6. Source Category Emission Reduction Targets

The PATS projected 2017 modeling results provide information about individual pollutant concentrations and associated risk, and the significant contributing emission source categories. DEQ analyzed the modeling data to understand the concentrations and spatial patterns of individual pollutants (see modeling results in Section 4). DEQ then analyzed the modeling data for individual source categories to identify relative ranking based on total risk for each category, risk driver pollutants and pollutant reduction targets. Source category analysis allowed DEQ and PATSAC to understand what reductions are roughly feasible for various categories and pollutants, and also to prioritize source categories for emission reductions.

This section describes emission reduction targets for the risk driver pollutants most predominantly associated with source categories. These pollutants generally cause the most risk from those source categories. Additional pollutant reduction targets for non risk driver pollutants can be found in Appendix 12.8. For On-Road Mobile, Area, and Point sources, DEQ tailored the analysis to match the characteristic spatial distributions and data quality for each category. For all categories, DEQ used a reasonable worst-case approach to set targets that would be the most protective for all individuals. No background or secondary concentrations were included in the emission reduction target analysis.

6.1 Mobile Sources

6.1.1 On-Road Mobile Source Pollutant Emission Reduction Targets

To develop reduction targets for on-road mobile air toxics, DEQ used values at receptors within 500 meters of major roadways. These values also fall within the top 20% of receptors for mobile source air toxics. This approach was supported by DEQ observations in mobile source air toxics studies and its own modeling showing that air toxics concentrations fall off steeply at 500 meters around busy roadways.
Figure 90 below shows concentrations of benzene along in three sections intersecting Interstate 5 in North Portland. Receptor locations are shown by red crosses, and the alignment of three cross-sections are also indicated. Concentrations along those cross-sections are plotted in Figure 91, and show distinctive concentration curves that flatten at about 500 meters from the roadway.

Figure 90: Benzene Concentrations at Receptors Adjacent to Interstate 5

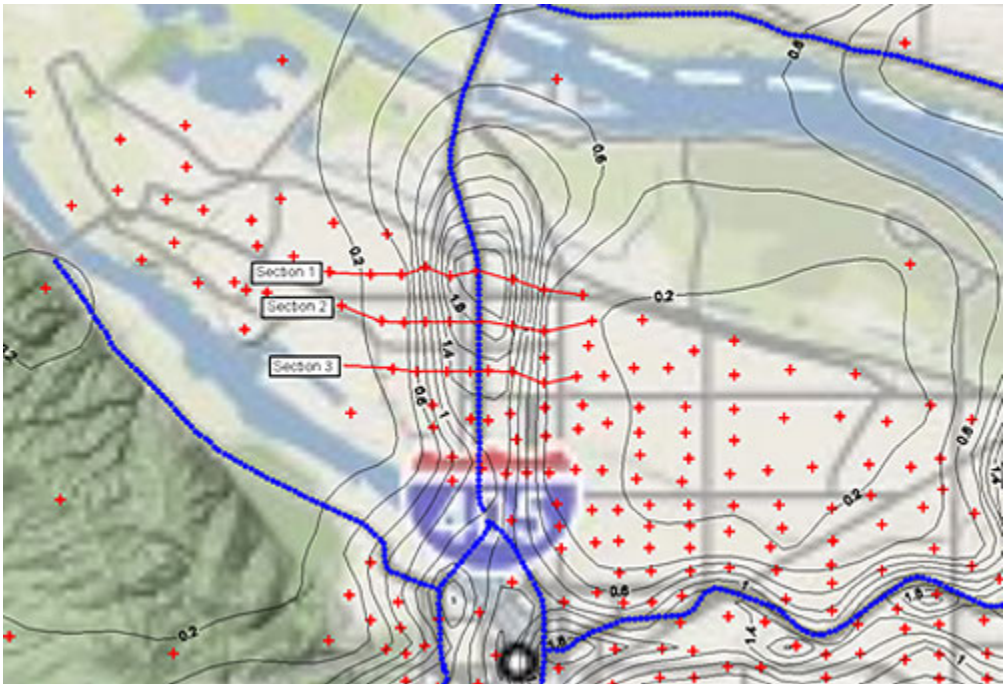

Figure 91: Roadway Concentration Curves from Receptors Adjacent to Interstate 5

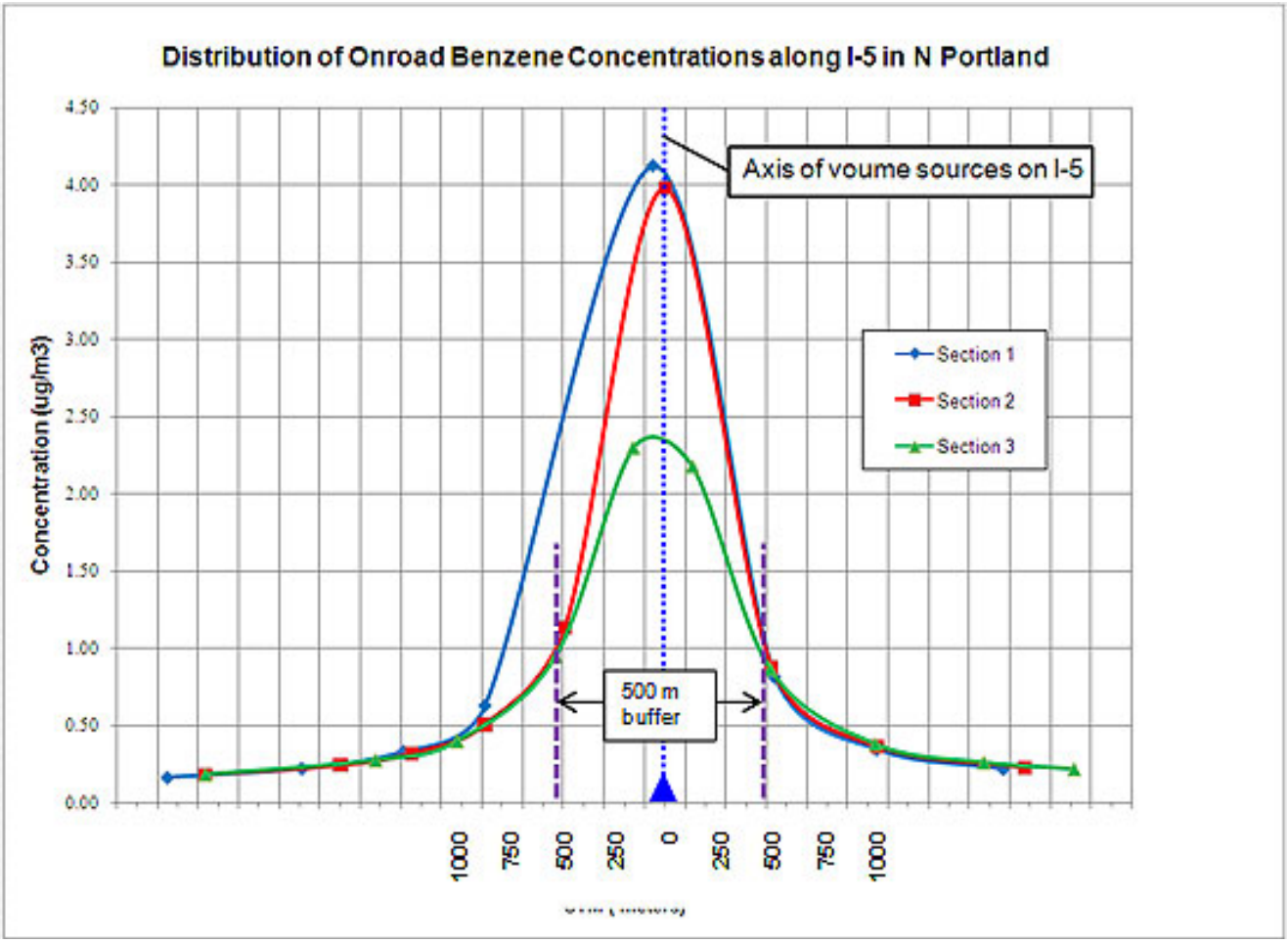

Figure 92: High Volume Roadway Receptors Used To Calculate Mobile Source Emission Reduction Targets

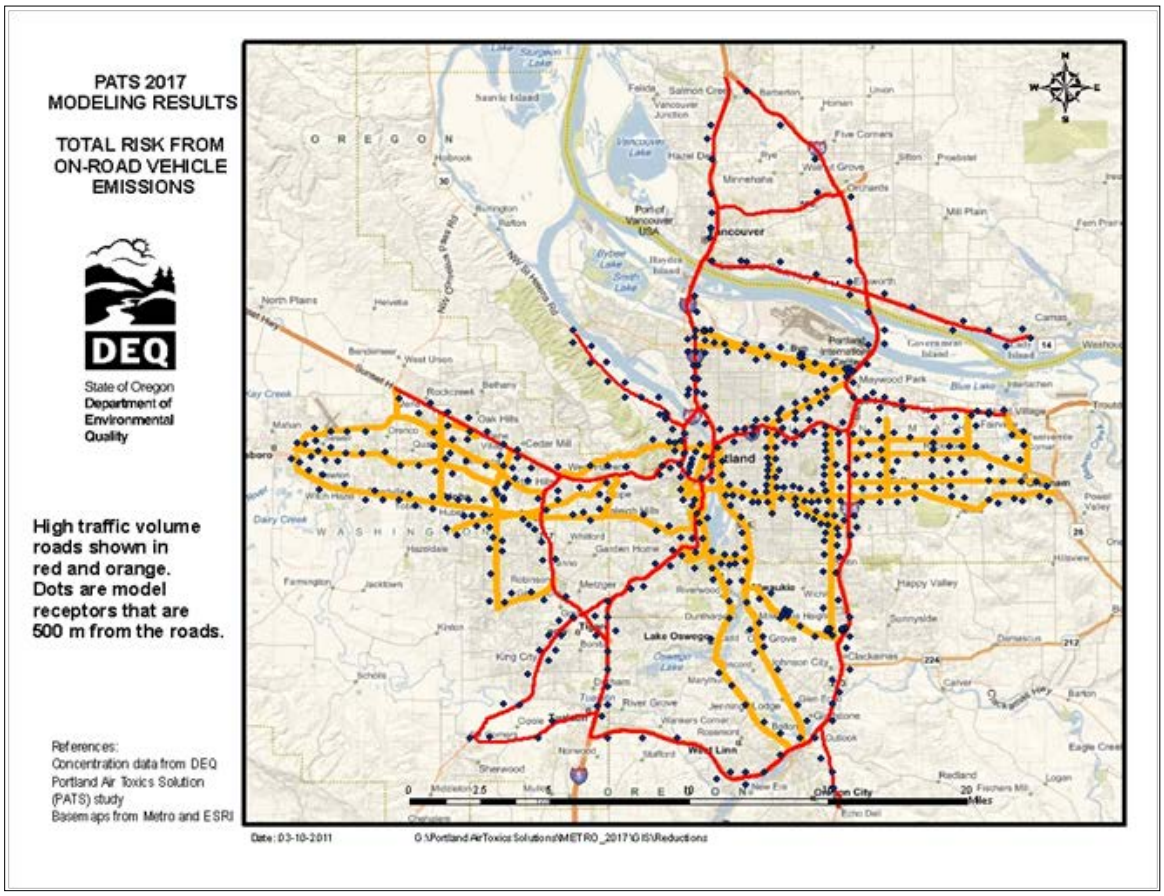

Figure 92 shows the high volume roadway receptors used to calculate mobile source emission reduction targets. On a neighborhood scale, these receptors are approximately within 1 to 7 blocks from roadways. Because major roadways in Portland run through densely settled neighborhoods, many people are exposed to the higher levels of air toxics from mobile sources.

In order to estimate proportional emissions reductions, DEQ first identified all receptors within 500 meters from these high volume roadways, and then determined the average contribution to concentrations at these receptors from the major category types (point, area, mobile). A percentage reduction was then developed for each pollutant emitted by mobile sources. Including emissions from all source categories at these receptors builds proportionality in to the emission reduction target for each source category. Percentage reductions can then be applied to emissions inventory values to estimate total tonnage to be reduced.

Table 13 shows these reduction targets for the pollutants associated predominantly with mobile sources. DEQ also developed mobile source reduction targets for other pollutants not shown on this chart: formaldehyde, acrolein, 15 PAH, and naphthalene.

Table 13: Reduction Targets for Pollutants Associated Predominantly with Mobile Sources

Impact around roadways: 500 meters	Average Concentration (ug/m3*)	Benchmark (ug/m3*)	Approximate Reduction Needed	Projected 2017 Emissions (tons per year)	Potential Reduction Needed (tons per year)
1,3-Butadiene	0.249	0.03	**88%**	25.55	22.5
Benzene	0.956	0.13	**86%**	205.98	177.1
Diesel PM	1.117	0.1	**91%**	81.72	74.4
Ethylbenzene	0.631	0.4	**37%**	85.61	31.7
Arsenic	0.000558	0.0002	**64%**	0.13	0.1
Chromium VI	0.000107	0.00008	**25%**	0.03	0.008

*ug/m3 = micrograms per cubic meter

6.1.2 Non Road Mobile Source Pollutant Emission Reduction Targets

For non road mobile sources, including construction equipment, rail and marine emissions, DEQ developed emission reduction targets by identifying the highest 20% of receptors. DEQ examined concentrations from all general emission sources (point, area, mobile) for these top 20% receptors, compared them to benchmarks, and generated percentage reductions needed for each pollutant by category. The reduction target percentage can then be applied to the emissions inventory tonnage to find an estimated reduction target for each pollutant by category. To understand the spatial distributions of pollutants from each category, DEQ mapped all pollutants from a category above benchmarks.

6.1.2.1 Construction

Figure 93 maps total risk from the construction category. Table 14 shows emission reduction targets for the construction category.

Figure 93: Total Risk from the Construction Category

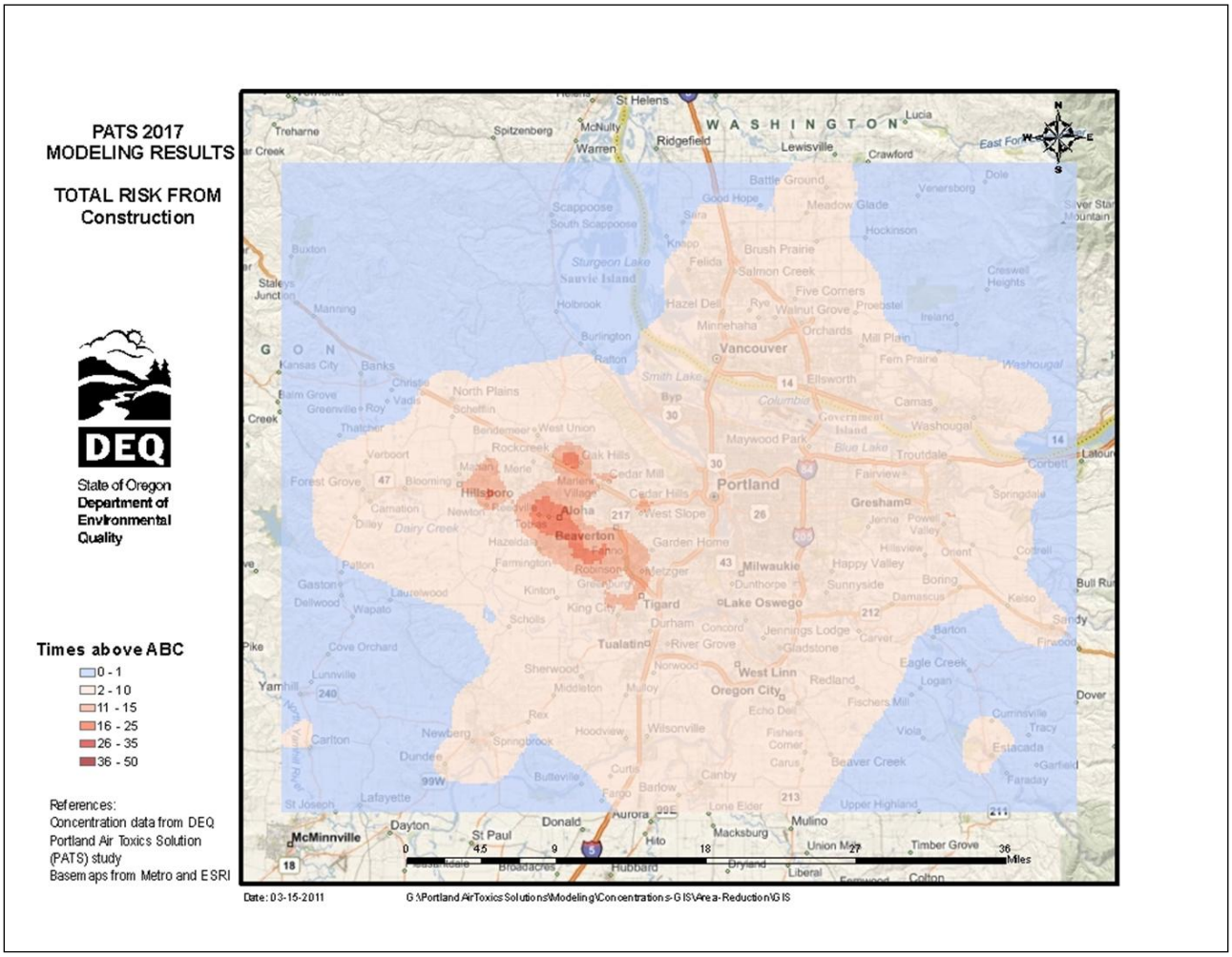

Table 14: Reduction Targets for Pollutants Associated Predominantly with Construction

Construction: analysis of the top 20% receptors					Area-Wide	
	All Source Categories				Construction Category	
	Average Concentration (ug/m3*)	Benchmark (ug/m3*)	Times above ambient benchmark concentration	Approx Reduction needed	Projected 2017 Emissions (tons per year)	Potential Reduction Needed (tons per year)
Diesel PM	1.2209	0.1	12.21	**92.5%**	247.3	228.7
PAH-15	0.0219	0.0009	24.33	**96.3%**	0.19	0.18

*ug/m3 = micrograms per cubic meter

6.1.2.2 Rail

Figure 94 shows total risk from the rail category. Table 15 shows emission reduction targets for the rail category.

Figure 94: Total Risk from the Rail Category

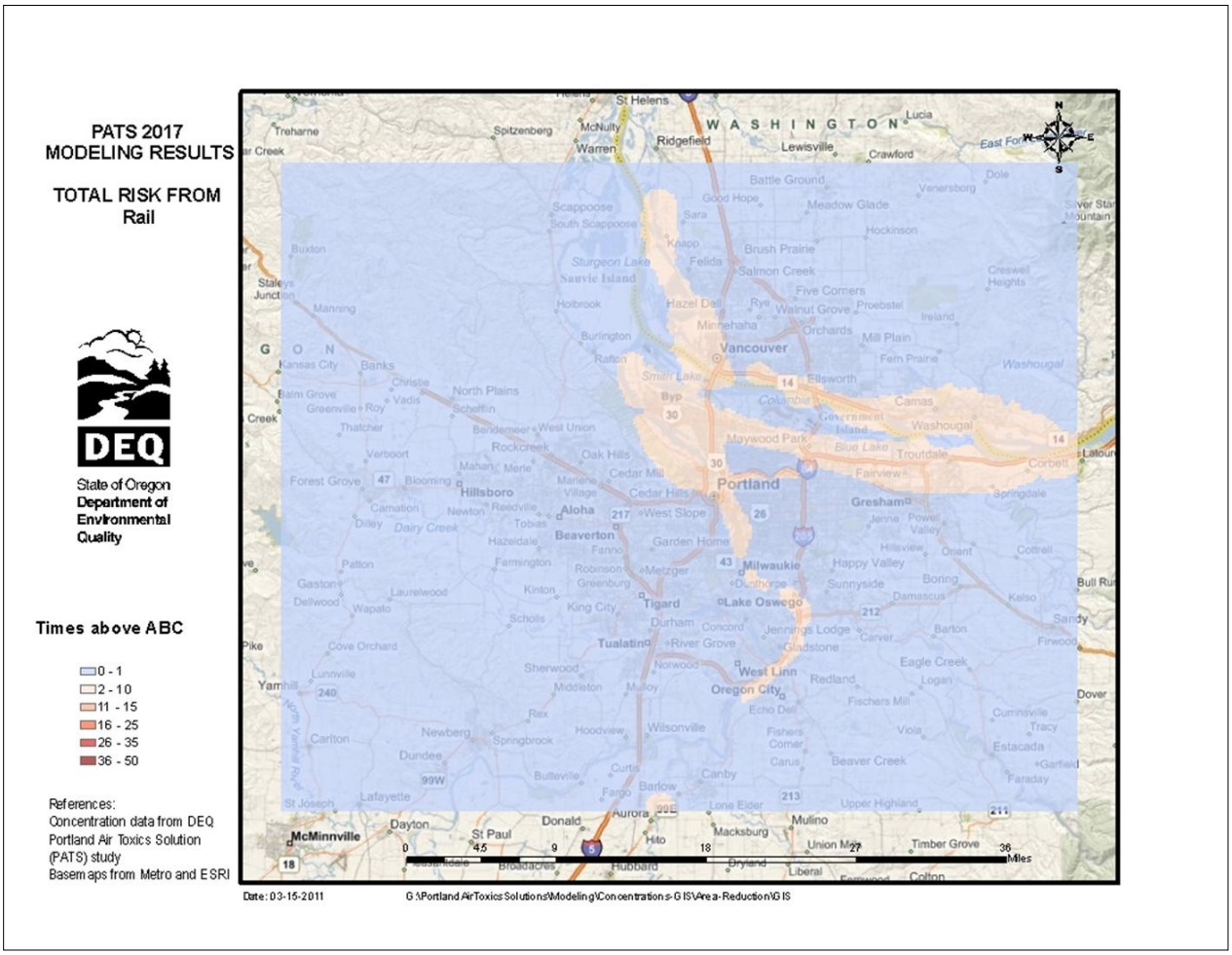

Table 15: Reduction Targets for Pollutants Associated Predominantly with Rail

Rail: analysis of the top 20 % of receptors					Rail Category	
	All Source Categories					
	Average Concentration (ug/m3*)	Benchmark (ug/m3*)	Times above ambient benchmark concentration	Approx. Reduction needed	Projected 2017 Emissions (tons per year)	Potential Reduction Needed (tons per year)
Diesel PM	0.9545	0.1	9.54	**91.8%**	38.8	35.6
PAH-15	0.0152	0.0009	16.89	**95.9%**	0.06	0.06

*ug/m3 = micrograms per cubic meter

6.1.2.3 Marine (Commercial and Recreational)

Figure 95 shows total risk from the marine category. Table 16 shows emission reduction targets for the marine category.

Figure 95: Total Risk from the Marine Category

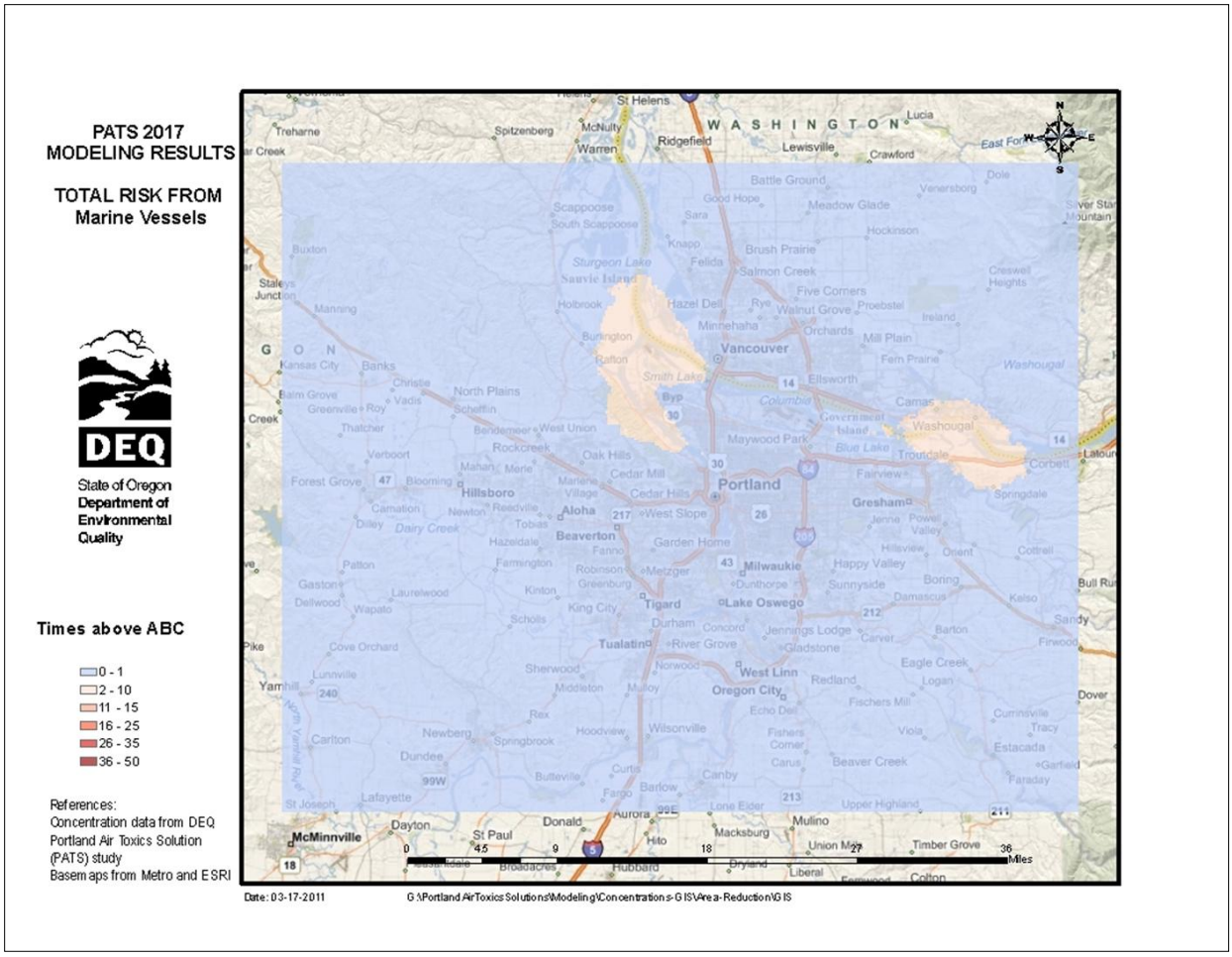

Table 16: Reduction Targets for Pollutants Associated Predominantly with Marine

Commercial & Recreational Marine: analysis of the top 20 % of receptors					Marine Category	
	All Source Categories					
	Average Concentration (ug/m3*)	Benchmark (ug/m3*)	Times above ambient benchmark concentration	Approx. Reduction needed	Projected 2017 Emissions (tons per year)	Potential Reduction Needed (tons per year)
Diesel PM	0.8191	0.1	8.19	**89.5%**	8.0	7.2
PAH-15	0.0126	0.0009	14.04	**94.1%**	0.012	0.012

*ug/m3 = micrograms per cubic meter

6.2 Area Source Emission Reduction Targets

DEQ used the same methodology for area sources (including residential wood combustion and solvent use) as it did for non road mobile sources. For each area source category DEQ identified the highest 20% of receptors. DEQ included concentrations from all emissions (point, area, mobile) for these top 20% receptors to find concentrations, compare them to benchmarks and generate percentage reductions needed for each pollutant by category. The reduction target percentage was then applied to the emissions inventory tonnage to find an estimated reduction target for each pollutant by category. Shown below are the area source categories that contribute more significantly to air toxics concentrations in the PATS area.

6.2.1 Residential Wood Combustion

Figure 96 shows total risk from the residential wood combustion category. Table 17 shows emission reduction targets for the residential wood combustion category.

Figure 96: Total Risk from the Residential Wood Combustion Category

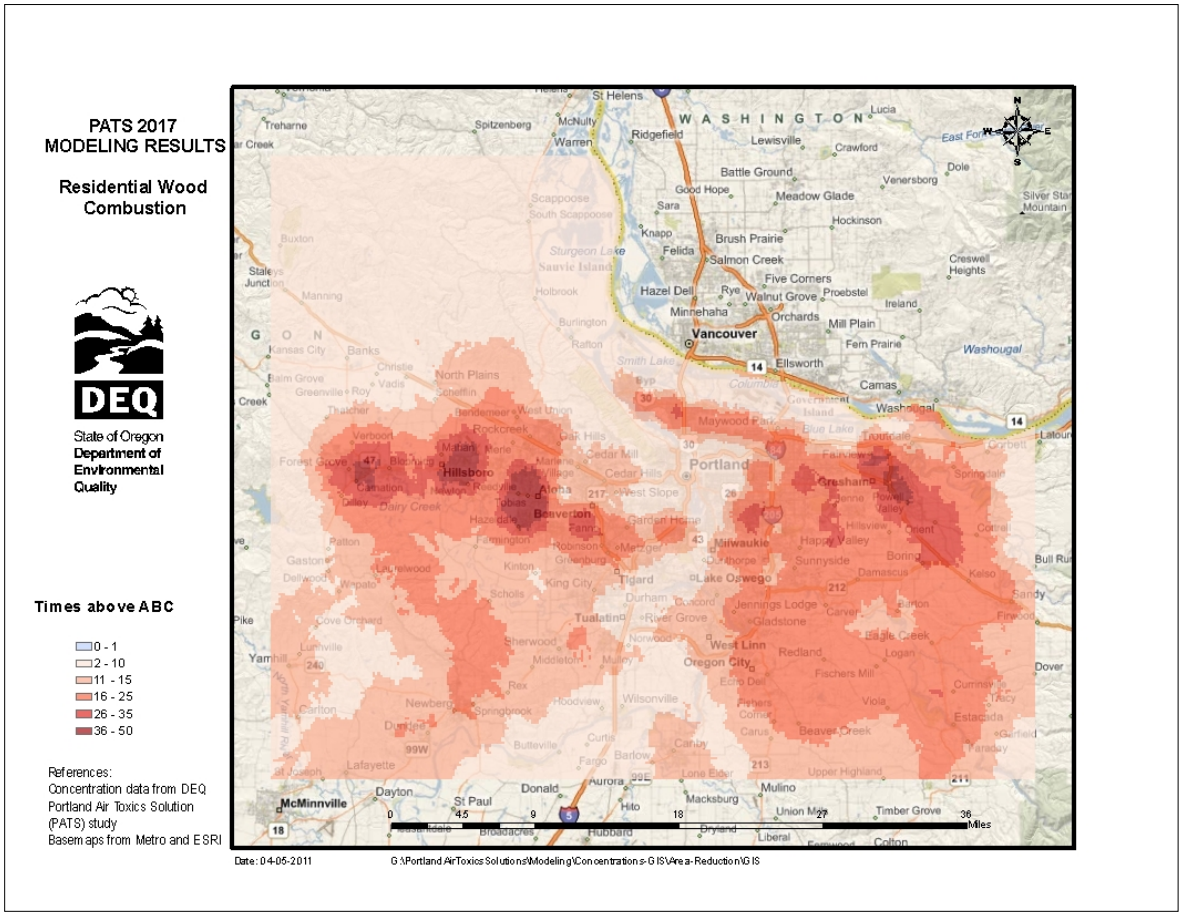

Table 17: Reduction Targets for Pollutants Associated Predominantly with Residential Wood Combustion

Residential Wood Combustion: analysis of the of the top 20% receptors					Residential Wood Combustion Category	
All Source Categories						
	Average Concentration (ug/m3*)	Benchmark (ug/m3*)	Times above ambient benchmark concentration	Approx. Reduction needed	Projected 2017 Emissions (tons per year)	Potential Reduction Needed (tons per year)
1,3 Butadiene	0.2872	0.03	9.57	**89.6%**	23.75	21.3
PAH-15	0.0280	0.0009	31.11	**96.8%**	12.59	12.18

*ug/m3 = micrograms per cubic meter

6.2.2 Lawn and Garden

Figure 97 shows total risk from the lawn and garden category.

Figure 97: Total Risk from the Lawn and Garden Category

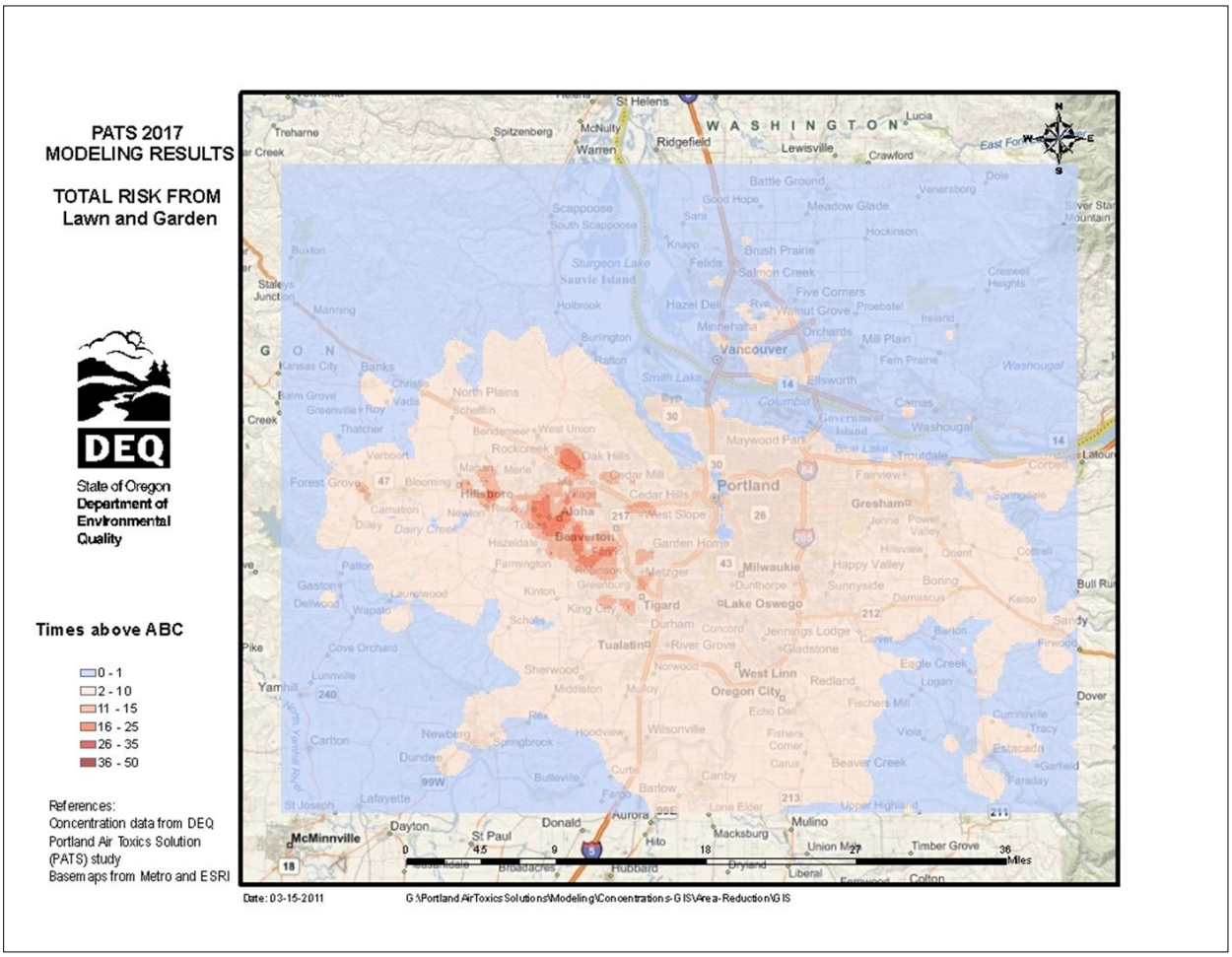

Table 18 below shows emission reduction targets for the lawn and garden category.

Table 18: Reduction Targets for Pollutants Associated Predominantly with Lawn and Garden

Lawn & Garden: analysis of the the top 20% receptors					Lawn and Garden Category	
	All Source Categories					
	Average Concentration (ug/m3*)	Benchmark (ug/m3*)	Times above ambient benchmark concentration	Approx. Reduction needed	Projected 2017 Emissions (tons per year)	Potential Reduction Needed (tons per year)
1,3 Butadiene	0.3163	0.03	10.54	**90.0%**	10.5	9.4
Formaldehyde	0.6940	0.077	9.01	**89.5%**	21.9	19.6
Diesel PM	1.3334	0.1	13.33	**92.3%**	15.1	14.0
PAH-15	0.0241	0.0009	26.81	**96.0%**	0.61	0.58

*ug/m3 = micrograms per cubic meter

6.2.3 Solvent Use

Figure 98 shows total risk from the solvent use category. Table 19 below shows emission reduction targets for the solvent use category.

Figure 98: Total Risk from the Solvent Use Category

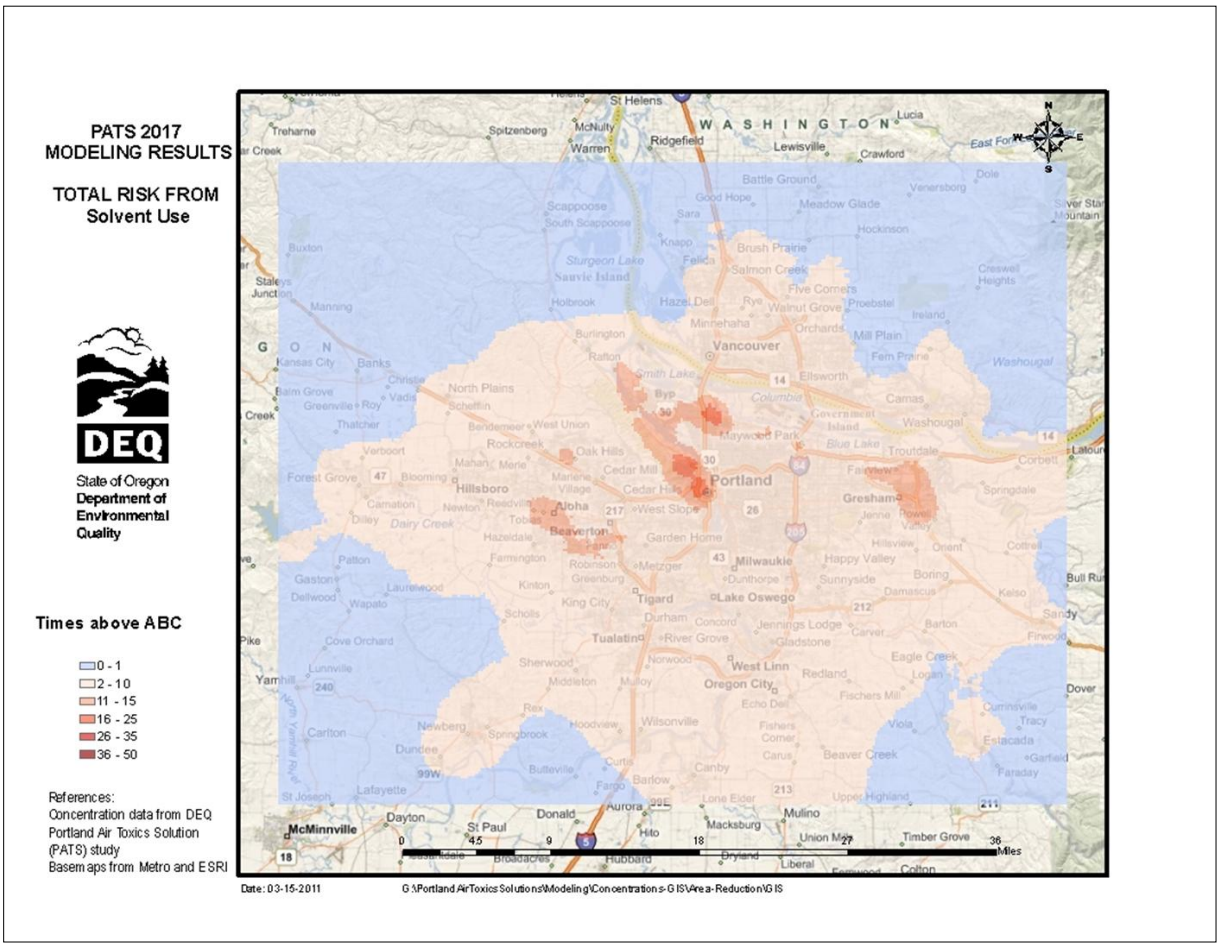

Table 19: Reduction Targets for Pollutants Associated Predominantly with Solvent Use

Solvent Use: analysis of the of the top 20% receptors					Solvent Use Category	
	All Source Categories					
	Average Concentration (ug/m3*)	Benchmark (ug/m3*)	Times above ambient benchmark concentration	Approx. Reduction needed	Projected 2017 Emissions (tons per year)	Potential Reduction Needed (tons per year)
Formaldehyde	0.7655	0.077	9.94	**89.9%**	1.4	1.3
Naphthalene	0.2580	0.03	8.60	**88.4%**	43.3	38.3
Benzene	1.1450	0.13	8.81	**88.6%**	20.4	18.1

*ug/m3 = micrograms per cubic meter

6.3 Point Source Emission Reduction Targets

There are 81 permitted facilities included in the PATS 2017 model. Because point source impacts are generally local in nature, DEQ focused point source reduction target analysis on concentrations at receptors closest to the facilities. To develop the approximate reductions needed for each facility, DEQ analyzed the receptor nearest to the facility with the highest impact from each of the four pollutants predominantly emitted by point sources: cadmium, manganese, nickel and lead. In addition, benzene was analyzed for point sources because it had several projected high concentrations at or near local receptors. This method is consistent with the mobile and area reasonable worst-case analyses that generated protective emission reduction targets. Reducing concentrations at the highest impacted receptors will also reduce impacts on surrounding receptors. No background or secondary concentrations were included in this analysis. The sections below show the approximate reductions needed at the highest impacted receptor for cadmium, manganese, nickel, lead, and benzene. For all point sources, refinements to emission inventories and modeling parameters could provide more accurate estimations of modeled concentrations. More information on point source emission reduction targets can be found in Appendix 12.8.

6.3.1 Cadmium

The map in Figure 99 shows total risk for cadmium from all sources. In the areas more than two times above the benchmark there is a 70% or higher contribution from industry. Table 20 lists the significant source categories that emit cadmium and approximate reduction needed. Model to monitor comparisons for cadmium suggest that there are additional cadmium sources in North Portland that are not included in the model. (See section 3.6) The elevated cadmium levels modeled in the Beaverton area are related to natural gas use.

Figure 99: Total Risk for Cadmium from All Sources (Point, Area, Mobile)

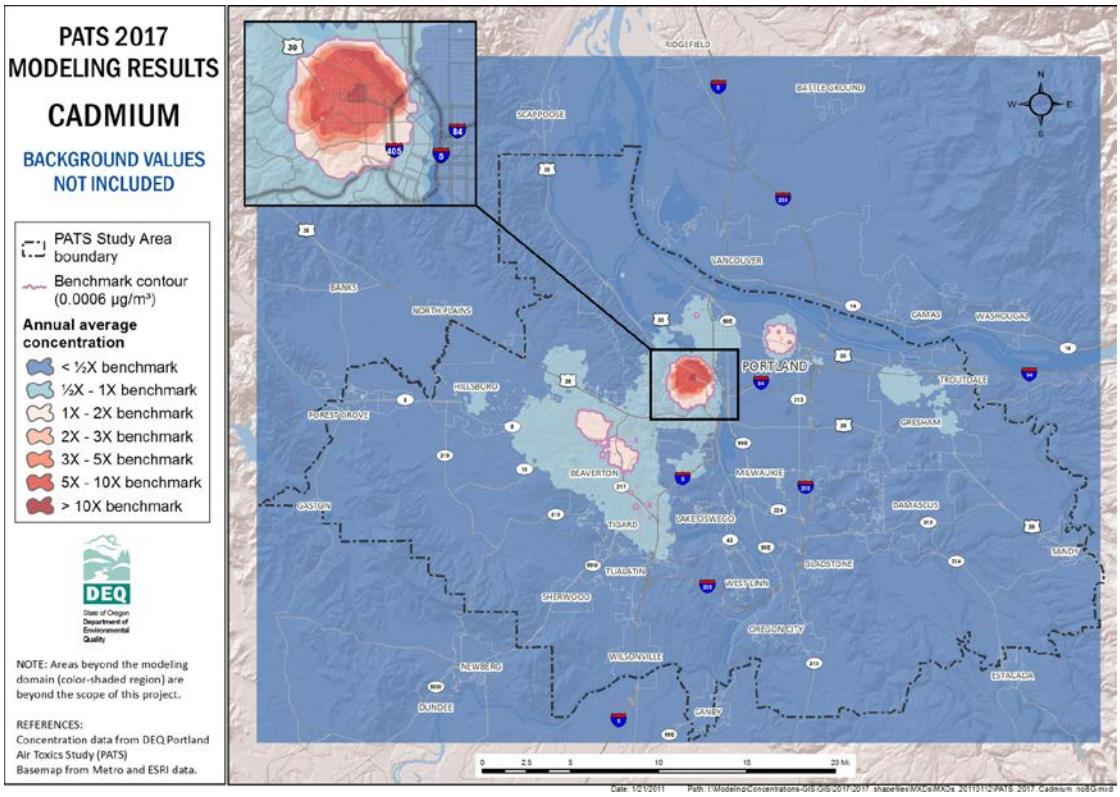

Table 20: Approximate Reduction Needed at Highest Impacted Receptor for Cadmium Point Sources

Source Category Description	Approximate Reduction Needed at Highest Impacted Receptor	Projected 2017 Emissions (lbs)	Potential Reduction (lbs)
Steel Foundries	96%	27	26
Heating Equipment Manufacturing	84%	11	9
Metal Coating, Engraving, and Allied Services to Manufacturers	94%	4	4
Asphalt Shingle and Coating Materials Manufacturing	66%	3	2

6.3.2 Manganese

The map in Figure 100 shows total risk for manganese from all sources. All areas above the benchmark for manganese have 100% of emission contributions from industrial sources. Table 21 lists the significant source categories that emit manganese and approximate reduction needed.

Figure 100: Total Risk for Manganese from All Sources (Point, Area, Mobile)

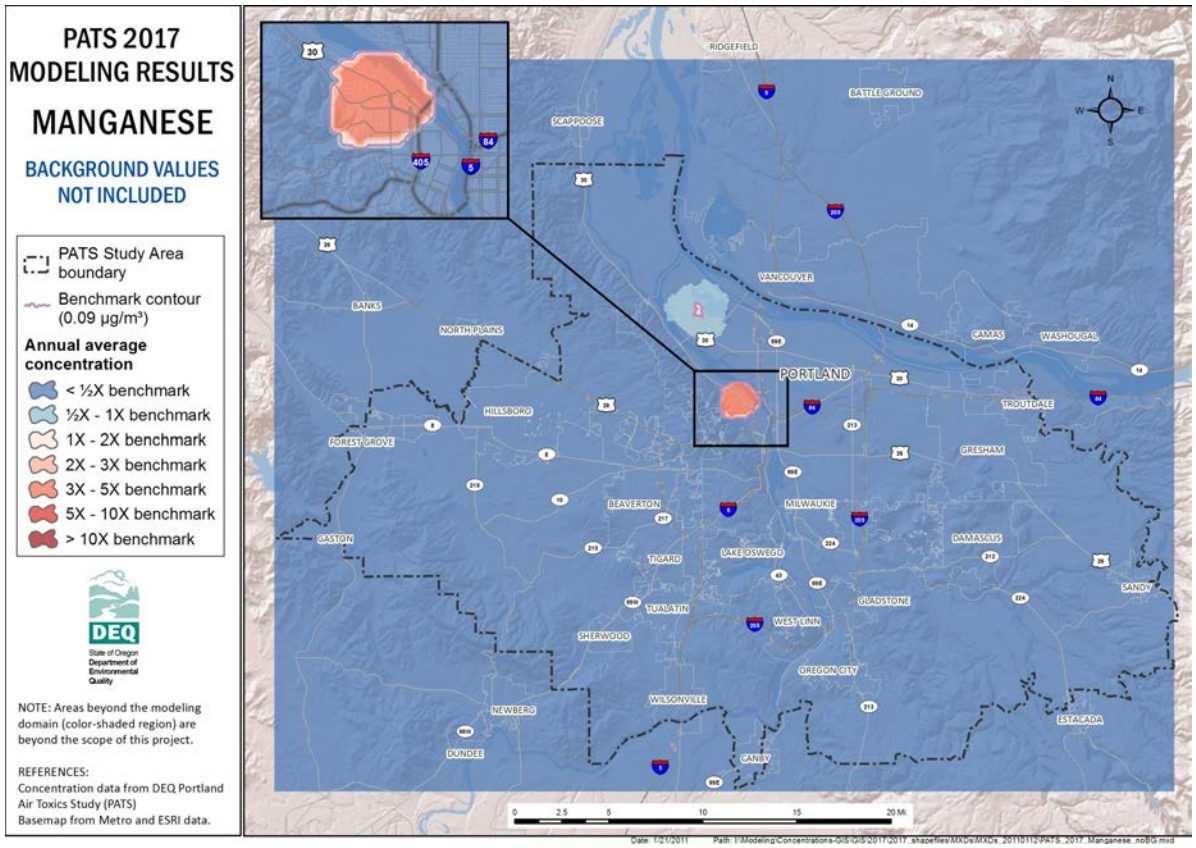

Table 21: Approximate Reduction Needed at Highest Impacted Receptor for Manganese Point Sources

Primary NAICS description	Approximate Reduction Needed at Highest Impacted Receptor	Projected 2017 Emissions (lbs)	Potential Reduction (lbs)
Steel Foundries	39% to 91%	816 to 1,951	743 to 753

6.3.3 Nickel

The map in Figure 101 shows total risk for nickel from all sources. All areas above the benchmark for nickel have 100% of emission contributions from industrial sources. Table 22 lists the significant source categories that emit nickel and approximate reduction needed.

Figure 101: Total Risk for Nickel from All Sources (Point, Area, Mobile)

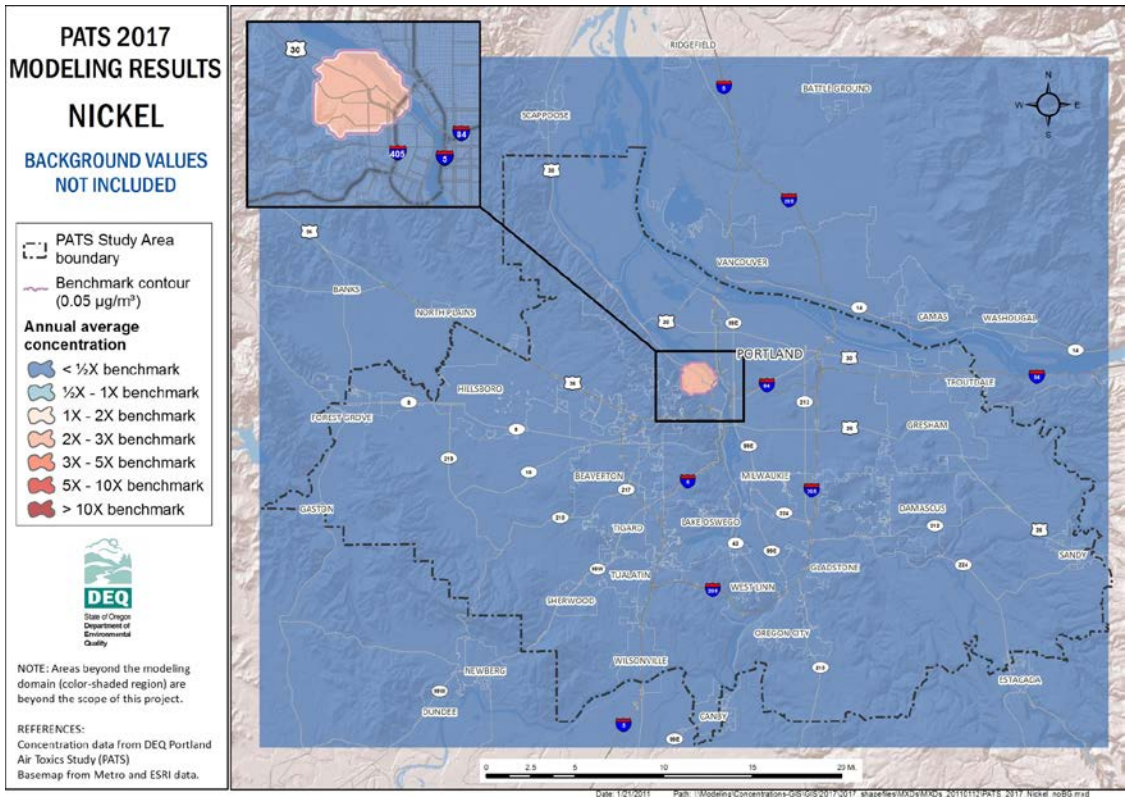

Table 22: Approximate Reduction Needed at Highest Impacted Receptor for Nickel Point Sources

Source Category Description	Approximate Reduction Needed at Highest Impacted Receptor	Projected 2017 Emissions (lbs)	Potential Reduction Needed (lbs)
Steel Foundries	72%	85	62

6.3.4 Lead

The map in Figure 102 shows total risk for lead from all sources. There was only one receptor showing a level above the lead benchmark. Due to the limitations of the mapping graphics, this receptor does not appear on the map. Table 23 lists the significant source category that emits lead and approximate reduction needed.

Figure 102: Total Risk for Lead from All Sources (Point, Area, Mobile)

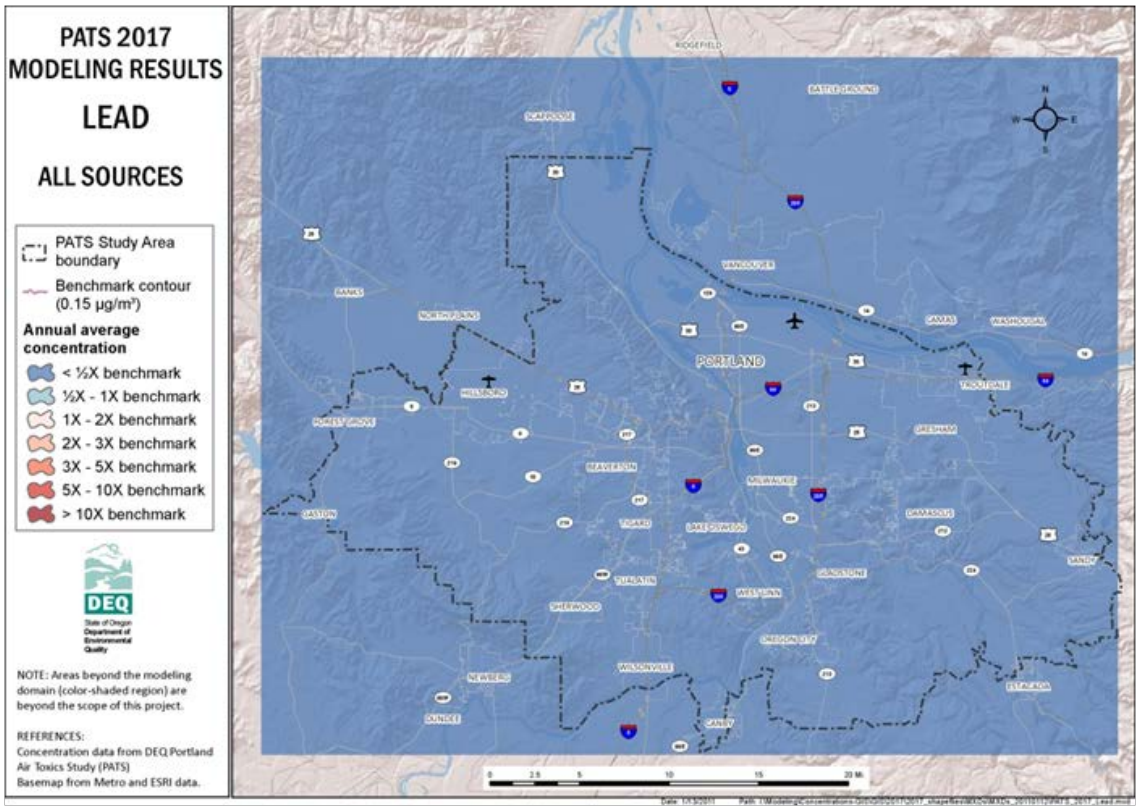

Table 23: Approximate Reduction Needed at Highest Impacted Receptor for Lead Point Sources

Source Category Description	Approximate Reduction Needed at Highest Impacted Receptor	Projected 2017 Emissions (lbs)	Potential Reduction (lbs)
Steel Foundries	49%	167	82

6.3.5 Benzene

The map in Figure 103 shows total risk for benzene from all sources. In the highest impacted areas, between two and 60% of the emission contributions come from industrial sources. Table 24 lists the significant source categories that emit benzene and approximate reduction needed.

Figure 103: Total Risk for Benzene from All Sources (Point, Area, Mobile)

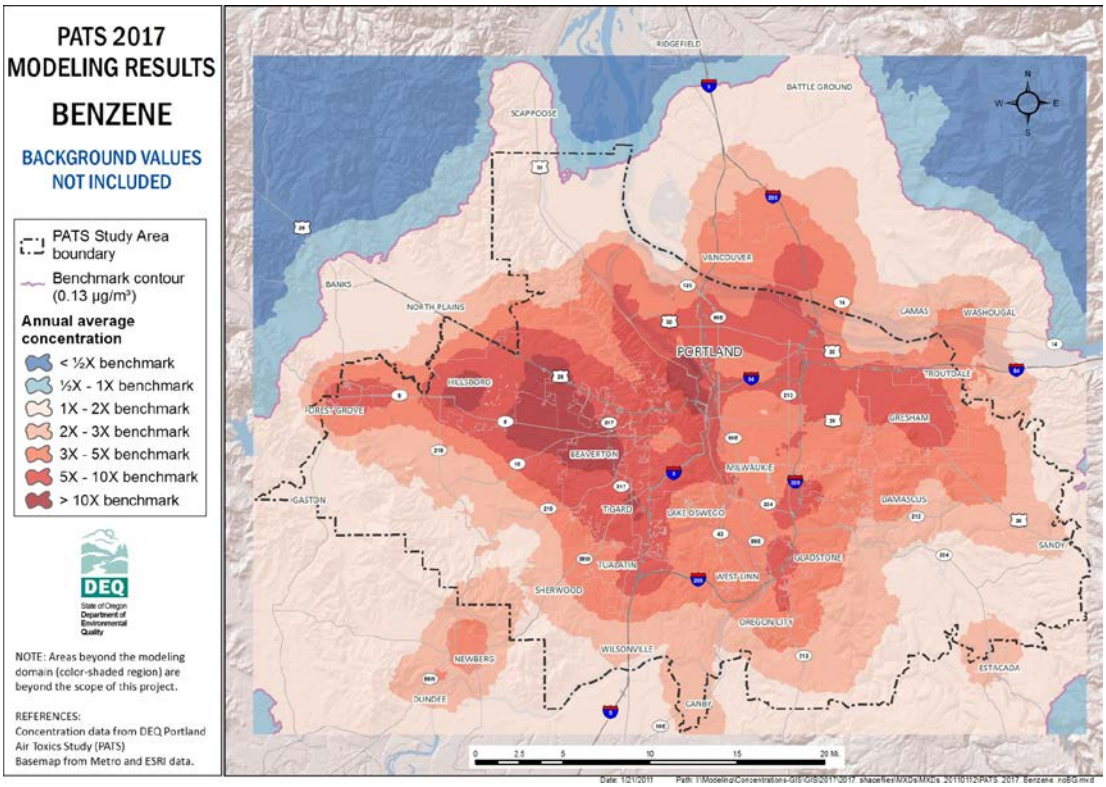

Table 24: Approximate Reduction Needed at Highest Impacted Receptor for Benzene Point Sources

Source Category Description	Approximate Reduction Needed at Highest Impacted Receptor	Projected 2017 Emissions (lbs)	Potential Reduction (lbs)
Steel Foundries	98%	5,269	5,156
Newsprint Mills	61%	7,517	4,559
Petroleum Refineries	93%	1,020	945
Petroleum Bulk Stations and Terminals	82% to 93%	44 to 1,567	35 to 1,309
General Warehousing and Storage	93%	677	627
Asphalt Shingle and Coating Materials Manufacturing	84% to 91%	122 to 505	102 to 457
Other Aircraft Parts and Auxiliary Equipment Manufacturing	85%	208	178
Pulp Mills	69%	221	152
Ship Building and Repairing	78%	143	111
Sawmills	29% to 84%	65 to 160	47 to 54
Pipeline Transportation of Natural Gas	48%	113	54
Heating Equipment (except Warm Air Furnaces) Manufacturing	88%	21	19
Iron and Steel Mills	48%	5	2
Paper (except Newsprint) Mills	69%	3	2
Semiconductor and Related Device Manufacturing	79%	2	2
Hazardous Waste Treatment and Disposal	90%	1	1