.71E-01	4.29425	2.33167	4.29	2.33	10.3	14.54	12.58
6/27/2003	2.94E+00	1.60E+00	2.51498	1.37333	2.94	1.60	10.3	13.19	11.85
6/28/2003	1.66E+00	9.01E-01	0	0	1.66	0.90	10.3	11.91	11.15
6/29/2003	3.64E+00	2.02E+00	5.49671	3.02	5.50	3.02	10.3	15.75	13.27
6/30/2003	1.95E+00	1.07E+00	10.02149	5.59892	10.02	5.60	10.3	20.27	15.85
7/1/2003	1.56E+00	8.56E-01	6.07331	3.07667	6.07	3.08	10.3	16.32	13.33
7/2/2003	2.83E+00	1.55E+00	1.4339	0.78446	2.83	1.55	10.3	13.08	11.80
7/3/2003	1.74E+00	9.56E-01	1.56317	0.70356	1.74	0.96	10.3	11.99	11.21
7/4/2003	8.44E-01	4.70E-01	4.3082	2.45553	4.31	2.46	10.3	14.56	12.71
7/5/2003	7.83E-01	4.29E-01	3.53088	1.85318	3.53	1.85	10.3	13.78	12.10
7/6/2003	1.45E+00	7.88E-01	4.44552	1.94623	4.45	1.95	10.3	14.70	12.20
7/7/2003	1.78E+00	9.63E-01	12.93333	7.26167	12.93	7.26	10.3	23.18	17.51
7/8/2003	2.68E+00	1.47E+00	6.15842	3.33038	6.16	3.33	5.0	11.16	8.33

Date	HBRP, AERMOD Flat Terrain Diesel Mode	HBRP, AERMOD Flat Terrain Nat. Gas Mode	HBRP, CTDMPLUS Diesel Mode	HBRP, CTDMPLUS Nat. Gas Mode	MAX (AERMOD/CTDMPLUS) Diesel Mode	MAX (AERMOD/CTDMPLUS) Nat. Gas Mode	Measured Background	Total Impact Diesel Mode	Total Impact Nat. Gas Mode
7/9/2003	1.81E+00	9.91E-01	1.87389	1.02278	1.87	1.02	5.0	6.87	6.02
7/10/2003	3.09E+00	1.69E+00	0.90278	0.24206	3.09	1.69	5.0	8.09	6.69
7/11/2003	1.16E+00	6.33E-01	0.82278	0.44994	1.16	0.63	5.0	6.16	5.63
7/12/2003	1.66E+00	8.97E-01	7.4365	4.08372	7.44	4.08	5.0	12.44	9.08
7/13/2003	2.04E+00	1.12E+00	19.49328	10.607	19.49	10.61	5.0	24.49	15.61
7/14/2003	4.53E+00	2.51E+00	9.93681	5.46177	9.94	5.46	4.4	14.34	9.86
7/15/2003	8.77E-01	4.82E-01	12.82948	7.03684	12.83	7.04	4.4	17.23	11.44
7/16/2003	2.30E+00	1.27E+00	15.94504	8.77777	15.95	8.78	4.4	20.35	13.18
7/17/2003	1.37E+00	7.48E-01	1.61333	0.87778	1.61	0.88	4.4	6.01	5.28
7/18/2003	5.32E-01	2.92E-01	13.39294	7.34733	13.39	7.35	4.4	17.79	11.75
7/19/2003	1.26E+00	6.87E-01	17.62011	9.67791	17.62	9.68	4.4	22.02	14.08
7/20/2003	1.31E+00	7.19E-01	10.296	5.57188	10.30	5.57	4.4	14.70	9.97
7/21/2003	1.30E+00	7.09E-01	1.75303	0.9702	1.75	0.97	4.4	6.15	5.37
7/22/2003	1.40E+00	7.68E-01	1.57678	0.87	1.58	0.87	4.4	5.98	5.27
7/23/2003	1.57E+00	8.61E-01	1.48678	0.74881	1.57	0.86	4.4	5.97	5.26
7/24/2003	1.47E+00	8.04E-01	1.21012	0.6651	1.47	0.80	4.4	5.87	5.20
7/25/2003	1.52E+00	8.38E-01	4.63496	2.59991	4.63	2.60	4.4	9.03	7.00
7/26/2003	7.49E-01	4.10E-01	3.09696	1.70106	3.10	1.70	7.7	10.80	9.40
7/27/2003	1.27E+00	7.09E-01	13.37778	7.23889	13.38	7.24	7.7	21.08	14.94
7/28/2003	5.84E-03	3.86E-03	1.46167	0.80889	1.46	0.81	7.7	9.16	8.51
7/29/2003	3.94E-02	2.11E-02	2.62778	1.43722	2.63	1.44	7.7	10.33	9.14
7/30/2003	1.17E+00	6.45E-01	2.62934	1.48798	2.63	1.49	7.7	10.33	9.19
7/31/2003	3.83E+00	2.11E+00	0.98469	0.39261	3.83	2.11	7.7	11.53	9.81
8/1/2003	1.54E+00	8.46E-01	3.5169	1.87883	3.52	1.88	10.3	13.82	12.18
8/2/2003	7.60E-01	4.18E-01	1.44389	0.73	1.44	0.73	10.3	11.74	11.03
8/3/2003	9.07E-01	4.91E-01	4.59778	1.92794	4.60	1.93	10.3	14.90	12.23
8/4/2003	1.69E+00	9.33E-01	1.49461	0.72912	1.69	0.93	10.3	11.99	11.23
8/5/2003	1.29E+00	7.10E-01	2.30872	1.22339	2.31	1.22	10.3	12.61	11.52
8/6/2003	1.22E+00	6.66E-01	3.08	1.51694	3.08	1.52	10.3	13.38	11.82
8/7/2003	2.03E+00	1.11E+00	0	0	2.03	1.11	7.1	9.13	8.21
8/8/2003	2.22E+00	1.22E+00	2.04525	1.12333	2.22	1.22	7.1	9.32	8.32
8/9/2003	3.54E+00	1.93E+00	2.61111	1.41944	3.54	1.93	7.1	10.64	9.03
8/10/2003	3.07E+00	1.69E+00	5.39556	1.58611	5.40	1.69	7.1	12.50	8.79
8/11/2003	2.40E+00	1.31E+00	0.79	0.41172	2.40	1.31	7.1	9.50	8.41
8/12/2003	1.88E+00	1.03E+00	9.16648	5.00131	9.17	5.00	7.1	16.27	12.10
8/13/2003	1.14E+00	6.27E-01	7.14359	3.9752	7.14	3.98	6.1	13.24	10.08
8/14/2003	2.46E+00	1.35E+00	2.1521	0.81004	2.46	1.35	6.1	8.56	7.45
8/15/2003	3.05E+00	1.67E+00	10.14761	5.52389	10.15	5.52	6.1	16.25	11.62
8/16/2003	1.35E+00	7.32E-01	8.28747	4.67335	8.29	4.67	6.1	14.39	10.77
8/17/2003	5.77E-01	3.13E-01	3.04017	1.60068	3.04	1.60	6.1	9.14	7.70
8/18/2003	1.37E+00	7.54E-01	7.07343	3.76825	7.07	3.77	6.1	13.17	9.87
8/19/2003	8.69E-01	4.80E-01	6.56244	3.63314	6.56	3.63	8.2	14.76	11.83
8/20/2003	6.45E+00	3.58E+00	2.77241	1.46178	6.45	3.58	8.2	14.65	11.78
8/21/2003	9.81E-01	5.32E-01	9.35556	5.13944	9.36	5.14	8.2	17.56	13.34
8/22/2003	7.67E-01	4.18E-01	9.26128	4.95558	9.26	4.96	8.2	17.46	13.16
8/23/2003	1.85E+00	1.01E+00	2.13336	1.21756	2.13	1.22	8.2	10.33	9.42
8/24/2003	1.49E+00	8.24E-01	0.00564	0.00325	1.49	0.82	8.2	9.69	9.02
8/25/2003	2.06E+00	1.13E+00	3.27316	1.75907	3.27	1.76	5.9	9.17	7.66
8/26/2003	1.77E+00	9.67E-01	13.86901	7.42118	13.87	7.42	5.9	19.77	13.32
8/27/2003	1.78E+00	9.74E-01	7.80226	4.26034	7.80	4.26	5.9	13.70	10.16
8/28/2003	1.04E+00	5.73E-01	15	8.26278	15.00	8.26	5.9	20.90	14.16
8/29/2003	1.24E+00	6.90E-01	7.02667	3.71111	7.03	3.71	5.9	12.93	9.61
8/30/2003	1.18E+00	6.49E-01	2.1248	1.11975	2.12	1.12	6.3	8.42	7.42
8/31/2003	2.48E+00	1.36E+00	3.59544	1.51022	3.60	1.51	6.3	9.90	7.81
9/1/2003	1.57E+00	8.63E-01	2.04498	1.11476	2.04	1.11	6.3	8.34	7.41
9/2/2003	2.16E+00	1.18E+00	4.29449	2.4228	4.29	2.42	6.3	10.59	8.72
9/3/2003	1.25E+00	6.89E-01	3.85514	2.17458	3.86	2.17	6.3	10.16	8.47
9/4/2003	6.71E-01	3.65E-01	4.00342	2.20283	4.00	2.20	6.3	10.30	8.50
9/5/2003	9.37E-01	5.07E-01	5.7	3.155	5.70	3.16	6.3	12.00	9.46
9/6/2003	7.91E-01	4.35E-01	0.62564	0.26081	0.79	0.43	7.1	7.89	7.53
9/7/2003	4.77E-01	2.62E-01	1.73944	0.95556	1.74	0.96	7.1	8.84	8.06
9/8/2003	8.75E-01	4.86E-01	4.31722	2.45222	4.32	2.45	7.1	11.42	9.55
9/9/2003	6.72E-01	3.76E-01	0.66858	0.17628	0.67	0.38	7.1	7.77	7.48
9/10/2003	2.48E+00	1.36E+00	7.20938	3.99072	7.21	3.99	7.1	14.31	11.09
9/11/2003	2.41E+00	1.31E+00	2.99612	1.74015	3.00	1.74	7.1	10.10	8.84
9/12/2003	1.64E+00	9.01E-01	2.47778	1.35444	2.48	1.35	8.0	10.48	9.35
9/13/2003	7.17E-01	3.86E-01	0.66489	0.25828	0.72	0.39	8.0	8.72	8.39
9/14/2003	9.34E-01	5.05E-01	2.36428	1.25278	2.36	1.25	8.0	10.36	9.25
9/15/2003	1.03E+00	5.67E-01	0.4789	0.19417	1.03	0.57	8.0	9.03	8.57
9/16/2003	1.23E+00	6.75E-01	2.61397	1.14231	2.61	1.14	8.0	10.61	9.14
9/17/2003	3.60E+00	1.99E+00	2.6941	1.65567	3.60	1.99	8.0	11.60	9.99
9/18/2003	1.34E+00	7.27E-01	5.032	2.74556	5.03	2.75	7.1	12.13	9.85
9/19/2003	1.65E+00	9.15E-01	4.83444	2.70944	4.83	2.71	7.1	11.93	9.81
9/20/2003	3.51E-01	1.93E-01	0.77567	0.40011	0.78	0.40	7.1	7.88	7.50
9/21/2003	1.33E+00	7.34E-01	2.93167	1.58667	2.93	1.59	7.1	10.03	8.69
9/22/2003	1.74E+00	9.51E-01	2.45778	1.34667	2.46	1.35	7.1	9.56	8.45
9/23/2003	2.30E+00	1.26E+00	4.23336	2.30944	4.23	2.31	7.1	11.33	9.41
9/24/2003	7.26E-01	4.03E-01	12.3682	6.78073	12.37	6.78	8.2	20.57	14.98
9/25/2003	1.58E-01	8.64E-02	1.93373	0.96278	1.93	0.96	8.2	10.13	9.16
9/26/2003	4.54E-02	2.55E-02	10.19389	5.68278	10.19	5.68	8.2	18.39	13.88
9/27/2003	4.44E-01	2.46E-01	7.45787	4.10623	7.46	4.11	8.2	15.66	12.31
9/28/2003	1.35E+00	7.40E-01	2.25667	1.29333	2.26	1.29	8.2	10.46	9.49
9/29/2003	1.33E+00	7.26E-01	1.24111	0.67389	1.33	0.73	8.2	9.53	8.93
9/30/2003	9.58E-01	5.31E-01	2.57821	1.39967	2.58	1.40	3.6	6.18	5.00
10/1/2003	5.10E-01	2.83E-01	1.07022	0.512	1.07	0.51	3.6	4.67	4.11
10/2/2003	1.40E+00	7.82E-01	0.17878	0.0001	1.40	0.78	3.6	5.00	4.38
10/3/2003	9.02E-01	4.98E-01	3.86333	2.10167	3.86	2.10	3.6	7.46	5.70
10/4/2003	6.91E-01	3.75E-01	6.39	3.47833	6.39	3.48	3.6	9.99	7.08
10/5/2003	1.31E+00	7.23E-01	2.5185	1.34599	2.52	1.35	3.6	6.12	4.95
10/6/2003	1.56E+00	8.59E-01	1.18261	0.58889	1.56	0.86	8.3	9.86	9.16
10/7/2003	1.39E+00	7.65E-01	8.07018	4.42916	8.07	4.43	8.3	16.37	12.73
10/8/2003	6.05E-01	3.35E-01	9.07492	4.98784	9.07	4.99	8.3	17.37	13.29
10/9/2003	1.32E+00	7.19E-01	5.45556	3.05833	5.46	3.06	8.3	13.76	11.36
10/10/2003	2.27E+00	1.24E+00	1.29184	0.70587	2.27	1.24	8.3	10.57	9.54
10/11/2003	8.13E-01	4.50E-01	2.87956	1.57521	2.88	1.58	8.3	11.18	9.88
10/12/2003	1.49E+00	8.17E-01	4.40892	1.75995	4.41	1.76	10.1	14.51	11.86
10/13/2003	6.27E-01	3.37E-01	2.33611	1.28889	2.34	1.29	10.1	12.44	11.39

Date	HBRP, AERMOD Flat Terrain		HBRP, CTDMPLUS		MAX (AERMOD/CTDMPLUS)		Measured	Total Impact	
	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Background	Diesel Mode	Nat. Gas Mode
10/14/2003	1.54E+00	8.55E-01	3.4005	1.86875	3.40	1.87	10.1	13.50	11.97
10/15/2003	1.46E+00	7.94E-01	1.8085	1.04684	1.81	1.05	10.1	11.91	11.15
10/16/2003	1.28E+00	7.04E-01	2.59558	1.36444	2.60	1.36	10.1	12.70	11.46
10/17/2003	2.39E+00	1.29E+00	0.67124	0.33683	2.39	1.29	10.1	12.49	11.39
10/18/2003	8.08E-01	4.48E-01	4.41615	2.31289	4.42	2.31	12.6	17.02	14.91
10/19/2003	4.84E-01	2.63E-01	3.59514	2.01859	3.60	2.02	12.6	16.20	14.62
10/20/2003	1.77E+00	9.68E-01	5.09667	2.83056	5.10	2.83	12.6	17.70	15.43
10/21/2003	3.61E-02	1.98E-02	1.20111	0.65278	1.20	0.65	12.6	13.80	13.25
10/22/2003	1.30E+00	7.15E-01	5.96612	3.27244	5.97	3.27	12.6	18.57	15.87
10/23/2003	2.06E+00	1.13E+00	5.78572	3.15094	5.79	3.15	12.6	18.39	15.75
10/24/2003	1.13E+00	6.22E-01	1.275	0.69333	1.28	0.69	11.7	12.98	12.39
10/25/2003	1.18E+00	6.42E-01	0.52461	0.13122	1.18	0.64	11.7	12.88	12.34
10/26/2003	9.52E-01	5.22E-01	0	0	0.95	0.52	11.7	12.65	12.22
10/27/2003	3.30E+00	1.83E+00	3.41372	1.85394	3.41	1.85	11.7	15.11	13.55
10/28/2003	1.57E+00	8.61E-01	2.5567	2.36682	2.56	2.37	11.7	14.26	14.07
10/29/2003	1.06E+00	5.81E-01	9.44139	5.19576	9.44	5.20	11.7	21.14	16.90
10/30/2003	2.51E+00	1.38E+00	0.2535	0.0487	2.51	1.38	10.8	13.31	12.18
10/31/2003	1.52E+00	8.36E-01	0.21256	0.10711	1.52	0.84	10.8	12.32	11.64
11/1/2003	6.93E-01	3.82E-01	9.35117	5.14706	9.35	5.15	10.8	20.15	15.95
11/2/2003	1.64E+00	9.07E-01	0.79368	0.43542	1.64	0.91	10.8	12.44	11.71
11/3/2003	1.23E+00	6.79E-01	1.52478	0.00498	1.52	0.68	10.8	12.32	11.48
11/4/2003	4.61E-01	2.54E-01	0	0	0.46	0.25	10.8	11.26	11.05
11/5/2003	5.85E-01	3.19E-01	2.94846	1.60546	2.95	1.61	8.0	10.95	9.61
11/6/2003	5.59E+00	3.07E+00	2.9925	1.6825	5.59	3.07	8.0	13.59	11.07
11/7/2003	3.79E+00	2.07E+00	1.83721	0.98178	3.79	2.07	8.0	11.79	10.07
11/8/2003	4.41E+00	2.43E+00	0.00004	0.00003	4.41	2.43	8.0	12.41	10.43
11/9/2003	4.44E+00	2.46E+00	0.28018	0.0001	4.44	2.46	8.0	12.44	10.46
11/10/2003	1.14E+00	6.30E-01	0.725	0.39972	1.14	0.63	8.0	9.14	8.63
11/11/2003	1.10E+00	6.16E-01	3.54839	1.94039	3.55	1.94	14.3	17.85	16.24
11/12/2003	9.87E-01	5.39E-01	0.39122	0.21572	0.99	0.54	14.3	15.29	14.84
11/13/2003	1.43E+00	7.99E-01	5.42333	3.05389	5.42	3.05	14.3	19.72	17.35
11/14/2003	6.67E+00	3.67E+00	0.43478	0.09554	6.67	3.67	14.3	20.97	17.97
11/15/2003	1.86E+00	1.04E+00	0.17154	0.09529	1.86	1.04	14.3	16.16	15.34
11/16/2003	2.22E+00	1.23E+00	2.40778	1.31722	2.41	1.32	14.3	16.71	15.62
11/17/2003	7.83E-01	4.33E-01	3.645	1.99	3.65	1.99	21.8	25.45	23.79
11/18/2003	6.86E-01	3.78E-01	0.16147	0.02587	0.69	0.38	21.8	22.49	22.18
11/19/2003	9.84E-01	5.41E-01	4.20531	2.3191	4.21	2.32	21.8	26.01	24.12
11/20/2003	9.78E-01	5.44E-01	2.12111	1.15833	2.12	1.16	21.8	23.92	22.96
11/21/2003	8.45E-01	4.66E-01	2.54778	1.39389	2.55	1.39	21.8	24.35	23.19
11/22/2003	1.09E+00	5.97E-01	1.25167	0.67222	1.25	0.67	21.8	23.05	22.47
11/23/2003	7.38E-01	4.07E-01	0.53228	0.2895	0.74	0.41	18.7	19.44	19.11
11/24/2003	1.94E+00	1.08E+00	1.38	0.76056	1.94	1.08	18.7	20.64	19.78
11/25/2003	5.66E-01	3.10E-01	1.31451	0.75878	1.31	0.76	18.7	20.01	19.46
11/26/2003	4.02E-01	2.20E-01	0.51344	0.28333	0.51	0.28	18.7	19.21	18.98
11/27/2003	4.66E-01	2.56E-01	0.70333	0.35878	0.70	0.36	18.7	19.40	19.06
11/28/2003	1.44E+01	7.90E+00	0	0	14.36	7.90	18.7	33.06	26.60
11/29/2003	7.04E+00	3.85E+00	1.38619	0.77095	7.04	3.85	3.4	10.44	7.25
11/30/2003	6.21E-03	1.28E-02	1.47889	0.80778	1.48	0.81	3.4	4.88	4.21
12/1/2003	6.97E-01	3.82E-01	0.61222	0.2515	0.70	0.38	3.4	4.10	3.78
12/2/2003	1.54E+00	8.51E-01	1.25135	0.51957	1.54	0.85	3.4	4.94	4.25
12/3/2003	5.07E-01	2.81E-01	1.43667	0.78167	1.44	0.78	3.4	4.84	4.18
12/4/2003	1.13E+01	6.25E+00	1.92451	1.05602	11.32	6.25	3.4	14.72	9.65
12/5/2003	3.70E+00	2.02E+00	0.73273	0.40014	3.70	2.02	3.0	6.70	5.02
12/6/2003	1.03E+00	5.68E-01	1.39608	0.77532	1.40	0.78	3.0	4.40	3.78
12/7/2003	9.56E-01	6.84E-01	5.96605	3.24533	5.97	3.25	3.0	8.97	6.25
12/8/2003	6.93E-01	3.85E-01	1.582	0.87044	1.58	0.87	3.0	4.58	3.87
12/9/2003	8.82E+00	4.90E+00	5.64348	3.17087	8.82	4.90	3.0	11.82	7.90
12/10/2003	8.95E-01	4.92E-01	0.77087	0.41078	0.89	0.49	3.0	3.89	3.49
12/11/2003	9.72E-01	5.32E-01	0.18906	0.0176	0.97	0.53	7.6	8.57	8.13
12/12/2003	4.31E+00	2.34E+00	0.11073	0.00236	4.31	2.34	7.6	11.91	9.94
12/13/2003	1.03E+01	5.63E+00	1.57826	0.85565	10.27	5.63	7.6	17.87	13.23
12/14/2003	6.20E-01	3.42E-01	0.71389	0.11292	0.71	0.34	7.6	8.31	7.94
12/15/2003	6.33E-01	3.52E-01	0	0	0.63	0.35	7.6	8.23	7.95
12/16/2003	2.78E+00	1.54E+00	2.16546	1.18864	2.78	1.54	7.6	10.38	9.14
12/17/2003	3.64E-01	2.02E-01	0	0	0.36	0.20	34.7	35.06	34.90
12/18/2003	1.06E+00	5.89E-01	1.155	0.63444	1.16	0.63	34.7	35.86	35.33
12/19/2003	2.48E+00	1.37E+00	2.998	1.6625	3.00	1.66	34.7	37.70	36.36
12/20/2003	4.00E-01	2.23E-01	2.42	1.32	2.42	1.32	34.7	37.12	36.02
12/21/2003	6.71E-01	3.69E-01	0.39989	0.21994	0.67	0.37	34.7	35.37	35.07
12/22/2003	6.75E-01	3.70E-01	0.00394	0.0022	0.67	0.37	34.7	35.37	35.07
12/23/2003	1.47E+01	8.10E+00	0	0	14.68	8.10	1.4	16.08	9.50
12/24/2003	2.44E+00	1.34E+00	0.43419	0.06815	2.44	1.34	1.4	3.84	2.74
12/25/2003	7.99E-01	4.43E-01	2.61333	1.43667	2.61	1.44	1.4	4.01	2.84
12/26/2003	1.16E+00	6.38E-01	0.85667	0.0029	1.16	0.64	1.4	2.56	2.04
12/27/2003	6.37E-01	3.56E-01	2.51332	1.38968	2.51	1.39	1.4	3.91	2.79
12/28/2003	8.75E+00	4.86E+00	0	0	8.75	4.86	1.4	10.15	6.26
12/29/2003	9.11E-01	5.02E-01	2.98042	1.62939	2.98	1.63	11.7	14.68	13.33
12/30/2003	6.88E-01	3.85E-01	4.62222	2.545	4.62	2.55	11.7	16.32	14.25
12/31/2003	2.90E+00	1.60E+00	0.59227	0.32509	2.90	1.60	11.7	14.60	13.30
8th highest value								37.12	36.02

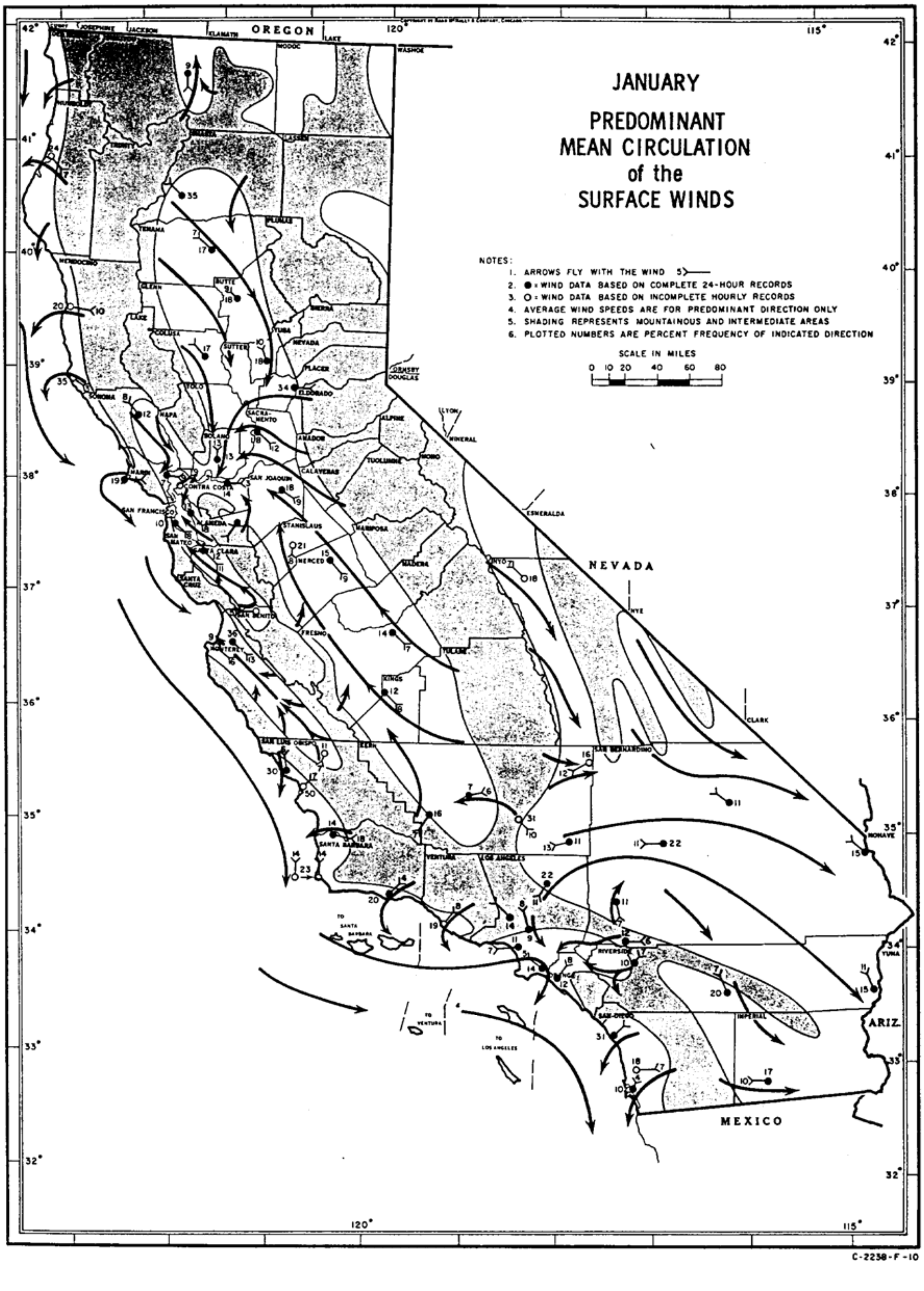
Date	HBRP, AERMOD Flat Terrain Diesel Mode	HBRP, AERMOD Flat Terrain Nat. Gas Mode	HBRP, CTDMPLUS Diesel Mode	HBRP, CTDMPLUS Nat. Gas Mode	MAX (AERMOD/CTDMPLUS) Diesel Mode	MAX (AERMOD/CTDMPLUS) Nat. Gas Mode	Measured Background	Total Impact Diesel Mode	Total Impact Nat. Gas Mode
1/1/2004	4.01E+00	2.21E+00	1.93558	1.02381	4.01	2.21	13.5	17.51	15.71
1/2/2004	2.16E+00	1.18E+00	0.20067	0.06061	2.16	1.18	13.5	15.66	14.68
1/3/2004	1.12E+00	6.16E-01	0.17035	0.08028	1.12	0.62	13.5	14.62	14.12
1/4/2004	1.22E+00	6.70E-01	0	0	1.22	0.67	13.4	14.62	14.07
1/5/2004	1.58E+00	8.74E-01	2.44	1.33833	2.44	1.34	13.4	15.84	14.74
1/6/2004	6.62E+00	3.64E+00	0.40507	0.10263	6.62	3.64	13.4	20.02	17.04
1/7/2004	1.42E+01	7.83E+00	0.00001	0.00001	14.21	7.83	13.4	27.61	21.23
1/8/2004	7.55E+00	4.12E+00	0.52208	0.28121	7.55	4.12	13.4	20.95	17.52
1/9/2004	7.07E+00	3.86E+00	0.0003	0	7.07	3.86	13.4	20.47	17.26
1/10/2004	4.09E-01	2.26E-01	2.58056	1.41222	2.58	1.41	13.3	15.88	14.71
1/11/2004	9.48E-01	5.22E-01	7.20894	3.92	7.21	3.92	13.3	20.51	17.22
1/12/2004	2.36E+00	1.29E+00	1.71545	0.96955	2.36	1.29	13.3	15.66	14.59
1/13/2004	2.41E+00	1.32E+00	0.24416	0.13563	2.41	1.32	13.3	15.71	14.62
1/14/2004	2.37E+00	1.29E+00	1.64475	0.90013	2.37	1.29	13.3	15.67	14.59
1/15/2004	5.66E-01	3.08E-01	4.82733	2.41343	4.83	2.41	13.3	18.13	15.71
1/16/2004	8.93E-01	4.92E-01	2.51334	1.37667	2.51	1.38	10.1	12.61	11.48
1/17/2004	4.03E-01	2.19E-01	1.38365	0.735	1.38	0.74	10.1	11.48	10.84
1/18/2004	3.60E-01	1.99E-01	14.12201	7.92234	14.12	7.92	10.1	24.22	18.02
1/19/2004	4.30E-01	2.37E-01	6.19498	3.39077	6.19	3.39	10.1	16.29	13.49
1/20/2004	1.06E+00	5.79E-01	5.86853	3.21039	5.87	3.21	10.1	15.97	13.31
1/21/2004	6.85E-01	3.74E-01	2.54333	1.39444	2.54	1.39	10.1	12.64	11.49
1/22/2004	3.20E-04	8.91E-03	0	0	0.00	0.01	12.0	12.00	12.01
1/23/2004	1.05E+00	5.71E-01	1.07889	0.58056	1.08	0.58	12.0	13.08	12.58
1/24/2004	1.27E+00	7.03E-01	2.40105	1.31842	2.40	1.32	12.0	14.40	13.32
1/25/2004	1.20E+00	6.65E-01	0.61	0.07872	1.20	0.66	12.0	13.20	12.66
1/26/2004	9.29E+00	5.13E+00	0	0	9.29	5.13	12.0	21.29	17.13
1/27/2004	8.73E-01	4.87E-01	7.71561	4.26348	7.72	4.26	12.0	19.72	16.26
1/28/2004	5.10E-01	2.78E-01	2.55234	1.22667	2.55	1.23	6.1	8.65	7.33
1/29/2004	3.36E+00	1.84E+00	2.55431	1.39444	3.36	1.84	6.1	9.46	7.94
1/30/2004	1.04E+00	5.67E-01	3.71778	2.03889	3.72	2.04	6.1	9.82	8.14
1/31/2004	7.30E-01	4.03E-01	0.39267	0.10078	0.73	0.40	6.1	6.83	6.50
2/1/2004	6.40E+00	3.51E+00	0.01926	0.01075	6.40	3.51	6.1	12.50	9.61
2/2/2004	6.42E+00	3.53E+00	0.00017	0.00001	6.42	3.53	6.1	12.52	9.63
2/3/2004	4.32E+00	2.37E+00	4.12542	2.13996	4.32	2.37	3.2	7.52	5.57
2/4/2004	1.13E+00	6.20E-01	2.45778	1.34056	2.46	1.34	3.2	5.66	4.54
2/5/2004	1.47E+00	8.15E-01	0.25694	0.141	1.47	0.81	3.2	4.67	4.01
2/6/2004	1.22E+00	6.65E-01	0.84167	0.45911	1.22	0.66	3.2	4.42	3.86
2/7/2004	1.39E+00	7.59E-01	1.58535	0.84084	1.59	0.84	3.2	4.79	4.04
2/8/2004	7.64E-01	4.16E-01	1.90803	0.00276	1.91	0.42	3.2	5.11	3.62
2/9/2004	9.25E-01	5.13E-01	0.49294	0.27461	0.92	0.51	0.4	1.32	0.91
2/10/2004	1.05E+00	5.71E-01	1.72817	0.89889	1.73	0.90	0.4	2.13	1.30
2/11/2004	1.73E+00	9.57E-01	0.67667	0.27433	1.73	0.96	0.4	2.13	1.36
2/12/2004	9.56E-01	5.27E-01	0.90167	0.48772	0.96	0.53	0.4	1.36	0.93
2/13/2004	5.98E+00	3.27E+00	0.00004	0.00002	5.98	3.27	0.4	6.38	3.67
2/14/2004	7.52E+00	4.15E+00	0.00155	0.00088	7.52	4.15	0.4	7.92	4.55
2/15/2004	8.56E+00	4.73E+00	0.00005	0.00001	8.56	4.73	1.1	9.66	5.83
2/16/2004	1.19E+01	6.59E+00	0.47056	0.11556	11.90	6.59	1.1	13.00	7.69
2/17/2004	6.56E+00	3.61E+00	0.01817	0.01006	6.56	3.61	1.1	7.66	4.71
2/18/2004	2.08E+00	1.15E+00	4.60138	2.2789	4.60	2.28	1.1	5.70	3.38
2/19/2004	7.35E-01	4.05E-01	5.18952	2.67044	5.19	2.67	1.1	6.29	3.77
2/20/2004	1.30E+00	7.16E-01	0	0	1.30	0.72	1.1	2.40	1.82
2/21/2004	6.17E-01	3.42E-01	1.5736	0.72111	1.57	0.72	3.7	5.27	4.42
2/22/2004	2.60E+00	1.45E+00	0.82611	0.18852	2.60	1.45	3.7	6.30	5.15
2/23/2004	3.24E+00	1.77E+00	4.39636	2.37045	4.40	2.37	3.7	8.10	6.07
2/24/2004	6.70E+00	3.71E+00	0.13294	0.01252	6.70	3.71	3.7	10.40	7.41
2/25/2004	1.60E+01	8.84E+00	0.00132	0.00077	15.96	8.84	3.7	19.66	12.54
2/26/2004	7.42E+00	4.06E+00	0.23883	0.06775	7.42	4.06	3.7	11.12	7.76
2/27/2004	5.81E-01	3.18E-01	0.59477	0.19257	0.59	0.32	6.3	6.89	6.62
2/28/2004	1.59E+00	8.77E-01	3.33444	1.83	3.33	1.83	6.3	9.63	8.13
2/29/2004	4.81E+00	2.66E+00	0.1363	0.05473	4.81	2.66	6.3	11.11	8.96
3/1/2004	1.33E+00	7.32E-01	5.64784	3.11511	5.65	3.12	6.3	11.95	9.42
3/2/2004	3.37E+00	1.87E+00	5.40131	4.10057	5.40	4.10	6.3	11.70	10.40
3/3/2004	1.40E+00	7.67E-01	21.01837	11.54361	21.02	11.54	6.3	27.32	17.84
3/4/2004	9.85E-01	5.50E-01	5.48129	3.07375	5.48	3.07	3.6	9.08	6.67
3/5/2004	1.52E+00	8.45E-01	0.49597	0.20235	1.52	0.84	3.6	5.12	4.44
3/6/2004	1.38E+00	7.54E-01	6.60556	3.57556	6.61	3.58	3.6	10.21	7.18
3/7/2004	9.95E-01	5.52E-01	9.3	5.19389	9.30	5.19	3.6	12.90	8.79
3/8/2004	1.82E+00	1.01E+00	2.44111	1.335	2.44	1.34	3.6	6.04	4.94
3/9/2004	2.45E+00	1.36E+00	5.03143	2.76463	5.03	2.76	3.6	8.63	6.36
3/10/2004	1.63E+00	9.00E-01	3.67106	2.07304	3.67	2.07	9.2	12.87	11.27
3/11/2004	1.04E+00	5.75E-01	3.72027	2.0606	3.72	2.06	9.2	12.92	11.26
3/12/2004	1.38E+00	7.59E-01	9.50257	5.23422	9.50	5.23	9.2	18.70	14.43
3/13/2004	1.26E+00	7.01E-01	11.72939	6.48958	11.73	6.49	9.2	20.93	15.69
3/14/2004	1.23E+00	6.88E-01	12.25189	6.76767	12.25	6.77	9.2	21.45	15.97
3/15/2004	1.72E+00	9.54E-01	7.87978	4.39504	7.88	4.40	9.2	17.08	13.60
3/16/2004	1.47E+00	8.14E-01	3.41628	1.91183	3.42	1.91	6.8	10.22	8.71
3/17/2004	2.14E+00	1.19E+00	0.00328	0.00188	2.14	1.19	6.8	8.94	7.99
3/18/2004	1.68E+00	9.30E-01	2.17161	1.19465	2.17	1.19	6.8	8.97	7.99
3/19/2004	1.51E+00	8.30E-01	7.15404	3.8969	7.15	3.90	6.8	13.95	10.70
3/20/2004	1.92E+00	1.06E+00	4.01333	0.22639	4.01	1.06	6.8	10.81	7.86
3/21/2004	1.46E+00	7.98E-01	4.24222	2.31389	4.24	2.31	6.8	11.04	9.11
3/22/2004	8.31E-01	4.55E-01	3.32516	1.56204	3.33	1.56	5.5	8.83	7.06
3/23/2004	1.67E+00	9.29E-01	9.64544	5.34833	9.65	5.35	5.5	15.15	10.85
3/24/2004	1.71E+00	9.43E-01	1.17816	0.27096	1.71	0.94	5.5	7.21	6.44
3/25/2004	7.09E+00	3.89E+00	0.31442	0.17596	7.09	3.89	3.7	10.79	7.59
3/26/2004	4.57E+00	2.53E+00	0.21071	0.1155	4.57	2.53	3.7	8.27	6.23
3/27/2004	1.56E+00	8.56E-01	0.94	0.51589	1.56	0.86	3.7	5.26	4.56
3/28/2004	1.08E+00	5.89E-01	0.66667	0.36367	1.08	0.59	8.3	9.38	8.89
3/29/2004	2.18E+00	1.22E+00	2.81604	1.40308	2.82	1.40	8.3	11.12	9.70
3/30/2004	2.14E+00	1.18E+00	11.64705	6.47768	11.65	6.48	8.3	19.95	14.78
3/31/2004	2.36E+00	1.31E+00	0.00082	0.00047	2.36	1.31	8.3	10.66	9.61
4/1/2004	2.79E+00	1.54E+00	1.38244	0.75328	2.79	1.54	8.3	11.09	9.84

Date	HBRP, AERMOD Flat Terrain Diesel Mode	Nat. Gas Mode	HBRP, CTDMPLUS Diesel Mode	Nat. Gas Mode	MAX (AERMOD/CTDMPLUS) Diesel Mode	Nat. Gas Mode	Measured Background	Total Impact Diesel Mode	Nat. Gas Mode
4/2/2004	2.71E+00	1.49E+00	0.36595	0.16139	2.71	1.49	8.3	11.01	9.79
4/3/2004	1.33E+00	7.32E-01	14.60731	8.1629	14.61	8.16	10.1	24.71	18.26
4/4/2004	1.67E+00	9.22E-01	8.96826	4.9379	8.97	4.94	10.1	19.07	15.04
4/5/2004	5.31E-01	2.92E-01	10.29684	5.54837	10.30	5.55	10.1	20.40	15.65
4/6/2004	9.16E-01	4.99E-01	1.54259	0.60234	1.54	0.60	10.1	11.64	10.70
4/7/2004	2.17E+00	1.18E+00	12.89951	7.06767	12.90	7.07	10.1	23.00	17.17
4/8/2004	6.34E-01	3.52E-01	2.73725	1.53352	2.74	1.53	10.1	12.84	11.63
4/9/2004	7.76E-01	4.27E-01	3.20944	1.74444	3.21	1.74	12.2	15.41	13.94
4/10/2004	1.71E+00	9.46E-01	0.528	0.2875	1.71	0.95	12.2	13.91	13.15
4/11/2004	2.01E+00	1.11E+00	3.57662	1.70789	3.58	1.71	12.2	15.78	13.91
4/12/2004	8.97E-01	4.96E-01	3.52	2.00056	3.52	2.00	12.2	15.72	14.20
4/13/2004	3.63E+00	2.02E+00	0.99742	0.48	3.63	2.02	12.2	15.83	14.22
4/14/2004	3.22E+00	1.79E+00	0.72064	0.14917	3.22	1.79	12.2	15.42	13.99
4/15/2004	3.46E+00	1.88E+00	0.94942	0.17534	3.46	1.88	3.7	7.16	5.58
4/16/2004	4.13E+00	2.28E+00	3.95222	1.92722	4.13	2.28	3.7	7.83	5.98
4/17/2004	2.69E+00	1.48E+00	0.52245	0.21389	2.69	1.48	3.7	6.39	5.18
4/18/2004	6.41E+00	3.56E+00	0.0011	0.00064	6.41	3.56	3.7	10.11	7.26
4/19/2004	8.90E+00	4.93E+00	0.22218	0.02108	8.90	4.93	3.7	12.60	8.63
4/20/2004	4.74E+00	2.63E+00	0.76591	0.42123	4.74	2.63	3.7	8.44	6.33
4/21/2004	1.77E+00	9.79E-01	2.09434	1.07594	2.09	1.08	5.7	7.79	6.78
4/22/2004	1.64E+00	8.99E-01	1.67789	0.95948	1.68	0.96	5.7	7.38	6.66
4/23/2004	2.16E+00	1.20E+00	7.05556	3.96279	7.06	3.96	5.7	12.76	9.66
4/24/2004	2.41E+00	1.33E+00	0.58778	0.32433	2.41	1.33	5.7	8.11	7.03
4/25/2004	2.03E+00	1.12E+00	6.78233	3.60833	6.78	3.61	5.7	12.48	9.31
4/26/2004	2.36E+00	1.30E+00	0	0	2.36	1.30	5.7	8.06	7.00
4/27/2004	1.64E+00	9.09E-01	5.66001	3.1444	5.66	3.14	10.8	16.46	13.94
4/28/2004	3.75E+00	2.08E+00	5.61748	3.07223	5.62	3.07	10.8	16.42	13.87
4/29/2004	2.98E+00	1.64E+00	0	0	2.98	1.64	10.8	13.78	12.44
4/30/2004	2.86E+00	1.57E+00	3.45519	1.95211	3.46	1.95	10.8	14.26	12.75
5/1/2004	1.29E+00	7.02E-01	6.3	3.48833	6.30	3.49	10.8	17.10	14.29
5/2/2004	1.69E+00	9.42E-01	2.33333	1.28167	2.33	1.28	10.8	13.13	12.08
5/3/2004	1.05E+00	5.80E-01	34.11761	18.74847	34.12	18.75	7.8	41.92	26.55
5/4/2004	2.20E+00	1.22E+00	0.39056	0.09278	2.20	1.22	7.8	10.00	9.02
5/5/2004	2.25E+00	1.24E+00	2.43213	1.32685	2.43	1.33	7.8	10.23	9.13
5/6/2004	3.85E+00	2.14E+00	1.42692	0.69944	3.85	2.14	7.8	11.65	9.94
5/7/2004	6.23E+00	3.43E+00	0.65077	0.18634	6.23	3.43	7.8	14.03	11.23
5/8/2004	4.26E+00	2.34E+00	0.84857	0.46202	4.26	2.34	7.8	12.06	10.14
5/9/2004	2.24E+00	1.24E+00	9.57482	4.99525	9.57	5.00	4.7	14.27	9.70
5/10/2004	2.44E+00	1.36E+00	9.6238	4.66687	9.62	4.67	4.7	14.32	9.37
5/11/2004	2.35E+00	1.29E+00	11.62023	6.34618	11.62	6.35	4.7	16.32	11.05
5/12/2004	2.48E+00	1.37E+00	2.68938	1.46767	2.69	1.47	4.7	7.39	6.17
5/13/2004	2.91E+00	1.60E+00	6.71939	3.51225	6.72	3.51	4.7	11.42	8.21
5/14/2004	3.22E+00	1.78E+00	28.64425	15.84778	28.64	15.85	4.7	33.34	20.55
5/15/2004	1.70E+00	9.37E-01	9.80386	5.38943	9.80	5.39	3.6	13.40	8.99
5/16/2004	1.84E+00	1.02E+00	7.92421	4.37089	7.92	4.37	3.6	11.52	7.97
5/17/2004	6.93E-01	3.76E-01	12.37889	6.76	12.38	6.76	3.6	15.98	10.36
5/18/2004	1.11E+00	6.06E-01	11.58938	6.48249	11.59	6.48	3.6	15.19	10.08
5/19/2004	3.11E+00	1.71E+00	2.50556	1.37191	3.11	1.71	3.6	6.71	5.31
5/20/2004	6.72E-01	3.67E-01	15.99253	8.92091	15.99	8.92	3.6	19.59	12.52
5/21/2004	2.05E+00	1.13E+00	22.2405	12.24236	22.24	12.24	4.3	26.54	16.54
5/22/2004	2.43E+00	1.34E+00	11.2044	6.27525	11.20	6.28	4.3	15.50	10.58
5/23/2004	2.77E+00	1.53E+00	6.62994	3.52249	6.63	3.52	4.3	10.93	7.82
5/24/2004	2.27E+00	1.25E+00	1.87513	0.97222	2.27	1.25	4.3	6.57	5.55
5/25/2004	1.72E+00	9.45E-01	3.57794	1.98117	3.58	1.98	4.3	7.88	6.28
5/26/2004	2.32E+00	1.28E+00	1.05411	0.53867	2.32	1.28	4.3	6.62	5.58
5/27/2004	2.36E+00	1.31E+00	5.09286	2.82783	5.09	2.83	2.6	7.69	5.43
5/28/2004	2.57E+00	1.42E+00	3.41203	1.90056	3.41	1.90	2.6	6.01	4.50
5/29/2004	2.43E+00	1.35E+00	8.43611	4.75222	8.44	4.75	2.6	11.04	7.35
5/30/2004	3.23E+00	1.77E+00	7.55556	4.17833	7.56	4.18	2.6	10.16	6.78
5/31/2004	3.38E+00	1.85E+00	14.51763	7.93057	14.52	7.93	2.6	17.12	10.53
6/1/2004	2.53E+00	1.38E+00	3.66611	2.04889	3.67	2.05	2.6	6.27	4.65
6/2/2004	1.84E+00	1.01E+00	8.91222	4.84667	8.91	4.85	5.0	13.91	9.85
6/3/2004	4.84E-01	2.63E-01	13.60894	7.32556	13.61	7.33	5.0	18.61	12.33
6/4/2004	1.25E+00	6.93E-01	8.12402	4.50654	8.12	4.51	5.0	13.12	9.51
6/5/2004	2.60E+00	1.43E+00	2.07024	1.14347	2.60	1.43	5.0	7.60	6.43
6/6/2004	1.18E+00	6.46E-01	3.6887	2.10056	3.69	2.10	5.0	8.69	7.10
6/7/2004	2.66E+00	1.47E+00	5.55599	3.13188	5.56	3.13	5.0	10.56	8.13
6/8/2004	2.34E+00	1.30E+00	24.58308	13.59114	24.58	13.59	4.8	29.38	18.39
6/9/2004	1.18E+00	6.56E-01	11.75201	6.51905	11.75	6.52	4.8	16.55	11.32
6/10/2004	2.60E+00	1.44E+00	18.56358	10.12063	18.56	10.12	4.8	23.36	14.92
6/11/2004	3.23E+00	1.78E+00	13.7189	7.50703	13.72	7.51	4.8	18.52	12.31
6/12/2004	2.76E+00	1.52E+00	4.00062	2.27137	4.00	2.27	4.8	8.80	7.07
6/13/2004	1.63E+00	8.92E-01	3.87117	2.13003	3.87	2.13	4.8	8.67	6.93
6/14/2004	2.66E+00	1.48E+00	14.84446	8.12386	14.84	8.12	7.2	22.04	15.32
6/15/2004	2.84E+00	1.56E+00	5.92056	3.24756	5.92	3.25	7.2	13.12	10.45
6/16/2004	2.02E+00	1.11E+00	2.38722	1.26667	2.39	1.27	7.2	9.59	8.47
6/17/2004	1.72E+00	9.45E-01	2.38889	1.30333	2.39	1.30	7.2	9.59	8.50
6/18/2004	1.53E+00	8.31E-01	7.35582	4.04516	7.36	4.05	7.2	14.56	11.25
6/19/2004	5.07E-01	2.84E-01	7.15519	4.0378	7.16	4.04	7.2	14.36	11.24
6/20/2004	9.83E-01	5.44E-01	17.23202	9.63592	17.23	9.64	4.0	21.23	13.64
6/21/2004	8.75E-01	4.84E-01	19.12894	10.59735	19.13	10.60	4.0	23.13	14.60
6/22/2004	7.54E-01	4.27E-01	14.65899	8.18391	14.66	8.18	4.0	18.66	12.18
6/23/2004	1.07E+00	5.85E-01	9.2752	5.17292	9.28	5.17	4.0	13.28	9.17
6/24/2004	1.18E+00	6.52E-01	5.99389	3.33856	5.99	3.34	4.0	9.99	7.34
6/25/2004	2.48E+00	1.36E+00	0	0	2.48	1.36	4.0	6.48	5.36
6/26/2004	2.36E+00	1.29E+00	8.8232	4.82458	8.82	4.82	3.1	11.92	7.92
6/27/2004	2.60E+00	1.44E+00	12.81289	7.42943	12.81	7.43	3.1	15.91	10.53
6/28/2004	1.25E+00	6.86E-01	2.18122	1.19287	2.18	1.19	3.1	5.28	4.29
6/29/2004	3.18E+00	1.77E+00	1.81992	1.04161	3.18	1.77	3.1	6.28	4.87
6/30/2004	1.39E+00	7.48E-01	0.79115	0.4175	1.39	0.75	3.1	4.49	3.85
7/1/2004	0.00E+00	0.00E+00	1.41483	0.29672	1.41	0.30	3.1	4.51	3.40
7/2/2004	1.19E-01	8.43E-02	9.64167	5.43522	9.64	5.44	5.3	14.94	10.74
7/3/2004	1.28E+00	7.03E-01	17.53159	9.49996	17.53	9.50	5.3	22.83	14.80
7/4/2004	1.85E+00	1.02E+00	5.51068	3.02895	5.51	3.03	5.3	10.81	8.33
7/5/2004	1.37E+00	7.52E-01	4.83117	2.6517	4.83	2.65	5.3	10.13	7.95
7/6/2004	1.68E+00	9.35E-01	8.94951	5.03418	8.95	5.03	5.3	14.25	10.33
7/7/2004	1.93E+00	1.07E+00	6.46028	3.5202	6.46	3.52	5.3	11.76	8.82

Date	HBRP, AERMOD Flat Terrain		HBRP, CTDMPLUS		MAX (AERMOD/CTDMPLUS)		Measured	Total Impact	
	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Diesel Mode	Nat. Gas Mode	Background	Diesel Mode	Nat. Gas Mode
7/8/2004	2.01E+00	1.10E+00	8.40436	4.70152	8.40	4.70	9.2	17.60	13.90
7/9/2004	4.10E+00	2.26E+00	3.60121	2.06117	4.10	2.26	9.2	13.30	11.46
7/10/2004	3.37E+00	1.86E+00	9.2063	5.12916	9.21	5.13	9.2	18.41	14.33
7/11/2004	1.61E+00	8.77E-01	4.11606	2.20065	4.12	2.20	9.2	13.32	11.40
7/12/2004	1.23E+00	6.76E-01	6.91128	3.73222	6.91	3.73	9.2	16.11	12.93
7/13/2004	1.91E-01	1.05E-01	0.98333	0.5315	0.98	0.53	9.2	10.18	9.73
7/14/2004	1.78E+00	9.77E-01	0.05028	0.00362	1.78	0.98	5.3	7.08	6.28
7/15/2004	2.47E+00	1.36E+00	1.39	0.79389	2.47	1.36	5.3	7.77	6.66
7/16/2004	1.13E+00	6.27E-01	11.0521	5.89496	11.05	5.89	5.3	16.35	11.19
7/17/2004	1.76E+00	9.59E-01	2.55908	1.35778	2.56	1.36	5.3	7.86	6.66
7/18/2004	3.14E+00	1.72E+00	4.98289	2.667	4.98	2.67	5.3	10.28	7.97
7/19/2004	4.07E+00	2.23E+00	9.19337	5.16216	9.19	5.16	5.3	14.49	10.46
7/20/2004	3.92E+00	2.15E+00	12.26918	6.581	12.27	6.58	3.6	15.87	10.18
7/21/2004	2.36E+00	1.29E+00	2.34834	1.27611	2.36	1.29	3.6	5.96	4.89
7/22/2004	1.10E+00	5.99E-01	7.41765	3.85906	7.42	3.86	3.6	11.02	7.46
7/23/2004	1.19E+00	6.50E-01	2.86	1.61556	2.86	1.62	3.6	6.46	5.22
7/24/2004	1.00E+00	5.51E-01	3.38455	1.67186	3.38	1.67	3.6	6.98	5.27
7/25/2004	1.68E+00	9.27E-01	7.52301	4.21722	7.52	4.22	3.6	11.12	7.82
7/26/2004	1.42E+00	7.91E-01	3.05505	1.68325	3.06	1.68	8.8	11.86	10.48
7/27/2004	9.63E-01	5.34E-01	5.08908	2.87078	5.09	2.87	8.8	13.89	11.67
7/28/2004	2.37E+00	1.31E+00	5.93096	3.24048	5.93	3.24	8.8	14.73	12.04
7/29/2004	1.16E+00	6.34E-01	1.46533	0.764	1.47	0.76	8.8	10.27	9.56
7/30/2004	7.61E-01	4.12E-01	4.52161	2.47903	4.52	2.48	8.8	13.32	11.28
7/31/2004	7.97E-01	4.37E-01	2.89657	1.5454	2.90	1.55	8.8	11.70	10.35
8/1/2004	1.66E+00	9.16E-01	10.36833	5.68556	10.37	5.69	5.5	15.87	11.19
8/2/2004	1.07E+00	5.77E-01	6.25235	3.63353	6.25	3.63	5.5	11.75	9.13
8/3/2004	2.27E+00	1.25E+00	5.34523	2.9872	5.35	2.99	5.5	10.85	8.49
8/4/2004	1.35E+00	7.34E-01	3.29065	1.82918	3.29	1.83	5.5	8.79	7.33
8/5/2004	3.25E+00	1.78E+00	2.02944	1.10833	3.25	1.78	5.5	8.75	7.28
8/6/2004	2.24E+00	1.24E+00	8.71778	4.94833	8.72	4.95	5.5	14.22	10.45
8/7/2004	1.53E+00	8.40E-01	7.66212	4.23645	7.66	4.24	4.5	12.16	8.74
8/8/2004	2.33E+00	1.29E+00	2.21238	1.09389	2.33	1.29	4.5	6.83	5.79
8/9/2004	1.08E+00	5.89E-01	15.695	8.66747	15.70	8.67	4.5	20.20	13.17
8/10/2004	7.40E-01	4.10E-01	5.55685	3.05572	5.56	3.06	4.5	10.06	7.56
8/11/2004	1.35E+00	7.49E-01	4.23843	2.30197	4.24	2.30	4.5	8.74	6.80
8/12/2004	1.13E+00	6.20E-01	1.57078	0.67151	1.57	0.67	4.5	6.07	5.17
8/13/2004	3.21E+00	1.78E+00	0.65728	0.31851	3.21	1.78	7.7	10.91	9.48
8/14/2004	8.39E-01	4.54E-01	8.51278	4.935	8.51	4.94	7.7	16.21	12.64
8/15/2004	1.49E+00	8.17E-01	3.79293	2.04833	3.79	2.05	7.7	11.49	9.75
8/16/2004	2.81E+00	1.54E+00	1.26316	0.68356	2.81	1.54	7.7	10.51	9.24
8/17/2004	8.59E-01	4.75E-01	8.18925	4.57902	8.19	4.58	7.7	15.89	12.28
8/18/2004	1.11E+00	6.10E-01	15.91612	8.91389	15.92	8.91	7.7	23.62	16.61
8/19/2004	1.62E+00	8.94E-01	4.47368	2.29335	4.47	2.29	7.2	11.67	9.49
8/20/2004	4.14E+00	2.29E+00	2.47074	1.31172	4.14	2.29	7.2	11.34	9.49
8/21/2004	1.73E+00	9.56E-01	3.92699	1.95594	3.93	1.96	7.2	11.13	9.16
8/22/2004	2.41E+00	1.33E+00	4.7	2.56172	4.70	2.56	7.2	11.90	9.76
8/23/2004	6.86E-01	3.65E-01	3.45175	1.86894	3.45	1.87	7.2	10.65	9.07
8/24/2004	1.89E+00	1.03E+00	3.92083	2.15035	3.92	2.15	7.2	11.12	9.35
8/25/2004	1.74E+00	9.51E-01	2.77783	1.40328	2.78	1.40	5.4	8.18	6.80
8/26/2004	2.59E+00	1.42E+00	4.92511	2.66659	4.93	2.67	5.4	10.33	8.07
8/27/2004	2.62E+00	1.44E+00	2.30111	1.28778	2.62	1.44	5.4	8.02	6.84
8/28/2004	2.68E+00	1.48E+00	2.21389	1.21444	2.68	1.48	5.4	8.08	6.88
8/29/2004	4.69E+00	2.60E+00	7.09497	3.86111	7.09	3.86	5.4	12.49	9.26
8/30/2004	1.01E+00	5.48E-01	4.56575	2.58037	4.57	2.58	5.4	9.97	7.98
8/31/2004	1.19E+00	6.55E-01	12.53699	6.65934	12.54	6.66	3.6	16.14	10.26
9/1/2004	1.67E+00	9.19E-01	15.46067	8.32796	15.46	8.33	3.6	19.06	11.93
9/2/2004	4.87E+00	2.68E+00	6.2495	3.45749	6.25	3.46	3.6	9.85	7.06
9/3/2004	2.08E+00	1.15E+00	1.61417	1.96227	2.08	1.96	3.6	5.68	5.56
9/4/2004	1.64E+00	8.93E-01	2.224	1.15056	2.22	1.15	3.6	5.82	4.75
9/5/2004	1.60E+00	8.68E-01	3.15823	1.71907	3.16	1.72	3.6	6.76	5.32
9/6/2004	1.45E+00	7.96E-01	2.39722	1.31002	2.40	1.31	11.3	13.70	12.61
9/7/2004	1.52E+00	8.27E-01	4.32906	2.36004	4.33	2.36	11.3	15.63	13.66
9/8/2004	2.04E+00	1.12E+00	2.30461	1.19556	2.30	1.20	11.3	13.60	12.50
9/9/2004	5.83E-01	3.23E-01	3.68385	2.06582	3.68	2.07	11.3	14.98	13.37
9/10/2004	1.51E+00	8.22E-01	6.43736	3.47684	6.44	3.48	11.3	17.74	14.78
9/11/2004	1.15E+00	6.23E-01	8.30606	4.39056	8.31	4.39	11.3	19.61	15.69
9/12/2004	1.46E+00	7.97E-01	7.81211	4.38752	7.81	4.39	5.3	13.11	9.69
9/13/2004	2.68E+00	1.47E+00	4.64856	2.54487	4.65	2.54	5.3	9.95	7.84
9/14/2004	3.03E+00	1.67E+00	16.35468	9.06352	16.35	9.06	5.3	21.65	14.36
9/15/2004	1.51E+00	8.15E-01	7.30209	4.09896	7.30	4.10	5.3	12.60	9.40
9/16/2004	1.01E+00	5.51E-01	6.13109	3.32585	6.13	3.33	5.3	11.43	8.63
9/17/2004	7.86E-01	4.27E-01	1.43186	0.7795	1.43	0.78	5.3	6.73	6.08
9/18/2004	2.24E+00	1.23E+00	0.32489	0.15689	2.24	1.23	5.3	7.54	6.53
9/19/2004	1.22E+00	6.76E-01	2.45222	1.34278	2.45	1.34	5.3	7.75	6.64
9/20/2004	2.12E+00	1.17E+00	2.48	0.95167	2.48	1.17	5.3	7.78	6.47
9/21/2004	1.51E+00	8.28E-01	2.32699	1.27716	2.33	1.28	5.3	7.63	6.58
9/22/2004	2.60E+00	1.44E+00	2.90611	1.59111	2.91	1.59	5.3	8.21	6.89
9/23/2004	1.89E+00	1.04E+00	0	0	1.89	1.04	5.3	7.19	6.34
9/24/2004	1.46E+00	8.10E-01	0.71333	0.38628	1.46	0.81	5.3	6.76	6.11
9/25/2004	2.39E+00	1.32E+00	7.42333	4.15534	7.42	4.16	5.3	12.72	9.46
9/26/2004	1.42E+00	7.75E-01	6.44722	3.52111	6.45	3.52	5.3	11.75	8.82
9/27/2004	1.46E+00	8.08E-01	10.94174	6.01177	10.94	6.01	5.3	16.24	11.31
9/28/2004	1.33E+00	7.38E-01	2.75378	0.90128	2.75	0.90	5.3	8.05	6.20
9/29/2004	1.15E+00	6.34E-01	5.67755	3.22567	5.68	3.23	5.3	10.98	8.53
9/30/2004	1.11E+00	6.12E-01	2.44833	1.33778	2.45	1.34	5.2	7.65	6.54
10/1/2004	1.55E+00	8.51E-01	0.42022	0.11528	1.55	0.85	5.2	6.75	6.05
10/2/2004	1.26E+00	6.95E-01	0.70444	0	1.26	0.70	5.2	6.46	5.90
10/3/2004	7.86E-01	4.25E-01	3.47453	1.87833	3.47	1.88	5.2	8.67	7.08
10/4/2004	1.17E+00	6.40E-01	1.79427	0.70733	1.79	0.71	5.2	6.99	5.91
10/5/2004	2.80E+00	1.56E+00	9.77155	5.38307	9.77	5.38	5.2	14.97	10.58
10/6/2004	1.39E+00	7.65E-01	2.56893	1.40725	2.57	1.41	5.1	7.67	6.51
10/7/2004	8.84E-01	4.89E-01	2.28473	1.25546	2.28	1.26	5.1	7.38	6.36
10/8/2004	3.35E+00	1.87E+00	1.17778	0.64444	3.35	1.87	5.1	8.45	6.97
10/9/2004	2.03E+00	1.11E+00	5.41935	2.96692	5.42	2.97	5.1	10.52	8.07
10/10/2004	1.83E+00	1.00E+00	2.49	1.36222	2.49	1.36	5.1	7.59	6.46
10/11/2004	1.48E+00	8.13E-01	6.31111	3.50333	6.31	3.50	5.1	11.41	8.60
10/12/2004	1.52E+00	8.33E-01	1.63778	0.89389	1.64	0.89	3.6	5.24	4.49

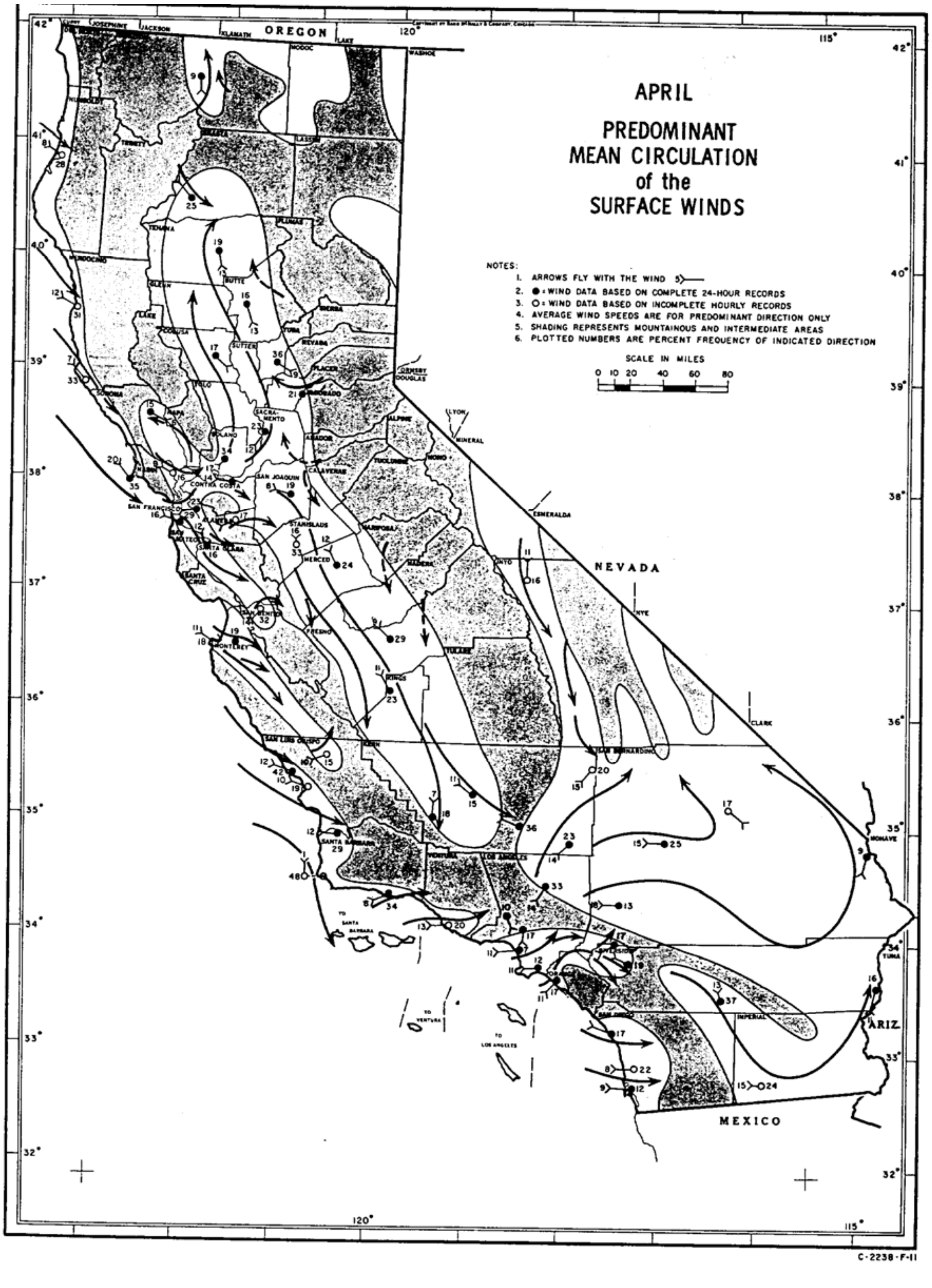
Date	HBRP, AERMOD Flat Terrain Diesel Mode	Nat. Gas Mode	HBRP, CTDMPLUS Diesel Mode	Nat. Gas Mode	MAX (AERMOD/CTDMPLUS) Diesel Mode	Nat. Gas Mode	Measured Background	Total Impact Diesel Mode	Nat. Gas Mode
10/13/2004	1.21E+00	6.67E-01	4.28392	2.35612	4.28	2.36	3.6	7.88	5.96
10/14/2004	2.02E+00	1.10E+00	3.85833	2.09422	3.86	2.09	3.6	7.46	5.69
10/15/2004	9.55E-01	5.23E-01	0.86306	0.23711	0.96	0.52	3.6	4.56	4.12
10/16/2004	6.54E-01	3.57E-01	6.52222	3.66833	6.52	3.67	3.6	10.12	7.27
10/17/2004	2.55E+00	1.39E+00	0.58227	0.31327	2.55	1.39	3.6	6.15	4.99
10/18/2004	1.12E+01	6.18E+00	0	0.00001	11.19	6.18	2.0	13.19	8.18
10/19/2004	4.44E+00	2.43E+00	0.27	0.04993	4.44	2.43	2.0	6.44	4.43
10/20/2004	8.79E-01	4.81E-01	5.21128	2.85056	5.21	2.85	2.0	7.21	4.85
10/21/2004	1.27E+00	6.96E-01	2.78111	1.53833	2.78	1.54	2.0	4.78	3.54
10/22/2004	7.32E-01	3.95E-01	0.03573	0.02039	0.73	0.39	2.0	2.73	2.39
10/23/2004	9.66E-01	5.31E-01	5.30332	2.83533	5.30	2.84	2.0	7.30	4.84
10/24/2004	1.11E+00	6.12E-01	4.73228	2.4983	4.73	2.50	9.0	13.73	11.50
10/25/2004	4.40E+00	2.42E+00	1.439	0.789	4.40	2.42	9.0	13.40	11.42
10/26/2004	8.76E-01	4.91E-01	1.62269	0.88187	1.62	0.88	9.0	10.62	9.88
10/27/2004	9.75E-01	5.38E-01	1.91833	1.08389	1.92	1.08	9.0	10.92	10.08
10/28/2004	7.19E-01	3.96E-01	2.7223	1.41167	2.72	1.41	9.0	11.72	10.41
10/29/2004	6.84E-01	3.73E-01	1.34889	0.73667	1.35	0.74	9.0	10.35	9.74
10/30/2004	8.58E-01	4.73E-01	5.44502	3.00562	5.45	3.01	16.1	21.55	19.11
10/31/2004	1.49E+00	8.21E-01	1.07944	0.59333	1.49	0.82	16.1	17.59	16.92
11/1/2004	1.36E+00	7.53E-01	4.17611	2.29833	4.18	2.30	16.1	20.28	18.40
11/2/2004	1.00E+00	5.43E-01	2.22633	1.20577	2.23	1.21	16.1	18.33	17.31
11/3/2004	3.44E+00	1.91E+00	7.06655	3.95237	7.07	3.95	16.1	23.17	20.05
11/4/2004	1.48E+00	8.12E-01	6.11111	3.34889	6.11	3.35	16.1	22.21	19.45
11/5/2004	4.53E-01	2.47E-01	0	0	0.45	0.25	23.1	23.55	23.35
11/6/2004	1.02E+00	5.57E-01	13.76406	7.59245	13.76	7.59	23.1	36.86	30.69
11/7/2004	6.12E-01	3.39E-01	0.77556	0.41989	0.78	0.42	23.1	23.88	23.52
11/8/2004	5.98E-01	3.24E-01	1.61374	0.78331	1.61	0.78	23.1	24.71	23.88
11/9/2004	4.89E+00	2.72E+00	1.74444	0.99806	4.89	2.72	23.1	27.99	25.82
11/10/2004	1.03E+00	5.68E-01	0.76056	0.03532	1.03	0.57	23.1	24.13	23.67
11/11/2004	9.30E-01	5.14E-01	0.50539	0.27478	0.93	0.51	10.4	11.33	10.91
11/12/2004	7.51E-01	4.14E-01	0.49811	0.27572	0.75	0.41	10.4	11.15	10.81
11/13/2004	5.62E-01	3.08E-01	11.65831	6.41429	11.66	6.41	10.4	22.06	16.81
11/14/2004	1.96E-01	1.09E-01	1.74433	0.98372	1.74	0.98	10.4	12.14	11.38
11/15/2004	1.53E+00	8.75E-01	0.66394	0.36386	1.53	0.87	10.4	11.93	11.27
11/16/2004	1.20E+00	6.62E-01	10.38975	5.72423	10.39	5.72	10.4	20.79	16.12
11/17/2004	1.70E+00	9.40E-01	4.25722	1.46778	4.26	1.47	19.3	23.56	20.77
11/18/2004	1.68E+00	9.28E-01	13.85141	7.34894	13.85	7.35	19.3	33.15	26.65
11/19/2004	2.87E+00	1.59E+00	8.13983	4.29918	8.14	4.30	19.3	27.44	23.60
11/20/2004	2.57E+00	1.42E+00	1.4537	1.24145	2.57	1.42	19.3	21.87	20.72
11/21/2004	1.04E+00	5.73E-01	0.77255	0.41406	1.04	0.57	19.3	20.34	19.87
11/22/2004	8.45E-01	4.63E-01	5.58889	3.04167	5.59	3.04	19.3	24.89	22.34
11/23/2004	1.49E+00	8.22E-01	5.16644	2.87294	5.17	2.87	10.3	15.47	13.17
11/24/2004	1.22E+00	6.76E-01	7.95556	4.46056	7.96	4.46	10.3	18.26	14.76
11/25/2004	3.77E-01	2.08E-01	9.44576	5.19181	9.45	5.19	10.3	19.75	15.49
11/26/2004	6.11E-01	3.37E-01	10.57494	5.83724	10.57	5.84	10.3	20.87	16.14
11/27/2004	1.41E+00	7.76E-01	4.51062	2.45901	4.51	2.46	10.3	14.81	12.76
11/28/2004	1.48E+00	8.14E-01	1.59444	0.90667	1.59	0.91	10.3	11.89	11.21
11/29/2004	6.66E-01	3.68E-01	2.50441	1.37349	2.50	1.37	20.7	23.20	22.07
11/30/2004	1.76E+00	9.73E-01	3.46171	1.90722	3.46	1.91	20.7	24.16	22.61
12/1/2004	1.10E+00	6.07E-01	2.44611	1.34833	2.45	1.35	20.7	23.15	22.05
12/2/2004	8.13E-01	4.49E-01	7.15175	4.25575	7.15	4.26	20.7	27.85	24.96
12/3/2004	1.17E+00	6.45E-01	2.52722	1.39389	2.53	1.39	20.7	23.23	22.09
12/4/2004	2.91E+00	1.63E+00	0.18228	0.09931	2.91	1.63	20.7	23.61	22.33
12/5/2004	9.78E-01	5.42E-01	0	0	0.98	0.54	20.9	21.88	21.44
12/6/2004	1.04E+01	5.75E+00	0.15152	0.08061	10.39	5.75	20.9	31.29	26.65
12/7/2004	7.78E+00	4.30E+00	0.08613	0.048	7.78	4.30	20.9	28.68	25.20
12/8/2004	4.80E+00	2.63E+00	0.51624	0.21594	4.80	2.63	20.9	25.70	23.53
12/9/2004	1.08E+00	5.93E-01	1.0725	0.61359	1.08	0.61	20.9	21.98	21.51
12/10/2004	2.78E-01	1.54E-01	0.55528	0.30828	0.56	0.31	20.9	21.46	21.21
12/11/2004	1.70E+00	9.40E-01	2.165	1.20833	2.17	1.21	17.9	20.07	19.11
12/12/2004	1.22E+00	6.74E-01	2.30682	1.25038	2.31	1.25	17.9	20.21	19.15
12/13/2004	4.54E+00	2.46E+00	1.42475	0.80187	4.54	2.46	17.9	22.44	20.36
12/14/2004	3.72E-01	2.03E-01	4.27944	2.40611	4.28	2.41	17.9	22.18	20.31
12/15/2004	4.58E-01	2.53E-01	0	0	0.46	0.25	17.9	18.36	18.15
12/16/2004	3.29E-01	1.82E-01	1.39684	0.76547	1.40	0.77	17.9	19.30	18.67
12/17/2004	2.52E+00	1.40E+00	2.69833	1.52778	2.70	1.53	14.2	16.90	15.73
12/18/2004	1.19E+00	6.53E-01	2.64608	1.43444	2.65	1.43	14.2	16.85	15.63
12/19/2004	7.70E-01	4.29E-01	2.77744	1.50328	2.78	1.50	14.2	16.98	15.70
12/20/2004	6.89E-01	3.77E-01	2.62979	1.44567	2.63	1.45	14.2	16.83	15.65
12/21/2004	1.61E+00	8.89E-01	2.51222	1.38	2.51	1.38	14.9	17.41	16.28
12/22/2004	1.63E+00	9.02E-01	6.62814	2.01748	6.63	2.02	14.9	21.53	16.92
12/23/2004	1.27E+00	6.99E-01	2.67611	1.46389	2.68	1.46	25.6	28.28	27.06
12/24/2004	1.23E+00	6.80E-01	6.1309	3.3721	6.13	3.37	25.6	31.73	28.97
12/25/2004	9.09E+00	5.01E+00	2.57263	1.41474	9.09	5.01	25.6	34.69	30.61
12/26/2004	2.80E+00	1.56E+00	0.96091	0.52818	2.80	1.56	25.6	28.40	27.16
12/27/2004	1.08E+00	5.93E-01	0.25472	0.14011	1.08	0.59	25.6	26.68	26.19
12/28/2004	7.68E-01	4.30E-01	3.65916	2.07003	3.66	2.07	6.9	10.56	8.97
12/29/2004	1.16E+01	6.42E+00	0.00145	0.00083	11.57	6.42	6.9	18.47	13.32
12/30/2004	4.28E+00	2.34E+00	0.00096	0.00054	4.28	2.34	6.9	11.18	9.24
12/31/2004	3.79E+00	2.08E+00	0		3.79	2.08	3.3	13.08	12.58
8th highest value								29.38	26.55

FIGURE 8.1B-1A JANUARY PREDOMINANT MEAN CIRCULATION OF THE SURFACE WINDS



C-2238-F-10

FIGURE 8.1B-1B APRIL PREDOMINANT MEAN CIRCULATION OF THE SURFACE WINDS



C-2238-F-11

FIGURE 8.1B-1C JULY PREDOMINANT MEAN CIRCULATION OF THE SURFACE WINDS

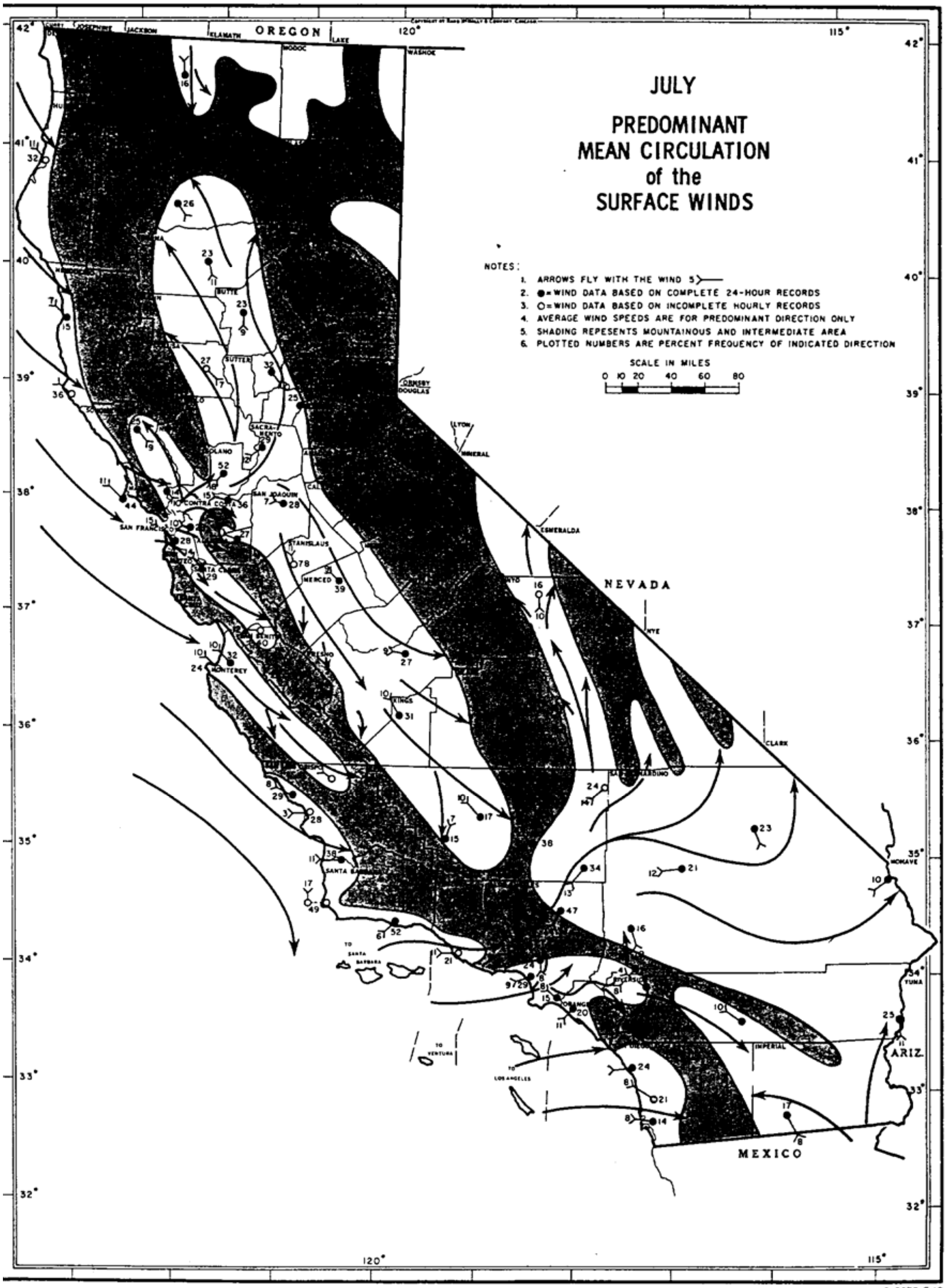


FIGURE 8.1B-1D OCTOBER PREDOMINANT MEAN CIRCULATION OF THE SURFACE WINDS

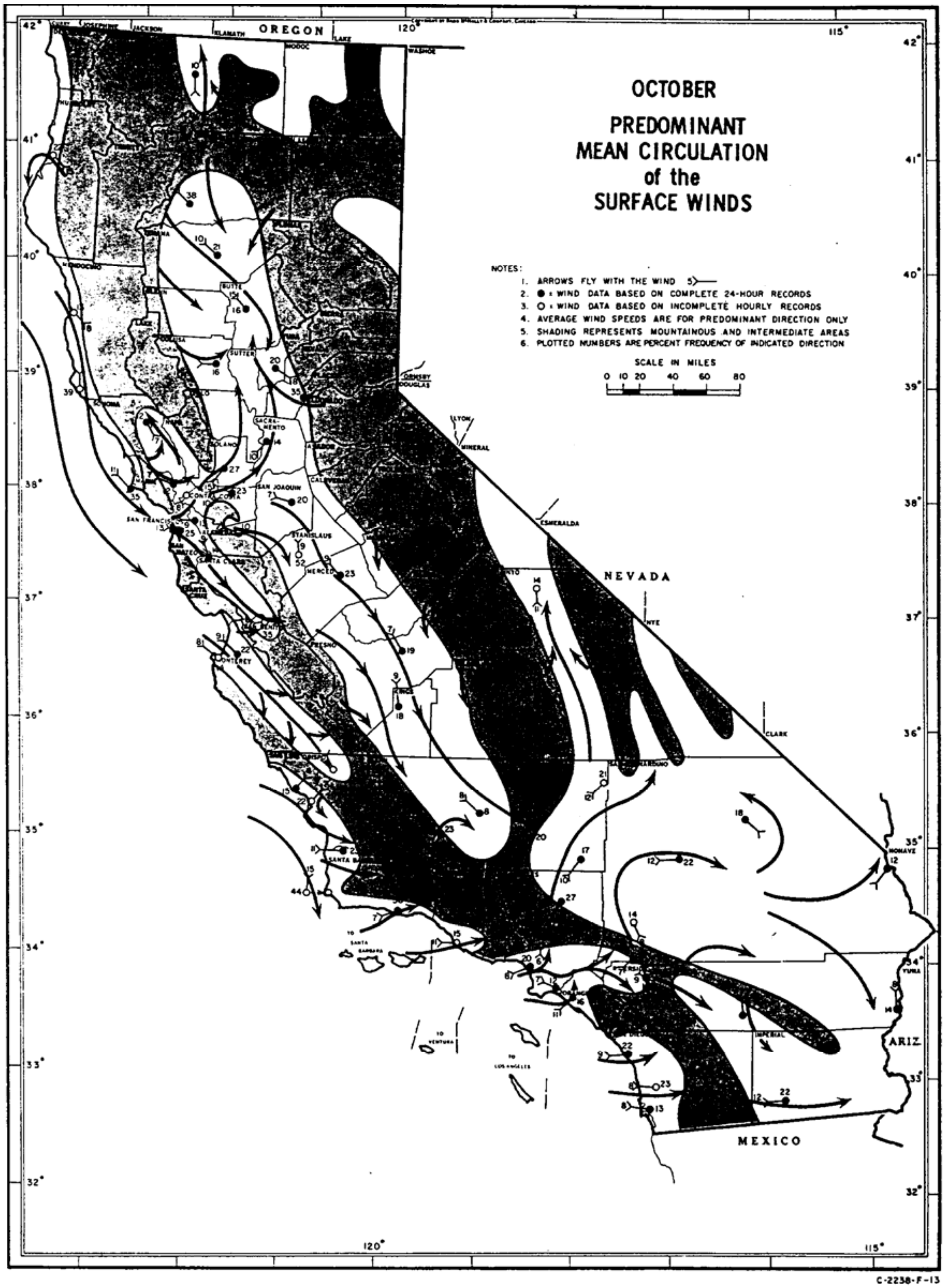


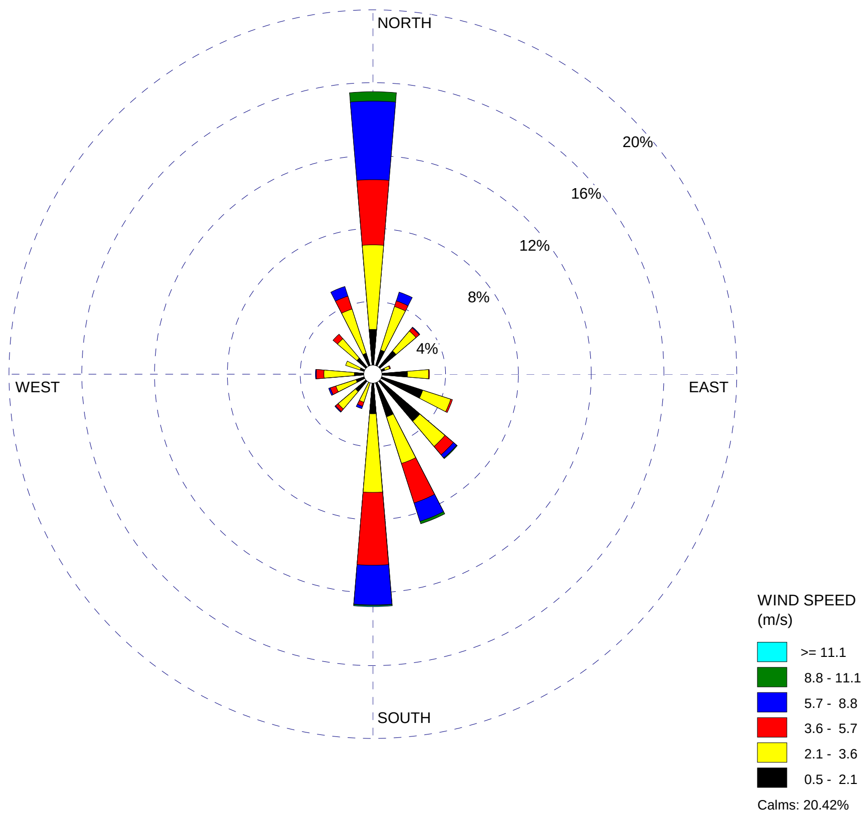
FIGURE 8.1B-2A 2001 1ST QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - First Quarter, 2001
January 1, 2001 through March 31, 2001

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2001 **Jan 1 - Mar 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **20.42%**	TOTAL COUNT: **2160 hrs.**	
	AVG. WIND SPEED: **2.34 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

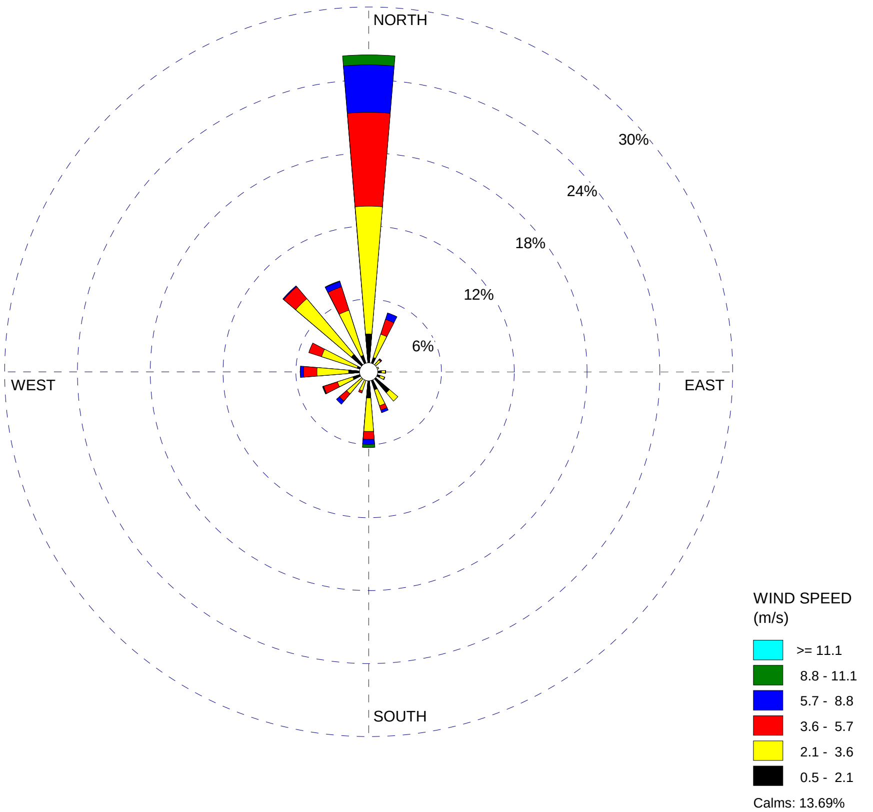
FIGURE 8.1B-2B 2001 2ND QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - Second Quarter, 2001
April 1, 2001 through June 30, 2001

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD: **2001 Apr 1 - Jun 30 00:00 - 23:00**	COMPANY NAME:	
		MODELER:	
	CALM WINDS: **13.69%**	TOTAL COUNT: **2184 hrs.**	
	AVG. WIND SPEED: **2.55 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

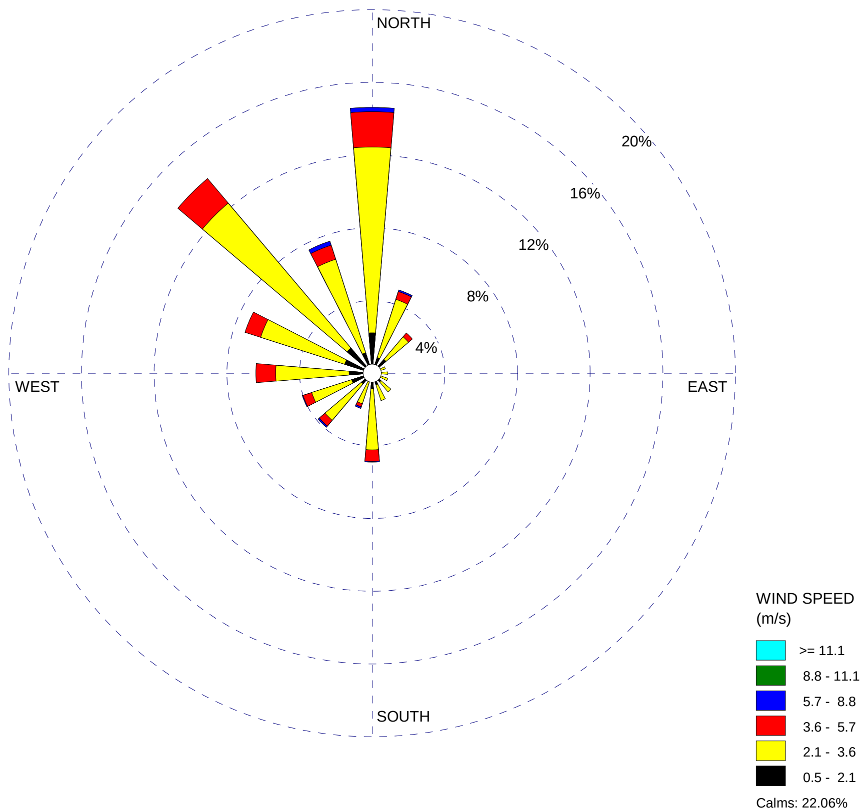
FIGURE 8.1B-2C 2001 3RD QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - Third Quarter, 2001
July 1, 2001 through September 30, 2001

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2001 **Jul 1 - Sep 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **22.06%**	TOTAL COUNT: **2208 hrs.**	
	AVG. WIND SPEED: **1.95 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

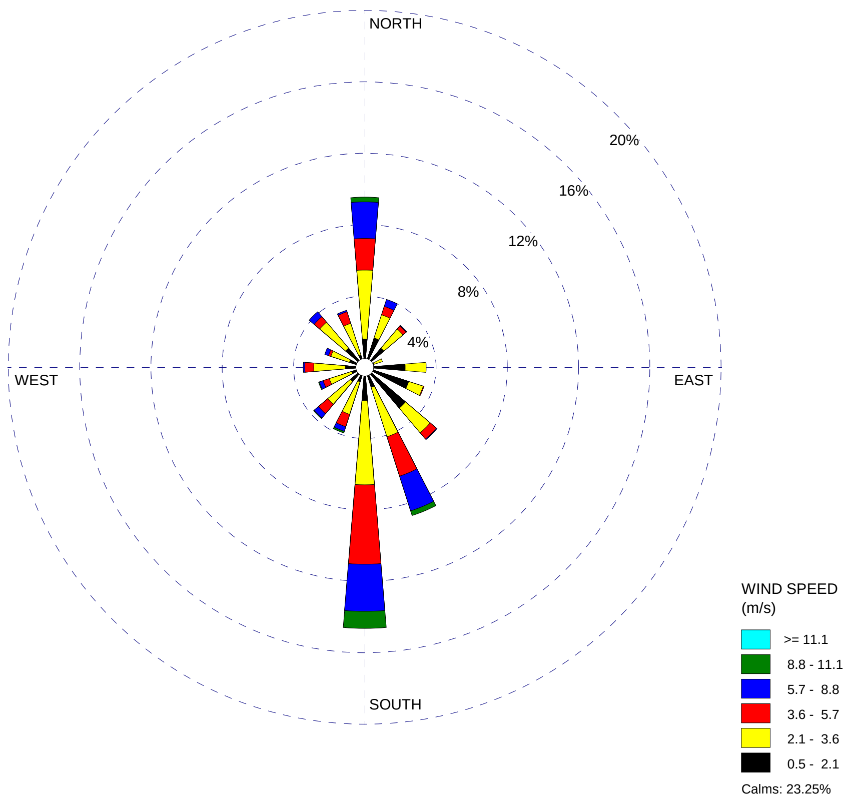
FIGURE 8.1B-2D 2001 4TH QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - Fourth Quarter, 2001
October 1, 2001 through December 31, 2001

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2001 **Oct 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **23.25%**	TOTAL COUNT: **2206 hrs.**	
	AVG. WIND SPEED: **2.36 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

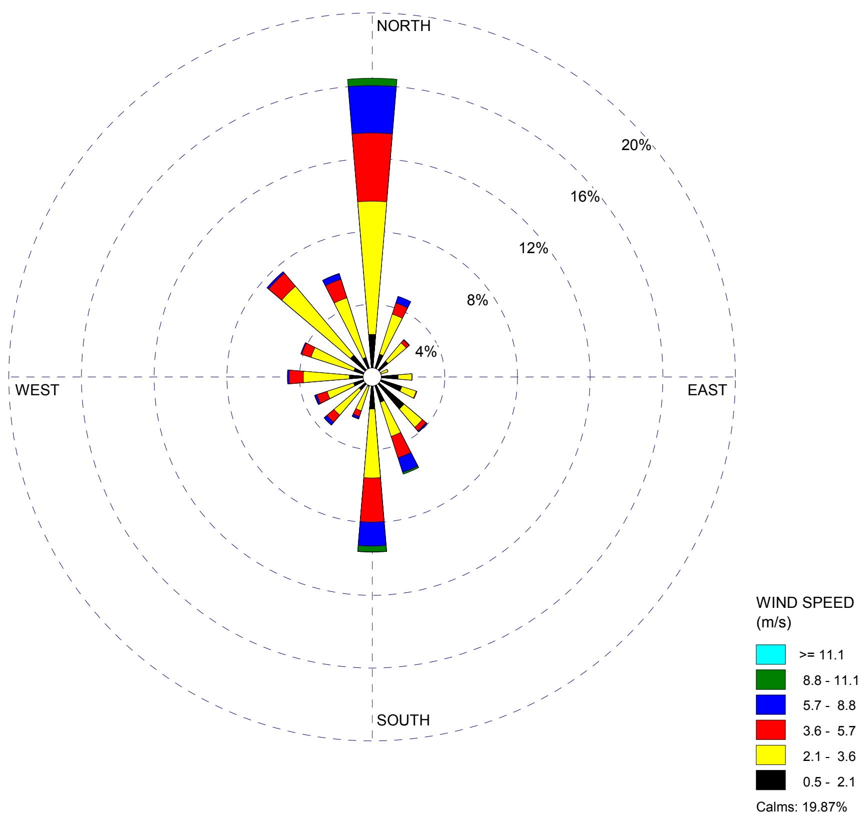
FIGURE 8.1B-2E 2001 ANNUAL WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - 2001
January 1, 2001 through December 31, 2001

DISPLAY:

Wind Speed
Direction (blowing from)

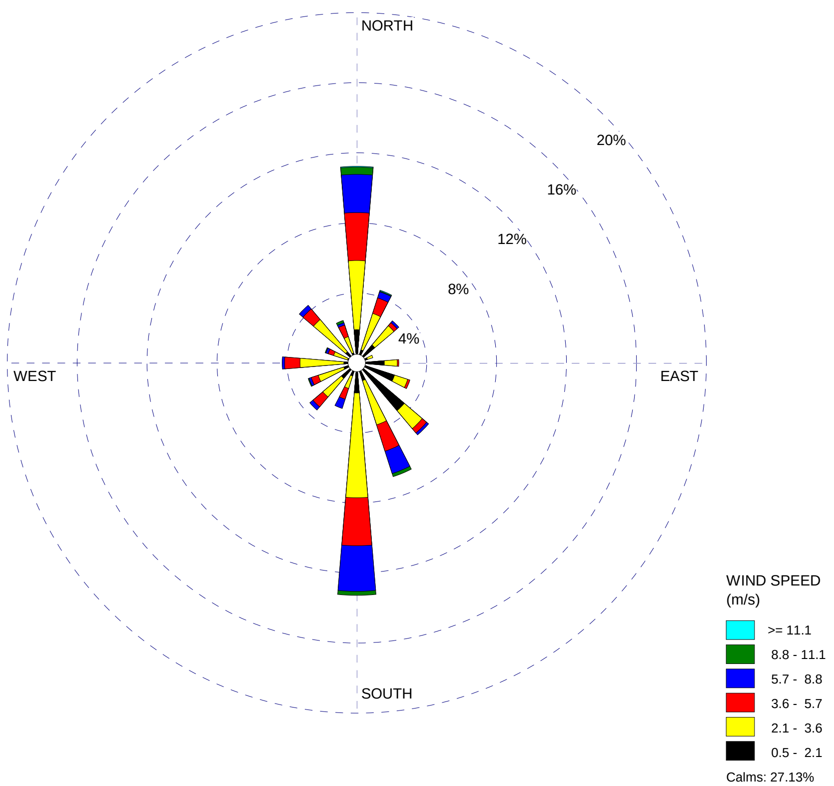


COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2001 **Jan 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **19.87%**	TOTAL COUNT: **8758 hrs.**	
	AVG. WIND SPEED: **2.30 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

FIGURE 8.1B-3A 2002 1ST QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT: Woodley Island, CA - First Quarter, 2002 January 1, 2002 through March 31, 2002	DISPLAY: Wind Speed Direction (blowing from)

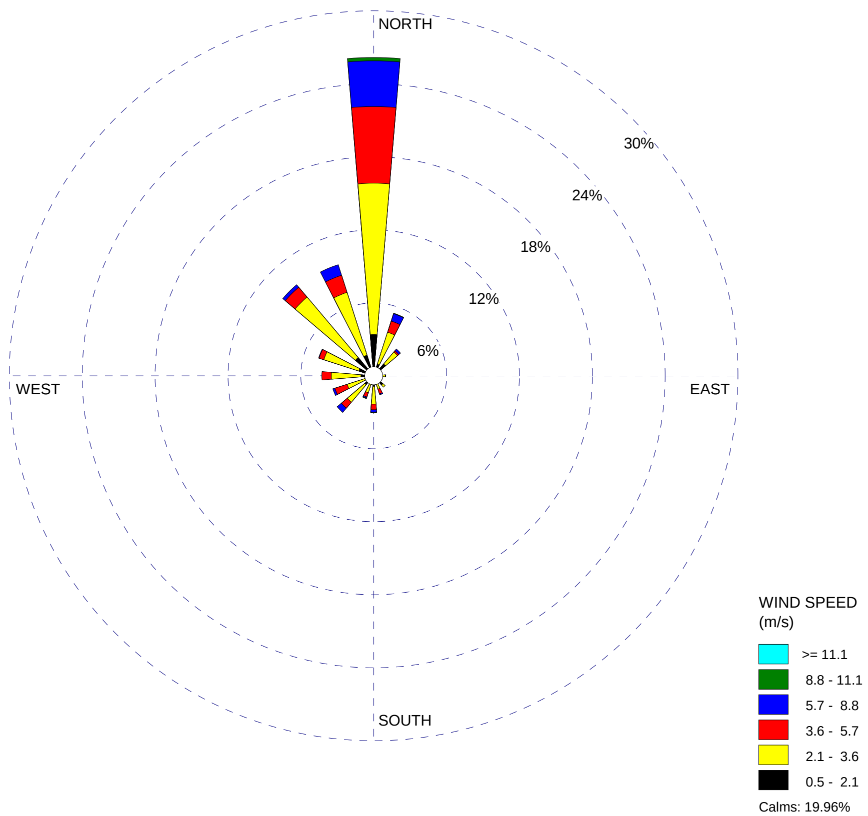


COMMENTS:	DATA PERIOD: 2002 Jan 1 - Mar 31 00:00 - 23:00	COMPANY NAME:	
		MODELER:	
	CALM WINDS: 27.13%	TOTAL COUNT: 2160 hrs.	
	AVG. WIND SPEED: 2.22 m/s	DATE: 7/14/2006	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

FIGURE 8.1B-3B 2002 2ND QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:	DISPLAY:
Woodley Island, CA - Second Quarter, 2002 **April 1, 2002 through June 30, 2002**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2002 **Apr 1 - Jun 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **19.96%**	TOTAL COUNT: **2184 hrs.**	
	AVG. WIND SPEED: **2.32 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

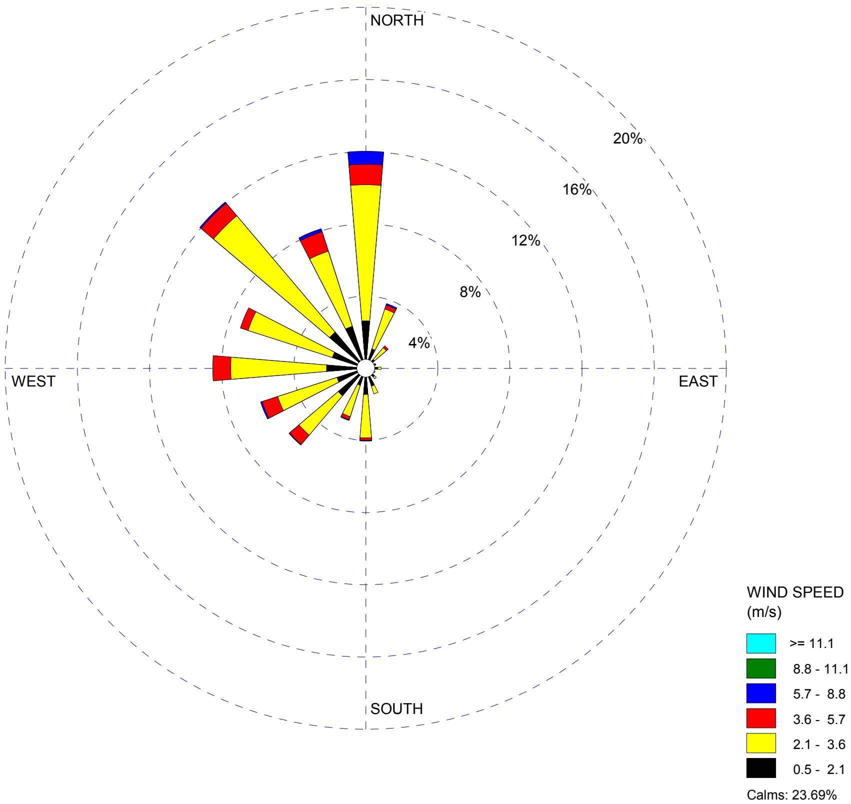
FIGURE 8.1B-3C 2002 3RD QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - Third Quarter, 2002
July 1, 2002 through September 30, 2002

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

2002
Jul 1 - Sep 30
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:

23.69%

TOTAL COUNT:

2208 hrs.

AVG. WIND SPEED:

1.77 m/s

DATE:

7/14/2006

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

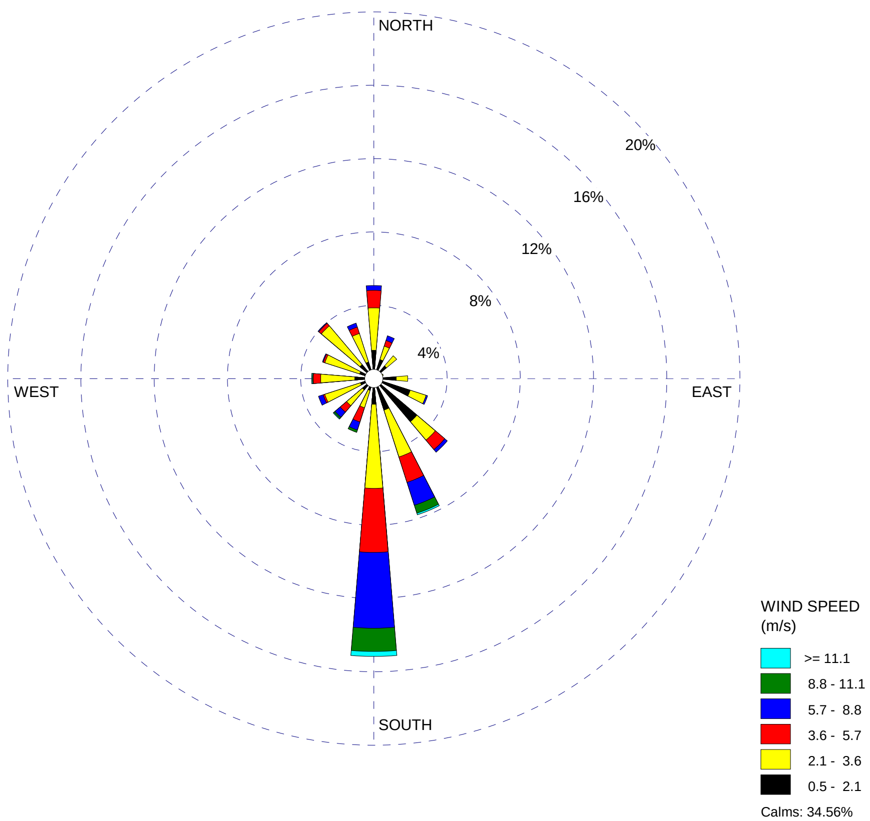
FIGURE 8.1B-3D 2002 4TH QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - Fourth Quarter, 2002
October 1, 2002 through December 31, 2002

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

2002
Oct 1 - Dec 31
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:

34.56%

TOTAL COUNT:

2208 hrs.

AVG. WIND SPEED:

2.04 m/s

DATE:

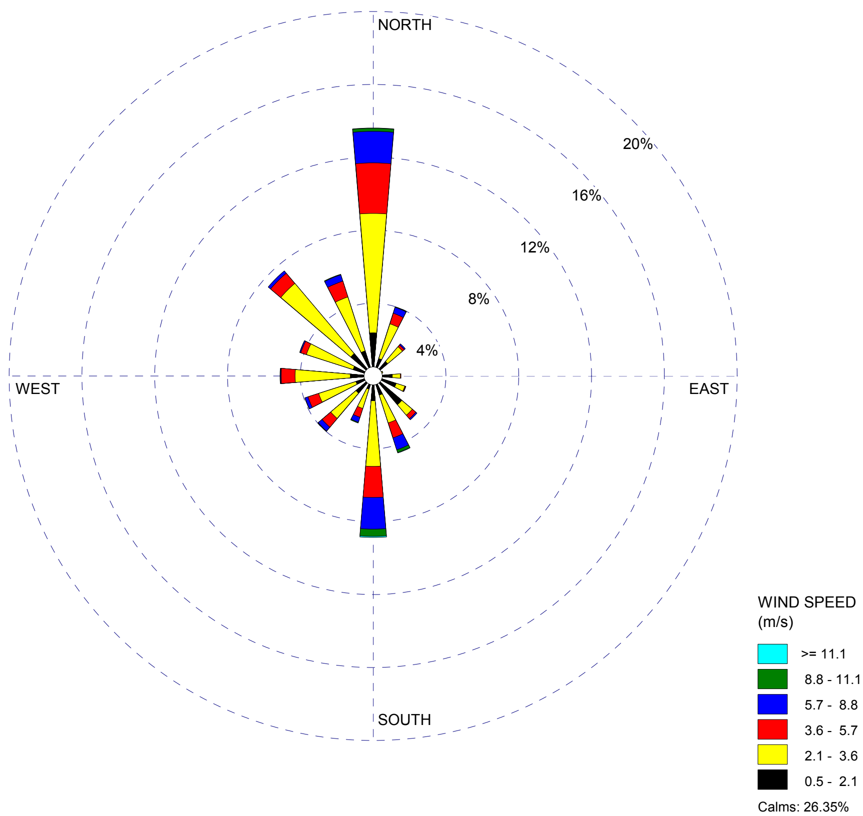
7/14/2006

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

FIGURE 8.1B-3E 2002 ANNUAL WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:	DISPLAY:
Woodley Island, CA - 2002 **January 1, 2002 through December 31, 2002**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2002 **Jan 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **26.35%**	TOTAL COUNT: **8760 hrs.**	
	AVG. WIND SPEED: **2.09 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

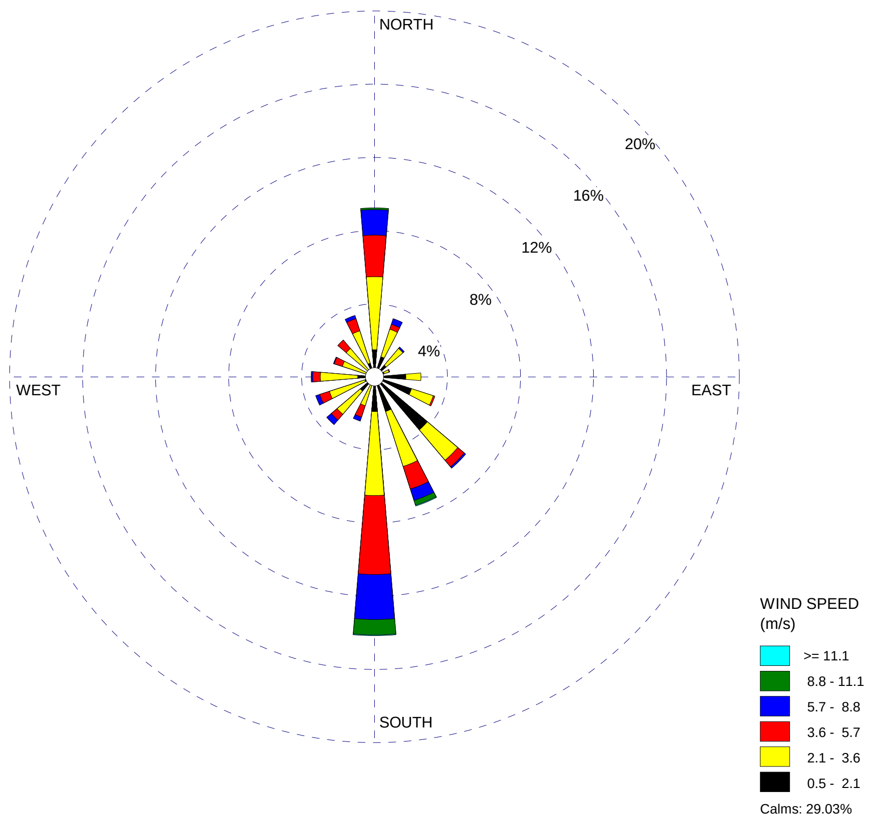
FIGURE 8.1B-4A 2003 1ST QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - First Quarter, 2003
January 1, 2003 through March 31, 2003

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2003 **Jan 1 - Mar 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **29.03%**	TOTAL COUNT: **2160 hrs.**	
	AVG. WIND SPEED: **2.08 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

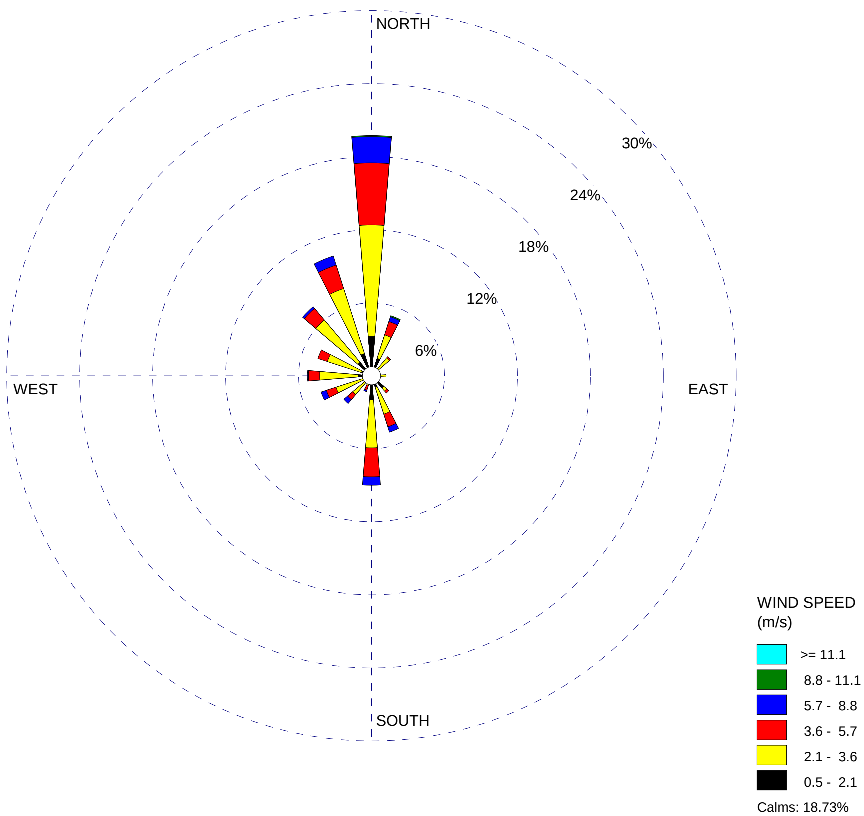
FIGURE 8.1B-4B 2003 2ND QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - Second Quarter, 2003
April 1, 2003 through June 30, 2003

DISPLAY:

Wind Speed
Direction (blowing from)

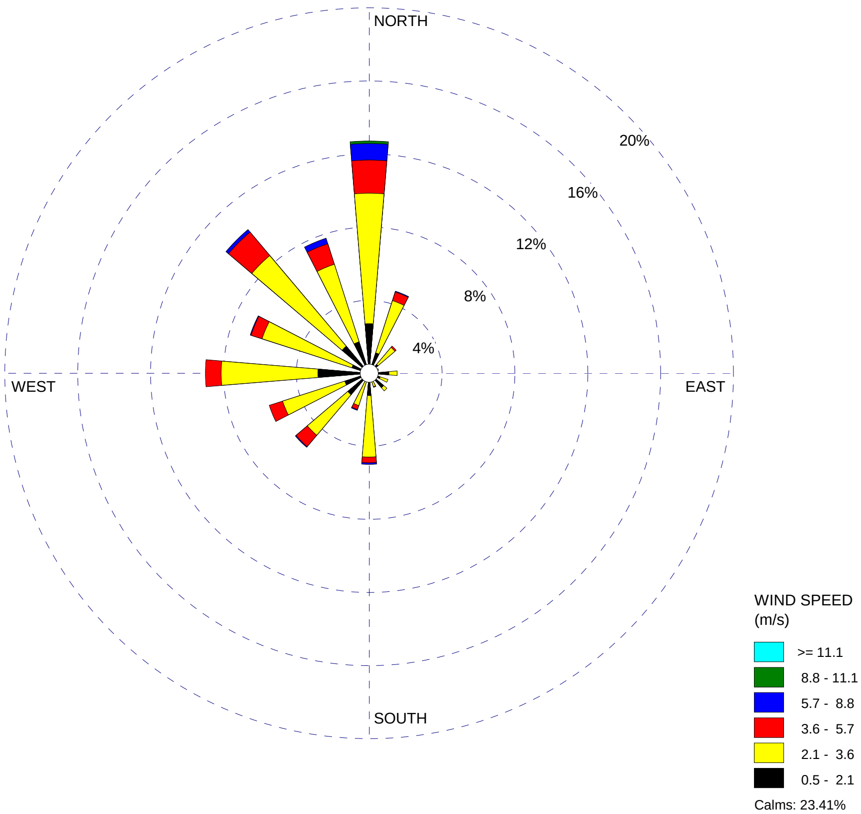


COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2003 **Apr 1 - Jun 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **18.73%**	TOTAL COUNT: **2184 hrs.**	
	AVG. WIND SPEED: **2.39 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

FIGURE 8.1B-4C 2003 3RD QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:	DISPLAY:
Woodley Island, CA - Third Quarter, 2003 **July 1, 2003 through September 30, 2003**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2003 **Jul 1 - Sep 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **23.41%**	TOTAL COUNT: **2208 hrs.**	
	AVG. WIND SPEED: **1.92 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

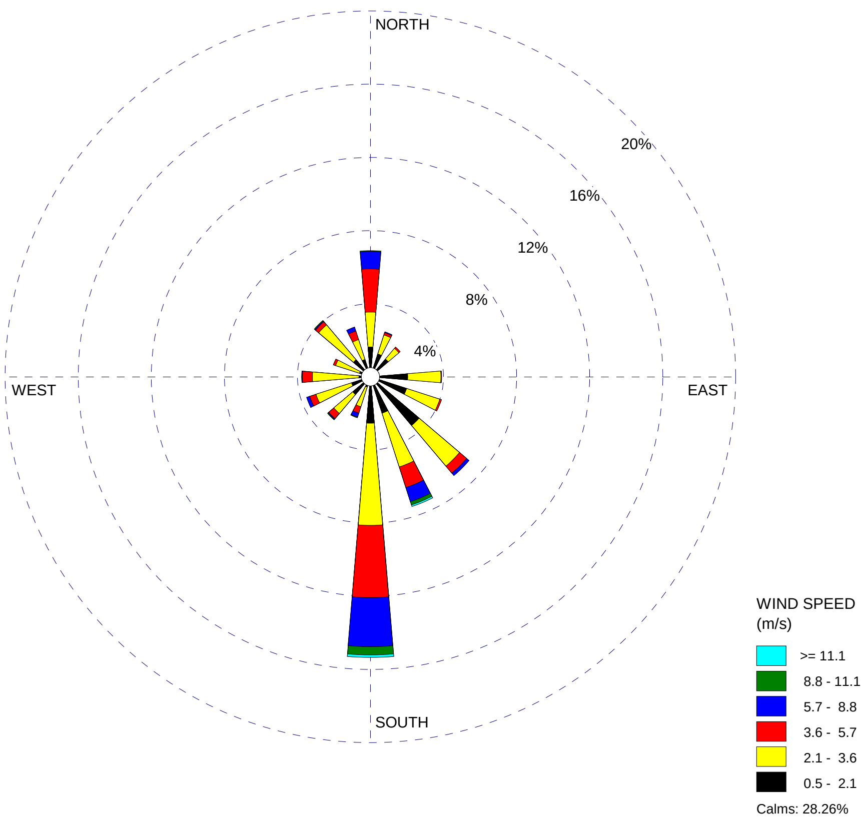
FIGURE 8.1B-4D 2003 4TH QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - Fourth Quarter, 2003
October 1, 2003 through December 31, 2003

DISPLAY:

Wind Speed
Direction (blowing from)

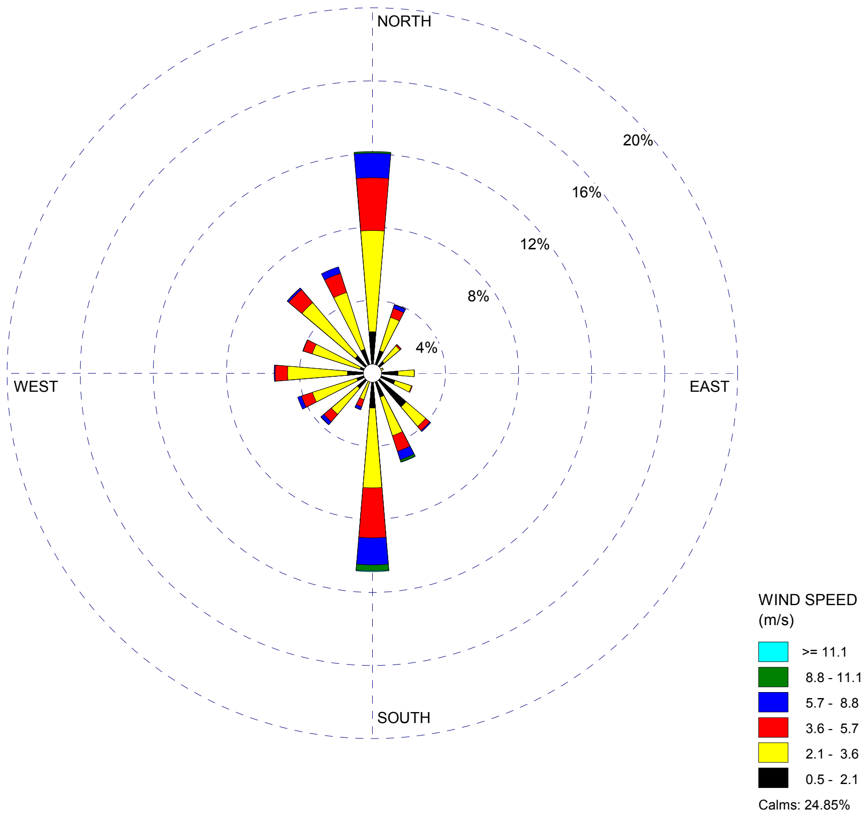


COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2003 **Oct 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **28.26%**	TOTAL COUNT: **2208 hrs.**	
	AVG. WIND SPEED: **1.99 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

FIGURE 8.1B-4E 2003 ANNUAL WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:	DISPLAY:
Woodley Island, CA - 2003 **January 1, 2003 through December 31, 2003**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2003 **Jan 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **24.85%**	TOTAL COUNT: **8760 hrs.**	
	AVG. WIND SPEED: **2.09 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

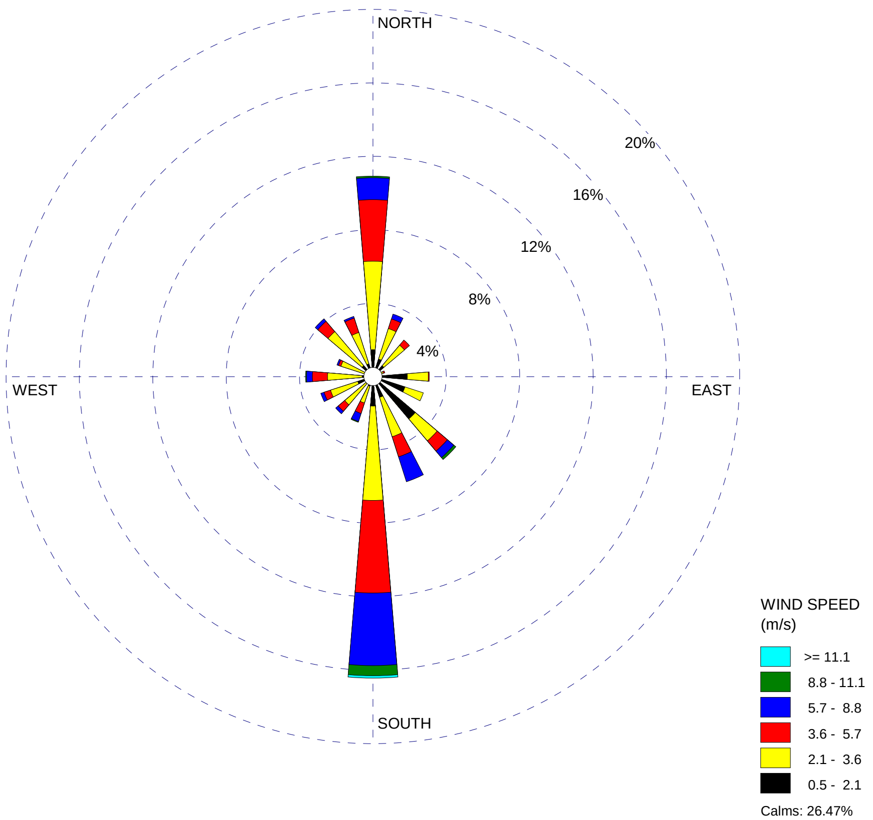
FIGURE 8.1B-5A 2004 1ST QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - First Quarter, 2004
January 1, 2004 through March 31, 2004

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

2004
Jan 1 - Mar 31
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:

26.47%

TOTAL COUNT:

2184 hrs.

AVG. WIND SPEED:

2.34 m/s

DATE:

7/14/2006

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

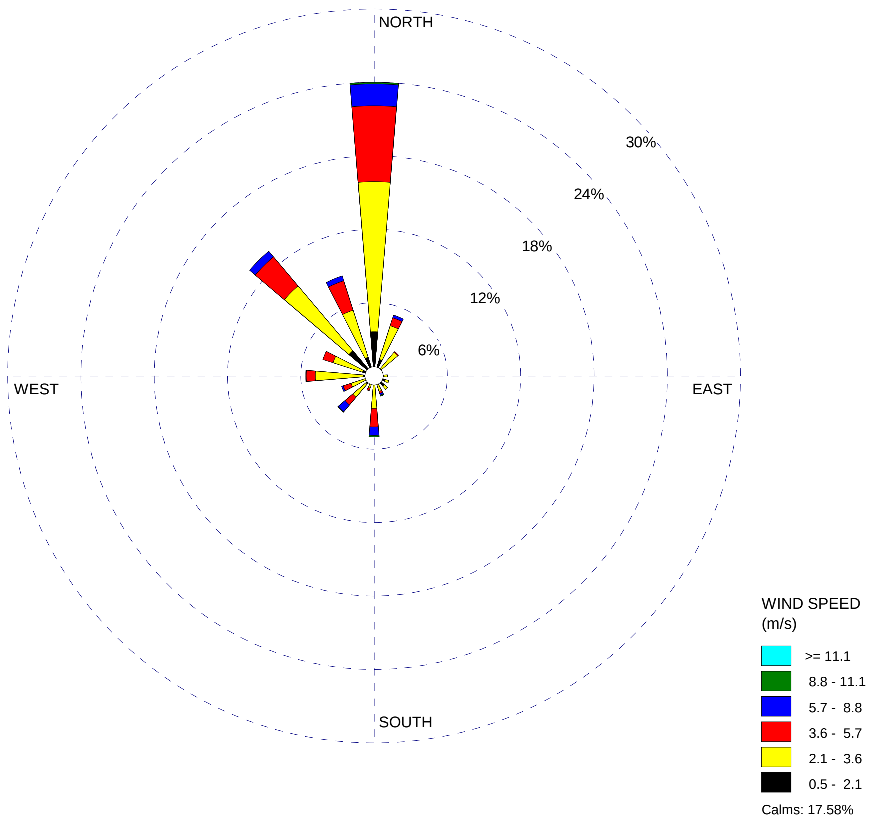
FIGURE 8.1B-5B 2004 2ND QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - Second Quarter, 2004
April 1, 2004 through June 30, 2004

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

2004
Apr 1 - Jun 30
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:

17.58%

TOTAL COUNT:

2184 hrs.

AVG. WIND SPEED:

2.44 m/s

DATE:

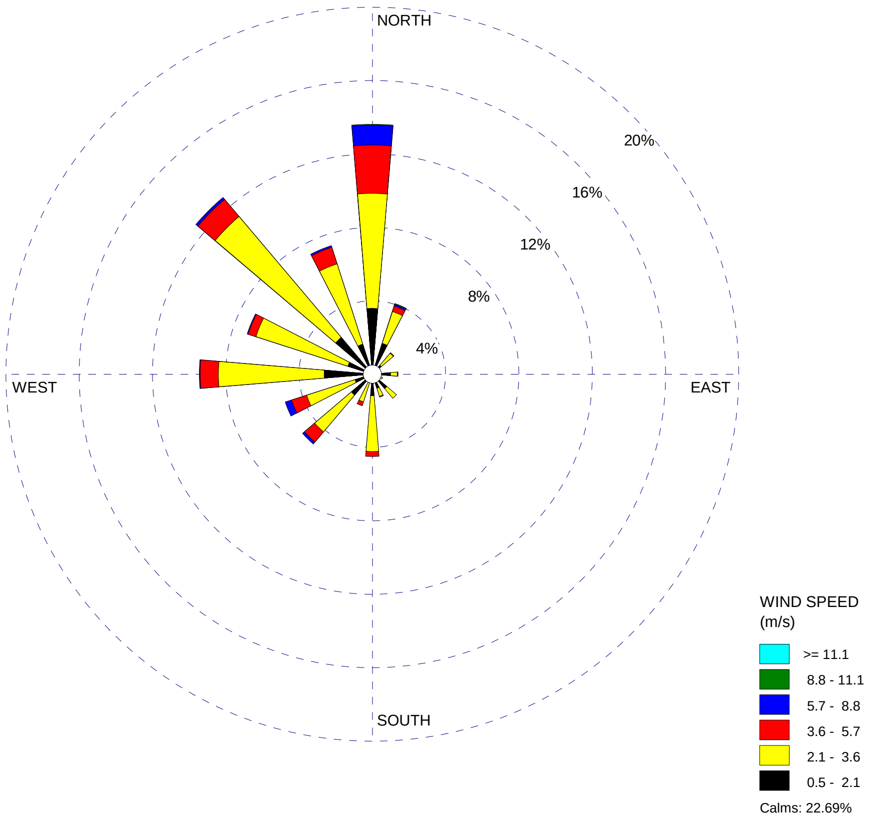
7/14/2006

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

FIGURE 8.1B-5C 2004 3RD QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:	DISPLAY:
Woodley Island, CA - Third Quarter, 2004 **July 1, 2004 through September 30, 2004**	**Wind Speed** **Direction (blowing from)**

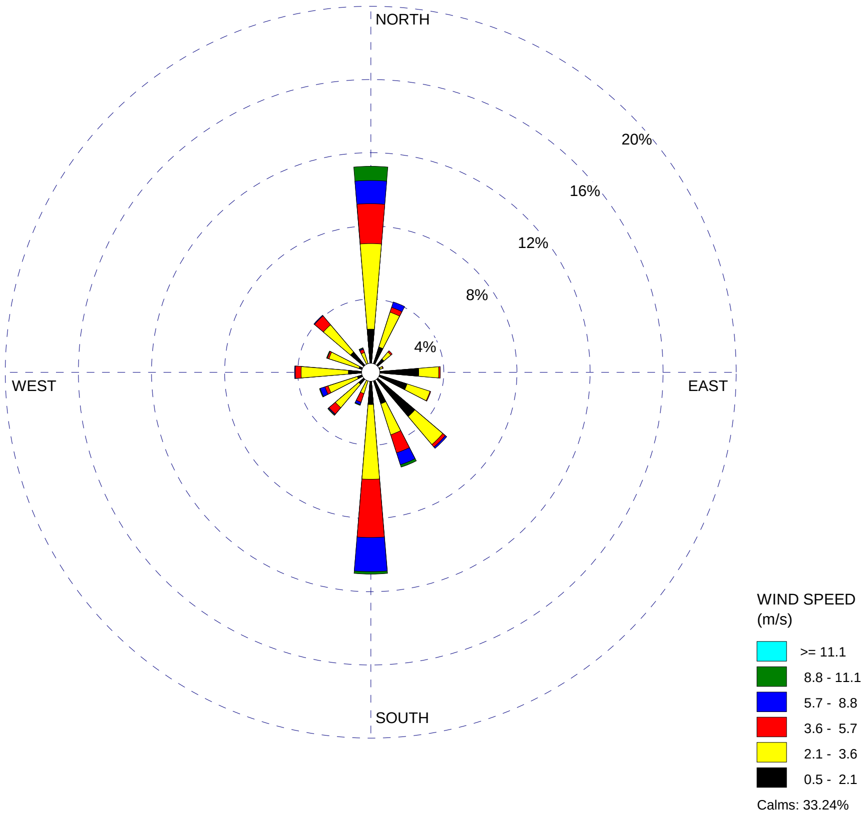


COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2004 **Jul 1 - Sep 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **22.69%**	TOTAL COUNT: **2208 hrs.**	
	AVG. WIND SPEED: **1.90 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

FIGURE 8.1B-5D 2004 4TH QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:	DISPLAY:
Woodley Island, CA - Fourth Quarter, 2004 **October 1, 2004 through December 31, 2004**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2004 **Oct 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **33.24%**	TOTAL COUNT: **2208 hrs.**	
	AVG. WIND SPEED: **1.83 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

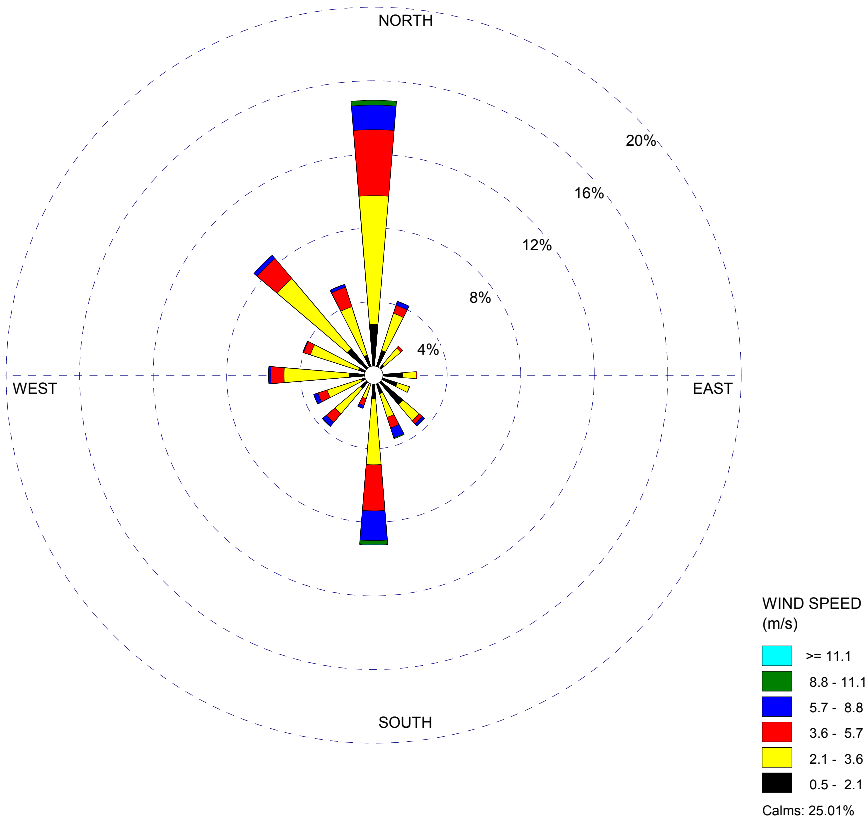
FIGURE 8.1B-5E 2004 ANNUAL WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - 2004
January 1, 2004 through December 31, 2004

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

2004
Jan 1 - Dec 31
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:

25.01%

TOTAL COUNT:

8784 hrs.

AVG. WIND SPEED:

2.13 m/s

DATE:

7/14/2006

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

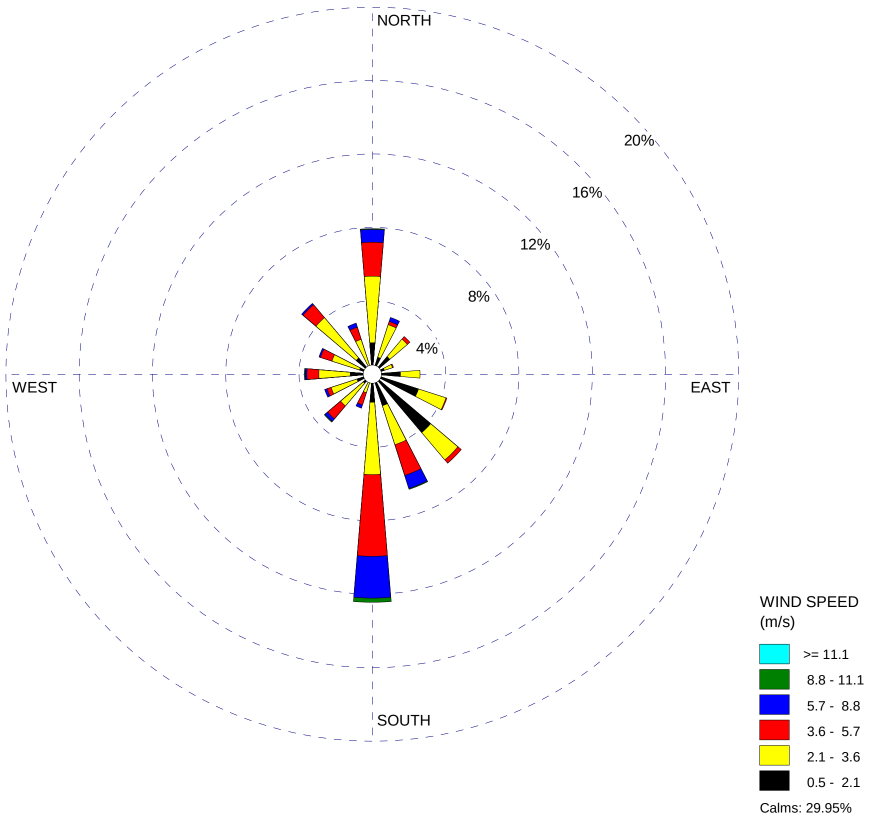
FIGURE 8.1B-6A 2005 1ST QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - First Quarter, 2005
January 1, 2005 through March 31, 2005

DISPLAY:

Wind Speed
Direction (blowing from)

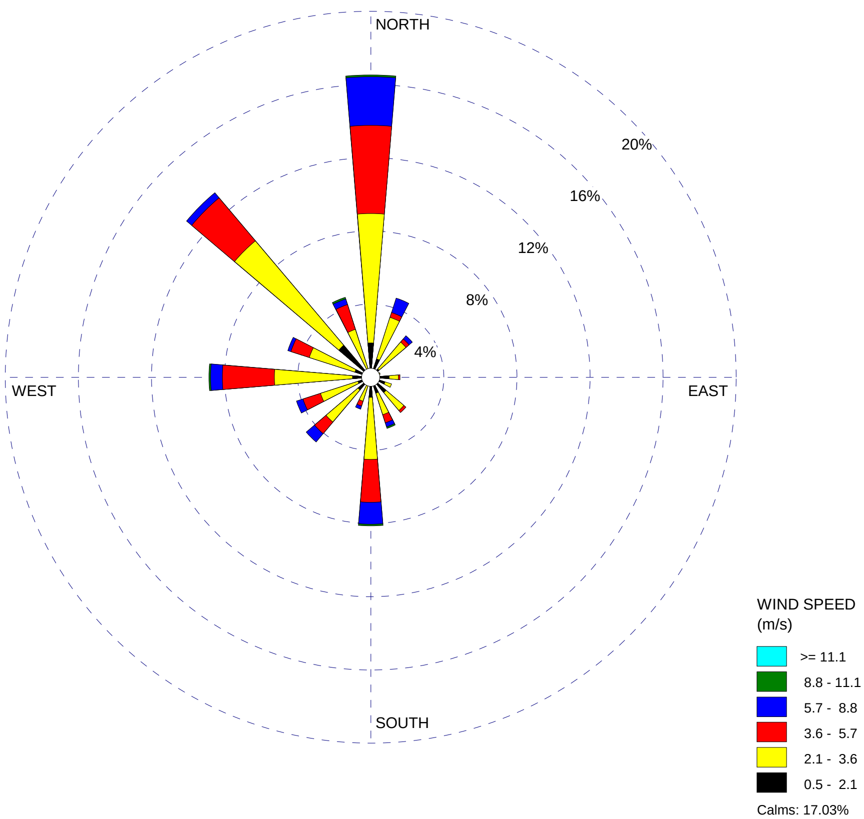


COMMENTS:	DATA PERIOD: **2005** **Jan 1 - Mar 31** **00:00 - 23:00**	COMPANY NAME:	
		MODELER:	
	CALM WINDS: **29.95%**	TOTAL COUNT: **2160 hrs.**	
	AVG. WIND SPEED: **1.94 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

FIGURE 8.1B-6B 2005 2ND QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:	DISPLAY:
Woodley Island, CA - Second Quarter, 2005 **April 1, 2005 through June 30, 2005**	**Wind Speed** **Direction (blowing from)**

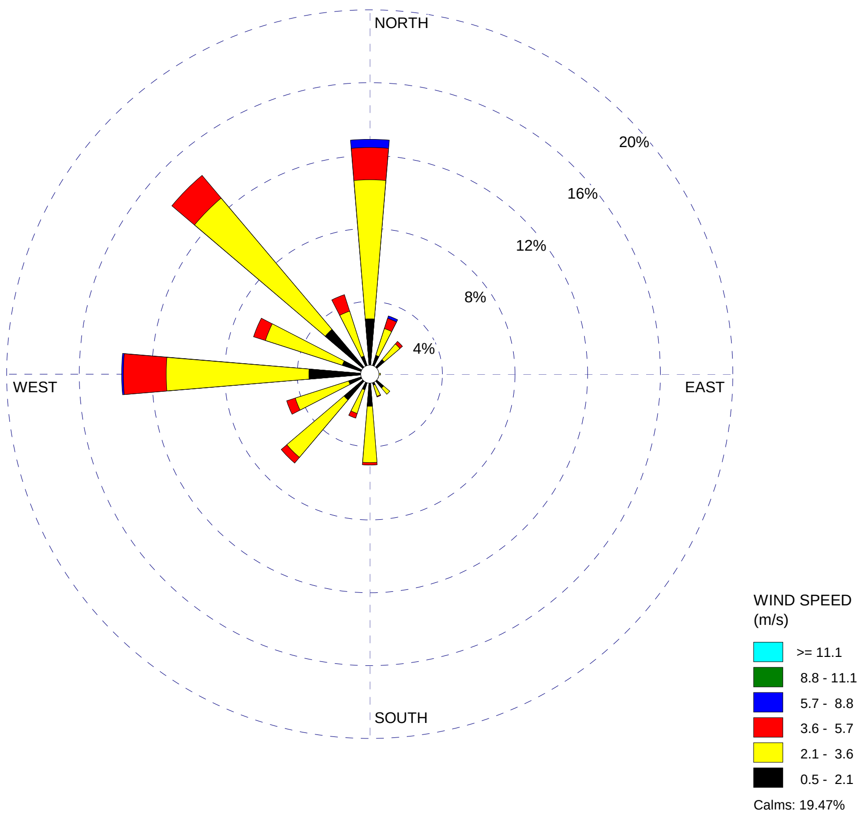


COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2005 **Apr 1 - Jun 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **17.03%**	TOTAL COUNT: **2184 hrs.**	
	AVG. WIND SPEED: **2.58 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

FIGURE 8.1B-6C 2005 3RD QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:	DISPLAY:
Woodley Island, CA - Third Quarter, 2005 **July 1, 2005 through September 30, 2005**	**Wind Speed** **Direction (blowing from)**



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2005 **Jul 1 - Sep 30** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **19.47%**	TOTAL COUNT: **2208 hrs.**	
	AVG. WIND SPEED: **1.88 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

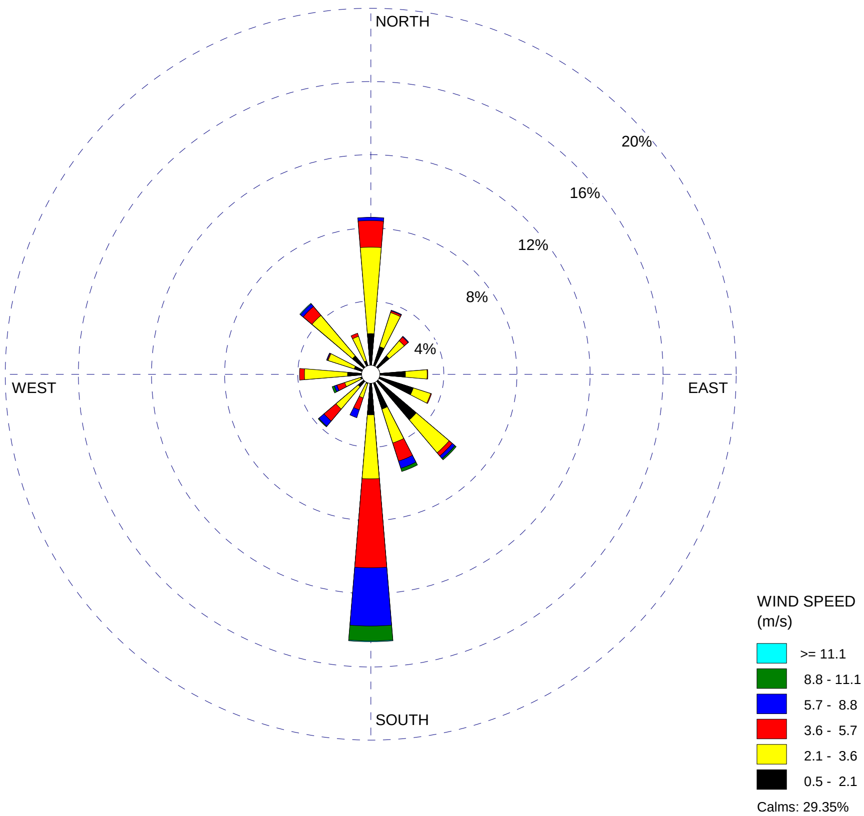
FIGURE 8.1B-6D 2005 4TH QUARTER WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - Fourth Quarter, 2005
October 1, 2005 through December 31, 2005

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	2005 **Oct 1 - Dec 31** **00:00 - 23:00**	MODELER:	
	CALM WINDS: **29.35%**	TOTAL COUNT: **2208 hrs.**	
	AVG. WIND SPEED: **1.95 m/s**	DATE: **7/14/2006**	PROJECT NO.:

WRPLOT View - Lakes Environmental Software

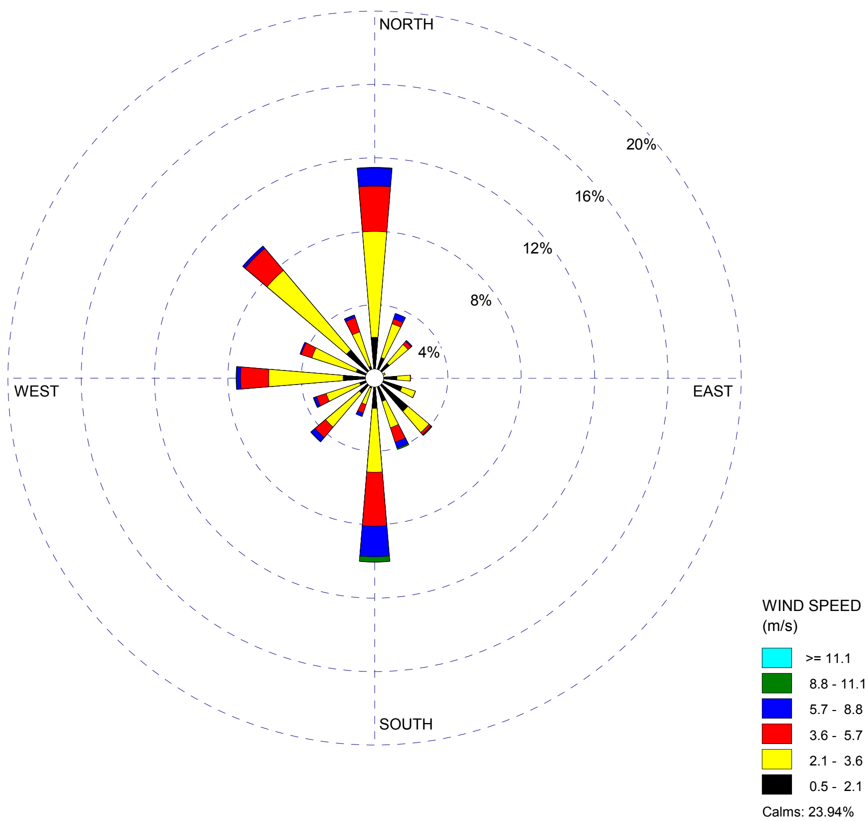
FIGURE 8.1B-6E 2005 ANNUAL WIND ROSE, WOODLEY ISLAND, CA

WIND ROSE PLOT:

Woodley Island, CA - 2005
January 1, 2005 through December 31, 2005

DISPLAY:

Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:

2005
Jan 1 - Dec 31
00:00 - 23:00

COMPANY NAME:

MODELER:

CALM WINDS:

23.94%

TOTAL COUNT:

8760 hrs.

AVG. WIND SPEED:

2.09 m/s

DATE:

7/14/2006

PROJECT NO.:

WRPLOT View - Lakes Environmental Software

HBRP METEOROLOGICAL DATA : WOODLEY ISLAND NWS, 2001-2005
WIND FREQUENCY DISTRIBUTIONS

2001: ANNUAL

WIND SPEEDS AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	1753	190	402	321	112	178	116	60	40	3172
NNE	10	105	120	110	15	21	19	7	0	407
NE	11	89	89	35	7	4	1	0	0	236
ENE	6	41	26	9	0	0	0	0	0	82
E	13	112	59	7	2	0	0	0	0	193
ESE	20	130	63	12	2	0	0	0	0	227
SE	27	175	90	31	5	14	4	0	1	347
SSE	19	109	95	111	32	64	38	12	10	490
S	25	129	172	229	70	101	59	26	30	841
SSW	5	43	74	57	11	14	5	2	2	213
SW	10	73	98	74	10	28	8	2	2	305
WSW	7	87	91	63	16	19	5	1	2	291
W	12	98	140	103	26	23	5	1	0	408
WNW	3	90	130	115	15	5	1	2	0	361
NW	6	131	242	234	27	14	6	3	0	663
NNW	8	91	177	157	30	38	16	4	1	522
Sub-Total:	1935	1693	2068	1668	380	523	283	120	88	8758

Average Wind Speed: 2.30 m/s

2001: FIRST QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	444	49	58	56	27	44	49	31	16	774
NNE	3	27	26	30	4	4	5	3	0	102
NE	7	29	25	7	4	0	1	0	0	73
ENE	2	14	5	2	0	0	0	0	0	23
E	4	37	23	2	1	0	0	0	0	67
ESE	13	49	31	4	2	0	0	0	0	99
SE	11	62	29	12	5	8	3	0	1	131
SSE	11	42	29	43	17	26	13	2	3	186
S	13	34	48	74	36	37	27	4	2	275
SSW	3	7	15	10	3	3	1	1	0	43
SW	3	24	18	10	0	3	1	0	0	59
WSW	3	18	18	9	2	3	1	1	0	55
W	4	18	25	16	1	4	0	0	0	68
WNW	0	16	12	6	0	0	0	0	0	34
NW	3	22	20	14	2	1	0	0	0	62
NNW	5	21	28	33	3	9	8	2	0	109
Sub-Total:	529	469	410	328	107	142	109	44	22	2160

Average Wind Speed: 2.34 m/s

2001: SECOND QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	307	59	136	134	59	94	46	13	18	866
NNE	6	21	23	36	7	9	7	2	0	111
NE	0	11	12	6	1	1	0	0	0	31
ENE	2	11	3	3	0	0	0	0	0	19
E	5	18	7	0	1	0	0	0	0	31
ESE	1	21	5	4	0	0	0	0	0	31
SE	12	37	14	6	0	0	0	0	0	69
SSE	6	28	16	19	2	3	3	0	0	77
S	5	42	36	27	6	9	3	2	6	136
SSW	2	13	13	8	2	2	0	0	0	40
SW	6	10	24	18	5	9	4	1	0	77
WSW	3	27	16	21	8	10	1	0	1	87
W	6	30	38	26	10	9	4	0	0	123
WNW	3	19	39	38	12	2	0	0	0	113
NW	2	39	65	80	10	4	2	0	0	202
NNW	1	30	46	50	19	20	3	1	1	171
Sub-Total:	367	416	493	476	142	172	73	19	26	2184

Average Wind Speed: 2.55 m/s

2001: THIRD QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	489	47	158	89	12	13	1	0	0	809
NNE	0	20	46	35	3	0	2	0	0	106
NE	1	21	25	15	1	1	0	0	0	64
ENE	0	6	8	3	0	0	0	0	0	17
E	1	10	5	3	0	0	0	0	0	19
ESE	0	9	10	1	0	0	0	0	0	20
SE	1	13	15	1	0	0	0	0	0	30
SSE	0	15	17	3	0	0	0	0	0	35
S	1	18	49	33	4	2	1	0	0	108
SSW	0	4	21	17	1	1	1	0	0	45
SW	0	17	35	26	3	4	1	0	0	86
WSW	0	26	34	24	3	2	0	0	0	89
W	0	28	53	42	13	5	0	0	0	141
WNW	0	35	68	57	2	0	0	0	0	162
NW	0	40	128	123	14	4	0	0	0	309
NNW	0	26	74	59	4	1	3	1	0	168
Sub-Total:	493	335	746	531	60	33	9	1	0	2208

Average Wind Speed: 1.95 m/s

2001: FOURTH QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	513	35	50	42	14	27	20	16	6	723
NNE	1	37	25	9	1	8	5	2	0	88
NE	3	28	27	7	1	2	0	0	0	68
ENE	2	10	10	1	0	0	0	0	0	23
E	3	47	24	2	0	0	0	0	0	76
ESE	6	51	17	3	0	0	0	0	0	77
SE	3	63	32	12	0	6	1	0	0	117
SSE	2	24	33	46	13	35	22	10	7	192
S	6	35	39	95	24	53	28	20	22	322
SSW	0	19	25	22	5	8	3	1	2	85
SW	1	22	21	20	2	12	2	1	2	83
WSW	1	16	23	9	3	4	3	0	1	60
W	2	22	24	19	2	5	1	1	0	76
WNW	0	20	11	14	1	3	1	2	0	52
NW	1	30	29	17	1	5	4	3	0	90
NNW	2	14	29	15	4	8	2	0	0	74
Sub-Total:	546	473	419	333	71	176	92	56	40	2206

Average Wind Speed: 2.36 m/s

2002: ANNUAL

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	2332	172	358	310	70	113	95	20	16	3486
NNE	19	70	114	78	16	28	19	3	3	350
NE	19	73	72	28	3	5	3	1	0	204
ENE	5	28	15	1	0	0	1	0	0	50
E	29	65	33	7	2	0	0	0	0	136
ESE	15	101	43	3	0	1	2	0	0	165
SE	34	150	56	19	7	7	4	1	1	279
SSE	14	83	84	85	19	40	34	13	16	388
S	23	96	176	186	49	74	97	32	42	775
SSW	14	53	62	49	13	23	12	5	6	237
SW	18	90	97	81	19	22	16	2	4	349
WSW	16	71	124	85	21	15	8	4	1	345
W	17	94	176	122	16	18	3	0	2	448
WNW	18	85	141	113	5	6	2	2	1	373
NW	22	119	286	183	28	14	9	0	0	661
NNW	17	111	154	144	29	34	21	1	3	514
Sub-Total:	2612	1461	1991	1494	297	400	326	84	95	8760

Average Wind Speed: 2.09 m/s

2002: FIRST QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	590	32	47	63	12	31	33	5	10	823
NNE	2	15	26	29	4	9	7	0	2	94
NE	4	25	26	8	1	3	1	0	0	68
ENE	3	11	7	0	0	0	0	0	0	21
E	7	28	13	4	1	0	0	0	0	53
ESE	2	47	17	2	0	1	0	0	0	69
SE	9	70	27	6	1	2	2	1	0	118
SSE	2	21	36	34	8	18	19	5	4	147
S	5	32	66	80	20	28	41	9	5	286
SSW	1	16	7	11	3	12	6	2	1	59
SW	3	22	18	18	5	6	3	1	0	76
WSW	4	13	22	14	2	6	0	1	1	63
W	1	16	37	26	2	8	3	0	0	93
WNW	1	12	8	13	1	4	1	1	1	42
NW	3	15	38	19	9	6	3	0	0	93
NNW	1	12	11	14	7	5	2	0	3	55
Sub-Total:	638	387	406	341	76	139	121	25	27	2160

Average Wind Speed: 2.22 m/s

2002: SECOND QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	445	63	161	159	43	65	49	13	6	1004
NNE	5	17	37	30	7	11	7	3	1	118
NE	8	21	22	8	0	2	2	1	0	64
ENE	1	1	2	0	0	0	0	0	0	4
E	9	8	5	0	1	0	0	0	0	23
ESE	1	10	5	0	0	0	0	0	0	16
SE	12	10	4	1	0	0	0	0	0	27
SSE	3	8	10	6	4	3	2	0	0	36
S	8	11	20	16	3	3	3	1	1	66
SSW	5	8	12	11	3	2	1	0	1	43
SW	4	17	22	23	8	4	6	1	1	86
WSW	2	14	24	18	8	8	3	0	0	77
W	6	17	34	27	7	2	0	0	0	93
WNW	5	23	37	34	3	1	1	0	0	104
NW	10	33	79	75	9	3	5	0	0	214
NNW	6	33	56	73	12	16	12	1	0	209
Sub-Total:	530	294	530	481	108	120	91	20	10	2184

Average Wind Speed: 2.32 m/s

2002: THIRD QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	531	46	112	65	8	12	8	2	0	784
NNE	10	16	39	14	1	3	1	0	0	84
NE	4	10	12	8	2	0	0	0	0	36
ENE	1	10	1	0	0	0	1	0	0	13
E	7	8	4	0	0	0	0	0	0	19
ESE	4	6	2	0	0	0	0	0	0	12
SE	3	12	3	0	0	0	0	0	0	18
SSE	7	16	8	2	0	0	0	0	0	33
S	7	25	41	15	0	0	1	0	0	89
SSW	6	16	28	16	0	1	0	0	0	67
SW	8	36	43	28	4	4	0	0	0	123
WSW	6	31	49	36	10	1	1	1	0	135
W	6	42	74	53	6	6	0	0	0	187
WNW	6	38	62	56	0	0	0	0	0	162
NW	4	54	121	75	9	2	1	0	0	266
NNW	10	45	60	44	9	10	2	0	0	180
Sub-Total:	620	411	659	412	49	39	15	3	0	2208

Average Wind Speed: 1.77 m/s

2002: FOURTH QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	766	31	38	23	7	5	5	0	0	875
NNE	2	22	12	5	4	5	4	0	0	54
NE	3	17	12	4	0	0	0	0	0	36
ENE	0	6	5	1	0	0	0	0	0	12
E	6	21	11	3	0	0	0	0	0	41
ESE	8	38	19	1	0	0	2	0	0	68
SE	10	58	22	12	6	5	2	0	1	116
SSE	2	38	30	43	7	19	13	8	12	172
S	3	28	49	75	26	43	52	22	36	334
SSW	2	13	15	11	7	8	5	3	4	68
SW	3	15	14	12	2	8	7	0	3	64
WSW	4	13	29	17	1	0	4	2	0	70
W	4	19	31	16	1	2	0	0	2	75
WNW	6	12	34	10	1	1	0	1	0	65
NW	5	17	48	14	1	3	0	0	0	88
NNW	0	21	27	13	1	3	5	0	0	70
Sub-Total:	824	369	396	260	64	102	99	36	58	2208

Average Wind Speed: 2.04 m/s

2003: ANNUAL
WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	2196	177	276	275	93	114	71	22	11	3235
NNE	7	106	113	67	18	18	13	2	2	346
NE	6	68	71	31	2	1	0	2	0	181
ENE	4	29	19	3	0	0	0	0	0	55
E	13	110	70	8	0	0	0	0	0	201
ESE	8	105	73	14	1	0	0	0	0	201
SE	27	184	99	32	9	10	2	3	0	366
SSE	10	110	114	108	31	33	22	7	13	448
S	18	149	212	271	56	112	72	27	32	949
SSW	3	29	65	51	14	10	8	3	1	184
SW	7	88	104	73	21	15	12	3	1	324
WSW	4	75	134	115	18	16	12	2	0	376
W	10	110	166	146	18	18	3	0	0	471
WNW	3	61	162	104	15	5	2	0	0	352
NW	5	105	197	176	31	15	6	0	1	536
NNW	9	112	169	152	38	29	22	4	0	535
Sub-Total:	2330	1618	2044	1626	365	396	245	75	61	8760

Average Wind Speed: 2.09 m/s

2003: FIRST QUARTER
WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	633	26	56	45	12	29	19	4	2	826
NNE	1	24	24	12	2	3	6	0	0	72
NE	2	16	18	8	0	0	0	2	0	46
ENE	3	9	5	2	0	0	0	0	0	19
E	8	29	16	2	0	0	0	0	0	55
ESE	3	43	19	10	0	0	0	0	0	75
SE	15	67	38	13	5	2	0	1	0	141
SSE	7	36	40	36	9	15	6	4	7	160
S	9	32	49	83	23	46	33	11	19	305
SSW	0	6	25	9	7	4	3	1	0	55
SW	2	20	20	18	2	7	4	1	0	74
WSW	1	11	29	23	1	4	2	2	0	73
W	0	20	24	24	2	3	2	0	0	75
WNW	1	6	23	16	3	1	1	0	0	51
NW	0	7	21	23	2	4	0	0	0	57
NNW	1	16	27	20	5	5	2	0	0	76
Sub-Total:	686	368	434	344	73	123	78	26	28	2160

Average Wind Speed: 2.08 m/s

2003: SECOND QUARTER
WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	413	65	111	121	41	44	23	14	5	837
NNE	3	30	29	21	10	10	6	2	2	113
NE	2	12	21	8	1	1	0	0	0	45
ENE	1	8	4	0	0	0	0	0	0	13
E	1	16	9	0	0	0	0	0	0	26
ESE	1	6	5	0	0	0	0	0	0	12
SE	7	22	5	3	0	4	0	0	0	41
SSE	2	20	24	36	8	10	5	1	0	106
S	4	39	50	59	12	22	7	3	0	196
SSW	0	5	11	3	5	3	3	0	0	30
SW	0	11	18	17	8	3	6	2	0	65
WSW	0	12	25	37	6	8	7	0	0	95
W	2	22	35	41	7	7	1	0	0	115
WNW	2	19	40	34	4	4	0	0	0	103
NW	0	32	53	52	17	5	3	0	0	162
NNW	3	39	70	65	19	15	12	2	0	225
Sub-Total:	441	358	510	497	138	136	73	24	7	2184

Average Wind Speed: 2.39 m/s

2003: THIRD QUARTER
WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	523	54	88	80	18	14	13	4	3	797
NNE	2	24	43	26	5	4	0	0	0	104
NE	0	14	19	9	1	0	0	0	0	43
ENE	0	6	5	1	0	0	0	0	0	12
E	0	24	9	1	0	0	0	0	0	34
ESE	1	13	10	0	0	0	0	0	0	24
SE	2	21	5	0	0	0	0	0	0	28
SSE	0	9	8	1	0	0	0	0	0	18
S	3	24	50	27	3	1	2	0	0	110
SSW	1	7	17	21	0	1	0	0	0	47
SW	4	30	44	29	7	2	1	0	0	117
WSW	3	28	46	41	7	2	0	0	0	127
W	6	56	68	58	7	3	0	0	0	198
WNW	0	22	77	43	8	0	1	0	0	151
NW	3	40	83	86	7	6	2	0	0	227
NNW	5	35	55	55	12	3	4	2	0	171
Sub-Total:	553	407	627	478	75	36	23	6	3	2208

Average Wind Speed: 1.92 m/s

2003: FOURTH QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	627	32	21	29	22	27	16	0	1	775
NNE	1	28	17	8	1	1	1	0	0	57
NE	2	26	13	6	0	0	0	0	0	47
ENE	0	6	5	0	0	0	0	0	0	11
E	4	41	36	5	0	0	0	0	0	86
ESE	3	43	39	4	1	0	0	0	0	90
SE	3	74	51	16	4	4	2	2	0	156
SSE	1	45	42	35	14	8	11	2	6	164
S	2	54	63	102	18	43	30	13	13	338
SSW	2	11	12	18	2	2	2	2	1	52
SW	1	27	22	9	4	3	1	0	1	68
WSW	0	24	34	14	4	2	3	0	0	81
W	2	12	39	23	2	5	0	0	0	83
WNW	0	14	22	11	0	0	0	0	0	47
NW	2	26	40	15	5	0	1	0	1	90
NNW	0	22	17	12	2	6	4	0	0	63
Sub-Total:	650	485	473	307	79	101	71	19	23	2208

Average Wind Speed: 1.99 m/s

2004: ANNUAL

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	2211	226	355	359	93	147	64	26	23	3504
NNE	11	113	122	78	14	14	10	7	1	370
NE	1	64	76	35	3	3	0	0	0	182
ENE	2	26	11	4	0	1	0	0	0	44
E	10	129	59	7	1	0	0	0	0	206
ESE	5	113	59	3	0	0	0	0	0	180
SE	10	173	80	31	2	10	9	1	3	319
SSE	4	89	70	69	10	30	25	15	6	318
S	7	108	176	224	51	112	80	29	23	810
SSW	4	34	46	49	6	14	10	2	2	167
SW	1	81	99	84	12	23	17	2	2	321
WSW	1	61	111	71	24	13	15	4	1	301
W	11	107	189	146	27	12	5	4	1	502
WNW	2	74	137	120	12	8	1	0	1	355
NW	6	161	260	223	42	47	11	0	0	750
NNW	12	88	130	159	37	19	8	1	1	455
Sub-Total:	2298	1647	1980	1662	334	453	255	91	64	8784

Average Wind Speed: 2.13 m/s

2004: FIRST QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	579	30	60	73	22	30	14	5	2	815
NNE	3	19	27	14	5	6	4	0	0	78
NE	0	17	24	12	2	2	0	0	0	57
ENE	0	8	5	1	0	1	0	0	0	15
E	3	38	22	4	0	0	0	0	0	67
ESE	1	39	23	0	0	0	0	0	0	63
SE	4	62	23	18	1	8	9	1	3	129
SSE	0	26	29	27	6	18	15	9	1	131
S	2	33	54	93	31	61	55	12	17	358
SSW	1	11	7	20	3	5	7	2	1	57
SW	1	10	18	20	2	4	3	0	0	58
WSW	1	18	19	16	3	5	2	1	0	65
W	0	13	29	18	11	1	4	3	1	80
WNW	0	8	21	13	1	1	1	0	0	45
NW	1	17	40	20	5	6	2	0	0	91
NNW	4	12	20	26	9	3	0	1	0	75
Sub-Total:	600	361	421	375	101	151	116	34	25	2184

Average Wind Speed: 2.34 m/s

2004: SECOND QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	387	76	158	150	46	60	23	4	3	907
NNE	1	30	37	33	5	3	3	2	0	114
NE	0	13	33	10	1	0	0	0	0	57
ENE	0	3	1	1	0	0	0	0	0	5
E	2	16	6	0	0	0	0	0	0	24
ESE	0	21	7	0	0	0	0	0	0	28
SE	0	24	6	2	0	0	0	0	0	32
SSE	1	8	8	14	1	2	2	0	2	38
S	1	13	24	32	6	20	8	2	3	109
SSW	0	5	11	8	1	3	0	0	0	28
SW	0	19	22	15	7	8	11	2	1	85
WSW	0	4	26	17	10	1	3	0	0	61
W	2	18	39	48	10	5	0	0	0	122
WNW	0	22	25	38	6	5	0	0	0	96
NW	2	57	81	91	27	26	7	0	0	291
NNW	3	32	39	78	16	14	5	0	0	187
Sub-Total:	399	361	523	537	136	147	62	10	9	2184

Average Wind Speed: 2.44 m/s

2004: THIRD QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	510	69	79	79	11	31	13	7	1	800
NNE	7	32	30	13	3	2	1	0	1	89
NE	1	13	13	7	0	0	0	0	0	34
ENE	1	4	3	0	0	0	0	0	0	8
E	5	17	8	0	1	0	0	0	0	31
ESE	1	10	2	0	0	0	0	0	0	13
SE	2	21	13	2	0	0	0	0	0	38
SSE	1	17	9	2	0	0	0	0	0	29
S	3	24	45	26	1	1	0	0	0	100
SSW	3	8	17	10	1	1	0	0	0	40
SW	0	33	39	31	2	3	2	0	0	110
WSW	0	22	42	25	8	6	7	0	0	110
W	9	49	79	60	6	4	1	0	0	208
WNW	2	29	68	52	5	2	0	0	0	158
NW	3	55	111	91	7	9	2	0	0	278
NNW	4	34	60	51	9	2	2	0	0	162
Sub-Total:	552	437	618	449	54	61	28	7	2	2208

Average Wind Speed: 1.90 m/s

2004: FOURTH QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	735	51	58	57	14	26	14	10	17	982
NNE	0	32	28	18	1	3	2	5	0	89
NE	0	21	6	6	0	1	0	0	0	34
ENE	1	11	2	2	0	0	0	0	0	16
E	0	58	23	3	0	0	0	0	0	84
ESE	3	43	27	3	0	0	0	0	0	76
SE	4	66	38	9	1	2	0	0	0	120
SSE	2	38	24	26	3	10	8	6	3	120
S	1	38	53	73	13	30	17	15	3	243
SSW	0	10	11	11	1	5	3	0	1	42
SW	0	19	20	18	1	8	1	0	1	68
WSW	0	17	24	13	3	1	3	3	1	65
W	0	27	42	20	0	2	0	1	0	92
WNW	0	15	23	17	0	0	0	0	1	56
NW	0	32	28	21	3	6	0	0	0	90
NNW	1	10	11	4	3	0	1	0	1	31
Sub-Total:	747	488	418	301	43	94	49	40	28	2208

Average Wind Speed: 1.83 m/s

2005: ANNUAL

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	2100	191	336	248	48	115	47	13	3	3101
NNE	1	102	121	59	4	19	9	9	0	324
NE	1	91	80	47	4	8	4	0	0	235
ENE	1	28	20	5	0	0	0	0	0	54
E	1	106	59	5	1	1	0	0	0	173
ESE	4	133	64	5	0	0	0	0	0	206
SE	4	204	116	23	4	3	2	1	2	359
SSE	7	110	92	57	28	33	14	9	8	358
S	3	142	194	185	75	138	79	35	26	877
SSW	1	49	60	35	16	17	10	4	1	193
SW	1	94	144	88	17	32	13	8	2	399
WSW	3	72	124	61	15	20	6	3	3	307
W	3	147	239	170	38	48	4	8	3	660
WNW	0	92	139	105	19	14	4	1	0	374
NW	3	172	331	231	41	35	10	0	1	824
NNW	0	59	120	77	23	26	7	2	2	316
Sub-Total:	2133	1792	2239	1401	333	509	209	93	51	8760

Average Wind Speed: 2.09 m/s

2005: FIRST QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	648	36	55	40	9	20	5	4	1	818
NNE	0	21	34	9	0	2	2	2	0	70
NE	0	27	22	7	2	0	0	0	0	58
ENE	0	15	7	4	0	0	0	0	0	26
E	1	32	20	3	0	0	0	0	0	56
ESE	0	57	33	2	0	0	0	0	0	92
SE	2	88	39	5	3	0	0	0	0	137
SSE	3	36	31	24	12	20	8	6	2	142
S	2	31	48	67	23	53	26	13	5	268
SSW	0	8	11	8	6	7	1	1	0	42
SW	1	13	22	19	5	9	1	3	1	74
WSW	2	17	28	5	3	1	3	0	0	59
W	0	26	26	14	7	4	0	2	1	80
WNW	0	16	19	19	8	3	1	0	0	66
NW	0	25	47	17	5	13	2	0	0	109
NNW	0	10	22	14	6	8	3	0	0	63
Sub-Total:	659	458	464	257	89	140	52	31	10	2160

Average Wind Speed: 1.94 m/s

2005: SECOND QUARTER
WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	373	40	89	99	20	68	33	8	2	732
NNE	0	23	34	20	1	8	6	7	0	99
NE	0	13	23	20	1	5	3	0	0	65
ENE	0	7	5	0	0	0	0	0	0	12
E	0	22	11	0	1	1	0	0	0	35
ESE	0	18	7	1	0	0	0	0	0	26
SE	0	24	22	8	0	1	0	0	0	55
SSE	0	20	20	13	3	3	2	1	2	64
S	0	24	49	45	14	23	16	4	2	177
SSW	0	10	11	11	3	1	3	1	0	40
SW	0	20	23	34	3	10	9	2	0	101
WSW	0	16	27	30	6	11	0	3	0	93
W	0	22	58	56	16	29	4	6	2	193
WNW	0	20	33	33	7	8	2	1	0	104
NW	0	50	95	107	19	12	5	0	0	288
NNW	0	9	31	33	10	9	4	2	2	100
Sub-Total:	373	338	538	510	104	189	87	35	10	2184

Average Wind Speed: 2.58 m/s

2005: THIRD QUARTER
WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	430	67	120	63	8	17	8	1	0	714
NNE	0	24	26	14	3	6	1	0	0	74
NE	0	23	17	9	0	3	0	0	0	52
ENE	0	3	2	0	0	0	0	0	0	5
E	0	10	3	0	0	0	0	0	0	13
ESE	1	7	3	0	0	0	0	0	0	11
SE	1	21	10	0	0	0	0	0	0	32
SSE	2	12	12	3	0	0	0	0	0	29
S	1	38	60	9	1	1	0	0	0	110
SSW	0	20	25	7	4	0	0	0	0	56
SW	0	41	72	23	3	2	0	0	0	141
WSW	1	26	54	20	4	1	0	0	0	106
W	2	72	114	89	12	12	0	0	0	301
WNW	0	35	63	43	4	3	0	0	0	148
NW	3	68	143	84	13	4	0	0	0	315
NNW	0	23	43	21	7	7	0	0	0	101
Sub-Total:	441	490	767	385	59	56	9	1	0	2208

Average Wind Speed: 1.88 m/s

2005: FOURTH QUARTER

WIND SPEED AT 10 METERS HEIGHT (m/s)

SECTOR	0 - 1	1 - 2	2 - 3	3 - 4	4 - 5	5 - 6	6 - 7	7 - 8	>=8	Total
N	649	48	72	46	11	10	1	0	0	837
NNE	1	34	27	16	0	3	0	0	0	81
NE	1	28	18	11	1	0	1	0	0	60
ENE	1	3	6	1	0	0	0	0	0	11
E	0	42	25	2	0	0	0	0	0	69
ESE	3	51	21	2	0	0	0	0	0	77
SE	1	71	45	10	1	2	2	1	2	135
SSE	2	42	29	17	13	10	4	2	4	123
S	0	49	37	64	37	61	37	18	19	322
SSW	1	11	13	9	3	9	6	2	1	55
SW	0	20	27	12	6	11	3	3	1	83
WSW	0	13	15	6	2	7	3	0	3	49
W	1	27	41	11	3	3	0	0	0	86
WNW	0	21	24	10	0	0	1	0	0	56
NW	0	29	46	23	4	6	3	0	1	112
NNW	0	17	24	9	0	2	0	0	0	52
Sub-Total:	660	506	470	249	81	124	61	26	31	2208

Average Wind Speed: 1.95 m/s

FIGURE 8.1B-7 BUILDING LAYOUT USED IN THE AIR QUALITY MODELING ANALYSIS

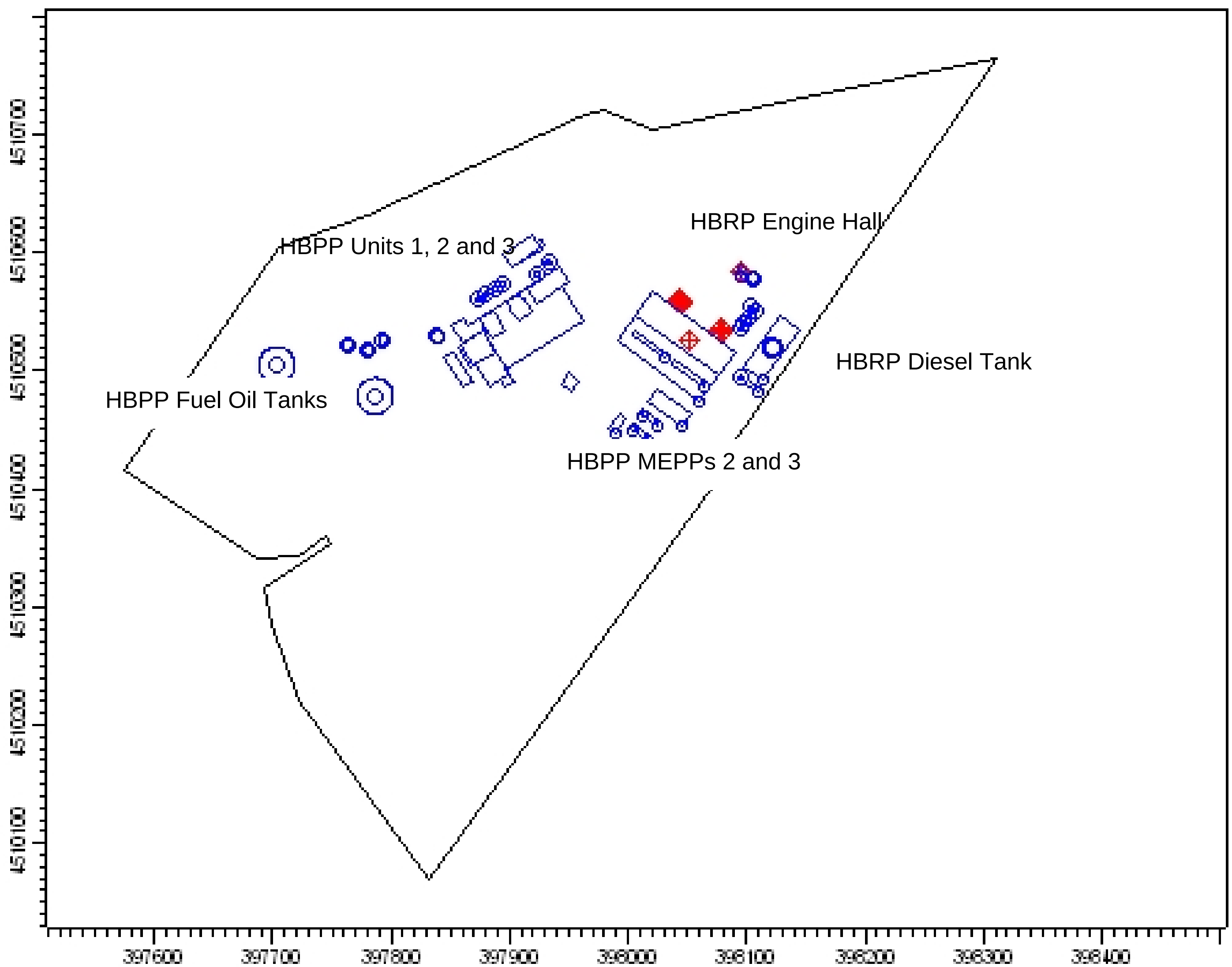


FIGURE 8.1B-8 AERMET SECTORS FOR SURFACE CHARACTERISTICS

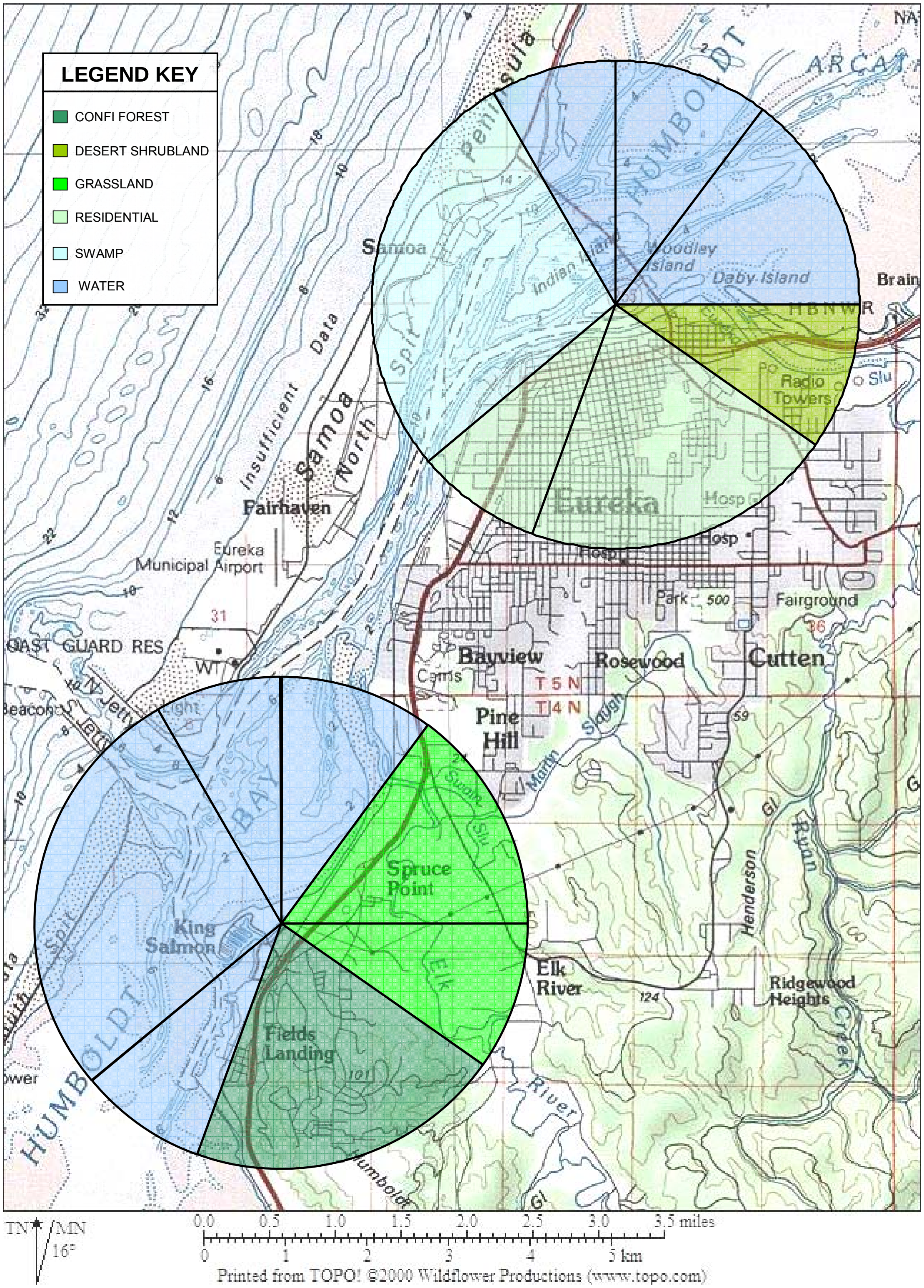


FIGURE 8.1B-9A FULL AERMOD RECEPTOR GRID

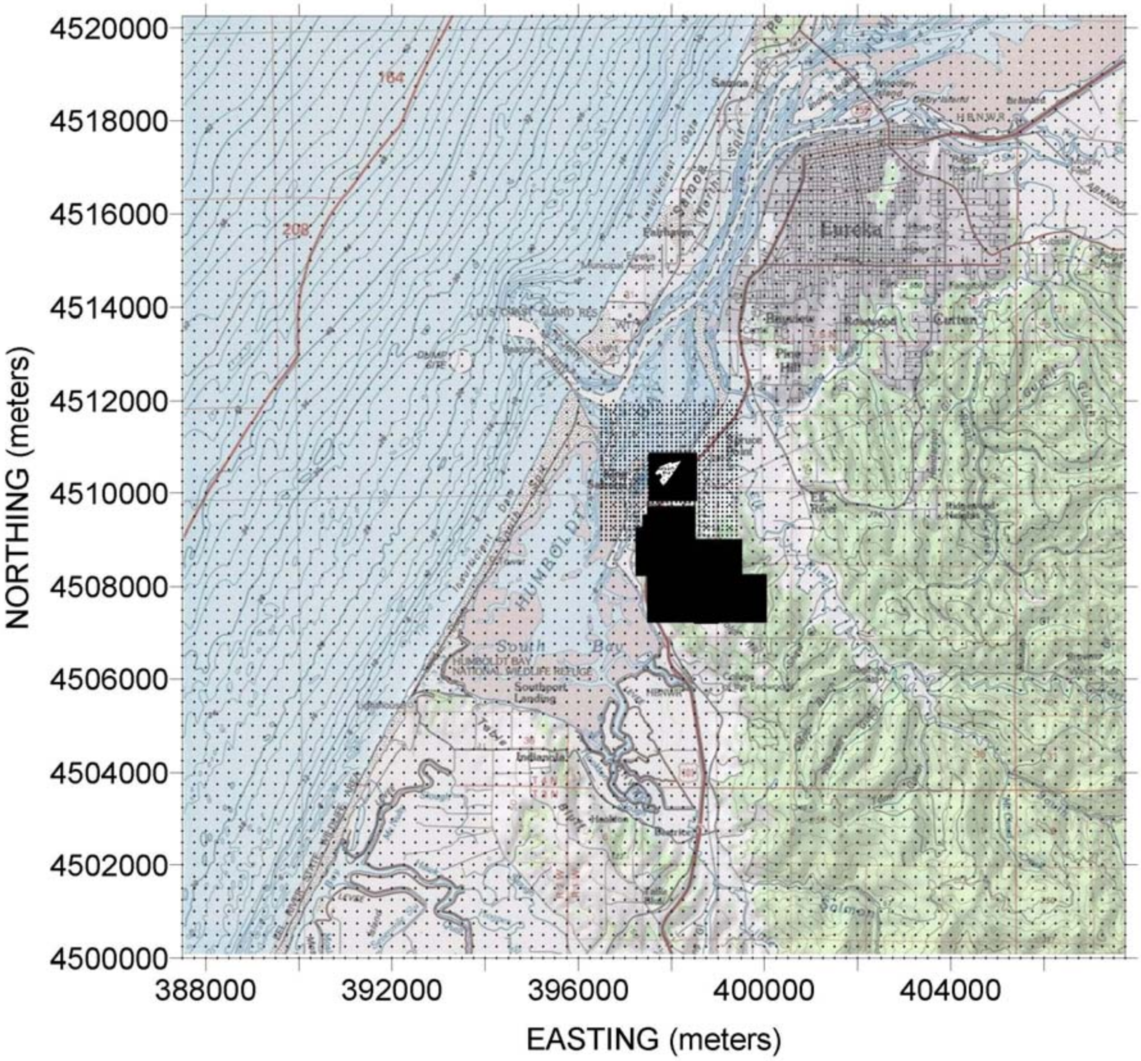


FIGURE 8.1B-9B AERMOD RECEPTOR GRID USED FOR MODELING FLAT TERRAIN (BELOW STACK TOP)

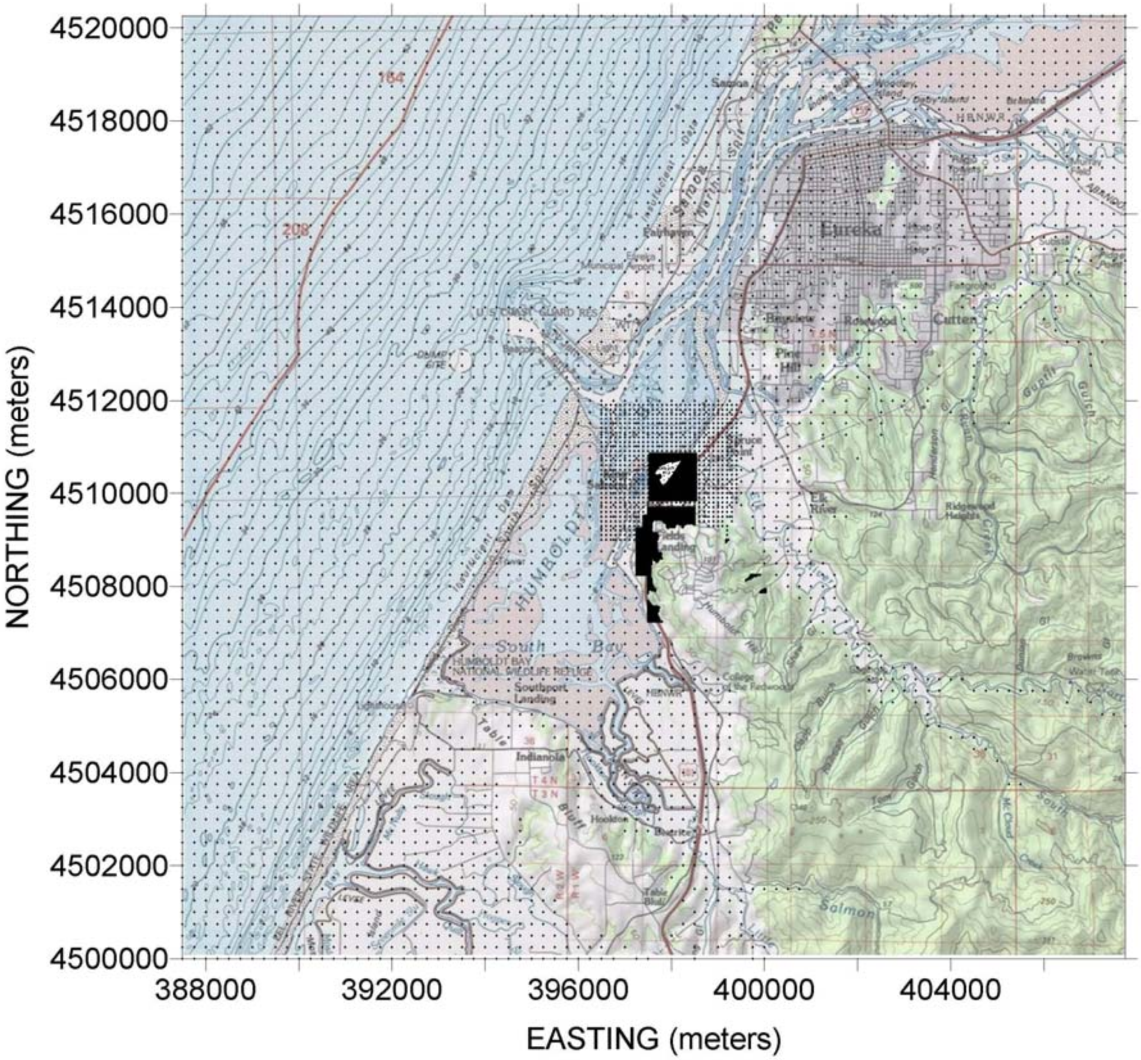


FIGURE 8.1B-9C RECEPTOR GRID FOR CTSCREEN MODELING

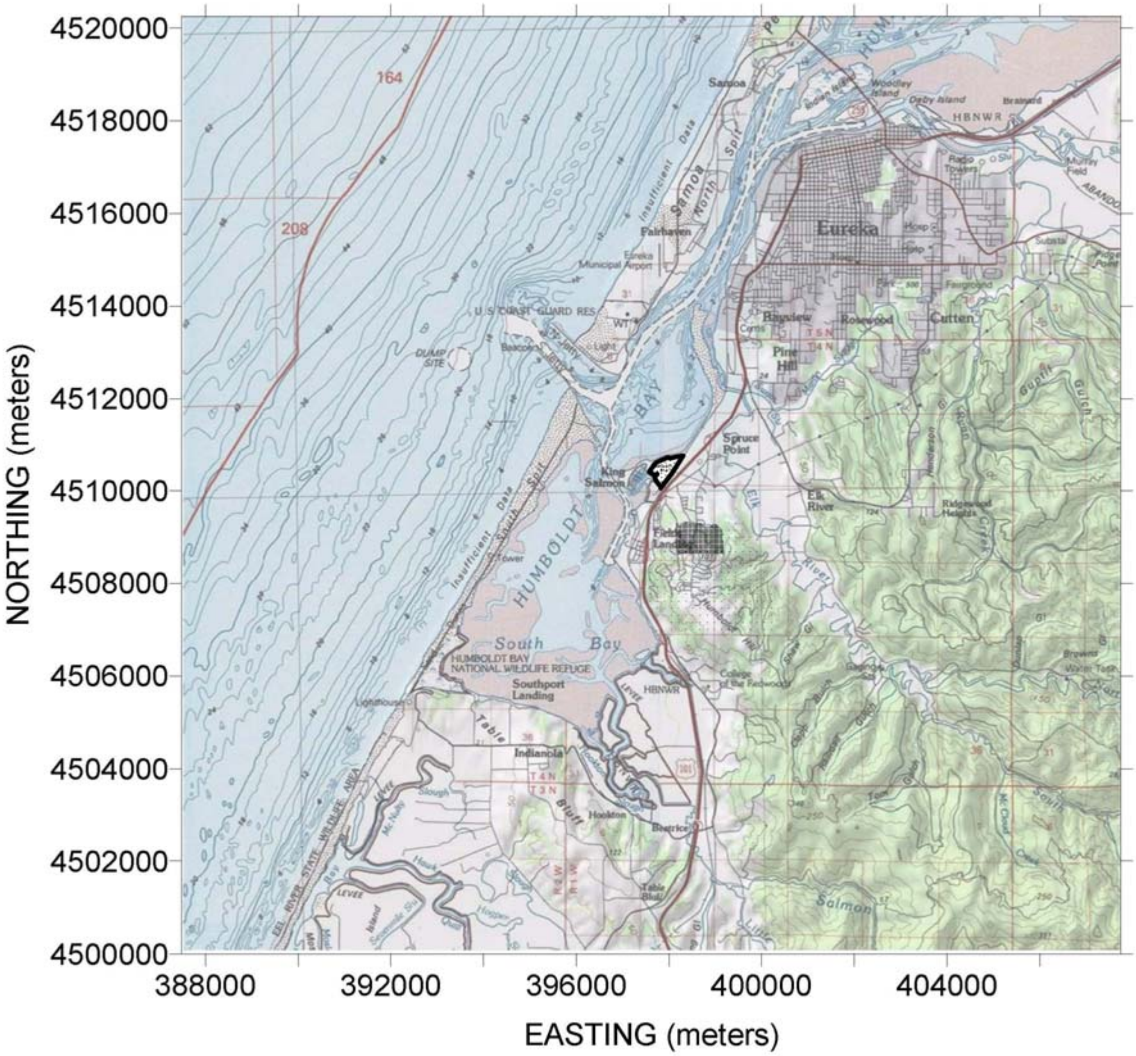
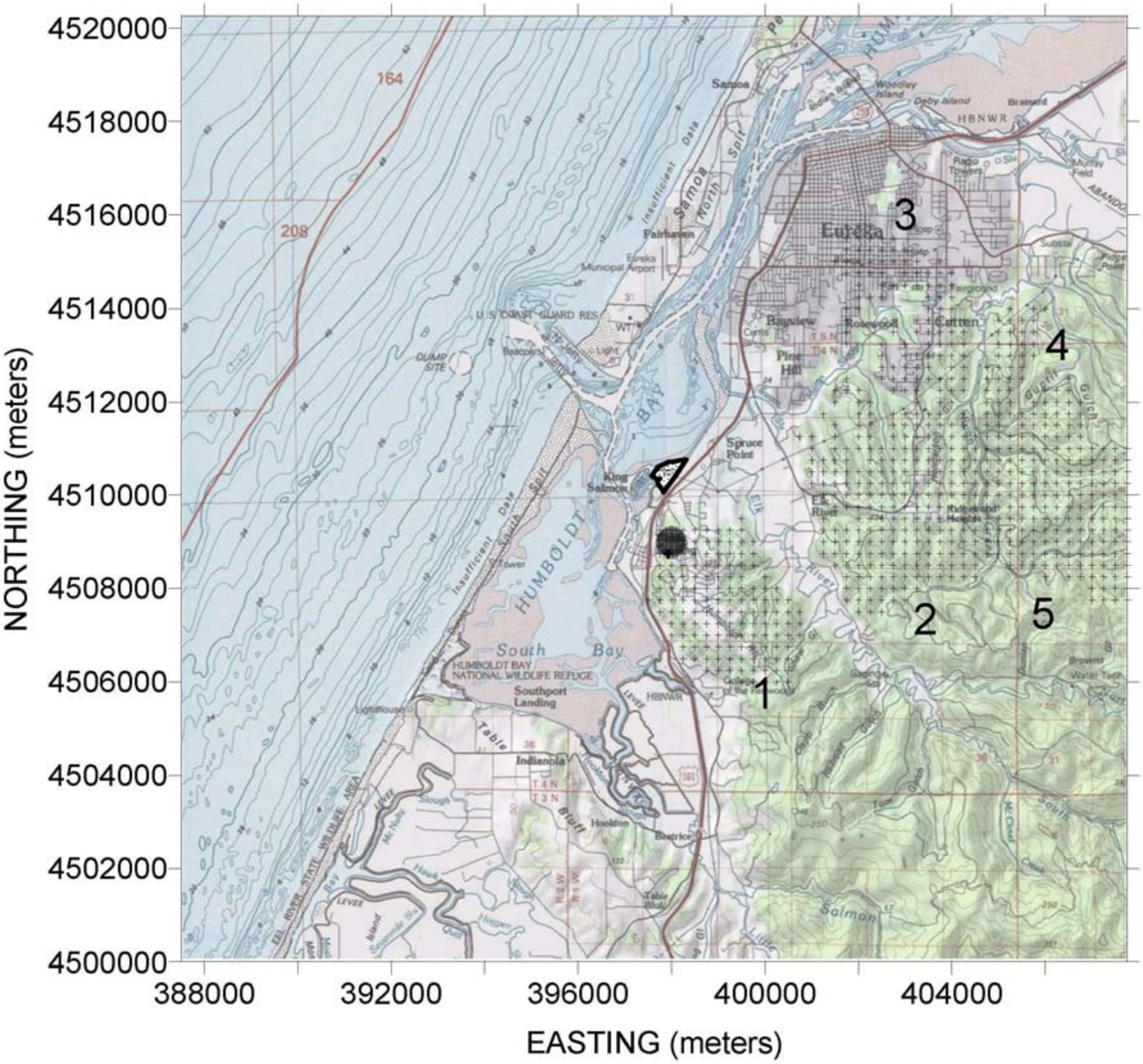


FIGURE 8.1B-9D RECEPTOR GRID FOR CTDMPLUS MODELING



Attachment 8.1B-1

Modeling Protocol

Humboldt Bay Power Plant Repowering Project
Modeling Protocol
Revised August 2007

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Pacific Gas and Electric Company (PG&E) has submitted an Application for Certification and an Application for Determination of Compliance for a repowering project at its Humboldt Bay Power Plant (HBPP) near Eureka. The proposed project will consist of installing ten Wartsila Model 18V50DF engine/generator sets to replace the existing boiler- and turbine-based fossil-fueled generating equipment. The project will also include radiative coolers for engine cooling and minor auxiliary equipment, and will have a total nominal net generating capacity of up to 163 MW. The proposed project will be a major modification under North Coast Unified Air Quality Management District (NCUAQMD or District) regulations.

The applicant has submitted air quality impact analyses to the District. After review of these analyses, the District has requested changes to the analytical protocol. The purpose of this document is to establish the procedure for meeting the District's air quality modeling requirements for the proposed project. Except as directed by the District, EPA modeling guidance[1] will be followed in preparing the ambient air quality impact analyses.

Net increases in emissions of some pollutants are expected to be above the significant increase thresholds for federal Prevention of Significant Deterioration (PSD) requirements (40 CFR 52.21). In accordance with District regulations, the modeling analyses to be prepared in accordance with this protocol will include a demonstration of compliance with many of the applicable PSD requirements.

This modeling protocol outlines the proposed use of air dispersion modeling techniques that will be used to assess impacts from the proposed sources, and has been prepared by Sierra Research on behalf of PG&E.

Impacts from operation of the facility will be compared to the following:

[1] U.S. Environmental Protection Agency (USEPA). "*Guideline on Air Quality Models*" (including supplements), 40 CFR Part 51 Appendix W, November 2005.

Air Quality Criteria	VOC [a]	NO_2	PM_{10}	$PM_{2.5}$	CO	SO_2
PSD Significant Impact Levels	√	√	√		√	√
PSD Monitoring Exemption Levels	√	√	√		√	√
Ambient Air Quality Standards (AAQS)	√	√	√	√[b]	√	√
Class I and Class II Visibility[c]		√	√			√
Impacts to Soils and Vegetation[c]		√	√			√
Class I Area Acid Deposition[c]		√	√			√

Notes:

a. VOC emissions are used as a surrogate for ozone impacts in the PSD review process; no ozone modeling will be carried out.

b. Although EPA guidance (71 FR 6727) provides that compliance with the federal $PM_{2.5}$ NAAQS should be evaluated using the PM_{10} NAAQS and not modeled directly, at the request of CARB compliance with both the federal 24-hour average AAQS and the state and federal annual average AAQS for $PM_{2.5}$ will be addressed based on $PM_{2.5}$ for non-PSD purposes.

c. The visibility, soils and vegetation and acid deposition analyses have been prepared and submitted to the Federal Land Managers (with a copy to the District) on February 2, 2007, in accordance with a protocol submitted to the FLMs in July 2006, and as modified to reflect the FLM's comments. No further revisions to the Class I impacts analysis protocol, or to the Class I impacts analysis, are proposed at this time.

PROJECT LOCATION

Ten new natural gas-fired reciprocating engine/generator sets and associated auxiliaries will be located just south of Eureka, on the site of the existing Humboldt Bay Power Plant. The UTM coordinates of the site are approximately 4,510.57 kilometers northing, 397.88 kilometers easting (NAD 27, Zone 10). The nominal site elevation is 1 meter above mean sea level. The area in the immediate vicinity of the project site is relatively flat with the western edge of the project area bordering on Humboldt Bay.

PROPOSED EMISSION SOURCES

The primary emission sources for the proposed project will be the Wärtsilä Model 18V50DF engine/generator sets. The reciprocating engines will be fired with natural gas and a small amount of ultra low-sulfur CARB Diesel fuel for pilot ignition; ultra low-sulfur CARB Diesel fuel will be used as a backup fuel in the event of a natural gas curtailment. The reciprocating engines will utilize advanced combustion designs and emission controls to limit emissions of NOx and CO. Emissions of PM_{10} and SO_2 will be kept to a minimum through efficient combustion practices and the exclusive use of clean-burning fuels.

Emissions from the new sources will be evaluated for a total of twelve operating conditions determined to represent the most likely potential operating modes for the plant. The 10 engines will be modeled as 10 individual point sources located at their specific physical locations, as shown in Figure 2.3-2 of the AFC. These twelve operating conditions and the specific stack parameters associated with engine operation in each mode are identified in Table 8.1B-3 of the AFC; this table is reproduced below.

HBRP Stack Parameters for Screening Modeling

Engine Case	Load/ Ambient Temp	Stack Diam (m)	Stack Ht[a] (m)	Exhaust Temp (deg K)	Exhaust Velocity (m/s)
1G	full/87	1.620	22.860	663.556	27.152
2G	low/87	1.620	22.860	697.444	16.441
3G	mid/87	1.620	22.860	692.444	22.686
4G	mid/21	1.620	22.860	686.333	22.784
5G	full/21	1.620	22.860	656.889	27.651
6G	low/21	1.620	22.860	697.444	16.856
1D	full/87	1.620	22.860	635.222	30.806
2D	low/87	1.620	22.860	642.444	18.613
3D	mid/87	1.620	22.860	621.889	25.044
4D	mid/21	1.620	22.860	584.111	25.252
5D	full/21	1.620	22.860	597.444	31.037
6D	low/21	1.620	22.860	599.111	18.223

Notes:

a. The stack height may be revised from this level depending on initial modeling results. A final stack height will be established and will be identified in the modeling documentation; the final stack height must be established before the remainder of the revised modeling analysis can proceed.

Each of the twelve operating modes will be evaluated in sensitivity runs based on AERMOD and the 2001-05 meteorological data collected at the National Weather Service Woodley Island station (discussed in more detail in the following sections). As described in Section 8.1.2.6.3 of the AFC (Screening Procedures for the HBRP Reciprocating Engines), a screening procedure is used to determine which of the potential operating modes produces the maximum modeled impacts for each pollutant and averaging period.[2] The low-load operating cases (2G, 6G, 2D and 6D) will not be evaluated for 24-hour or annual average impacts, and the mid-load cases (3G, 4G, 3D, 4D) will not be evaluated for annual average impacts, because these operating cases are not expected to persist for more than a few hours at any time.

Impacts on 100% Diesel operation for all engines will be evaluated for 1-hour, 3-hour, 8-hour, and 24-hour average impacts, because the project permit will contain a condition prohibiting operation on 100% Diesel fuel for an entire year. Annual average impacts will be determined

[2] The results of the original screening modeling procedures are shown in Table 8.1B-4, Appendix 8.1B, of the AFC.

based on the proposed annual potential to emit for the project. PG&E will eliminate the separate calculation of maximum annual emissions for federal PSD and CEQA (as shown in the last section of Table 8.1-17 of the AFC) and accept annual plantwide emission limits based on the calculation of annual emissions for regulatory compliance (shown in Table 8.1-17 at the bottom of p. 8.1-30 of the AFC). These maximum annual emissions will be the basis for the annual average impact modeling.

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Based on the results of the screening procedure, the operating case that produces the highest modeled ambient concentration for each individual pollutant and averaging period will be used in the refined air quality impact analysis. The revised ambient air quality impact analysis that will be submitted in support of the revised modeling analysis will provide the results of the revised screening analysis, will identify the operating cases that produce the highest concentration for each pollutant and averaging period, and will provide the specific stack parameters (stack height, stack diameter, exhaust temperature and exhaust velocity) that will be used to evaluate compliance with applicable PSD increments and compliance with the AAQS for all applicable pollutants and averaging periods.

Compliance with the ambient air quality standards will be demonstrated in accordance with the procedure outlined in the October 1990 Draft PSD Workshop Manual (p. C.51, "The Compliance Demonstration"). The first step in the compliance demonstration is to determine, for each pollutant and averaging period, whether the proposed new equipment, HBRP, will cause a significant ambient impact anywhere. As indicated in the PSD workshop manual, "If the significant net emissions increase[3] from a proposed source would not result in a significant ambient impact anywhere, the application is usually not required to go beyond a preliminary analysis in order to make the necessary showing of compliance for a particular pollutant." The significance levels for air quality impacts are shown in the following table. If the maximum modeled impact for any pollutant and averaging period is below the appropriate significance level, no further analysis is necessary.

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Significance Levels for Air Quality Impacts in Class II Areas[a] ($\mu g/m^3$)					
	Averaging Period				
Pollutant	Annual	24-hour	8-hour	3-hour	1-hour
SO_2	1	5	--	25	--
PM_{10}	1	5	--	--	--
NOx	1	--	--	--	--
CO	--	--	500	--	2000
Note: a. From 40 CFR 51.165, shown as Table C-4 in the 1990 draft PSD Workshop Manual.					

3 Note that this guidance requires modeling only for pollutants for which there is a significant net increase. As the proposed project will result in significant net increases only for ROG and PM_{10} emissions, the PSD guidance would require an ambient air quality impact analysis only for PM_{10} (because Gaussian models are not suited to evaluating

If the modeled impacts from HBRP alone are above the PSD significance thresholds shown in the table above, the second step of the compliance demonstration is required to show that the proposed new source, in conjunction with existing sources, will not cause or contribute to a violation of any ambient air quality standard.[4] As discussed in more detail on page 12 of this protocol, the impacts of existing sources are represented by the existing ambient air quality data collected at Eureka (PM_{10} and $PM_{2.5}$), Willits and Ukiah (NO_2 and CO) and San Francisco (SO_2). In accordance with Section 8.2.1 of Appendix W to 40 CFR Part 51,

> "Background concentrations are an essential part of the total air quality concentration to be considered in determining source impacts. Background air quality includes pollutant concentrations due to: (1) Natural sources; (2) nearby sources other than the one(s) currently under consideration; and (3) unidentified sources. Typically, air quality data should be used to establish background concentrations in the vicinity of the source(s) under consideration."

Because ambient PM_{10} and $PM_{2.5}$ levels are the result of secondary pollutant formation as well as directly emitted particulate matter, it is appropriate to rely on the locally monitored air quality data for PM_{10} and $PM_{2.5}$ to represent background concentrations in the project area.

The impact of the proposed new equipment (HBRP) will modeled using the maximum allowable emission limits as proposed in the application and the design capacities of the engines, assuming continuous operation, in accordance with the guidance on Table 8-2 of Appendix W. If the predicted total ground level concentration obtained by adding the maximum impact of the proposed new equipment to the monitored background concentrations is below the state or federal ambient air quality standards for each pollutant and averaging period, no further analysis is required for that pollutant and averaging period.

The increments analysis will include changes in emissions from increment-consuming sources as discussed in the previously-submitted increments analysis. The only changes to the increments analysis that will be made for the revised submittal are: (1) the Wärtsilä engines at HBRP will be modeled as ten individual point sources rather than as two combined sources; (2) the modeled stack heights will reflect the final physical stack height selected for the project; and (3) the amount of increment consumed by the existing Humboldt Bay Power Plant will be adjusted to reflect the updated baseline emissions inventory submitted to the District in March 2007.

Deleted: If the proposed new equipment, combined with existing background concentrations, will result in predicted total ground level concentration in excess of an applicable ambient air quality standard, then the third step of the compliance demonstration procedure will be undertaken. According to the 1990 draft PSD Workshop Manual, ¶

¶

"For a NAAQS violation to which an applicant contributes significantly, a PSD permit may be granted only if sufficient emissions reductions are obtained to compensate for the adverse ambient impacts caused by the proposed source. ***Emissions reductions are considered to compensate for the proposed source's adverse impact when, at a minimum, (1) the modeled net concentration, resulting from the proposed emissions increase and the federally enforceable emissions reduction, is less than the applicable significant ambient impact level at each affected receptor,*** and (2) no new violations will occur." [emphasis added]¶

¶

In accordance with this guidance, only if the modeled impacts from the proposed new equipment, combined with existing background concentrations, are predicted to cause a new violation of a standard for which the District is currently in attainment will this netting procedure be used. The federally enforceable emissions reductions to be used in the netting procedure will occur from the shutdown of the existing Humboldt Bay Power Plant generating units, using the assumptions outlined below.¶

¶

The applicant proposes to use netting only to demonstrate compliance with state and federal ambient air quality standards and with the Class II increments, and not for the screening health risk assessment. The screening health risk assessment will compare the modeled risks of the proposed new HBRP with established significance criteria and will not consider the existing Humboldt ... [1]

impacts on ozone from individual sources). However, as required under the District NSR rule, this procedure will be used for the ambient air quality impact analyses for NO_2, SO_2, CO and $PM_{2.5}$ as well.

[4] Since the applicable EPA guidance does not define significance levels for $PM_{2.5}$ while the District requires that this analysis be performed, $PM_{2.5}$ impacts will be presumed to be above any applicable significance level regardless of the modeled concentration, and the second step of the process will be performed.

EXISTING EMISSION SOURCES

The existing Humboldt Bay Power Plant (HBPP) consists of two dual-fuel steam boilers (Units 1 and 2), and two liquid-fueled mobile emergency power plants (MEPPs). The steam boilers are normally fired on natural gas, but can be fired on #6 fuel oil as well. Fuel oil firing of the steam boilers normally occurs during curtailment of natural gas supplies to the power plant. The MEPPs are always fired on distillate fuel,[5] and may be operated during natural gas curtailments, periods of high electrical demand, or when one of the steam boilers is undergoing maintenance.

For the 24-hour averaging PM_{10} increments analysis, the existing units will be modeled at loads consistent with the corresponding operation of the new units. For comparison with the new units when operated on gas, the steam boilers will be assumed to be operating on gas, while the MEPPs will operate on distillate fuel.[6] For comparison with the new units when operated on 100% Diesel fuel, the steam boilers will be assumed to be operated on #6 fuel oil, while the MEPPs will operate on Diesel fuel, consistent with a gas curtailment scenario as reflected in the updated baseline calculations provided to the District in March 2007.

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Deleted: for short-term averaging periods

The specific operating assumptions for the existing units that will be used to correspond to each of the reciprocating engine operating cases used in evaluating 24-hour average impacts are summarized in the following table.

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Existing Unit Operating Assumptions					
HBRP Operating Cases			Assumed HBPP Operations		
Engine Cases	Engine Loads	Output, MW	Boiler Load	MEPP Load	Output, MW
1, 5	100%	163	2@100%	2@100%	135
3, 4	75%	122	2@88%	2@100%	122

Deleted: 2, 6 ... [2]

For example, if the screening modeling analysis described in the preceding section indicates that Case 5G has the highest modeled 24-hour average PM_{10} impacts, then the 24-hour average PM_{10} impacts from the existing units will be modeled assuming full load operation of both boilers on natural gas and full load operation of both MEPPs on distillate fuel.

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Deleted: If the screening modeling analysis indicates that Case 1D has the highest 8-hour average CO impacts, then the 8-hour average CO impacts from the existing units will be modeled assuming full load operation of both boilers on #6 fuel oil and full load operation of both MEPPs on distillate fuel.¶

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For annual average PM_{10} increments analysis, the average emission rates for the historical baseline period (4th quarter 2004 through 3rd quarter 2006) will be used to characterize the existing emission sources.

[5] The MEPPs are not physically capable of burning natural gas.

[6] As discussed in Section 2.0 of the AFC, the steam boilers, Units 1 and 2, operate on either natural gas or fuel oil while the MEPPs operate only on distillate fuel.

EXISTING METEOROLOGICAL DATA

The project site is at a coastal location southwest of Eureka. There is no ongoing meteorological measurement program at Humboldt Bay Power Plant. Meteorological data were collected at the project site in the mid-1960s (1966-67), but these data are not available in hourly format as needed for modeling, and there are concerns regarding instrument sensitivity and data quality for data collected that long ago. While the data are not considered suitable for modeling, they can be used to create a wind rose to illustrate the prevailing wind speeds and directions at the site. The wind rose in Figure 1, which was developed from onsite data collected in 1966-67, indicates that on an annual basis, prevailing winds at the project site are from the north. The occurrence of high wind speeds (defined here as wind speeds greater than 9.5 m/s) is low. Calm conditions are not observed in this meteorological data set.

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Since the new generating units will result in the shutdown of the existing emission sources, the project's impacts are represented by the net change in concentrations associated with the increase from the new sources and the decrease from the shutdown of the existing sources. To determine the net air quality impact associated with the project for comparison with the state and federal ambient air quality standards as outlined under the third step in the compliance demonstration (discussed above), the emissions from both the new and existing sources will be modeled as positive values using separate source groups.[7] The net impacts from the new HBRP units and the shutdown of the existing generating units will be evaluated on an receptor by receptor, hour by hour basis so that the change in ambient impact due to the replacement of the existing generating units is properly accounted for (per the reference to "each affected receptor" in the PSD Workbook guidance). An electronic file containing period-by-period, receptor-by-receptor impacts[8] will be created for each source group. These impacts will be mathematically combined, with the impacts of the existing sources subtracted from the impacts of the new sources, to determine the net impacts. These net impacts will then be aggregated to obtain annual average net impacts. This net impact analysis will be thoroughly documented and will include identification of models used, discussion of operational assumptions, emission rates and stack parameters for all sources, and sample calculations.¶

¶

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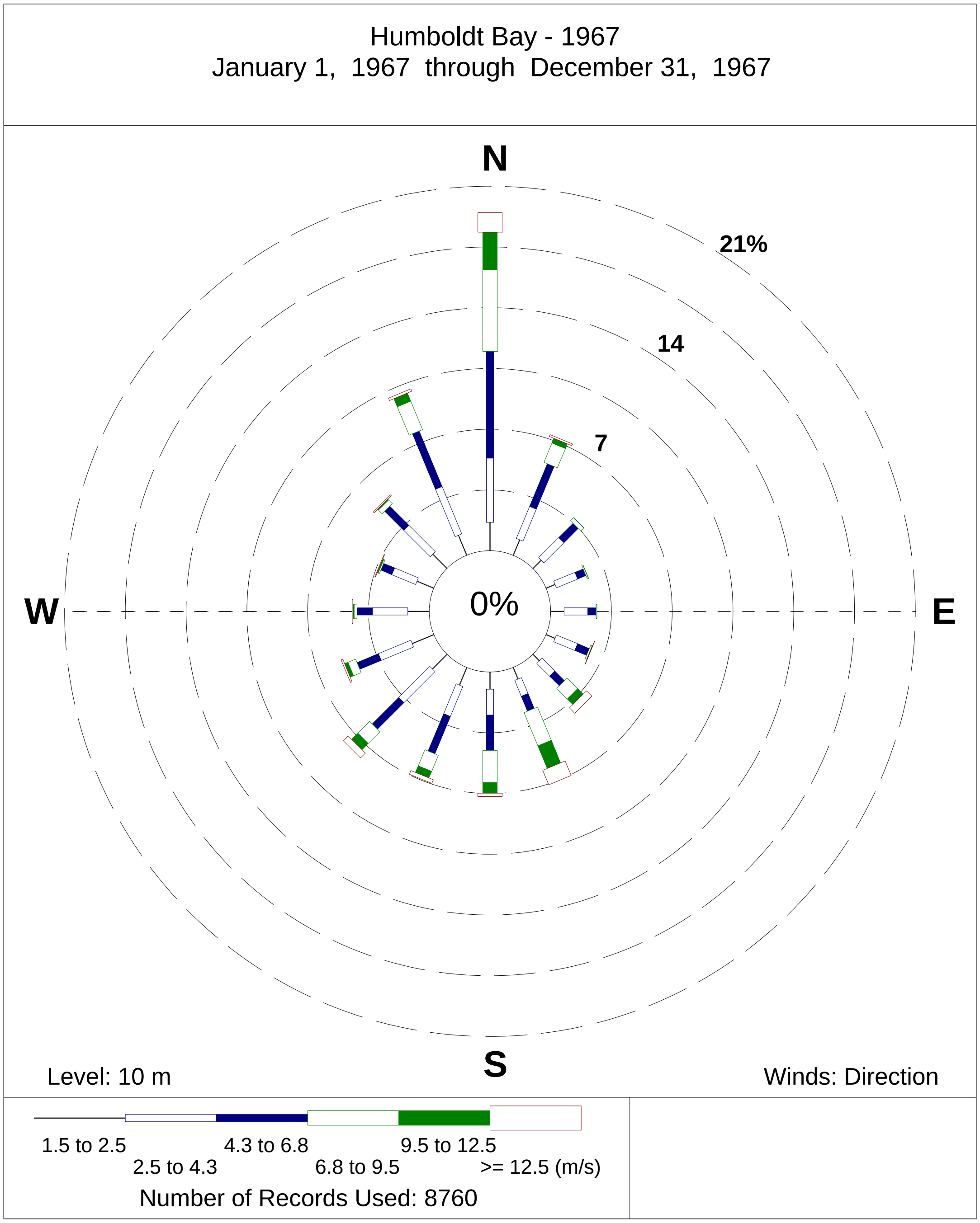
Figure 1
Wind Speeds and Directions Recorded at Humboldt Bay Power Plant



Surface meteorological measurements are made by the National Weather Service (NWS) at Woodley Island. As requested by the District, PG&E will use five years of the surface meteorological data measured at NWS Woodley Island during the period 2001 through 2005 to represent meteorological conditions at HBRP. The Woodley Island monitoring site is about 6 miles northeast of the project site. NWS collects cloud cover readings only during daylight hours at the Woodley Island monitoring site; consistent with the recommendations of the NCUAQMD staff, stability during nighttime hours was determined using data from Arcata airport, about 17 miles north of the project site. Because the Arcata airport is in a similar coastal location, atmospheric stability there is expected to be representative of stability at both the power plant and Woodley Island monitoring sites.

The Woodley Island meteorological data were available only in paper form. Sierra Research contracted with Trinity Consultants to transcribe the data to electronic format, perform quality assurance reviews on the transcription, fill in missing data using EPA-approved procedures (including the Arcata night-time stability data), and create the model-ready meteorological data set. All intermediate work products are available for review by the regulatory agencies.

There is no nearby location where satisfactory upper air data are gathered for the purpose of determining mixing heights and other surface boundary layer parameters. The nearest NWS sounding station is Medford, Oregon, which is 185 km (115 miles) away. That location is inland, and not characteristic of either the meteorological data or project sites. Although the NWS station at Oakland Airport is farther from the site than Medford (378 km, or 235 miles away), it is in a comparable coastal location to the project site, so the upper air data collected there are representative of upper air conditions at the project site. For ISCST3 modeling purposes seasonally-averaged twice-daily mixing heights from Holzworth (1972) might suffice, but for AERMOD, that approach cannot be used. Thus, Oakland sounding data will be used for determining mixing heights and other surface boundary layer parameters.

The preceding discussion has focused on meteorological data needed to run AERMOD. As discussed in a later section, an additional model, CTDMPLUS, may be used in lieu of CTSCREEN for receptors in the terrain above stack-top height that is in close proximity to the south-southeast of the project. CTDMPLUS is an EPA-approved air dispersion model, and is fully supported with user guidance documentation.[9]

CTDMPLUS requires an extensive suite of meteorological data composed not only of wind speed, direction, and temperature, but also horizontal and vertical wind direction standard deviations (sigma theta and sigma phi, respectively) as well as vertical wind speed standard deviation (sigma w). The data set directed by the NCUAQMD for use in modeling the project, derived from measurements taken at Woodley Island, does not include these non-standard measurements.

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[9] USEPA. Technology Transfer Network, Support Center for Regulatory Atmospheric Modeling, http://www.epa.gov/scram001/dispersion_prefrec.htm#ctdmplus.

It is possible to develop conservative values for these standard deviation parameters that are consistent with the available meteorological data and use them to prepare a meteorological data set that is usable in CTDMPLUS and yields conservative (i.e., high) ground-level concentrations.

As directed by the NCUAQMD, air quality impact analyses for the project will be based on five years of surface meteorological data measured at the Woodley Island monitoring station. These data were used to produce two processed meteorological data sets: one for AERMET/AERMOD and one for ISCST3[10]. All three of these Gaussian dispersion models, ISCST3, AERMOD and CTDMPLUS, require upper air data as well as surface data. The upper air data will come from Oakland International Airport as discussed earlier.

The following meteorological parameters are needed for CTDMPLUS and can be taken directly from the AERMET files:

- Observed mixing height, provided as the height of the convective or planetary boundary layer (PBL)
- Calculated mixing height, provided as the height of the mechanical, or surface, boundary layer (SBL)
- friction velocity (USTAR)
- Monin-Obukhov length (L), and
- roughness length (Z_O).

The remaining standard deviations (sigma values) are not available from AERMOD and must be obtained from the ISCST3 files. Stability classes determined by MPRM[11] or PCRAMMET[12] from the measured Woodley Island meteorological data will be used to select the most conservative values from the following ranges recommended in EPA's Meteorological Monitoring Guidance document:[13]

Stability Category	Sigma Phi (σ_Φ)/ Regulatory Range (degrees)	Sigma Theta (σ_θ)/ Regulatory Range (degrees)
A	11.5	22.5
B	10.0 – 11.5	17.5 – 22.5
C	7.8 – 10.0	12.5 – 17.5
D	5.0 – 7.8	7.5 – 12.5
E	2.4 – 5.0	3.8 – 7.5
F	< 2.4	< 3.8

10 The ISCST3 met data set will be used to create a complete CTDMPLUS met data set; see below.

11 The Meteorological Processor for Regulatory Models

12 EPA meteorological preprocessor

13 Tables 6-8a and 6-9a in Meteorological Monitoring Guidance for Regulatory Modeling Applications, EPA-454/R-99-005, US EPA Office of Air and Radiation, Office of Air Quality Planning and Standards, February, 2000.

The most conservative values (that is, the values that produce the highest modeled impacts) for sigma theta and sigma phi within each range will be determined by conducting a sensitivity analysis for all combinations of stack conditions to be modeled using CTDMPLUS and receptor locations for which CTDMPLUS will be used (that is, receptors above stack height). The sensitivity analysis will use the upper and lower values of each range for each stability category. For example, for stability category D, four combinations will be evaluated as follows:

σ_Φ	σ_θ
5.0	7.5
5.0	12.5
7.8	7.5
7.8	12.5

For stability category A, maximum values for σ_Φ and σ_θ of 15.0 and 27.0, respectively, will be evaluated. For stability category F, minimum values for σ_Φ and σ_θ of 1.0 and 2.0, respectively, will be evaluated.

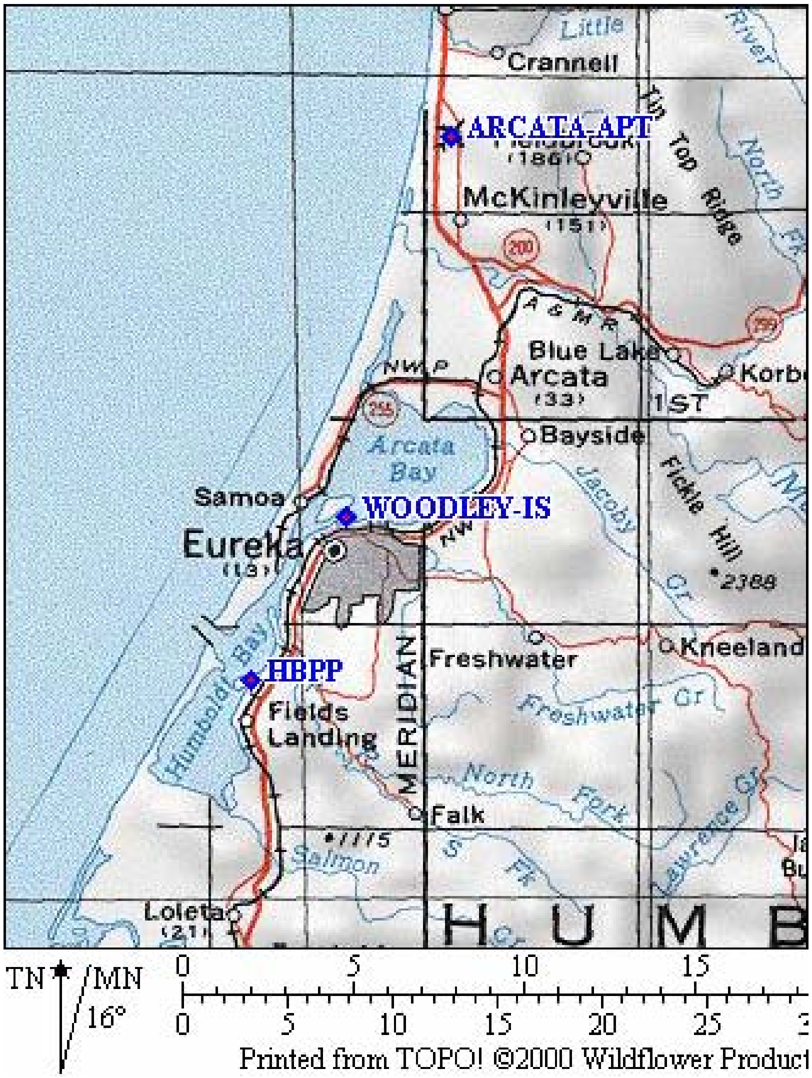
Sigma-w is estimated by multiplying sigma-phi (after conversion from degrees to radians) by the horizontal wind speed.

The relative locations of project site and monitoring stations for meteorological data are presented in Figure 2.

SITE REPRESENTATION – METEOROLOGICAL DATA

USEPA defines the term “on-site data” to mean data that would be representative of atmospheric dispersion conditions at the source and at locations where the source may have a significant impact on air quality. Specifically, the meteorological data requirement originates in the Clean Air Act at Section 165(e)(1), which requires an analysis “of the ambient air quality at the proposed site and in areas which may be affected by emissions from such facility for each pollutant subject to regulation under [the Act] which will be emitted from such facility.”

Figure 2
HBPP Site Location, with Meteorological Data Sites Indicated



This requirement and USEPA's guidance on the use of on-site monitoring data are also outlined in the "*On-Site Meteorological Program Guidance for Regulatory Modeling Applications*" (1987). The representativeness of the data depends on (a) the proximity of the meteorological monitoring site to the area under consideration, (b) the complexity of the topography of the area, (c) the exposure of the meteorological sensors, and (d) the period of time during which the data are collected. As discussed below, either Woodley Island or Arcata Airport meteorological data are representative of conditions at the project site.

Representativeness has been defined in the PSD Monitoring Guideline[14] as data that characterize the air quality for the general area in which the proposed project would be constructed and operated. Because of the reasonably close proximity of the meteorological data sites to the proposed project site (distance between the project site and the two monitoring locations is less than 20 miles), the same large-scale topographic features that influence the meteorological data monitoring stations also influence the proposed project site in the same manner.

The Humboldt Bay Power Plant lies along the southeastern shore of Humboldt Bay, about 6.5 km (4.0 miles) south-southwest of downtown Eureka, near the mouth of the Elk River. A 600-foot-tall ridge along the western edge of the Elk River Valley, called Humboldt Hill, terminates less than 1 km south-southeast of the power plant, and for dispersion purposes, constitutes the most significant terrain obstacle. Other ridges and terrain features, running north-south, parallel to the coast, and constituting the eastern edge of the Elk River Valley, lie 4 km inland.

Nighttime drainage winds pouring down the Elk River and across the southern part of Humboldt Bay are likely to occur, much as drainage winds are observed at the Arcata Airport (Figure 3) and Woodley Island[15]. Such winds are not observed for the onsite wind rose. The occurrence of drainage winds in a particular meteorological set depends on the nature of the immediate terrain. Given the lay of the land, it is likely that such winds occur at the project site.

The general topography at Woodley Island and Arcata Airport is flat, similar to the project site, and the regional topography involving the coastline and hills/mountains is similar for the three areas as well. The intervening area between the Arcata Airport, the Woodley Island site and the project site is a relatively flat plain that lies adjacent to the water's edge in the Humboldt Bay and the Pacific Ocean. Based on proximity and these regional topographic factors, winds measured at Woodley Island are considered by the NCUAQMD staff to be representative of winds at the project site. Based on these same factors, the applicant believes that the Arcata Airport meteorological data would also be representative of winds at the project site.

Terrain height and distance to terrain are also similar at the three locations, although Humboldt Hill is nearer to the project site than higher terrain is to the other two sites. Since the axis of Humboldt Hill points straight at the Humboldt Bay Power Plant, however, it is unlikely that the hill affects the distribution of wind speeds and directions at the project site.

The HBPP project site is also a coastal location, likely with similar daytime wind speeds as at Woodley Island and Arcata airport. Thus, it is our assessment that the wind direction and wind speed data collected at the Woodley Island and Arcata Airport meteorological monitoring stations are similar to the dispersion conditions at the HBRP project site and to the regional area. Thus, the Woodley Island and Arcata Airport meteorological data sets satisfy the definition of representative data.

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[14] USEPA, 1987. Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD), Office of Air Quality Planning and Standards, Research Triangle Park, NC, EPA-450/4-87-007, May 1987.

[15] Wind roses for Woodley Island are presented in the AFC, Appendix 8.1.B, Figures 8.1B-2A through 8.1B-6D.

Representativeness has also been defined in the "*Workshop on the Representativeness of Meteorological Observations*" (Nappo et. al., 1982) as "the extent to which a set of measurements taken in a space-time domain reflects the actual conditions in the same or different space-time domain taken on a scale appropriate for a specific application." Judgments of representativeness should be made only when sites are climatologically similar, as the project site, the Woodley Island site and the Arcata Airport site clearly are.

EXISTING AMBIENT AIR QUALITY DATA

All ambient air quality data will be taken from the EPA AIRS and AQS databases.[16]

Background ambient air quality data for project area PM_{10} and $PM_{2.5}$ are available for Eureka for 2006 and years prior. For these pollutants, the following readings during the period 2001-2006 will be used to represent project background.

- For PM_{10}, the highest 24-hour average and annual average values between 2004 and 2006 will be used to represent project background.

- For $PM_{2.5}$, contemporaneous (with the meteorological data) 24-hour average concentrations during the period 2001 through 2004[17] will be used to represent project background concentrations. Since $PM_{2.5}$ measurements are taken on a once-in-six-day basis, each $PM_{2.5}$ measurement will be presumed to represent the day of measurement and each of the five subsequent days. Missing data will be filled in by interpolation using data from the data immediately preceding and following the missing data point. These day-specific project background data will be combined with contemporaneous modeled project impacts to evaluate compliance with the $PM_{2.5}$ AAQS for non-PSD purposes. The highest three-year average of the combined project plus background 98^{th} percentile 24-hour average concentrations will be used to evaluate compliance with the 24-hour average $PM_{2.5}$ AAQS for non-PSD purposes. The highest three-year average of the combined project plus background annual average concentrations will be used to evaluate compliance with the annual average $PM_{2.5}$ AAQS for non-PSD purposes.

The nearest monitoring sites that collect ambient O_3, NO_2, and CO data are at Willits and Ukiah, which are located about 100 and 125 miles south-southwest of the project site, respectively. Ambient data collected at Willits and Ukiah are expected to conservatively overestimate existing concentrations of gaseous pollutants at the project. Although the cities themselves have lower populations than Eureka, they are located along State Highway 101 in a more heavily traveled

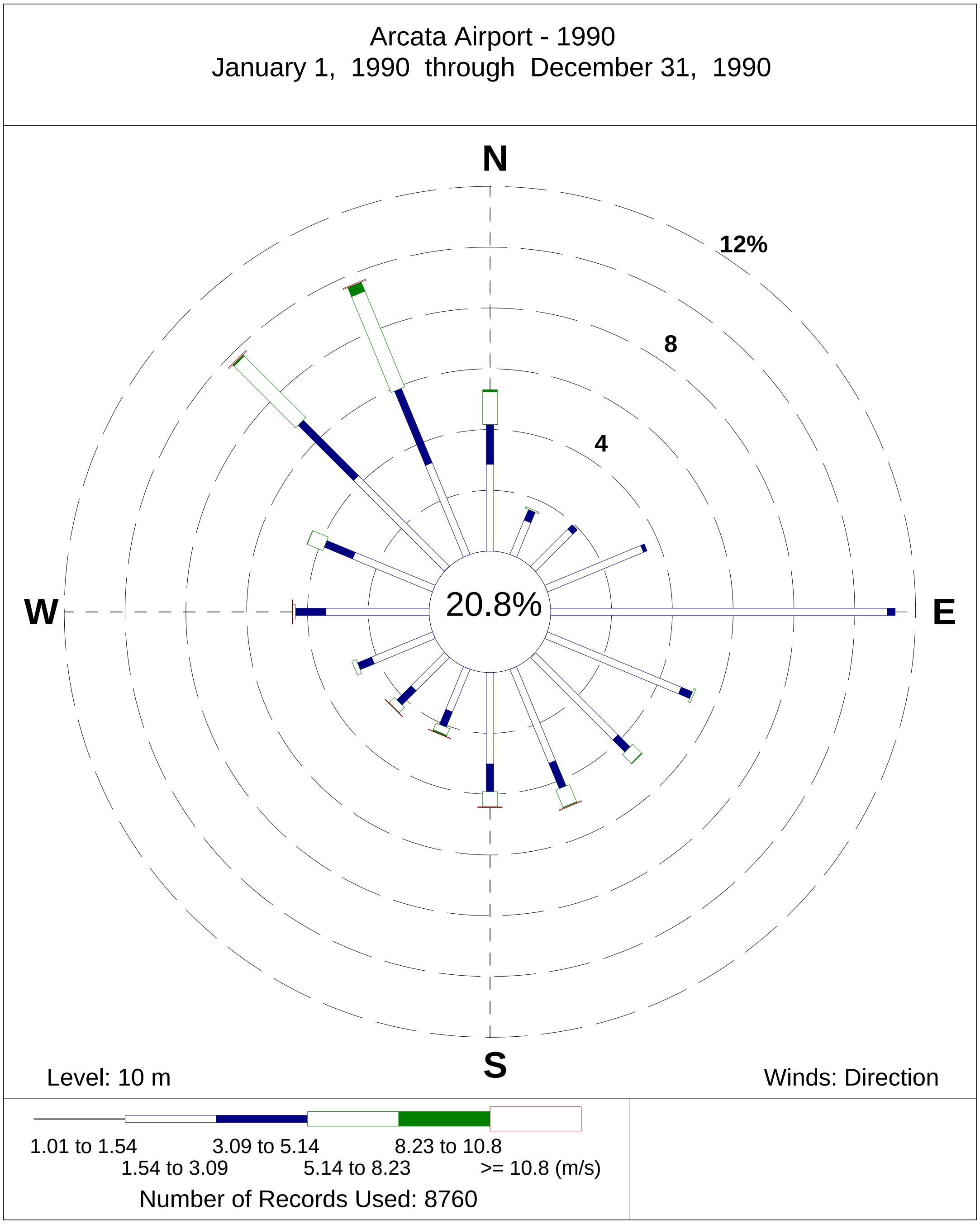
16 http://www.epa.gov/air/data/index.html and http://www.epa.gov/ttn/airs/airsaqs/detaildata/downloadaqsdata.htm

17 No monitored $PM_{2.5}$ concentrations are available for the Eureka monitoring station between June 27 and November 27, 2005. Because of this large amount of missing data, 2005 will not be included in the evaluation of $PM_{2.5}$ impacts.

corridor than the Eureka corridor. For each of these three pollutants and the appropriate averaging periods, the highest of the readings at Willits and Ukiah during the period 2004-2006 will be used.

SO_2 was monitored at Ukiah through 1993 and at Willits only during 1994. The nearest coastal monitoring station providing current SO_2 ambient data is at San Francisco. Because the San Francisco area is much more urbanized than the project area, current SO_2 levels in San Francisco are expected to be much higher than existing ambient levels in Eureka. The highest monitored concentrations at either the Willits or Ukiah stations during the three-year period 1992-1994 or current concentrations (2004-2006) at San Francisco will be used to represent background SO_2 concentrations in the project area.

Figure 3
Wind Speeds and Directions at Arcata Airport



AIR QUALITY DISPERSION MODELS

Overview

Several USEPA air dispersion models are proposed for use to quantify pollutant impacts on the surrounding environment based on the emission sources' operating parameters and their locations. The models proposed for use are:

- Building Profile Input Program – Plume Rise Model Enhancements (BPIP-PRIME, Version 95086);
- American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) model, also known as AERMOD (Version 070206);
- SCREEN3 (Version 96043);
- CTSCREEN (Version 94111);
- CTDMPLUS (Version 93228); and
- CALPUFF (Version 5.711a).

These models, along with options for their use and how they are used, are discussed below.

Simple and Complex Terrain Receptors

For all receptors in simple and complex terrain, modeling will be performed using AERMOD. The stacks will be represented as ten individual stacks, using the stack parameters listed on page 3 of this protocol.

The guideline model AERMOD will be used with hourly meteorological data from the Woodley Island monitoring station, processed as described above. USEPA adopted AERMOD as a guideline model on November 9, 2005. The AERMOD model is a steady-state, multiple-source, Gaussian dispersion model that is appropriate for sources located in rural or urban areas and receptors located in simple or complex terrain. AERMOD accounts for building wake effects (i.e., plume downwash) based on the PRIME building downwash algorithms..[18] The AERMOD model requires hourly meteorological data consisting of wind direction and speed (vector with reference height), temperature (with reference height), Monin-Obukhov length, surface roughness length, heights of the mechanically and convectively generated boundary layers, surface friction velocity, convective velocity scale, and vertical potential temperature gradient in the 500-meter layer above the planetary boundary layer. The model assumes that there is no variability in meteorological parameters over a one-hour time period, hence the term "steady-state." The AERMOD model allows input of multiple sources and source groupings, eliminating

[18] AERMOD was adopted as a guideline model by USEPA as a replacement for ISCST3. AERMOD incorporates an improved downwash algorithm as compared to ISCST3 (Federal Register, November 9, 2005; Volume 70, Number 216, Pages 68218-68261).

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the need for multiple model runs. Complex phenomena such as building-induced plume downwash are treated in this model.

Standard AERMOD control parameters will be used (stack tip downwash, non-screening mode, non-flat terrain, sequential meteorological data check employed). Stack-tip downwash, which adjusts the effective stack height downward following the methods of Briggs (1972) for cases where the stack exit velocity is less than 1.5 times the wind speed at stack top, will be selected per USEPA guidance.

Two AERMET preprocessors (Stages 1 and 2, and Stage 3) are used to prepare meteorological data for use in AERMOD. In accordance with USEPA guidance for rural sources using rural NWS data,[19] surface roughness characteristics are input for wind direction sectors in the vicinity of the monitoring station at Stage 3 of the meteorological data preparation. Source site values were used for albedo and Bowen ratio. In defining sectors for surface characteristics, USEPA (2000) suggests that a user specify a sector no smaller than a 30-degree arc. The expected wind direction variability over the course of an hour, as well as the encroachment of characteristics from the adjacent sectors with travel time, makes it hard to preserve the identity of a narrow (i.e., < 30 degrees) sector's characteristics. Use of a weighted-average[20] of characteristics by surface area within a 30-degree (or wider) sector makes it possible to have a unique portion of the surface significantly influence the properties of the sector that it occupies.

The length of the upwind fetch for defining the nature of the turbulent characteristics of the atmosphere at the source location has been defined as 3 kilometers in Irwin (1978) and in USEPA's *Guideline on Air Quality Models*[21] for the purpose of defining land-use characteristics.

For the HBPP facility, at least two wind direction sectors are evident: one sector for winds from the Humboldt Bay and the Pacific, and a second wind sector for directions from the land. Thus, at least two wind direction sectors will be employed; more will be used if appropriate. Given the general lack of seasonality at this California coastal location, site characteristics will be varied only seasonally, not monthly.

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19 USEPS, "AERMOD Implementation Guide," September 27, 2005. http://www.epa.gov/scram001/7thconf/aermod.

20 Weighting will be based on wind direction frequency, such as determined from a wind rose.

21 Published as Appendix W to 40 CFR Part 51 (as revised).

Refined Analysis of Impacts at Receptors Above Stack Top

The CTSCREEN, CTDMPLUS and/or CALPUFF models will be used for a more refined evaluation of project impacts on elevated terrain. AERMOD depends on a simplified representation of terrain to establish the location of a dividing streamline with respect to terrain. Pollutants below the dividing streamline are blown around a terrain obstacle, and pollutants above are blown over the obstacle. CTSCREEN and CTDMPLUS process terrain in a more sophisticated way to establish where the dividing streamline should be placed for a given source and will provide a more realistic assessment of plume impaction on elevated terrain.

> If the modeling application involves a well defined hill or ridge and a detailed dispersion analysis of the spatial pattern of plume impacts is of interest, CTDMPLUS, listed in Appendix A, is available. CTDMPLUS provides greater resolution of concentrations about the contour of the hill feature than does AERMOD through a different plume-terrain interaction algorithm.[22]

In the event CTSCREEN is used for a more refined evaluation of $PM_{2.5}$ impacts, the highest second-high (H2H) value[23] will be combined with the highest three-year average 98th percentile background concentration for the period 2001-2004[24] to determine compliance with the $PM_{2.5}$ AAQS for non-PSD purposes. For determining compliance with the annual average $PM_{2.5}$ AAQS for non-PSD purposes, the highest modeled annual average concentration will be combined with the highest three-year average annual average background concentration for the period 2001-2004.

In the event CTDMPLUS is used for a more refined evaluation of $PM_{2.5}$ impacts, day-specific project background data (determined as described above) will be combined with modeled project impacts to evaluate compliance with the $PM_{2.5}$ AAQS for non-PSD purposes. The highest three-year average of the combined project plus background 98th percentile 24-hour average concentrations will be used to evaluate compliance with the 24-hour average $PM_{2.5}$ AAQS for non-PSD purposes. The highest three-year average of the combined project plus background annual average concentrations will be used to evaluate compliance with the annual average $PM_{2.5}$ AAQS for non-PSD purposes.

CALPUFF is a multi-layer, multi-species non-steady-state puff dispersion modeling system that simulates the effects of time- and space-varying meteorological conditions on pollutant transport, transformation, and removal. The CALPUFF modeling system is one of the two USEPA

22 40 CFR Part 51, Appendix W, Section 4.2.2 (Refined Analytical Techniques).

23 CTSCREEN generates HSH values for 3-hour and 24-hour averaging periods. "Users Guide to CTDMPLUS: Volume 2: The Screening Mode (CTSCREEN), p. 2-6. Available at http://www.epa.gov/scram001/userg/screen/ctscreen.pdf

24 As discussed above, 2005 will not be used because of the multi-month period of missing $PM_{2.5}$ data.

preferred/recommended air dispersion models[25] (AERMOD being the other). CALPUFF is intended for use on scales from tens of meters from a source to hundreds of kilometers. CALPUFF is the only preferred model available for evaluating the effects of chemical transformation on directly emitted pollutants. Because recent studies suggest that secondary particulate matter may account for over half of total ambient $PM_{2.5}$ nationwide, $PM_{2.5}$ modeling should take into account not only the fine particles emitted directly by stationary sources but also the various precursors, emitted by certain sources, which result in secondarily formed fine particles through chemical reactions in the atmosphere.[26] Therefore, a complete and valid assessment of the impact of the proposed project on $PM_{2.5}$ concentrations would account for the effects not only of directly emitted $PM_{2.5}$, but also of $PM_{2.5}$ that is formed as a result of NOx and SO_2 emissions. The large reductions in NOx and SO_2 emissions that will result from shutting down the existing Humboldt Bay Power Plant generating units will provide a reduction in fine particulate precursors sufficient to completely offset the increase in PM emissions from the project at a ratio of 3.58 pounds of NOx to 1 pound of PM_{10}.[27] The CALPUFF model may allow the evaluation of the impacts of NOx and SO_2 emissions reductions on modeled $PM_{2.5}$ levels.

As a refined technique, CALPUFF may be used to simulate the air dispersion between the HBRP and the near-field terrain to the south-southeast. In accordance with EPA guidance in Appendix W,[28] CALPUFF will be run using the single station surface and upper air meteorological data in AERMOD data file format. The meteorological data set used for the AERMOD modeling, which is based on the Woodley Island 2001-2005 surface data and concurrent Oakland upper air data, will be used. This will help to maintain consistency between the meteorological data used in the two modeling analyses. CALPUFF has the ability to simulate chemical reactions in the plume puffs as well as following the path of each puff.

Ambient Ratio Method and Ozone Limiting Method

Annual NO_2 concentrations will be calculated using the Ambient Ratio Method (ARM), adopted in Supplement C to the Guideline on Air Quality Models (USEPA, 1995). The Guideline allows a nationwide default of 75% for the conversion of nitric oxide (NO) to NO_2 on an annual basis and the calculation of NO_2/NOx ratios.

If NO_2 concentrations need to be examined in more detail, the Plume Volume Molar Ratio Method

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[25] USEPA, Technology Transfer Network, Support Center for Regulatory Atmospheric Modeling, Air Quality Models, Dispersion Modeling, Preferred/Recommended Models, http://www.epa.gov/scram001/dispersion_prefrec.htm#calpuff, accessed May 19, 2007.

[26] Memo from John S. Seitz, Director, Office of Air Quality Planning & Standards, to EPA Regional Directors, New Source Review staff and others, dated October 21, 1997.

[27] The applicant proposed an interpollutant offset ratio for NOx to PM_{10} of 2.54, based on an analysis of available ambient data. The ARB staff reviewed additional ambient data and concluded that a more appropriate ratio was 3.58 to 1.

[28] 40 CFR Part 51, Appendix W, op cit., Appendix A, Section A.4.b, Meteorological Data 2.

(PVMRM)[29,30,31] will be used. Hourly ozone data collected at the Ukiah or Willits monitoring station during the years 2001-2005 will be used in conjunction with PVMRM to calculate hourly NO_2 concentrations from hourly NOx concentrations. The PVMRM involves an initial comparison of the estimated maximum NOx concentration and the ambient O_3 concentration to determine which is the limiting factor to NO_2 formation. If the O_3 concentration is greater than the maximum NOx concentration and if the amount of O_3 in the plume is sufficient, total conversion is assumed. If the NOx concentration is greater than the O_3 concentration, the formation of NO_2 is limited by the ambient O_3 available in the plume. In this case, the NO_2 concentration is set equal to the O_3 concentration plus a correction factor that accounts for in-stack and near-stack thermal conversion within the plume.

Since 1998, the similar Ozone Limiting Method (OLM) has been implemented using the ISCST3-OLM model.[32] The OLM compared the concentrations of NOx and O_3 as described above for PVMRM, but did not limit the conversion to NO_2 by the total amount of O_3 available in the plume. AERMOD PVMRM is now available as a second, non-regulatory option. For this project, AERMOD PVMRM will be used to calculate the NO_2 concentration based on the PVMRM method and hourly ozone data. Missing hourly ozone data will be substituted prior to use with day-appropriate values (e.g., from the previous day, or the next day, for the same hour). Any other missing hourly ozone data (if any) will be substituted with 40 ppb ozone (typical ozone tropospheric background level).

Fumigation

The SCREEN3 model will be used to evaluate inversion breakup and shoreline fumigation impacts for short-term averaging periods (24 hours or less), as appropriate. The methodology in USEPA, 1992 (Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised) will be followed for these analyses. Combined impacts for all sources under fumigation conditions will be evaluated, based on USEPA modeling guidelines.

Screening Level Health Risk Assessment

Consistent with ARB guidance, the screening level health risk assessment will be performed based on an assessment of annual average operations reflecting the maximum 50 hours per year of Diesel operation allowable under the Stationary Diesel Engine Air Toxics Control Measure, with the balance of the year's operations reflecting the combustion of natural gas. The screening level

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29 Hanrahan, P.L., 1999a. "The plume volume molar ratio method for determining NO2/NOx ratios in modeling. Part I: Methodology," J. Air & Waste Manage. Assoc., 49, 1324-1331.

30 Cimorelli, A. J., S. G. Perry, A. Venkatram, J. C. Weil, R. J. Paine, R. B. Wilson, R. F. Lee, W. D. Peters, R. W. Brode, and J. O. Paumier, 2004: AERMOD: Description of Model Formulation. EPA 454/R-03-004. U. S. Environmental Protection Agency, Research Triangle Park, NC.

31 USEPA. Addendum – AERMOD: Model Formulation Document (see previous footnote).

32 Cole, Henry and John Summerhays, "A Review of Techniques Available for Estimating Short-Term NO2 Concentrations," Journal of the Air Pollution Control Association, pp. 812-817, August 1979.

approach accounts for the four following pathways: inhalation, dermal absorption, and soil and mother's milk ingestion.

GOOD ENGINEERING PRACTICE (GEP) STACK HEIGHT AND DOWNWASH

AERMOD can account for building downwash effects on dispersing plumes. Stack locations and heights and building locations and dimensions will be input to BPIP-PRIME. The first part of BPIP-PRIME determines and reports on whether a stack is being subjected to wake effects from a structure or structures. The second part calculates direction-specific building dimensions for each structure, which are used by AERMOD to evaluate wake effects. The BPIP-PRIME output is formatted for use in AERMOD input files.

RECEPTOR SELECTION

Receptor and source base elevations will be determined from USGS Digital Elevation Model (DEM) data using the 7½-minute format (10- to 30-meter spacing between grid nodes). All coordinates will be referenced to UTM North American Datum 1983 (NAD83), Zone 10. The AERMOD receptor elevations will be interpolated among the DEM nodes according to standard AERMAP procedure. For determining concentrations in elevated terrain, the AERMAP terrain preprocessor receptor-output (ROU) file option will be chosen; hills will not be imported into AERMOD for CTDM-like processing.

Cartesian coordinate receptor grids will be used to provide adequate spatial coverage surrounding the project area for assessing ground-level pollution concentrations, to identify the extent of significant impacts, and to identify maximum impact locations. A 250-meter resolution coarse receptor grid will be developed and will extend outwards at least 10 km (or more as necessary to calculate the significant impact area).

For the full impact analyses, a nested grid will be developed to fully represent the maximum impact area(s). The near-field receptor grid will have 25-meter resolution along the facility fence-line in a single tier of receptors composed of four segments extending out to the distances shown in Figure 4. Beyond the near-field receptor grid, receptors will be placed with 100-meter resolution from the boundary of the near-field receptor grid out to a distance of 1,000 meters from the fenceline, with 250-meter spacing beyond 1000 meters. When maximum first-high or maximum second-high impacts (or, for $PM_{2.5}$, maximum 98^{th} percentile impacts) occur in the 250-meter spaced area, additional refined receptor grids with 25-meter resolution will be placed around the maximum coarse grid impacts and extended out 1,000 meters in all directions. Concentrations within the facility fenceline will not be calculated.

The following 7.5 minute USGS Digital Elevation Model (DEM) quadrangles will be employed for modeling the HBPP Facility:

- Eureka;
- Cannibal Island;
- Fields Landing;
- McWhinney Creek; and
- Arcata South.

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USEPA (2005). *40 CFR Part 51, Appendix W. Guideline on Air Quality Models*. Last update November 9, 2005.

Attachment 8.1B-2

Results of the CTDMPLUS Sensitivity Analysis

August 3, 2007

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Memo to: Rick Martin, Air Pollution Control Officer
North Coast Unified Air Pollution Control District

From: Gary Rubenstein

Subject: Results of CTDMPLUS Input Parameter Sensitivity Analysis
Humboldt Bay Repowering Project

In the May 2007 version of the modeling protocol prepared for the Humboldt Bay Repowering Project (HBRP), we proposed a procedure for deriving sigma values for CTDMPLUS, as follows:

> *CTDMPLUS requires an extensive suite of meteorological data composed not only of wind speed, direction, and temperature, but also horizontal and vertical wind direction standard deviations (sigma theta and sigma phi, respectively) as well as vertical wind speed standard deviation (sigma w). The data set directed by the NCUAQMD for use in modeling the project, derived from measurements taken at Woodley Island, does not include these non-standard measurements.*
>
> *It is possible to reasonably infer conservative (i.e., smallest) values for these standard deviation parameters that are consistent with the available meteorological data, to prepare a meteorological data set usable in CTDMPLUS, yet are also likely to yield conservative (i.e., high) ground-level concentrations.*

The protocol stated, "Small values for the standard deviation parameters decrease modeled dispersion and, hence, increase predicted concentrations."

In June 11, 2007, comments on this portion of the protocol, the staff of the California Air Resources Board (ARB) stated the following:

> *We disagree with the applicant's proposal. Small values for sigma theta and sigma phi do not always infer conservative impacts. In certain situations for tall stacks, a larger value for these standard deviations will disperse the emissions over a larger vertical plane and bring the emissions down to the ground causing higher impacts when compared to smaller values. Therefore, we recommend that the applicant conduct a sensitivity analysis for all combinations of stack conditions and receptor locations to determine the appropriate conservative value for sigma theta and sigma phi.*

In accordance with ARB's recommendations, and as discussed in the July 2007 revised protocol, we conducted a sensitivity analysis to determine the appropriate conservative values for sigma theta and sigma phi. For the sensitivity analysis, we looked at the five hills surrounding the project site (shown in the attached figure) and evaluated stack parameters for the eight operating cases (full load and part load, gas and liquid fuel operation) used for 24-hour average impacts. Four different combinations of the standard deviation parameters were used for each analysis:

- Bottom of both sigma theta and sigma phi ranges;
- Bottom of sigma theta range; top of sigma phi range;
- Top of sigma theta range; bottom of sigma phi range; and
- Top of both sigma theta and sigma phi ranges.

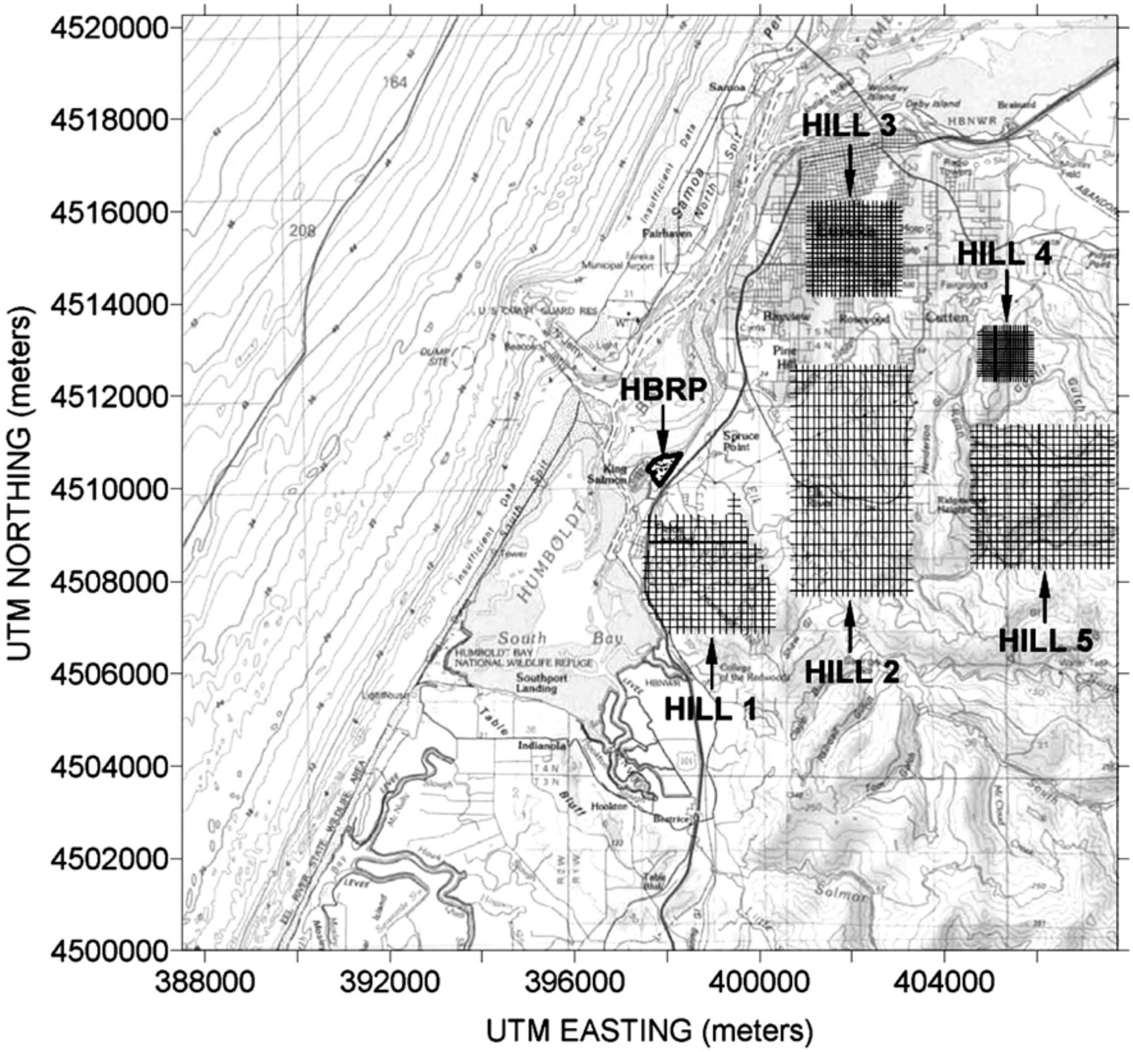
The results of the sensitivity analysis are summarized in the attached table. These results show that while other combinations of parameters sometimes produce higher intermediate results, the project maxima are always associated with the lowest values for the two dispersion parameters, as we had indicated in our initial protocol.

Based on these results, we propose to use the lowest values for the two dispersion parameters in the final CTDMPLUS modeling analysis for the HBRP. If you would like to evaluate our modeling results in more detail, we will provide the modeling files and a more detailed summary of the modeling results.

If you have any questions regarding this proposal, please do not hesitate to call.

Attachments

Receptors Evaluated in CTDMPLUS Sensitivity Analysis



Summary of Sensitivity Analysis Results
CTDMPLUS Input Parameters for HBRP

	Max 24-hour average PM10, All Years					
Case 4D	Hill 1	Hill 2	Hill 3	Hill 4	Hill 5	Max
Bottom of both sigma theta and sigma phi ranges	**57.80**	**15.83**	2.34	**6.65**	8.77	**57.80**
Bottom of sigma theta range; top of sigma phi range	53.29	15.63	**2.73**	6.64	7.82	53.29
Top of sigma theta range; bottom of sigma phi range	46.04	15.58	1.74	6.39	**8.79**	46.04
Top of both sigma theta and sigma phi ranges	44.16	15.38	2.02	6.30	7.78	44.16
Maximum	57.80	15.83	2.73	6.65	8.79	57.80

	Max 24-hour average PM10, All Years					
Case 3D	Hill 1	Hill 2	Hill 3	Hill 4	Hill 5	Max
Bottom of both sigma theta and sigma phi ranges	**56.01**	**15.27**	2.28	6.41	8.60	**56.01**
Bottom of sigma theta range; top of sigma phi range	51.87	15.14	**2.65**	**6.45**	7.74	51.87
Top of sigma theta range; bottom of sigma phi range	44.78	15.00	1.67	6.16	**8.63**	44.78
Top of both sigma theta and sigma phi ranges	43.27	14.87	1.97	6.12	7.66	43.27
Maximum	56.01	15.27	2.65	6.45	8.63	56.01

	Max 24-hour average PM10, All Years					
Case 4G	Hill 1	Hill 2	Hill 3	Hill 4	Hill 5	Max
Bottom of both sigma theta and sigma phi ranges	**25.75**	**7.03**	1.04	2.95	3.92	**25.75**
Bottom of sigma theta range; top of sigma phi range	23.80	6.96	**1.22**	**2.96**	3.53	23.80
Top of sigma theta range; bottom of sigma phi range	20.50	6.91	0.77	2.83	**3.94**	20.50
Top of both sigma theta and sigma phi ranges	19.79	6.84	0.90	2.81	3.49	19.79
Maximum	25.75	7.03	1.22	2.96	3.94	25.75

	Max 24-hour average PM10, All Years					
Case 3G	Hill 1	Hill 2	Hill 3	Hill 4	Hill 5	Max
Bottom of both sigma theta and sigma phi ranges	**25.70**	**7.02**	1.04	2.94	3.92	**25.70**
Bottom of sigma theta range; top of sigma phi range	23.76	6.95	**1.21**	**2.96**	3.53	23.76
Top of sigma theta range; bottom of sigma phi range	20.47	6.90	0.77	2.83	**3.94**	20.47
Top of both sigma theta and sigma phi ranges	19.77	6.83	0.90	2.80	3.49	19.77
Maximum	25.70	7.02	1.21	2.96	3.94	25.70

	Max 24-hour average PM10, All Years					
Case 1G	Hill 1	Hill 2	Hill 3	Hill 4	Hill 5	Max
Bottom of both sigma theta and sigma phi ranges	**23.11**	6.23	0.95	2.61	**3.77**	**23.11**
Bottom of sigma theta range; top of sigma phi range	21.68	**6.23**	**1.11**	**2.69**	3.37	21.68
Top of sigma theta range; bottom of sigma phi range	18.90	6.09	0.68	2.52	3.75	18.90
Top of both sigma theta and sigma phi ranges	18.33	6.09	0.82	2.55	3.35	18.33
Maximum	23.11	6.23	1.11	2.69	3.77	23.11

	Max 24-hour average PM10, All Years					
Case5G	Hill 1	Hill 2	Hill 3	Hill 4	Hill 5	Max
Bottom of both sigma theta and sigma phi ranges	**22.92**	6.17	0.94	2.59	**3.76**	**22.92**
Bottom of sigma theta range; top of sigma phi range	21.53	**6.18**	**1.10**	**2.67**	3.36	21.53
Top of sigma theta range; bottom of sigma phi range	18.78	6.03	0.67	2.49	3.74	18.78
Top of both sigma theta and sigma phi ranges	18.22	6.04	0.81	2.54	3.34	18.22
Maximum	22.92	6.18	1.10	2.67	3.76	22.92

Summary of Sensitivity Analysis Results
CTDMPLUS Input Parameters for HBRP

Case 1D	Max 24-hour average PM10, All Years					
	Hill 1	Hill 2	Hill 3	Hill 4	Hill 5	Max
Bottom of both sigma theta and sigma phi ranges	**47.29**	12.61	2.01	5.33	**8.02**	**47.29**
Bottom of sigma theta range; top of sigma phi range	44.80	**12.72**	**2.30**	**5.57**	7.18	44.80
Top of sigma theta range; bottom of sigma phi range	41.77	12.32	1.37	5.13	7.98	41.77
Top of both sigma theta and sigma phi ranges	39.16	12.41	1.71	5.28	7.15	39.16
Maximum	47.29	12.72	2.30	5.57	8.02	47.29

Case 5D	Max 24-hour average PM10, All Years					
	Hill 1	Hill 2	Hill 3	Hill 4	Hill 5	Max
Bottom of both sigma theta and sigma phi ranges	**49.04**	13.14	2.03	5.54	**8.18**	**49.04**
Bottom of sigma theta range; top of sigma phi range	46.25	**13.20**	**2.37**	**5.75**	7.30	46.25
Top of sigma theta range; bottom of sigma phi range	41.47	12.85	1.43	5.33	8.14	41.47
Top of both sigma theta and sigma phi ranges	39.32	12.90	1.76	5.45	7.28	39.32
Maximum	49.04	13.20	2.37	5.75	8.18	49.04

APPENDIX 8.1C

Screening Health Risk Assessment

APPENDIX 8.1C

Screening Health Risk Assessment

The screening level health risk assessment has been prepared using CARB's Hotspots Analysis and Reporting Program (HARP) computer program (Version 1.2a, August 26, 2005) and associated guidance in the OEHHA's *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (August 2003). The HARP model was used to assess cancer risk as well as chronic and acute risk impacts. The following paragraphs describe the procedures used to prepare this risk assessment.

Modeling Inputs

The risk assessment module of the HARP model was run using unit ground level impacts to obtain derived cancer risks for each toxic chemical of interest.[1] Cancer risks were obtained for the derived (OEHHA) method, the derived (adjusted) method, average point estimate and high-end point estimate options. The HARP model output was cancer risk by pollutant and route for each type of analysis, based on an exposure of 1.0 $\mu g/m^3$. HARP model output showing the unit values is included as Attachment 8.1C-1. Individual cancer risks are expressed in units of risk per $\mu g/m^3$ of exposure. To calculate the weighted risk for each source, the annual average emission rate in g/s for each pollutant was multiplied by the individual cancer risk for that pollutant in $(\mu g/m^3)^{-1}$. The resulting weighted cancer risks for each pollutant were then summed for the source. An identical approach was used to determine the acute and chronic health impacts associated with the proposed project. Details of the calculations of risk "rates" for modeling are shown in Tables 8.1C-2 through 8.1C-5.

Risk Analysis Method

The results of the engine screening analysis (see Appendix 8.1B, Table 8.1B-4) were used to determine the worst-case full load operating conditions for modeling for the annual and 1-hour averaging periods, used in determining cancer risk and chronic HHI, and acute HHI, respectively. The total weighted risk "rate" for each source was used in place of emission rates in the modeling analysis. The weighted risk "rates" used for the HRA modeling are summarized in Table 8.1C-6. The calculated value was then total cancer risk at each receptor. As discussed in Section 8.1.2.4.3, the screening analysis for the criteria pollutant modeling analysis was performed using the AERMOD, CTSCREEN and CTDMPLUS models, the 2001 through 2005 Woodley Island meteorological data, specific receptor grids, and the stack parameters for six full-load operating cases. The exhaust characteristics for the highest full-load annual average unit impact from the screening analysis, Case 1G, was used to model cancer risks from the engines for the proposed project.[2]

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[1] Procedure is described in Part B of Topic 8 of the HARP How-To Guides: How to Perform Health Analyses Using a Ground Level Concentration.

[2] Annual average emissions were modeled using gas firing stack parameters because the engines will be fueled on natural gas well over 90% of the time on an annual basis.

The contribution of each toxic compound to total cancer risk and total HHI for each analysis method was then determined using the individual contribution of each compound to the total weighted risk "rate."

Summary of Results

The results of the screening level health risk assessment are summarized in the following table.

Table 8.1C-1
Screening Level Risk Assessment Results

Risk Methodology	HBRP
Modeled Residential Cancer Risk (in one million)	
Residential: Derived (OEHHA) Method	8.6
Residential: Average Point Estimate	5.9
Residential: High-end Point Estimate	8.6
Residential: Derived (adjusted) Method	6.6
Modeled Worker Cancer Risk (in one million)	
Worker Exposure: Derived (OEHHA) Method	1.3
Modeled Acute and Chronic Impacts	
Acute HHI, natural gas mode	0.56
Acute HHI, diesel mode	0.09
Chronic HHI	0.09

Deleted: 6.5
Deleted: 4.4
Deleted: 6.5
Deleted: 5.1
Deleted: 1.1
Deleted: 0.39
Deleted: 0.05

As shown in Table 8.1C-1, the cancer risk from the project is below the significance level of 10 in one million. In addition, the acute and chronic health hazard indices are well below the significance level of one. The analysis of potential cancer risk described in this section employs extremely conservative methods and assumptions, as follows:

- The analysis includes representative weather data over 5 years to ensure that the least favorable conditions producing the highest ground-level concentration of power plant emissions are included. The analysis then assumes that these worst-case weather conditions, which in reality occurred only once in 5 years, will occur every year for 70 years.
- The power plant is assumed to operate at hourly, daily, and annual emission conditions that produce the highest ground-level concentrations. In fact, the power plant is expected to operate at a variety of conditions that will produce lower emissions and impacts.
- The analysis assumes that a sensitive individual is at the location of the highest ground-level concentration of power plant emissions continuously over the entire 70-year period. In reality, people rarely live in their homes for 70 years, and even if they do, they leave their homes to attend school, go to work, go shopping, and so on.

70-year period. In reality, people rarely live in their homes for 70 years, and even if they do, they leave their homes to attend school, go to work, go shopping, and so on.

The point of using these unrealistic assumptions is to consciously overstate the potential impacts. No one will experience exposures as great as those assumed for this analysis. By determining that even this highly overstated exposure will not be significant, there is a high degree of confidence that the much lower exposures that actual persons will experience will not result in a significant increase in cancer risk. In short, the analysis ensures that there will not be significant public health impacts at any location, under any weather condition, under any operating condition.

The locations of the three maximum acute, chronic, and cancer risks are shown in Figure 8.1C-1.

FIGURE 8.1C-1 LOCATIONS OF THE HIGHEST MODELED ACUTE, CHRONIC AND CANCER RISKS FROM PROJECT OPERATION

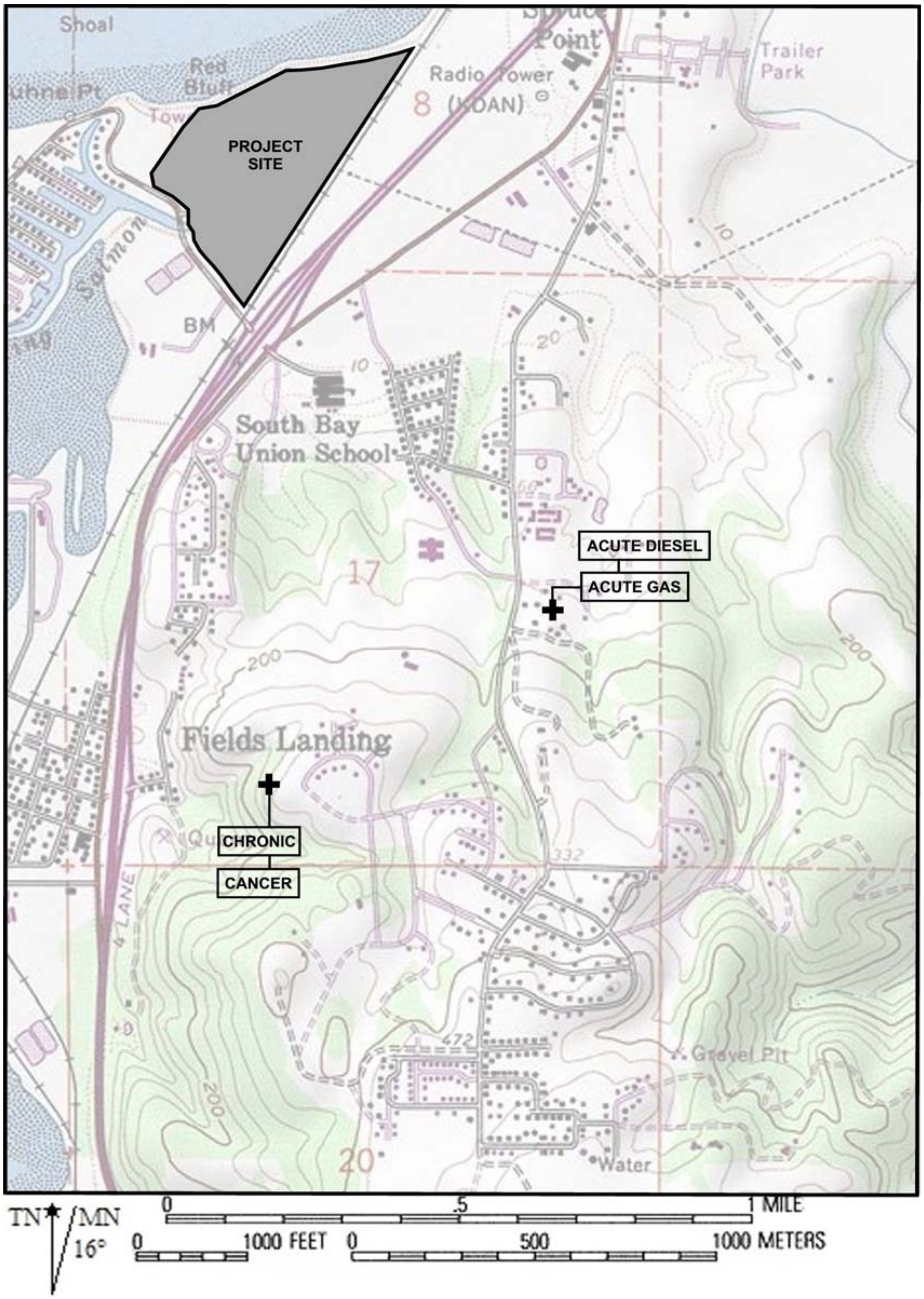

Table 8.1C-2
HBRP
Calculation of Modeling Inputs for Wärtsilä Reciprocating Engine Cancer Risk Assessment
Rev 08/07

		Derived (OEHHA) Method		Average Point Estimate		High-End Point Estimate		Derived (Adjusted) Method		Worker Exp: Derived (OEHHA) Method	
Compound	Annual Average Emissions Per Engine g/s	Unit Risk (per ug/m3)	Cancer Risk Model Input (per ug/m3 per g/s)	Unit Risk (per ug/m3)	Cancer Risk Model Input (per ug/m3 per g/s)	Unit Risk (per ug/m3)	Cancer Risk Model Input (per ug/m3 per g/s)	Unit Risk (per ug/m3)	Cancer Risk Model Input (per ug/m3 per g/s)	Unit Risk (per ug/m3)	Cancer Risk Model Input (per ug/m3 per g/s)
Ammonia	1.81E-01	0	0	0	0	0	0	0	0	0	0
Propylene	4.22E-02	0	0	0	0	0	0	0	0	0	0
Acetaldehyde	4.15E-03	3.77E-06	1.56E-02	2.60E-06	1.08E-02	3.77E-06	1.56E-02	2.90E-06	1.20E-02	5.72E-07	2.37E-03
Acrolein	4.63E-04	0	0	0	0	0	0	0	0	0	0
Benzene	1.72E-03	3.77E-05	6.48E-02	2.60E-05	4.47E-02	3.77E-05	6.48E-02	2.90E-05	4.99E-02	5.72E-06	9.83E-03
1,3-Butadiene	2.88E-03	2.26E-04	0.65	1.56E-04	4.49E-01	2.26E-04	0.65	1.74E-04	5.01E-01	3.43E-05	9.87E-02
Diesel PM	4.00E-03	4.15E-04	1.66	2.86E-04	1.14	4.15E-04	1.66	3.19E-04	1.28	6.29E-05	2.52E-01
Ethylbenzene	5.57E-04	0	0	0	0	0	0	0	0	0	0
Formaldehyde	3.08E-02	7.91E-06	2.43E-01	5.46E-06	1.68E-01	7.91E-06	2.43E-01	6.08E-06	1.87E-01	1.20E-06	3.69E-02
Hexane	8.88E-03	0	0	0	0	0	0	0	0	0	0
Naphthalene	1.98E-04	4.52E-05	8.97E-03	3.12E-05	6.19E-03	4.52E-05	8.97E-03	3.48E-05	6.90E-03	6.86E-06	1.36E-03
PAHs (Note 1)	1.41E-07	3.98E-02	5.60E-03	8.05E-03	1.13E-03	4.02E-02	5.66E-03	3.98E-02	5.60E-03	1.47E-02	2.07E-03
Toluene	1.88E-03	0	0	0	0	0	0	0	0	0	0
Xylene	5.07E-03	0	0	0	0	0	0	0	0	0	0
			2.65E+00 per ug/m3		1.82E+00 per ug/m3		2.65E+00 per ug/m3		2.04E+00 per ug/m3		4.03E-01 per ug/m3

Notes:
(1) Emission rates for individual PAHs weighted by risk relative to B(a)P. See Table A-8.

Table 8.1C-3
HBRP
Calculation of Modeling Inputs and HHIs for Wärtsilä Reciprocating Engine Acute and Chronic Risk Assessment
Rev 08/07

	Acute Health Impacts, Natural Gas Mode				Acute Health Impacts, Diesel Mode				Chronic Health Impacts			
Compound	Max Hourly Emissions Per Engine g/s	HARP Acute HI (per ug/m3)	Acute HHI Model Input (per ug/m3 per g/s)	Modeled Contribution to Acute HHI	Max Hourly Emissions Per Engine g/s	HARP Acute HI (per ug/m3)	Acute HHI Model Input (per ug/m3 per g/s)	Modeled Contribution to Acute HHI	Annual Average Emissions, g/s	HARP Chronic HI (per ug/m3)	HHI Model Input (per ug/m3 per g/s)	Modeled Contribution to Chronic HHI
Ammonia	0.2436	3.13E-04	7.62E-05	1.11E-02	0.2654	3.13E-04	8.31E-05	1.21E-02	1.81E-01	5.00E-03	9.04E-04	4.00E-03
Propylene	0.0576	--	--	--	0.0317	--	--	--	4.22E-02	3.33E-04	1.41E-05	6.21E-05
Acetaldehyde	5.637E-03	--	--	--	2.853E-04	--	--	--	4.15E-03	1.11E-01	4.60E-04	2.03E-03
Acrolein	6.292E-04	5.26E+00	3.31E-03	4.84E-01	8.798E-05	5.26E+00	4.63E-04	6.76E-02	4.63E-04	1.67E+01	7.73E-03	3.42E-02
Benzene	2.395E-03	7.69E-04	1.84E-06	2.69E-04	8.305E-03	7.69E-04	6.39E-06	9.33E-04	1.72E-03	1.67E-02	2.87E-05	1.27E-04
1,3-Butadiene	3.909E-03	--	--	--	--	--	--	--	2.88E-03	5.00E-02	1.44E-04	6.36E-04
Diesel PM	--	--	--	--	7.007E-01	--	--	--	4.00E-03	2.00E-01	8.00E-04	3.54E-03
Ethylbenzene	7.573E-04	--	--	--	--	--	--	--	5.57E-04	5.00E-04	2.79E-07	1.23E-06
Formaldehyde	4.181E-02	1.06E-02	4.43E-04	6.48E-02	1.809E-03	1.06E-02	1.92E-05	2.80E-03	3.08E-02	3.33E-01	1.02E-02	4.53E-02
Hexane	1.207E-02	--	--	--	--	--	--	--	8.88E-03	1.43E-04	1.27E-06	5.62E-06
Naphthalene	2.792E-04	--	--	--	1.340E-03	--	--	--	1.98E-04	1.11E-01	2.20E-05	9.74E-05
PAHs	2.278E-07	--	--	--	5.107E-06	--	--	--	1.41E-07	--	--	--
Toluene	2.573E-03	2.70E-05	6.95E-08	1.02E-05	3.075E-03	2.70E-05	8.30E-08	1.21E-05	1.88E-03	3.33E-03	6.25E-06	2.76E-05
Xylene	6.900E-03	4.55E-05	3.14E-07	4.59E-05	2.204E-03	4.55E-05	1.00E-07	1.47E-05	5.07E-03	1.43E-03	7.25E-06	3.20E-05
		Total =	3.83E-03	0.56		Total =	5.72E-04	0.09		Total =	2.04E-02	0.09

Table 8.1C-4
HBRP
Cancer Risk Assessment Modeling Inputs and Results for Emergency Units

		Derived (OEHHA) Method		Average Point Estimate		High-End Point Estimate		Derived (Adjusted) Method		Worker Exposure: Derived (OEHHA) Method	
Compound	Annual Average Emissions, g/s	Unit Risk (per ug/m3)	Cancer Risk Model Input (per ug/m3 per g/s)	Unit Risk (per ug/m3)	Cancer Risk Model Input (per ug/m3 per g/s)	Unit Risk (per ug/m3)	Cancer Risk Model Input (per ug/m3 per g/s)	Unit Risk (per ug/m3)	Cancer Risk Model Input (per ug/m3 per g/s)	Unit Risk (per ug/m3)	Cancer Risk Model Input (per ug/m3 per g/s)
Emergency Generator											
Diesel Exhaust Particulate	3.79E-05	4.15E-04	1.57E-02 per ug/m3	2.86E-04	1.08E-02 per ug/m3	4.15E-04	1.57E-02 per ug/m3	3.19E-04	1.21E-02 per ug/m3	6.29E-05	2.39E-03 per ug/m3
Diesel Fire Pump Engine											
Diesel Exhaust Particulate	4.66E-05	4.15E-04	1.93E-02 per ug/m3	2.86E-04	1.33E-02 per ug/m3	4.15E-04	1.93E-02 per ug/m3	3.19E-04	1.49E-02 per ug/m3	6.29E-05	2.93E-03 per ug/m3

Table 8.1C-5
HBRP
Calculation of Modeling Inputs and HHIs for Aux Equipment Acute and Chronic Risk Assessment

Compound	Max Hourly Emissions for Em Gen. g/s	HARP Acute HI (per ug/m3)	Acute HHI Model Input (per ug/m3 per g/s)	Annual Average Emissions, g/s	HARP Chronic HI (per ug/m3)	Chronic HHI Model Input (per ug/m3 per g/s)
Emergency Generator						
Particulate Em from Diesel-Fueled Engines	6.647E-03	n/a	n/a	3.79E-05	2.00E-01	7.59E-06
		Total =	0.00E+00		Total =	7.59E-06
Fire Pump Engine						
Particulate Em from Diesel-Fueled Engines	8.17E-03	n/a	n/a	4.66E-05	2.00E-01	9.32E-06
					Total =	9.32E-06

Table 8.1C-6
HBRP
Summary of Modeling Input Values for Screening HRA
Rev 8/07

Unit	Derived (OEHHA) Method Cancer Risk (Res)	Average Point Estimate Cancer Risk (Res)	High-end Point Estimate Cancer Risk (Res)	Derived (Adjusted) Method Cancer Risk (Res)	Derived (OEHHA) Method Cancer Risk (Worker)	Chronic HHI Model Input (per ug/m3)	Natural Gas Acute HHI Model Input (per ug/m3)	Liquid Fuel Acute HHI Model Input (per ug/m3)
Wärtsilä Reciprocating Engines (per engine)	2.648E+00	1.823E+00	2.648E+00	2.038E+00	4.028E-01	2.036E-02	3.831E-03	5.72E-04
Black start Diesel engine	1.574E-02	1.085E-02	1.574E-02	1.210E-02	2.386E-03	7.587E-06	0.0	0.0
Diesel fire pump engine	1.934E-02	1.333E-02	1.934E-02	1.487E-02	2.932E-03	9.323E-06	0.0	0.0

All modeling input values are in units of per ug/m3

Stack Parameters					
	Stack Diam (m)	Stack Ht (m)	Exhaust Temp (deg K)	Exhaust Velocity (m/s)	
Wärtsilä Reciprocating Engines (Case 1G)	1.620	30.480	663.556	27.152	acute gas, chronic and cancer
Wärtsilä Reciprocating Engines (Case 5D)	1.620	30.480	597.444	31.037	acute liquid fuel only
Black start Diesel engine	0.152	3.048	769.611	87.073	
Diesel fire pump engine	0.127	12.192	838.556	44.856	

Attachment 8.1C-1

HARP Model Risk Assessment Module Output

This file: c:\HARP\projects\demo\PointEstimateRisk.txt

Created by HARP Version 1.2a Build 23.03.27
Uses ISC Version 99155
Uses BPIP Version 95086
Creation date: 8/14/2006 11:13:36 AM

EXCEPTION REPORT
   (there have been no changes or exceptions)

INPUT FILES:
   Source-Receptor file:
   Averaging period adjustment factors file: not applicable
   Emission rates file: none
   Site parameters file: C:\HARP\PROJECTS\DEMO\MSATs.sit

GLC DATA SOURCE:
  concentrations loaded from file C:\HARP\PROJECTS\DEMO\MSATs.CML
  concentrations read from file C:\HARP\PROJECTS\DEMO\SFAirport.CML
  User memo:

Screening mode is OFF

Exposure Duration: 70 year (adult resident)
Analysis Method: Average Point Estimate
Health Effect: Cancer

SITE PARAMETERS

DEPOSITION

   Deposition rate (m/s)   0.05

DRINKING WATER

*** Pathway disabled ***

FISH

*** Pathway disabled ***

PASTURE

*** Pathway disabled ***

HOME GROWN PRODUCE

*** Pathway disabled ***

PIGS, CHICKENS AND EGGS

*** Pathway disabled ***

DERMAL ABSORPTION

*** Pathway enabled ***

SOIL INGESTION

*** Pathway enabled ***

MOTHER'S MILK

*** Pathway enabled ***

CHEMICAL GROUND LEVEL CONCENTRATIONS (micrograms/m^3) (*** indicates not a multipathway chemical)

ABBREV	CAS	GLC Avrg	GLC Max	GLC Water	GLC Pasture	GLC Fish
Acetaldehyde	75070	1.000E+00	1.000E+00	***	***	***
Acrolein	107028	1.000E+00	1.000E+00	***	***	***
NH3	7664417	1.000E+00	1.000E+00	***	***	***
Benzene	71432	1.000E+00	1.000E+00	***	***	***
1,3-Butadiene	106990	1.000E+00	1.000E+00	***	***	***
DieselExhPM	9901	1.000E+00	1.000E+00	***	***	***
Formaldehyde	50000	1.000E+00	1.000E+00	***	***	***
Hexane	110543	1.000E+00	1.000E+00	***	***	***
B[a]anthracene	56553	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[a]P	50328	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[b]fluoranthen	205992	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[k]fluoranthen	207089	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Chrysene	218019	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
In[1,2,3-cd]pyr	193395	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Naphthalene	91203	1.000E+00	1.000E+00	***	***	***
Propylene	115071	1.000E+00	1.000E+00	***	***	***
Propylene Oxide	75569	1.000E+00	1.000E+00	***	***	***
Toluene	108883	1.000E+00	1.000E+00	***	***	***
Xylenes	1210	1.000E+00	1.000E+00	***	***	***
Ethyl Benzene	100414	1.000E+00	1.000E+00	***	***	***
Anthracene	120127	1.000E+00	1.000E+00	***	***	***
D[a,h]anthracen	53703	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
PM	11101	0.000E+00	0.000E+00	***	***	***

CHEMICAL CROSS-REFERENCE TABLE

CHEM	CAS	ABBREVIATION	POLLUTANT NAME	BACKGROUND (ug/m^3)
0001	75070	Acetaldehyde	Acetaldehyde	0.000E+00
0002	107028	Acrolein	Acrolein	0.000E+00
0003	7664417	NH3	Ammonia	0.000E+00
0004	71432	Benzene	Benzene	0.000E+00
0005	106990	1,3-Butadiene	1,3-Butadiene	0.000E+00
0006	9901	DieselExhPM	Diesel engine exhaust, particulate matter	0.000E+00
0007	50000	Formaldehyde	Formaldehyde	0.000E+00
0008	110543	Hexane	Hexane	0.000E+00
0009	56553	B[a]anthracene	Benz[a]anthracene	0.000E+00
0010	50328	B[a]P	Benzo[a]pyrene	0.000E+00
0011	205992	B[b]fluoranthen	Benzo[b]fluoranthene	0.000E+00
0012	207089	B[k]fluoranthen	Benzo[k]fluoranthene	0.000E+00
0013	218019	Chrysene	Chrysene	0.000E+00
0014	193395	In[1,2,3-cd]pyr	Indeno[1,2,3-cd]pyrene	0.000E+00
0015	91203	Naphthalene	Naphthalene	0.000E+00
0016	115071	Propylene	Propylene	0.000E+00
0017	75569	Propylene Oxide	Propylene oxide	0.000E+00
0018	108883	Toluene	Toluene	0.000E+00
0019	1210	Xylenes	Xylenes (mixed)	0.000E+00
0020	100414	Ethyl Benzene	Ethyl benzene	0.000E+00
0021	120127	Anthracene	Anthracene	0.000E+00
0022	53703	D[a,h]anthracen	Dibenz[a,h]anthracene	0.000E+00
0023	11101	PM	Particulate Matter	0.000E+00

EMISSIONS DATA SOURCE:
CHEMICALS ADDED OR DELETED: none

AVERAGE DOSE BY PATHWAY (mg/(kg-d)) FOR CANCER CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	2.60E-04	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	0.00E+00
0002	2.60E-04	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	0.00E+00
0003	2.60E-04	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	0.00E+00
0004	2.60E-04	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	0.00E+00
0005	2.60E-04	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	0.00E+00
0006	2.60E-04	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	0.00E+00
0007	2.60E-04	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	0.00E+00
0008	2.60E-04	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	0.00E+00
0009	2.60E-04	1.66E-04	4.21E-04	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
0010	2.60E-04	1.66E-04	4.21E-04	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
0011	2.60E-04	1.66E-04	4.21E-04	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
0012	2.60E-04	1.66E-04	4.21E-04	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
0013	2.60E-04	1.66E-04	4.21E-04	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
0014	2.60E-04	1.66E-04	4.21E-04	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
0015	2.60E-04	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	0.00E+00
0016	2.60E-04	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	0.00E+00
0017	2.60E-04	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	0.00E+00
0018	2.60E-04	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	0.00E+00
0019	2.60E-04	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	0.00E+00
0020	2.60E-04	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	0.00E+00
0021	2.60E-04	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	0.00E+00
0022	2.60E-04	1.66E-04	4.21E-04	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
0023	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	0.00E+00	0.00E+00

AVERAGE CANCER RISK

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	MEAT	ORAL	TOTAL
0001	2.60E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.60E-06
0002	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0003	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0004	2.60E-05	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	0.00E+00	0.00E+00	0.00E+00	2.60E-05
0005	1.56E-04	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	0.00E+00	0.00E+00	0.00E+00	1.56E-04
0006	2.86E-04	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	0.00E+00	0.00E+00	0.00E+00	2.86E-04
0007	5.46E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.46E-06
0008	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	1.01E-04	1.99E-04	5.05E-04	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	7.04E-04	8.05E-04
0010	1.01E-03	1.99E-03	5.05E-03	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	7.04E-03	8.05E-03
0011	1.01E-04	1.99E-04	5.05E-04	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	7.04E-04	8.05E-04
0012	1.01E-04	1.99E-04	5.05E-04	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	7.04E-04	8.05E-04
0013	1.01E-05	1.99E-05	5.05E-05	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	7.04E-05	8.05E-05
0014	1.01E-04	1.99E-04	5.05E-04	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	7.04E-04	8.05E-04
0015	3.12E-05	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	0.00E+00	0.00E+00	0.00E+00	3.12E-05
0016	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	3.38E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.38E-06
0018	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0019	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0020	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

0022	1.07E-03	6.80E-04	1.72E-03	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	2.40E-03	3.47E-03
0023	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SUM	3.00E-03	3.49E-03	8.84E-03	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	1.23E-02	1.53E-02

```
This file: c:\HARP\projects\demo\DerOEHHAMethod.txt

Created by HARP Version 1.2a  Build 23.03.27
Uses ISC Version 99155
Uses BPIP Version 95086
Creation date: 8/14/2006 11:17:33 AM


EXCEPTION REPORT
   (there have been no changes or exceptions)

INPUT FILES:
   Source-Receptor file:
   Averaging period adjustment factors file: not applicable
   Emission rates file: none
   Site parameters file: C:\HARP\PROJECTS\DEMO\MSATs.sit

GLC DATA SOURCE:
  concentrations loaded from file C:\HARP\PROJECTS\DEMO\MSATs.CML
  concentrations read from file C:\HARP\PROJECTS\DEMO\SFAirport.CML
  User memo:

Screening mode is OFF

Exposure Duration: 70 year (adult resident)
Analysis Method: Derived (OEHHA) Method
Health Effect: Cancer, Chronic and Acute

SITE PARAMETERS

DEPOSITION

   Deposition rate (m/s)             0.05

DRINKING WATER

*** Pathway disabled ***

FISH

*** Pathway disabled ***

PASTURE

*** Pathway disabled ***

HOME GROWN PRODUCE

*** Pathway disabled ***

PIGS, CHICKENS AND EGGS

*** Pathway disabled ***

DERMAL ABSORPTION

*** Pathway enabled ***

SOIL INGESTION

*** Pathway enabled ***
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MOTHER'S MILK

*** Pathway enabled ***

CHEMICAL GROUND LEVEL CONCENTRATIONS (micrograms/m^3) (*** indicates not a multipathway chemical)

ABBREV	CAS	GLC Avrg	GLC Max	GLC Water	GLC Pasture	GLC Fish
Acetaldehyde	75070	1.000E+00	1.000E+00	***	***	***
Acrolein	107028	1.000E+00	1.000E+00	***	***	***
NH3	7664417	1.000E+00	1.000E+00	***	***	***
Benzene	71432	1.000E+00	1.000E+00	***	***	***
1,3-Butadiene	106990	1.000E+00	1.000E+00	***	***	***
DieselExhPM	9901	1.000E+00	1.000E+00	***	***	***
Formaldehyde	50000	1.000E+00	1.000E+00	***	***	***
Hexane	110543	1.000E+00	1.000E+00	***	***	***
B[a]anthracene	56553	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[a]P	50328	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[b]fluoranthen	205992	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[k]fluoranthen	207089	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Chrysene	218019	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
In[1,2,3-cd]pyr	193395	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Naphthalene	91203	1.000E+00	1.000E+00	***	***	***
Propylene	115071	1.000E+00	1.000E+00	***	***	***
Propylene Oxide	75569	1.000E+00	1.000E+00	***	***	***
Toluene	108883	1.000E+00	1.000E+00	***	***	***
Xylenes	1210	1.000E+00	1.000E+00	***	***	***
Ethyl Benzene	100414	1.000E+00	1.000E+00	***	***	***
Anthracene	120127	1.000E+00	1.000E+00	***	***	***
D[a,h]anthracen	53703	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
PM	11101	0.000E+00	0.000E+00	***	***	***

CHEMICAL CROSS-REFERENCE TABLE

CHEM	CAS	ABBREVIATION	POLLUTANT NAME	BACKGROUND (ug/m^3)
0001	75070	Acetaldehyde	Acetaldehyde	0.000E+00
0002	107028	Acrolein	Acrolein	0.000E+00
0003	7664417	NH3	Ammonia	0.000E+00
0004	71432	Benzene	Benzene	0.000E+00
0005	106990	1,3-Butadiene	1,3-Butadiene	0.000E+00
0006	9901	DieselExhPM	Diesel engine exhaust, particulate matter	0.000E+00
0007	50000	Formaldehyde	Formaldehyde	0.000E+00
0008	110543	Hexane	Hexane	0.000E+00
0009	56553	B[a]anthracene	Benz[a]anthracene	0.000E+00
0010	50328	B[a]P	Benzo[a]pyrene	0.000E+00
0011	205992	B[b]fluoranthen	Benzo[b]fluoranthene	0.000E+00
0012	207089	B[k]fluoranthen	Benzo[k]fluoranthene	0.000E+00
0013	218019	Chrysene	Chrysene	0.000E+00
0014	193395	In[1,2,3-cd]pyr	Indeno[1,2,3-cd]pyrene	0.000E+00
0015	91203	Naphthalene	Naphthalene	0.000E+00
0016	115071	Propylene	Propylene	0.000E+00
0017	75569	Propylene Oxide	Propylene oxide	0.000E+00
0018	108883	Toluene	Toluene	0.000E+00
0019	1210	Xylenes	Xylenes (mixed)	0.000E+00
0020	100414	Ethyl Benzene	Ethyl benzene	0.000E+00
0021	120127	Anthracene	Anthracene	0.000E+00
0022	53703	D[a,h]anthracen	Dibenz[a,h]anthracene	0.000E+00
0023	11101	PM	Particulate Matter	0.000E+00

EMISSIONS DATA SOURCE:
CHEMICALS ADDED OR DELETED: none

DOMINANT PATHWAYS FOR CANCER

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	YES	-	-	-	-	-	-	-	-	-	-	-
0002	-	-	-	-	-	-	-	-	-	-	-	-
0003	-	-	-	-	-	-	-	-	-	-	-	-
0004	YES	-	-	-	-	-	-	-	-	-	-	-
0005	YES	-	-	-	-	-	-	-	-	-	-	-
0006	YES	-	-	-	-	-	-	-	-	-	-	-
0007	YES	-	-	-	-	-	-	-	-	-	-	-
0008	-	-	-	-	-	-	-	-	-	-	-	-
0009	-	YES	YES	-	-	-	-	-	-	-	-	-
0010	-	YES	YES	-	-	-	-	-	-	-	-	-
0011	-	YES	YES	-	-	-	-	-	-	-	-	-
0012	-	YES	YES	-	-	-	-	-	-	-	-	-
0013	-	YES	YES	-	-	-	-	-	-	-	-	-
0014	-	YES	YES	-	-	-	-	-	-	-	-	-
0015	YES	-	-	-	-	-	-	-	-	-	-	-
0016	-	-	-	-	-	-	-	-	-	-	-	-
0017	YES	-	-	-	-	-	-	-	-	-	-	-
0018	-	-	-	-	-	-	-	-	-	-	-	-
0019	-	-	-	-	-	-	-	-	-	-	-	-
0020	-	-	-	-	-	-	-	-	-	-	-	-
0021	-	-	-	-	-	-	-	-	-	-	-	-
0022	-	YES	YES	-	-	-	-	-	-	-	-	-
0023	-	-	-	-	-	-	-	-	-	-	-	-

DERIVED DOSE BY PATHWAY (mg/(kg-d)) FOR CANCER CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	3.77E-04	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	0.00E+00
0002	2.60E-04	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	0.00E+00
0003	2.60E-04	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	0.00E+00
0004	3.77E-04	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	0.00E+00
0005	3.77E-04	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	0.00E+00
0006	3.77E-04	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	0.00E+00
0007	3.77E-04	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	0.00E+00
0008	2.60E-04	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	0.00E+00
0009	2.60E-04	2.81E-03	4.21E-04	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
0010	2.60E-04	2.81E-03	4.21E-04	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
0011	2.60E-04	2.81E-03	4.21E-04	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
0012	2.60E-04	2.81E-03	4.21E-04	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
0013	2.60E-04	2.81E-03	4.21E-04	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
0014	2.60E-04	2.81E-03	4.21E-04	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
0015	3.77E-04	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	0.00E+00
0016	2.60E-04	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	0.00E+00
0017	3.77E-04	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	0.00E+00
0018	2.60E-04	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	0.00E+00
0019	2.60E-04	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	0.00E+00
0020	2.60E-04	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	0.00E+00
0021	2.60E-04	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	0.00E+00

0022	2.60E-04	2.81E-03	4.21E-04	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
0023	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	0.00E+00	0.00E+00

DERIVED CANCER RISK

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	MEAT	ORAL	TOTAL
0001	3.77E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-06
0002	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0003	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0004	3.77E-05	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	0.00E+00	0.00E+00	0.00E+00	3.77E-05
0005	2.26E-04	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	0.00E+00	0.00E+00	0.00E+00	2.26E-04
0006	4.15E-04	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	0.00E+00	0.00E+00	0.00E+00	4.15E-04
0007	7.91E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.91E-06
0008	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	1.01E-04	3.37E-03	5.05E-04	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	3.87E-03	3.98E-03
0010	1.01E-03	3.37E-02	5.05E-03	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	3.87E-02	3.98E-02
0011	1.01E-04	3.37E-03	5.05E-04	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	3.87E-03	3.98E-03
0012	1.01E-04	3.37E-03	5.05E-04	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	3.87E-03	3.98E-03
0013	1.01E-05	3.37E-04	5.05E-05	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	3.87E-04	3.98E-04
0014	1.01E-04	3.37E-03	5.05E-04	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	3.87E-03	3.98E-03
0015	4.52E-05	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	0.00E+00	0.00E+00	0.00E+00	4.52E-05
0016	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	4.90E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.90E-06
0018	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0019	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0020	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0022	1.07E-03	1.15E-02	1.72E-03	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	1.32E-02	1.43E-02
0023	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SUM	3.23E-03	5.90E-02	8.84E-03	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	6.79E-02	7.11E-02

DOMINANT PATHWAYS FOR CHRONIC

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	YES	-	-	-	-	-	-	-	-	-	-	-
0002	YES	-	-	-	-	-	-	-	-	-	-	-
0003	YES	-	-	-	-	-	-	-	-	-	-	-
0004	YES	-	-	-	-	-	-	-	-	-	-	-
0005	YES	-	-	-	-	-	-	-	-	-	-	-
0006	YES	-	-	-	-	-	-	-	-	-	-	-
0007	YES	-	-	-	-	-	-	-	-	-	-	-
0008	YES	-	-	-	-	-	-	-	-	-	-	-
0009	YES	YES	YES	-	-	-	-	-	-	-	-	-
0010	YES	YES	YES	-	-	-	-	-	-	-	-	-
0011	YES	YES	YES	-	-	-	-	-	-	-	-	-
0012	YES	YES	YES	-	-	-	-	-	-	-	-	-
0013	YES	YES	YES	-	-	-	-	-	-	-	-	-
0014	YES	YES	YES	-	-	-	-	-	-	-	-	-
0015	YES	-	-	-	-	-	-	-	-	-	-	-
0016	YES	-	-	-	-	-	-	-	-	-	-	-
0017	YES	-	-	-	-	-	-	-	-	-	-	-
0018	YES	-	-	-	-	-	-	-	-	-	-	-
0019	YES	-	-	-	-	-	-	-	-	-	-	-
0020	YES	-	-	-	-	-	-	-	-	-	-	-
0021	YES	-	-	-	-	-	-	-	-	-	-	-
0022	YES	YES	YES	-	-	-	-	-	-	-	-	-
0023	-	-	-	-	-	-	-	-	-	-	-	-

INHALATION CONCENTRATION (ug/m^3) AND DERIVED DOSE BY PATHWAY (mg/(kg-d)) FOR CHRONIC CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	1.00E+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	0.00E+00	0.00E+00
0002	1.00E+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	0.00E+00	0.00E+00
0003	1.00E+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	0.00E+00	0.00E+00
0004	1.00E+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	0.00E+00	0.00E+00

0005	1.00E+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	0.00E+00	0.00E+00
0006	1.00E+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	0.00E+00	0.00E+00
0007	1.00E+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	0.00E+00	0.00E+00
0008	1.00E+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	0.00E+00	0.00E+00
0009	1.00E+00	2.93E-03	4.39E-04	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
0010	1.00E+00	2.93E-03	4.39E-04	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
0011	1.00E+00	2.93E-03	4.39E-04	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
0012	1.00E+00	2.93E-03	4.39E-04	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
0013	1.00E+00	2.93E-03	4.39E-04	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
0014	1.00E+00	2.93E-03	4.39E-04	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
0015	1.00E+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	0.00E+00	0.00E+00
0016	1.00E+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	0.00E+00	0.00E+00
0017	1.00E+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	0.00E+00	0.00E+00
0018	1.00E+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	0.00E+00	0.00E+00
0019	1.00E+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	0.00E+00	0.00E+00
0020	1.00E+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	0.00E+00	0.00E+00
0021	1.00E+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	0.00E+00	0.00E+00
0022	1.00E+00	2.93E-03	4.39E-04	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
0023	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	0.00E+00	0.00E+00

DERIVED CHRONIC HI

CHEM	CV	CNS	BONE	DEVEL	ENDO	EYE	GILV	IMMUN	KIDN	REPRO	RESP	SKIN	BLOOD	MAX
0001	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	1.11E-01	0.00E+00	0.00E+00	1.11E-01
0002	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E+01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E+01	0.00E+00	0.00E+00	1.67E+01
0003	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	5.00E-03	0.00E+00	0.00E+00	5.00E-03
0004	0.00E+00	1.67E-02	0.00E+00	1.67E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.67E-02	1.67E-02
0005	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	5.00E-02	0.00E+00	0.00E+00	0.00E+00	5.00E-02
0006	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	2.00E-01	0.00E+00	0.00E+00	2.00E-01
0007	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-01	0.00E+00	0.00E+00	3.33E-01
0008	0.00E+00	1.43E-04	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	0.00E+00	1.43E-04
0009	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0010	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0011	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0012	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0013	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0014	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0015	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	1.11E-01	0.00E+00	0.00E+00	1.11E-01
0016	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	3.33E-04	0.00E+00	0.00E+00	3.33E-04
0017	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	3.33E-02	0.00E+00	0.00E+00	3.33E-02
0018	0.00E+00	3.33E-03	0.00E+00	3.33E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.33E-03	0.00E+00	0.00E+00	3.33E-03
0019	0.00E+00	1.43E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.43E-03	0.00E+00	0.00E+00	1.43E-03
0020	0.00E+00	0.00E+00	0.00E+00	5.00E-04	5.00E-04	0.00E+00	5.00E-04	0.00E+00	5.00E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.00E-04
0021	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0022	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0023	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SUM	0.00E+00	2.16E-02	0.00E+00	2.05E-02	5.00E-04	1.70E+01	5.00E-04	0.00E+00	5.00E-04	5.00E-02	1.75E+01	0.00E+00	1.67E-02	1.75E+01

ACUTE HI

CHEM	CV	CNS	BONE	DEVEL	ENDO	EYE	GILV	IMMUN	KIDN	REPRO	RESP	SKIN	BLOOD	MAX
0001	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0002	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.26E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.26E+00	0.00E+00	0.00E+00	5.26E+00
0003	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.13E-04	0.00E+00	0.00E+00	3.13E-04
0004	0.00E+00	0.00E+00	0.00E+00	7.69E-04	0.00E+00	0.00E+00	0.00E+00	7.69E-04	0.00E+00	7.69E-04	0.00E+00	0.00E+00	7.69E-04	7.69E-04
0005	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0006	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0007	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.06E-02	0.00E+00	1.06E-02	0.00E+00	0.00E+00	1.06E-02	0.00E+00	0.00E+00	1.06E-02
0008	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0010	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0011	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0012	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0013	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00

0014	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0015	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0016	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	0.00E+00	0.00E+00	0.00E+00	3.23E-04	0.00E+00	3.23E-04	0.00E+00	0.00E+00	0.00E+00	3.23E-04	3.23E-04	0.00E+00	0.00E+00	3.23E-04
0018	0.00E+00	2.70E-05	0.00E+00	2.70E-05	0.00E+00	2.70E-05	0.00E+00	0.00E+00	0.00E+00	2.70E-05	2.70E-05	0.00E+00	0.00E+00	2.70E-05
0019	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.55E-05	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.55E-05	0.00E+00	0.00E+00	4.55E-05
0020	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0022	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0023	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SUM	0.00E+00	2.70E-05	0.00E+00	1.12E-03	0.00E+00	5.27E+00	0.00E+00	1.14E-02	0.00E+00	1.12E-03	5.27E+00	0.00E+00	7.69E-04	5.27E+00

This file: c:\HARP\projects\demo\HEndPointEstimateRisk.txt

Created by HARP Version 1.2a Build 23.03.27
Uses ISC Version 99155
Uses BPIP Version 95086
Creation date: 8/14/2006 11:16:28 AM

EXCEPTION REPORT
   (there have been no changes or exceptions)

INPUT FILES:
   Source-Receptor file:
   Averaging period adjustment factors file: not applicable
   Emission rates file: none
   Site parameters file: C:\HARP\PROJECTS\DEMO\MSATs.sit

GLC DATA SOURCE:
  concentrations loaded from file C:\HARP\PROJECTS\DEMO\MSATs.CML
  concentrations read from file C:\HARP\PROJECTS\DEMO\SFAirport.CML
  User memo:

Screening mode is OFF

Exposure Duration: 70 year (adult resident)
Analysis Method: High-end Point Estimate
Health Effect: Cancer

SITE PARAMETERS

DEPOSITION

   Deposition rate (m/s)   0.05

DRINKING WATER

*** Pathway disabled ***

FISH

*** Pathway disabled ***

PASTURE

*** Pathway disabled ***

HOME GROWN PRODUCE

*** Pathway disabled ***

PIGS, CHICKENS AND EGGS

*** Pathway disabled ***

DERMAL ABSORPTION

*** Pathway enabled ***

SOIL INGESTION

*** Pathway enabled ***

MOTHER'S MILK

*** Pathway enabled ***

CHEMICAL GROUND LEVEL CONCENTRATIONS (micrograms/m^3) (*** indicates not a multipathway chemical)

ABBREV	CAS	GLC Avrg	GLC Max	GLC Water	GLC Pasture	GLC Fish
Acetaldehyde	75070	1.000E+00	1.000E+00	***	***	***
Acrolein	107028	1.000E+00	1.000E+00	***	***	***
NH3	7664417	1.000E+00	1.000E+00	***	***	***
Benzene	71432	1.000E+00	1.000E+00	***	***	***
1,3-Butadiene	106990	1.000E+00	1.000E+00	***	***	***
DieselExhPM	9901	1.000E+00	1.000E+00	***	***	***
Formaldehyde	50000	1.000E+00	1.000E+00	***	***	***
Hexane	110543	1.000E+00	1.000E+00	***	***	***
B[a]anthracene	56553	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[a]P	50328	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[b]fluoranthen	205992	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[k]fluoranthen	207089	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Chrysene	218019	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
In[1,2,3-cd]pyr	193395	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Naphthalene	91203	1.000E+00	1.000E+00	***	***	***
Propylene	115071	1.000E+00	1.000E+00	***	***	***
Propylene Oxide	75569	1.000E+00	1.000E+00	***	***	***
Toluene	108883	1.000E+00	1.000E+00	***	***	***
Xylenes	1210	1.000E+00	1.000E+00	***	***	***
Ethyl Benzene	100414	1.000E+00	1.000E+00	***	***	***
Anthracene	120127	1.000E+00	1.000E+00	***	***	***
D[a,h]anthracen	53703	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
PM	11101	0.000E+00	0.000E+00	***	***	***

CHEMICAL CROSS-REFERENCE TABLE

CHEM	CAS	ABBREVIATION	POLLUTANT NAME	BACKGROUND (ug/m^3)
0001	75070	Acetaldehyde	Acetaldehyde	0.000E+00
0002	107028	Acrolein	Acrolein	0.000E+00
0003	7664417	NH3	Ammonia	0.000E+00
0004	71432	Benzene	Benzene	0.000E+00
0005	106990	1,3-Butadiene	1,3-Butadiene	0.000E+00
0006	9901	DieselExhPM	Diesel engine exhaust, particulate matter	0.000E+00
0007	50000	Formaldehyde	Formaldehyde	0.000E+00
0008	110543	Hexane	Hexane	0.000E+00
0009	56553	B[a]anthracene	Benz[a]anthracene	0.000E+00
0010	50328	B[a]P	Benzo[a]pyrene	0.000E+00
0011	205992	B[b]fluoranthen	Benzo[b]fluoranthene	0.000E+00
0012	207089	B[k]fluoranthen	Benzo[k]fluoranthene	0.000E+00
0013	218019	Chrysene	Chrysene	0.000E+00
0014	193395	In[1,2,3-cd]pyr	Indeno[1,2,3-cd]pyrene	0.000E+00
0015	91203	Naphthalene	Naphthalene	0.000E+00
0016	115071	Propylene	Propylene	0.000E+00
0017	75569	Propylene Oxide	Propylene oxide	0.000E+00
0018	108883	Toluene	Toluene	0.000E+00
0019	1210	Xylenes	Xylenes (mixed)	0.000E+00
0020	100414	Ethyl Benzene	Ethyl benzene	0.000E+00
0021	120127	Anthracene	Anthracene	0.000E+00
0022	53703	D[a,h]anthracen	Dibenz[a,h]anthracene	0.000E+00
0023	11101	PM	Particulate Matter	0.000E+00

EMISSIONS DATA SOURCE:
CHEMICALS ADDED OR DELETED: none

HIGH-END DOSE BY PATHWAY (mg/(kg-d)) FOR CANCER CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	3.77E-04	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	0.00E+00
0002	3.77E-04	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	0.00E+00
0003	3.77E-04	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	0.00E+00
0004	3.77E-04	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	0.00E+00
0005	3.77E-04	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	0.00E+00
0006	3.77E-04	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	0.00E+00
0007	3.77E-04	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	0.00E+00
0008	3.77E-04	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	0.00E+00
0009	3.77E-04	2.81E-03	4.21E-04	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
0010	3.77E-04	2.81E-03	4.21E-04	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
0011	3.77E-04	2.81E-03	4.21E-04	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
0012	3.77E-04	2.81E-03	4.21E-04	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
0013	3.77E-04	2.81E-03	4.21E-04	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
0014	3.77E-04	2.81E-03	4.21E-04	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
0015	3.77E-04	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	0.00E+00
0016	3.77E-04	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	0.00E+00
0017	3.77E-04	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	0.00E+00
0018	3.77E-04	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	0.00E+00
0019	3.77E-04	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	0.00E+00
0020	3.77E-04	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	0.00E+00
0021	3.77E-04	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	0.00E+00
0022	3.77E-04	2.81E-03	4.21E-04	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
0023	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	0.00E+00	0.00E+00

HIGH-END CANCER RISK

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	MEAT	ORAL	TOTAL
0001	3.77E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.77E-06
0002	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0003	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0004	3.77E-05	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	0.00E+00	0.00E+00	0.00E+00	3.77E-05
0005	2.26E-04	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	0.00E+00	0.00E+00	0.00E+00	2.26E-04
0006	4.15E-04	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	0.00E+00	0.00E+00	0.00E+00	4.15E-04
0007	7.91E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	7.91E-06
0008	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	1.47E-04	3.37E-03	5.05E-04	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	3.87E-03	4.02E-03
0010	1.47E-03	3.37E-02	5.05E-03	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	3.87E-02	4.02E-02
0011	1.47E-04	3.37E-03	5.05E-04	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	3.87E-03	4.02E-03
0012	1.47E-04	3.37E-03	5.05E-04	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	3.87E-03	4.02E-03
0013	1.47E-05	3.37E-04	5.05E-05	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	3.87E-04	4.02E-04
0014	1.47E-04	3.37E-03	5.05E-04	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	3.87E-03	4.02E-03
0015	4.52E-05	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	0.00E+00	0.00E+00	0.00E+00	4.52E-05
0016	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	4.90E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.90E-06
0018	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0019	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0020	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

0022	1.55E-03	1.15E-02	1.72E-03	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	1.32E-02	1.48E-02
0023	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SUM	4.36E-03	5.90E-02	8.84E-03	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	6.79E-02	7.22E-02

```
This file: c:\HARP\projects\demo\DerAdjMethod.txt

Created by HARP Version 1.2a  Build 23.03.27
Uses ISC Version 99155
Uses BPIP Version 95086
Creation date: 8/14/2006 11:18:33 AM


EXCEPTION REPORT
   (there have been no changes or exceptions)

INPUT FILES:
   Source-Receptor file:
   Averaging period adjustment factors file: not applicable
   Emission rates file: none
   Site parameters file: C:\HARP\PROJECTS\DEMO\MSATs.sit

GLC DATA SOURCE:
  concentrations loaded from file C:\HARP\PROJECTS\DEMO\MSATs.CML
  concentrations read from file C:\HARP\PROJECTS\DEMO\SFAirport.CML
  User memo:

Screening mode is OFF

Exposure Duration: 70 year (adult resident)
Analysis Method: Derived (Adjusted) Method
Health Effect: Cancer

SITE PARAMETERS

DEPOSITION

   Deposition rate (m/s)             0.05

DRINKING WATER

*** Pathway disabled ***

FISH

*** Pathway disabled ***

PASTURE

*** Pathway disabled ***

HOME GROWN PRODUCE

*** Pathway disabled ***

PIGS, CHICKENS AND EGGS

*** Pathway disabled ***

DERMAL ABSORPTION

*** Pathway enabled ***

SOIL INGESTION

*** Pathway enabled ***
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MOTHER'S MILK

*** Pathway enabled ***

CHEMICAL GROUND LEVEL CONCENTRATIONS (micrograms/m^3) (*** indicates not a multipathway chemical)

ABBREV	CAS	GLC Avrg	GLC Max	GLC Water	GLC Pasture	GLC Fish
Acetaldehyde	75070	1.000E+00	1.000E+00	***	***	***
Acrolein	107028	1.000E+00	1.000E+00	***	***	***
NH3	7664417	1.000E+00	1.000E+00	***	***	***
Benzene	71432	1.000E+00	1.000E+00	***	***	***
1,3-Butadiene	106990	1.000E+00	1.000E+00	***	***	***
DieselExhPM	9901	1.000E+00	1.000E+00	***	***	***
Formaldehyde	50000	1.000E+00	1.000E+00	***	***	***
Hexane	110543	1.000E+00	1.000E+00	***	***	***
B[a]anthracene	56553	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[a]P	50328	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[b]fluoranthen	205992	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[k]fluoranthen	207089	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Chrysene	218019	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
In[1,2,3-cd]pyr	193395	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Naphthalene	91203	1.000E+00	1.000E+00	***	***	***
Propylene	115071	1.000E+00	1.000E+00	***	***	***
Propylene Oxide	75569	1.000E+00	1.000E+00	***	***	***
Toluene	108883	1.000E+00	1.000E+00	***	***	***
Xylenes	1210	1.000E+00	1.000E+00	***	***	***
Ethyl Benzene	100414	1.000E+00	1.000E+00	***	***	***
Anthracene	120127	1.000E+00	1.000E+00	***	***	***
D[a,h]anthracen	53703	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
PM	11101	0.000E+00	0.000E+00	***	***	***

CHEMICAL CROSS-REFERENCE TABLE

CHEM	CAS	ABBREVIATION	POLLUTANT NAME	BACKGROUND (ug/m^3)
0001	75070	Acetaldehyde	Acetaldehyde	0.000E+00
0002	107028	Acrolein	Acrolein	0.000E+00
0003	7664417	NH3	Ammonia	0.000E+00
0004	71432	Benzene	Benzene	0.000E+00
0005	106990	1,3-Butadiene	1,3-Butadiene	0.000E+00
0006	9901	DieselExhPM	Diesel engine exhaust, particulate matter	0.000E+00
0007	50000	Formaldehyde	Formaldehyde	0.000E+00
0008	110543	Hexane	Hexane	0.000E+00
0009	56553	B[a]anthracene	Benz[a]anthracene	0.000E+00
0010	50328	B[a]P	Benzo[a]pyrene	0.000E+00
0011	205992	B[b]fluoranthen	Benzo[b]fluoranthene	0.000E+00
0012	207089	B[k]fluoranthen	Benzo[k]fluoranthene	0.000E+00
0013	218019	Chrysene	Chrysene	0.000E+00
0014	193395	In[1,2,3-cd]pyr	Indeno[1,2,3-cd]pyrene	0.000E+00
0015	91203	Naphthalene	Naphthalene	0.000E+00
0016	115071	Propylene	Propylene	0.000E+00
0017	75569	Propylene Oxide	Propylene oxide	0.000E+00
0018	108883	Toluene	Toluene	0.000E+00
0019	1210	Xylenes	Xylenes (mixed)	0.000E+00
0020	100414	Ethyl Benzene	Ethyl benzene	0.000E+00
0021	120127	Anthracene	Anthracene	0.000E+00
0022	53703	D[a,h]anthracen	Dibenz[a,h]anthracene	0.000E+00
0023	11101	PM	Particulate Matter	0.000E+00

EMISSIONS DATA SOURCE:
CHEMICALS ADDED OR DELETED: none

DOMINANT PATHWAYS FOR CANCER

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	A	-	-	-	-	-	-	-	-	-	-	-
0002	-	-	-	-	-	-	-	-	-	-	-	-
0003	-	-	-	-	-	-	-	-	-	-	-	-
0004	A	-	-	-	-	-	-	-	-	-	-	-
0005	A	-	-	-	-	-	-	-	-	-	-	-
0006	A	-	-	-	-	-	-	-	-	-	-	-
0007	A	-	-	-	-	-	-	-	-	-	-	-
0008	-	-	-	-	-	-	-	-	-	-	-	-
0009	-	YES	YES	-	-	-	-	-	-	-	-	-
0010	-	YES	YES	-	-	-	-	-	-	-	-	-
0011	-	YES	YES	-	-	-	-	-	-	-	-	-
0012	-	YES	YES	-	-	-	-	-	-	-	-	-
0013	-	YES	YES	-	-	-	-	-	-	-	-	-
0014	-	YES	YES	-	-	-	-	-	-	-	-	-
0015	A	-	-	-	-	-	-	-	-	-	-	-
0016	-	-	-	-	-	-	-	-	-	-	-	-
0017	A	-	-	-	-	-	-	-	-	-	-	-
0018	-	-	-	-	-	-	-	-	-	-	-	-
0019	-	-	-	-	-	-	-	-	-	-	-	-
0020	-	-	-	-	-	-	-	-	-	-	-	-
0021	-	-	-	-	-	-	-	-	-	-	-	-
0022	-	YES	YES	-	-	-	-	-	-	-	-	-
0023	-	-	-	-	-	-	-	-	-	-	-	-

DERIVED DOSE BY PATHWAY (mg/(kg-d)) FOR CANCER CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	2.90E-04	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	0.00E+00
0002	2.60E-04	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	0.00E+00
0003	2.60E-04	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	0.00E+00
0004	2.90E-04	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	0.00E+00
0005	2.90E-04	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	0.00E+00
0006	2.90E-04	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	0.00E+00
0007	2.90E-04	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	0.00E+00
0008	2.60E-04	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	0.00E+00
0009	2.60E-04	2.81E-03	4.21E-04	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
0010	2.60E-04	2.81E-03	4.21E-04	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
0011	2.60E-04	2.81E-03	4.21E-04	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
0012	2.60E-04	2.81E-03	4.21E-04	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
0013	2.60E-04	2.81E-03	4.21E-04	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
0014	2.60E-04	2.81E-03	4.21E-04	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
0015	2.90E-04	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	0.00E+00
0016	2.60E-04	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	0.00E+00
0017	2.90E-04	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	0.00E+00
0018	2.60E-04	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	0.00E+00
0019	2.60E-04	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	0.00E+00
0020	2.60E-04	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	0.00E+00
0021	2.60E-04	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	0.00E+00

0022	2.60E-04	2.81E-03	4.21E-04	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
0023	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	0.00E+00	0.00E+00

DERIVED CANCER RISK

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	MEAT	ORAL	TOTAL
0001	2.90E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	2.90E-06
0002	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0003	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0004	2.90E-05	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	0.00E+00	0.00E+00	0.00E+00	2.90E-05
0005	1.74E-04	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	0.00E+00	0.00E+00	0.00E+00	1.74E-04
0006	3.19E-04	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	0.00E+00	0.00E+00	0.00E+00	3.19E-04
0007	6.08E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.08E-06
0008	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	1.01E-04	3.37E-03	5.05E-04	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	3.87E-03	3.98E-03
0010	1.01E-03	3.37E-02	5.05E-03	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	3.87E-02	3.98E-02
0011	1.01E-04	3.37E-03	5.05E-04	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	3.87E-03	3.98E-03
0012	1.01E-04	3.37E-03	5.05E-04	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	3.87E-03	3.98E-03
0013	1.01E-05	3.37E-04	5.05E-05	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	3.87E-04	3.98E-04
0014	1.01E-04	3.37E-03	5.05E-04	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	3.87E-03	3.98E-03
0015	3.48E-05	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	0.00E+00	0.00E+00	0.00E+00	3.48E-05
0016	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	3.76E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.76E-06
0018	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0019	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0020	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0022	1.07E-03	1.15E-02	1.72E-03	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	1.32E-02	1.43E-02
0023	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SUM	3.06E-03	5.90E-02	8.84E-03	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	6.79E-02	7.09E-02

```
This file: c:\HARP\projects\demo\WorkerExp.txt

Created by HARP Version 1.2a  Build 23.03.27
Uses ISC Version 99155
Uses BPIP Version 95086
Creation date: 8/14/2006 11:19:30 AM


EXCEPTION REPORT
   (there have been no changes or exceptions)

INPUT FILES:
   Source-Receptor file:
   Averaging period adjustment factors file: not applicable
   Emission rates file: none
   Site parameters file: C:\HARP\PROJECTS\DEMO\MSATs.sit

GLC DATA SOURCE:
  concentrations loaded from file C:\HARP\PROJECTS\DEMO\MSATs.CML
  concentrations read from file C:\HARP\PROJECTS\DEMO\SFAirport.CML
  User memo:

Screening mode is OFF

Exposure Duration: Standard work schedule (49 wks/yr, 5 days/wk, 8 hrs/day, 40 yrs)
Analysis Method: Point estimate
Health Effect: Cancer

SITE PARAMETERS

DEPOSITION

   Deposition rate (m/s)             0.05

DRINKING WATER

*** Pathway disabled ***

FISH

*** Pathway disabled ***

PASTURE

*** Pathway disabled ***

HOME GROWN PRODUCE

*** Pathway disabled ***

PIGS, CHICKENS AND EGGS

*** Pathway disabled ***

DERMAL ABSORPTION

*** Pathway enabled ***

SOIL INGESTION

*** Pathway enabled ***
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MOTHER'S MILK

*** Pathway enabled ***

CHEMICAL GROUND LEVEL CONCENTRATIONS (micrograms/m^3) (*** indicates not a multipathway chemical)

ABBREV	CAS	GLC Avrg	GLC Max	GLC Water	GLC Pasture	GLC Fish
Acetaldehyde	75070	1.000E+00	1.000E+00	***	***	***
Acrolein	107028	1.000E+00	1.000E+00	***	***	***
NH3	7664417	1.000E+00	1.000E+00	***	***	***
Benzene	71432	1.000E+00	1.000E+00	***	***	***
1,3-Butadiene	106990	1.000E+00	1.000E+00	***	***	***
DieselExhPM	9901	1.000E+00	1.000E+00	***	***	***
Formaldehyde	50000	1.000E+00	1.000E+00	***	***	***
Hexane	110543	1.000E+00	1.000E+00	***	***	***
B[a]anthracene	56553	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[a]P	50328	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[b]fluoranthen	205992	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
B[k]fluoranthen	207089	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Chrysene	218019	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
In[1,2,3-cd]pyr	193395	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
Naphthalene	91203	1.000E+00	1.000E+00	***	***	***
Propylene	115071	1.000E+00	1.000E+00	***	***	***
Propylene Oxide	75569	1.000E+00	1.000E+00	***	***	***
Toluene	108883	1.000E+00	1.000E+00	***	***	***
Xylenes	1210	1.000E+00	1.000E+00	***	***	***
Ethyl Benzene	100414	1.000E+00	1.000E+00	***	***	***
Anthracene	120127	1.000E+00	1.000E+00	***	***	***
D[a,h]anthracen	53703	1.000E+00	1.000E+00	1.000E+00	1.000E+00	1.000E+00
PM	11101	0.000E+00	0.000E+00	***	***	***

CHEMICAL CROSS-REFERENCE TABLE

CHEM	CAS	ABBREVIATION	POLLUTANT NAME	BACKGROUND (ug/m^3)
0001	75070	Acetaldehyde	Acetaldehyde	0.000E+00
0002	107028	Acrolein	Acrolein	0.000E+00
0003	7664417	NH3	Ammonia	0.000E+00
0004	71432	Benzene	Benzene	0.000E+00
0005	106990	1,3-Butadiene	1,3-Butadiene	0.000E+00
0006	9901	DieselExhPM	Diesel engine exhaust, particulate matter	0.000E+00
0007	50000	Formaldehyde	Formaldehyde	0.000E+00
0008	110543	Hexane	Hexane	0.000E+00
0009	56553	B[a]anthracene	Benz[a]anthracene	0.000E+00
0010	50328	B[a]P	Benzo[a]pyrene	0.000E+00
0011	205992	B[b]fluoranthen	Benzo[b]fluoranthene	0.000E+00
0012	207089	B[k]fluoranthen	Benzo[k]fluoranthene	0.000E+00
0013	218019	Chrysene	Chrysene	0.000E+00
0014	193395	In[1,2,3-cd]pyr	Indeno[1,2,3-cd]pyrene	0.000E+00
0015	91203	Naphthalene	Naphthalene	0.000E+00
0016	115071	Propylene	Propylene	0.000E+00
0017	75569	Propylene Oxide	Propylene oxide	0.000E+00
0018	108883	Toluene	Toluene	0.000E+00
0019	1210	Xylenes	Xylenes (mixed)	0.000E+00
0020	100414	Ethyl Benzene	Ethyl benzene	0.000E+00
0021	120127	Anthracene	Anthracene	0.000E+00
0022	53703	D[a,h]anthracen	Dibenz[a,h]anthracene	0.000E+00
0023	11101	PM	Particulate Matter	0.000E+00

EMISSIONS DATA SOURCE:
CHEMICALS ADDED OR DELETED: none

AVERAGE DOSE BY PATHWAY (mg/(kg-d)) FOR CANCER CALCULATIONS

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG
0001	5.72E-05	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	0.00E+00
0002	5.72E-05	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	0.00E+00
0003	5.72E-05	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	0.00E+00
0004	5.72E-05	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	0.00E+00
0005	5.72E-05	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	0.00E+00
0006	5.72E-05	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	0.00E+00
0007	5.72E-05	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	0.00E+00
0008	5.72E-05	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	0.00E+00
0009	5.72E-05	1.07E-03	1.39E-04	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
0010	5.72E-05	1.07E-03	1.39E-04	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
0011	5.72E-05	1.07E-03	1.39E-04	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
0012	5.72E-05	1.07E-03	1.39E-04	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
0013	5.72E-05	1.07E-03	1.39E-04	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
0014	5.72E-05	1.07E-03	1.39E-04	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
0015	5.72E-05	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	0.00E+00
0016	5.72E-05	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	0.00E+00
0017	5.72E-05	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	0.00E+00
0018	5.72E-05	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	0.00E+00
0019	5.72E-05	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	0.00E+00
0020	5.72E-05	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	0.00E+00
0021	5.72E-05	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	0.00E+00
0022	5.72E-05	1.07E-03	1.39E-04	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
0023	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	0.00E+00	0.00E+00

AVERAGE CANCER RISK

CHEM	INHAL	DERM	SOIL	MOTHER	FISH	WATER	VEG	DAIRY	BEEF	CHICK	PIG	EGG	MEAT	ORAL	TOTAL
0001	5.72E-07	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	0.00E+00	0.00E+00	0.00E+00	5.72E-07
0002	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0003	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0004	5.72E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	5.72E-06
0005	3.43E-05	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	0.00E+00	0.00E+00	0.00E+00	3.43E-05
0006	6.29E-05	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	0.00E+00	0.00E+00	0.00E+00	6.29E-05
0007	1.20E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.20E-06
0008	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0009	2.23E-05	1.28E-03	1.66E-04	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	1.45E-03	1.47E-03
0010	2.23E-04	1.28E-02	1.66E-03	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	1.45E-02	1.47E-02
0011	2.23E-05	1.28E-03	1.66E-04	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	1.45E-03	1.47E-03
0012	2.23E-05	1.28E-03	1.66E-04	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	1.45E-03	1.47E-03
0013	2.23E-06	1.28E-04	1.66E-05	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	1.45E-04	1.47E-04
0014	2.23E-05	1.28E-03	1.66E-04	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	1.45E-03	1.47E-03
0015	6.86E-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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.86E-06
0016	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0017	7.43E-07	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	0.00E+00	0.00E+00	0.00E+00	7.43E-07
0018	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0019	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0020	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
0021	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00

0022	2.34E-04	4.37E-03	5.68E-04	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	4.94E-03	5.17E-03
0023	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	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
SUM	6.61E-04	2.24E-02	2.91E-03	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	2.53E-02	2.60E-02

APPENDIX 8.1D

Construction Emissions and Impact Analysis

APPENDIX 8.1D

Construction Emissions and Impact Analysis

Onsite Construction

The initial construction of the HBRP is expected to last approximately 21 months, including 1 month of road construction, 2 months of site clearing and 18 months of project construction. Construction activities will occur in the following main phases:

- Road construction;
- Site preparation;
- Foundation work;
- Installation of major equipment; and
- Construction/installation of major structures.

Road Construction

Construction of the new access road along the east side of the Intake Canal will occur over approximately a 1-month period. Road construction activities will generate combustion and fugitive dust emissions similar to those described below for construction activities. The following table summarizes the emissions associated with road construction activities. Because emissions during this phase are lower than emissions during the construction phase, no further evaluation was performed.

Table 8.1D-2

Maximum Daily Emissions During Road Construction, Pounds Per Day

	NOx	CO	VOC	SOx	PM_{10}	$PM_{2.5}$
Onsite						
Construction Equipment	23.9	19.5	2.9	0.0	0.7	0.7
Fugitive Dust	--	--	--	--	9.0	2.6
Offsite						
Worker Travel, Truck Deliveries[a]	45.5	54.7	6.3	0.1	1.0	1.0
Total Emissions						
Total	69.4	74.2	9.2	0.1	10.7	4.3

Note:

a. Offsite emissions.

Site Preparation

The demolition of the painting and sandblasting building, storage building and diesel tank basin from the HBRP project site to prepare the site for construction will occur over approximately a 2-month period prior to commencement of any construction activities related to the HBRP. As with road construction and project construction activities, site preparation will generate combustion and fugitive dust emissions. The following table summarizes the emissions associated with site preparation activities. Because emissions during this phase are lower than emissions during the construction phase, no further evaluation was performed.

Table 8.1D-1

Maximum Daily Emissions During Site Preparation, Pounds Per Day

	NOx	CO	VOC	SOx	PM_{10}	$PM_{2.5}$
Onsite						
Construction Equipment	37.1	23.8	3.8	0.1	1.0	1.0
Fugitive Dust	--	--	--	--	9.5	1.7
Offsite						
Worker Travel, Truck Deliveries[a]	37.8	67.4	7.7	0.1	0.9	0.9
Total Emissions						
Total	74.9	91.2	11.5	0.2	11.4	3.6

Note:
a. Offsite Emissions

Construction Activities

The construction of HBRP will begin with site preparation activities, which include installation of drainage systems, underground utilities and conduits, grading and backfilling operations, and installation of pilings. After site preparation is finished, the construction of the foundations and structures is expected to begin. Once the foundations and structures are finished, installation and assembly of the mechanical and electrical equipment are scheduled to commence.

Fugitive dust emissions from the construction of the project will result from:

- Dust entrained during site preparation and grading/excavation at the construction site;
- Dust entrained during onsite travel on paved and unpaved surfaces;
- Dust entrained during aggregate and soil loading and unloading operations; and
- Wind erosion of areas disturbed during construction activities.

Combustion emissions during construction will result from:

- Exhaust from the diesel construction equipment used for site preparation, grading, excavation, trenching, and construction of onsite structures;
- Exhaust from water trucks used to control construction dust emissions;
- Exhaust from portable welding machines;
- Exhaust from pickup trucks and diesel trucks used to transport workers and materials around the construction site;
- Exhaust from diesel trucks used to deliver concrete, fuel, and construction supplies to the construction site; and

- Exhaust from automobiles used by workers to commute to the construction site.

To determine the potential worst-case daily construction impacts, exhaust and dust emission rates have been evaluated for each source of emissions. Maximum short-term impacts are calculated based on the equipment mix expected during Month 7 of the construction schedule. Annual emissions are based on the average equipment mix during the peak 12-month period out of the overall 18-month construction period.

Linear Facilities

The linear facilities that were constructed for the existing Humboldt Power Plant have adequate capacity to supply process water, natural gas fuel, and potable water for the HBRP project. A new 4 to 6–inch potable water pipeline will be constructed in the location of the temporary access road. The pipeline will interconnect with an existing Humboldt Community Services District (HCSD) pipeline in King Salmon Avenue. The pipeline will be constructed prior to or simultaneously with the construction of the temporary access road and not concurrently with project construction.

Transport of Heavy Equipment to HBRP Project Site

As discussed in Section 8.12, Traffic and Transportation, the Wärtsilä engines and generators will be transported to the project site by barge and heavy truck. After offloading from the ocean freighter that will deliver the engines and generators to Eureka, the heavy equipment will be loaded onto barges and transported across Humboldt Bay to Fields Landing. At Fields Landing, the equipment will be transferred to heavy haul tractors and transported north on Highway 1 to HBRP.

The tug vessels that tow the barges and the heavy haul tractor trailers will generate exhaust emissions. The following table summarizes emissions associated with the heavy equipment transportation.

Table 8.1D-3

Maximum Daily Emissions During Heavy Equipment Transportation, Pounds Per Day[a]

	NOx	CO	ROC	SOx	PM_{10}	$PM_{2.5}$
Offsite						
Barge Transport	253.9	0.2	312.8	36.8	14.7	14.7
Truck Transport	12.6	4.6	0.4	0.0	0.4	0.4
Total	266.5	4.8	313.2	36.8	15.1	15.1

Note:

a. Offsite emissions.

Available Mitigation Measures

The following typical mitigation measures are proposed to control exhaust emissions from the diesel heavy equipment and potential emissions of fugitive dust during construction of the project.

- Unpaved roads and disturbed areas in the project construction site will be watered as frequently as necessary to prevent fugitive dust plumes. The frequency of watering can be reduced or eliminated during periods of precipitation.
- The vehicle speed limit will be 15 miles per hour within the construction site.
- The construction site entrances shall be posted with visible speed limit signs.
- Construction equipment vehicle tires will be inspected and washed as necessary to be cleaned free of dirt prior to entering paved roadways.
- Gravel ramps of at least 20 feet in length will be provided at the tire washing/cleaning station.
- Unpaved exits from the construction site will be graveled or treated to prevent track-out to public roadways.
- Construction vehicles will enter the construction site through the treated entrance roadways, unless an alternative route has been submitted to and approved by the Compliance Project Manager.
- Construction areas adjacent to any paved roadway will be provided with sandbags or other measures as specified in the Storm Water Pollution Prevention Plan (SWPPP) to prevent run-off to roadways.
- Paved roads within the construction site will be swept at least twice daily (or less during periods of precipitation) on days when construction activity occurs to prevent the accumulation of dirt and debris.
- At least the first 500 feet of any public roadway exiting from the construction site shall be swept at least twice daily (or less during periods of precipitation) on days when construction activity occurs or on any other day when dirt or runoff from the construction site is visible on public roadways.
- Soil storage piles and disturbed areas that remain inactive for longer than 10 days will be covered or treated with appropriate dust suppressant compounds.
- Vehicles used to transport solid bulk material on public roadways and having the potential to cause visible emissions will be provided with a cover, or the materials will be sufficiently wetted and loaded onto the trucks in a manner to provide at least one foot of freeboard.
- Wind erosion control techniques (such as windbreaks, water, chemical dust suppressants, and/or vegetation) will be used on all construction areas that may be disturbed. Any windbreaks installed to comply with this condition shall remain in place until the soil is stabilized or permanently covered with vegetation.

An on-site Air Quality Construction Mitigation Manager will be responsible for directing and documenting compliance with construction-related mitigation conditions.

Estimates of Emissions with Mitigation Measures - Onsite Construction

Tables 8.1D-4 and 8.1D-5 show the estimated maximum daily and annual heavy equipment exhaust and fugitive dust emissions with recommended mitigation measures for onsite construction activities. Detailed emission calculations are included as Attachment 8.1D-1.

Table 8.1D-4

Maximum Daily Emissions During Construction, Pounds Per Day

	NOx	CO	VOC	SOx	PM_{10}	$PM_{2.5}$
Onsite						
Construction Equipment	111.9	321.4	27.5	0.2	3.4	3.4
Fugitive Dust	--	--	--	--	12.5	1.6
Offsite						
Worker Travel, Truck Deliveries[a]	240.6	411.4	47.0	0.4	5.5	5.5
Total Emissions						
Total	352.5	732.8	74.5	0.6	21.4	10.5

Note:

a. Offsite emissions.

Table 8.1D-5

Peak Annual Emissions During Project Construction, Tons Per Year

	NOx	CO	VOC	SOx	PM_{10}	$PM_{2.5}$
Onsite						
Construction Equipment	10.9	26.9	2.3	0.0	0.3	0.3
Fugitive Dust	--	--	--	--	1.1	0.1
Offsite						
Worker Travel, Truck Deliveries[a]	13.5	31.7	3.6	0.0	0.3	0.3
Total Emissions						
Total	24.4	58.6	5.9	0.0	1.7	0.7

Note:

a. Offsite emissions.

Analysis of Ambient Impacts from Onsite Construction

Ambient air quality impacts from emissions during construction of the project were estimated using an air quality dispersion modeling analysis. The modeling analysis considers the construction site location, the surrounding topography, and the sources of emissions during construction, including vehicle and equipment exhaust emissions and fugitive dust.

Existing Ambient Levels

As with the modeling analysis of project operating impacts (Section 8.1.2.5), ambient monitoring data collected from monitoring stations in the project area were used to establish the ambient background levels for the construction impact modeling analysis. Table 8.1D-6 shows the maximum concentrations of NOx, SO_2, CO, and PM_{10} recorded for 2004 through 2006.

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TABLE 8.1D-6
Maximum Background Concentrations, 2004-2006 ($\mu g/m^3$)

Pollutant	Averaging Time	2004	2005	2006
NO_2	1-hour, Willits	67.7	52.6	75.2
	1-hour, Ukiah	69.6	69.6	73.3
	Annual, Willits	15.1	15.1	17.0
	Annual, Ukiah	17.0	15.1	15.1
SO_2[a]	1-hour, SF	114.4	49.4	65.0
	3-hour, SF	70.2	33.8	39.0
	24-hour, SF	21.0	18.4	15.3
	Annual, SF	5.3	5.3	5.8
CO	1-hour, Willits	2250	2125	2,375
	1-hour, Ukiah	2875	3250	2,750
	8-hour, Willits	1300	1167	1,211
	8-hour, Ukiah	1978	1678	1,800
PM_{10}[b]	24-Hour	64	71	72.2
	Annual	20.7	13.6	21.1
$PM_{2.5}$[b]	24-Hour[c]	23	32	22
	Annual	8.1	9.1	7.6

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Note:

a. SO_2 background data collected at San Francisco Arkansas Street.

b. PM_{10} and $PM_{2.5}$ data collected at Eureka I Street.

c. 24-hour average $PM_{2.5}$ value shown is 98th percentile value as that is the basis of the ambient air quality standard.

Dispersion Model

The EPA guideline Industrial Source Complex Short Term (ISCST) model was used to estimate ambient impacts from construction activities.

The emission sources for the construction site were grouped into three categories: exhaust emissions, construction dust emissions, and windblown dust emissions. The exhaust and construction dust emissions were modeled as volume sources. The windblown dust emissions were modeled as area sources. For the volume sources, the vertical dimension was set to 6 meters. For combustion sources in the project site area, the horizontal dimension was set to 104 meters, with sigma-y = 24 meters (based on the width of the construction area).

For the windblown dust sources, the area covers the active construction area. An effective plume height of 0.5 meters was used in the modeling analysis. The construction impacts modeling analysis receptor set excluded the areas under the applicant's control, including the existing Humboldt Bay Power Plant property.

To determine the construction impacts on short-term ambient standards (24 hours and less), the worst-case daily onsite construction emission levels shown in Table 8.1D-4 were used. For pollutants with annual average ambient standards, the annual onsite emission levels shown in Table 8.1D-5 were used.

As with the refined modeling discussed in Section 8.1, the construction impact modeling was performed using the 2001 to 2005 Woodley Island monitoring station meteorological data set.

Modeling Results

Based on the emission rates of NOx, SO_2, CO, and PM_{10} and the meteorological data, the ISCST model calculates hourly and annual ambient impacts for each pollutant. As mentioned above, the modeled 1-hour, 3-hour, 8-hour, and 24-hour ambient impacts are based on the worst-case daily emission rates of NOx, SO_2, CO, and PM_{10}. The annual impacts are based on the annual emission rates of these pollutants.

The 1-hour and annual average concentrations of NO_2 were computed following the revised EPA guidance for computing these concentrations (August 9, 1995 *Federal Register*, 60 FR 40465). The ISCST_OLM model was used for the 1-hour average NO_2 impacts; uncorrected 1-hour impacts are also reported for comparison. The annual average was calculated using the ambient ratio method (ARM) with the national default value of 0.75 for the annual average NO_2/NOx ratio.

The modeling analysis results are shown in Table 8.1D-7. Also included in the table are the maximum background levels that have occurred in the last 3 years and the resulting total ambient impacts. Construction impacts alone for all modeled pollutants are expected to be below the most stringent state and national standards. With the exception of the 24-hour and annual average PM_{10}, construction activities are not expected to cause an exceedance of state or federal ambient air quality standards. However, the state 24-hour and annual PM_{10} standards are exceeded in the absence of the construction emissions for the project.

The dust mitigation measures already proposed by the applicant are expected to be effective in minimizing fugitive dust emissions. The attached isopleth diagrams show the extent of the modeled impacts from construction PM_{10} for the 24-hour and annual averaging periods. The attached isopleth diagrams also show 1-hour average NO_2 modeled impacts.

Table 8.1D-7

Modeled Maximum Onsite Construction Impacts

Pollutant	Averaging Time	Maximum Impacts ($\mu g/m^3$)	Background ($\mu g/m^3$)	Total Impact ($\mu g/m^3$)	State Standard ($\mu g/m^3$)	Federal Standard ($\mu g/m^3$)
NO_2[a]	1-hour	227	75.2	302	338	--
	Annual	20	17.0	37	--	100
SO_2	1-hour	3	114.4	117	650	--
	3-hour	1	70.2	71	--	1300
	24-hour	0.3	21.0	21	109	365
	Annual	0.04	5.8	6	--	80
CO	1-hour	5,231	3,250	8,481	23,000	40,000
	8-hour	1,138	1,978	3,116	10,000	10,000
PM_{10}[b]	24-hour	27	72.2	99	50	150
	Annual	3	21.1	24	20	50
$PM_{2.5}$[b]	24-hour	8	32	40	--	35
	Annual	1	9.1	10	12	15

Notes:

a. Ozone limiting method applied for 1-hour average, using concurrent O_3 data (1990). ARM applied for annual average, using national default 0.75 ratio.

b. PM_{10} and $PM_{2.5}$ impacts shown are from fugitive dust as well as combustion sources. Annual average $PM_{2.5}/PM_{10}$ impact from combustion sources only is 0.8 $\mu g/m^3$.

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As shown on these isopleth diagrams, maximum impacts occur on the project site fenceline, and concentrations decrease rapidly within a couple of hundred meters of the project site. For example, maximum modeled 24-hour average PM_{10} impacts along the fenceline are approximately 27 $\mu g/m^3$. However, impacts are reduced by half within 100 meters of the facility fenceline. Maximum impacts are reduced to about 10 $\mu g/m^3$ at the freeway.

It is also important to note that emissions in an exhaust plume are dispersed through the entrainment of ambient air, which dilutes the concentration of the emissions as they are carried away from the source by winds. The process of mixing the pollutants with greater and greater volumes of cleaner air is controlled primarily by the turbulence in the atmosphere. This dispersion occurs both horizontally, as the exhaust plume rises above the emission point, and vertically, as winds carry the plume horizontally away from its source.

The rise of a plume above its initial point of release is a significant contributing factor to the reductions in ground-level concentrations, both because a rising plume entrains more ambient air as it travels downwind, and because it travels farther downwind (and thus also undergoes more horizontal dispersion) before it impacts the ground. Vertical plume rise occurs as a result of buoyancy (plume is hotter than ambient air, and hot air, being less dense, tends to rise) and/or momentum (plume has an initial vertical velocity).

In ISCST3, area sources are not considered to have either buoyant or momentum plume rise, and therefore the model assumes that there is no vertical dispersion taking place. Thus a significant source of plume dilution is ignored when sources are modeled as area sources. The project construction site impacts are not unusual in comparison to most construction project analyses. Construction sites that use good dust suppression techniques and low-emitting vehicles typically do not cause exceedances of air quality standards. The input and output modeling files are being provided electronically.

Health Risk of Diesel Exhaust

The combustion portion of annual PM_{10} emissions from Table 8.1D-5 above was modeled separately to determine the annual average Diesel PM_{10} exhaust concentration. This was used with HARP-derived risk values for Diesel exhaust particulate[3] for a 70-year lifetime to determine the potential carcinogenic risk from Diesel exhaust during construction. The exposure was also adjusted by a factor of 19/840, or 0.0226, to adjust a 70-year (840 month) lifetime to the 19-month construction exposure period.

The maximum modeled annual average concentration of Diesel exhaust PM_{10} at any location is 0.78 µg/m^3. The risk values obtained from HARP range from 2.86×10^{-4} (average point estimate value) to 4.15×10^{-4} (derived OEHHA and high end risk estimates). Using the range of risk values and adjustment factors described above, the carcinogenic risk due to exposure to Diesel exhaust during construction activities is expected to be between approximately 5 and 8 in one million. These risk estimates are less than the significance level of 10 in one million.

It is also important to note that these impacts are highly localized near the project site. The annual average Diesel combustion PM_{10} isopleth diagram in Figure 8.1D-3 shows that the area in which the risk may exceed 1 in one million (Diesel PM_{10} impact greater than or equal to approximately 0.1 µg/m^3) extends only about 700 meters beyond the facility fenceline and does not include any residences. This analysis remains conservative because, as discussed above, the modeled PM_{10} concentrations from construction operations are overpredicted by the ISCST3 model.

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At the request of ARB staff, cancer risk from DPM during construction activities was also evaluated for a 9-year exposure period. Using the high end risk estimate for DPM from HARP of 4.15×10^{-4} per µg/m^3 for a 70-year exposure period, the unit risk value is $9/70 * 4.15 \times 10^{-4} = 5.34 \times 10^{-5}$ per µg/m^3 for a 9-year exposure period. Therefore, the risk to the MEI based on the 9-year exposure period is

$$5.34 \times 10^{-5} \text{ per } \mu g/m^3 * 0.78\ \mu g/m^3 = 4.16 \times 10^{-5}$$

or about 42 in one million.

Based on the high end risk estimate, cancer risk, based on the 9-year exposure, would exceed 10 in one million where the modeled concentration exceeds

$$1 \times 10^{-5} \div 5.34 \times 10^{-5} \text{ per } \mu g/m^3 = 0.187\ \mu g/m^3$$

The isopleth diagram in Figure 8.1D-8 shows that even using this extremely conservative approach to assessing potential cancer risk during project construction, the area where the risk would exceed 10 in one million barely extends beyond the freeway

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[3] See Section 8.1.2.8 for a discussion of the use of the HARP model to derive cancer risk values.

area where the risk would exceed 10 in one million barely extends beyond the freeway east of the Humboldt Bay Power Plant and does not include any residences, schools or other potentially sensitive receptors.

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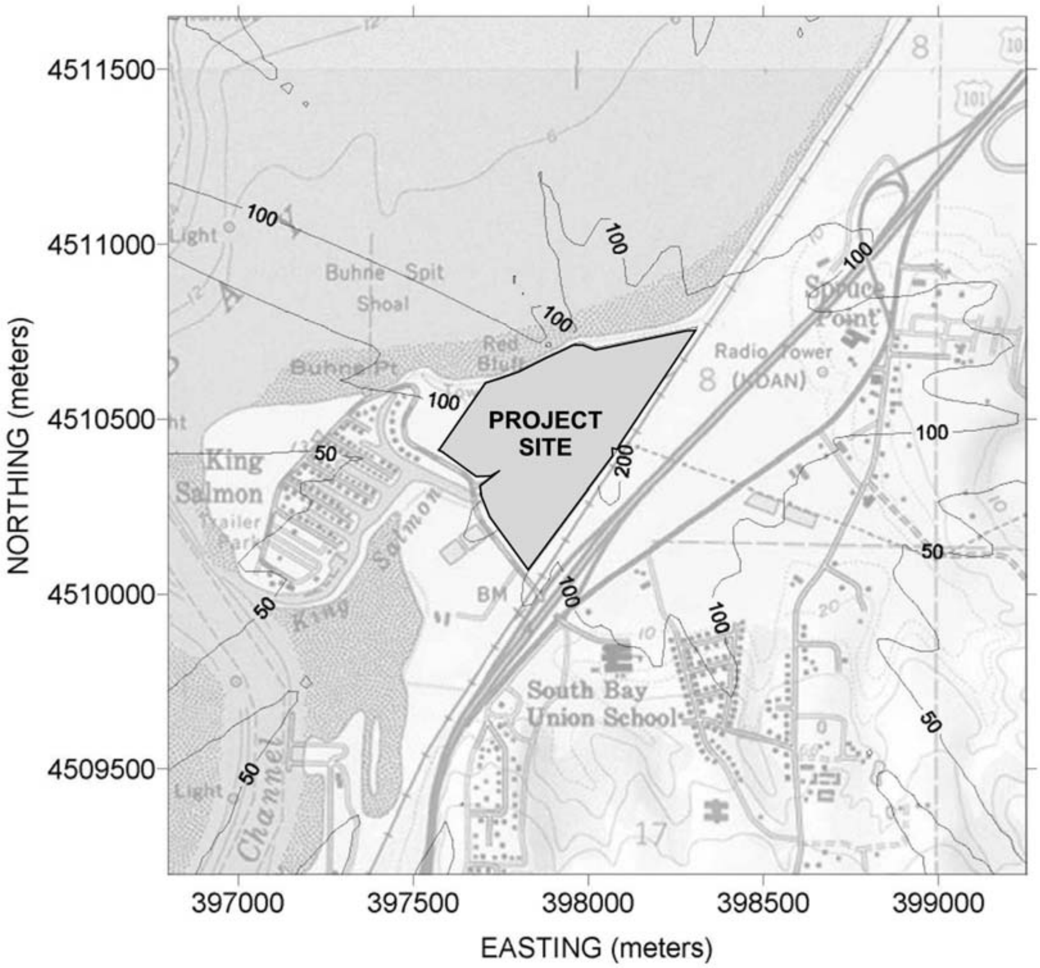
FIGURE 8.1D-1

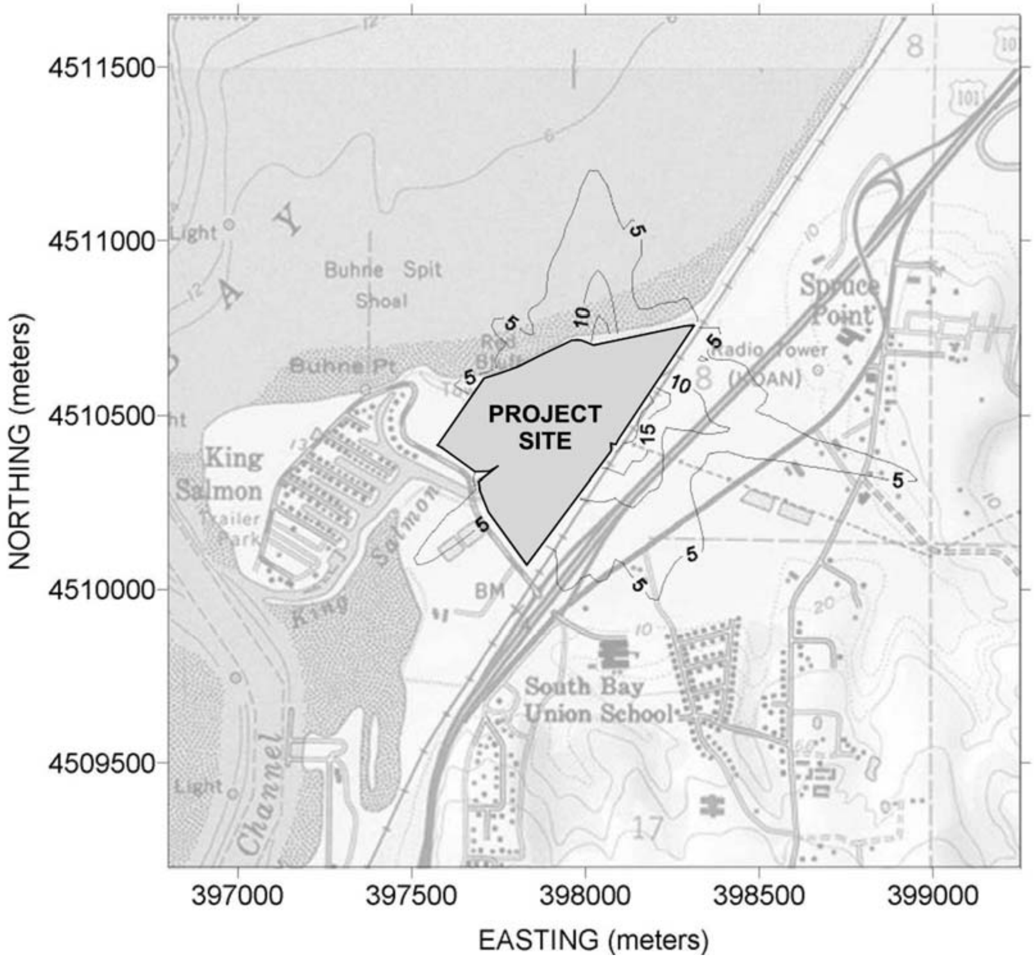
MAXIMUM 1-HOUR AVERAGE NO_2 IMPACTS DURING CONSTRUCTION ACTIVITIES (OZONE-LIMITED)



Concentrations are shown in μg/m^3.

FIGURE 8.1D-2

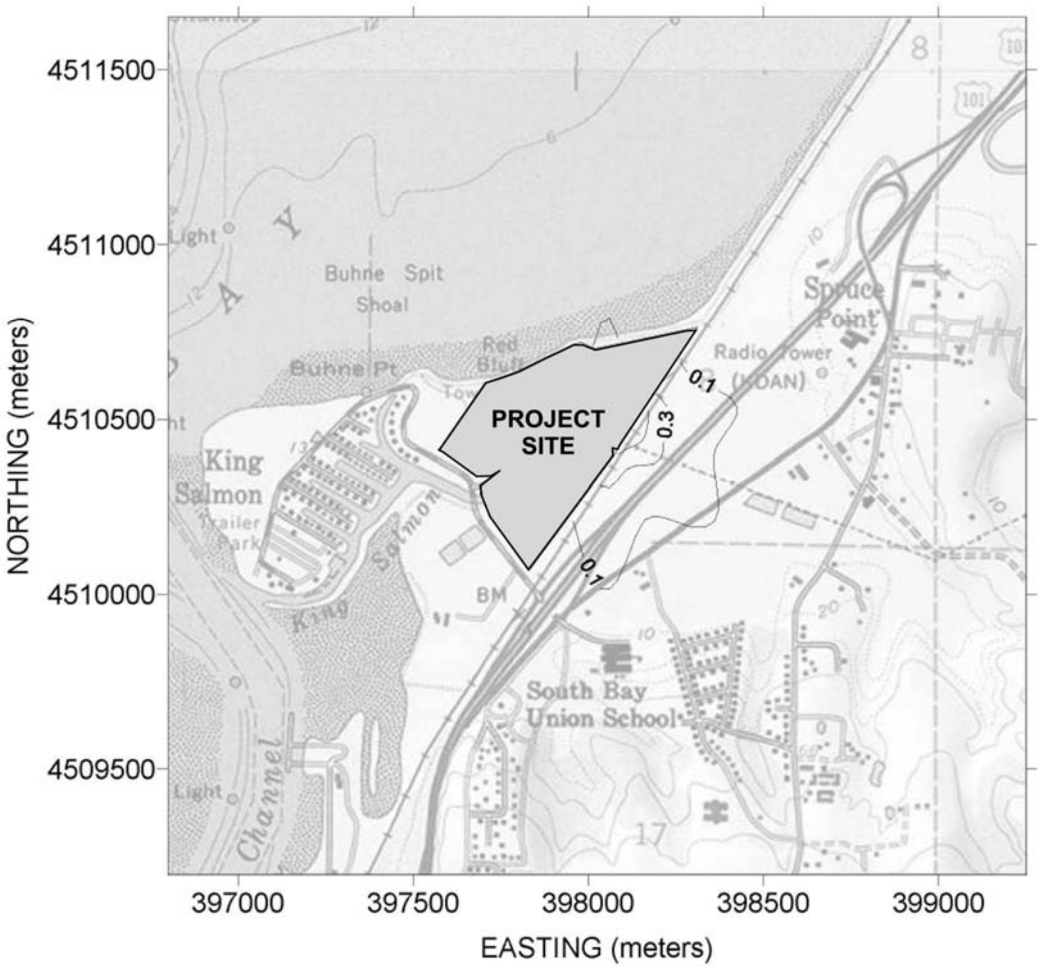
MAXIMUM 24-HOUR AVERAGE PM_{10} IMPACTS DURING CONSTRUCTION ACTIVITIES, ALL SOURCES



Concentrations are shown in $\mu g/m^3$.

FIGURE 8.1D-3

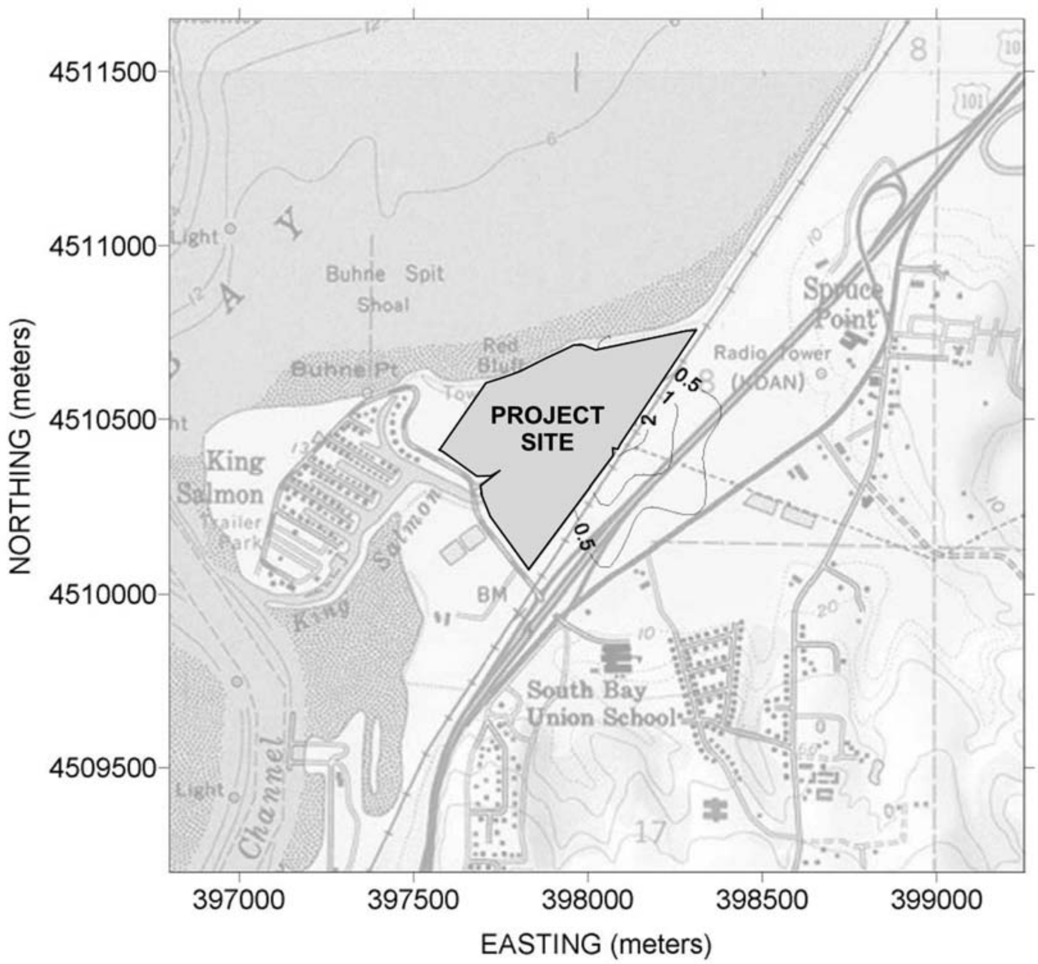
MAXIMUM ANNUAL AVERAGE $PM_{10}/PM_{2.5}$ IMPACTS DURING CONSTRUCTION ACTIVITIES, COMBUSTION SOURCES



Concentrations are shown in $\mu g/m^3$.

FIGURE 8.1D-4

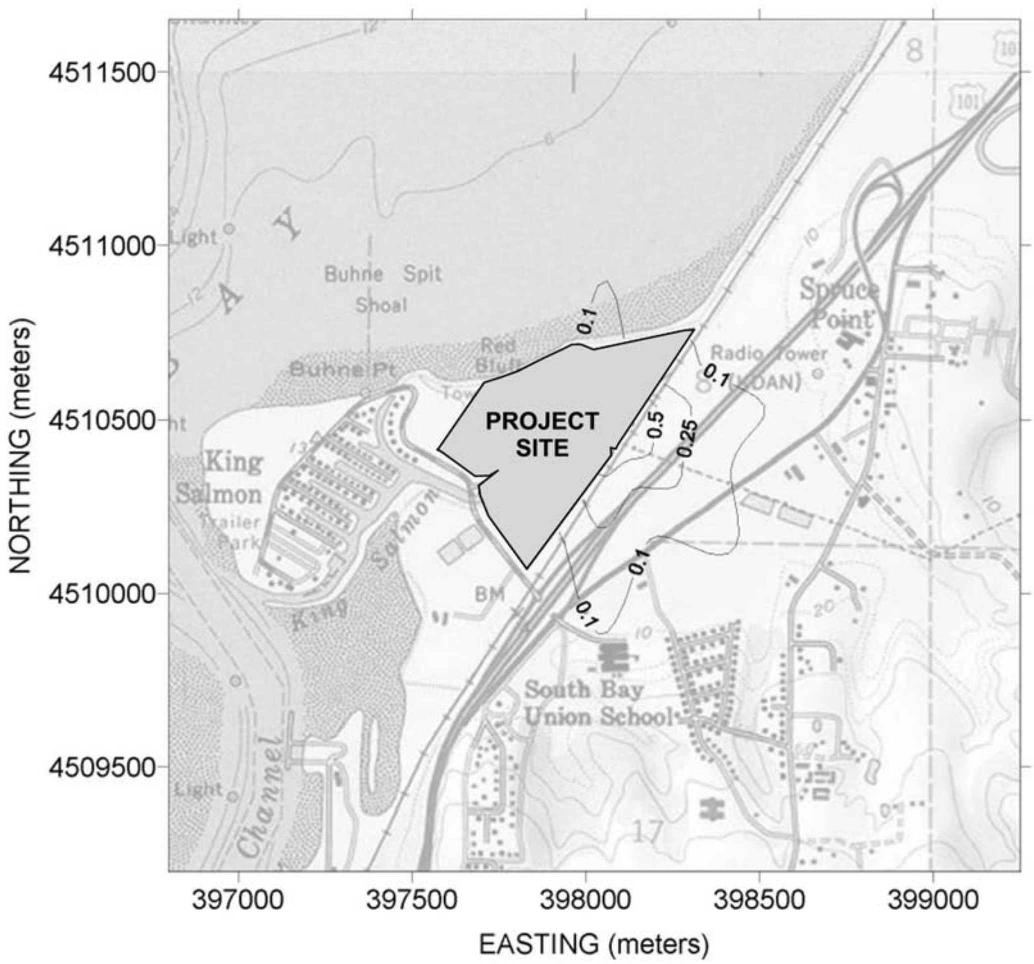
MAXIMUM ANNUAL AVERAGE PM_{10} IMPACTS DURING CONSTRUCTION ACTIVITIES, ALL SOURCES



Concentrations are shown in µg/m^3.

FIGURE 8.1D-5

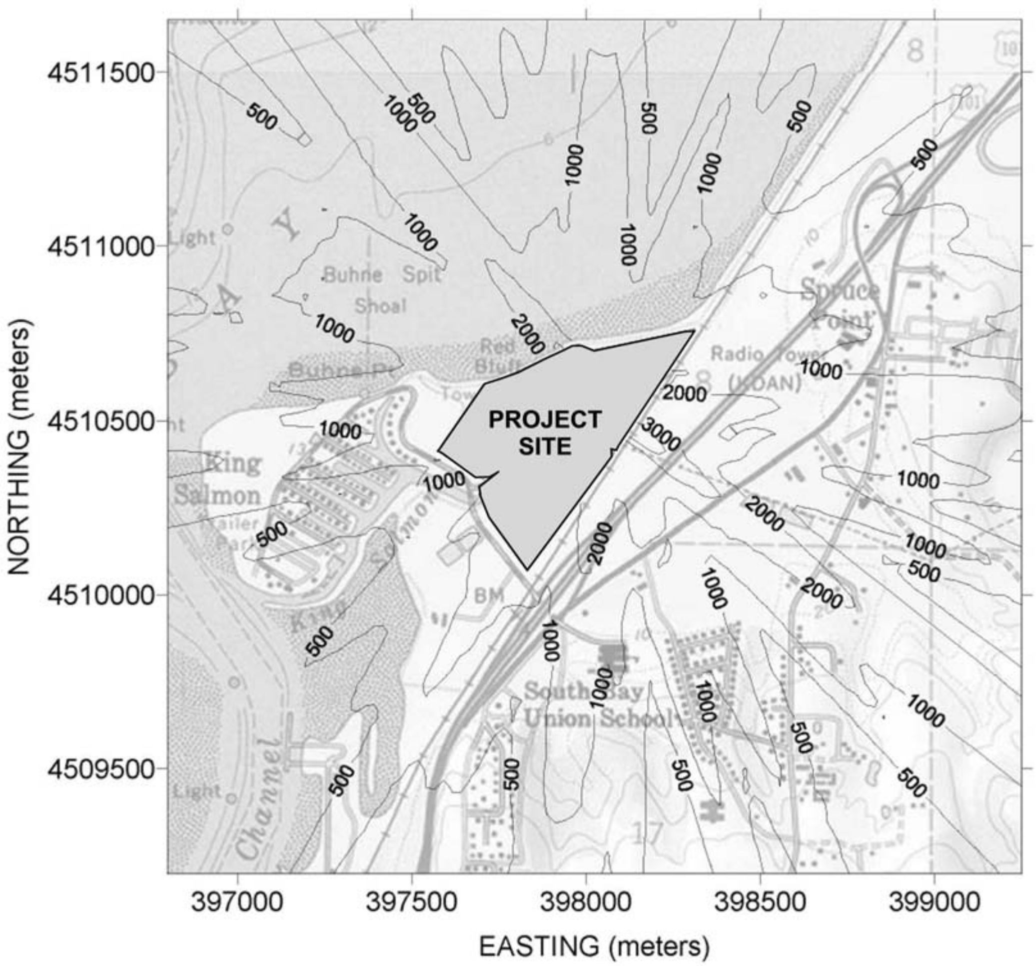
MAXIMUM ANNUAL AVERAGE $PM_{2.5}$ IMPACTS DURING CONSTRUCTION ACTIVITIES, ALL SOURCES



Concentrations are shown in $\mu g/m^3$.

FIGURE 8.1D-6

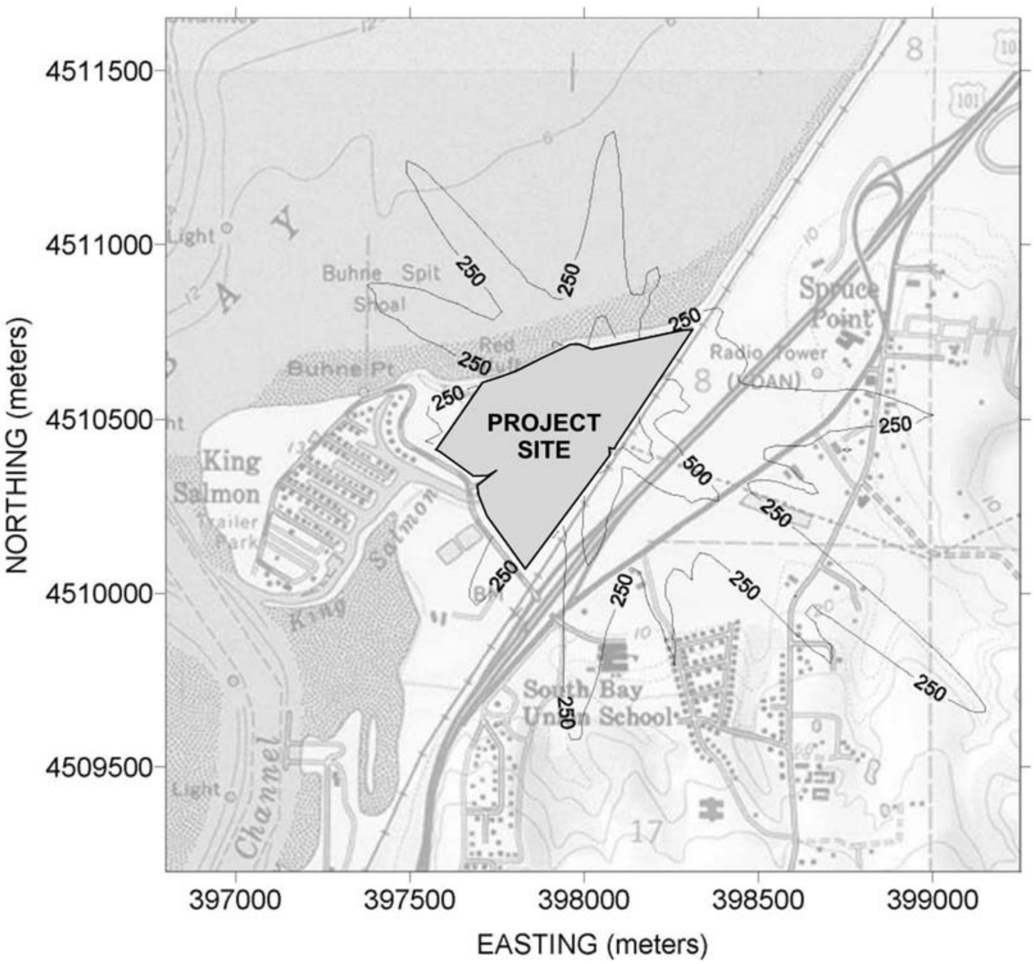
MAXIMUM 1-HOUR AVERAGE CO IMPACTS DURING CONSTRUCTION ACTIVITIES



Concentrations are shown in $\mu g/m^3$.

FIGURE 8.1D-7

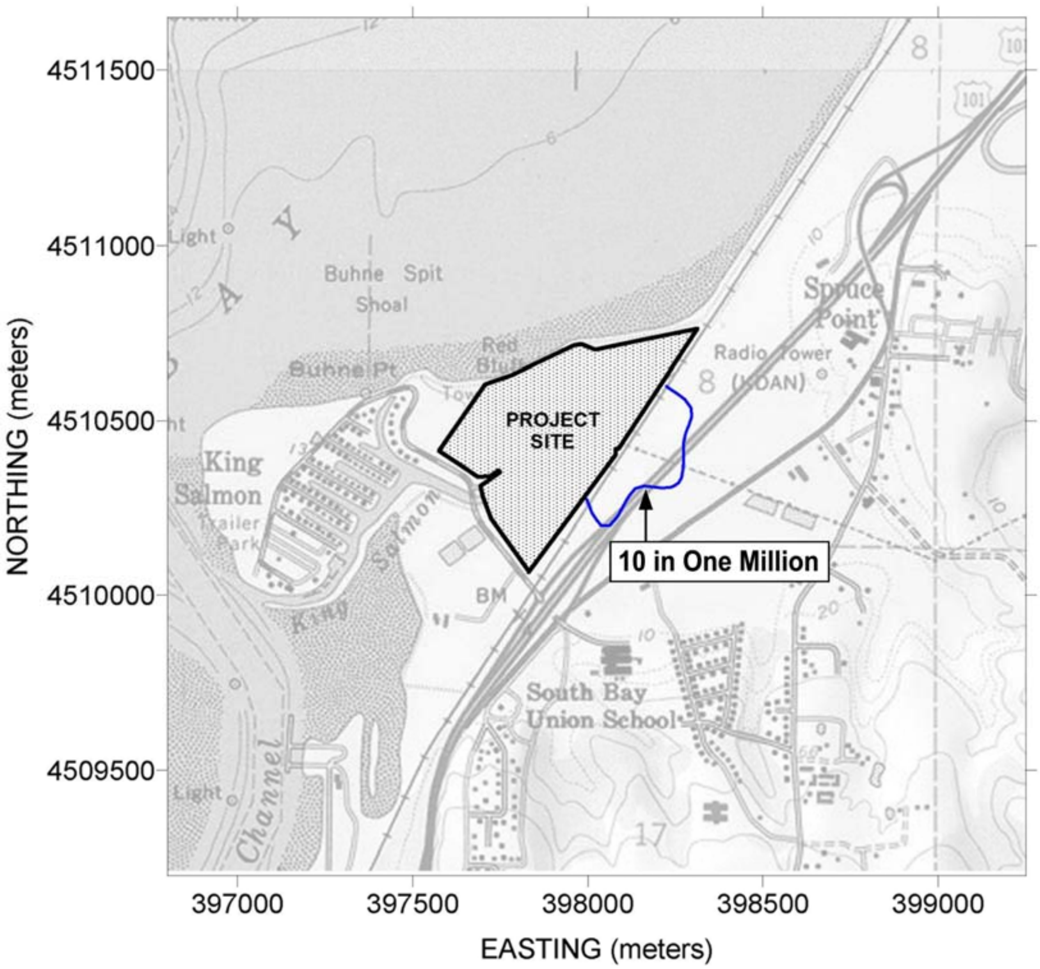
MAXIMUM 8-HOUR AVERAGE CO IMPACTS DURING CONSTRUCTION ACTIVITIES



Concentrations are shown in $\mu g/m^3$.

FIGURE 8.1D-8

AREA WHERE CANCER RISK FROM DPM DURING PROJECT CONSTRUCTION EXCEEDS 10 IN ONE MILLION, 9-YEAR EXPOSURE PERIOD



ATTACHMENT 8.1D-1
DETAILED EMISSION CALCULATIONS

DETAILED CONSTRUCTION EMISSION CALCULATIONS

Onsite Combustion Emissions (Construction Phase

			Base Factors g/bhp, if Tier 1 >50 hp (1)						Appendix A Table A3 Adjustment (2)						Adjustment (3)	Adjusted Factors (g/bhp)					
Equipment	HP Cat.	Tier	BSFC lb/hp	NOx	CO	VOC	SOx	PM10	Adj. Type	NOx	CO	VOC	SOx	PM10	PM10 Fuel S	BSFC	NOx	CO	VOC	SOx	PM10
Pilling machine (Driver), 640 HP	600-750	2	0.367	4.1000	1.3272	0.1669	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.90	2.03	0.18	0.0049	0.08
Trucks for pile delivery, 300 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Crane, pile lifting, 300 HP	300-600	2	0.367	4.3351	0.8425	0.1669	0.0050	0.1316	None	1.00	1.00	1.00	1.00	1.00	-0.086	0.367	4.34	0.84	0.17	0.0049	0.05
Truck, Soil moving, 325 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Excavator, 345 HP	300-600	2	0.367	4.3351	0.8425	0.1669	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	4.12	1.29	0.18	0.0049	0.08
Tractor, Track type, 185 HP	175-300	2	0.367	4.0000	0.7475	0.3085	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.80	1.14	0.32	0.0049	0.08
Wheel Loader, 318 HP	300-600	2	0.367	4.3351	0.8425	0.1669	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	4.12	1.29	0.18	0.0049	0.08
Compactor, 354 HP	300-600	2	0.367	4.3351	0.8425	0.1669	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	4.12	1.29	0.18	0.0049	0.08
Compactor plate, 4 HP	Gasoline	na	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Motor Grader, 165 HP	100-175	2	0.367	4.1000	0.8667	0.3384	0.0050	0.1800	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.90	1.33	0.36	0.0049	0.13
Concrete pump, 350 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Concrete trucks, 400 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Compactor, 83 HP	50-100	2	0.408	4.7000	2.3655	0.3672	0.0056	0.2400	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.47	3.62	0.39	0.0055	0.20
Troweling equipment, 4 HP	Gasoline	na	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Telehandler, 99 HP	50-100	2	0.408	4.7000	2.3655	0.3672	0.0056	0.2400	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.47	3.62	0.39	0.0055	0.20
Backhoe Loader, 88 HP	50-100	2	0.408	4.7000	2.3655	0.3672	0.0056	0.2400	LoLF	1.10	2.57	2.29	1.18	1.97	-0.113	0.481	5.17	6.08	0.84	0.0064	0.36
Air compressor, 49 HP	25-50	2	0.408	4.7279	1.5323	0.2789	0.0056	0.3389	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.49	2.34	0.29	0.0055	0.32
Manlift Scissors, JLG, 46 HP	25-50	2	0.408	4.7279	1.5323	0.2789	0.0056	0.3389	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.49	2.34	0.29	0.0055	0.32
Boom lift, JLG 65 HP	50-100	2	0.408	4.7000	2.3655	0.3672	0.0056	0.2400	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.47	3.62	0.39	0.0055	0.20
Trucks for gravel/pavement dlvr (200 HP)	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Paving equipment, 224 HP	175-300	2	0.367	4.0000	0.7475	0.3085	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.80	1.14	0.32	0.0049	0.08
Compactor, 22HP	16-25	2	0.408	4.4399	2.1610	0.4380	0.0056	0.2665	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.22	3.31	0.46	0.0055	0.23
Trucks Civil, 200 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Trucks Mechanical (includes insulators and sheet metal workers), 200 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Trucks Elect, 200 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Forklift, 10,000 lb capacity, 100 HP	100-175	2	0.367	4.1000	0.8667	0.3384	0.0050	0.1800	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.90	1.33	0.36	0.0049	0.13
Forklift, 8,000 lb capacity, 80 HP	50-100	2	0.408	4.7000	2.3655	0.3672	0.0056	0.2400	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.47	3.62	0.39	0.0055	0.20
Genie lift, 45ft, 50 HP	25-50	2	0.408	4.7279	1.5323	0.2789	0.0056	0.3389	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.49	2.34	0.29	0.0055	0.32
JLG (scissor lift), 45ft, 65 HP	50-100	2	0.408	4.7000	2.3655	0.3672	0.0056	0.2400	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.47	3.62	0.39	0.0055	0.20
Generator, 10kVA	Gasoline	na	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline	Gasoline
Truck (general cleanup, etc.), 200 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Welding Unit, 22 HP	16-25	2	0.408	4.4399	2.1610	0.4380	0.0056	0.2665	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.22	3.31	0.46	0.0055	0.23
Water Truck, 250 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad

Equipment	Tier	Adjusted factors lbs/1000 gallon (4) NOx	CO	VOC	SOx	PM10	Total Daily Fuel Use(5) (Gals/day)	Daily Emissions Lbs/day NOx	CO	VOC	SOx	PM10	Total Annual Peak Fuel Use(6) (Gals/yr)	Annual Emissions Lbs/yr NOx	CO	VOC	SOx	PM10	Total Annual Average Fuel Use(7) (Gals/yr)	Annual Emissions Lbs/yr NOx	CO	VOC	SOx	PM10
Pilling machine (Driver), 640 HP	2	164.48	85.75	7.40	0.21	3.17	0.00	0.00	0.00	0.00	0.00	0.00	4,875	801.83	418.02	36.08	1.01	15.47	3,250	534.55	278.68	24.05	0.68	10.31
Trucks for pile delivery, 300 HP	na	170.43	162.60	18.67	0.21	3.61	0.00	0.00	0.00	0.00	0.00	0.00	4,069	693.48	661.63	75.96	0.86	14.70	2,713	462.32	441.08	50.64	0.57	9.80
Crane, pile lifting, 300 HP	2	184.89	35.93	7.12	0.21	1.95	0.00	0.00	0.00	0.00	0.00	0.00	4,063	751.12	145.98	28.92	0.85	7.93	2,708	500.75	97.32	19.28	0.56	5.28
Truck, Soil moving, 325 HP	na	170.43	162.60	18.67	0.21	3.61	0.00	0.00	0.00	0.00	0.00	0.00	8,138	1386.96	1323.25	151.93	1.72	29.41	5,425	924.64	882.17	101.29	1.14	19.60
Excavator, 345 HP	2	173.91	54.43	7.40	0.21	3.17	50.00	8.70	2.72	0.37	0.01	0.16	7,583	1318.81	412.78	56.12	1.58	24.07	5,056	879.20	275.19	37.41	1.05	16.04
Tractor, Track type, 185 HP	2	160.47	48.29	13.68	0.21	3.17	0.00	0.00	0.00	0.00	0.00	0.00	1,625	260.76	78.48	22.23	0.34	5.16	1,806	289.73	87.20	24.70	0.38	5.73
Wheel Loader, 318 HP	2	173.91	54.43	7.40	0.21	3.17	35.00	6.09	1.91	0.26	0.01	0.11	4,550	791.28	247.67	33.67	0.95	14.44	4,044	703.36	220.15	29.93	0.84	12.84
Compactor, 354 HP	2	173.91	54.43	7.40	0.21	3.17	0.00	0.00	0.00	0.00	0.00	0.00	1,463	254.34	79.61	10.82	0.30	4.64	2,925	508.68	159.22	21.65	0.61	9.28
Compactor plate, 4 HP	na	195.25	7792.25	408.25	0.00	12.80	3.75	0.73	29.22	1.53	0.00	0.05	542	105.76	4220.80	221.14	0.00	6.93	397	77.56	3095.25	162.17	0.00	5.08
Motor Grader, 165 HP	2	164.48	56.00	15.00	0.21	5.69	0.00	0.00	0.00	0.00	0.00	0.00	433	71.27	24.26	6.50	0.09	2.46	867	142.55	48.53	13.00	0.18	4.93
Concrete pump, 350 HP	na	170.43	162.60	18.67	0.21	3.61	15.65	2.67	2.54	0.29	0.00	0.06	2,035	346.74	330.81	37.98	0.43	7.35	1,356	231.16	220.54	25.32	0.29	4.90
Concrete trucks, 400 HP	na	170.43	162.60	18.67	0.21	3.61	281.70	48.01	45.80	5.26	0.06	1.02	34,247	5836.81	5568.69	639.37	7.22	123.75	22,832	3891.21	3712.46	426.25	4.81	82.50
Compactor, 83 HP	2	169.60	137.47	14.65	0.21	7.55	0.00	0.00	0.00	0.00	0.00	0.00	650	110.24	89.36	9.52	0.14	4.91	433	73.49	59.57	6.35	0.09	3.27
Troweling equipment, 4 HP	na	195.25	7792.25	408.25	0.00	12.80	3.75	0.73	29.22	1.53	0.00	0.05	488	95.18	3798.72	199.02	0.00	6.24	325	63.46	2532.48	132.68	0.00	4.16
Telehandler, 99 HP	2	169.60	137.47	14.65	0.21	7.55	26.00	4.41	3.57	0.38	0.01	0.20	6,760	1146.49	929.32	99.00	1.40	51.05	6,009	1019.11	826.06	88.00	1.25	45.37
Backhoe Loader, 88 HP	2	168.09	197.65	27.34	0.21	11.71	12.50	2.10	2.47	0.34	0.00	0.15	1,625	273.14	321.18	44.43	0.34	19.03	1,444	242.79	285.50	39.49	0.30	16.91
Air compressor, 49 HP	2	170.61	89.05	11.12	0.21	12.17	6.35	1.08	0.57	0.07	0.00	0.08	826	140.84	73.51	9.18	0.17	10.05	550	93.89	49.01	6.12	0.11	6.70
Manlift Scissors, JLG, 46 HP	2	170.61	89.05	11.12	0.21	12.17	0.00	0.00	0.00	0.00	0.00	0.00	2,201	375.56	196.03	24.49	0.46	26.79	2,201	375.56	196.03	24.49	0.46	26.79
Boom lift, JLG 65 HP	2	169.60	137.47	14.65	0.21	7.55	0.00	0.00	0.00	0.00	0.00	0.00	2,201	373.35	302.62	32.24	0.46	16.62	2,201	373.35	302.62	32.24	0.46	16.62
Trucks for gravel/pavement dlvr (200 HP)	na	54.03	374.19	43.02	0.19	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	2,261	122.13	845.87	97.25	0.43	2.26
Paving equipment, 224 HP	2	160.47	48.29	13.68	0.21	3.17	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	650	104.30	31.39	8.89	0.14	2.06
Compactor, 22HP	2	160.21	125.59	17.47	0.21	8.79	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	183	29.39	23.04	3.20	0.04	1.61
Trucks Civil, 200 HP	na	54.03	374.19	43.02	0.19	1.00	78.25	4.23	29.28	3.37	0.01	0.08	14,581	787.75	5455.87	627.28	2.77	14.59	11,077	598.44	4144.77	476.54	2.11	11.08
Trucks Mechanical (includes insulators and sheet metal workers), 200 HP	na	54.03	374.19	43.02	0.19	1.00	78.25	4.23	29.28	3.37	0.01	0.08	11,868	641.19	4440.82	510.58	2.26	11.87	12,207	659.51	4567.70	525.16	2.32	12.21
Trucks Elect, 200 HP	na	54.03	374.19	43.02	0.19	1.00	46.95	2.54	17.57	2.02	0.01	0.05	6,104	329.75	2283.85	262.58	1.16	6.11	7,234	390.82	2706.79	311.21	1.38	7.24
Forklift, 10,000 lb capacity, 100 HP	2	164.48	56.00	15.00	0.21	5.69	18.50	3.04	1.04	0.28	0.00	0.11	2,405	395.57	134.67	36.09	0.50	13.68	2,806	461.50	157.12	42.10	0.58	15.96
Forklift, 8,000 lb capacity, 80 HP	2	169.60	137.47	14.65	0.21	7.55	20.00	3.39	2.75	0.29	0.00	0.15	2,600	440.96	357.43	38.08	0.54	19.63	2,889	489.95	397.14	42.31	0.60	21.81
Genie lift, 45ft, 50 HP	2	170.61	89.05	11.12	0.21	12.17	12.70	2.17	1.13	0.14	0.00	0.15	1,651	281.67	147.02	18.36	0.34	20.10	1,834	312.97	163.36	20.41	0.38	22.33
JLG (scissor lift), 45ft, 65 HP	2	169.60	137.47	14.65	0.21	7.55	12.70	2.15	1.75	0.19	0.00	0.10	2,477	420.01	340.45	36.27	0.51	18.70	3,027	513.35	416.11	44.33	0.63	22.86
Generator, 10kVA	na	195.25	7792.25	408.25	0.00	12.80	12.70	2.48	98.96	5.18	0.00	0.16	2,201	429.81	17153.34	898.69	0.00	28.17	1,468	286.54	11435.56	599.13	0.00	18.78
Truck (general cleanup, etc.), 200 HP	na	54.03	374.19	43.02	0.19	1.00	31.30	1.69	11.71	1.35	0.01	0.03	5,425	293.11	2030.09	233.41	1.03	5.43	5,877	317.54	2199.26	252.86	1.12	5.88
Welding Unit, 22 HP	2	160.21	125.59	17.47	0.21	8.79	38.10	6.10	4.78	0.67	0.01	0.33	8,117	1300.52	1019.45	141.80	1.69	71.35	6,145	984.58	771.79	107.35	1.28	54.01
Water Truck, 250 HP	na	170.43	162.60	18.67	0.21	3.61	31.30	5.33	5.09	0.58	0.01	0.11	7,460	1271.38	1212.98	139.27	1.57	26.96	6,104	1040.22	992.44	113.95	1.29	22.05
Total =							815.45	111.87	321.37	27.47	0.16	3.21	153,261.33	21,725.70	53,798.71	4,681.00	30.67	627.57	130,304.78	17,698.60	42,621.40	3,909.73	26.05	526.30
														10.86	26.90	2.34	0.02	0.31		8.85	21.31	1.95	0.01	0.26

Daily and Annual Dust Emissions (Construction Phase)

Daily Fugitive Dust Emissions (peak month)									
Equipment	Number of Units	Daily Process Rate Per Unit	Total Process Rate	Units	PM2.5 Emission Factor(1) (lbs/unit)	PM10 Emission Factor(1) (lbs/unit)	Control Factor(1) (%)	PM2.5 Emissions (lbs/day)	PM10 Emissions (lbs/day)
Excavator	1	1,260.0	1,260.0	tons	5.3E-05	0.0015	0%	0.07	1.90
Backhoe	1	787.5	787.5	tons	5.3E-05	0.0015	0%	0.04	1.19
Truck, Civil - Unpaved Road Travel	5	0.7	3.4	vmt	0.22	1.4328	94%	0.04	0.28
Truck, Cleanup - Unpaved Road Travel	2	0.7	1.4	vmt	0.22	1.4328	94%	0.02	0.11
Truck, Concrete - Unpaved Road Travel	18	0.7	12.3	vmt	0.46	2.9806	94%	0.32	2.07
Loader - Unloading	1	525.0	525.0	tons	1.98E-05	0.0001	0%	0.01	0.03
Loader - Unpaved Road Travel	1	0.9	0.9	vmt	0.50	3.2508	94%	0.03	0.17
Forklift - Unpaved Road Travel	4	2.0	7.8	vmt	0.26	1.7100	94%	0.12	0.76
Truck, Water - Unpaved Road Travel	2	4.1	8.2	vmt	0.44	2.8400	94%	0.20	1.31
Truck, Mechanical - Unpaved Road Travel	5	0.7	3.4	vmt	0.22	1.4328	94%	0.04	0.28
Truck, Electrical - Unpaved Road Travel	3	0.7	2.0	vmt	0.22	1.4328	94%	0.03	0.17
Windblown Dust (active construction area)	N/A	117,360.0	117,360.0	sq.ft.	6.73E-06	1.682E-05	94%	0.04	0.11
Delivery Truck Unpaved Road Travel	45	0.7	31.6	vmt	0.35	2.3088	94%	0.63	4.12
Total =								1.58	12.50

Notes:
(1) See notes for fugitive dust emission calculations.

Peak Annual Fugitive Dust Emissions					
Activity	Average Daily PM2.5 Emissions(1) (lbs/day)	Average Daily PM10 Emissions(1) (lbs/day)	Days per Year	Annual PM2.5 Emissions (tons/yr)	Annual PM10 Emissions (tons/yr)
Construction Activities	0.98	7.89	260	0.13	1.03
Windblown Dust	0.04	0.11	365	0.01	0.02
Total =				0.14	1.05

Notes:
(1) Based on average of daily emissions during peak 12-month construction period.

Offsite Delivery Truck Emissions (Construction Phase)

Delivery Truck Daily Emissions (Maximum Monthly)													
Number of Deliveries Per Day(1)	Average Round Trip Haul Distance (miles)	Vehicle Miles Traveled Per Day	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)					
			NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
45	134	6030	0.0368	0.0351	0.0040	0.0000	0.0008	221.62	211.44	24.28	0.27	4.70
Idle exhaust (2)												0.189

Delivery Truck Peak Annual Emissions												
Number of Deliveries Per Year	Average Round Trip Haul Distance (miles)	Vehicle Miles Traveled Per Year	Emission Factors (lbs/vmt)(1)					Annual Emissions (tons/yr)				
			NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
4680	134	627120.00	0.0368	0.0351	0.0040	0.0000	0.0008	11.52	10.99	1.26	0.01	0.24
Idle exhaust (2,3)												0.00983

Notes:

(1) Emission factors from delivery trucks and worker travel from EMFAC2002, V2.2, Humboldt County, model years 1965 to 2008.

(2) Peak annual number of trucks per year times 1 hr idle time per visit times 0.0042 lb/hr

(3) Based on 1.91 g/hr idle emission rate for the composite HDD truck fleet in 2001 from EPA's PART5 model.

Offsite Worker Travel Emissions (Construction Phase)

Worker Travel Daily Emissions (Maximum Monthly)														
Number of Workers Per Day(1)	Average Vehicle Occupancy (person/veh.)	Number of Round Trips Per Day	Average Round Trip Haul Distance (Miles)	Vehicle Miles Traveled Per Day (Miles)	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
					NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
145	1	145	67	9,715	0.0019	0.0206	0.0023	0.0000	0.0001	18.94	199.93	22.67	0.08	0.76

Worker Travel Peak Annual Emissions															
Average Number of Workers Per Day	Average Vehicle Occupancy (person/veh.)	Number of Round Trips Per Day	Average Round Trip Haul Distance (Miles)	Days per Year	Vehicle Miles Traveled Per Year	Emission Factors (lbs/vmt)(1)					Annual Emissions (tons/yr)				
						NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
125	1	125	67	240	2,015,360	0.0019	0.0206	0.0023	0.0000	0.0001	1.96	20.74	2.35	0.01	0.08

Notes:

(1) Emission factors from delivery trucks and worker travel from EMFAC2002, V2.2, Humboldt County, model years 1965 to 2008.

DETAILED SITE CLEARING EMISSION CALCULATIONS

Onsite Combustion Emissions (Site Clearing)

	Base Factors g/bhp, if Tier 1 >50 hp (1)								Appendix A Table A3 Adjustment (2)						Adjustment (3)	Adjusted Factors (g/bhp)					
Equipment	HP Cat.	Tier	BSFC lb/hp	NOx	CO	VOC	SOx	PM10	Adj. Type	NOx	CO	VOC	SOx	PM10	PM10 Fuel S	BSFC	NOx	CO	VOC	SOx	PM10
Backhoe, 75 HP	50-100	2	0.408	4.7000	2.3655	0.3672	0.0056	0.2400	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.47	3.62	0.39	0.0055	0.20
Crane, 200 HP	175-300	2	0.367	4.0000	0.7475	0.3085	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.80	1.14	0.32	0.0049	0.08
Excavator, 290 HP	175-300	2	0.367	4.0000	0.7475	0.3085	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.80	1.14	0.32	0.0049	0.08
Forklift, 100 HP	50-100	2	0.408	4.7000	2.3655	0.3672	0.0056	0.2400	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.47	3.62	0.39	0.0055	0.20
Loader, 190 HP	175-300	2	0.367	4.0000	0.7475	0.3085	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.80	1.14	0.32	0.0049	0.08
Excavator, 130 HP	300-600	2	0.367	4.3351	0.8425	0.1669	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	4.12	1.29	0.18	0.0049	0.08
Scraper, 200 HP	175-300	2	0.367	4.0000	0.7475	0.3085	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.80	1.14	0.32	0.0049	0.08
Motor Grader, 185 HP	100-175	2	0.367	4.1000	0.8667	0.3384	0.0050	0.1800	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.90	1.33	0.36	0.0049	0.13
Compactor, 110 HP	50-100	2	0.408	4.7000	2.3655	0.3672	0.0056	0.2400	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.47	3.62	0.39	0.0055	0.20
Truck (dump), 400 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Truck (general), 200 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Water Truck, 300 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad

	Adjusted factors lbs/1000 gallon (4)						Total Daily Fuel Use(5) (Gals/day)	Daily Emissions Lbs/day				
Equipment	Tier	NOx	CO	VOC	SOx	PM10		NOx	CO	VOC	SOx	PM10
Backhoe, 75 HP	2	169.60	137.47	14.65	0.21	7.55	15.00	2.54	2.06	0.22	0.00	0.11
Crane, 200 HP	2	160.47	48.29	13.68	0.21	3.17	31.25	5.01	1.51	0.43	0.01	0.10
Excavator, 290 HP	2	160.47	48.29	13.68	0.21	3.17	35.00	5.62	1.69	0.48	0.01	0.11
Forklift, 100 HP	2	169.60	137.47	14.65	0.21	7.55	9.25	1.57	1.27	0.14	0.00	0.07
Loader, 190 HP	2	160.47	48.29	13.68	0.21	3.17	25.00	4.01	1.21	0.34	0.01	0.08
Excavator, 130 HP	2	173.91	54.43	7.40	0.21	3.17	11.25	1.96	0.61	0.08	0.00	0.04
Scraper, 200 HP	2	160.47	48.29	13.68	0.21	3.17	27.50	4.41	1.33	0.38	0.01	0.09
Motor Grader, 185 HP	2	164.48	56.00	15.00	0.21	5.69	20.00	3.29	1.12	0.30	0.00	0.11
Compactor, 110 HP	2	169.60	137.47	14.65	0.21	7.55	15.00	2.54	2.06	0.22	0.00	0.11
Truck (dump), 400 HP	na	170.43	162.60	18.67	0.21	3.61	15.65	2.67	2.54	0.29	0.00	0.06
Truck (general), 200 HP	na	54.03	374.19	43.02	0.19	1.00	15.65	0.85	5.86	0.67	0.00	0.02
Water Truck, 300 HP	na	170.43	162.60	18.67	0.21	3.61	15.65	2.67	2.54	0.29	0.00	0.06
Total =							236.20	37.14	23.81	3.84	0.05	0.95

Daily Dust Emissions (Site Clearing)

Daily Fugitive Dust Emissions (peak month)									
Equipment	Number of Units	Daily Process Rate Per Unit	Total Process Rate	Units	PM2.5 Emission Factor(1) (lbs/unit)	PM10 Emission Factor(1) (lbs/unit)	Control Factor(1) (%)	PM2.5 Emissions (lbs/day)	PM10 Emissions (lbs/day)
Backhoe	1	787.5	787.5	tons	5.3E-05	0.0015081	0	0.04	1.19
Crane	1	na	na	na	0	0	0	0	0
Excavator	1	1260	1,260.0	tons	5.3E-05	0.0015081	0	0.07	1.90
Forklift	1	2.0	2.0	vmt	0.262197	1.7099803	94%	0.03	0.19
Loader	1	525	525.0	tons	1.98E-05	6.303E-05	0	0.01	0.03
Excavator	1	1,260.0	1,260.0	tons	5.3E-05	0.0015	0%	0.07	1.90
Grader	1	9.0	9.0	vmt	0.01933	0.2754	94%	0.01	0.14
Scraper	1	5.0	5.0	hrs	0.23	0.4194	0%	1.15	2.10
Truck, Dump - Unpaved Road Travel	1	1.9	1.9	vmt	0.44	2.84	94%	0.05	0.30
Truck, General - Unpaved Road Travel	1	1.9	1.9	vmt	0.22	1.4328	94%	0.02	0.15
Truck, Water - Unpaved Road Travel	1	4.1	4.1	vmt	0.44	2.8400	94%	0.10	0.66
Windblown Dust (active construction area)	N/A	117,360.0	117,360.0	sq.ft.	6.73E-06	1.682E-05	94%	0.04	0.11
Delivery Truck Unpaved Road Travel	9	0.7	6.3	vmt	0.35	2.3088	94%	0.13	0.82
Total =								1.72	9.50

Notes:
(1) See notes for fugitive dust emission calculations.

Offsite Delivery Truck Emissions (Site Clearing)

Delivery Truck Daily Emissions (Maximum Monthly)												
Number of Deliveries Per Day(1)	Average Round Trip Haul Distance (miles)	Vehicle Miles Traveled Per Day	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
			NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
7	134	938	0.0368	0.0351	0.0040	0.0000	0.0008	34.47	32.89	3.78	0.04	0.73
Idle exhaust (2)												0.0294

Notes:

(1) Emission factors from delivery trucks and worker travel from EMFAC2002, V2.2, Humboldt County, model years 1965 to 2008.

(2) Peak annual number of trucks per year times 1 hr idle time per visit times 0.0042 lb/hr

(3) Based on 1.91 g/hr idle emission rate for the composite HDD truck fleet in 2001 from EPA's PART5 model.

Offsite Worker Travel Emissions (Site Clearing)

Worker Travel Daily Emissions (Maximum Monthly)														
Number of Workers Per Day(1)	Average Vehicle Occupancy (person/veh.)	Number of Round Trips Per Day	Average Round Trip Haul Distance (Miles)	Vehicle Miles Traveled Per Day (Miles)	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
					NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
25	1	25	67	1,675	0.0019	0.0206	0.0023	0.0000	0.0001	3.27	34.47	3.91	0.01	0.13

Notes:
(1) Emission factors from delivery trucks and worker travel from EMFAC2002, V2.2, Humboldt County, model years 1965 to 2008.

DETAILED ROAD CONSTRUCTION EMISSION CALCULATIONS

Onsite Combustion Emissions (Road Construction Phase)

			Base Factors g/bhp, if Tier 1 >50 hp (1)						Appendix A Table A3 Adjustment (2)						Adjustment (3)	Adjusted Factors (g/bhp)					
Equipment	HP Cat.	Tier	BSFC lb/hp	NOx	CO	VOC	SOx	PM10	Adj. Type	NOx	CO	VOC	SOx	PM10	PM10 Fuel S	BSFC	NOx	CO	VOC	SOx	PM10
Excavator, 130 HP	300-600	2	0.367	4.3351	0.8425	0.1669	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	4.12	1.29	0.18	0.0049	0.08
Scraper, 200 HP	175-300	2	0.367	4.0000	0.7475	0.3085	0.0050	0.1316	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.80	1.14	0.32	0.0049	0.08
Motor Grader, 185 HP	100-175	2	0.367	4.1000	0.8667	0.3384	0.0050	0.1800	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	3.90	1.33	0.36	0.0049	0.13
Compactor, 110 HP	50-100	2	0.408	4.7000	2.3655	0.3672	0.0056	0.2400	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.096	0.412	4.47	3.62	0.39	0.0055	0.20
Truck (general), 200 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad
Water Truck, 300 HP	Onroad	na	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad	Onroad

		Adjusted factors lbs/1000 gallon (4)					Total Daily Fuel Use(5) (Gals/day)	Daily Emissions Lbs/day				
Equipment	Tier	NOx	CO	VOC	SOx	PM10		NOx	CO	VOC	SOx	PM10
Excavator, 130 HP	2	173.91	54.43	7.40	0.21	3.17	4.50	0.78	0.24	0.03	0.00	0.01
Scraper, 200 HP	2	160.47	48.29	13.68	0.21	3.17	46.20	7.41	2.23	0.63	0.01	0.15
Motor Grader, 185 HP	2	164.48	56.00	15.00	0.21	5.69	33.60	5.53	1.88	0.50	0.01	0.19
Compactor, 110 HP	2	169.60	137.47	14.65	0.21	7.55	27.60	4.68	3.79	0.40	0.01	0.21
Truck (general), 200 HP	na	54.03	374.19	43.02	0.19	1.00	18.78	1.01	7.03	0.81	0.00	0.02
Water Truck, 300 HP	na	170.43	162.60	18.67	0.21	3.61	26.29	4.48	4.28	0.49	0.01	0.10
Total =							156.97	23.90	19.45	2.87	0.03	0.67

Daily Dust Emissions (Road Construction Phase)

Daily Fugitive Dust Emissions (peak month)									
Equipment	Number of Units	Daily Process Rate Per Unit	Total Process Rate	Units	PM2.5 Emission Factor(1) (lbs/unit)	PM10 Emission Factor(1) (lbs/unit)	Control Factor(1) (%)	PM2.5 Emissions (lbs/day)	PM10 Emissions (lbs/day)
Excavator	1	1,260.0	1,260.0	tons	5.3E-05	0.0015	0%	0.07	1.90
Grader	1	9.0	9.0	vmt	0.01933	0.2754	94%	0.01	0.14
Scraper	1	8.4	8.4	hrs	0.23	0.4194	0%	1.94	3.52
Truck, Cleanup - Unpaved Road Travel	1	1.9	1.9	vmt	0.22	1.4328	94%	0.02	0.15
Truck, Water - Unpaved Road Travel	1	19.1	19.1	vmt	0.44	2.8400	94%	0.47	3.07
Windblown Dust (active construction area)	N/A	20,000.0	20,000.0	sq.ft.	6.73E-06	1.682E-05	94%	0.01	0.02
Delivery Truck Unpaved Road Travel	9	0.2	1.7	vmt	0.35	2.3088	94%	0.03	0.22
Total =								2.55	9.03

Notes:
(1) See notes for fugitive dust emission calculations.

Offsite Delivery Truck Emissions (Road Construction Phase)

Delivery Truck Daily Emissions (Maximum Monthly)													
Number of Deliveries Per Day(1)	Average Round Trip Haul Distance (miles)	Vehicle Miles Traveled Per Day	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
			NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
9	134	1206	0.0368	0.0351	0.0040	0.0000	0.0008	44.32	42.29	4.86	0.05	0.94
Idle exhaust (2)												0.0378

Notes:

(1) Emission factors from delivery trucks and worker travel from EMFAC2002, V2.2, Humboldt County, model years 1965 to 2008.

(2) Peak annual number of trucks per year times 1 hr idle time per visit times 0.0042 lb/hr

(3) Based on 1.91 g/hr idle emission rate for the composite HDD truck fleet in 2001 from EPA's PART5 model.

Offsite Worker Travel Emissions (Road Construction Phase)

Worker Travel Daily Emissions (Maximum Monthly)														
Number of Workers Per Day(1)	Average Vehicle Occupancy (person/veh.)	Number of Round Trips Per Day	Average Round Trip Haul Distance (Miles)	Vehicle Miles Traveled Per Day (Miles)	Emission Factors (lbs/vmt)(1)					Daily Emissions (lbs/day)				
					NOx	CO	POC	SOx	PM10	NOx	CO	POC	SOx	PM10
9	1	9	67	603	0.0019	0.0206	0.0023	0.0000	0.0001	1.18	12.41	1.41	0.01	0.05

Notes:
(1) Emission factors from delivery trucks and worker travel from EMFAC2002, V2.2, Humboldt County, model years 1965 to 2008.

DETAILED HEAVY TRANSPORT EMISSION CALCULATIONS

On-Road Combustion Emissions (Heavy Haul)

Equipment	HP Cat.	Tier	BSFC lb/hp	Base Factors g/bhp, if Tier 1 >50 hp (1) NOx	CO	VOC	SOx	PM10	Appendix A Table A3 Adjustment (2) Adj. Type	NOx	CO	VOC	SOx	PM10	Adjustment (3) PM10 Fuel S	Adjusted Factors (g/bhp) BSFC	NOx	CO	VOC	SOx	PM10
Heavy Truck	600-750	1	0.367	5.8215	1.3272	0.1473	0.0050	0.2201	Hi LF	0.95	1.53	1.05	1.01	1.23	-0.087	0.371	5.53	2.03	0.15	0.0049	0.18

Equipment	Adjusted factors lbs/1000 gallon (4) Tier	NOx	CO	VOC	SOx	PM10	Total Daily Fuel Use(5) (Gals/day)	Daily Emissions Lbs/day NOx	CO	VOC	SOx	PM10
Heavy Truck	1	233.54	85.75	6.53	0.21	7.77	54.00	12.61	4.63	0.35	0.01	0.42

Calculation of Tug/Barge Emissions During Transport of Engines to Plant Site

Activity	Distance, miles	Speed, mph	Time, hrs	Engine Load Mains	Engine Load Gens	Weighted Mains	Weighted Gens
Tow Loaded Barge: Simpson Samoa Dock to Fields Landing	6	1	6	40%	50%	26.1%	32.6%
Idle at dock during unloading	0	0	2	10%	50%	2.2%	10.9%
Return Empty Barge to Simpson Samoa Dock	6	5	1.2	50%	50%	6.5%	6.5%
Daily Total			9.2			34.8%	50.0%

	Pollutant NOx	SO2	CO	ROC	PM10
Emission Factor, g/bhp-hr	6.9	0.005	8.5	1	0.4
Full Load Em Rate, Mains, lb/hr	76.06	0.06	93.69	11.02	4.41
Full Load Em Rate, Gens lb/hr	2.28	0.00	2.81	0.33	0.13
Max. Hourly Operating Emissions, lb/hr	39.17	0.03	48.25	5.68	2.27
Max. Daily Operating Emissions, lb/day	253.9	0.2	312.8	36.8	14.7
Max. Total Barge Transport Emissions, lb	5,077.6	3.7	6,255.1	735.9	294.4

Emission Factor Source:
URBEMIS2002, Appendix H, 2000
Assumptions:

Tug Boat Main Generator Engine	5000	bhp
Tug Boat Aux Generator Engine	150	bhp
Round trips per day	1	
Total round trips	20	

NOTES - EMISSION CALCULATIONS

Notes - Fugitive Dust Emission Calculations

Wind erosion of active construction area - 'Source: "Improvement of Specific Emission Factors (BACM Project No. 1), Final Report", prepared for South Coast AQMD by Midwest Research Institute, March 1996

Level 2 Emission Factor =	0.011	ton/acre-month
Construction Schedule =	30	days/month
=	0.7	lbs/acre-day
=	1.682E-05	PM10 lbs/scf-day
	6.7278E-06	PM2.5 lbs/scf-day

Material Unloading - Source: AP-42, p. 13.2.4-3, 1/95

E = (k)(0.0032)[(U/5)^1.3]/[(M/2)^1.4]

k = particle size constant =	0.35	for PM10
k = particle size constant =	0.11	for PM2.5
U = average wind speed =	2.14	m/sec (based on average of five years of wind data for Humboldt)
=	4.79	mph
M = moisture content =	15.0%	(SCAQMD CEQA Handbook, Table A9-9-G-1, moist soil)
E = PM10 emission factor =	0.0001	lb/ton
E = PM2.5 emission factor =	0.00002	lb/ton

Loader Unpaved Road Travel - Source: AP-42, Section 13.2.2, 12/03

E = (k)[(s/12)^0.9][(W/3)^0.45]

k = particle size constant =	1.5	for PM10
k = particle size constant =	0.23	for PM2.5
s = surface silt content =	8.50	(AP-42, Table 13.2.2-1, 12/03, construction haul route)
W = avg. vehicle weight =	33.35	tons (avg. of loaded and unloaded weights, 980H loader, Caterpillar Performance Handbook, 2006)
E = PM10 emission factor =	3.25	lb PM10/VMT
E = PM2.5 emission factor =	0.50	lb PM2.5/VMT
Soil Density =	1.05	ton/yd3 (Caterpillar Performance Handbook, 10/89)
Loader Bucket Capacity =	5	yd3 (980H loader, Caterpillar Performance Handbook, 2006)
=	5.25	ton/load
Daily Soil Transfer Rate =	525	ton/day (operating 5 hrs/day)
Daily Loader Trips =	100	loading trips/day
Loading Travel Distance =	50	ft/load (estimated)
Daily Loader Travel Distance =	5,000	ft/day
=	0.9	mi/day

Excavator Trenching - Source: AP-42, Table 11.9-1 (dragline operations), 7/98

E = (0.75)(0.0021)(d^0.7)/(M^0.3)

d = drop height =	3	ft (estimated)
M = moisture content =	15.0%	(SCAQMD CEQA Handbook, Table A9-9-G-1, moist soil)
E = PM10 emission factor =	0.0015	PM10 lb/ton
E = PM2.5 emission factor =	0.0001	PM2.5 lb/ton
Excavating Rate =	240.0	yd3/hr (based on 2.0 yd3 bucket on a Cat. 345 excavator and a 30 sec. Cycle time)
=	1,200	yd3/day for 1 unit @ 5 hrs/day of operation
Soil Density =	1.0500	ton/yd3 (Caterpillar Performance Handbook, 10/89)
Daily Soil Transfer Rate =	1260.0000	ton/day (estimated)

Notes - Fugitive Dust Emission Calculations

Unpaved Road Travel - Source: AP-42, Section 13.2.2, 12/03.

E = (k)[(s/12)^0.9*(W/3)^0.45

k = particle size constant =	1.5	for PM10
k = particle size constant =	0.23	for PM2.5
s = silt fraction =	8.50	(AP-42, Table 13.2.2-1, 12/03, constructio
W = water truck avg. veh. weight =	10.0	tons empty (estimated)
=	39.4	tons loaded (estimated with 8,000 gallon water capacity)
=	24.7	tons average
W = dump truck avg. veh. weight =	15.0	tons (for heavy duty Diesel trucks)
=	40.0	tons (for heavy duty Diesel trucks)
=	27.5	tons (for heavy duty Diesel trucks)
W = forklift avg. veh. weight =	8.0	tons empty (estimated)
W = auto/pickup avg. vehicle weight =	2.4	tons (CARB Area Source Manual, 9/97)
W = delivery truck avg. veh. wt. =	27.5	tons (for heavy duty Diesel trucks)
W = 3 ton truck avg. veh. Wt =	5.4	tons (estimate)
W = scraper avg. veh. wt. =	28.2	tons empty (615 scraper, Caterpillar Performance Handbook, 10/89)
	48.6	tons loaded (615 scraper, Caterpillar Performance Handbook, 10/89)
	38.4	tons mean weight
W = fuel truck avg. veh. weight =	8.0	tons empty (estimated)
=	18.2	tons loaded (estimated with 3,000 gallons Diesel fuel capacity)
=	13.1	tons average
E = water truck emission factor =	2.84	lb PM10/VMT
E = dump truck emission factor =	2.98	lb PM10/VMT
E = forklift emiss. factor =	1.71	lb PM10/VMT
E = auto/pickup emiss. factor =	0.99	lb PM10/VMT
E = delivery truck emiss. factor =	2.98	lb PM10/VMT
E = 3-ton truck emiss. factor =	1.43	lb PM10/VMT
E = scraper emiss. factor =	3.46	lb PM10/VMT
E = fuel truck emiss. factor =	2.13	lb PM10/VMT
E = water truck emission factor =	0.44	lb PM2.5/VMT
E = dump truck emission factor =	0.46	lb PM2.5/VMT
E = forklift emiss. factor =	0.26	lb PM2.5/VMT
E = auto/pickup emiss. factor =	0.15	lb PM2.5/VMT
E = delivery truck emiss. factor =	0.46	lb PM2.5/VMT
E = 3-ton truck emiss. factor =	0.22	lb PM2.5/VMT
E = scraper emiss. factor =	0.53	lb PM2.5/VMT
E = fuel truck emiss. factor =	0.33	lb PM2.5/VMT

Gravel Road Travel - Source: AP-42, Section 13.2.2, 12/03.

E = (k)[(s/12)^0.9*(W/3)^0.45

k = particle size constant =	1.5	for PM10
k = particle size constant =	0.23	for PM2.5
s = silt fraction =	6.40	(AP-42, Table 13.2.2
W = water truck avg. veh. weight =	10.0	tons empty (estimate
=	39.4	tons loaded (estimat water capacity)
=	24.7	tons average
W = dump truck avg. veh. weight =	15.0	tons (for heavy duty
=	40.0	tons (for heavy duty
=	27.5	tons (for heavy duty
W = forklift avg. veh. weight =	8.0	tons empty (estimate
W = auto/pickup avg. vehicle weight =	2.4	tons (CARB Area So
W = delivery truck avg. veh. wt. =	27.5	tons (for heavy duty
E = auto/pickup emiss. factor =	0.77	lb PM10/VMT
E = delivery truck emiss. factor =	2.31	lb PM10/VMT
E = auto/pickup emiss. factor =	0.12	lb PM2.5/VMT
E = delivery truck emiss. factor =	0.35	lb PM2.5/VMT

Notes - Fugitive Dust Emission Calculations
Unpaved Road Travel and Active Excavation Area Control - Source: Control of Open Fugitive Dust Sources, U.S EPA, 9/88

C = 100 - (0.8)(p)(d)(t)/(i)

p = potential average hourly daytime	
evaporation rate =	0.26 mm/hr (EPA document, Figure 3-2, summer)
evaporation rate =	0.196 mm/hr (EPA document, Figure 3-2, annual)
d = average hourly daytime traffic rate =	37.0 vehicles/hr (estimated)
t = time between watering applications =	1.00 hr/application (estimated)
i = application intensity =	1.4 L/m2 (typical level in EPA document, page 3-23)
C = average summer watering control efficienc	94.3%
C = average annual watering control efficiency	95.7%

Finish Grading - Source: AP-42, Table 11.9-1, 7/98

E = (0.60)(0.051)(S^2.0)

S = mean vehicle speed =	3.0 mph (estimate)
E = emission factor =	0.2754 PM10 lb/VMT
E = emission factor =	0.0193 PM2.5 lb/VMT

Bulldozer Operation and Scraper Excavation - Source: AP-42, Table 11.9.1, 7/98

E = (0.75)(s^1.5)/(M^1.4)

s = silt content =	8.5% (AP-42, Table 13.2.2-1, 12/03, construction haul route)
M = moisture content =	15.0% (SCAQMD CEQA Handbook, Table A9-9-G-1)
E = emission factor =	0.42 PM10 lb/hr
E = emission factor =	0.23 PM2.5 lb/hr

Scraper Travel

W = mean vehicle weight =	28.2 tons empty (615E scraper, Caterpillar Performance Handbook, 10/89)
=	48.6 tons loaded (615E scraper, Caterpillar Performance Handbook, 10/89)
=	38.4 tons mean weight
Daily Scraper Haul Tonnage =	1,428 ton/day (estimated)
Scraper Load =	20.4 ton (615E scraper, Caterpillar Performance Handbook, 10/89)
Daily Scraper Loads =	70.00 loads/day
Daily Scraper Hauling Distance =	0.08 miles/load (estimated)
Daily Scraper Travel =	11.36 miles/day

Backhoe

Excavating Rate =	150.0 yd3/hr (based on 1.25 yd3 bucket on a Cat. 428D backhoe and a 30 sec. cycle time)
	750 yd3/day for 1 excavator @ 5 hrs/day of operation
Soil Density =	1.05 ton/yd3 (Caterpillar Performance Handbook, 10/89)
Daily Soil Transfer Rate =	788 ton/day (estimated)

Notes: Onsite Combustion Emissions

(1) - Steady State Emission Factors from Table A2 of EPA November 2002 NR-009b Publication.
(2) - In use adjustment factors per Table A3 EPA November 2002 NR-009b Publication.
(3) - PM10 and SO2 adjustments due to Equation 5 and Equation 7 on pages 18 and 19, Respectively of EPA Report No. NR-009b
(4) - Calculation uses adjusted BSFC and assumed 7.1 lbs/gallon. The onroad emission factors are not adjusted.
(5) - Daily fuel use based on peak combustion month equipment schedule.
(6) - Annual fuel use based on average level during peak 12-month period.
(7) - Annual fuel use based on average level during entire construction period.

APPENDIX 8.1E

Evaluation of Best Available Control Technology (BACT)

APPENDIX 8.1E

Evaluation of Best Available Control Technology (BACT)

BACT Requirements

Summary of BACT Determination

The emission rates determined to be BACT for this project are summarized below. The information considered in making these determinations is discussed in detail in the following sections.

Natural Gas Firing (except during startup and shutdown)

- NOx emission limit of 6.0 ppmv @ 15% O_2 constitutes BACT for lean-burn reciprocating engines fired on natural gas. This level, once demonstrated, will establish a new achieved-in-practice BACT level for lean-burn engines. Utilizing SCR with a design exhaust NOx concentration of 6.0 ppmv at 15% O_2, the proposed project will comply with the BACT NOx emission limit.

- ROC emission limit of 28 ppmv @ 15% O_2 constitutes BACT for lean-burn reciprocating engines capable of meeting 6 ppm NOx fired on natural gas. At a design exhaust ROC concentration of 28.0 ppmv at 15% O_2, the HBRP engines will meet an ROC limit that is comparable to the most stringent BACT limit achieved in practice by similar engines, while significantly reducing NOx emission levels to a new standard.

- CO emission limit of 13 ppmv @ 15% O_2 constitutes BACT for natural gas-fired lean-burn reciprocating engines. Utilizing a CO catalyst, with a design exhaust CO concentration of 13.0 ppmv at 15% O_2, the HBRP engines will meet a CO limit that is significantly below the most stringent BACT limit achieved in practice by similar engines, and is comparable to the most stringent level deemed to be technologically feasible.

- PM_{10} emission limit of 0.02 g/bhp-hr constitutes achieved-in-practice BACT for natural gas-fired lean-burn reciprocating engines. The use of natural gas for all discretionary firing constitutes BACT for PM_{10} for HBRP lean-burn engines fired on natural gas.

Emergency Backup Diesel Fuel Firing

- The BACT controls will achieve an exhaust NOx concentration of 35.0 ppmv at 15% O_2. This constitutes BACT for liquid fuel firing in a dual-fuel fired lean-burn engine capable of achieving 6ppm NOx on natural gas.

- The BACT controls will achieve an exhaust ROC concentration of 40.0 ppmv at 15% O_2 . This constitutes BACT for liquid fuel firing in a dual-fuel fired lean-burn engine capable of achieving 6ppm NOx on natural gas.

- The BACT controls will achieve an exhaust CO concentration of 20.0 ppmv at 15% O_2 . This constitutes BACT for liquid fuel firing in a dual-fuel fired lean-burn engine capable of achieving 6ppm NOx on natural gas.

- PM_{10} emission limit of 0.15 gm/hp-hr constitutes BACT for new compression ignition emergency engines fired on Diesel fuel.

Startup/Shutdown

BACT for all pollutants during startup/shutdown periods consists of minimization of the duration of the activity. The startup/shutdown period will be limited to 60 minutes per event or less. NOx, CO, and ROC emissions will be required to meet specified limits during startup activities.

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Rules and Applicability

Rule 110 Section 5.1 requires the application of BACT to any new or modified emissions unit if the new unit or modification results in an increase in permitted daily emissions greater than certain thresholds. BACT is defined in Rule 110 Section 4.5 as the more stringent of:

4.5.1 the most effective emission control device, emission limit, or technique which has been required or used for the type of equipment comprising such emissions unit unless the applicant demonstrates to the satisfaction of the APCO that such limitations are not achievable; or

4.5.2 any other emission control device or technique, alternative basic equipment, different fuel or process, determined to be technologically feasible and cost-effective by the APCO. The cost-effective analysis shall be performed in accordance with the methodology and criteria specified by the APCO.

The HBRP will have emissions in excess of the thresholds for NOx, ROC, CO, and PM_{10}, so BACT will be required for these pollutants. Because SO_2 emissions from the project will be below the regulatory threshold of 80 pounds per day, BACT will not be required for SO_2.

Federal Prevention of Significant Deterioration (PSD) requires the application of BACT to any regulated pollutant for which the modification results in a significant net emissions increase. BACT is defined in 40 CFR 52.21(b)(12) as:

> "an emissions limitation (including a visible emission standard) based on the maximum degree of reduction for each pollutant subject to regulation under Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant. In no event shall application of best available control technology result in emissions of any pollutant which would exceed the emissions allowed by any applicable standard under 40 CFR parts 60 and 61. If the Administrator

determines that technological or economic limitations on the application of measurement methodology to a particular emissions unit would make the imposition of an emissions standard infeasible, a design, equipment, work practice, operational standard, or combination thereof, may be prescribed instead to satisfy the requirement for the application of best available control technology. Such standard shall, to the degree possible, set forth the emissions reduction achievable by implementation of such design, equipment, work practice or operation, and shall provide for compliance by means which achieve equivalent results."

As shown in Table 8.1-34, HBRP will result in a significant net increase in emissions for ROC and PM_{10}, so the project is subject to PSD BACT requirements for those pollutants as well.

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Top-Down BACT Analysis—Definition

The following "top-down" BACT analyses for NO_X, ROC, CO, and PM_{10} have been prepared in accordance with EPA's 1990 Draft New Source Review Workshop Manual. A "top-down" BACT analysis takes into account energy, environmental, economic, and other costs associated with each alternative technology.

In a top-down analysis, all plausible control technologies are identified. Next, technically infeasible technologies are eliminated. The remaining candidate technologies are then ranked for effectiveness. In the "top-down" process, the most stringent, or "top" control alternative, is examined first. That alternative is established as BACT unless the applicant demonstrates, and the permitting authority in its informed judgment agrees, that technical considerations, or energy, environmental, or economic impacts justify a conclusion that the most stringent technology is not feasible in that case. If the most stringent technology is eliminated in this fashion, then the next most stringent alternative is considered, and so on. BACT analysis is done on a case-by-case basis.

Typically, BACT is determined for the operating scenario that is responsible for the bulk of project emissions. Control technology is optimized for that scenario. The effectiveness of the selected controls during other operation is then determined.

For example, SCR is frequently selected as the NOx control technology for routine operations of combustion equipment. SCR requires, however, that the exhaust gases be at an appropriate temperature to function, and the variable conditions during startup and shutdown result in temperatures where SCR catalysts are not effective. As a result, BACT during startup and shutdown for a system controlled by SCR is usually "no control," and operating requirements are imposed to minimize the duration and emissions during startup and shutdown.

For the HBRP, BACT technology has been selected based on the combustion of natural gas. The BACT limits during fuel oil firing and startup/shutdown are then based on the appropriate operation of the selected technology under the alternate conditions.

Alternative Generating Technologies

A BACT review is limited to the technologies available to control emissions from "the type of equipment comprising such a source." The review does not extend to consideration of different types of equipment that might comprise such a source. On the other hand, it is reasonable to discuss available alternatives, especially when the type of equipment selected is inherently more polluting than some of those alternatives.

Several alternative generating technologies were reviewed in a process that resulted in the selection of clean, natural gas-fired compression ignition reciprocating internal combustion engines for the HBRP. The alternative technologies included conventional oil and natural gas-fired plants, combined-cycle combustion turbines, biomass-fired plants, waste-to-energy plants, solar plants, wind generation plants, and others. None of these technologies was considered better than or equal to the Wärtsilä 18V50DF internal combustion engine-generators selected for the HBRP to meet the specific needs for base and intermediate load power supply in this region. These needs include flexibility to dispatch power in small increments across the entire range of output (from 0-100%), and rapid startup and shutdown. These features meet the special load-following requirements necessary to provide power to the electricity users in northwestern California.

The multi-unit configuration of this power plant design allows for modular operation. PG&E can operate as many individual generating sets as required for optimal efficiency to follow existing loads. Because single units have a relatively flat heat rate at 50 percent load and above, the plant can be operated efficiently anywhere between 5 percent load (1 generator set operating at 50 percent load) to 100 percent (all ten units operating at 100 percent). No other technology can approach this kind of modularity and operational efficiency for load following economically. Standard combustion turbine technology, for example, would have to be run uneconomically and inefficiently at partial loads to meet the load following requirements necessary for this installation.

In addition, the Wärtsilä 18V50DF technology offers the most efficient conversion of fuel to electrical power of any technology considered for this application. The low heat rate (8,571 Btu/kWh higher heating value [HHV]) means more economical operation and lower fuel consumption.

The Wärtsilä 18V50DF technology will allow for a switch to emergency backup Diesel fuel under emergency conditions, which is another project requirement. If there were a disruption of the site's natural gas supply, these units could switch to Diesel fuel within one minute at any operational load lower than 80 percent. This design features offers a flexibility that meets the project's objectives and that is not matched with competing technologies. Project alternatives are discussed in more detail in Section 9.9.1, Generation Technology Alternatives.

BACT Analysis for NOx

Identify All Control Technologies

There are three basic means of controlling NOx emissions from reciprocating internal combustion engines: fuel limitations, combustion controls, and post-combustion controls. Fuel limitations reduce NOx formation by using the cleanest fuels available. Combustion controls act to reduce the formation of NOx during the combustion process, while post-combustion controls remove NOx from the exhaust stream. Potential NOx control technologies for reciprocating internal combustion engines include the following, either individually or in combination:

Fuel Specifications

Fuel specification (natural gas only)

Fuel specification (ultralow sulfur (CARB) Diesel fuel)

Water/fuel emulsions

Combustion Controls

Aftercooling

Electronic Fuel Injection Timing Retard (FITR)

Exhaust Gas Recirculation (EGR)

Lean burn combustion

Pre-Chamber Combustion Ignition (also described as Clean Burn Combustion or Pre-Stratified Charge)

Rich burn combustion

Turbocharging

Water/steam injection

Post-Combustion Controls

Diesel Particulate filters

Non-selective catalytic reduction (NSCR)

SCONOx

Selective catalytic reduction (SCR)

Selective non-catalytic reduction (SNCR)

Eliminate Technically Infeasible Options

The performance and technical feasibility of available NOx control technologies are discussed in more detail below.

Fuel Specifications

Fuel restrictions that lower NOx emissions include exclusive use of natural gas, the use of CARB ultralow sulfur Diesel fuel, and the use of water/fuel emulsions.

The proposed project will use natural gas except for periods of natural gas curtailment and periodic tests of liquid fuel firing capability. The HBRP reciprocating engines will be required to use California ultralow sulfur Diesel fuel when operating in emergency backup firing mode; no alternative Diesel fuels (including biodiesel fuels or water/fuel emulsions) have yet been approved by CARB for use in compression ignition engines. Therefore, the use of other liquid fuels was eliminated based on regulatory infeasibility.

Combustion Controls

Combustion modifications that lower NOx emissions include aftercooling, electronic fuel injection timing retard, exhaust gas recirculation (EGR), lean-burn combustion, intake air cooling, pre-chamber combustion, rich-burn combustion, turbocharging, and water/steam injection.

EGR, intake air cooling, rich burn combustion, and water/steam injection were all eliminated based on technical infeasibility. The remaining technologies are carried forward to the next step of the analysis.

EGR: EGR would result in increased fouling of the air intake systems, combustion chamber deposits, and engine wear rates due to the chemical and physical properties of the exhaust gas. In addition, this control technique is not commercially available from manufacturers of stationary internal combustion engines.

Pre-chamber combustion: This technology is applicable to IC engines fired with gaseous fuels. This includes both spark-ignited engines and compression ignition engines operating in pilot injection mode (as opposed to firing only Diesel fuel). Because the HBRP engines must be operated in liquid-fuel-only mode for emergency backup operation, this technique is technologically infeasible for this application.

Rich burn combustion: The ability to fire on gas or oil is a project requirement. There are no dual-fuel rich-burn engines available.

Water/steam injection: Steam injection techniques, applicable to boilers and turbines, reduce peak combustion temperatures, and for these applications realize a decrease in NOx emissions. However, water or steam would corrode the interior of internal combustion engines and downstream components, and increase engine wear; therefore these techniques are considered to be technically infeasible for this application.

Lean combustion uses excess air (greater than stoichiometric air-to-fuel ratio) in the combustion zone to cool the engine, thereby reducing the rate of thermal NOx formation. This combustion control technique is used by Wärtsilä to reduce NOx formation during both natural gas (with pilot injection) firing and backup Diesel fuel firing operating modes.

Post-Combustion Controls

Post-combustion controls that lower NOx emissions include NSCR, SCONOx, SCR, and SNCR.

NSCR, SCONOx, and SNCR were eliminated based on technical infeasibility. The remaining technology (SCR) is carried forward to the next step of the analysis.

Nonselective catalytic reduction (NSCR): NSCR uses a three-way CO and hydrocarbon catalyst without injected reagents to reduce NOx to nitrogen and water. NSCR is typically used in automobile exhaust and rich-burn stationary IC engines, and typically employs a platinum/rhodium catalyst. NSCR is effective only in a stoichiometric or fuel-rich environment where the combustion gas is nearly depleted of oxygen. Because the Wärtsilä 18V50DF is a lean-burn engine, NSCR is not a feasible control technology.

SCONOx is a proprietary catalytic oxidation and adsorption technology that uses a single catalyst for the control of NOx, CO, and ROC emissions. The catalyst is a monolithic design, made from a ceramic substrate with both a proprietary platinum-based oxidation catalyst and a potassium carbonate adsorption coating. The catalyst simultaneously oxidizes NO to NO_2, CO to CO_2, and ROCs to CO_2 and water, while NO_2 is adsorbed onto the catalyst surface where it is chemically converted to and stored as potassium nitrates and nitrites. SCONOx has not yet been demonstrated on a commercially operated natural-gas-fired internal combustion engine.

Selective Non-Catalytic Reduction (SNCR) involves injection of ammonia or urea with proprietary conditioners into the exhaust gas stream without a catalyst. SNCR technology requires gas temperatures in the range of 1200° to 2000° F and is most commonly used in boilers. The exhaust temperatures for the HBRP engines are in the 750 to 800° F range, which is well below the minimum SNCR operating temperature. Some method of exhaust gas reheat, such as additional fuel combustion, would be required to achieve exhaust temperatures compatible with SNCR operations, and this requirement makes SNCR technologically infeasible for this application. Even when technically feasible, SNCR is unlikely to achieve NOx reductions in excess of 80%-85%.

Selective Catalytic Reduction (SCR) is a post-combustion technique that controls both thermal and fuel NOx emissions by reducing NOx with a reagent (generally ammonia or urea) in the presence of a catalyst to form water and nitrogen. NOx conversion is sensitive to exhaust gas temperature, and performance can be limited by contaminants in the exhaust gas that may mask the catalyst (sulfur compounds, particulates, heavy metals, and silica). SCR is used in numerous reciprocating engine and gas turbine installations throughout the United States, almost exclusively in conjunction with other wet or dry NOx combustion controls. SCR requires the consumption of a reagent (ammonia or urea) and requires periodic catalyst replacement. Estimated levels of NOx control are in excess of 90%.

Based on the discussions above, the technologically feasible NOx control technologies for the proposed project are listed in Table 8.1E-1.

Rank Remaining Control Technologies by Control Effectiveness

The remaining technically feasible control technologies are ranked by NOx control effectiveness in Table 8.1E-1. All of these technologies will be used by the project.

TABLE 8.1E-1
NOx Control Alternatives

NOx Control Alternative	Available?	Technically Feasible?	NOx Emissions (@ 15% O_2)	Environmental Impact	Energy Impacts
Fuel Restrictions	Yes	Yes			
Turbocharging	Yes	Yes			
FITR	Yes	Yes		Increased CO/ROC	Decreased Efficiency
Lean Burn Combustion	Yes	Yes	160-240 ppm		
Selective Catalytic Reduction	Yes	Yes	>90% reduction 6 ppm	Ammonia slip	Decreased Efficiency

Determination of BACT Emission Rates

A literature search was conducted to identify the current regulatory environment for control of lean burn internal combustion engines:

- Reviewed published BACT guidelines for natural gas-fired lean burn internal combustion engines;
- Reviewed recent BACT determinations for natural gas-fired lean burn internal combustion engines; and
- Reviewed published prohibitory rules for natural gas-fired lean burn internal combustion engines.

All of the published BACT guidelines pertain to spark-ignition engines. Since the HBRP reciprocating engines are compression-ignited and not spark ignited, the BACT determinations cited here are not for the same type of source and therefore are not directly applicable to the proposed project. However, the BACT determinations can be used as guidance in determining what should be considered to be BACT for this particular class and category of source.

Published BACT Guidelines

Published BACT guidelines from the following agencies were reviewed to identify relevant previously established BACT emission rates:

- Bay Area Air Quality Management District (BAAQMD);
- San Joaquin Valley Air Pollution Control District (SJVAPCD); and
- South Coast Air Quality Management District (SCAQMD).

The BAAQMD's BACT guidelines specify that, for natural gas-fired lean-burn reciprocating internal combustion engines, a NOx limit of 12 ppmv @ 15% O_2 has been "achieved in practice." Other permits have been issued with limits as low as 6ppm, based upon a demonstration of cost effectiveness.

The SJVAPCD's BACT guidelines specify that, for natural gas-fired lean-burn reciprocating internal combustion engines, a NOx limit of 9 ppmv @ 15% O_2 has been achieved in practice and 5 ppmv @ 15% O_2 is technologically feasible.

The SCAQMD's BACT guidelines specify that, for natural gas-fired lean-burn reciprocating internal combustion engines, a NOx limit of 9 ppmv @ 15% O_2 has been achieved in practice. SCAQMD's guidelines do not suggest a "technologically feasible" level.

Table 8.1E-2 summarizes published BACT guidelines for spark-ignited lean burn reciprocating natural gas-fired reciprocating internal combustion engines for the three agencies.

Table 8.1E-3 summarizes published BACT guidelines for liquid fuel fired compression ignition internal combustion engines. This table is included because BACT must be determined for the periods when liquid fuels are being fired (during engine testing and for emergency backup operation during emergencies, including natural gas curtailment).

Table 8.1E-2

Published BACT Guidelines for Spark-Ignited Lean Burn Reciprocating Internal Combustion Engines (Natural Gas)

District	BACT Guideline			
	NOx	ROC	CO	PM_{10}
BAAQMD—Achieved in Practice	12 ppmc [a]	32 ppmc	74 ppmc	n/a
BAAQMD—Technologically Feasible	6 ppmc	n/a	12 ppmc	n/a
SJVAPCD—Achieved in Practice	9 ppmc	25 ppmc	56 ppmc	0.02 g/bhp-hr
SJVAPCD—Technologically Feasible	5 ppmc	n/a	12 ppmc	n/a
SCAQMD—Achieved in Practice	9 ppmc	25 ppmc	33 ppmc	n/a

Note:

a. ppmc: ppmvd, corrected to 15% O_2

Table 8.1E-3

Published BACT Determinations for Compression Ignition Lean Burn Internal Combustion Engines (Liquid Fuels)

District	BACT Guideline			
	NOx	ROC	CO	PM_{10}
BAAQMD—Achieved in Practice	490 ppmc	309 ppmc	319 ppmc	0.1 g/bhp-hr
BAAQMD -- Technologically Feasible	107 ppmc	62 ppmc	n/a	n/a
SJVAPCD—Achieved in Practice	9 ppmc	25 ppmc	56 ppmc	0.02 g/bhp-hr
SCAQMD—Achieved in Practice	50 ppmc	39 ppmc	89 ppmc	0.045 g/bhp-hr

Recent BACT Determinations

CARB's BACT Clearinghouse contains six determinations in the spark-ignited reciprocating natural gas internal combustion engine category: two of these were for small engines (<200 bhp); two were for rich burn engines; and one burns field gas, not clean natural gas. The remaining determination was the following:

- NEO California Power LLC in Tehama County (San Joaquin Valley AQMD). The facility utilizes 16 Wärtsilä 18V220SG engines (3870 hp each) to power a 44 MW peaking power plant. The limits imposed were 9 ppmc NOx, 56 ppmc CO, 25 ppmc ROC, 0.02 g/hp-hr PM_{10}. Compliance was demonstrated in 2001 and 2003.

EPA's BACT Clearinghouse has a number of determinations in the spark-ignited natural gas internal combustion category. The NEO California Power project (described above) had the second lowest emission rate listed. The facility with the lowest emission rate was for an engine using Clear Burn Engine Technology, which does not allow for liquid fuel firing.

Published Prohibitory Rules

Published prohibitory rules from USEPA, BAAQMD, SMAQMD, San Diego County Air Pollution Control District (SDCAPCD), SJVAPCD, and SCAQMD were reviewed to identify the NOx standards that govern existing natural gas-fired compression ignition reciprocating engines.

Federal New Source Performance Standard (NSPS)

On July 11, 2006, USEPA adopted a NSPS for stationary compression ignition internal combustion engines (NSPS Subpart IIII). When fired on natural gas, the Wärtsilä engines are pilot ignition engines, not compression ignition engines, and are therefore not subject to the NSPS. Nevertheless, the NSPS requirements provide a yardstick against which the performance of the Wärtsilä engines may be measured.

The NSPS specifies a NOx limit of 1.2 gm/hp-hr. This is equivalent to an outlet concentration of 120 ppm NOx. The proposed NOx BACT limits of 6.0 ppm during natural gas firing and 35 ppm during emergency backup Diesel fuel firing are much lower than the new NSPS.

USEPA has adopted a NESHAPS standard for reciprocating internal combustion engines (NESHAPS subpart ZZZZ). This standard requires use of an oxidizing catalyst or NSCR to reduce emissions of formaldehyde, and is therefore not relevant to a discussion of NOx control requirements.

District Prohibitory Rules

Table 8.1E-4 summarizes published prohibitory rules for existing spark-ignited natural gas-fired lean burn internal combustion engines from the following agencies:

- BAAQMD;
- Sacramento Metropolitan Air Quality Management District (SMAQMD);
- San Diego County Air Pollution Control District (SDCAPCD);
- SJVAPCD; and
- SCAQMD.

The BACT limits proposed for this project are well below the limits shown in Table 8.1E-4.

Table 8.1E-4

Published Prohibitory Rules for Spark-Ignited Natural Gas-Fired Lean Burn Internal Combustion Engines

District/Rule	Emission Limit		
	NOx	**ROC**	**CO**
BAAQMD – Rule 9-8	140 ppmc	None	2000 ppmcc
SMAQMD – Rule 412	65 ppmc	250 ppmc	4000 ppmc
SDAPCD – 69.4.1	65 ppmc	250 ppmc	4500 ppmc
SJVAPCD – Rule 4701 (dual fired)	80 ppmc	750 ppmc	2000 ppmc
SCAQMD – Rule 1110.2	36 ppmc	250 ppmc	2000 ppmc

Conclusion—BACT for NOx

BACT must be at least as stringent as the most stringent level achieved in practice, federal rule, or district prohibitory rule. The most stringent NOx level achieved in practice for a lean-burn spark-ignition engine fired on natural gas is 9ppm, as listed in SCAQMD and SJVAPCD BACT guidelines.

However, the SJVAPCD guidelines indicate that 5.0 ppm @ 15% O_2 on a 3-hour average is technically feasible. It should be noted that, if SJVAPCD has issued a permit with a 5 ppm limit, it has not submitted that information to either the EPA or the CARB BACT clearinghouse. In addition, the HBRP reciprocating engines are pilot ignition and not spark ignition engines; therefore, the BACT determinations for spark ignited engines are not directly applicable.

The 50DF engines proposed for Humboldt have uncontrolled NOx levels of 160-240 ppm, depending on engine load (down to 50% load). There are lean burn engine designs that have uncontrolled NOx levels closer to 125 ppm. The difference may be attributable to the higher compression ratio of the HBRP engines. The higher compression ratio, in turn, results in higher pressures and temperatures, which lead to higher NOx concentrations. The HBRP engines would be expected to have higher efficiencies as well, another side effect of the higher compression ratio. Higher efficiencies, in turn, mean lower emission rates when expressed in lbs/MW-hr.

The HBRP facility will be designed to meet a NOx level of 6.0 ppmv @ 15% O_2 on a 3-hour average basis. Considering the higher compression ratio that is inherent in the compression ignition design, the higher energy efficiency, and uncertainty associated with establishing a new BACT level so far below that achieved in practice, it is infeasible to require these engines to meet a NOx level of 5.0 ppmv.

BACT for NOx for these engines while firing on CARB Diesel fuel is the rate achievable by the engines utilizing the proposed controls for natural gas. Because the uncontrolled NOx emissions are approximately six times higher when firing on fuel oil, the controlled NOx emissions are approximately six times higher when firing on fuel oil. The HBRP facility will be designed to meet a NOx level of 35 ppmv @ 15% O_2 on a 3-hour average basis while firing fuel oil.

BACT for NOx on startup and shutdown is the minimization of duration of startup and shutdown. Startup and shutdown will be limited to 30 minutes per event, and emissions will be limited to 55 lb/event during natural gas firing and 176 lb/event during emergency backup Diesel firing.

BACT Analysis for CO

Identify All Control Technologies

There are two basic means of controlling CO emissions from internal combustion engines: combustion controls and post-combustion controls. Combustion controls act to minimize CO by ensuring complete combustion, while post-combustion controls oxidize CO to CO2 in the exhaust stream.

Combustion Controls

Aftercooling

Electronic Fuel Injection Timing Retard (FITR)

Exhaust Gas Recirculation (EGR)

Intake air cooling

Lean burn combustion

Pre-Chamber Combustion Ignition (also described as Clean Burn Combustion or Pre-Stratified Charge)

Rich burn combustion

Timing adjustments

Turbocharging

Water/steam injection

Post-combustion controls

Oxidation catalyst

Eliminate Technically Infeasible Options

The performance and technical feasibility of available CO control technologies are discussed in more detail below.

Combustion Controls

To an extent, better combustion control of CO comes at the expense of better NOx control. Complete CO combustion is easier to achieve at higher combustion temperatures, but higher combustion temperatures can lead to increased NOx formation.

In practice, combustion controls are selected for NOx control and then tuned to minimize NOx formation until CO emissions begin to increase sharply.

See Section 8.1E1.2.2 for a discussion of the feasibility of combustion controls. All feasible NOx combustion controls have been incorporated into the project design.

Post-Combustion Controls

The only post-combustion control that lowers CO emissions is an oxidation catalyst.

Oxidation catalyst modules and pre-engineered packages are generally a cost-effective way to reduce carbon monoxide levels and have a side benefit of also reducing emissions of unburned hydrocarbon and toxic organic compounds. Oxidation catalysts are manufactured with precious metal–based formulations. Typical catalysts are made with a metal and ceramic honeycomb substrate coupled with application-specific wash coats and catalyst coatings. The precious metal–based formulations provide high destruction levels at lower operating temperatures.

Environmental Impacts

In addition to the positive reduction in CO emissions, the oxidation catalyst will lower ROC emissions, including emissions of toxic ROCs.

Energy Impacts

The use of an oxidation catalyst will create an additional pressure drop, resulting in a slight increase in energy consumption.

Based on the discussions above, the technologically feasible CO control technologies for the proposed project are listed in Table 8.1E-4.

Rank Remaining Control Technologies by Control Effectiveness

The remaining technically feasible control technologies are ranked by CO control effectiveness in Table 8.1E-5.

TABLE 8.1E-5
CO Control Alternatives

NOx Control Alternative	Available?	Technically Feasible?	CO Emissions (@ 15% O_2)	Environmental Impact	Energy Impacts
Combustion controls	Yes	Yes		Optimized for NOx controls	Decreased Efficiency
Oxidation Catalyst	Yes	Yes	12-13 ppmv	Reduce ROC emissions	Decreased Efficiency

Determination of BACT Emission Rates

A literature search was conducted to identify the current regulatory environment for control of lean burn internal combustion engines:

- Reviewed published BACT guidelines for natural gas-fired lean burn internal combustion engines;

- Reviewed recent BACT determinations for natural gas-fired lean burn internal combustion engines; and
- Reviewed published prohibitory rules for natural gas-fired lean burn internal combustion engines.

Published BACT Guidelines

Published BACT guidelines from the following agencies were reviewed to identify relevant previously established BACT emission rates:

- Bay Area Air Quality Management District (BAAQMD);
- San Joaquin Valley Air Pollution Control District (SJVAPCD); and
- South Coast Air Quality Management District (SCAQMD).

The BAAQMD's BACT guidelines specify that, for natural gas-fired lean-burn internal combustion engines, a CO limit of 74 ppmv @ 15% O_2 has been "achieved in practice." Other permits have been issued with limits as low as 12 ppm, based upon a demonstration of cost effectiveness.

The SJVAPCD's BACT guidelines contained a determination for natural gas-fired lean-burn internal combustion engines. The SJVAPCD concluded that a CO exhaust concentration of 56 ppmv @ 15% O_2 constituted BACT that had been achieved in practice and 12 ppmv @ 15% O_2 constituted BACT that is technologically feasible.

The SCAQMD BACT guidelines contained a determination for natural gas-fired lean-burn internal combustion engines. The SCAQMD concluded that a CO exhaust concentration of 33 ppmv @ 15% O_2 constituted BACT that had been achieved in practice.

Table 8.1E-1 summarizes published BACT guidelines for natural gas-fired reciprocating engines for the three agencies. Table 8.1E-2 summarizes published BACT guidelines for liquid fuel fired internal combustion engines. This table is included because BACT must be determined for the periods when liquid fuels are being fired (during engine testing and during natural gas curtailment).

Recent BACT Determinations

CARB's BACT Clearinghouse contains six determinations in the spark-ignited natural gas internal combustion engine category: two of these were for small engines (<200 bhp); two were for rich burn engines; and one burns field gas, not clean natural gas. The remaining determination was the following:

- NEO California Power LLC in Tehama County (San Joaquin Valley AQMD). The facility utilizes 16 Wärtsilä 18V220SG engines (3870 hp) to power a 44 MW peaking power plant. The limits imposed were 9 ppm NOx, 56 ppm CO, 25 ppm ROC, .02 gm/hp-hr PM_{10}. Compliance was demonstrated in 2001 and 2003.

EPA's BACT Clearinghouse has a number of determinations in the natural gas internal combustion category. The NEO California Power project (described above) had the second lowest emission rate listed. The facility with the lowest emission rate was for an engine using Clear Burn Engine Technology, which does not allow for liquid fuel firing.

Published Prohibitory Rules

Published prohibitory rules from USEPA, BAAQMD, SMAQMD, San Diego County Air Pollution Control District (SDCAPCD), SJVAPCD, and SCAQMD were reviewed to identify the CO standards that govern existing natural gas-fired lean burn engines.

Federal New Source Performance Standard (NSPS)

On July 11, 2006, USEPA adopted a NSPS for stationary compression ignition internal combustion engines (NSPS Subpart IIII). The NSPS does not address CO emissions.

USEPA has adopted a NESHAPS standard for reciprocating internal combustion engines (NESHAPS subpart ZZZZ). This standard limits emissions of formaldehyde. When an oxidizing catalyst is utilized to comply with the requirements of the NESHAP, CO emissions from pilot-ignition engines (which are classified as compression ignition engines under the NESHAP) must be reduced by 70%.

District Prohibitory Rules

Table 8.1E-4 summarizes published prohibitory rules for existing natural gas-fired lean burn internal combustion engines from the following agencies:

- BAAQMD;
- Sacramento Metropolitan Air Quality Management District (SMAQMD);
- San Diego County Air Pollution Control District (SDCAPCD);
- SJVAPCD; and
- SCAQMD.

Conclusion—BACT for CO

BACT must be at least as stringent as the most stringent level achieved in practice, federal rule, or district prohibitory rule. The most stringent CO level achieved in practice for a lean-burn spark-ignition engine fired on natural gas is 56 ppm, as listed in SJVAPCD BACT guidelines.

However, the Bay Area and SJVAPCD guidelines indicate that 12.0 ppm @ 15% O2 on a 3-hour average is technically feasible. While this level may be achievable for spark-ignited engines, the Wärtsilä engines use a pilot-ignition technology. According to the engine manufacturer, the lowest level that can be guaranteed for this engine is 13 ppm. Because 12 ppm is not technically feasible, but 13 ppm is, BACT for this project is 13 ppm. The HBRP facility will be designed to meet a CO level of 13.0 ppmv @ 15% O2 on a 3-hour average basis.

BACT for CO for these engines while firing on fuel oil is the rate achievable by the engines utilizing the proposed controls for natural gas. The HBRP facility will be designed to meet a CO level of 20 ppmv @ 15% O_2 on a 3-hour average basis while firing fuel oil.

BACT for CO on startup and shutdown is the minimization of duration of startup and shutdown. Startup and shutdown will be limited to 30 minutes per event, and emissions will be limited to 22 lb/event.

BACT Analysis for ROC

Identify All Control Technologies

The techniques for controlling CO will also control ROC: combustion controls and post-combustion controls. Combustion controls act to minimize ROC by ensuring complete combustion, while post-combustion controls oxidize hydrocarbons to CO_2 in the exhaust stream. Once BACT controls for CO are installed, ROC emissions are reduced as well.

See the section for CO controls for a discussion of the feasibility and effectiveness of these controls.

Rank Remaining Control Technologies by Control Effectiveness

The technically feasible control technologies are ranked by ROC control effectiveness in Table 8.1E-6.

TABLE 8.1E-6
ROC Control Alternatives

NOx Control Alternative	Available?	Technically Feasible?	ROC Emissions (@ 15% O_2)	Environmental Impact	Energy Impacts
Combustion controls	Yes	Yes		Optimized for NOx controls	Decreased Efficiency
Oxidation Catalyst	Yes	Yes	25-28 ppmv	Reduce CO emissions	Decreased Efficiency

Determination of BACT Emission Rates

A literature search was conducted to identify the current regulatory environment for control of lean burn internal combustion engines:

- Reviewed published BACT guidelines for natural gas-fired lean burn internal combustion engines;
- Reviewed recent BACT determinations for natural gas-fired lean burn internal combustion engines; and
- Reviewed published prohibitory rules for natural gas-fired lean burn internal combustion engines.

Published BACT Guidelines

Published BACT guidelines from the following agencies were reviewed to identify relevant previously established BACT emission rates:

- Bay Area Air Quality Management District (BAAQMD);
- San Joaquin Valley Air Pollution Control District (SJVAPCD); and
- South Coast Air Quality Management District (SCAQMD).

The BAAQMD's BACT guidelines specify that, for natural gas-fired lean-burn internal combustion engines, a ROC limit of 32 ppmv @ 15% O_2 has been "achieved in practice."

The SJVAPCD's BACT guidelines contained a determination for natural gas-fired lean-burn internal combustion engines. The SJVAPCD concluded that a ROC exhaust concentration of 25 ppmv @ 15% O_2 constituted BACT that had been achieved in practice.

The SCAQMD BACT guidelines contained a determination for natural gas-fired lean-burn internal combustion engines. The SCAQMD concluded that a ROC exhaust concentration of 26 ppmv @ 15% O_2 constituted BACT that had been achieved in practice.

Table 8.1E-2 summarizes published BACT guidelines for natural gas-fired reciprocating engines for the three agencies.

Table 8.1E-3 summarizes published BACT guidelines for liquid fuel fired internal combustion engines. This table is included because BACT must be determined for the periods when liquid fuels are being fired (during engine testing and during natural gas curtailment). The technically feasible CO emission limit during emergency backup Diesel firing is 20 ppmc.

Recent BACT Determinations

CARB's BACT Clearinghouse contains six determinations in the spark-ignited natural gas internal combustion engine category: two of these were for small engines (<200 bhp); two were for rich burn engines; and one burns field gas, not clean natural gas. The remaining determination was the following:

- NEO California Power LLC in Tehama County (San Joaquin Valley AQMD). The facility utilizes 16 Wärtsilä 18V220SG engines (3870 hp) to power a 44 MW peaking power plant. The limits imposed were 9 ppm NOx, 56 ppm CO, 25 ppm ROC, .02 gm/hp-hr PM_{10}. Compliance was demonstrated in 2001 and 2003.

EPA's BACT Clearinghouse has a number of determinations in the natural gas internal combustion category. The NEO California Power project (described above) had the second lowest emission rate listed. The facility with the lowest emission rate was for an engine using Clear Burn Engine Technology, which does not allow for liquid fuel firing.

Published Prohibitory Rules

Published prohibitory rules from USEPA, BAAQMD, SMAQMD, San Diego County Air Pollution Control District (SDCAPCD), SJVAPCD, and SCAQMD were reviewed to identify the ROC standards that govern existing natural gas-fired lean burn internal combustion engines.

Federal New Source Performance Standard (NSPS)

On July 11, 2006, USEPA adopted a NSPS for stationary compression ignition internal combustion engines (NSPS Subpart IIII). The NSPS does not address ROC emissions.

USEPA has adopted a NESHAPS standard for reciprocating internal combustion engines (NESHAPS subpart ZZZZ). This standard is intended to limit emissions of formaldehyde. When an oxidizing catalyst is utilized to meet the requirements of the NESHAP, CO control is used as a surrogate for formaldehyde emissions control, and CO emissions must be reduced by 70%. The NESHAPS does not address ROC emissions.

District Prohibitory Rules

Table 8.1E-4 summarizes published prohibitory rules for existing natural gas-fired lean burn internal combustion engines from the following agencies:

- BAAQMD;
- Sacramento Metropolitan Air Quality Management District (SMAQMD);
- San Diego County Air Pollution Control District (SDCAPCD);
- SJVAPCD; and
- SCAQMD.

Conclusion—BACT for ROC

BACT must be at least as stringent as the most stringent level achieved in practice, federal rule, or district prohibitory rule for a comparable class or category of source. The most stringent ROC level achieved in practice for a lean-burn spark-ignition engine fired on natural gas is 25 ppm, as listed in SJVAPCD BACT guidelines. While this level may be achievable for spark-ignited engines, the Wärtsilä engines use a pilot-ignition technology. According to the engine manufacturer, the lowest level that can be guaranteed for this engine is 28 ppm. Because 25 ppm is not technically feasible, but 28 ppm is, BACT for this project is 28 ppm. The HBRP facility will be designed to meet a ROC level of 28.0 ppmv @ 15% O_2 on a 3-hour average basis.

BACT for ROC for these engines while firing on fuel oil is the rate achievable by the engines utilizing the proposed controls for natural gas. The HBRP facility will be designed to meet a ROC level of 40 ppmv @ 15% O_2 on a 3-hour average basis while firing fuel oil.

BACT for ROC on startup and shutdown is the minimization of duration of startup and shutdown. Startup and shutdown will be limited to 30 minutes per event, and emissions will be limited to less than 10 lb/event.

BACT Analysis for PM_{10}

Identify All Control Technologies

There are three basic means of controlling PM_{10} emissions from internal combustion engines: fuel limitations, combustion controls, and post-combustion controls.

Combustion Controls

Minimization of non-gaseous fuels reduces particulate emissions. Reducing the sulfur content of fuels (liquid and gaseous) reduces particulate emissions.

Post-combustion controls

Diesel oxidation catalysts

Diesel particulate filters

Diesel particulate traps

Deleted: P

Electrostatic precipitators (ESPs)

Eliminate Technically Infeasible Options

The performance and technical feasibility of available PM_{10} control technologies are discussed in more detail below.

Post-Combustion Controls

Filters and ESPs can be used to remove fine soot from engine exhaust. Some filters work by physically filtering the particulate from the exhaust. Others work by trapping the particulate on a catalyst surface which causes the particulate to be fully oxidized.

Rank Remaining Control Technologies by Control Effectiveness

The remaining technically feasible control technologies are ranked by PM_{10} control effectiveness in Table 8.1E-7.

TABLE 8.1E-7
PM_{10} Control Alternatives

NOx Control Alternative	Available?	Technically Feasible?	PM_{10} reductions (@ 15% O_2)	Environmental Impact	Energy Impacts
Combustion controls	Yes	Yes		Optimized for NOx controls	Decreased Efficiency
Diesel oxidation catalysts	Yes	Yes	>30%	Highly effective in controlling CO and organic HAP emissions	Decreased Efficiency
Particulate traps/filters	No	No	50-90%		Decreased Efficiency

Oxidation Catalysts

Oxidation catalysts can be used to control emissions of diesel particulate matter (DPM) and other toxic compounds in diesel exhaust. Oxidation catalysts are most effective in reducing emissions of gaseous organics and organic aerosols, and are less effective in reducing emissions of solid (filterable) particulate matter.[4] Oxidation catalysts are sensitive to the sulfur level of the fuel; however, the use of CARB ultra-low sulfur diesel fuel (15 ppmw) results in an exhaust gas sulfur concentration comparable to the use of natural gas.[5] Oxidation catalysts typically reduce particulate matter emissions by approximately 20[6] to 35[7] percent. The HBRP engines will be equipped with oxidation

[4] The definition of DPM in the Air Toxic Control Measure for Stationary Compression Ignition Engines is based on filterable particulate matter.

[5] See SO_2 emissions calculations for natural gas firing and emergency diesel firing in Tables 8.1A-2 and 8.1A-3 of the HBRP AFC.

[6] USEPA, OTAQ, “Technical Highlights: Questions and Answers on Using a Diesel Oxidation Catalyst in Heavy-Duty Trucks and Buses,” EPA420-F-03-016, June 2003.

[7] Slide presentation on DOC performance presented by Engelhard to CARB in 2001.

Deleted: Manufacturers of Emission Control Technology (MECA) website, http://www.meca.org/page.ww?section=Emission+Control+Technology&name=Off-Road+Diesel +Equipment.

catalysts; however, no credit has been taken for the reductions in particulate emissions associated with these devices because of the uncertainty in the control efficiency for both filterable particulate matter and organic aerosols. This uncertainty is related to two factors: (1) variability in source test results, and (2) the low uncontrolled emission factors associated with the HBRP engines.

Diesel Particulate Filters

Diesel particulate filters collect particulate matter, trap the material on the filter surface, and oxidize the particulates at high temperatures. The high temperatures may be achieved using just the exhaust heat from the engine, or from a supplemental heating source, depending on the characteristics of the engine, the particulate loading, and the engine's duty cycle. Diesel particulate filters typically reduce DPM emissions by 85 percent or more.[8] There are no diesel particulate filters that have been used on engines as large as those proposed for HBRP.[9] In developing the Compression Ignition Engine New Source Performance Standard (CI NSPS), EPA concluded that DPFs were not feasible for engines with a displacement of greater than 30 liters per cylinder.[10] This conclusion is discussed in correspondence between EPA and its consultant for development of the NSPS:

> During the development of the proposed NSPS, EPA met with the Engine Manufacturers Association (EMA) and the European Association of Internal Combustion Engine Manufacturers (Euromot) to obtain information about stationary CI engines and discuss draft concepts for the NSPS. Both groups had concerns about potentially requiring larger size stationary CI engines to meet the standards for nonroad diesel engines. One concern raised by Euromot during the meeting was the inability of very large stationary CI engines to meet the EPA emission standards for nonroad diesel engines. According to Euromot, these engines cannot use the same emission control technologies as nonroad engines, for example diesel particulate filter and exhaust gas recirculation, due to their large size. These large engines tend to operate several thousands of hours per year and at constant speed and load as opposed to nonroad engines that normally operate for a few hundred hours per year and often at transient conditions. These large engines are not produced in mass quantities, and only a few may be installed in the U.S. per year. No engines of this size were found to be located in the continental U.S. For these reasons, EPA feels it is more appropriate to regulate the owners and operators of these engines and is not requiring manufacturers to certify these engines… The requirement of 60 percent PM control or more is based on the capabilities of an electrostatic precipitator (ESP).[11]

Comments submitted on the proposed NSPS by a consultant in Alaska suggested that DPMs were feasible for these largest engines. However, this commenter added:

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[8] Clean Air Fleets website, http://www.cleanairfleets.org/ect.html.

9 USEPA, OTAQ: "Summary and Analysis of Comments: Control of Emissions from Nonroad Diesel Engines, Comments by the Engine Manufacturers Association (EMA)." EPA420-R-04-008, May 2004.

[10] The HBRP engines have cylinders that displace 114 liters each.

[11] Memo from Bradley Nelson, Alpha-Gamma Technologies, Inc., to Jaime Pagán, EPA Energy Strategies Group, dated May 22, 2006.

> A currently available technology, particulate filter traps, is suited to these large units, although the particulate removal efficiency is less than 60 percent. However, it must be noted that particulate emissions will already be reduced considerably by the use of low and ultra-low sulfur diesel fuel.[12]

A literature search was performed to determine whether particulate filters were available for this type of application. The largest engine found using a diesel particulate filter was about 4,000 hp, while the HBRP engines are rated at nearly 21,500 hp.

Electrostatic Precipitators

CARB does not identify ESPs as a potential control technology for particulate emissions from diesel engines. However, as discussed above, this technology was considered and evaluated by EPA in development of the CI NSPS. EPA concluded that ESPs were feasible and cost-effective when applied to diesel engines using heavy fuel oils.[13] EPA did not reach the same conclusion with respect to light fuel oils, such as CARB ultra-low sulfur diesel. When applied to diesel engines using heavy fuel oils, ESPs have the potential to reduce particulate emissions by approximately 60 percent. There are no data available to estimate the control efficiency for ESPs for diesel engines using CARB ultra-low sulfur diesel or similar light fuel oils.

ESPs remove particulate matter that is in particle form at the exhaust gas temperature. As a result, the ESP has the potential to remove only the filterable fraction (in-stack) of the particles. In the case of the HBRP engines, the filterable fraction will be less than 0.11 grams per brake-horsepower hour (gm/bhp-hr), and less than 5.56 lbs/hr.[14]

ESPs work by using an electric charge to ionize particulate matter and attract the particles to a plate that is periodically cleaned. Thus, the efficiency of an ESP is directly related to the resistivity of the target particles.[15] For engines similar in size to those proposed for HBRP, dry ESPs have been demonstrated only for engines using high sulfur and ash fuels such as heavy fuel oil (HFO) and Orimulsion,[16] which generate particles having good resistivity characteristics.

The particles collected using an ESP are released to a hopper by physically rapping the ESP collection plates to loosen the particles so that they will fall due to gravity. This is done while the ESP is in the gas stream and the combustion source is operating. Without an ability to ensure particle agglomeration on the plates, it is likely that a substantial fraction of the collected fine particulate matter from diesel combustion in the HBRP engines would be reentrained during the rapping process, thus returning the collected particulate matter to the exhaust gas stream.

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[12] Comments by Alfred K. Bohn, PE Proposed Rulemaking - Docket Number OAR-2005-0029: New Source Performance Standards for Stationary Compression Ignition Internal Combustion Engines, September 7, 2005.

[13] US EPA "Summary and Analysis of Comments", May 2004. Op.cit.

[14] Wärtsilä performance data, personal communication.

[15] USEPA, OAQPS, "Lesson 3: ESP Design Parameters and Their Effects on Collection Efficiency," http://yosemite.epa.gov/oaqps/EOGtrain.nsf/fabbfcfe2fc93dac85256afe00483cc4/6a234c29e34af9fa85256b66004ebeae/$FILE/12bles3.pdf.

[16] Orimulsion is a fossil fuel produced from bitumen. It typically has a sulfur content of over 2.5% (wt). See http://www.sovereign-publications.com/bitumene.htm.

When used in the exhaust stream of gas-fired engines, an ESP could present a potential safety hazard by providing a source of ignition in situations where abnormally high concentrations of unburned gas are present in the exhaust system.[17]

Comments provided to EPA during the development of Subpart ZZZZ suggest that wet ESP technology would be effective in removing particulate matter from oil-fired combustion devices. Wet ESPs operate similarly to dry ESPs, except that instead of rapping the collector plates to remove the particles, the particles are washed from the collector walls by a spray of liquid.[18] Data presented by Hamon[19] suggests that for an oil-fired boiler, collection efficiencies of 79 to 95 percent may be achieved. However, the particulate emission rates for the oil-fired boiler are equivalent to inlet grain loadings of between 0.5 and 0.9 gr/scf, approximately twice as high as the exhaust particulate grain loadings for the HBRP engines.

Information provided by EPA on wet ESPs[20] lists the following considerations for their use:

- Temperature: Wet wire-plate ESPs are limited to operating at temperatures below the dew point of the exhaust gas (approximately 60°C or 140°F). Since the exhaust temperature of the Wärtsilä engines is expected to be on the order of 600 to 700°F, the engine exhaust would have to be cooled by 460 to 560°F before the exhaust gas could be passed through a wet ESP. This, in turn, would require the injection of approximately 53,000 scfm of ambient air (approximately 88 percent of the exhaust gas flow) into the exhaust of each engine, downstream of all of the catalyst systems. The electric load associated with this cooling would be significant, and would be in addition to the electric load required to ionize the particulate matter and charge the plates (discussed further below). The cooling air would also further dilute the particulate concentrations below the already-low levels expected, thus further reducing the expected control efficiency. The extremely low exhaust gas temperatures would reduce plume rise and decrease dispersion, thus reducing any potential benefits associated with reduced particulate emission rates.
- Water Use: Wet ESPs require a source of wash water to be injected or sprayed near the top of the collector plates. The wash system replaces the rapping mechanism used by dry ESPs. The water flows with the collected particles into a sump from which the fluid is pumped or drained. Although a portion of the fluid may be recycled to reduce the total amount of water required, this technology would create a new water use and wastewater disposal requirement for the project.
- Operating Conditions: ESPs in general are not well suited for use in processes which are highly variable because they are very sensitive to fluctuations in gas stream conditions (flow rates, temperatures, particulate and gas composition, and particulate loading). The Wärtsilä engines were selected for this project in part because of their ability to operate at any load and on either natural gas or diesel fuel, but these engine

[17] Wärtsilä, personal communication.

[18] EPA-CICA Fact Sheet, Wet Electrostatic Preciptator, Wire-Plate Type, downloaded from http://www.epa.gov/ttn/catc/dir1/fwespwpi.pdf.

[19] Mastropietro, Robert A. Hamon Research-Cottrell, Inc. "The Use of Treatment Time and Emissions Instead of SCA and Efficiency for Sizing Electrostatic Precipitators," August 29, 1997.

[20] EPA-CICA Fact Sheet, Wet Electrostatic Precipitator, op. cit.

characteristics would produce the variable load conditions for which ESPs are not well suited. Consequently, to ensure that exhaust gas stream variability does not interfere with ESP performance, it would also be necessary to install 10 separate ESPs. The space required for these installations would likely preclude the ability to group the stacks to enhance dispersion, thus adding to the poorer dispersion already expected as a result of the cooler plumes.

Finally, comments provided to EPA during the NSPS rulemaking proceeding indicated that an ESP would require approximately 10 percent of the power generated by the engine being controlled to ionize the particulate matter and charge the plates.[21] This could result in a situation where one of the 10 engines proposed for the HBRP project was operating on diesel fuel solely to power the ESPs when the other engines are operated on diesel fuel.

At the March 12 CEC workshop, reference was made to a description of an ESP used on a Wärtsilä diesel engine. The website reference is to the use of an ESP on a diesel engine fueled with a high ash fuel oil.[22] Wärtsilä estimates the post-treatment particulate emission rate at 50 mg/Nm^3 (dry, 15% O_2) or lower, using an ESP under these circumstances. This is equivalent to 0.03 gr/dscf at the nominal exhaust oxygen concentration of 13 percent for the HBRP engines during diesel firing. This is comparable to the level achieved by the HBRP engines using ultra-low sulfur diesel fuel without an ESP. This is also consistent with EPA's finding in the NSPS rulemaking for compression ignition engines, where the use of ultra-low sulfur fuel and engine modifications are presented as an alternative to the use of an ESP for particulate control.

> The final rule has been written considering the comments received and requires 60 percent PM reduction or an emission limit of 0.15 g/KW-hr (0.11 g/HP-hr). EPA believes the PM standard will be achievable through the use of lower sulfur fuel, on-engine controls, and aftertreatment. EPA believes that the PM percent reduction requirement is feasible through application of ESP.[23]

There is no evidence to suggest that the use of an ESP on the HBRP engines would achieve any significant reduction in particulates.

Fabric Filter Baghouses

Traditional fabric filter types are not designed to operate at the high flue gas temperatures of a reciprocating engine; maximum acceptable gas stream temperatures for fabric filter systems are on the order of 500°F.[24] Thus, the exhaust gas from the HBRP engines would need to be reduced by approximately 100°F to 200°F to enable the use of a fabric filter baghouse. This, in turn, would require the injection of approximately 19,000 scfm of ambient air (approximately 30 percent of the exhaust gas flow) into the exhaust of each engine, downstream of all of the catalyst systems. In addition to the electric load associated with this cooling, such a system would increase the size of the baghouse

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[21] Comments by Alfred K. Bohn, op. cit.

[22] http://www.wartsila.com/,en,solutions,0,generalcontent,E2B96D7E-8B0F-4B77-814E-173EBE0978DE,5D037227-09A5-4C00-93E3-06FF36D75F6F,,.htm.

[23] USEPA, Standards of Performance for Stationary Compression Ignition Internal Combustion Engines, Final Rule, 70FR39869.

[24] http://www.epa.gov/ttn/catc/dir1/cs6ch1.pdf.

required because of the larger gas flow requiring treatment, and would require the use of larger-diameter stacks (approximately 10 percent) to accommodate the higher flow rates. The cooling air would also further dilute the particulate concentrations below the already-low levels expected, thus further reducing the expected control efficiency. The lower exhaust gas temperatures and larger diameter stacks would reduce plume rise and decrease dispersion, thus reducing any potential benefits associated with reduced particulate emission rates.

Fabric filter systems generally result in an increased backpressure of 5" to 20" w.c.[25] Wärtsilä has indicated that any increase in backpressure will result in a derate to the engines' performance.[26] Consequently, an additional engine may be required to meet the project objective of providing 163 MW of capacity for HBRP. Fabric filter systems are most effective in high-dust environments; the filter cake that deposits on the filters enhances the collection efficiency. In contrast to many other types of emission control systems, the collection efficiency of fabric filters is at its lowest when the filters are new and clean, and collection efficiency is enhanced over time.[27]

Fabric filter baghouses remove particles that are in solid form at the exhaust gas temperature. As a result, particle fabric filters have the potential to remove only the filterable fraction (in-stack) of the particles.

Fabric filter systems are typically constant-output devices. Thus, once designed and installed, the outlet grain loading does not vary with changes in the inlet grain loading.[28] Typical inlet grain loadings in applications that use fabric filter systems are in the range of 0.5 to 10 grains per actual cubic foot. By comparison, the filterable particulate levels in the HBRP exhaust will be no higher than approximately 0.06 gr/acf, or more than 10 times lower than the typical inlet grain loadings for these systems.

There are no fabric filter control systems installed on any diesel engines of this size using light fuel oil.

Deleted: Particulate filters and traps are used only on reciprocating engines burning Diesel or heavy oil fuels. The expense of the controls is justified by the relatively high particulate loading in the exhaust and by the high toxicity of Diesel particulates. For engines firing other fuels, however, particulate filters and traps are not justified. The particulates that are formed are not nearly as toxic as Diesel particulate, and the quantity of particulate emitted by combustion of clean natural gas is much lower (0.02 gm/hp-hr) than the levels emitted by combustion of Diesel fuel (uncontrolled emissions of 0.7 gm/hp-hr and up). ¶
A literature search was performed to determine whether particulate filters or traps were available for this type of application. The largest engine found using a Diesel particulate filter was about 4,000 hp, while these engines are rated at nearly 21,500 hp. While electrostatic precipitator (ESP) particulate controls are in use on a Wärtsilä reciprocating engine power plant in Korea, this installation is fueled with heavy oil and thus has much higher exhaust particulate grain loadings that are more susceptible to control using ESP technology. Therefore particulate traps, filters, and ESPs are not considered to be available or technologically feasible for these reciprocating engines using limited quantities of ultra low sulfur CARB Diesel fuel and having extremely low exhaust particulate grain loadings.¶

Determination of BACT Emission Rates

A literature search was conducted to identify the current regulatory environment for control of lean burn internal combustion engines:

- Reviewed published BACT guidelines for natural gas-fired lean burn internal combustion engines;
- Reviewed recent BACT determinations for natural gas-fired lean burn internal combustion engines; and
- Reviewed published prohibitory rules for natural gas-fired lean burn internal combustion engines.

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[25] Ibid.

[26] Wärtsilä , personal communication.

[27] http://www.epa.gov/ttn/catc/dir1/ff-revar.pdf.

[28] Ibid.

Published BACT Guidelines

Published BACT guidelines from the following agencies were reviewed to identify relevant previously established BACT emission rates:

- Bay Area Air Quality Management District (BAAQMD);
- San Joaquin Valley Air Pollution Control District (SJVAPCD); and
- South Coast Air Quality Management District (SCAQMD).

The SJVAPCD's BACT guidelines contained a determination for natural gas-fired lean-burn internal combustion engines. The SJVAPCD concluded that a PM_{10} exhaust concentration of 0.02 g/bhp-hr constituted BACT that had been achieved in practice. Table 8.1E-2 summarizes published BACT guidelines for the three agencies.

Table 8.1E-3 summarizes published BACT guidelines for liquid fuel fired internal combustion engines. This table is included because BACT must be determined for the periods when liquid fuels are being fired (during engine testing and during natural gas curtailment).

Recent BACT Determinations

CARB's BACT Clearinghouse contains six determinations in the spark-ignited natural gas internal combustion engine category: two of these were for small engines (<200 bhp); two were for rich burn engines; and one burns field gas, not clean natural gas. The remaining determination is as follows:

- NEO California Power LLC in Tehama County (San Joaquin Valley AQMD). The facility utilizes 16 Wärtsilä 18V220SG engines (3870 hp) to power a 44 MW peaking power plant. The limits imposed were 9 ppm NOx, 56 ppm CO, 25 ppm ROC, 0.02 g/hp-hr PM_{10}. Compliance was demonstrated in 2001 and 2003.

EPA's BACT Clearinghouse has a number of determinations in the natural gas internal combustion category. The NEO California Power project (described above) had the second lowest emission rate listed. The facility with the lowest emission rate was for an engine using Clear Burn Engine Technology, which does not allow for liquid fuel firing.

Published Prohibitory Rules

Published prohibitory rules from USEPA, BAAQMD, SMAQMD, San Diego County Air Pollution Control District (SDCAPCD), SJVAPCD, and SCAQMD were reviewed to identify the PM_{10} standards that govern existing natural gas-fired lean burn engines.

Federal New Source Performance Standard (NSPS)

On July 11, 2006, USEPA adopted a NSPS for stationary compression ignition internal combustion engines (NSPS Subpart IIII). The Wärtsilä engines are subject to the NSPS if their annual Diesel fuel use exceeds 2% of their total fuel use on a heat input basis. The NSPS requires compression ignition engines in this size range (displacement in excess of 30 liters per cylinder) to reduce particulate emissions by 60% or to meet an exhaust emission level of 0.11 gm/bhp-hr. This limit applies only to filterable particulate, not total particulate (filterable plus condensable), so is not comparable to the total PM_{10} emission limit for which a BACT determination is being made. However, the HBRP engines will meet the NSPS limit when operated on Diesel fuel.

USEPA has adopted a NESHAPS standard for reciprocating internal combustion engines (NESHAPS subpart ZZZZ). The NESHAPS does not address the emissions of PM_{10}.

District Prohibitory Rules

Table 8.1E-4 summarizes published prohibitory rules for existing natural gas-fired lean burn internal combustion engines from the following agencies:

- BAAQMD;
- Sacramento Metropolitan Air Quality Management District (SMAQMD);
- San Diego County Air Pollution Control District (SDCAPCD);
- SJVAPCD; and
- SCAQMD.

CARB Air Toxics Control Measure (ATCM) for Diesel Engines

In 2003, the CARB adopted an ATCM to reduce diesel PM emissions from stationary diesel-fueled compression ignition engines.

The HBRP engines are compression ignited. As discussed in Section 8.1.5.2.2.2, however, the engines are exempt from the ATCM while firing natural gas fuel with pilot injection. They are subject to the ATCM during emergency backup Diesel firing, however. The ATCM standard for new emergency backup Diesel engines is 0.15 g/bhp-hr. This limit applies to the filterable portion of the PM_{10} emissions only, and therefore is not directly comparable to the proposed total (filterable plus condensable) PM_{10} limit of 10.8 lb/hr during emergency backup Diesel fuel firing. The HBRP engines will comply with the ATCM requirements during Diesel fuel firing.

Conclusion—BACT for PM_{10}

BACT must be at least as stringent as the most stringent level achieved in practice, federal rule, or district prohibitory rule. The most stringent PM_{10} level achieved in practice for a lean-burn spark-ignition engine fired on natural gas is 0.02 gram per bhp-hr (g/bhp), as listed in SJVAPCD BACT guidelines. The HBRP reciprocating engines use pilot ignition, not spark ignition, so the achieved in practice level is not for the same class of source and thus is not directly applicable. The HBRP engines will meet a PM_{10} limit that ranges from 0.07 g/bhp-hr at full load to 0.14 g/bhp-hr at minimum load while operating in natural gas mode.

BACT for PM_{10} for these engines while operating in diesel mode is the rate achievable by the engines utilizing the proposed controls for natural gas. The HBRP facility will be designed to meet a total PM_{10} level of 10.8 lb/hr across all engine loads and the filterable PM_{10} limit of 0.15 g/hp-hr level required by the ATCM. The applicant expects that the PM_{10} emissions during diesel mode operation will be lower than the levels guaranteed by the manufacturer, and has proposed to comply with a daily emission limit for all 10 engines that is 30% lower than the guaranteed emission rate.

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APPENDIX 8.1F

Cumulative Impacts Analysis for the HBRP

APPENDIX 8.1F

Cumulative Impacts Analysis for the HBRP

Cumulative air quality impacts from the HBRP and other reasonably foreseeable projects will be both regional and localized in nature. Regional air quality impacts are possible for pollutants such as ozone, which is formed through a photochemical process that can take hours to occur. Carbon monoxide, NOx, and SOx impacts are generally localized in the area in which they are emitted. PM_{10} can create a local air quality problem in the vicinity of its emission source, but can also be a regional issue when it is formed in the atmosphere from ROC, SOx, and NOx.

The cumulative impacts analysis considered the potential for both regional and localized impacts due to emissions from proposed operation of HBRP. Regional impacts were evaluated by comparing maximum daily and annual emissions from HBRP with emissions of ozone and PM_{10} precursors in both Humboldt County and the entire North Coast Unified AQMD. Localized impacts were evaluated by looking at other local sources of pollutants that are not included in the background air quality data to determine whether these sources in combination with HBRP would be expected to cause significant cumulative air quality impacts.

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Regional Impacts

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Regional impacts are evaluated by assessing HBRP's contribution to regional emissions. Although the relative importance of ROC and NOx emissions in ozone formation differs from region to region and from day to day, state law requires reductions in emissions of both precursors to reduce overall ozone levels. The change in the sum of emissions of these pollutants, equally weighted, provides a rough estimate of the impact of HBRP on regional ozone levels. Similarly, a comparison of the emissions of PM_{10} precursor emissions from HBRP with regional PM_{10} precursor emissions provides an estimate of the impact of HBRP on regional PM_{10} levels.

Under NCUAQMD regulations, HBRP will be required to provide offsets for increases in NOx, ROC, and PM_{10} emissions from the project at a 1.0 to 1 ratio. Therefore, emissions of ozone and PM_{10} precursors from the project will be fully mitigated. Regulatory offset requirements are calculated based on quarterly emissions, but the regional inventories are expressed in tons per day of emissions. Comparisons are shown on both a daily and annual basis.

The following tables summarize these comparisons; detailed calculations are shown in the attached tables. HBRP emissions are compared with regional emissions in 2008, as the project is expected to begin operation in 2008. Humboldt County and NCUAQMD emissions projections for 2008 were taken from the Air Resources Board's web-based emission inventory projection software, available at *www.arb.ca.gov/app/emsinv/emssumcat.php.*

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These comparisons show that the total ozone and PM_{10} precursor emissions reductions from the shutdown of the existing Humboldt Bay Power Plant generating equipment will be larger than the reasonably foreseeable potential emissions from HBRP. Therefore, HBRP will have an overall positive impact on regional ozone and PM_{10} formation.

Table 8.1F-1
Comparison of HBRP Emissions to Regional Precursor Emissions in 2008: Daily Basis

	Humboldt County	NCUAQMD
Ozone Precursors – Daily Basis		
Total Ozone Precursors, tons/day	49.9	67.9
Total HBRP Ozone Precursor Emissions, tons/day	5.66	
HBRP Ozone Precursor Emissions as Percent of Regional Total	11.3%	8.3%
Reductions from Shutdown of HBPP, tons/day	13.2	
HBRP Ozone Precursor Emissions after offsets, tons/day	(7.5)	
HBRP Ozone Precursor Emissions as Percent of Regional Total, after offsets	0.0%	0.0%
PM_{10} Precursors – Daily Basis		
Total PM_{10} Precursors, tons/day	80.9	129.8
Total HBRP PM_{10} Precursors, tons/day	7.0	
HBRP PM_{10} Precursors as Percent of Regional Total	8.6%	5.4%
Reductions from Shutdown of HBPP, tons/day	36.7	
HBRP PM_{10} Precursors after offsets, tons/day	0.0%	0.0%

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Table 8.1F-2
Comparison of HBRP Emissions to Regional Precursor Emissions in 2008: Annual Basis*

	Humboldt County	NCUAQMD
Ozone Precursors – Annual Basis		
Total Ozone Precursors, tons/year	18,227	24,773
Total HBRP Ozone Precursor Emissions, tons/year	363.2	
HBRP Ozone Precursor Emissions as Percent of Regional Total	2.0%	1.5%
Reductions from Shutdown of HBPP, tons/year	961.3	
HBRP Ozone Precursor Emissions after offsets, tons/year	-598.1	
PM_{10} Precursors – Annual Basis		
Total PM_{10} Precursors, tons/year	29,538	47,388
Total HBRP PM_{10} Precursor Emissions, tons/year	486.3	
HBRP PM_{10} Precursor Emissions as Percent of Regional Total	1.6%	1.0%
Reductions from Shutdown of HBPP, tons/year	1,018.7	
HBRP PM_{10} Precursor Emissions after offsets, tons/year	-532.3	

Note: * County and AQMD emissions calculated as 365 times daily emissions.

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Localized Impacts

To evaluate potential cumulative impacts of HBRP in combination with other projects in the area, projects within a radius of 6 miles (10 km) of the project were used for the cumulative impacts analysis.

Within this search area, three categories of projects with combustion sources were used as criteria for identification:

- Existing projects that have been in operation since at least 2005.
- Projects for which air pollution permits to construct have been issued and that began operation after 2005.
- Projects for which air pollution permits to construct have not been issued, but that are reasonably foreseeable.

Existing projects that have been in operation since at least 2005 will be reflected in the ambient air quality data that has been used to represent background concentrations; consequently, no further analysis of the emissions from this category of facilities will be performed. The cumulative impacts analysis adds the modeled impacts of selected facilities to the maximum measured background air quality levels, thus ensuring that these existing projects are taken into account.

Projects for which air pollution permits to construct have been issued but that were not operational in 2005 were identified through a request of permit records from the North Coast Unified AQMD. Projects that had a permit to construct issued after January 1, 2004, were included in the cumulative air quality impacts analysis. The January 1, 2004 date was selected based on the typical length of time a permit to construct is valid and typical project construction times, to ensure that projects that are not reflected in the 2005 ambient air quality data are included in the analysis. Projects for which the emissions change was smaller than 10 pounds per day were assumed to be *de minimis*, and were included in the dispersion modeling analysis.

A list of projects within the area for which air pollution permits to construct have not yet been issued, but that are reasonably foreseeable, was also requested from the NCUAPCD staff.

The District responded that there were no projects that met these criteria within 6 miles of the project site. Therefore, the actual emissions reductions from the shutdown of the Humboldt Bay Power Plant generating units and the potential to emit from the proposed new HBRP equipment were modeled to assess localized cumulative project impacts.

Short-term cumulative impacts from temporary simultaneous activities at HBRP were previously evaluated. These temporary simultaneous activities include the following:

- Construction of the new HBRP units while the existing Humboldt Bay Power Plant generating units are in use. The construction of the new units will occur while the existing plant is in operation. The assessment of localized cumulative impacts included ISCST3 and CTSCREEN modeling analyses of the combined impacts of the two activities (see Data Response 12).

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- Commissioning of the new HBRP units while the existing Humboldt Bay Power Plant generating units are in use. Because the Humboldt Bay Power Plant generating units must continue to operate until the new units have been brought online, commissioning of the new units will occur simultaneously with operation of the existing facility. The ambient air quality impacts of commissioning in combination with Humboldt Bay Power Plant operation was evaluated as part of the assessment of localized cumulative impacts (see Data Response 13).

- Although it is extremely speculative, the demolition of Units 1 and 2 at Humboldt Bay Power Plant could occur while the HBRP generating units are in operation. While there is no requirement that Units 1 and 2 be demolished as a condition of HBRP operation, there is a reasonably likelihood that demolition will take place sometime during the operational life of HBRP. As discussed in Data Response 77, planning the demolition of Units 1 and 2 has not reached the point at which it is possible to project average and maximum construction workforce levels or to schedule the time frame for demolition. This is because, as described in Data Response 77(a), Units 1 and 2 are classified as Class II areas, and therefore, their demolition will take place under the NRC's jurisdiction and in accordance with the MARSSIM. Therefore it is not possible to provide a detailed analysis of potential air quality impacts from the demolition of Units 1 and 2. However, in general, it is expected that air quality impacts during demolition of Units 1 and 2 would be similar to the air quality impacts from construction of the HBRP. A detailed analysis of cumulative impacts of construction of HBRP and operation of Humboldt Bay Power Plant (Data Response 12) showed that there was expected to be little or no overlap between the impacts of the two projects because of the nature of the activities. Based on the available information, we conclude that there would be little or no overlap between the impacts of the demolition project and the operation of the HBRP.

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APPENDIX 8.1G

Offsets and Interpollutant Offset Ratio Analysis

APPENDIX 8.1G

Offsets and Interpollutant Offset Ratio Analysis

Under District Rule 110 §5.2, HBRP must provide offsets that are at least equal to that portion of the potential to emit that exceeds 25 tons per year for PM_{10} and PM_{10} precursors. Most of the required offsets will be provided through the shutdown of the existing generating units at Humboldt Bay Power Plant. Table 8.1G-1 shows quarterly and annual proposed potential to emit from the new HBRP units and quarterly actual historical reductions from the existing Humboldt Bay Power Plant units that will be shut down following successful commissioning, startup testing, and commercial operation of HBRP.

TABLE 8.1G-1

Offsets Provided by the Shutdown of Existing Units at Humboldt Bay Power Plant[a]

Pollutant	Q1, tons	Q2, tons	Q3, tons	Q4, tons	Annual, tons
NOx					
Emissions Increase, New Units	42.7	43.1	44.2	44.2	174.3
Actual Historical Reduction, Shutdown of Existing Units	234.3	204.6	230.4	267.6	936.8
Net Increase (Reduction)	**(191.6)**	**(161.5)**	**(186.2)**	**(223.4)**	**(762.5)**
ROC					
Emissions Increase, New Units	46.6	47.1	47.6	47.6	188.9
Actual Historical Reduction, Shutdown of Existing Units	6.4	5.3	6.2	6.6	24.5
Net Increase (Reduction)	**40.2**	**41.8**	**41.4**	**41.0**	**164.4**
PM_{10}					
Emissions Increase, New Units	29.3	29.6	30.0	30.0	118.7
Actual Historical Reduction, Shutdown of Existing Units	5.9	6.6	8.1	6.7	27.4
Net Increase (Reduction)	**23.4**	**23.0**	**21.8**	**23.3**	**91.3**

Note:

a. HBRP SO_2 PTE is less than 25 tpy, so no offsets are required.

District Rule 110 §5.4 allows the APCO to approve interpollutant offsets on a case-by-case basis. HBRP proposes to use the excess NOx reductions from the shutdown of the Humboldt Bay Power Plant as offsets for ROC and PM_{10}. The ARB has determined that interpolllutant offset ratios of 1 ton of NOx for 1 ton of ROC and 3.58 tons of NOx for 1 ton of PM_{10} will provide equivalent air quality benefits as required under the NSR rules. HBRP has also purchased ERCs from a nearby source, Eel River Sawmill, that was recently shut down.

The required quarterly calculation of offsets is provided in Table 8.1G-2. This calculation demonstrates that more than sufficient offsets are being provided to achieve

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the no net increase and net air quality benefit provisions of the District NSR rule. The excess NOx reductions beyond those required to offset the HBRP emissions will be banked by PG&E to assist in creating a functional ERC transaction system in the District.

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Table 8.1G-2
HBRP
Calculation of Emission Reduction Credits
Rev March 07 to reflect 10/04 -- 9/06 baseline and higher NOx:PM10 ratic
Rev 08/08 to reflect new NG PM em limit

	Q1 (tons)	Q2 (tons)	Q3 (tons)	Q4 (tons)	Annual, tons	Exclusion, tons
NOx	90	91	92	92	365	
Project Emissions	42.7	43.1	44.2	44.2	174.3	25
Project Emissions Subject to Offset	36.8	37.2	37.6	37.6	149.3	
Onsite Reductions (Note 1)	*234.3*	*204.6*	*230.4*	*267.6*	*936.8*	
Offsite NOx ERCs (Note 2)	0.93	0.89	0.90	0.89	3.6	
Surplus NOx ERCs	*198.4*	*168.2*	*193.6*	*230.8*	*791.1*	
NOx ERCs for ROC	*-33.6*	*-35.2*	*-34.7*	*-34.3*	*-137.8*	
Net Surplus NOx ERCs	*164.8*	*133.1*	*158.9*	*196.5*	*653.3*	
NOx ERCs for PM10	*-55.6*	*-54.3*	*-49.8*	*-55.1*	*-214.9*	
Net Surplus NOx ERCs	***109.1***	***78.7***	***109.1***	***141.5***	***438.4***	
ROC						
Project Emissions	46.6	47.1	47.6	47.6	188.9	25
Project Emissions Subject to Offset	40.4	40.9	41.3	41.3	163.9	
Onsite Reductions (Note 1)	*6.4*	*5.3*	*6.2*	*6.6*	*24.5*	
Offsite ROC ERCs (Note 2)	0.41	0.39	0.39	0.39	1.6	
ROC Deficit	*-33.6*	*-35.2*	*-34.7*	*-34.3*	*-137.8*	
NOx for ROC at 1:1 (Note 3)	*33.6*	*35.2*	*34.7*	*34.3*	*137.8*	
Net ROC Deficit	0	0	0	0	0.0	
SOx						
Project Emissions	3.2	3.3	3.3	3.3	4.4	25
Project Emissions Subject to Offset	0.0	0.0	0.0	0.0	0.0	
Onsite Reductions (Note 1)	*0.5*	*0.9*	*27.7*	*0.8*	*30.0*	
Net Surplus SOx ERCs	***0.5***	***0.9***	***27.7***	***0.8***	***30.0***	
PM10						
Project Emissions	***29.3***	***29.6***	***30.0***	***30.0***	***118.7***	25
Project Emissions Subject to Offset	23.1	23.4	23.6	23.6	93.7	
Onsite Reductions (Note 1)	*5.9*	*6.6*	*8.1*	*6.7*	*27.4*	
Offsite PM10 ERCs (Note 2)	1.6	1.6	1.6	1.6	6.3	
PM10 Deficit	*-15.5*	*-15.2*	*-13.9*	*-15.4*	*-60.0*	
Surplus NOx ERCs Used for PM10 (Note 4)	*15.5*	*15.2*	*13.9*	*15.4*	*60.0*	
Net PM10 ERC Deficit	0.0	0.0	0.0	0.0	0.0	

Notes:

1. Distance ratio of 1:1 applies to onsite reductions from shutdown of Humboldt Bay Power Plant
2. Offsite ERCs purchased from Eel River Sawmills March 26, 2007; adjusted for distance ratio of 1.5:1.
3. See Attachment 8.1G-1.
4. NOx:PM10 offset ratio of 3.58 to 1 provided by ARB March 22, 2007.

Table 8.1G-3
HBRP
Calculation of Emission Reductions for CEQA
Rev 08/07

	Annual Emissions, tons
NOx	
Project Emissions	*174.3*
Onsite Reductions (Note 1)	*936.8*
Offsite NOx ERCs (Note 2)	5.4
Surplus NOx Reductions	*767.9*
NOx Reductions for ROC	*-162.0*
Net Surplus NOx Reductions	*605.9*
NOx Reductions for PM10	*293.0*
Net Surplus NOx Reductions	312.9
ROC	
Project Emissions	*188.9*
Onsite Reductions (Note 1)	*24.5*
Offsite ROC ERCs (Note 2)	2.4
ROC Deficit	*-162.0*
NOx for ROC at 1:1 (Note 3)	*162.0*
Net ROC Deficit	0.0
SOx	
Project Emissions	*4.4*
Onsite Reductions (Note 1)	*30.0*
Net Surplus SOx Reductions	*25.6*
PM10	
Project Emissions	***118.7***
Onsite Reductions (Note 1)	*27.4*
Offsite PM10 ERCs (Note 2)	9.5
PM10 Deficit	*-81.8*
NOx for PM10 at 3.58:1 (Note 4)	*81.8*
Net PM10 Deficit	0.0

Notes:
1. Onsite reductions from shutdown of Humboldt Bay Power Plant.
2. Offsite ERCs purchased from Eel River Sawmills March 26, 2007.
3. See offset ratio calculations in Attachment 8.1G-1.
4. Revised NOx for PM10 ratio provided by ARB March 22, 2007.

Attachment 8.1G-1

Interpollutant Offset Analysis

The objective of an emission offset requirement is to ensure that new projects will have a net air quality benefit in the region. The offset program seeks to achieve this by reducing emissions at one location to balance, or offset, an emission increase elsewhere.

The simplest case involves the generation of emission offsets by reductions from an existing source at, or near, the new source. When the pollutants are the same and the location is the same, the presence or absence of a net air quality benefit is relatively easy to determine: if the new emissions are less than the old emissions, a regional net air quality benefit is achieved.

When the location of the source of offsets is different from the source of new emissions, the areas impacted by the two sources differ. It is often impossible to demonstrate that the area impacted by the new source is benefited everywhere by the reductions from the existing source. Agencies usually address this by setting an offset ratio that takes distance into account. The amount of reductions required is higher than the emission increase, resulting in a net benefit to the region as a whole and to most locations in the impacted area as well. This approach is usually coupled with a requirement to conduct an impact analysis to ensure that no significant increases occur in those areas where the effect of the increase is greater than the benefit from the decrease.

The analysis becomes much more complicated when the proposed reduction is of a different pollutant than that emitted by the proposed new source. The principle is the same: a net air quality benefit must be demonstrated. However, when the offsetting pollutant is different than the new pollutant, the demonstration is not straightforward.

Although the statutory requirement is to show an overall net air quality benefit, the practice has been to apply this test on a pollutant-specific basis. The agencies have allowed the reduction of one pollutant to offset the increase of another pollutant only where the two pollutants can be related, generally because one pollutant is a precursor for the other, or both are precursors for a third pollutant.

The NCUAQMD is not in attainment with the state 24-hour standard for PM_{10}. The District's new source review rule requires offsets for most increases in emissions of PM_{10} and its precursors, which include NOx, SO_2, and ROC. PG&E will be required to provide offsets for the PM_{10}, NOx, and ROC emissions from HBRP. PG&E has ample NOx reductions from the shutdown of the Humboldt Bay Power Plant to use as offsets. However, it does not have sufficient ROC and PM_{10} offsets available to fully offset these pollutants with ROC and PM_{10} reductions.

NCUAQMD allows the use of interpollutant offsets, provided the project demonstrates a net air quality benefit and the impact analysis demonstrates that the project does not worsen or cause non-compliance with any ambient air quality standard.

HBRP proposes to meet the NOx offset requirements through provision of NOx reductions; the PM_{10} offset requirements mostly through interpollutant offsets of NOx reductions; and the ROC offset requirements mostly through interpollutant offsets of NOx reductions. The impact analysis requirement was addressed in Section 8.1.2.5.

This analysis provides a technical basis for determining that the proposed offset ratios for NOx to PM_{10} and NOx to ROC are sufficient to demonstrate a net air quality benefit.

Determining an Offset Ratio

Reductions of precursor pollutants as offsets for the pollutant being formed have been approved by other California air districts for other major projects. See Attachment 8.1G-1.1 for two examples of approved offset ratio calculations (SO_2 for PM_{10} and NOx for PM_{10}).

All examples of projects for which PM_{10} precursors have been accepted as offsets for PM_{10} emissions have based the offset ratio on the relative effect that the precursor emissions have on ambient PM_{10} levels versus directly-emitted PM_{10}. The health benefits due to reductions of ambient concentrations of NOx, SO_2, or ozone have not been considered.

The determination of an appropriate interpollutant offset ratio begins by determining the air quality impact (i.e., ground level concentration) due to directly emitted PM_{10} from sources similar to the new source in units of microgram/cubic meter per ton per year (tpy) emitted. The general methodology is to identify the portion of measured average PM_{10} levels that is attributed to direct PM_{10} emissions from combustion sources, and divide that concentration by the portion of the emission inventory that contributes to it. The result is the theoretical amount that the regional average PM_{10} concentrations would go up for every new ton of PM_{10} directly emitted by the source category.

Next, the same calculation is performed for the portion of ambient PM_{10} that is the result of secondary particulate formation from emissions of the pollutant providing the offsets. If the proposal is to provide NOx reductions to offset PM_{10} increases, the nitrate portion of the ambient PM_{10} levels is divided by the NOx inventory contributing to formation of those nitrates.

NOx for PM_{10}

The NOx to PM_{10} interpollutant offset ratio is the amount of NOx that would result in 1 $\mu g/m^3$ of ground-level PM_{10} divided by the amount of directly emitted PM_{10} that would result in 1 $\mu g/m^3$ of ground-level PM_{10}.

Ambient PM_{10} Measurements

The NCUAQMD and other jurisdictions recognize that ambient concentrations vary seasonally and require offsets to be provided on a quarterly basis. Recognizing that ambient particulate levels are higher in the winter than other seasons, some districts allow emission reductions from the winter season to be used to offset increases in other seasons, but not vice versa.

All of the criteria pollutants subject to offsets for this project are, or are precursors for, PM_{10} - a pollutant for which offsets are required because, on certain days, ambient levels exceed short-term ambient standards. The agency's goal is to reduce the pollutant levels on the worst days to below the ambient standards.

In determining whether interpollutant offsets provide a net air quality benefit, therefore, it is reasonable to give greatest consideration to the season of most concern, and set a single ratio based on the days when pollutant levels exceed the standards. This approach has been taken by the SJVAPCD in setting PM_{10} interpollutant offset ratios.

In Humboldt County, PM_{10} and $PM_{2.5}$ levels are highest during the late fall and winter. Colder, more stagnant conditions during this time of the year are conducive to the buildup of PM, including the formation of secondary ammonium nitrate. In addition, increased emissions from residential wood burning during this time of year contribute to higher direct particulate emissions.

Source Categories Included in the Inventory

The goal of the offset ratio analysis is to determine what the impact of directly emitted PM_{10} from the new source is, and to compare that with the impact of indirect PM_{10} from the source providing the offsets. Ideally, each source category would be defined as narrowly as possible—for example, individual types of combustion sources, such as power plants and automobiles, would be treated separately—so that the direct and indirect PM_{10} impacts would be related as closely as possible.

However, studies[29] that have quantified the contribution of source categories to measured ambient PM have not been able to make distinctions between similar sources. At present, the best that they can do is determine that a fraction comes directly from wood burning, another fraction comes directly from other combustion sources (automobiles, power plants, etc.), fractions form indirectly from nitrates and sulfates, a fraction comes from marine air, and the rest from various other sources.

Calculations

In order to determine the appropriate NOx to PM_{10} offset ratio for HBRP, the information listed in Table 1 was used.

The North Coast Air Basin is in attainment of the federal PM_{10} 24-hour standards, but exceeds the state standard. Annual average PM_{10} concentrations are well below the federal standard, but remain very close to the new state standard of 20 µg/m3.

Offsets are required for PM_{10} because the region has not attained the state 24-hour PM_{10} standard. As a result, this analysis uses the PM_{10} and nitrate data for the day with the highest monitored 24-hour average PM_{10} concentration. Ambient monitoring data from 2005 were used to coincide with the most current emissions inventory, which is the 2005 planning inventory. Because nitrate data are not available for the NCUAQMD, chemical mass balance data from the BAAQMD were used to characterize relative fractions of measured ambient PM_{10} and $PM_{2.5}$ coming from directly emitted PM_{10} and from nitrate on the days with the highest monitored concentrations. The ARB has indicated that, based on similarities between the North Coast Air Basin, the Bay Area, and San Joaquin regions, the percentage of PM_{10} that comes from secondary pollutants should be about

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[29] Chemical Mass Balance (CMB) modeling is a way of estimating how much various sources contribute to ambient PM_{10} concentrations. The CMB model uses a computer program whose inputs are source profiles and an ambient PM_{10} sample or samples which have been analyzed for a variety of chemical components. The CMB model finds the mix of sources whose combined amounts of chemical components best approximates those in the ambient sample. In other words, the output of the CMB model is estimates of the relative contributions from the various emissions sources that would result in the specific profile of chemical components that make up the PM_{10} in the ambient sample.

the same, at least on an annual basis.[30] This analysis assumes that this is also true on the worst-case day.

The CMB modeling for the Bay Area is based on $PM_{2.5}$, not PM_{10}. Because almost all PM emitted from combustion sources is $PM_{2.5}$, and because all secondary PM is $PM_{2.5}$, the CMB data can be used to estimate combustion and nitrate levels as a fractions of total $PM_{2.5}$. The worst-case $PM_{2.5}$ concentration for 2005 is listed in Table 1. Assuming that the $PM_{2.5}$ speciation is the same as for the Bay Area, 32% of the worst-case $PM_{2.5}$ comes from direct combustion sources (other than wood combustion), while 42% is secondary nitrate.

Emissions come from the North Coast Air Basin Planning Inventory for calendar year 2005. Directly emitted non-wood combustion PM comes from the following source categories: stationary source combustion, managed burning and disposal, cooking, and mobile direct emissions. The entire regional NOx emissions are used because nitrate forms without regard to the category from which NOx is emitted.

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[30] CARB Technical Report, “Characterization of Ambient PM_{10} and $PM_{2.5}$ in California,” June 2005

Table 1
DATA USED IN CALCULATING THE NOX TO PM_{10} OFFSET RATIO

Data	Value
Ambient PM_{10} concentration (max daily)[31]	71 μg/m^3
Ambient $PM_{2.5}$ concentration (max daily)	31.8 μg/m^3
Portion of PM_{10} concentration attributed to direct emission from stationary combustion sources[32]	10.2 μg/m^3
Directly emitted organic PM_{10} from combustion (North Coast Air Basin)[33]	17.4 tpd
PM_{10} impact from stationary combustion sources[34]	0.586 μg/m^3 per tpd
Nitrate portion of PM_{10} concentration [35]	13.4 μg/m^3
NOx emission inventory (North Coast Air Basin)[36]	58.04 tpd
Secondary PM_{10} impact from NOx emissions[37]	0.231 μg/m^3 per tpd
Tons of NOx to equal effect of 1 ton PM_{10}[38]	2.54

A more detailed description of the calculation procedure is provided in Appendix 8.1G-1.2. Based on this analysis, a reduction of 2.54 tons of NOx would provide the same impact on ambient PM_{10} levels as a reduction of 1.0 ton of PM_{10}, so an offset ratio of 2.54:1.0 will be proposed.

Based on a subsequent analysis performed by ARB staff, a NOx:PM_{10} ratio of 3.58 to 1 has been used in the final offset and mitigation calculations.

NOx for ROC

Another approach to mitigating project impacts through offsets is by reducing emissions of one precursor pollutant to offset increases of another precursor pollutant. Most of the examples have been NOx for ROC and vice versa, where both pollutants are precursors

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[31] CARB Air Quality Data (Top 4 Summary for Eureka-I Street Station). Data from 2005.

[32] Assumed stationary source combustion direct contribution to $PM_{2.5}$ same as BAAQMD (32%); assumed all combustion PM_{10} emitted as $PM_{2.5}$

[33] CARB website 2006 Almanac Data, PM_{10}, Projected Emission Inventory
North Coast Air Basin, 2005 inventory (winter); sum of stationary source combustion, managed burning and disposal, cooking, and mobile direct emissions

[34] Portion of PM_{10} attributed to direct emissions from stationary source combustion divided by stationary source PM_{10} emissions

[35] CARB summary of PM_{10} and $PM_{2.5}$ data for the North Coast Air Basin states that no nitrate or sulfate data are available. Based on similarities with Bay Area and San Joaquin, CARB estimates 30% of the annual $PM_{2.5}$ to be secondary sulfate and nitrate (on an annual basis). On the winter days when PM10 concentrations are highest, nitrate levels are much higher. Studies in the Bay Area, for example, reported nitrate portion of $PM_{2.5}$ on peak particulate days at 42%. Sulfate levels, on the other hand, do not appear to vary seasonally. The ultimate fate of NOx in the atmosphere is very complex and is greatly affected by sunlight and temperature.

[36] CARB website 2006 Almanac Data, Oxides of Nitrogen, Projected Emission Inventory North Coast Air Basin, 2005 inventory (winter)

[37] Nitrate concentration divided by NOx emissions

[38] Impact of directly emitted PM_{10} divided by impact of secondary PM_{10} from NOx: 0.586/0.231 = 2.54

for ozone formation. Note that in the present proposal, the same precursor pollutants are involved. However, they are considered here in their roles as precursors for PM_{10} formation.

Two approaches have been used to develop interpollutant offset ratios for NOx and ROC in their role as ozone precursors. The more rigorous approach considers the relative contribution that each pollutant makes to the formation of the secondary pollutant. This involves complex photochemical modeling. The offset ratio is the relative strength of the two pollutants as ozone precursors. In practice, the offset ratio is never less than 1 to 1.

The second approach is a simplified version of the first. In some regions the agencies have determined that the formation of ozone is limited by one or the other precursor. Under these conditions, offset of one precursor by the other can only go one way. The agency can determine, with certainty, that a reduction of one pollutant is always more beneficial than a reduction of the other pollutant. The agencies that allow interpollutant offsets will usually allow use of the more harmful pollutant as a source of offsets, again at a 1 to 1 ratio.

Neither approach is applicable here. The requirement for offsets for ROC is based on its being a precursor for PM_{10}, not ozone. The mechanism for formation of secondary PM_{10} from ROC does not involve reaction with NOx.

The proposed methodology for determining an offset ratio for NOx to ROC is, however, conceptually similar. Each pollutant will be evaluated for its impact on ambient PM_{10} levels, and the proposed offset ratio will be based on the relative strength of the pollutant as a PM_{10} precursor. Because of uncertainties in the calculations, an offset ratio of less than 1:1 will not be proposed.

The approach begins by determining the ambient PM_{10} impact due to directly emitted NOx from sources in the county (on average) in units of microgram/cubic meter per tpy. That calculation was laid out in the previous section.

Next, the same calculation is performed for the portion of ambient PM_{10} that is the result of secondary particulate formation from emission of ROC. The organic portion of the ambient PM_{10} levels attributable to secondary formation from ROC is divided by the ROC inventory contributing to formation of those particulates.

In order to determine the appropriate ROC to PM_{10} offset ratio, the following information is needed:

Table 2
NOX TO ROC OFFSET RATIO

Data	Value
Secondary PM_{10} impact from NOx emissions[39]	0.231 μg/m^3 per tpd
Secondary organic portion of PM_{10} concentration [40]	Less than 5.09 μg/m^3
ROC emission inventory (North Coast Air Basin)[41]	59.315 tpd
Secondary PM_{10} impact from ROC emissions[42]	Less than 0.086 μg/m^3 per tpd
Tons of NOx to equal effect of one ton ROC on PM_{10}43	Less than 0.37: 1

A detailed description of the calculation process is provided in Attachment 8.1G-1.3. Based on these calculations, a reduction of 0.37 tons of NOx would provide the same impact on ambient PM_{10} levels as a reduction of 1.0 ton of PM_{10}. However, because of the uncertainty inherent in these calculations an offset ratio of 1.0 to 1.0 is proposed.

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[39] See the calculations for NOx:PM_{10} offsets

[40] Secondary organic aerosols may constitute up to 16% of $PM_{2.5}$ (Characterization of Ambient PM_{10} and $PM_{2.5}$ in California, CARB). PM2.5 concentration = 31.8 μg/m^3

[41] CARB website 2005 inventory

[42] Divide secondary organic PM_{10} by ROC emissions

[43] Divide impact of impact of secondary PM_{10} from ROC by impact of secondary PM_{10} from NOx: 0.086/0.231 = 0.37

Attachment 8.1G-1.1

Examples of Interpollutant Offset Ratio Calculations Accepted by SJVAPCD, EPA, and CEC

Example 1: Modesto Irrigation District (SJVACPD, 2003)

SOx for PM_{10}

Ratio proposed: 1.0:1.0

Rationale:

1. Annual average nitrate, sulfate, chloride, and total PM_{10} ambient air measurements used to partially speciate the PM_{10}
2. Unspeciated PM_{10} split between direct-combustion-related PM_{10} (fuel combustion and mobile sources) and other direct PM_{10} sources
    a. Direct-combustion-related PM_{10} based on Chemical Mass Balance modeling performed for the District's PM_{10} attainment demonstration plan (24-hour models)
3. Annual average direct-combustion PM_{10} concentration is divided by total annual direct-combustion PM_{10} emissions from district-wide inventory
4. Annual average sulfate concentration is divided by total annual SO_2 emissions from district-wide inventory
5. Ratio of (3) to (4) represents the amount of SO_2 reductions needed to have equivalent impact on PM_{10} concentrations as reducing 1 TPY of directly emitted combustion PM_{10}.

Example 2: Pastoria Energy Facility (SJVAPCD, 2005)

NOx for PM_{10}

Ratio proposed: 2.16:1

1. Direct-combustion-related PM_{10} based on Chemical Mass Balance modeling performed for the District's PM_{10} attainment demonstration plan (24-hour models)
2. Annual average direct-combustion PM_{10} concentration (attributed to industry) is divided by total annual direct-combustion PM_{10} emissions (from industry) from district-wide inventory
3. Annual average nitrate concentration (attributed to local [county] sources) is divided by total annual NOx emissions from countywide inventory
4. Ratio of (2) to (3) represents the amount of NO_2 reductions needed to have an equivalent impact on PM_{10} concentrations as reducing 1 TPY of directly emitted combustion PM_{10}

Attachment 8.1G-1.2

Detailed Description of NOx to PM_{10} Offset Ratio Methodology

Step 1: Actual worst day average nitrate, sulfate, chloride, and PM_{10} ambient air measurements are used to partially speciate the PM_{10}. Missing data is filled in by appropriate gap-filling. In this case, the highest PM_{10} day in 2005 was used.

Step 2: The unspeciated balance of PM_{10} (after subtracting the ammonium sulfate, ammonium nitrate, and ammonium chloride from the total PM_{10}) is split between direct-combustion-related PM_{10} (fuel combustion and mobile sources) and other direct PM_{10} sources. The contribution from direct-combustion can be based on Chemical Mass Balance (CMB) modeling performed for a District's PM_{10} Attainment Demonstration Plan, if available.

Step 3: The region's direct-combustion emissions are obtained from the regional emission inventory. In this case, the winter inventory for planning year 2005 was used.

Step 4: The peak daily average PM_{10} concentration due to direct-combustion sources and the peak daily average nitrate concentration for calendar year 2005 are adjusted (downward) to account for the contribution due to pollution transport. Because the goal is to determine what effect local sources have on regional PM_{10} concentrations, the impact from outside sources must be excluded. In this case, the region is assumed to be upwind of the other districts. No adjustments were made for transport of NOx or PM_{10} for this analysis.

Step 5: The direct PM_{10} impact (in units of $\mu g/m^3$ per ton/day) from local combustion sources is calculated by dividing the adjusted direct-combustion-related PM_{10} concentration by the direct-combustion regional PM_{10} emissions. The secondary impact from NOx emissions is calculated by dividing the adjusted nitrate concentration by all regional NOx emissions.

Step 6: The NOx to PM_{10} ratio is determined by dividing the NOx impact by the direct PM_{10} impact.

Appendix 8.1G-1.3

Detailed Description of NOx to ROG Offset Ratio Methodology

Step 1: Actual worst day average nitrate, sulfate, chloride, and PM_{10} ambient air measurements are used to partially speciate the PM_{10}. Missing data is filled in by appropriate gap-filling. The portion of organic PM_{10} that is due to secondary particulate formation is estimated. In this case, the highest PM_{10} day in 2005 was used.

Step 2: The unspeciated balance of PM_{10} (after subtracting the ammonium sulfate, ammonium nitrate, and ammonium chloride from the total PM_{10}) is split between direct-combustion-related PM_{10} (fuel combustion and mobile sources) and other direct PM_{10} sources. The contribution from direct-combustion can be based on Chemical Mass Balance (CMB) modeling performed for a district's PM_{10} Attainment Demonstration Plan, if available.

Step 3: The region's direct-combustion emissions are obtained from the regional emission inventory. In this case, the winter inventory for planning year 2005 was used.

Step 4: The peak daily average PM_{10} concentration due to direct-combustion sources and the peak daily average secondary organic PM_{10} concentration for calendar year 2005 are adjusted (downward) to account for the contribution due to pollution transport. Because the goal is to determine what effect local sources have on regional PM_{10} concentrations, the impact from outside sources must be excluded. In this case, the region is assumed to be upwind of the other districts. No adjustments were made for transport of NOx or PM_{10} for this analysis.

Step 5: The direct PM_{10} impact (in units of $\mu g/m^3$ per ton/day) from local combustion sources is calculated by dividing the adjusted direct-combustion-related PM_{10} concentration by the direct-combustion regional PM_{10} emissions. The secondary impact from ROG emissions is calculated by dividing the adjusted nitrate concentration by all regional ROG emissions.

Step 6: The ROG:PM_{10} ratio is determined by dividing the ROG impact by the direct PM_{10} impact.

Step 7: The NOx:ROG ratio is determined by dividing the ROG impact by the NOx impact.