

## **Appendix E3**

**Health Impact Analysis for the San Francisco Bay Area and the  
Communities Near the Ports of Los Angeles and Long Beach**

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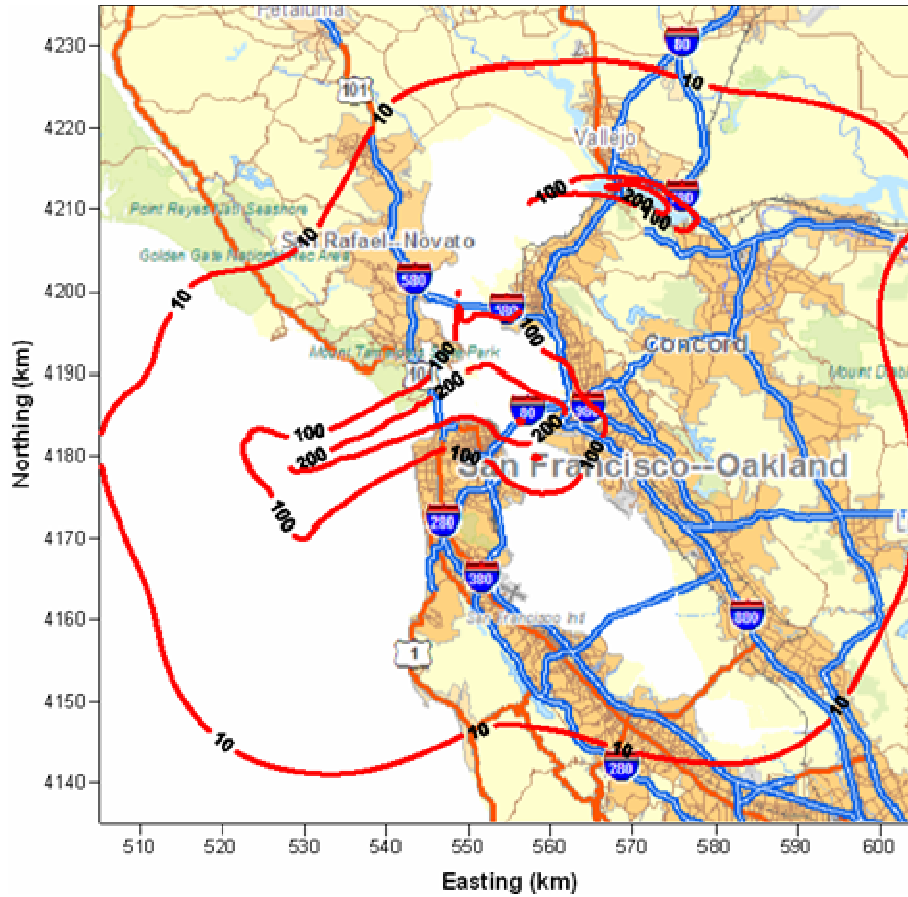
## **Health Impact Analysis for the San Francisco Bay Area and the Communities Near the Ports of Los Angeles and Long Beach**

In this appendix we provide estimates of the cancer and noncancer health impacts due to the emissions of diesel PM and PM from ocean-going vessels (OGV). These analyses were performed using the data generated from the “Diesel Particulate Matter Exposure Assessment Study for the Ports of Los Angeles and Long Beach” Final Report dated April 2006 (ARB, 2006) and the draft “Diesel Particulate Matter Health Risk Assessment for the West Oakland Community Preliminary Summary of Results” dated March 19, 2008 (ARB, 2008). Both of these studies can be found at <http://www.arb.ca.gov/ports/ports.htm>.

### Potential Cancer Risk in the San Francisco Bay Area

Emissions from OGVs result in significant health risk impacts in the San Francisco Bay Area. Figure E3-1 shows the potential cancer risk isopleths for diesel PM emissions from OGVs in the San Francisco Bay area. As shown in Figure E3-1, the area in which the potential cancer risks are predicted to exceed 100 chances in a million is estimated to encompass about 31,000 acres having a population of 421,000. For risk levels over 200 chances in a million, the impacted areas encompass about 3,800 acres where about 16,500 people live. Overall, about 63 percent of the effective modeling domain (excluding the port property and the ocean/water area) has an estimated risk level of over 10 in a million and about 83 percent of the 5 million people who live in the modeling domain are exposed to potential cancer risk levels of 10 chances in a million or greater (see Table E3-1).

**Figure E3-1: Estimated Potential Cancer Risk from OGV Diesel PM Emissions in the San Francisco Bay Area (chances in a million)**



**Table E3-1: Summary of Area Impacted and Population Affected by Cancer Risk Levels in the San Francisco Bay Area**

Cancer Risk Level	Acres Impacted	Population Affected
Risk > 200	3,800	16,500
Risk > 100	31,000	421,000
Risk > 10	984,000	4,015,000

Notes: Risk is expressed as chances per million over 70 year lifetime. The effective inland area is 1,564,000 acres. The total population within the modeling domain is 5 million.

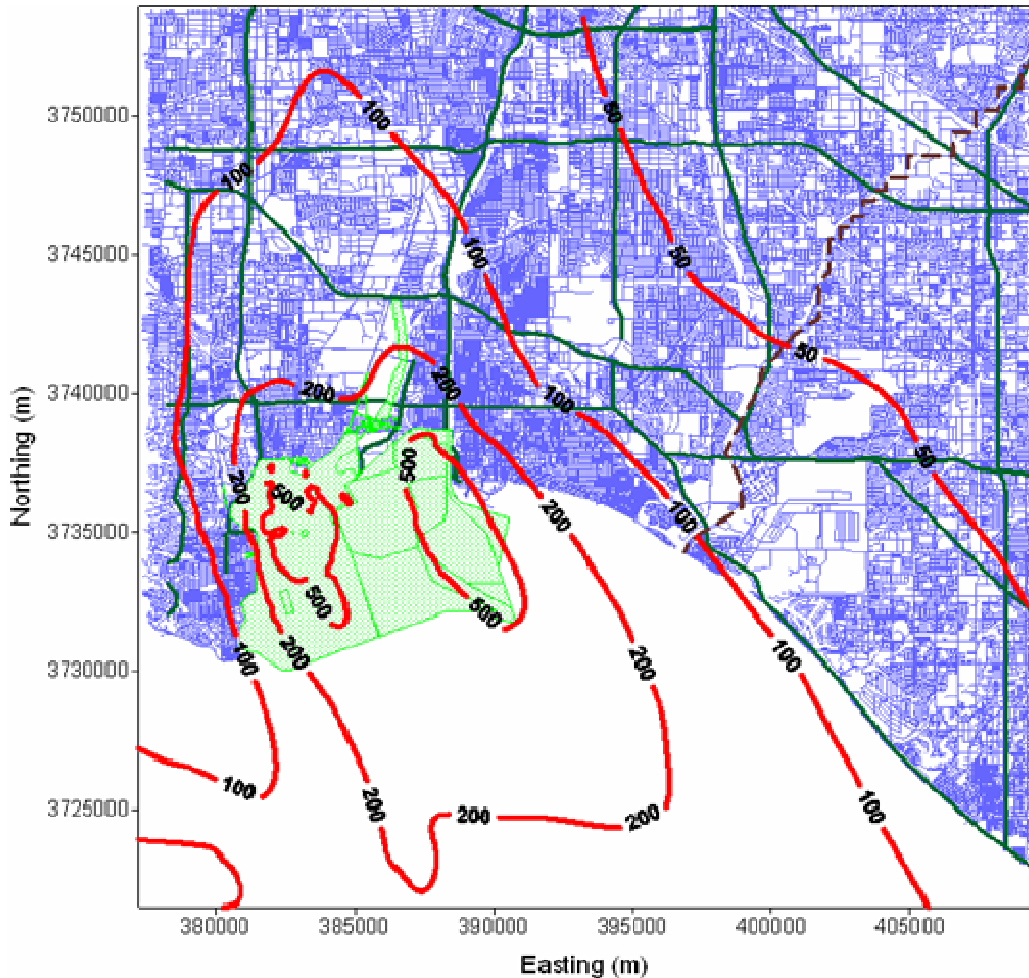
Potential Cancer Risk at the Ports of Los Angeles and Long Beach

Emissions from OGVs also result in significant health risk impacts on nearby residential areas around the Ports of Los Angeles and Long Beach. Figure E3-2 shows the potential cancer risk isopleths for diesel PM emissions from OGVs at the Ports of Los Angeles and Long Beach superimposed on a map that covers

the ports and the nearby communities. As shown in Figure E3-2, the area in which the cancer risks are predicted to exceed 100 chances in a million has been estimated to be about 44,000 acres with a population of 525,000. For the risk level of over 200 chances in a million, the impacted areas have been estimated to be about 12,000 acres and about 105,000 people living around the ports who are exposed to the risk level. Overall, about 100 percent of the effective modeling domain (excluding the port property and the surrounding ocean area) has an estimated cancer risk level of over 10 in a million and about all of the 2 million people who are living in the domain are exposed to this risk level (see Table E3-2).

The population numbers within the isopleth boundaries were estimated using the U.S. Census Bureau's year 2000 census data. The acres impacted and population affected for the risk ranges of greater than 10, 100, 200, and 500 in a million are presented in Table E3-2. As shown in Table E3-2, about 2 million people living in the area around the ports have a predicted cancer risk of greater than 25 in a million due to OGV emissions (data not shown). Note that the size of the modeling domain was limited by the technical capabilities of the model. However it is clear that a significant number of people outside the modeling domain area are exposed to risks greater than 10 in a million.

**Figure E3-2: Estimated Potential Cancer Risk from OGV Diesel PM Emissions at the Ports of Los Angeles and Long Beach (chances in a million)**



**Table E3-2: Summary of Area Impacted and Population Affected by Cancer Risk Levels in Areas Near the Ports of Los Angeles and Long Beach**

<b>Cancer Risk Level</b>	<b>Acres Impacted</b>	<b>Population Affected</b>
Risk > 200	12,000	105,000
Risk > 100	44,000	525,000
Risk > 10	163,435	2,000,000

Notes: Risk is expressed as chances per million over 70 year lifetime. The effective modeling domain is the land area outside of port property - about 255 square miles or 163,435 acres. The total population within the domain is about 2 million.

## Non-cancer Health Impacts in the San Francisco Bay Area and at the Ports of Los Angeles and Long Beach

We also estimated non-cancer health impacts for directly emitted diesel PM in the San Francisco Bay area and at the Ports of Los Angeles and Long Beach using the same methodology described in the Staff Report.

For directly emitted diesel PM from OGV activities in the San Francisco Bay area, we estimated the following non-cancer health impacts:

- 35 premature deaths (10 – 60, 95% confidence interval (CI))
- 500 cases of asthma-related and other lower respiratory symptoms (190 – 800, 95% CI)
- 5,000 work loss days (4,000 – 5,500, 95% CI)
- 29,000 minor restricted activity days (22,800 – 33,600, 95% CI)

For directly emitted diesel PM from OGV activities at the Ports of Los Angeles and Long Beach, we estimated the following non-cancer health impacts:

- 31 premature deaths (16 – 48, 95% CI)
- 830 cases of asthma-related and other lower respiratory symptoms (200 – 1,500, 95% CI)
- 7,300 work loss days (6,100 – 8,400, 95% CI)
- 38,500 minor restricted activity days (31,400 – 45,600, 95% CI)

Note that these estimated values for each study may not be comparable to each other because of their different air dispersion models used to estimate ambient PM levels, the modeling domain, emission inventories, population density, meteorological conditions, and other factors. For example, the estimates for the Ports of Los Angeles and Long Beach were limited to a relatively small domain of 20 mi x 20 mi having a population of about 2 million in the Southern California, while the domain for the San Francisco Bay area study was about 60 mi x 60 mi with the population of about 5 million people.

In addition, in May 2008 ARB released a draft methodology for estimating premature deaths associated with long-term exposures to fine airborne particulate matter in California that proposes increasing the relative risk factor from 6% to 10% increase in premature death per 10  $\mu\text{g}/\text{m}^3$  increase in PM<sub>2.5</sub> exposures (ARB, 2008). The methodology is out for public review and, if approved, the estimated premature deaths presented above would be increased by approximately 67%.

Several key assumptions were used in our estimation. They involve the selection and applicability of the concentration-response functions to California data, exposure estimation, subpopulation estimation, and baseline incidence rates. These are briefly described below.

- The CARB staff assumed the model-predicted exposure estimates could be applied to the entire population within each modeling grid. That is, the entire population within each modeling grid was assumed to be exposed uniformly to modeled concentration. This assumption is typical of this type of estimation.
- The CARB staff assumed the baseline incidence rates were uniform across each modeling grid and in many cases across each county. This assumption is consistent with methods used by the U.S. EPA for its regulatory impact assessment. The incidence rates match those used by U.S. EPA.

## REFERENCES

(ARB, 2006) State of California, Air Resources Board, Diesel Particulate Matter Exposure Assessment Study for the Ports of Los Angeles and Long Beach, April 2006

<http://www.arb.ca.gov/regact/marine2005/portstudy0406.pdf>

(ARB, 2008) State of California, Air Resources Board, Diesel Particulate Matter Health Risk Assessment for the West Oakland Community (Draft), Preliminary Summary of Results, March 2008

<http://www.arb.ca.gov/ch/communities/ra/westoakland/documents/draftsummary031908.pdf>