APPENDIX C

Additional Potential Cancer Risk Isopleths and Data Summaries for Port Operations (Part I), UP Oakland Railyard (Part II), and Non-Port/Non-UP Activity (Part III)

This page is intentionally blank.

TABLE OF CONTENTS

Appendix C: Additional Potential Cancer Risk Isopleths for Port Operations (Part I), UP Oakland Railyard (Part II), and Non-Port/Non-UP Activity (Part III)

List of Tables **Page**

List of Tables (cont.) **Page**

List of Figures **Page**

List of Figures (cont.) **Page**

INTRODUCTION

This appendix provides additional potential cancer risk isopleths and associated summary tables by part (Part I, II, & III) and by source category for the West Oakland community. Also provided, are additional isopleths and summary tables for Part I (Port) source category impacts on the regional domain. As stated in the main report, the West Oakland community is bounded by the Port of Oakland, UP rail yard, and the I580, I880, and I-980 freeways. The community is approximately about 1,800 acres (or about 3 squared miles) and about 22,000 people reside in the community. The regional modeling domain (100 km x 100 km) covers an effective land area (excluding the Port property and the over water region) of about 6,500 square kilometers. The population within this modeling domain is about 5 million based on the U.S. Census Bureau's year 2000 census data. The risk numbers, impacted areas, and affected population presented below are based on the effective land area within the modeling domain; that is, the risk levels for areas within the port property and over-/water surfaces are excluded from this analysis. Note that if the modeling domain expands, the risks, impacted areas, and affected population presented in this analysis would be changed.

C.1 West Oakland Community Potential Cancer Risks from Port Operations (Part I)

In this section, we provide the potential cancer risk isopleths and summary tables for the Port-related impacts on the West Oakland community. The following is a summary, in order of presentation, of the information included in this section:

- Isopleths showing the potential cancer risks resulting in the West Oakland community from exposures to Port diesel PM emissions – all activities and sources. (Figure C-1)
- A bar chart that shows the population-weighted potential cancer risks by category from Port operations. (Figure C-2)
- Summary tables that present the impacted area and affected population in the West Oakland community by different risk levels for each category. (Tables C-1 and C-2)
- Isopleths showing the potential cancer risks resulting in the West Oakland community due to exposures to the diesel PM emissions from the different Port (Part I) source categories (Figure C-3 to C-8)

Figure C-1: Estimated West Oakland Community Potential Cancer Risk Due to All Port (Part I) Diesel PM Emissions Sources (2005)

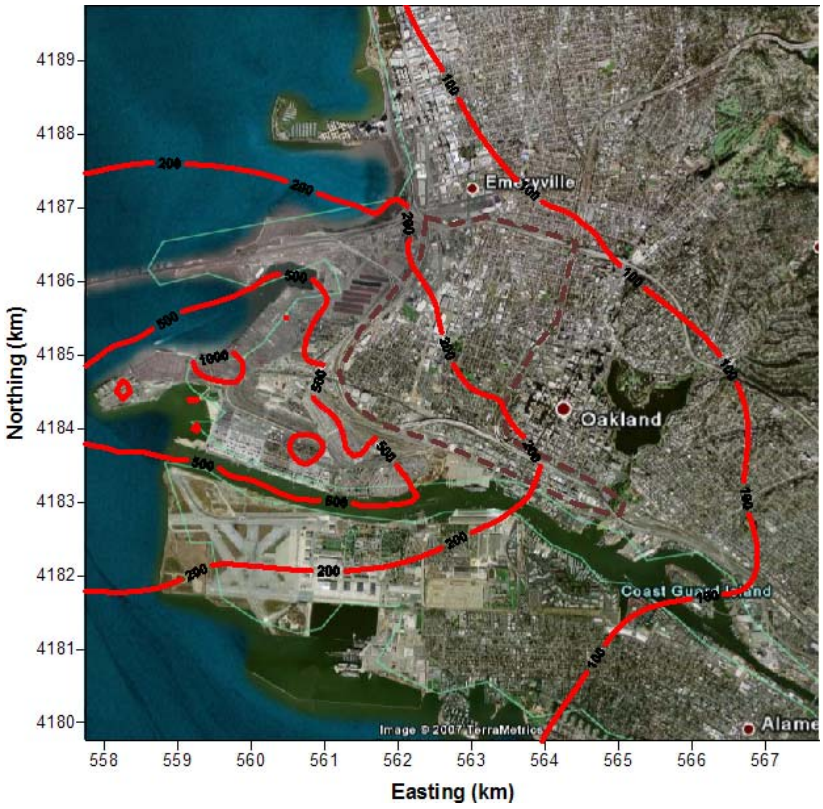


Figure C-2: Population-weighted Potential Cancer Risks in the West Oakland Community by Category for Port (Part I) Activities (2005)

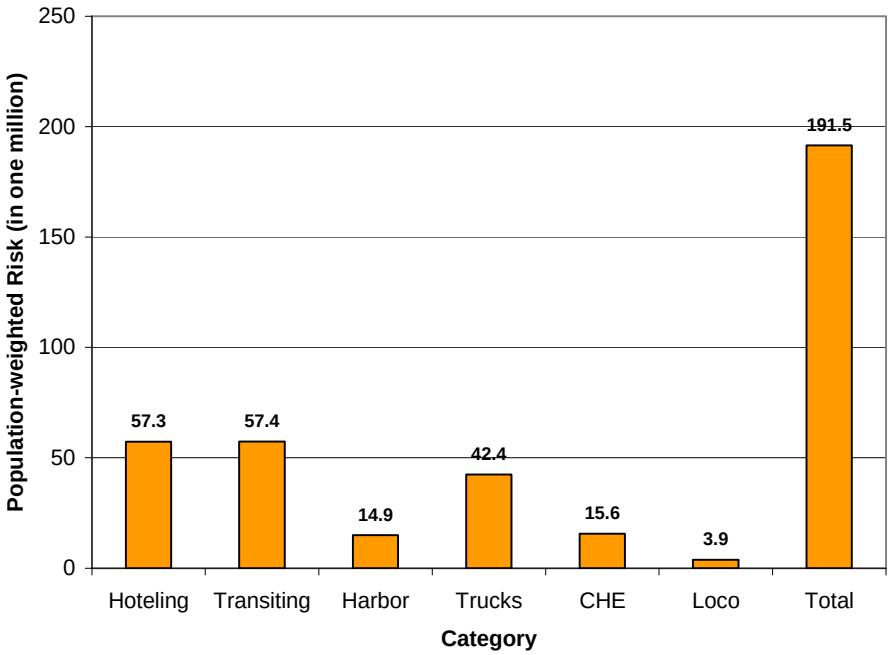


Table C-1: Impacted Area (Acres) in West Oakland Community by Potential Cancer Risk Levels and by Category from Port (Part I) Activities

Risk Level	OGV	HOTEL	HARBOR	TRUCK	LOCO	CHE	COMBINED
Risk > 1000	0	0	0	0	0	0	0
Risk > 500	0	0	0	0	0	0	0
Risk > 200	0	0	0	0	0	0	770
Risk > 100	0	0	0	30	0	0	1,800
Risk > 10	1,800	1,800	1,700	1,800	140	1,600	1,800

Note: OGV = transiting + maneuvering; total area for West Oakland community = 1,800 acres.

Table C-2: Affected Population in West Oakland Community by Potential Cancer Risk Levels and by Category from Port (Part-I) Activities

Risk Level	OGV	HOTEL	HARBOR	TRUCK	LOCO	CHE	COMBINED
Risk > 1000	0	0	0	0	0	0	0
Risk > 500	0	0	0	0	0	0	0
Risk > 200	0	0	0	0	0	0	7,000
Risk > 100	0	0	0	20	0	0	22,200
Risk > 10	22,200	22,200	19,600	22,200	1,500	18,000	22,200

Note: OGV = transiting + maneuvering; total population for West Oakland community = 22,200

Figure C-3: Estimated West Oakland Community Potential Cancer Risk Due to Port (Part I) OGV Transiting, Anchorage, and Maneuvering Diesel PM Emissions (2005)

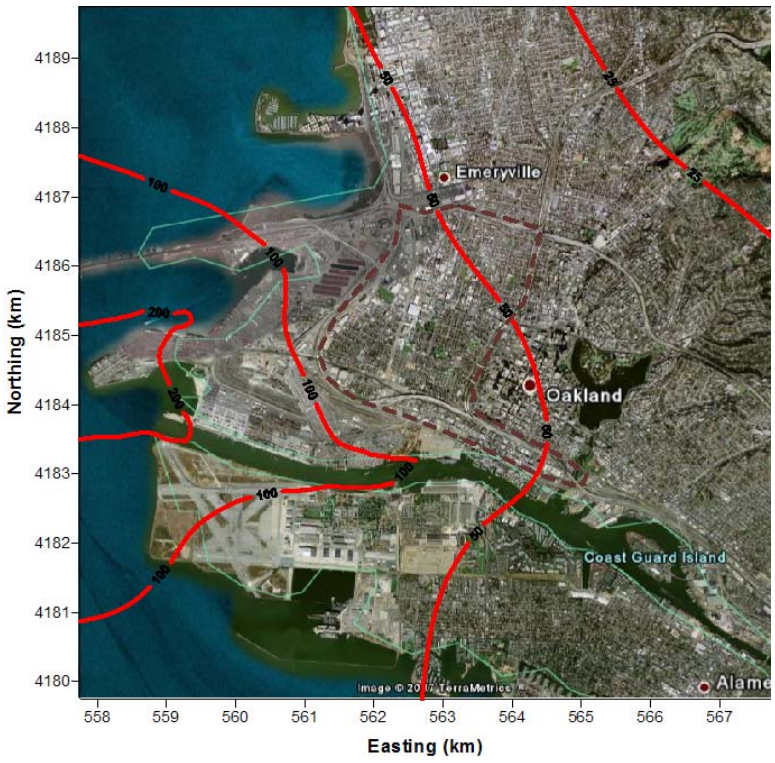


Figure C-4: Estimated West Oakland Community Potential Cancer Risk Due to Port (Part I) OGV Hotelling Diesel PM Emissions (2005)

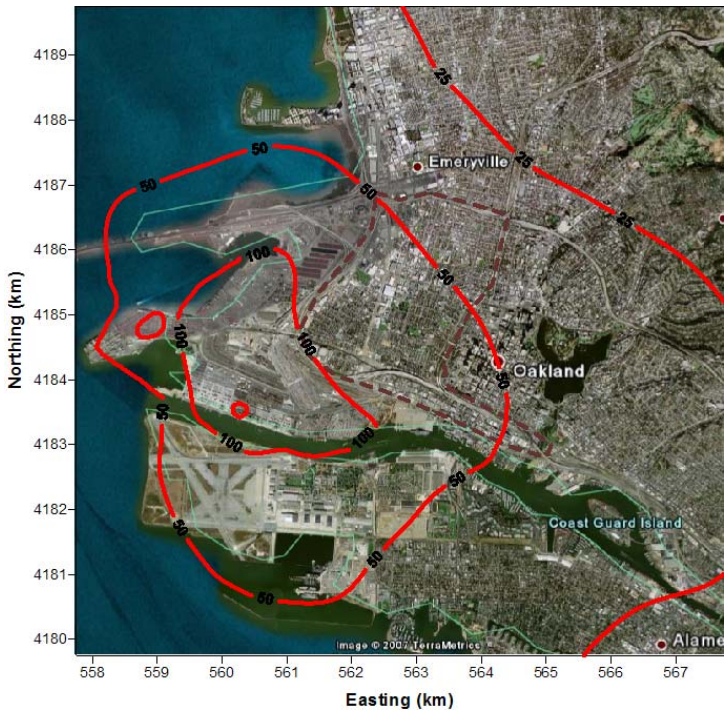


Figure C-5: Estimated West Oakland Community Potential Cancer Risk Due to Port (Part I) Commercial Harbor Craft Diesel PM Emissions (2005)

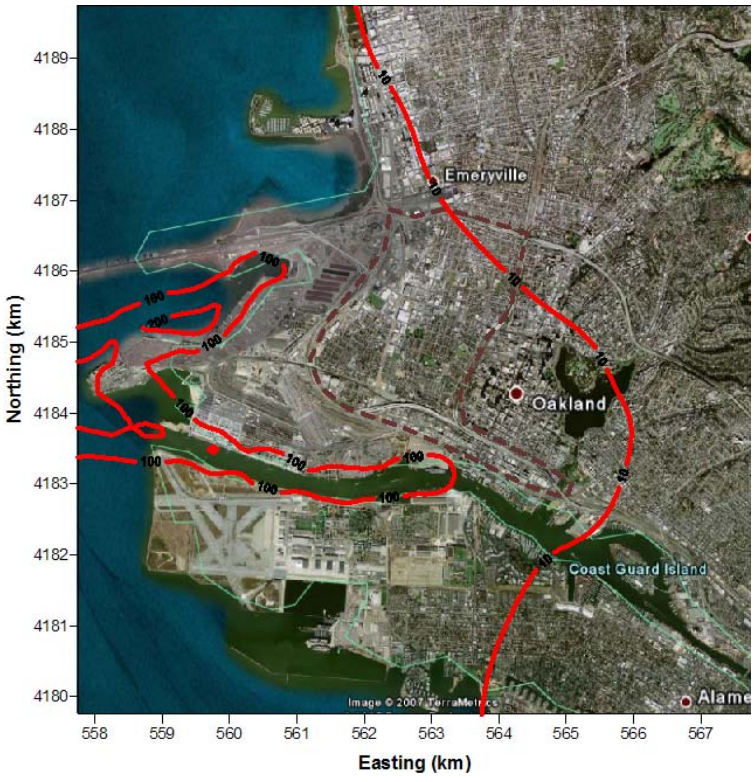


Figure C-6: Estimated West Oakland Community Potential Cancer Risk Due to Port (Part I) Cargo Handling Equipment Diesel PM Emissions (2005)

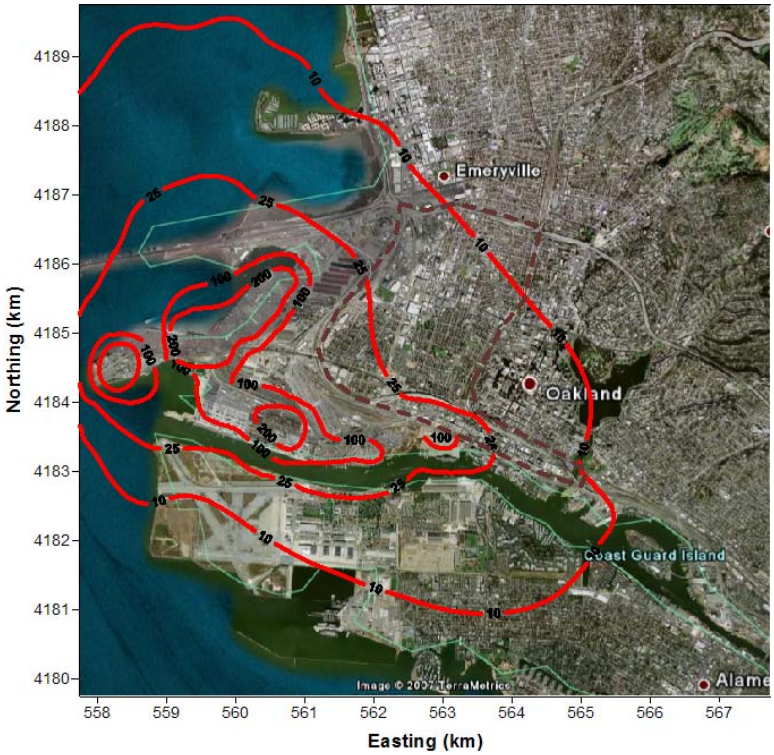


Figure C-7: Estimated West Oakland Community Potential Cancer Risk Due to Port (Part I) Locomotive Diesel PM Emissions (2005)

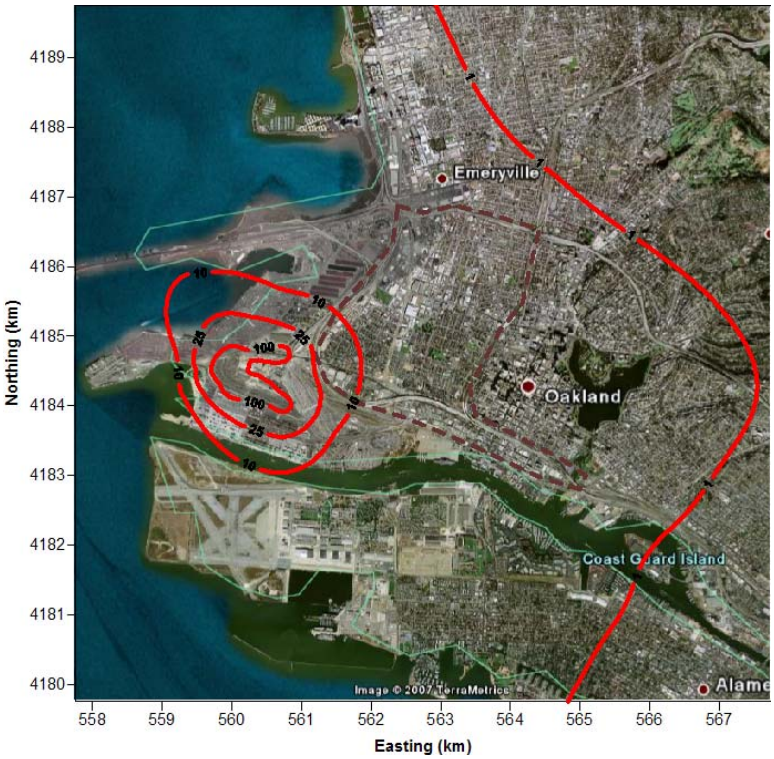
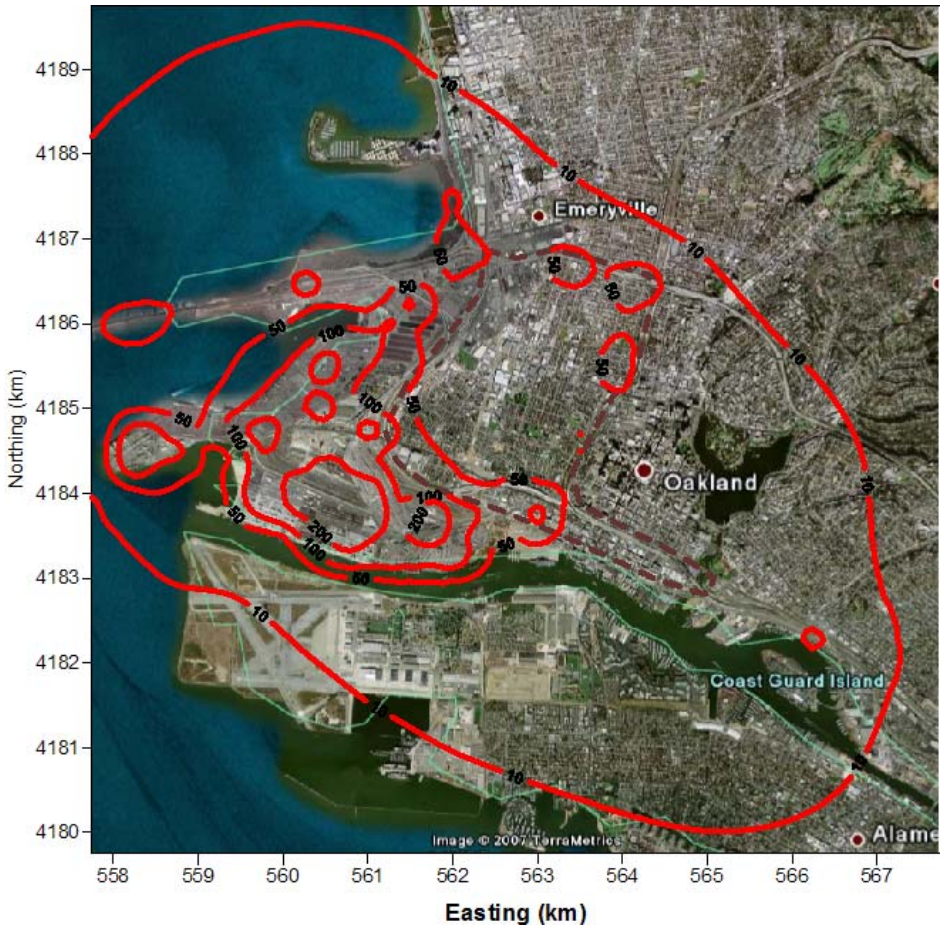


Figure C-8: Estimated West Oakland Community Potential Cancer Risk Due to Port (Part I) Drayage Truck Diesel PM Emissions (2005)



C.2 West Oakland Community Potential Cancer Risks from Union Pacific Rail Yard Operations (Part II)

In this section, we provide the potential cancer risk isopleths and summary tables for the UP Railyard-related impacts on the West Oakland community. The following is a summary, in order of presentation, of the information included in this section:

- Isopleths showing the potential cancer risks resulting in the West Oakland community from exposures to UP Railyard diesel PM emissions – all activities and sources. (Figure C-9)
- A bar chart that shows the population-weighted potential cancer risks by category from UP Railyard operations. (Figure C-10)
- Summary tables that present the impacted area and affected population in the West Oakland community by different risk levels for each category. (Tables C-3 and C-4)

Figure C-9: Estimated West Oakland Community Potential Cancer Risk Due to All UP Railyard (Part II) Diesel PM Emissions Sources (2005)

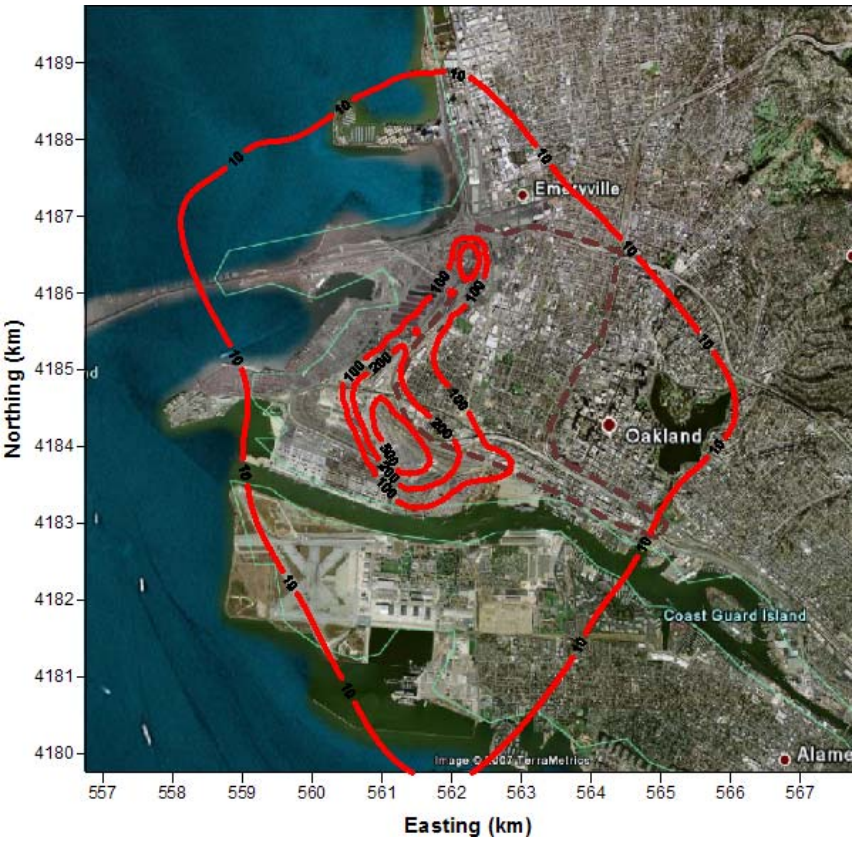


Figure C-10: Population-weighted Potential Cancer Risks in the West Oakland Community by Category for UP Railyard (Part II) Activities (2005)

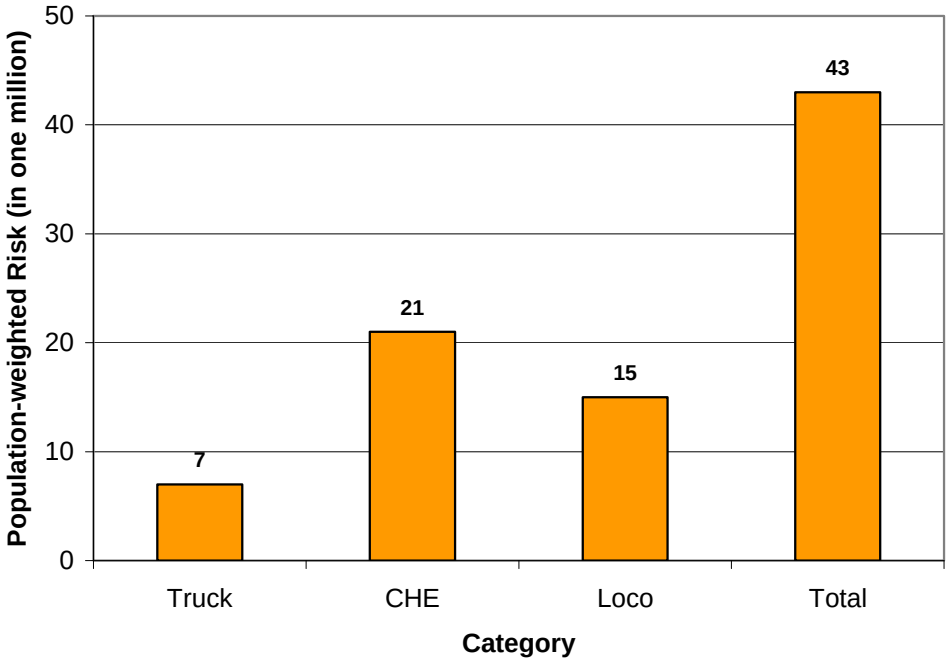


Table C-3: Impacted Area (Acres) in West Oakland Community by Potential Cancer Risk Levels and by Category from UP Railyard (Part II) Activities

Risk Level	TRUCK	LOCO	CHE	TRUs	COMBINED
Risk > 200	0	0	0	0	80
Risk > 100	0	0	0	0	280
Risk > 10	600	1,100	700	1,000	1,750

Note: OGV = transiting + maneuvering; total area for West Oakland community = 1,800 acres.

Table C-4: Affected Population in West Oakland Community by Potential Cancer Risk Levels and by Category from UP Railyard (Part II) Activities

Risk Level	TRUCK	LOCO	CHE	TRUs	COMBINED
Risk > 200	0	0	0	0	100
Risk > 100	0	0	0	0	1,800
Risk > 10	5,200	11,000	6,200	8,700	22,000

Note: OGV = transiting + maneuvering; total population for West Oakland community = 22,200

C.3 West Oakland Community Potential Cancer Risks from Non-Port/Non-UP Railyard Operations (Part III)

In this section, we provide the potential cancer risk isopleths and summary tables for the Part III (Non-Port and Non-UP Railyard) impacts on the West Oakland community. The following is a summary, in order of presentation, of the information included in this section:

- Isopleth showing the potential cancer risks resulting in the West Oakland community from exposures to Part III diesel PM emissions – all activities and sources. (Figure C-11)
- A bar chart that shows the population-weighted potential cancer risks by category from Part III activities. (Figure C-12)
- Summary tables that present the impacted area and affected population in the West Oakland community by different risk levels for each category. (Tables B-5 and C-6)
- Isopleths showing the potential cancer risks resulting in the West Oakland community due to exposures to the diesel PM emissions from the different Part III source categories (Figure C-13 to C-19)

Figure C-11: Estimated West Oakland Community Potential Cancer Risk Due to All Part III (Non-Port/Non-UP) Diesel PM Emissions Sources (2005)

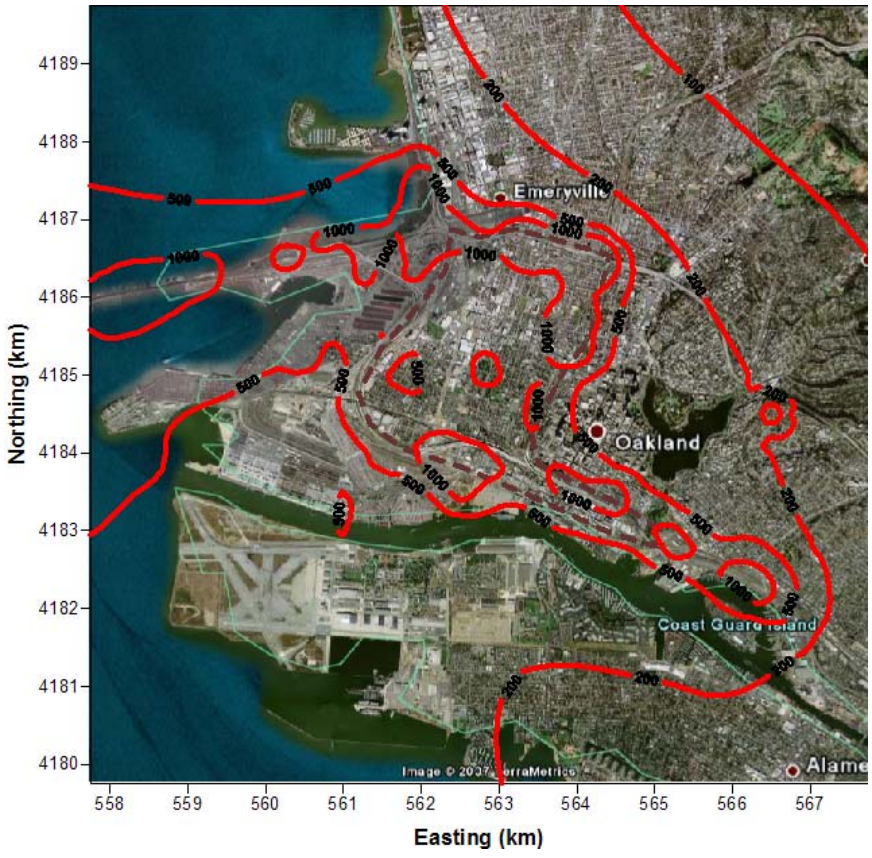


Figure C-12: Population-weighted Potential Cancer Risks in the West Oakland Community by Category for Part III (Non-Port/Non-UP) Activities (2005)

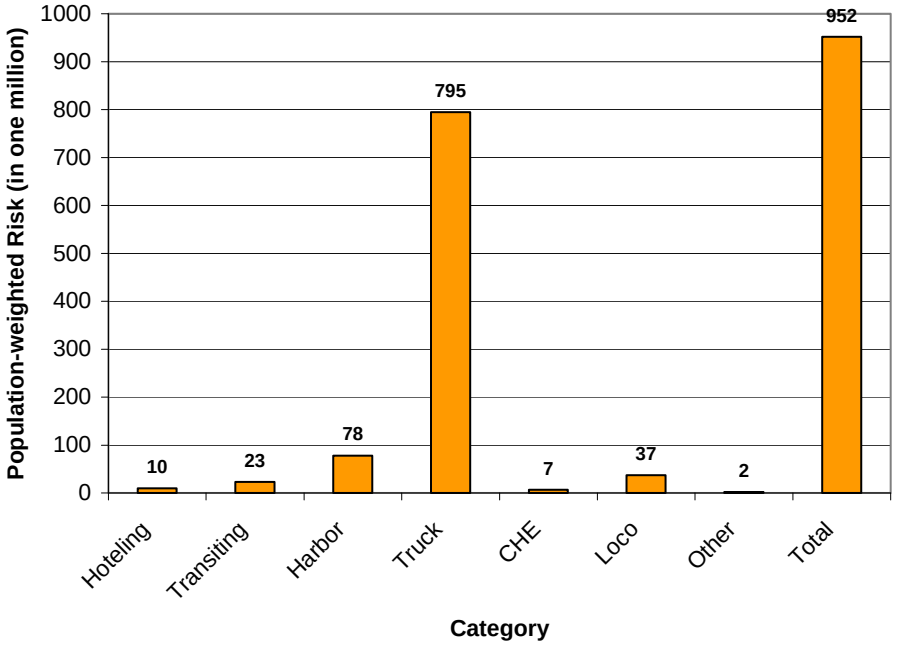


Table C-5: Impacted Area (Acres) in West Oakland Community by Potential Cancer Risk Levels and by Category from Part III (Non-Port/Non-UP) Activities

Risk Level	OGV	HOTEL	HARBOR	TRUCK	LOCO	CHE	OTHERS	COMBINED
Risk > 1000	0	0	0	300	0	0	0	500
Risk > 500	0	0	0	1,000	0	0	0	1,700
Risk > 200	0	0	0	1,800	140	15	0	1,800
Risk > 100	0	0	540	1,800	250	15	0	1,800
Risk > 10	1,800	1,065	1,800	1,800	1,500	500	15	1,800

Note: OGV = transiting + maneuvering; total area for West Oakland community = 1,800 acres.

Table C-6: Affected Population in West Oakland Community by Potential Cancer Risk Levels and by Category from Part III (Non-Port/Non-UP) Activities

Risk Level	OGV	HOTEL	HARBOR	TRUCK	LOCO	CHE	OTHERS	COMBINED
Risk > 1000	0	0	0	5,700	0	0	0	6,300
Risk > 500	0	0	0	13,500	0	0	0	20,500
Risk > 200	0	0	0	22,200	450	40	0	22,200
Risk > 100	0	0	5,900	22,200	1,250	40	0	22,200
Risk > 10	22,200	10,800	22,200	22,200	16,400	4,700	150	22,200

Note: OGV = transiting + maneuvering; total population for West Oakland community = 22,200

Figure C-13: Estimated West Oakland Community Potential Cancer Risk Due to Part III (Non-Port/Non-UP) OGV Transiting and Maneuvering Diesel PM Emissions (2005)

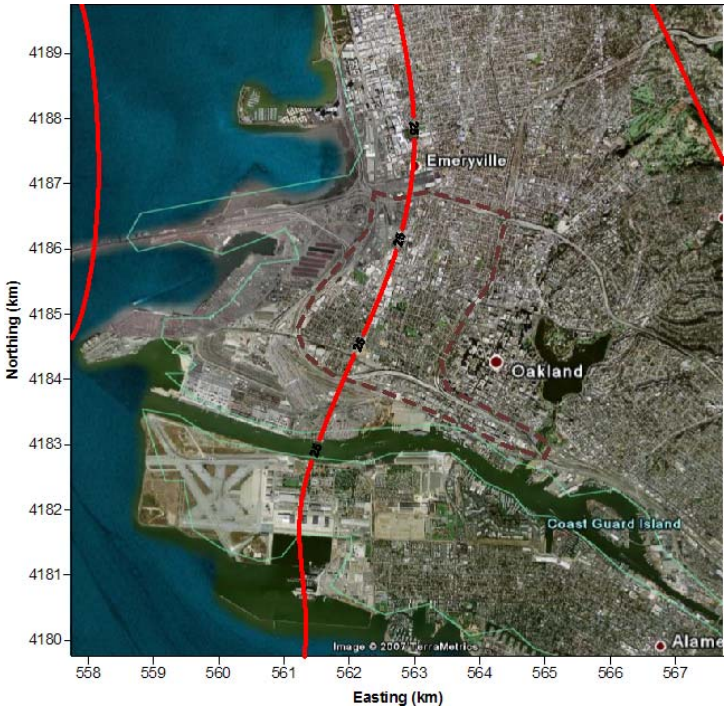


Figure C-14: Estimated West Oakland Community Potential Cancer Risk Due to Part III (Non-Port/Non-UP) OGV Hotelling and Anchorage Diesel PM Emissions (2005)

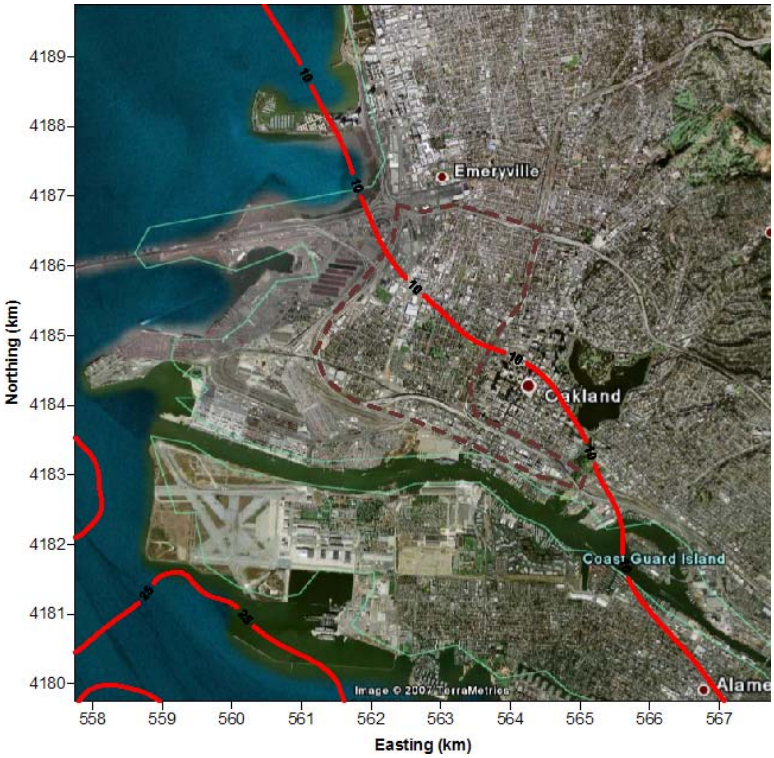


Figure C-15: Estimated West Oakland Community Potential Cancer Risk Due to Part III (Non-Port/Non-UP) Commercial Harbor Craft Diesel PM Emissions (2005)

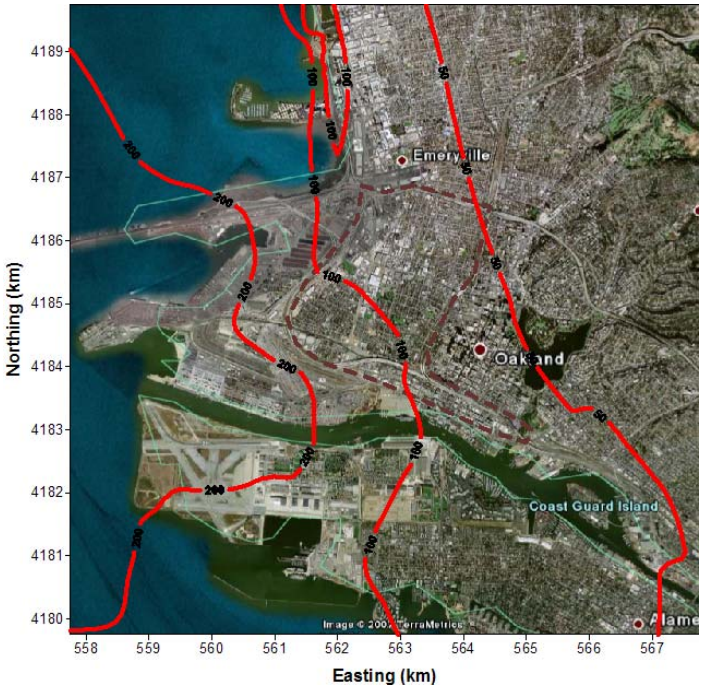


Figure C-16: Estimated West Oakland Community Potential Cancer Risk Due to Part III (Non-Port/Non-UP) Cargo Handling Equipment Diesel PM Emissions (2005)

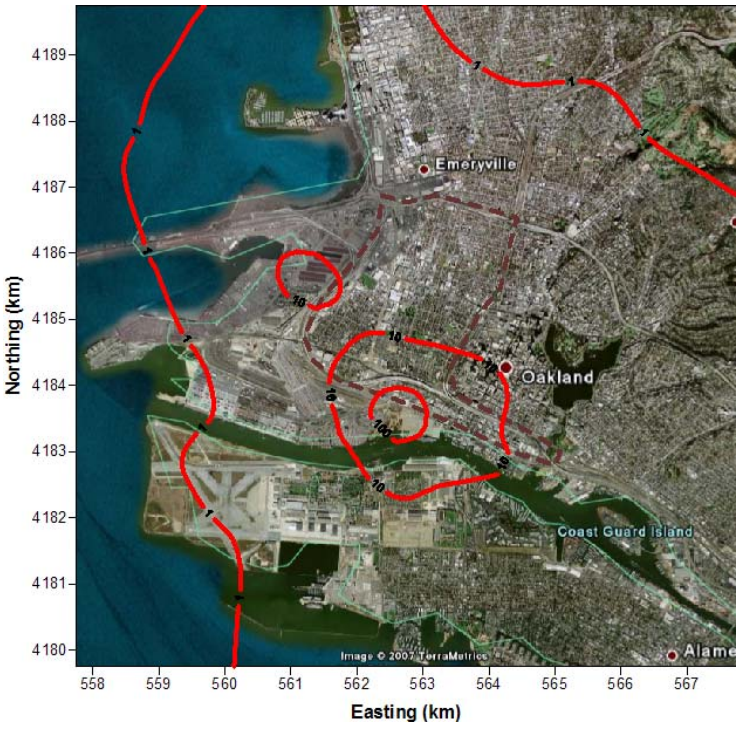


Figure C-17: Estimated West Oakland Community Potential Cancer Risk Due to Part III (Non-Port/Non-UP) Locomotive Diesel PM Emissions (2005)

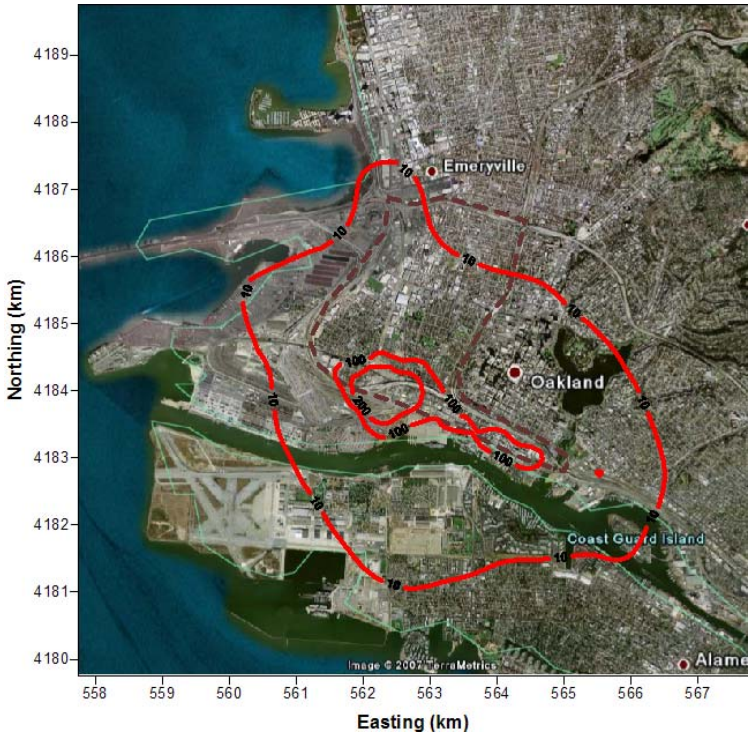


Figure C-18: Estimated West Oakland Community Potential Cancer Risk Due to Part III (Non-Port/Non-UP) On-Road Truck Diesel PM Emissions

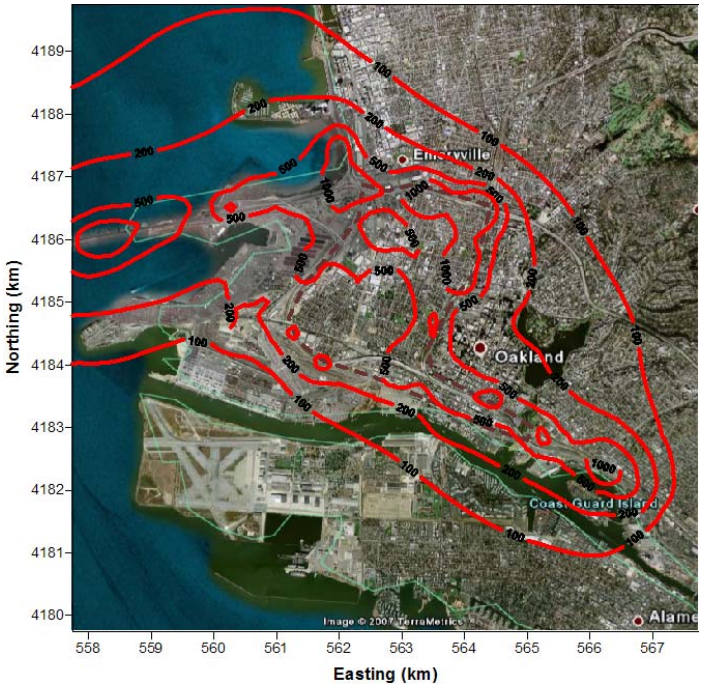
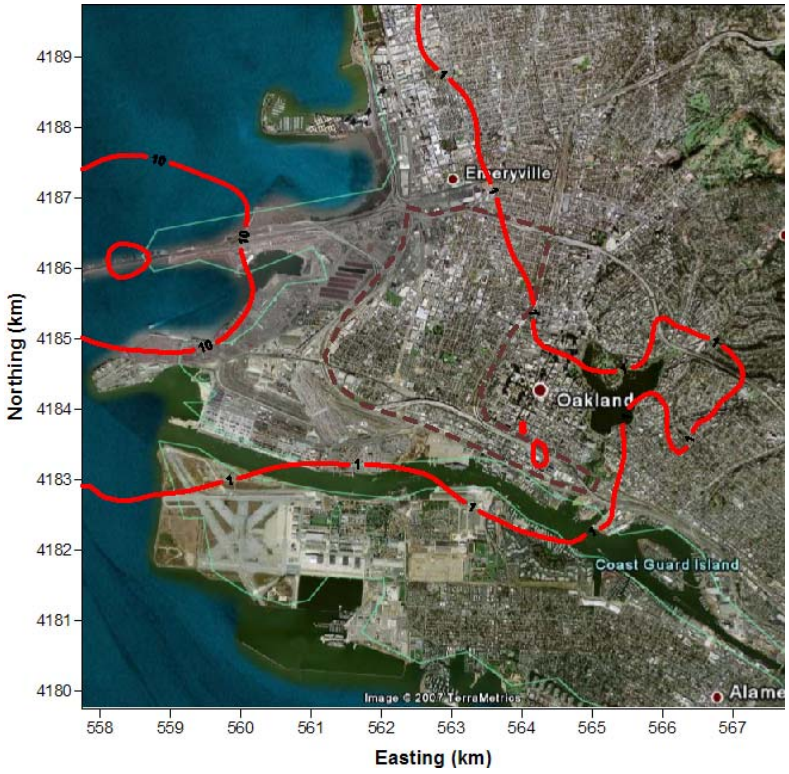


Figure C-19: Estimated West Oakland Community Potential Cancer Risk Due to Part III (Non-Port/Non-UP) Construction and Stationary Sources Diesel PM Emissions (2005)



C.4 Regional Potential Cancer Risks from Port Operations (Part I)

In this section, we present the potential cancer risks resulting in the regional domain (100 km x 100 km) due to diesel PM emissions from the Port (Part I) activities. The following is a summary, in order of presentation, of the information included in this section:

- Isopleths showing the potential cancer risks resulting in the regional domain from exposures to Port (Part I) diesel PM emissions – all activities and sources. (Figure C-20)
- A bar chart that shows the population-weighted potential cancer risks in the regional domain by category from Port (Part I) operations. (Figure C-21)
- Summary tables that present the impacted area and affected population in the regional domain by different risk levels for each category. (Tables C-7 and C-8)
- Isopleths showing the potential cancer risks resulting in the regional domain due to exposures to the diesel PM emissions from the different Port (Part I) source categories (Figure C-22 to C-27)

Figure C-20: Estimated Regional Domain Potential Cancer Risk Due to All Port (Part I) Diesel PM Emissions Sources (2005)

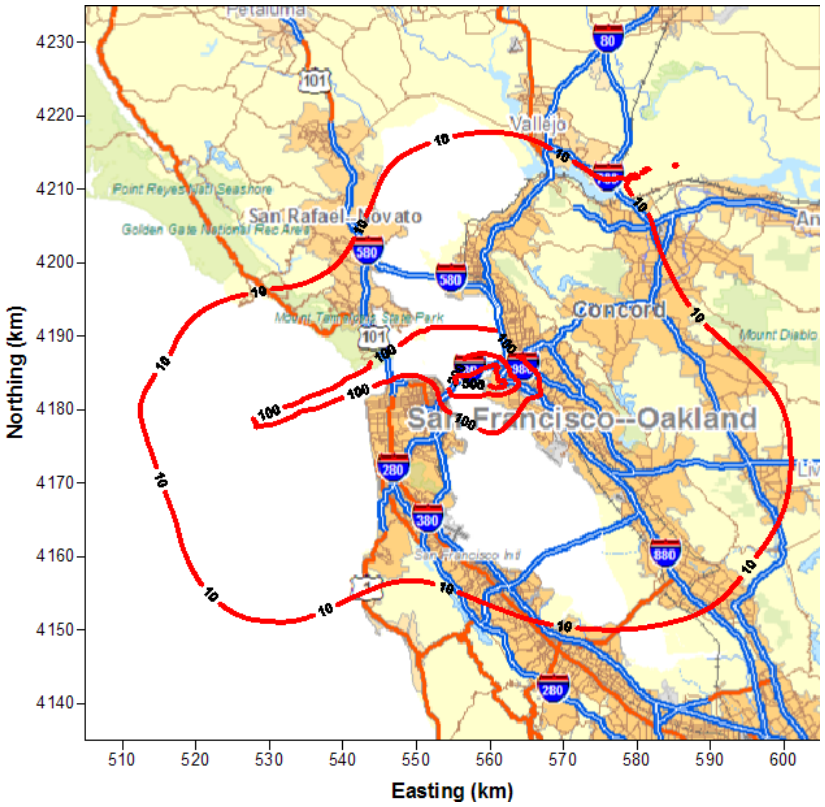


Table C-7: Impacted Area (Acres) in the Regional Domain by Potential Cancer Risk Levels and by Category from Port (Part I) Activities

Risk Level	OGV	HOTEL	HARBOR	TRUCK	LOCO	CHE	COMBINED
Risk > 1000	0	0	0	0	0	0	0
Risk > 500	0		0	0	0	0	60
Risk > 200	60	0	0	0	0	0	2,600
Risk > 100	1,250	60	250	60	0	0	11,800
Risk > 10	254,200	49,600	9,800	9,600	250	5,300	551,500

Note: OGV = transiting + maneuvering; total area for the regional domain = 1,564,000 acres.

Table C-8: Affected Population in the Regional Domain by Potential Cancer Risk Levels and by Category from Port (Part I) Activities

Risk Level	OGV	HOTEL	HARBOR	TRUCK	LOCO	CHE	COMBINED
Risk > 1000	0	0	0	0	0	0	0
Risk > 500	0	0	0	0	0	0	20
Risk > 200	100	0	0	0	0	0	9,600
Risk > 100	1,250	20	140	150	0	0	131,000
Risk > 10	2,185,000	618,500	95,700	127,000	1,700	41,700	3,179,000

Note: OGV = transiting + maneuvering; total population for the regional domain = 5 million.

Figure C-21: Population-weighted Risks by Category for the Port Operations (Part I) in the Regional Domain for 2005

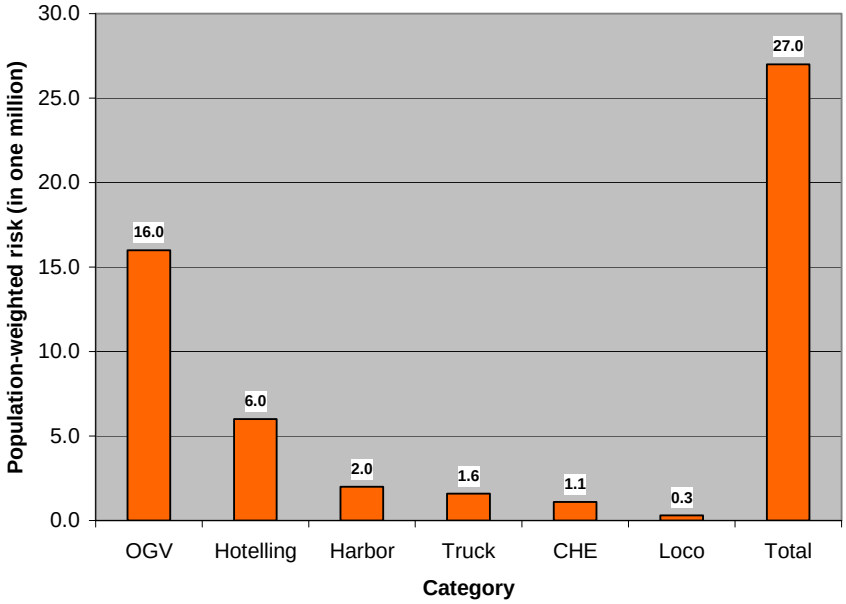


Figure C-22: Estimated Regional Domain Potential Cancer Risk Due to Part I (Port) OGV Transiting, Anchorage, and Maneuvering Diesel PM Emissions (2005)

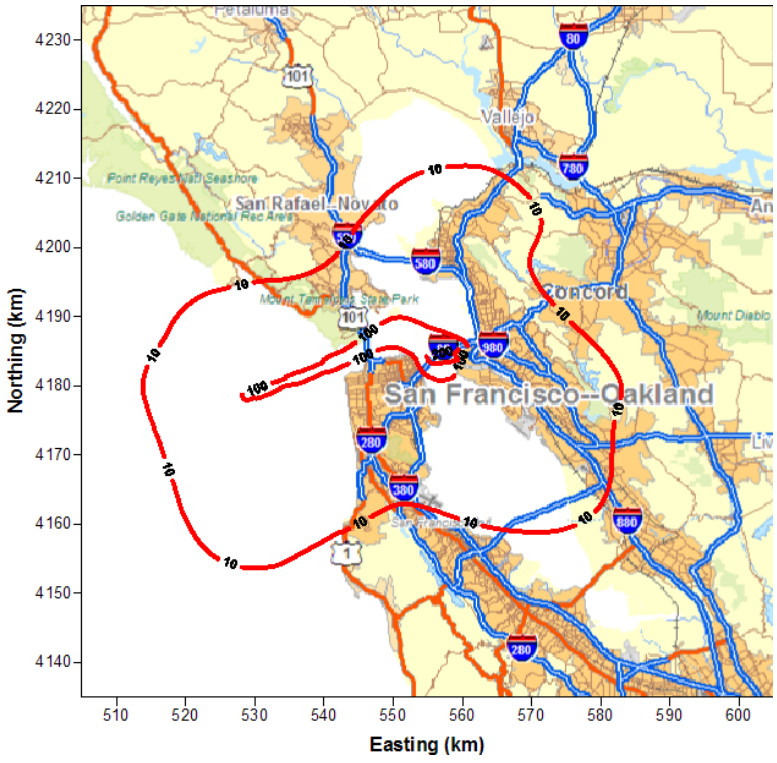


Figure C-23: Estimated Regional Domain Potential Cancer Risk Due to Part I (Port) OGV Hotelling Diesel PM Emissions (2005)

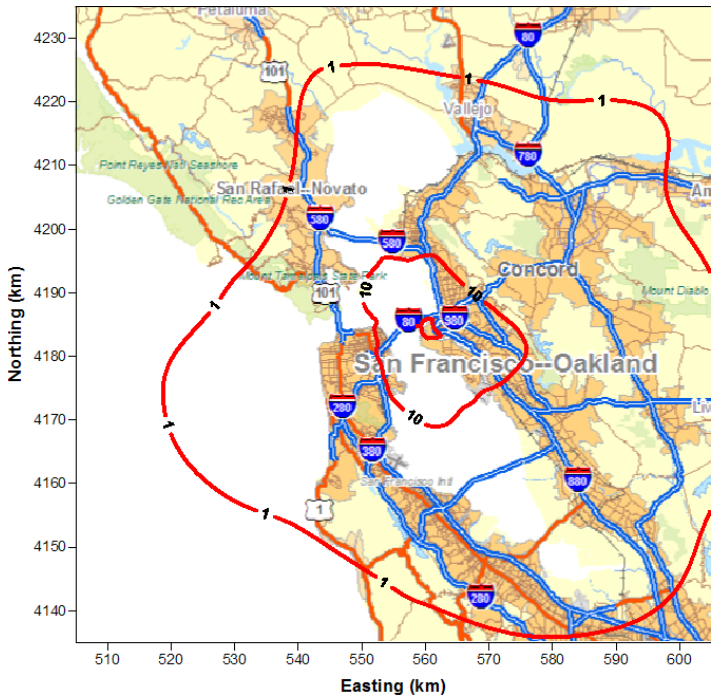


Figure C-24: Estimated Regional Domain Potential Cancer Risk Due to Part I (Port) Commercial Harbor Craft Diesel PM Emissions (2005)

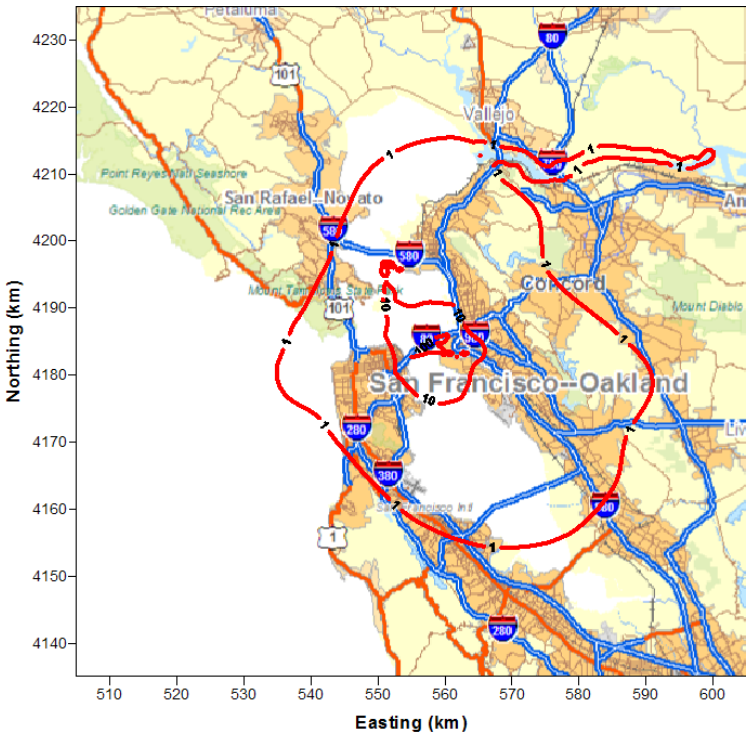


Figure C-25: Estimated Regional Domain Potential Cancer Risk Due to Part I (Port) Cargo Handling Equipment Diesel PM Emissions (2005)

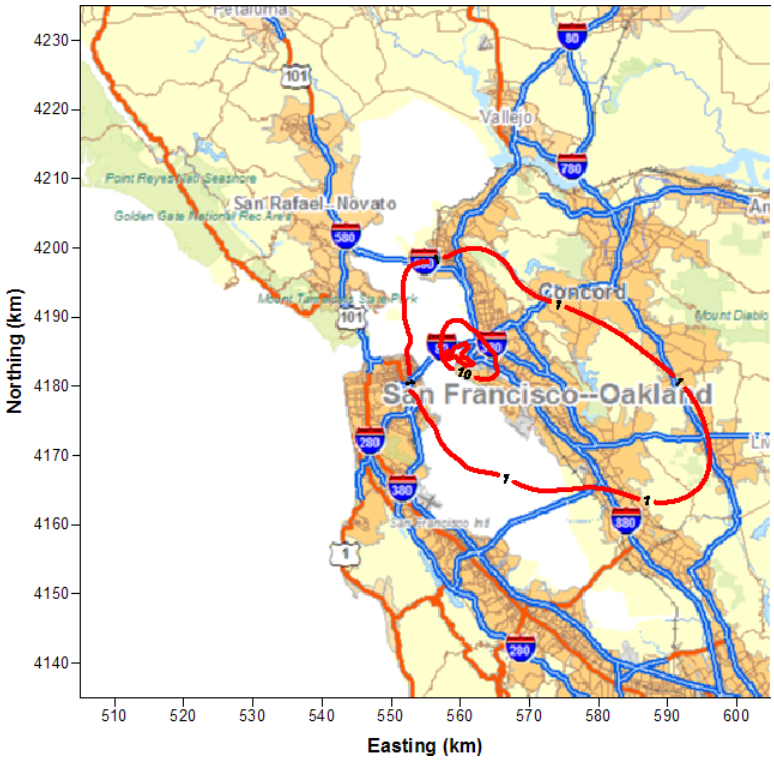


Figure C-26: Estimated Regional Domain Potential Cancer Risk Due to Part I (Port) Locomotive Diesel PM Emissions (2005)

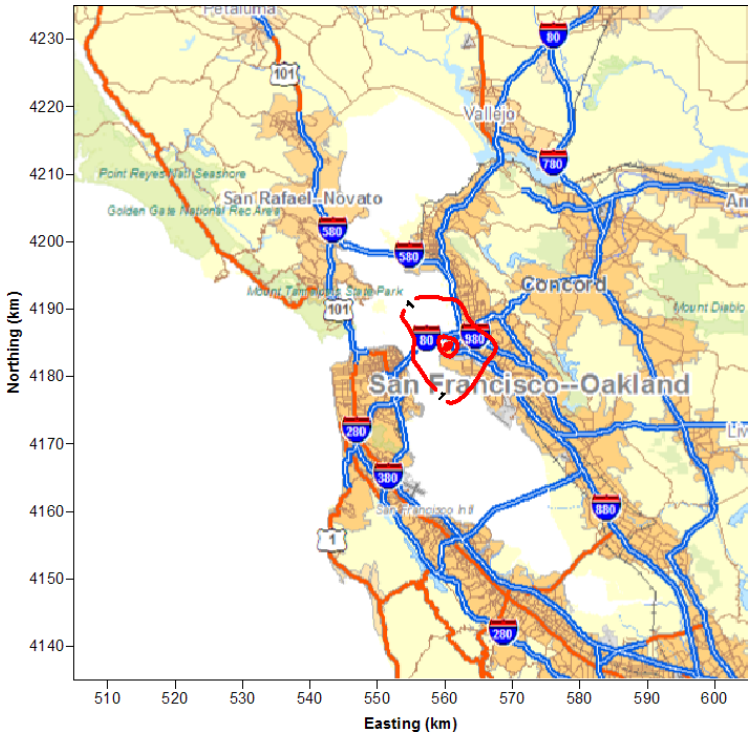
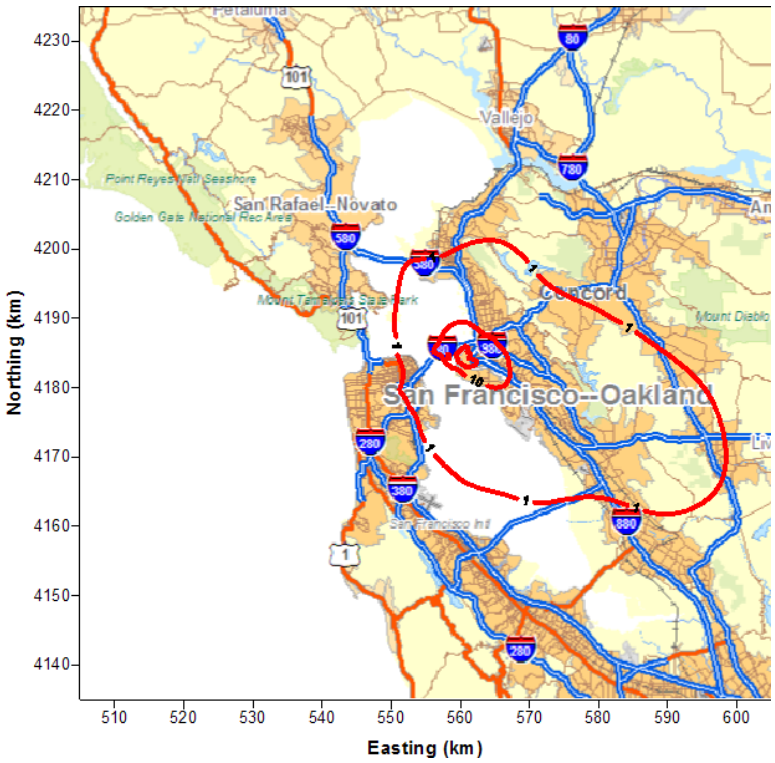


Figure C-27: Estimated Regional Domain Potential Cancer Risk Due to Part I (Port) Drayage Truck Diesel PM Emissions (2005)



C.5 West Oakland Community Potential Cancer Risks from All OGVs

In this section, we provide the potential cancer risk isopleth and summary table for OGV impacts on the West Oakland community. The diesel PM emissions for the OGVs presented in this section include those resulting from transiting, maneuvering, hotelling, and anchorage from Part I and Part III OGVs within the regional domain. The following is a summary, in order of presentation, of the information included in this section:

- Isopleth showing the potential cancer risks resulting in the West Oakland community from exposures to the OGV diesel PM emissions – all activities and sources (Figure C-28)
- Summary table that presents the impacted area and affected population in the West Oakland community by different risk levels (Table C-9)

Figure C-28: Estimated West Oakland Community Potential Cancer Risk Due to All OGV Diesel PM Emissions (2005)

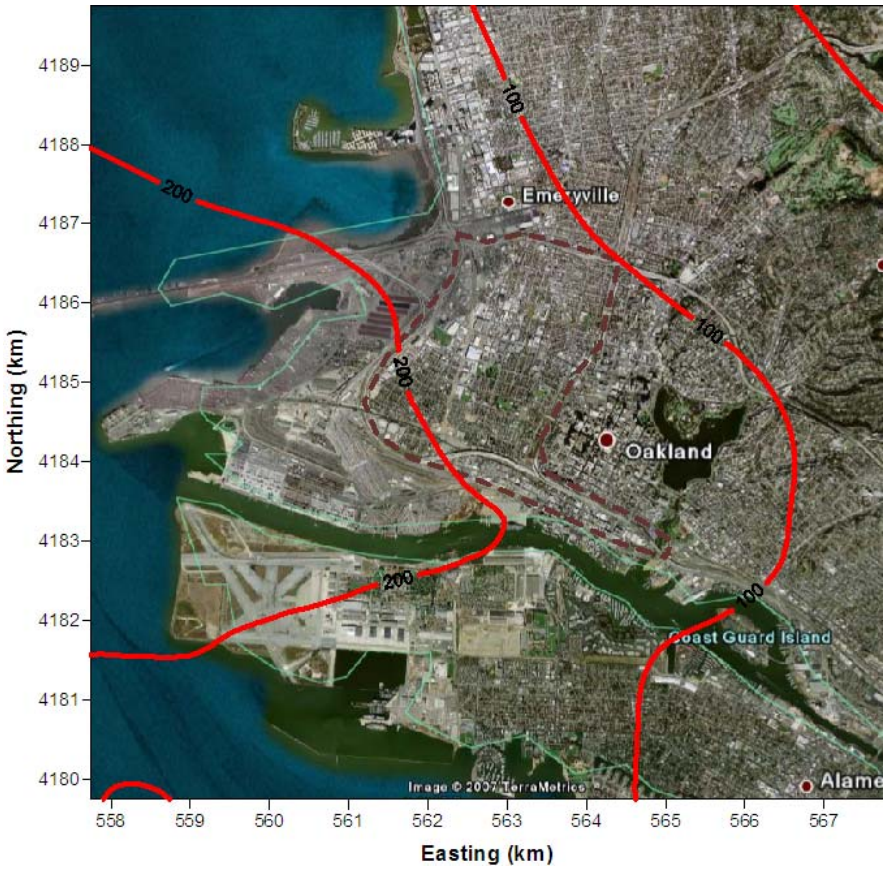


Table C-9: Impacted Area (Acres) and Affected Population (Number) in West Oakland Community by Potential Cancer Risk Levels from All OGV Activities

Risk Level	Impacted In-land Area		Affected Population	
	(acres)	(% of total)	(number)	(% of total)
Risk > 500	0	0	0	0
Risk > 200	160	9	1,100	5
Risk > 100	1,800	100	22,200	100
Risk > 10	1,800	100	22,200	100
Note: For West Oakland Community, total area = 1,800 acres,; total population = 22,200				

C.6 West Oakland Community Potential Cancer Risks from All Commercial Harbor Craft

In this section, we provide the potential cancer risk isopleth and summary table for all commercial harbor craft impacts on the West Oakland community. The diesel PM emissions for the commercial harbor craft presented in this section include those resulting from Port-related (Part I) and non-Port-related (Part III) activities within the regional domain. The following is a summary, in order of presentation, of the information included in this section:

- Isopleth showing the potential cancer risks resulting in the West Oakland community from exposures to the commercial harbor craft diesel PM emissions – all activities and sources (Figure C-29)
- Summary table that presents the impacted area and affected population in the West Oakland community by different risk levels. (Table C-10)

Figure C-29: Estimated West Oakland Community Potential Cancer Risk Due to All Commercial Harbor Craft Diesel PM Emissions (2005)

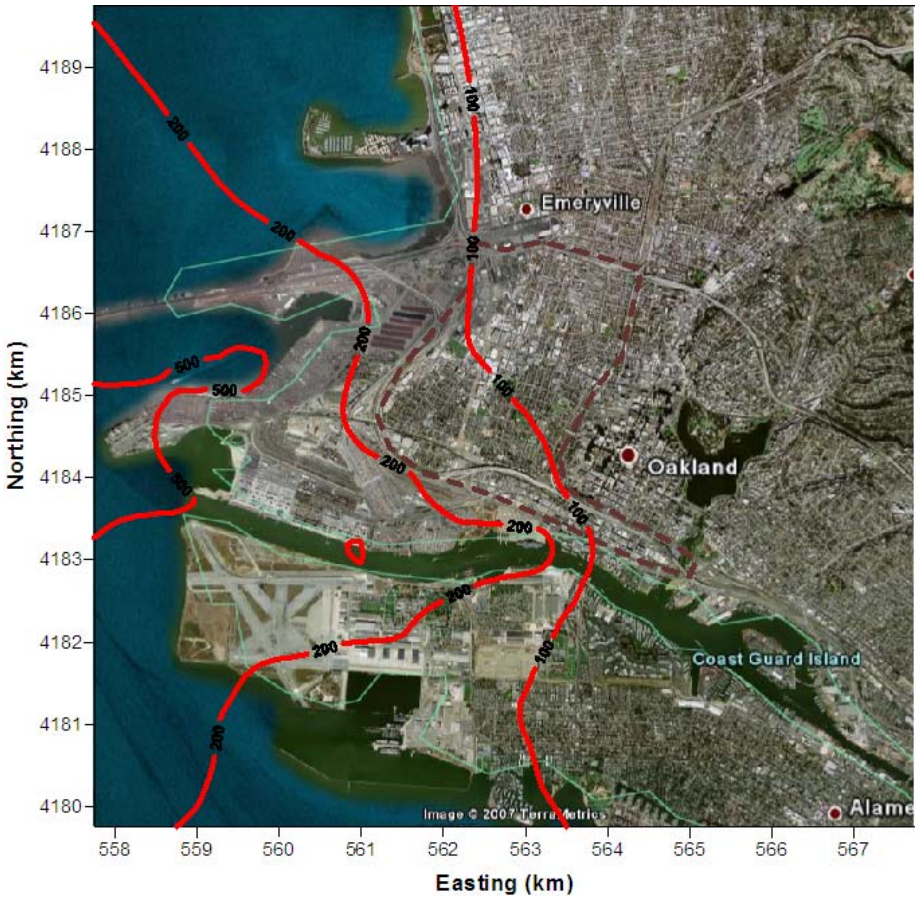


Table C-10: Impacted Area (Acres) and Affected Population (Number) in West Oakland Community by Potential Cancer Risk Levels from All Commercial Harbor Craft Activities

Risk Level	Impacted In-land Area		Affected Population	
	(acres)	(% of total)	(number)	(% of total)
Risk > 500	0	0	0	0
Risk > 200	0	0	0	0
Risk > 100	800	45	7,200	33
Risk > 10	1,800	100	22,200	100
Note: For West Oakland Community, total area = 1,800 acres,; total population = 22,200				

C.7 West Oakland Community Potential Cancer Risks from Combined OGVs and Harbor Craft

In this section, we provide the potential cancer risk isopleth and summary table for combined OGVs and commercial harbor craft impacts on the West Oakland community. Note that diesel PM emissions for the OGVs and commercial harbor craft presented in this section include those resulting the port-related (Part I) and non-port-related (Part III) activities within the regional domain. The following is a summary, in order of presentation, of the information included in this section:

- Isopleth showing the potential cancer risks resulting in the West Oakland community from exposures to the commercial harbor craft diesel PM emissions – all activities and sources (Figure C-30)
- Summary table that presents the impacted area and affected population in the West Oakland community by different risk levels (Table C-11)

Figure C-30: Estimated West Oakland Community Potential Cancer Risk Due to All OGV and Commercial Harbor Craft Diesel PM Emissions (2005)

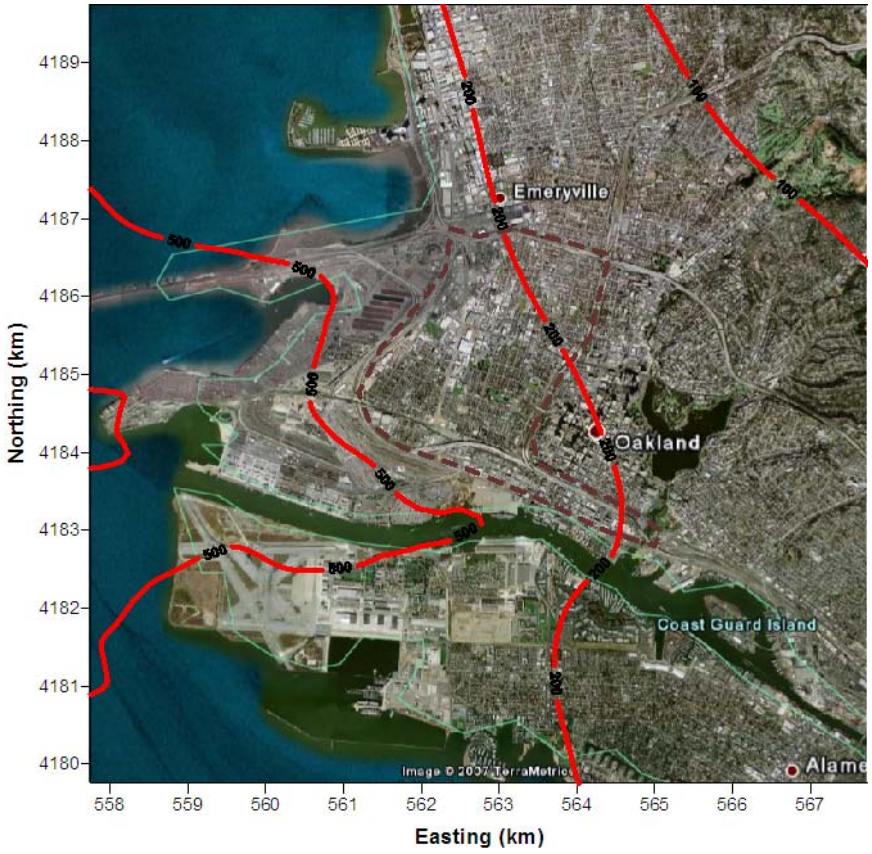


Table C-11: Impacted Area (Acres) and Affected Population (Number) in West Oakland Community by Potential Cancer Risk Levels from Combined OGV and Commercial Harbor Craft Activities

Risk Level	Impacted In-land Area		Affected Population	
	(acres)	(% of total)	(number)	(% of total)
Risk > 500	0	0	0	0
Risk > 200	1,450	81	15,400	70
Risk > 100	1,800	100	22,200	100
Risk > 10	1,800	100	22,200	100
Note: For West Oakland Community, total area = 1,800 acres,; total population = 22,200				

C.8 West Oakland Community Potential Cancer Risks from All On-Road Truck Activities

In this section, we provide the potential cancer risk isopleth and summary table for all the on-road truck impacts on the West Oakland community. The diesel PM emissions for the on-road trucks presented in this section include those resulting from the Port-related (Part I), UP Railyard-related (Part II), and off-Port-related (Part III) activities within the community. The following is a summary, in order of presentation, of the information included in this section:

- Isopleth showing the potential cancer risks resulting in the West Oakland community from exposures to the combined on-road truck diesel PM emissions (Part I, Part II, and Part III) (Figure C-31)
- Summary table that presents the impacted area and affected population in the West Oakland community by different risk levels (Table C-12)

Figure C-31: Estimated West Oakland Community Potential Cancer Risk Due to All On-Road Truck Diesel PM Emissions within the Community (2005)

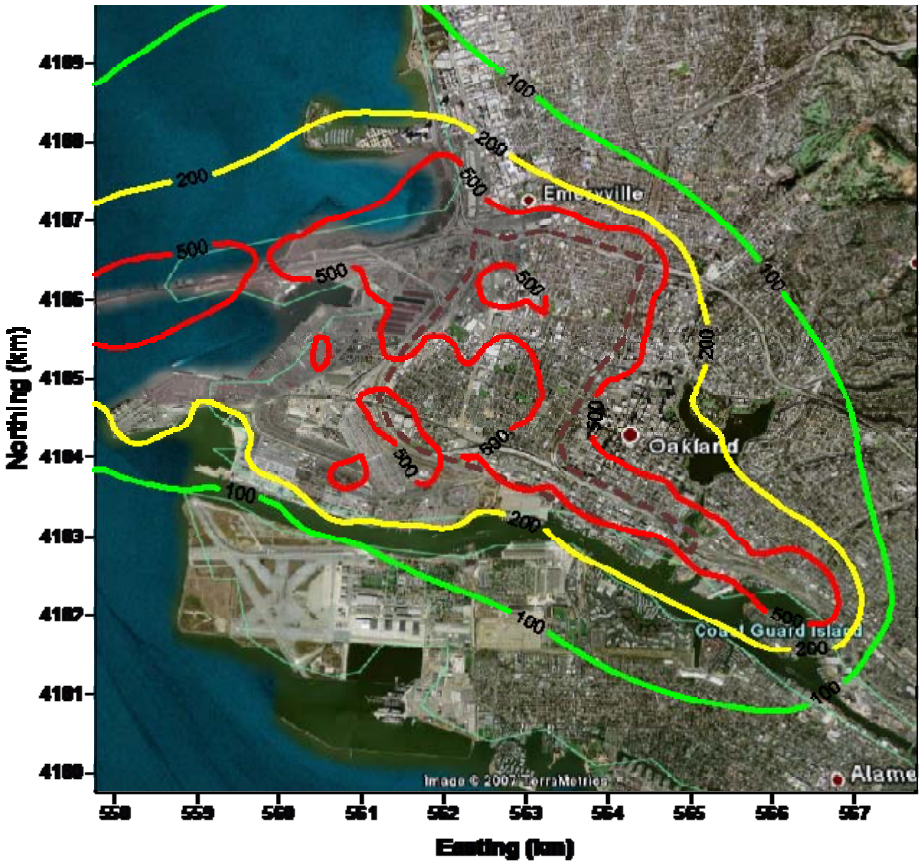


Table C-12: Impacted Area (Acres) and Affected Population (Number) in West Oakland Community by Potential Cancer Risk Levels from All On-Road Truck Activities

Risk Level	Imapcted In-land Area		Affected Population	
	acres	%	number	%
Risk > 1000	310	17.5%	5,700	25.7%
Risk > 500	1,140	64.2%	14,200	64.0%
Risk > 200	1,800	100.0%	22,200	100.0%
Risk > 100	1,800	100.0%	22,200	100.0%
Risk > 10	1,800	100.0%	22,200	100.0%
Note: Total area for the community = 1,800 acres; total population = 22,200.				

C.9 Regional Potential Cancer and Non-cancer Health Impacts from All OGVs

In this section, we present the potential cancer risks and non-cancer health impacts resulting in the regional domain (100 km x 100 km) due to diesel PM emissions from all OGV activities. The non-cancer health impacts resulting from diesel PM emissions in the whole San Francisco Air Bain are also presented. The following is a summary, in order of presentation, of the information included in this section:

- Isopleths showing the potential cancer risks resulting in the regional domain from exposures to all OGV diesel PM emissions – all activities and sources (Figure C-32)
- Summary table that presents the impacted area and affected population in the regional domain by different risk levels (Table C-13)
- Summary table that presents the non-cancer health impacts in the regional domain and the San Francisco Air Basin (Table C-14)

Following the figures and tables is a description of the methodology used to estimate the non-cancer health impacts.

Figure C-32: Estimated Regional Domain Potential Cancer Risk Due to All OGV Diesel PM Emissions (2005)

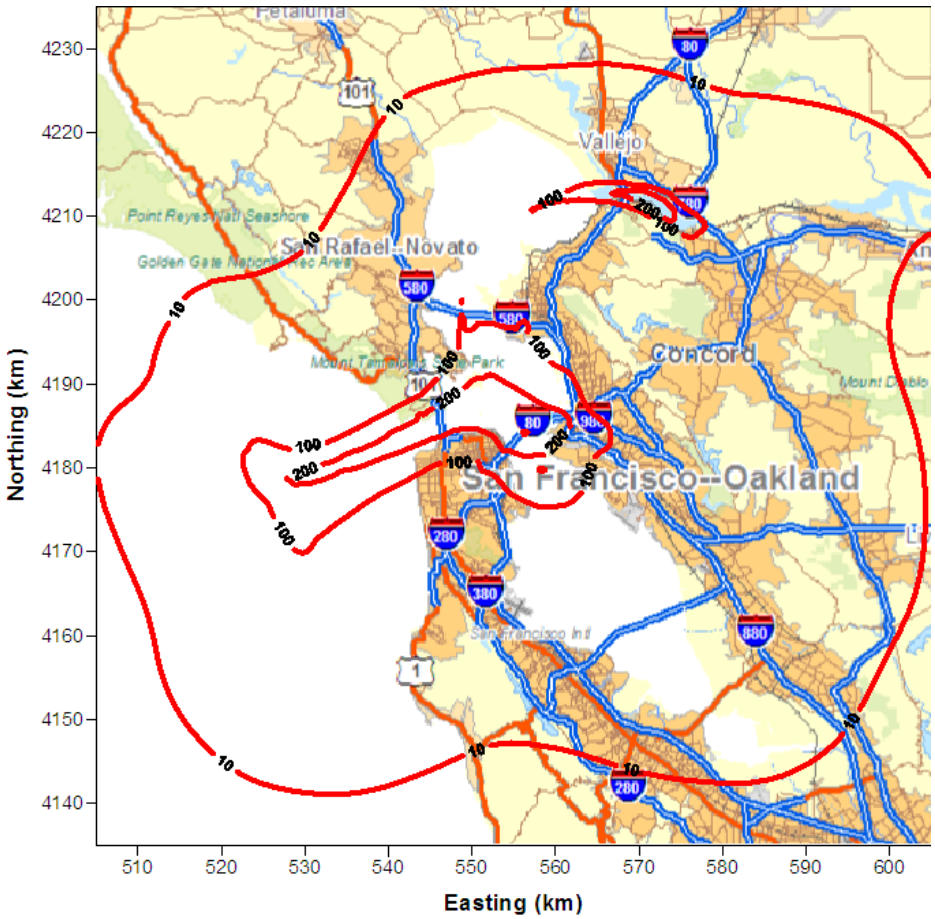


Table C-13: Impacted In-land Area and Affected Population in the Regional Domain by Potential Cancer Risk Levels from All OGV Activities

Risk Level	Impacted In-land Area		Affected Population	
	(acres)	(% of total)	(number)	(% of total)
Risk > 1000	0	0	0	0
Risk > 500	0	0	0	0
Risk > 200	3,800	< 1	16,500	< 1
Risk > 100	31,000	2	421,000	9
Risk > 10	984,000	63	4,015,000	83
Note: For the regional domain (100 km x 100 km), total in-land area = 1,564,00 acres; total population (all ages) = 5 million.				

Table C-14: Estimated Non-cancer Health Impacts Resulting from All OGV Diesel PM Emissions in the Regional Domain and the San Francisco Air Basin (2005)

(Values in parentheses are for the regional domain)

Endpoint	# of Cases per Year (Mean)	# of Cases per Year 95 % Confidence Interval
Premature Death	35 (28)	10 – 60 (8 – 49)
Hospital Admission (Respiratory & Cardiovascular)	15 (12)	8 – 22 (6 – 18)
Asthma - Related & Other Lower Respiratory Symptoms	525 (420)	200 – 850 (160 – 680)
Acute Bronchitis	45 (35)	0 – 100 (0 – 80)
Work Loss Day	5,000 (4,000)	4,300 – 5,800 (3,400 – 4,600)
Minor Restricted Activity Days	29,000 (23,000)	24,000 – 35,000 (19,000 – 28,000)

To estimate non-cancer health impacts resulting from all OGV activities within the San Francisco Air Basin, we first estimated the non-cancer health impacts associated with exposures to the model-predicted ambient levels of directly emitted diesel PM within the regional modeling domain. To estimate the potential non-cancer health impacts, staff developed population exposure estimates using the model-predicted concentrations of directly emitted diesel PM within each modeling grid cell to the population within the grid cell. The populations within each grid cell were determined from U.S. Census Bureau year 2000 census data.

ARB staff used the same PM-mortality relationship as were used in the Ports and Goods Movement Emission Reduction Plan (ARB, 2006). The methodology for estimating these health impacts is described in Appendix A of the Emission Reduction Plan for Ports and Goods Movement in California (ARB, 2006) and Methodology for Estimating the Premature Deaths Associated with Long-term Exposures to Fine Airborne Particulate Matter in California (ARB, 2008). We calculated the number of annual cases of death and other health effects associated with exposure to the PM concentration modeled for each of the grid cells. The totals over the entire modeling area were then calculated. For each grid cell, each health effect was estimated based on concentration-response functions derived from published epidemiological studies relating changes in ambient concentrations to changes in health endpoints, the population affected, and the baseline incidence rates. The selection of the concentration-response functions was based on the latest epidemiologic literature, as described in Emission Reduction Plan for Ports and Goods Movement in California (ARB, 2006). [1]

[1] In October 2008, ARB released a revised methodology for estimating premature deaths associated with long-term exposures to fine airborne particulate matter in California that increases the relative risk factor from 6% to 10% increase in premature death per 10μg/m^3 increase in PM2.5 exposures (CARB, 2008).

The non-cancer health impacts for the modeling domain were then used to extrapolate a value for the entire San Francisco Air Basin. To do this ARB staff determined the ratio of the resulted non-cancer health values over the OGV emissions within the regional domain. Because the remaining OGV emissions (total emissions minus those in the regional modeling domain) within the San Francisco Air Basin are most likely distributed over the outer ocean area beyond the Golden Gate Bridge, we adjusted the these remaining diesel PM emissions by applying the diesel PM emissions impact adjustment factor which was developed in the Goods Movement Emission Reduction Plan (ARB, 2006) to reflect the impact of diesel PM emissions released from the off-shore. The remaining non-cancer health endpoints were then estimated by multiplying the adjusted remaining diesel PM emissions by the ratio developed above. For each endpoint, the reported values in Table C-14 are the sum of the values resulting from the regional modeling results and the estimated from the remaining emissions. Mathematically the estimated can be expressed by the following equation:

$$H_{i,SF} = H_{i,RM} + \frac{H_{i,RM}}{E_{RM}} * \left(E_{SF} - E_{RM}\right) * F_{adj} \qquad \text{(C-1)}$$

where $H_{i,SF}$ is the non-cancer health impact for endpoint i in the San Francisco Air Basin, $H_{i,RM}$ is the non-cancer health impact for endpoint i in the regional modeling domain, E_{SF} and E_{RM} are the diesel PM emissions within the San Francisco Air Basin and the regional modeling domain, respectively, and F_{adj} is the emissions impact adjustment factor (for this case, F_{adj} = 0.25).

C.10 Regional Potential Cancer and Non-cancer Health Impacts from All Commercial Harbor Craft

In this section, we present the potential cancer risks and non-cancer health impacts resulting in the regional domain (100 km x 100 km) due to diesel PM emissions from all commercial harbor craft activities. The non-cancer health impacts resulting from diesel PM emissions in the San Francisco Air Basin are also presented. The following is a summary, in order of presentation, of the information included in this section:

- Isopleths showing the potential cancer risks resulting in the regional domain from exposures to all commercial harbor craft diesel PM emissions – all activities and sources (Figure C-33)
- Summary table that presents the impacted area and affected population in the regional domain by different risk levels (Table C-15)

Using the 10% relative risk factor would increase the estimated premature deaths reported above by 67%.

- Summary table that presents the non-cancer health impacts in the regional domain and in the San Francisco Air Basin (Table C-16)

Figure C-33: Estimated Regional Domain Potential Cancer Risk Due to All Commercial Harbor Craft Diesel PM Emissions (2005)

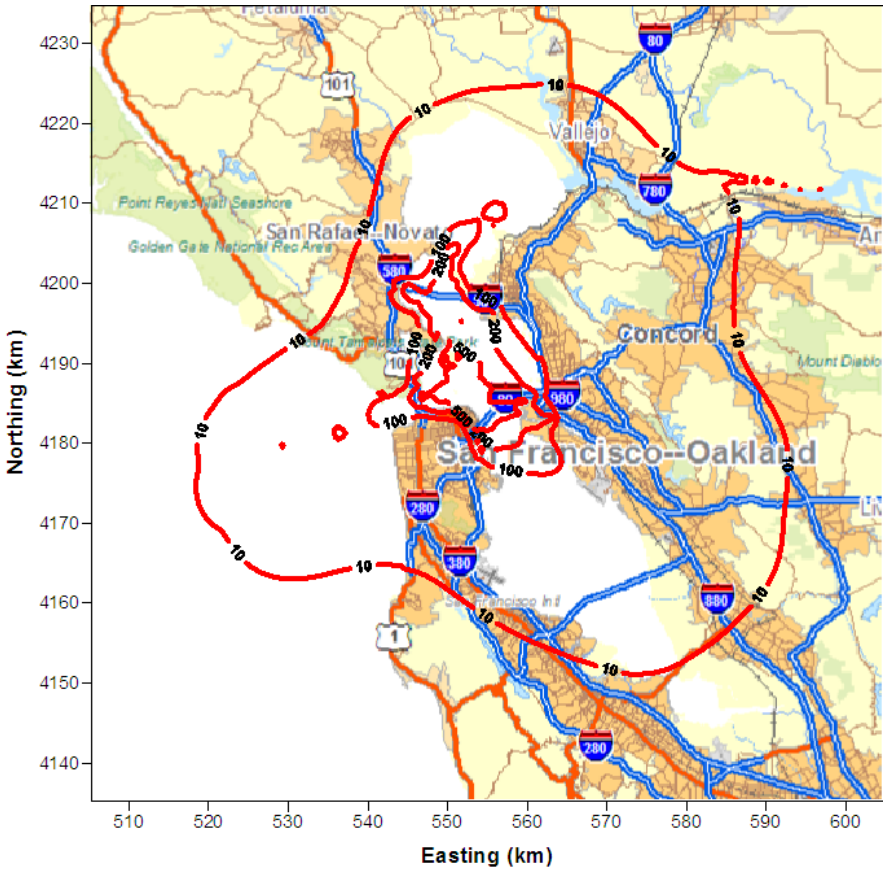


Table C-15: Impacted In-land Area and Affected Population in the Regional Domain by Potential Cancer Risk Levels from All Harbor Craft Activities

Risk Level	Impacted In-land Area		Affected Population	
	(acres)	(% of total)	(number)	(% of total)
Risk > 1000	370	< 1	4,500	< 1
Risk > 500	1,700	< 1	14,000	< 1
Risk > 200	5,400	< 1	51,000	1
Risk > 100	16,700	1	158,000	3
Risk > 10	520,000	33	3,083,000	64
Note: For the regional domain (100 km x 100 km), total in-land area = 1,564,00 acres; total population (all ages) = 5 million.				

Table C-16: Estimated Non-cancer Health Impacts Resulting from All Commercial Harbor Craft Diesel PM Emissions in the Regional Domain and the San Francisco Air Basin (2005)
(Values in parentheses are for the regional domain)

Endpoint	# of Cases per Year (Mean)	# of Cases per Year 95 % Confidence Interval
Premature Death	25 (19)	6 – 43 (5 - 34)
Hospital Admission (Respiratory & Cardiovascular)	11 (9)	5 – 16 (4 - 13)
Asthma - Related & Other Lower Respiratory Symptoms	330 (260)	125 – 530 (100 – 420)
Acute Bronchitis	28 (22)	0 – 60 (0 - 50)
Work Loss Day	3,500 (2,800)	3,000 - 4,000 (2,400 – 3,200)
Minor Restricted Activity Days	20,000 (16,000)	16,000 – 24,000 (13,000 – 19,000)

Note that the non-cancer health impacts resulting from all harbor activities within the San Francisco Air Basin were estimated using the same methodology and assumption described above.

C.11 Regional Potential Cancer and Non-cancer Health Impacts from Combined OGVs and Commercial Harbor Craft

In this section, we present the potential cancer risks and non-cancer health impacts resulting in the regional domain (100 km x 100 km) due to diesel PM emissions from combined OGVs and commercial harbor craft activities. The non-cancer health impacts resulting from diesel PM emissions in the San Francisco Air Basin are also presented. The following is a summary, in order of presentation, of the information included in this section:

- Isopleths showing the potential cancer risks resulting in the regional domain from exposures to combined OGVs and commercial harbor craft diesel PM emissions – all activities and sources (Figure C-34)
- Summary table that presents the impacted area and affected population in the regional domain by different risk levels (Table C-17)
- Summary table that presents the non-cancer health impacts in the regional domain and in the San Francisco Air Basin (Table C-18)

Figure C-34: Estimated Regional Domain Potential Cancer Risk Due to All OGV and Commercial Harbor Craft Diesel PM Emissions (2005)

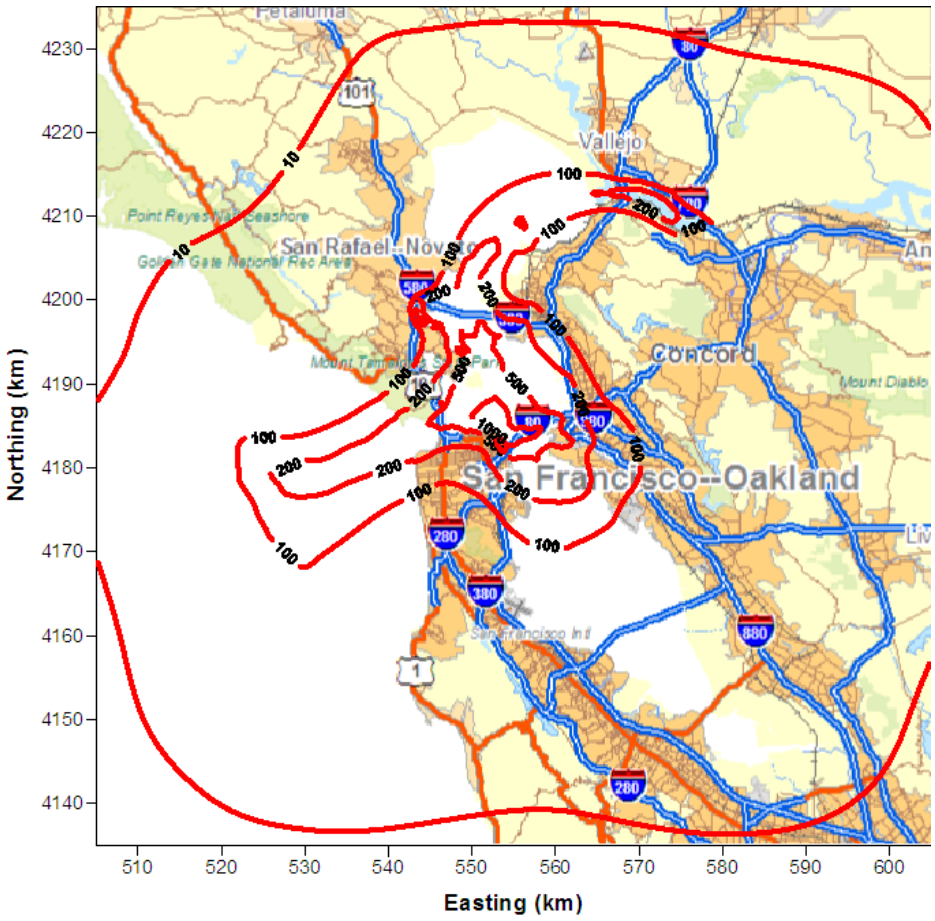


Table C-17: Impacted In-land Area and Affected Population in the Regional Domain by Potential Cancer Risk Levels from All OGVs and Commercial Harbor Craft Activities

Risk Level	Impacted In-land Area		Affected Population	
	(acres)	(% of total)	(number)	(% of total)
Risk > 1000	500	< 1	5,000	< 1
Risk > 500	3,200	< 1	23,800	< 1
Risk > 200	21,000	1	244,500	5
Risk > 100	76,000	5	1,054,000	22
Risk > 10	1,262,000	81	4,393,000	91
Note: For the regional domain (100 km x 100 km), total in-land area = 1,564,00 acres; total population (all ages) = 5 million.				

Table C-18: Estimated Non-cancer Health Impacts Resulting from All OGVs and Commercial Harbor Craft Diesel PM Emissions in the Regional Domain and the San Francisco Air Basin (2005)[2]
(Values in parentheses are for the regional domain)

Endpoint	# of Cases per Year (Mean)	# of Cases per Year 95 % Confidence Interval
Premature Death	55 (48)	16 – 100 (13 – 83)
Hospital Admission (Respiratory & Cardiovascular)	26 (21)	16 – 38 (11 – 31)
Asthma - Related & Other Lower Respiratory Symptoms	850 (700)	320 – 1,400 (260 – 1,100)
Acute Bronchitis	70 (58)	0 – 160 (0 – 130)
Work Loss Day	8,500 (6,900)	7,300 - 10,000 (5,800 – 8,000)
Minor Restricted Activity Days	50,000 (40,000)	40,000 – 60,000 (33,000 – 48,000)

C.12 Regional Potential Cancer and Non-cancer Health Impacts from Goods Movement-Related Trucks

In this section, we present the potential non-cancer health impacts resulting in the San Francisco Air Basin due to diesel PM emissions from all goods movement related on-road truck activities within the Basin. We used the similar methodology and assumption presented in Section I above to estimate the non-cancer health impacts in the Air Basin, i.e.,

$$H_{i,SF} = \left(\frac{H_{i,RM}}{E_{com}} \right) * E_{SF} * F_{adj} \qquad \text{(C-2)}$$

where $H_{i,SF}$ is the non-cancer health impact for endpoint i in the San Francisco Air Basin, $H_{i,RM}$ is the non-cancer health impact for endpoint i in the regional modeling domain, E_{SF} and E_{com} are the diesel PM emissions within the San Francisco Air Basin and the community domain (Port, UP Railyard, and West Oakland community), respectively, and F_{adj} is the emissions impact adjustment factor (for this case, F_{adj} = 1.0).

[2] In October 2008, ARB released a revised methodology for estimating premature deaths associated with long-term exposures to fine airborne particulate matter in California that increases the relative risk factor from 6% to 10% increase in premature death per 10μg/m^3 increase in PM2.5 exposures (CARB, 2008). Using the 10% relative risk factor would increase the estimated premature deaths reported above by 67%.

Table C-19 summarizes the results of the non-cancer health impacts resulting from all goods movement related on-road truck activities in the San Francisco Air Basin.

Table C-19: Estimated Non-cancer Health Impacts Resulting from Goods Movement Related Truck Diesel PM Emissions in the San Francisco Air Basin (2005)[3]

Endpoint	# of Cases per Year (Mean)	# of Cases per Year 95 % Confidence Interval
Premature Death	95	25 – 160
Hospital Admission (Respiratory & Cardiovascular)	60	25 – 100
Asthma - Related & Other Lower Respiratory Symptoms	1,700	650 – 2,700
Acute Bronchitis	140	0 – 300
Work Loss Day	13,000	11,000 - 16,000
Minor Restricted Activity Days	78,000	64,000 – 93,000

[3] In October 2008, ARB released a revised methodology for estimating premature deaths associated with long-term exposures to fine airborne particulate matter in California that increases the relative risk factor from 6% to 10% increase in premature death per 10μg/m^3 increase in PM2.5 exposures (CARB, 2008). Using the 10% relative risk factor would increase the estimated premature deaths reported above by 67%.

References

(ARB, 2006) California Air Resources Board. Emission Reduction Plan for Ports and Goods Movement, available at http://www.arb.ca.gov/planning/gmerp/march21plan/appendix_a.pdf

(ARB, 2008) California Air Resources Board. Methodology for Estimating Premature Deaths Associated with long-term Exposures to Fine Airborne Particulate Matter in California (Draft). Available at: http://www.arb.ca.gov/research/health/pm-mort/pm-mort.htm.