Hampton Lumber Mills, Inc. – Tillamook

Modeling Protocol and Risk Assessment Workplan

Prepared for:

Hampton Lumber Mills, Inc.

Submitted on:

October 14, 2026

TRINITY CONSULTANTS/BRIDGEWATER GROUP

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1.0 Introduction

Hampton Lumber Mills, Inc., dba Tillamook Lumber Company (Hampton) operates a sawmill at 3111 East 3rd Street in Tillamook, Oregon. The site is shown in Figure 1-1. The sawmill currently operates under a Title V Air Operating Permit (#29-0007-TV-01).

On January 2, 2025, the Oregon Department of Environmental Quality (DEQ) called Hampton into the Cleaner Air Oregon (CAO) program, requiring an Air Toxics Emissions Inventory (ATEI) be submitted by April 2, 2025. Hampton requested a 30-day extension, which DEQ accepted, thus setting the ATEI submittal deadline to May 2, 2025. Hampton submitted the ATEI on May 2, 2025. DEQ issued a written request on November 14, 2025, requiring additional information and a revised ATEI. Hampton submitted a revised ATEI on January 30, 2026. DEQ reviewed the ATEI and, on July 14, 2026, identified additional updates that were needed before approval. Hampton submitted a third revised ATEI on August 21, 2026. DEQ reviewed and, on September 14, 2026, approved the ATEI with additional conditions.

The next step in the CAO process is to submit a Modeling Protocol (MP) by October 14, 2026 [OAR 340-245-0030(1)(b)]. MP requirements are listed in OAR 340-245-0210(1)(a). For a Level 3 or 4 risk assessment, the Risk Assessment Work Plan (RAWP) must be submitted to DEQ by November 13, 2026 [OAR 340-245-0030(1)(c)]. RAWP requirements are listed in OAR 340-245-0210(2). This document is a combined Modeling Protocol and Level 3 Risk Assessment Work Plan (MPRAWP).

Figure 1-1: Site Location



2.0 Process Information

2.1 Process Overview

Hampton receives logs of hemlock and Douglas fir, which are loaded into the sawmill and cut to size before being loaded into drying kilns. The lumber is dried with non-contact steam, with occasional steam directly added for moisture control. The lumber is then cut to final size, inspected, marked, and packaged for transport. The collected wood chips and sawdust from the mill are used as fuel for the boiler, which provides steam heat for the drying kilns, or sold for offsite use. A Process Flow Diagram with emissions units is provided in Figure 2-1.

2.2 Toxic Emission Units

The inventory of TEUs at the facility is presented in Table 2-1. This table provides the Permit ID, TEU ID from the AQ520 form, and the model ID. The modeled sources are shown in Figure 2-2.

Figure 2-1: Process Flow Diagram with Emissions Units

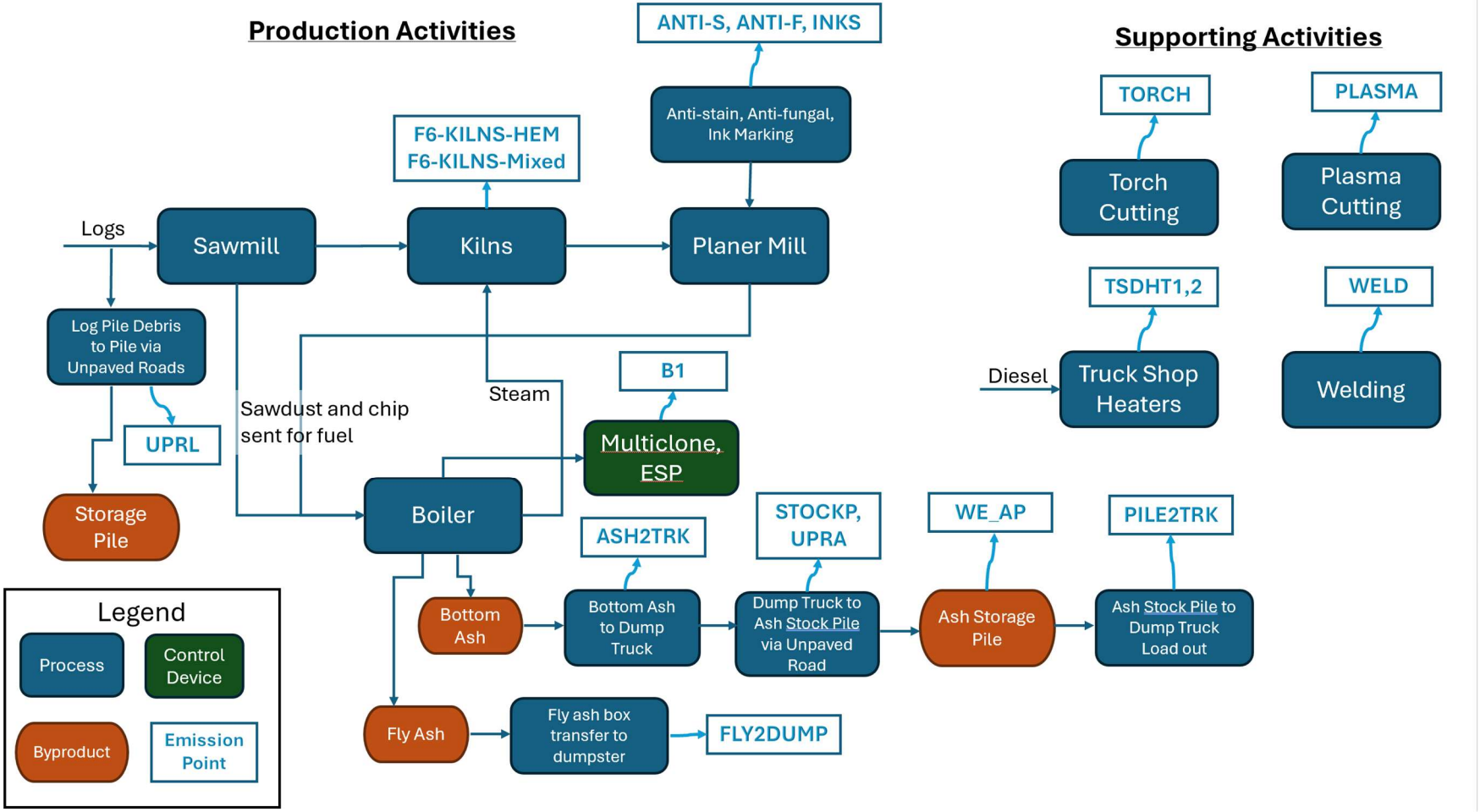


Table 2-1: Inventory of TEUs

Permit ID	TEU ID	Model ID	Description
B1	B1	BOIL	Hogged Fuel Boiler: 150,000-pound steam per hour Wellons Fuel Cell-Water Tube unit, controlled by a Multiclone and ESP
B1	B1 SU PRE-ESP	BOILSUP1	Hogged Fuel Boiler - Startup Scenario, Pre-ESP
B1	B1 SU POST-ESP	BOILSUP2	Hogged Fuel Boiler - Startup Scenario, Post-ESP
F6	KILNS-Hem	KILN	Seven lumber drying kilns when used for Hemlock*
F6	KILNS-Mixed	KILN	Seven lumber drying kilns when used for Douglas fir or when kilns are used for both species *
	TSDHT1	TSDHT1	500,000 Btu/hr diesel-fired furnace for shop heating
	TSDHT2	TSDHT2	454,000 Btu/hr diesel-fired furnace for shop heating
	ASH2TRK	ASH1	Bottom ash from the boiler is loaded into trucks
	STOCKP	STOCKP	Bottom ash dumped onto stockpile,
	PILE2TRK	STOCKP	Bottom ash loaded from stockpile to truck for offsite shipment
	FLY2DUMP	FLYDUMP	Fly ash loaded to dumpster
F4	UNPA	UNPA	Unpaved roads - bottom ash
F4	UNPL	UNPL	Unpaved Roads - Log Pile
	WE-AP	APWE	Wind erosion off ash stockpile
	WELD-MW-71T	MAINS	Welding Maintenance Shop 71T
	WELD-MW-7018	MAINS	Welding Maintenance Shop 7018
	WELD-PMW-7018	PMWS	Welding Planer Millwright Shop 7018
	WELD-KS-7018	KITS	Welding Kit Shed 7018
	WELD-TS-7018	TRKS	Welding Truck Shop 7018
	WELD-MW-70S-6	MAINS	Welding Maintenance Shop 70S-6
	WELD-UF-70S-6	UFR	Welding Upper Filing Room 70S-6
	WELD-HS-70S-6	HSFR	Welding Head Saw Filing Room 70S-6
	PLASMAT-MW	MAINS	Plasma Table - Main. Shop
	PLASMAH-MW	MAINS	Plasma Hand Held - Main. Shop
	PLASMAH-PMW	PMWS	Plasma Hand Held – Planer Millwright Shop
	TORCH	MAINS	Oxy-acetylene torch - Main. shop
	INKS	PSIX	Ink marking onto finished lumber
F7	ANTI-S	PSIX	Anti-stain application
F7	ANTI-F	PMNE	Anti-fungal end treatment (planer mill north end)

Table 2-2: Model Source Types and Locations

Point Sources	Description	UTM X(m)	UTM Y(m)	Elev (m)
BOIL	Hogged Fuel Boiler	434953	5033396	6.5
BOILSUP1	Hogged Fuel Boiler: Pre-ESP Start-up	434953	5033396	6.5
BOILSUP2	Hogged Fuel Boiler: Post-ESP Start-up	434953	5033396	6.5
TSDHT2	Diesel Heater 2	434957.7	5033864	11.4
TSDHT1	Diesel Heater 1	434957.7	5033865	11.4

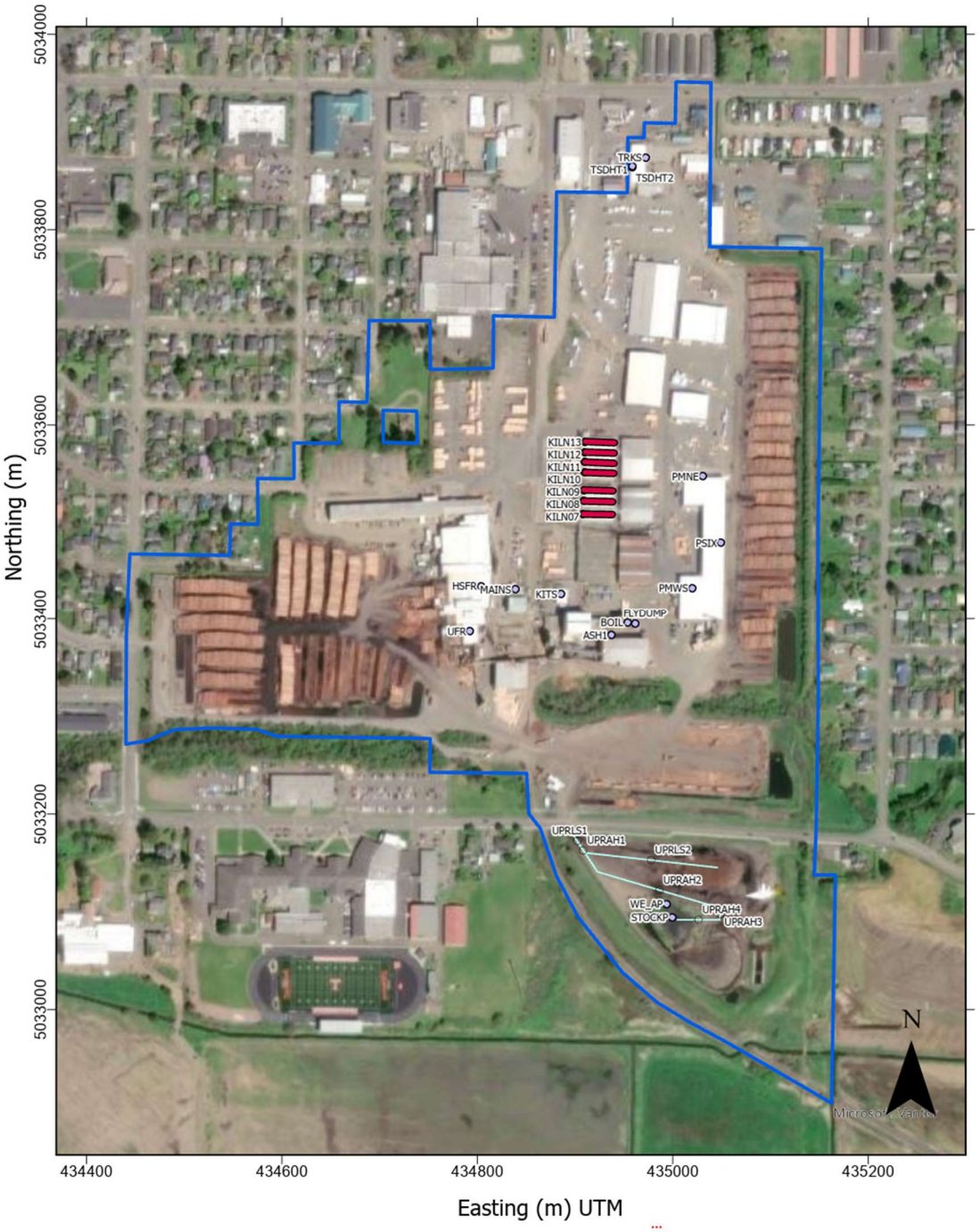
Volume Sources		UTM X(m)	UTM Y(m)	Elev (m)
ASH1	Transfer of bottom ash from collection bin to dump truck	434937	5033383	6.5
STOCKP	Bottom Ash stockpile	434999	5033094	6.5
FLYDUMP	Flyash Dumpster	434961	5033395	6.5
MAINS	Maintenance Shop	434838	5033431	7.6
PMWS	Planer Millwright Shop	435019	5033433	7.7
KITS	Kit Shed	434885.5	5033427	6.5
TRKS	Truck Shop	434972	5033874	11.4
UFR	Upper Filing Room	434792	5033387	7.6
HSFR	Head Saw Filing Room	434803	5033435	7.6
PSIX	Planer Stain/Inks exhaust	435049	5033479	7.7
PMNE	Planer Mill North End	435030	5033547	7.7

Areapoly Source		UTM X(m)	UTM Y(m)	Elev (m)	Npts
WE_AP	Wind Erosion Ash Pile	434993.5	5033108	6.5	4

Buoyant Line Sources (KILN)		X1 (m)	Y1(m)	X2 (m)	Y2(m)	Elev (m)
KILN07	Kiln Line 7	434907.8	5033509	434937.8	5033508	8.7
KILN08	Kiln Line 8	434908	5033522	434938	5033521	8.7
KILN09	Kiln Line 9	434908.2	5033533	434938.2	5033532	8.7
KILN10	Kiln Line 10	434909.4	5033551	434939.4	5033550	8.7
KILN11	Kiln Line 11	434909.5	5033562	434939.5	5033561	8.7
KILN12	Kiln Line 12	434909.7	5033572	434939.7	5033571	8.7
KILN13	Kiln Line 13	434909.9	5033583	434939.9	5033582	8.7

Unpaved Road Line Sources (UNPL, UNPA)		X1 (m)	Y1(m)	X2 (m)	Y2(m)	Elev (m)
UPRLS1	UPR log pile seg 1	434893.4	5033184	434909.5	5033160	6.5
UPRLS2	UPR log pile seg 2	434909.5	5033160	435045	5033145	6.5
UPRAH1	UPR Ash Haul 1	434893.4	5033184	434922.4	5033141	6.5
UPRAH2	UPR Ash Haul 2	434922.4	5033141	435049.3	5033103	6.5
UPRAH3	UPR Ash Haul 3	435049.3	5033103	435047.3	5033092	6.5
UPRAH4	UPR Ash Haul 4	435047.3	5033092	435004.2	5033091	6.5

Figure 2-2: Model Source Locations



2.3 Compounds Emitted

Table 2-3 shows the toxics air contaminants (TACs) emitted from the facility, the form of the pollutant (particulate or volatile gas), and whether the pollutant has an Early-Life (EL) or Multi-Pathway (MP) adjustment made to its Risk-Based Concentrations (RBCs). TACs without RBCs are shown at the bottom of the table.

Table 2-3: Compounds Emitted

CAS #	Toxic Air Contaminant (TAC)	Type	Adjustment	HI Type
Compounds with RBC's				
75-07-0	Acetaldehyde	Volatile	-	HI3
67-64-1	Acetone	Volatile	-	HI3
107-02-8	Acrolein	Volatile	-	HI5
7429-90-5	Aluminum and compounds	Particulate	-	HI5
7664-41-7	Ammonia	Volatile	-	HI3
7440-36-0	Antimony and compounds	Particulate	-	HI3
7440-38-2	Arsenic and compounds	Particulate	Y	HI3
71-43-2	Benzene	Volatile	-	HI3
7440-41-7	Beryllium and compounds	Particulate	-	HI3
117-81-7	Bis(2-ethylhexyl) phthalate (DEHP)	Volatile	Y	--
74-83-9	Bromomethane (Methyl bromide)	Volatile	-	HI3
106-99-0	1,3-Butadiene	Volatile	-	HI3
78-93-3	2-Butanone (Methyl ethyl ketone)	Volatile	-	HI3
7440-43-9	Cadmium and compounds	Particulate	Y	HI3
56-23-5	Carbon tetrachloride	Volatile	-	HI3
7782-50-5	Chlorine	Volatile	-	HI3
108-90-7	Chlorobenzene	Volatile	-	HI3
67-66-3	Chloroform	Volatile	-	HI3
74-87-3	Chloromethane (Methyl chloride)	Volatile	-	HI3
18540-29-9	Chromium VI, chromate and dichromate particulate	Particulate	Y	HI3
7440-48-4	Cobalt and compounds	Particulate	-	HI3
7440-50-8	Copper and compounds	Particulate	-	HI3
74-90-8	Cyanide, Hydrogen	Volatile	-	HI3
106-46-7	p-Dichlorobenzene (1,4-Dichlorobenzene)	Volatile	-	HI3
75-09-2	Dichloromethane (Methylene chloride)	Volatile	Y	HI3
78-87-5	1,2-Dichloropropane (Propylene dichloride)	Volatile	-	HI3
112-34-5	Diethylene glycol monobutyl ether	Volatile	-	HI3
121-14-2	2,4-Dinitrotoluene	Volatile	-	--
100-41-4	Ethyl benzene	Volatile	-	HI3
107-06-2	Ethylene dichloride (EDC, 1,2-Dichloroethane)	Volatile	-	HI3
C239	Fluorides	Volatile	Y	HI3
50-00-0	Formaldehyde	Volatile	-	HI3
110-54-3	Hexane	Volatile	-	HI3
7647-01-0	Hydrochloric acid	Volatile	-	HI3
7664-39-3	Hydrogen fluoride	Volatile	Y	HI3
67-63-0	Isopropyl alcohol	Volatile	-	HI3
98-82-8	Isopropylbenzene (Cumene)	Volatile	-	HI3
7439-92-1	Lead and compounds	Particulate	Y	HI3
7439-96-5	Manganese and compounds	Particulate	-	HI3

CAS #	Toxic Air Contaminant (TAC)	Type	Adjustment	HI Type
7439-97-6	Mercury and compounds	Particulate	Y	HI3
67-56-1	Methanol	Volatile	-	HI3
108-10-1	Methyl isobutyl ketone (MIBK, Hexone)	Volatile	-	HI3
91-20-3	Naphthalene	Volatile	Y	HI3
C365	Nickel compounds, insoluble	Particulate	-	HI3
87-86-5	Pentachlorophenol	Volatile	-	--
108-95-2	Phenol	Volatile	-	HI3
1336-36-3	Polychlorinated biphenyls (PCBs)	Volatile	Y	--
C646	Polychlorinated dibenzo-p-dioxins (PCDDs) & dibenzofurans (PCDFs) TEQ	Volatile	Y	HI3
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	Volatile	-	HI3
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	Volatile	-	HI3
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	Volatile	-	HI3
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	Volatile	-	HI3
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	Volatile	-	HI3
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	Volatile	-	HI3
3268-87-9	Octachlorodibenzo-p-dioxin (OCDD)	Volatile	-	HI3
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TcDF)	Volatile	-	HI3
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	Volatile	-	HI3
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	Volatile	-	HI3
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	Volatile	-	HI3
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	Volatile	-	HI3
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	Volatile	-	HI3
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	Volatile	-	HI3
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	Volatile	-	HI3
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	Volatile	-	HI3
39001-02-0	Octachlorodibenzofuran (OCDF)	Volatile	-	HI3
C401	Polycyclic aromatic hydrocarbons (PAHs)	Volatile	Y	--
56-55-3	Benz[a]anthracene	Volatile	-	--
50-32-8	Benzo[a]pyrene	Volatile	Y	HI3
205-99-2	Benzo[b]fluoranthene	Volatile	-	--
191-24-2	Benzo[g,h,i]perylene	Volatile	-	--
205-82-3	Benzo[j]fluoranthene	Volatile	-	--
207-08-9	Benzo[k]fluoranthene	Volatile	-	--
218-01-9	Chrysene	Volatile	-	--
53-70-3	Dibenz[a,h]anthracene	Volatile	-	--
206-44-0	Fluoranthene	Volatile	-	--
193-39-5	Indeno[1,2,3-cd]pyrene	Volatile	-	--
123-38-6	Propionaldehyde	Volatile	-	HI5
107-98-2	Propylene glycol monomethyl ether	Volatile	-	HI3
7782-49-2	Selenium and compounds	Volatile	-	HI3
7631-86-9	Silica, crystalline (respirable)	Particulate	-	HI5
100-42-5	Styrene	Volatile	-	HI3
127-18-4	Tetrachloroethene (Perchloroethylene)	Volatile	-	HI3
108-88-3	Toluene	Volatile	-	HI3
71-55-6	1,1,1-Trichloroethane (Methyl chloroform)	Volatile	-	HI3
79-01-6	Trichloroethene (TCE, Trichloroethylene)	Volatile	Y	HI3
88-06-2	2,4,6-Trichlorophenol	Volatile	-	--
7440-62-2	Vanadium (fume or dust)	Particulate	-	HI3
75-01-4	Vinyl chloride	Volatile	Y	HI3

CAS #	Toxic Air Contaminant (TAC)	Type	Adjustment	HI Type
1330-20-7	Xylene (mixture), including m-xylene, o-xylene, p-xylene	Volatile	-	HI3
Compounds without RBC's				
832-69-9	1-Methylphenanthrene	Volatile	-	-
51-28-5	2,4-Dinitrophenol	Volatile	-	-
95-57-8	2-Chlorophenol	Volatile	-	-
91-57-6	2-Methyl naphthalene	Volatile	-	-
56-49-5	3-Methylcholanthrene	Volatile	-	-
534-52-1	4,6-Dinitro-o-cresol (and salts)	Volatile	-	-
100-02-7	4-Nitrophenol	Volatile	-	-
57-97-6	7,12-Dimethylbenz[a]anthracene	Volatile	-	-
83-32-9	Acenaphthene	Volatile	-	-
208-96-8	Acenaphthylene	Volatile	-	-
98-86-2	Acetophenone	Volatile	-	-
120-12-7	Anthracene	Volatile	-	-
7440-39-3	Barium and compounds	Particulate	-	-
192-97-2	Benzo[e]pyrene	Volatile	-	-
85-68-7	Butyl benzyl phthalate	Volatile	-	-
4170-30-3	Crotonaldehyde	Volatile	-	-
84-74-2	Dibutyl phthalate	Volatile	-	-
84-66-2	Diethylphthalate	Volatile	-	-
2807-30-9	Ethylene glycol monopropyl ether	Volatile	-	-
86-73-7	Fluorene	Volatile	-	-
1313-27-5	Molybdenum trioxide	Volatile	-	-
198-55-0	Perylene	Volatile	-	-
85-01-8	Phenanthrene	Volatile	-	-
C504	Phosphorus and compounds	Particulate	-	-
108-65-6	Propylene glycol monomethyl ether acetate	Volatile	-	-
129-00-0	Pyrene	Volatile	-	-
7440-22-4	Silver and compounds	Particulate	-	-
7440-28-0	Thallium and compounds	Particulate	-	-
75-69-4	Trichlorofluoromethane (Freon 11)	Volatile	-	-
7440-66-6	Zinc and compounds	Particulate	-	-
C518	Phthalates	Volatile	-	-

3.0 Source Characterization

Table 3-1 shows the model parameters for each source. Details are provided in the sections below. The model was set up to run using unit emissions (as described below).

Table 3-1: Model Source Parameters

POINT	Emis (g/s)	Hgt (m)	Hgt (ft)	Temp (K)	Temp (F)	Vel (m/s)	Dia (m)	Dia (In)
BOIL	1	25.83	84.76	436.5	326	4.43	2.44	96
BOILSUP1	1	25.83	84.76	327.6	130	2.48	2.44	96
BOILSUP2	1	25.83	84.76	382.0	228	3.45	2.44	96
TSDHT2	1	7.01	23.0	449.8	350	0.71	0.25	10
TSDHT1	1	6.71	22.0	449.8	350	0.80	0.23	9

VOLUME	Emis (g/s)	Hgt (m)	Hgt (ft)	Sigma Y (m)	Sigma Z (m)
ASH1	1	3.05	10.0	2.33	1.42
STOCKP	1	2.44	8.0	5.81	2.27
FLYDUMP	1	1.83	6.0	0.57	1.70
MAINS	1	2.29	7.5	3.24	2.13
PMWS	1	6.10	20.0	5.12	5.67
KITS	1	2.44	8.0	3.24	2.27
TRKS	1	3.35	11.0	3.24	3.12
UFR	1	10.16	33.3	4.19	7.09
HSFR	1	7.62	25.0	6.98	7.09
PSIX	1	6.10	20.0	5.12	5.67
PMNE	1	6.10	20.0	9.72	5.67

AREAPOLY	Emis (g/s/m^2)	Hgt (m)	Hgt (ft)	Area (m^2)	Npts	Sigma Z (m)
WE_AP	0.00131	4.88	16.0	765.65	4	1.49

Buoyant Line	Emis (g/s)	Hgt (m)	Hgt (ft)
KILN07-13	0.1429	7.15	23.4

Line Sources	Emis (g/s/m^2)	Hgt (m)	Hgt (ft)	Width (m)	Sigma Z (m)
UPRLS1-2	0.00070	2.72	8.93	8.59	2.53
UPRAH1-4	0.00049	2.72	8.93	8.59	2.53

3.1 Hogged Fuel Boiler

Model ID: BOIL, BOILSUP1, BOILSUP2
Hampton operates a 150,000-pound steam per hour Wellons Fuel Cell-Water Tube boiler (TEU B1), with a rated heat input design capacity of 216 million British thermal units per hour (MMBtu/hr), and with a maximum projected daily heat input of 5,184 MMBtu/day and an annual heat input of 1,419,120 MMBtu/yr. The boiler is controlled by a multiclone and an Electrostatic Precipitator (ESP). The boiler has a stack height of 84.75 ft with a 96-inch exhaust diameter. Steady-state conditions assumed an operating temperature of 326 °F and an exhaust flow of 43,843 cubic feet per minute (CFM).

DEQ requires Hampton to evaluate short-term startup and shutdown conditions. During normal boiler shutdown, the ESP is able to remain engaged until all fuel has been combusted and useful thermal energy (i.e., steam) is no longer supplied for any purpose. Therefore, there are no times during boiler shutdown when the boiler is operating without ESP control. Thus, shutdown was not evaluated.

For startup, the boiler manufacturer recommends that the exhaust temperature should be between 250 and 300 °F before the ESP can be safely energized to minimize the possibility of an explosion. As a result, there is a period of time at the beginning of boiler startup where the boiler is combusting fuel and the ESP is not operating (TEU B1 SU PRE-ESP). Fuel combustion rates during this period are low because the boiler must be slowly heated up in the stepwise process. Based on a review of past boiler startups, the maximum amount of fuel that may be combusted prior to achieving conditions that allow the ESP to be engaged is 500 MMBtu. Once the ESP is turned on, the fuel usage is increased to operational levels (TEU B1 SU POST-ESP), with the maximum post-ESP fuel usage estimated to be 4,000 MMBtu. The duration of boiler startup and the duration that the ESP is not operating can vary greatly depending on conditions. Typically, startup can take between 7 and 15 hours, with the pre-ESP operation taking 3 to 12 hours from the first firing of fuel.

Both the pre-startup condition (BOILSUP1) and post-ESP condition (BOILSUP2) will be evaluated assuming each of these startup conditions takes 24 hours. Hampton is requesting this so that there is no hour limitation placed on the startup operations. Based on a review of past boiler startups, Hampton, in some startups, was able to energize the ESP when the stack temperature reached 200 °F. Thus, the pre-ESP modeled temperature was set to the average of this activation temperature and a representative daily ambient (60 °F) temperature (e.g., Tpre = (200+60)/2=130 °F). For the pre-ESP volumetric flow rate, a value of 24,500 CFM was used based on the average volumetric flow rates during the pre-ESP period from multiple startups. These assumptions are conservative as the fuel usage rates for the past boiler startups are well less than the 500 MMBtu used to derive the emissions.

For the post-ESP condition, the modeled temperature was set to 228 °F which is the average of the minimum ESP activation temperature (200 °F) and nominal operation temperature (326 °F). For the post-ESP volumetric flow rate, a value of 34,172 CFM was used based on the average of the pre-ESP flow rate (24,500 CFM) and normal operation flow rate (43,843 CFM).

3.2 Drying Kilns

Model ID: Kiln07-13 grouped to KILN
Hampton operates seven lumber drying kilns, using indirect steam to dry stacks of cut lumber in a batch process. Each hemlock batch takes 40 to 72 hours to complete depending on the kiln and season of the year, while Douglas fir takes 29 to 72 hours. The kilns (i.e., the chambers, containing one or more tracks, in which the lumber is dried) are numbered from 07 to 13.

The kilns will be modeled as sets of buoyant line sources. The buoyant line implementation in AERMOD is based on the buoyant line source algorithm from the Buoyant Line and Point Source (BLP) dispersion model[1] with very little modification and similar limitations. The parameters for the buoyant line source are entered via the BLPINPUT card. Figure 3-1 shows a schematic of the needed parameters and Table 3-2 shows the values used.

Figure 3-1: Buoyant Line Source Characterization

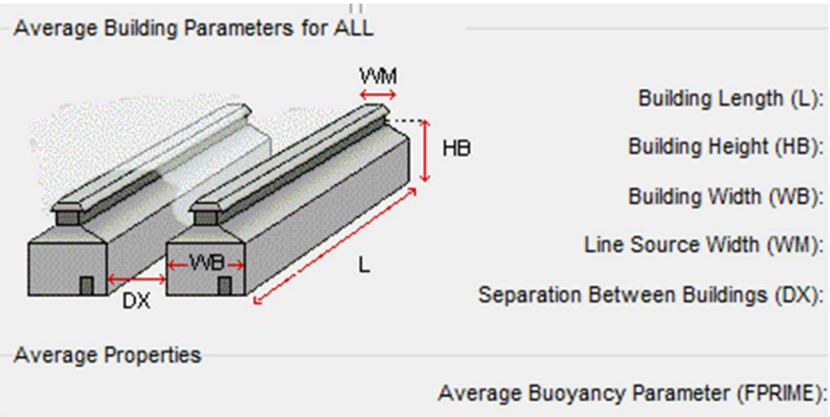


Table 3-2: Buoyant Line Input Parameters

Parameter	Units	K789	K1013
Blavgblen (L)	m	37.46	35.99
Blavgbhgt (HB)	m	7.15	7.15
Blavgbwid (WB)	m	11.54	10.46
Blavglwid (WM)	m	0.50	0.50
Blavgbsep (DX)	m	0.00	0.00
Blavgfprm (FPRIME)	m^4/s^3	8.12	8.12

The kilns are aligned west to east. All kilns are configured with two lines of vents on each kiln, with one line of vents being used as intakes and the other line being used for exhaust. During drying, the exhaust is toggled between the two vent lines at a regular interval. Thus, the modeled line source was centered between the two lines of vents. Kilns 07, 08, & 09 are grouped together as one block of adjacent kilns and Kilns 10, 11, 12, & 13 as another block. Kilns 07-09 are

[1] Schulman, L.L., and J.S. Scire, 1980: Buoyant Line and Point Source (BLP) Dispersion Model User's Guide. Final Report. Environmental Research & Technology, Inc. P-7304B. July 1980.

bigger than Kilns 10-13. Thus, each kiln group has its own input parameters, as shown in Table 3-2.

The building length (L) is the length of the kiln, building height (BH) is the average roof height, building width (BW) is the width of a bay, and line source width (W_m) is the size of the vents (0.5 m). The separation between buildings (DX) is zero, as the bays are adjacent. The average buoyancy parameter (FPRIME) is given by:

$$\text{FPRIME } (m^4/s^3) = g\ (L\ W_m\ w)\ (T_s\text{-}T_a)/T_s$$

where:

g = acceleration of gravity (9.81 m/s^2)
L = line source length (m)
W_m = line source width (m)
w = exit velocity (m/s)
T_s = exit temperature (K)
T_a = ambient air temperature (K)

Note that the expression (L W_m w) is equal to the exhaust volume (V) out of the kiln. For the kilns, the following values will be used:

V = 10,860 ACFM/kiln (vendor specification) = 5.12 m^3/s
T_s = 185 °F = 358.15 K (lower bound of operating conditions)
T_a = 80.8 °F = 300.26 K (typical highest daily average temperature)
FPRIME = 9.81 * 5.12 * (358.15-300.26)/358.15 = 8.12 m^4/s^3

The ATEI provides the total kiln emissions and not emissions per kiln, so the seven kilns are combined using a SRCGROUP card to define the single KILN source. Thus, each kiln is assigned a unit emission rate of 1/7 (g/s).

3.3 Truck Shop Diesel Heaters

Model ID: TSDHT1, TSDHT2
The truck shop is heated by two diesel-fired heaters:

TSDHT1: 500,000 Btu/hr, Clean-Burn, Model CB-5000
TSDHT2: 454,000 Btu/hr, Armstrong Air Conditioning, Model LG14-350/450 B60-2A

Maximum projected annual diesel combustion is 8,000 gallons per year, split equally between TSDHT1 and TSDHT2.

The TSDHT1 stack is about 4 ft above the truck shop roof eave (estimated to be 18.4 ft). The TSDHT2 stack is about a foot higher than TSDHT1. Both stacks are lower than the building peak (estimated to be 25.7 ft). For the truck shop building, the height was set to the average of the peak and eave heights ((18.4+25.7)/2=22 ft). The TSDHT1 stack height was then set to the building height while the TSDHT2 stack was set a foot higher. Both stacks exhaust vertically.

3.4 Ash Handling

Model ID: ASH1, STOCKP, FLYDUMP

In a hogged-fuel boiler, bottom ash is the heavy, coarse residue that falls to the bottom of the combustion chamber. It makes up much of the total ash produced by the boiler. Bottom ash is conveyed by an enclosed drag chain from the boiler to a covered collection bin. When full, the collected ash is dumped with a forklift into a dump truck (TEU: ASH2TRK). When the dump truck is full, the ash is unloaded at the south storage area and stockpiled (TEU: STOCKP). During summer months, the stockpiled ash is loaded into trucks via front-end loader for transfer offsite and use as a soil amendment (TEU: PILE2TRK).

The TEU ASH2TRK is modeled as a volume source with a release height based on the height of the top of the truck (10.5 ft). Because the truck is loaded in a space between building structures, sigma-y is based on the width of the space between the buildings (~10 m) to account for the nearby building influences. Sigma-z is the truck height divided by 2.15 as per guidance.

TEU's STOCKP and PILE2TRK occur at the bottom ash stockpile, as both involve activities occurring next to the pile. Thus, these sources will be modeled with the same volume source based on the size of the pile. The stockpile is surrounded by a 16-ft vegetated berm with an opening for the trucks to enter (east side of the pile). Material is piled up within the berm area, sloping up to an estimated height of 22.5 ft with a flat top. Thus, the release height was set to the berm height (16 ft), sigma-y set as the pile width divided by 4.3 and sigma-z as the berm height divided by 2.15.

Fly ash consists of fine, lightweight particles that rise with the exhaust gases and are captured by the ESP. Fly ash collected by the ESP is conveyed by enclosed screw conveyors to one of three collection bins. Each of the bins is covered and fully enclosed during fly ash collection. When a collection bin is full, the cover is removed and the ash transferred to a roll-off dumpster (TEU: FLY2DUMP). The roll-off dumpster is covered and fully enclosed at all times other than active transfer activities. When full, the roll-off dumpster is picked up by a waste management company and hauled offsite for final disposition. For this source, the release height is assumed to be the top of the dumpster (6 ft), sigma-y is the dumpster width divided by 4.3, and the sigma-z is the dumpster height divided by 2.15.

3.5 Unpaved Roads

Model ID: UPRLS1-2 for UNPL; UPRAH1-4 for UNPA
Most of the surfaces at Hampton are paved. However, in the southern part of the property, the truck routes to the log debris pile (TEU: UNPL) and to the bottom ash stockpile (TEU: UNPA) are not (see Figure 3-2). The UNPL source has two segments (UPRLS1-2) and the UNPA source has four segments (UPRAH1-4). Note that the first segments (UPRLS1 and UPRAH1) overlap at the entrance of the area.

The roads are characterized using the Haul Road Workgroup Recommendations[2] (November 2011) approach. The release height is 0.5*VH*1.7, where VH is the vehicle height (10.5 ft). The line width is the vehicle width (8.5 ft) plus 6 meters, and sigma-z is the VH*1.7/2.15.

3.6 Bottom Ash Stockpile Wind Erosion

Model ID: WE_AP
Wind erosion emissions from the bottom ash stockpile (TEU: WE_AP) were also included. As mentioned, the stockpile is surrounded by a 16-ft vegetated berm with an opening for the trucks to enter (east side of the pile). For the emissions calculations, the exposed surface area was calculated based on the configuration of the pile, assuming the exposed area was above the berm. For the max daily emissions, the largest area was used. For chronic emissions, a smaller surface area more representative of an average over a year was considered.

For the modeling, an AREAPOLY source type will be used to characterize the source since the pile area is not rectangular (see Figure 3-2). The release height will be set to the berm height (16 ft) with a sigma-z of the berm height divided by 2.15. Since emissions are only supposed to occur when winds exceed 12 mph (5.4 m/s) at the pile, an EMISFACT WSPEED card will be used to account for the wind dependence by setting the emissions to zero when the wind speeds are less than 5.4 m/s. The form of the card is:

```
EMISFACT WE_AP WSPEED   0   0   0   1   1
```

The wind speed category ranges are defined in the WINDCATS card. The values defined in WINDCATS card correspond to the upper limit of the categories' wind speeds in meters per second. There is no upper limit to the last category of speeds:

```
WINDCATS   1.54   3.09   5.4   8.5   10.8
```

[2] https://www.epa.gov/sites/default/files/2020-10/documents/haul_road_workgroup-final_report_package-20120302.pdf

Figure 3-2: Unpaved Line Sources and Bottom Ash Stockpile Locations



3.7 Welding, Plasma Cutting and Torch Cutting

Model ID: MAINS, PMWS, KITS, TRKS, UFR, and HSFR
These sources occur within the various maintenance shops across the facility, as shown in Table 3-3.

Welding is performed in various locations for maintenance. DEQ requested welding emissions be identified by wire type and building location. Thus, the Welding TEUs are identified as "WELD-SHOP-WT". "SHOP" is the building where the welding occurs and "WT" is the wire type. The wire types are FCAW E71T (71T), SMAW E7018 (7018), and ER70S-6 (70S-6). The buildings are identified in Table 3-4, along with their heights, release height adjustment factors (RHAF), and widths. Each building is modeled as a volume source with the release height being the building height multiplied by the applicable RHAF. Note the RHAF for UFR is 2/3 of the building height because it is on a second floor. Sigma-y is the building width divided by 4.3, and sigma-z is the building height divided by 2.15.

Plasma cutting of steel plate is performed on a plasma cutting table with a water deck (PLASMAT), as well as with a hand-held plasma cutter (PLASMAH). Table cutting occurs in the maintenance shop (TEU: PLASMAT-MW) while handheld plasma cutting occur in both the maintenance shop (TEU: PLASMAH-MW) and planer millwright shop (TEU: PLASMAH-PMW).

Torch cutting of metal plate (TEU: TORCH) is also performed in the maintenance shop.

Table 3-3: Welding, Plasma Cutting, and Torch Cutting Locations

Shop	Description	Weld	PlasmaT	PlasmaH	Torch
MAINS	Main Maintenance Shop	X	X	X	X
PMWS	Planer Millwright Shop	X		X	
KITS	Kit Shed	X			
TRKS	Truck Shop	X			
UFR	Upper Filing Room	X			
HSFR	Head Saw Filing Room	X			

Table 3-4: Building ID, Heights, and Widths

BB	Description	Build Hgt (ft)	Hgt Adj	Rel Hgt (ft)	Width (m)
MAINS	Maintenance Shop	15	0.5	7.5	14
PMWS	Planer Millwright Shop	40	0.5	20	22
KITS	Kit Shed	16	0.5	8	14
TRKS	Truck Shop	22	0.5	11	14
UFR	Upper Filing Room	50	0.67	33.3	18
HSFR	Head Saw Filing Room	50	0.5	25	30

3.8 Ink Printing and Anti-Staining Application

Model ID: PSIX

Inside the planer millwright shop, ink markings are applied to finished boards. In the same area, Hampton applies anti-stain coating to lumber passing through the planer building prior to packaging for shipment. Boards are optically scanned, and then a computer-controlled spray operation within a vented enclosure applies the coating to boards where staining is likely to occur. This enclosure is vented out the side of the planer mill building.

The vent out of the planer building was modeled as a volume source with a release height of ½ the building height, a sigma-y of the building width (22 m)/4.3 and a sigma-z as the building height divided by 2.15.

3.9 Anti-Fungal Application

Model ID: PMNE
Hampton applies a spray treatment to the ends of stacked lumber prior to final wrapping for shipment to prevent end-rot of boards during shipment and storage prior to sale and use (TEU: ANTI-F). The liquid is applied in the packing area on the north end of the planer mill (PMNE), which is open along the north end of the building.

The emissions from PMNE are modeled as a volume source with a release height of ½ the building height, a sigma-y of the building width (41.8 m)/4.3 and a sigma-z as the building height divided by 2.15.

4.0 Modeling Protocol

4.1 Building Locations

For point sources, the evaluation of building downwash on the adjacent stack is deemed necessary, since the stack height may be below Good Engineering Practice (GEP) heights. The formula for GEP height estimation is:

$$H_s = H_b + 1.50L_b$$

where: H_s = GEP stack height
H_b = building height
L_b = the smaller of the building dimension of the height, length, or width

The effects of aerodynamic downwash due to buildings and other structures will be accounted for by using wind direction-specific building parameters calculated by the EPA-approved Building Parameter Input Program Prime (BPIP-Prime) and the algorithms included in AERMOD. The BPIP-Prime software package calculates the direction-specific building dimensions for input into AERMOD. Figure 4-1 shows the building footprints and Table 4-1 shows the description and heights. Four offsite buildings on the east property are included, as they are close to the point sources on Building 1. Building heights will be determined from measurements, statewide LIDAR data[3] available from DOGAMI, and design drawings.

[3] https://gis.dogami.oregon.gov/maps/lidarviewer/

Figure 4-1: Building Locations

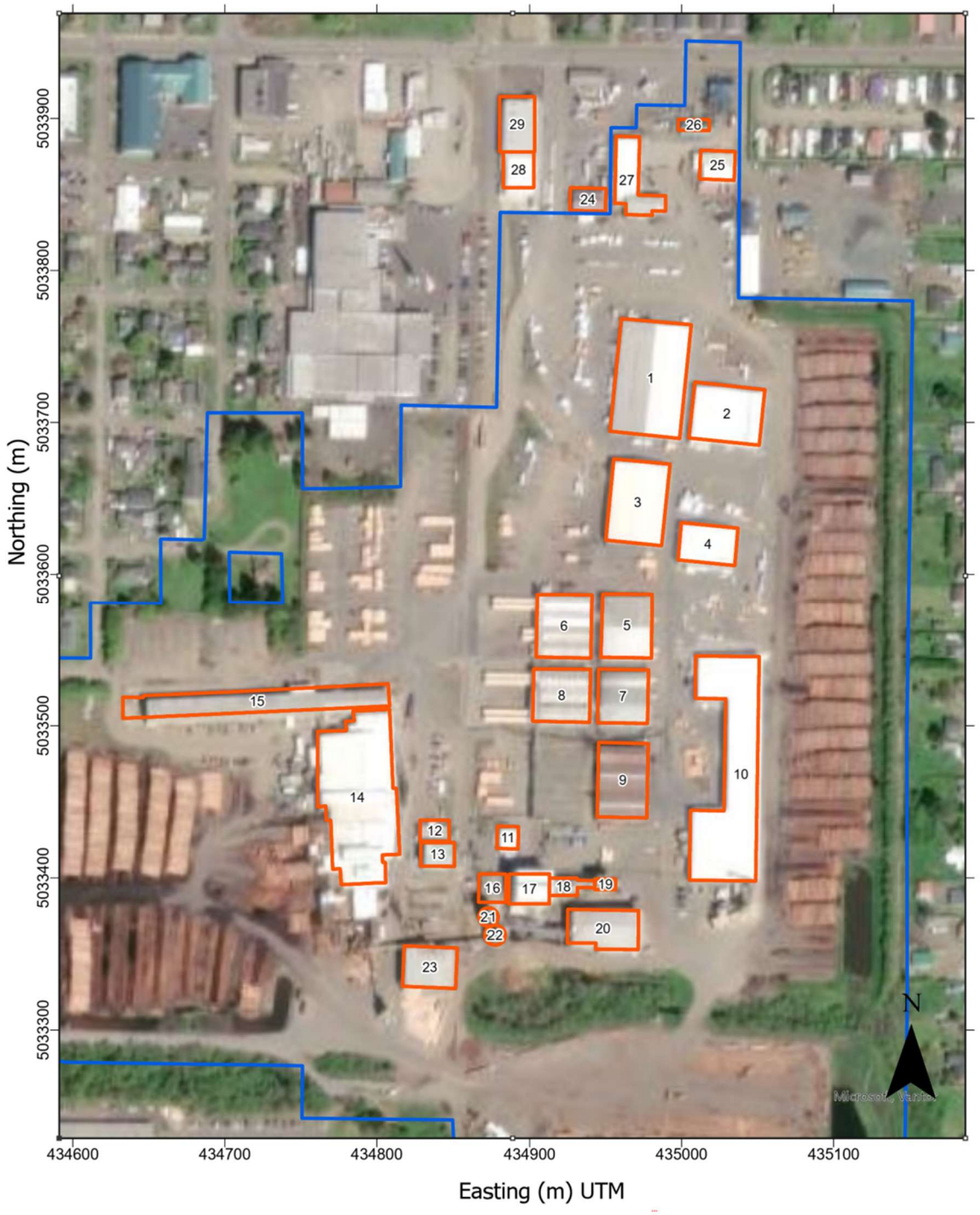


Table 4-1: Building IDs and Heights

Id	Name	NNN	Height (ft)	Elev Group	Elevation
1	DryS1	Dry Shed 1	50	1	9.6
2	DryS2	Dry Shed 2	50	1	9.6
3	CARS	Car Loading Shed	50	1	9.6
4	DRYS3	Dry Shed 3	50	1	9.6
5	UCOOL	Cooling Shed Upper	23.44	2	8.7
6	KILN1013	Kiln 10-13	23.44	2	8.7
7	CCOOL	Cooling Shed Center	23.44	2	8.7
8	KILN789	Kiln 7-9	23.44	2	8.7
9	LCOOL	Cooling Shed Lower	23.44	3	6.5
10	PLAN	Planer Building	40	4	7.7
11	CARP	Carpenter Shop	16	3	6.5
12	FAB	Fab Shop	15	6	7.6
13	MACH	Machine shop	44	6	7.6
14	SAW2	Sawmill Trim & Sort Line	50	6	7.6
15	SAW1	Sawmill	50	7	7.6
16	MOTOR	Motor Room	19	3	6.5
17	BOIL	Boiler Building	56.5	3	6.5
18	BOILEX	Boiler Exhaust Process	28.25	3	6.5
19	ESP1	ESP	53.75	3	6.5
20	FUEL	Fuel Building	50	3	6.5
21	SILON	Silo North	78	3	6.5
22	SILOS	Silo South	78	3	6.5
23	OFUEL	Old Fuel Building	42	5	6.8
24	OCOIL	Offsite Carson Oil	18	8	11.4
25	WARE	Warehouse	26	8	11.4
26	ENGIN	Engineering/Timber	17	8	11.4
27	TRUC	Truck Shop and Wash	22	8	11.4
28	OFFA	Offsite Building A	32	8	11.4
29	OFFB	Offsite Building B	35	8	11.4

4.2 Model Selection

Air quality dispersion modeling will be conducted to simulate the downwind transport of toxic air contaminants emitted by all the existing TEUs at the facility. The analysis estimates the maximum offsite concentrations using the AERMOD (AMS [American Meteorological Society]/EPA [Environmental Protection Agency] Regulatory Model), which follows the procedure requirements as specified in 40 CFR Part 51, Appendix W, "Guidelines on Air Quality Models (Revised)". AERMOD incorporates air dispersion for both surface and elevated sources, and accounts for differing terrain (i.e., simple and/or complex). AERMOD includes three components: a meteorological data preprocessor, AERMET; a terrain data preprocessor, AERMAP; and the air dispersion model, AERMOD. The dispersion modeling was performed using the following versions for AERMOD and all preprocessors:

- AERMOD: 26135
- AERMET: 26135
- AERMAP: 24142
- AERSURFACE: 26135
- BPIP: 04274

AERMOD modeling will be performed using regulatory default options, which include stack-tip downwash, buoyancy-induced dispersion, upper-bound downwash concentrations, default wind speed profile exponents and vertical potential temperature gradients, and a routine for processing concentration averages during calm winds and when there are missing meteorological data. The effects from local terrain are also incorporated.

4.3 Rural/Urban Determination

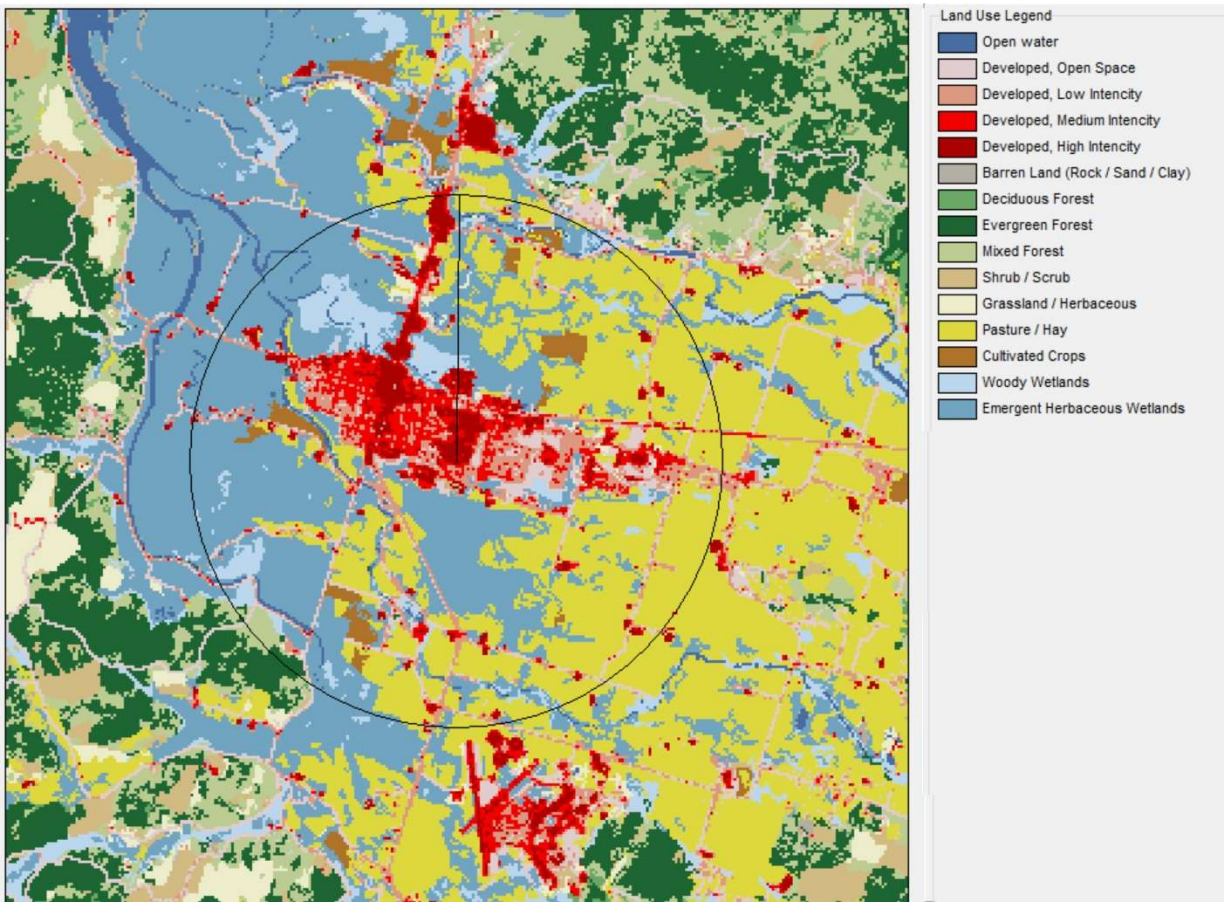
The model allows for the choice of rural or urban conditions around the source location, which depends upon the land use characteristics within 3 kilometers of the facility (as per Appendix W to 40 CFR Part 51, section 7.2.1.1). Following Auer (1977), if the land use is industrial, commercial, or medium to high density residential, then these areas are designated as urban. All other types of land use are considered rural. The most objective approach is to use the 2016 NLCD land cover classification data (the same data set as used in AERSURFACE) and designate the "Developed, Low, Medium and High Intensity" areas (IDs 22, 23 & 24) as urban based on Auer's classification. All other areas are designated as rural.

Figure 4-2 shows the 2016 NLCD land use classification within 3 km of the facility and Table 4-2 shows the counts of each type. Only 18% of the land use is identified as urban, thus rural dispersion coefficients will be used.

Table 4-2: 2016 NLCD Land Classification within 3 km of Tillamook Lumber

Cat	Description	Count	Type
11	Open Water:	365	Rural
21	Developed, Open Space:	1606	Rural
22	Developed, Low Intensity:	2399	Urban
23	Developed, Medium Intensity:	1962	Urban
24	Developed, High Intensity:	1377	Urban
31	Barren Land (Rock/Sand/Clay):	66	Rural
42	Evergreen Forest:	86	Rural
43	Mixed Forest:	135	Rural
52	Shrub/Scrub:	24	Rural
71	Grasslands/Herbaceous:	186	Rural
81	Pasture/Hay:	10456	Rural
82	Cultivated Crops:	643	Rural
90	Woody Wetlands:	1435	Rural
95	Emergent Herbaceous Wetland:	10670	Rural
	Total:	31410	
	Percent Urban	5738	18%
	Percent Rural	25672	82%

Figure 4-2: 2016 NLCD Land Use Classification around Tillamook Lumber



4.4 Meteorological Data

For this analysis, five years (2018-2022) of hourly surface meteorological data from the National Weather Service (NWS) station at the Tillamook airport (KTMK, Station #01188) will be used. The station is located about 7.5 miles from the facility. A five-year wind rose is shown in Figure 4-3.

The surface parameters (surface roughness, Bowen ratio, and noontime albedo) will be determined using the most recent version of AERSURFACE using 2016 NLCD land use data. For each year, AERSURFACE was run for average, wet, and dry conditions on a monthly basis, using 12 evenly spaced sectors. A 30-year moisture analysis using annual precipitation data from the PRISM explorer[4] site (dataset AN81m) for the Tillamook airport area was used. This dataset provides a consistent and continuous dataset for precipitation values, as it is based on all relevant station networks and data sources available. The last 30 years of annual precipitation values are shown in Table 4-3. If the individual year precipitation exceeded the 70th percentile, then the year is defined as wet. If the yearly precipitation is less than the 30th percentile, then it is defined as dry. If the precipitation is between the 30th and 70th percentiles, it is defined as average. Since albedo and Bowen ratio are area averages, all sectors have the same values. Also, albedo and surface roughness are the same for all wetness conditions. For each modeled year, the appropriate monthly surface parameters will be then entered into the AERMET METPREP section.

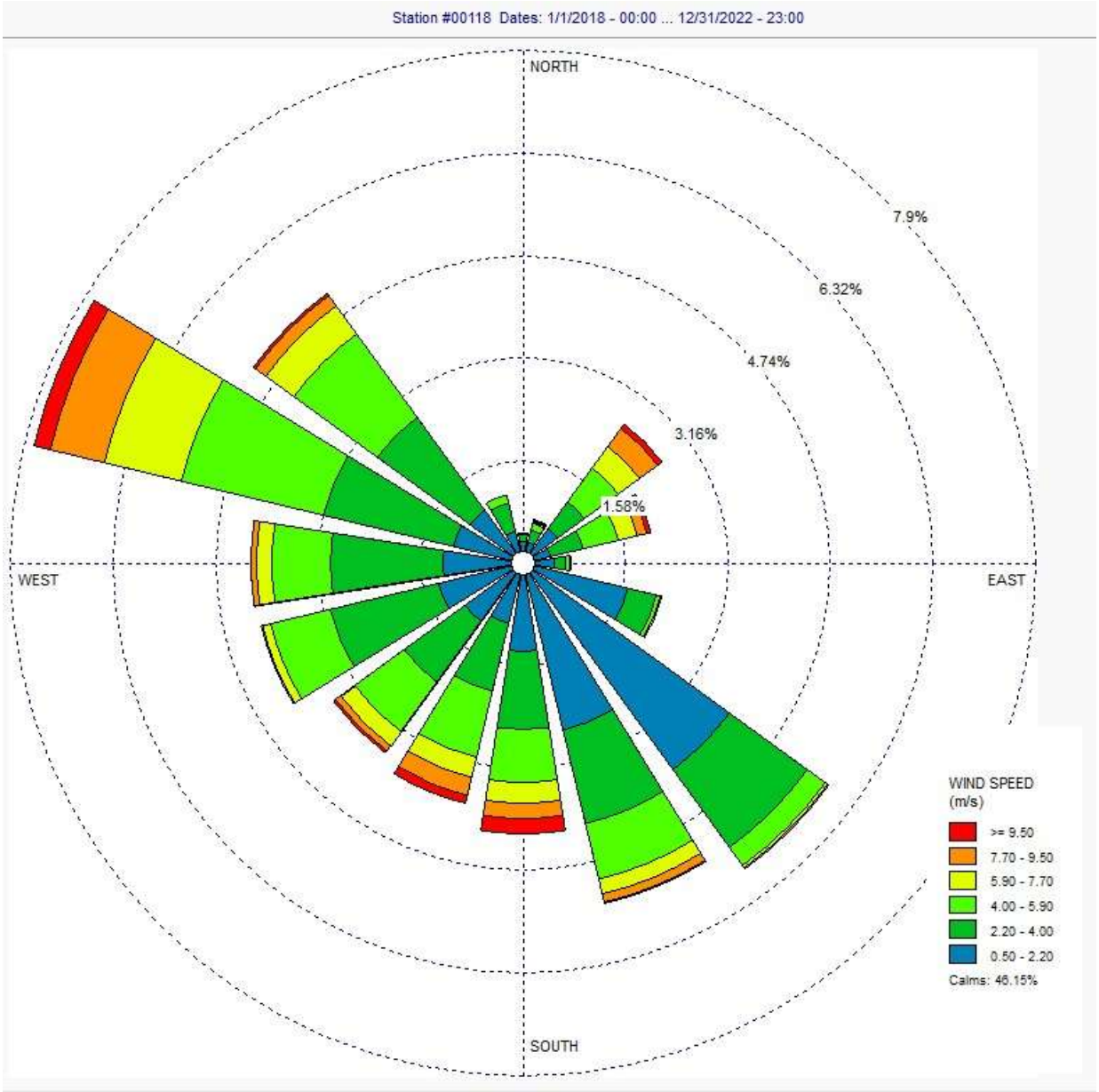
Table 4-3: 30-Year Moisture Analysis

Year	PPT (in)	Year	PPT (in)	Condition
1993	40.21	2008	40.99	
1994	48.9	2009	43.3	
1995	59.83	2010	53.38	
1996	73.82	2011	49.83	
1997	65.27	2012	63.34	
1998	59.41	2013	39.9	
1999	61.14	2014	54.28	
2000	40.87	2015	50.7	
2001	42.83	2016	54.85	
2002	42.71	2017	57.67	
2003	50.59	2018	41.54	Dry
2004	46.25	2019	36.4	Dry
2005	47.92	2020	52.18	Average
2006	62.29	2021	50.58	Average
2007	47.48	2022	47.59	Average
70th Percentile			54.45	
30th Percentile			45.37	

[4] https://prism.oregonstate.edu/explorer/

The months of December to February are classified as “winter”, March to May as “spring”, June to August as “summer”, and September to November as “autumn”. The data will be processed using the AERMET program with the adjust U-star option selected.

Figure 4-3: Tillamook Airport Wind Rose



4.5 Receptor Grid

Under the Cleaner Air Oregon Rules, OAR 340-245-0020(43) indicates that residential exposure locations are to be located "outside the boundary where people may reasonably be present for most hours of the day over a period of many years." Likewise, OAR 340-245-0020(36) indicates "nonresidential exposure location" means an exposure location outside the boundary of a source where people may reasonably be present for a few hours several days per week, possibly over a period of several years." Where the property borders other commercial property, receptors on the property boundary will be evaluated. When the property line is adjacent to a roadway, railroad track, or an easement under power poles, the CAO boundary is expanded to exclude these areas from the evaluation, as these areas are not where the public would normally congregate. Thus, the receptor boundary for the CAO assessment was expanded to exclude these areas, as shown below in Figure 4-4.

Receptor elevations for AERMOD will be determined using the AERMAP preprocessor. AERMAP uses United States Geological Survey (USGS) 1-degree and 7.5-minute Digital Elevation Model (DEM) files and a newer National Elevation Dataset (NED). AERMAP was run to generate the receptor elevations using the NED data.

The following receptor grid spacing was used in the modeling analyses:

- 25-meter spacing along the CAO boundary,
- 25-meter spacing out to 200 m from the CAO boundary,
- 50-meter spacing out to 1.0 km,
- 100-meter spacing out to 2.0 km,
- 200-meter spacing out to 5.0 km,
- 500-meter spacing out to 10.0 km.

For CAO, schools or daycares within 2 km will be explicitly identified. For schools, a statewide GIS layer[5] will be used to identify the location of schools within 2 km of the facility. For daycares, two sources will be used:

- An internet search using child-care referral website;
- Oregon Child Care Centers ArcGIS Online database

Each school or daycare will be explicitly identified with a receptor assigned a daycare/school. There are 41 schools and daycares within 2 km of the facility (see Table 5-2). The list of schools and daycares is provided in a spreadsheet.

Near-field and far-field receptor grids are shown in Figure 4-4 and 4-5.

AERMAP was run to calculate terrain and hill heights for each modeled receptor using 1/3-Arc-Second National Elevation Dataset (NED) elevation data. The NED dataset was downloaded using the Lakes Environmental AERMOD View program.

[5] https://spatialdata.oregonexplorer.info/geoportal/details;id=1270fe6e833f4d0eabacc71300069738

Figure 4-4: Near Field Receptors

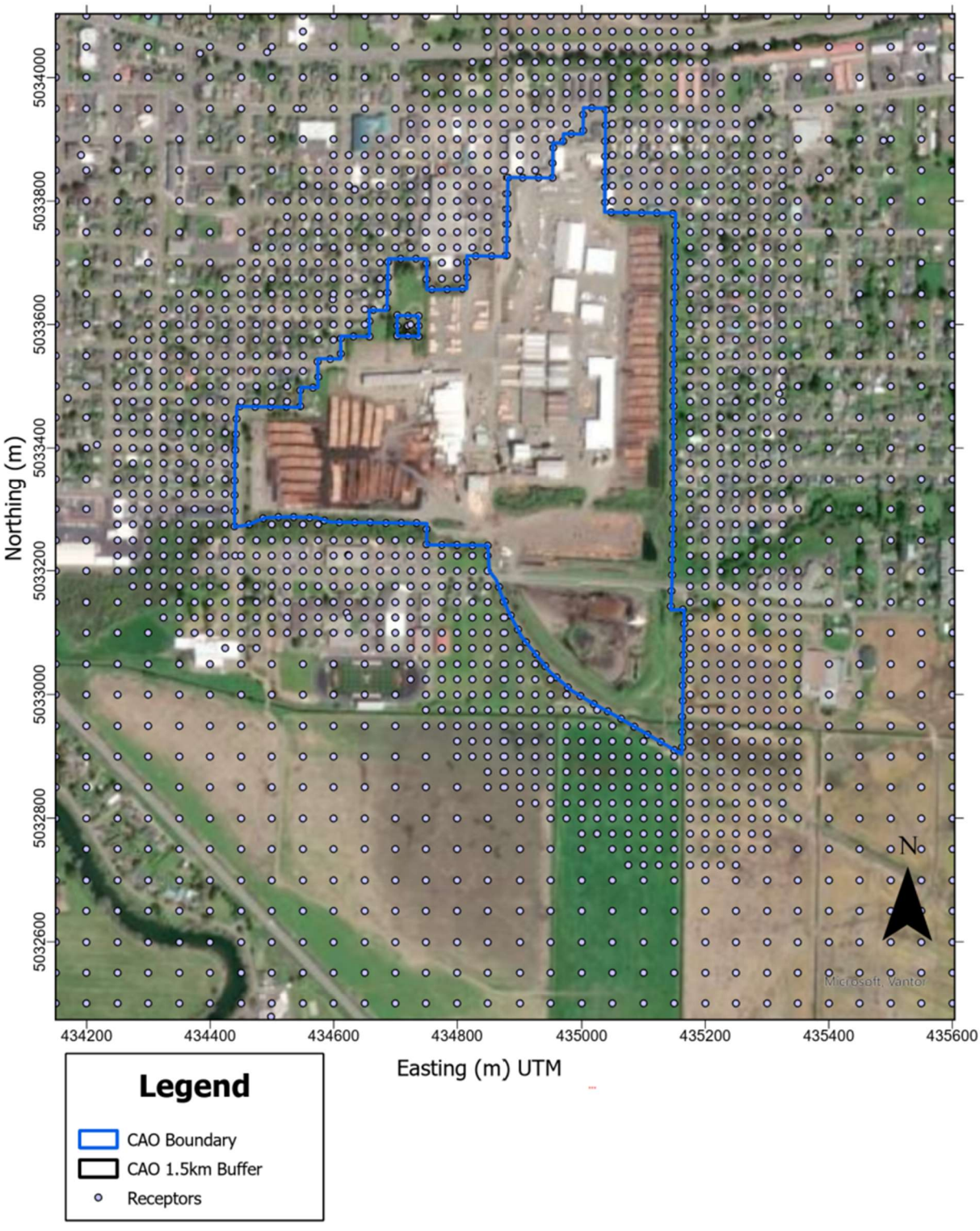
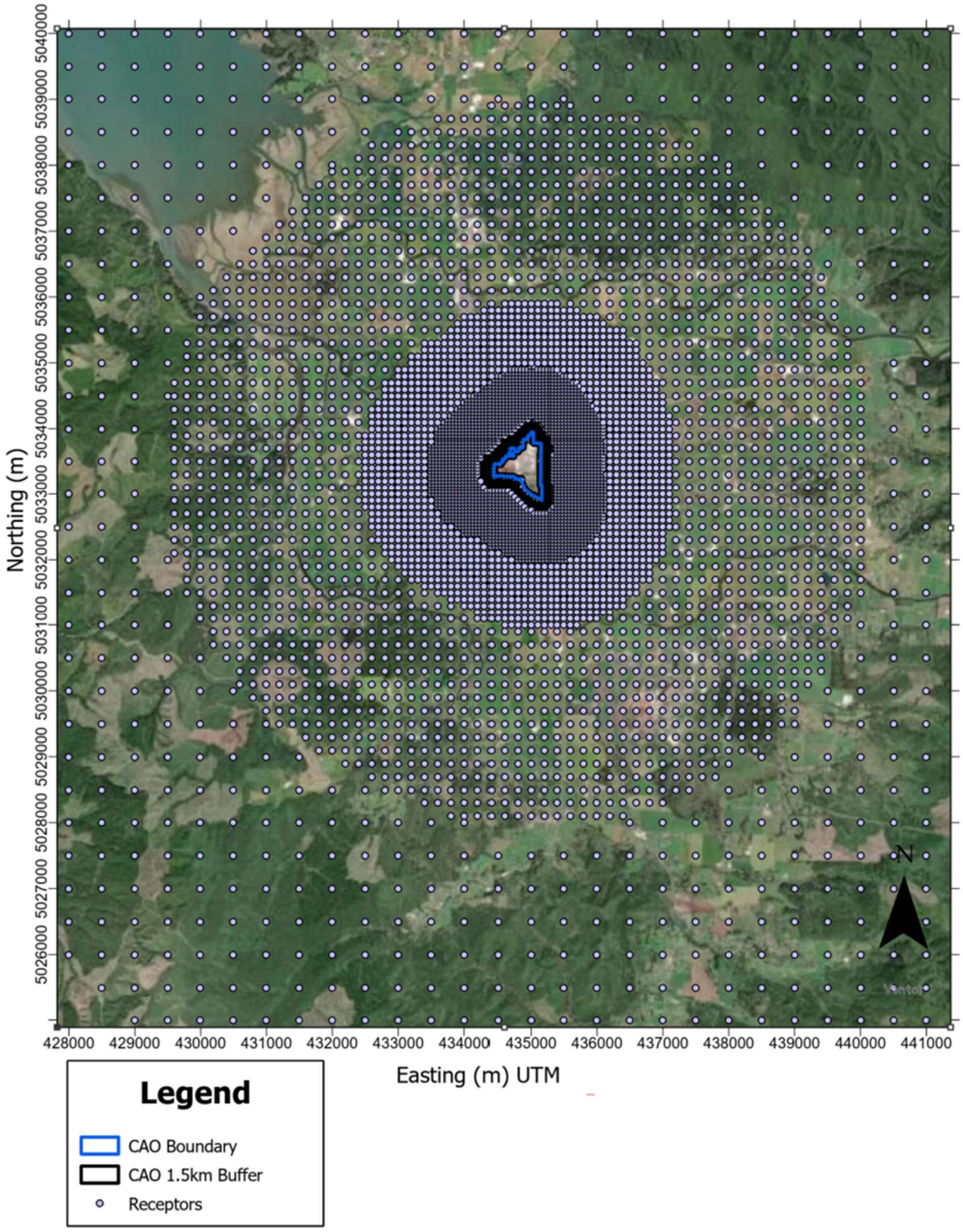


Figure 4-5: Far Field Receptors

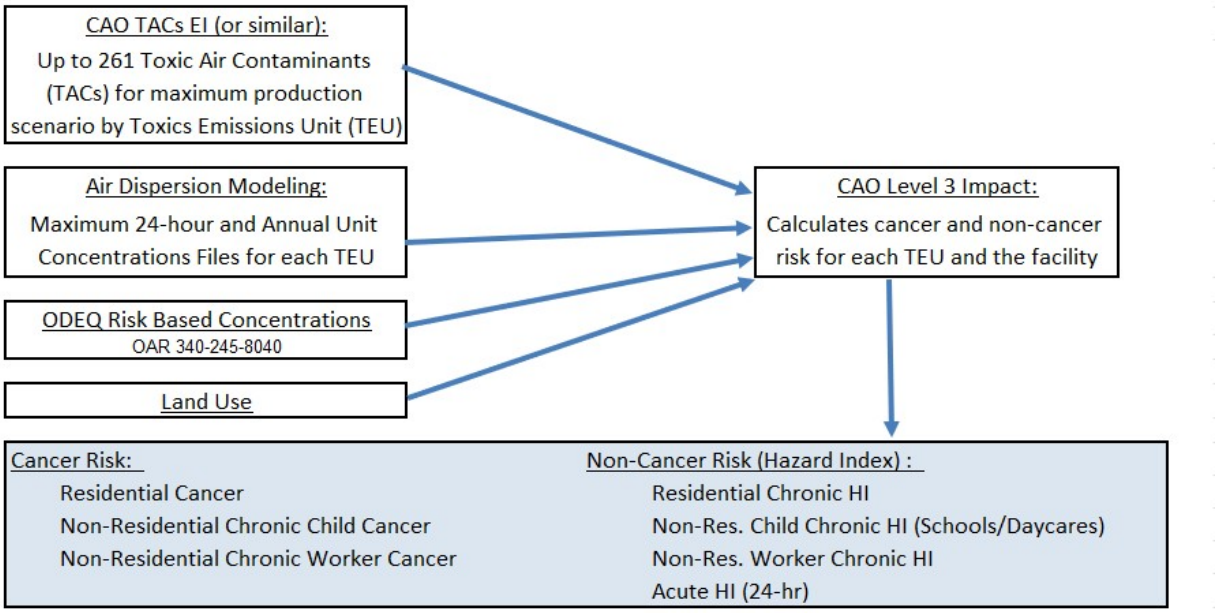


5.0 Risk Assessment Work Plan

5.1 Methodology

Figure 5-1 shows the Level 3 Risk Assessment process. Using the ATEI (e.g., AQ520 CAO spreadsheet), the 24-hr and annual average unit concentration files from AERMOD runs, the RBCs, and the land use designations at each receptor, the chronic cancer, chronic non-cancer, and acute hazard index risk will be calculated at every receptor.

Figure 5-1: Level 3 Refined Risk Assessment



The land use classifications are applied to receptors around the facility to define their exposure class. The receptors, identified by class, are shown in Figure 5-2. Receptor exposure classes are defined as residential, nonresidential child (schools/daycares), nonresidential worker (industrial/commercial), open space, and excluded. The "excluded" class applies to receptors where the risk is not calculated, for example, along roads or highways or along the facility property line or train tracks where people will likely not congregate. Chronic exposure is only applicable to residential, nonresidential child, and nonresidential worker classes. The acute exposure is applied to all classes except the excluded class.

5.2 Exposure Locations

Each receptor is assigned an exposure type based on its land use designation. For this, the Statewide 2023 Oregon Zoning data from the Oregon Department of Land Conservation and Development will be used. This data layer is an element of the Oregon GIS Framework and is

available through the Oregon Spatial Data Library. This feature class contains zoning data from 198 local jurisdictions. The dataset has 55 zoning classifications, which are binned into three categories: residential, industrial/commercial, and open space.

A crosswalk between the statewide land use categories and the exposure types is shown in Table 5-1. The residential bin includes any category designating a residence. For example, mixed-use commercial and residential areas and tribal reservation lands are defined as residential. The open space category includes parks, forests, beaches, and agricultural areas. Open space receptors will be evaluated for acute risk only. The Public Lands category will be designated as a Child/Worker exposure type as per Oregon DEQ CAO guidance. The zoning dataset does not identify residences located in industrial, farmland, or forested areas. Residences within 1.5 km will be identified and assigned the appropriate land use.

The zoning dataset does not identify schools or daycares. For schools, a statewide GIS layer[6] will be used to identify the location of schools within 2 km of the facility. For daycares, two sources will be used:

- An internet search using child-care referral website[7];
- Oregon Child Care Centers ArcGIS Online database.

Each school or daycare will be explicitly modeled as a receptor designated with the daycare/school and worker exposure classes. There are 41 schools and daycares within 2 km. The list of schools and daycares is provided in Table 5-2.

DEQ has recently required facilities to treat Effective Farm Use (EFU) and Mixed Farm-Forest (MFF) land uses as exclusively residential, citing OAR 340-245-0020(43) and CAO guidance. However, DEQ's "Cleaner Air Oregon State Zoning to Exposure Location Crosswalk" guidance (7/24/2020) states the recommended exposure assignments for EFU and MFF zoning are "Residential for house, worker for barnyards, acute-only for fields". Furthermore, DEQ's "Recommended Procedures for Toxic Air Contaminant Health Risk Assessments" (October 2022) states on page 5 that:

> "If land is zoned for uses allowing residents, include residential exposure, except as described below. You should consider likely exposure scenarios based on the intended activity at a location. For example, in farmland where a residence is allowed, include exposure to any current houses. However, it is not necessary to consider an unlikely future addition of a house in an agricultural field." (emphasis added)

Thus, Hampton requests that DEQ allow Hampton to utilize DEQ's recommended exposure assignments without being required to submit the additional AQ521 and AQ522 forms.

A detailed review of the land uses and exposure assignments will be made for areas within 1.5 kilometers of the facility. Figure 5-2 and Figure 5-3 show the land use around the facility, with receptor exposure types. The black dashed line identifies the area within 1.5 km of the facility.

[6] https://spatialdata.oregonexplorer.info/geoportal/details;id=1270fe6e833f4d0eabacc71300069738

[7] https://winnie.com/

A spreadsheet with receptors and their exposure types is provided with this submittal.

Table 5-1: Statewide Land Use Crosswalk

LU Code	Description	CAO code	LU Code	Description	CAO code
BD	Beaches and Dunes	Openspace	MFL10	Marginal Farm Land 10+	Openspace
CC	Commercial - Central	IndustCom	MHDR	Medium High-density Res.	RES
CE	Coastal Estuarine	Openspace	MLDR	Medium Low-density Res.	RES
CEE	Combo equal emphasis	IndustCom	MUREH	Mixed-Use Com. & Res. Extremely High	RES
CG	Commercial - General	IndustCom	MURH	Mixed-Use Com. & Res. High	RES
CN	Commercial - Neighborhood	IndustCom	MURL	Mixed-Use Com. & Res. Low	RES
CO	Commercial - Office	IndustCom	MURM	Mixed-Use Com. & Res. Medium	RES
CPE	Combo with priority emphasis	IndustCom	MURMH	Mixed-Use Com. & Res. Med-high	RES
CS	Coastal Shorelands	Openspace	MURVH	Mixed-Use Com. & Res. V.High	RES
EFU160	Exclusive Farm Use 160+	Variable*	ND	No Data	Openspace
EFU20	Exclusive Farm Use 20+	Variable*	O	Other	Openspace
EFU40	Exclusive Farm Use 40+	Variable*	OSC	Open Space/Conservation	Openspace
EFU80	Exclusive Farm Use 80	Variable*	PF	Public & semi-public Uses	Child/Work
FF160	Mixed Farm-Forest 160+	Variable*	PF80	Prime Forest 80	Openspace
FF20	Mixed Farm-Forest 20	Variable*	POS	Parks & Open Space	Openspace
FF40	Mixed Farm-Forest 40	Variable*	RC	Rural Commercial	IndustCom
FF80	Mixed Farm-Forest 80	Variable*	RI	Rural Industrial	IndustCom
FOR	Federal Forest	Openspace	RNG	Federal Range	Openspace
FUD	Future Urban Development	Openspace	RR1	Rural Residential 1 acre	RES
HDR	High-density Res.	RES	RR10	Rural Residential 10 acres	RES
IC	Industrial Campus	IndustCom	RR2	Rural Residential 2-4 acres	RES
IH	Industrial - Heavy	IndustCom	RR5	Rural Residential 5 acres	RES
IL	Industrial - Light	IndustCom	SF80	Secondary Forest 80	Openspace
IO	Industrial Office	IndustCom	UCRC	UC Rural Commercial	IndustCom
IRM	Indian reservation/tribal trust	Openspace	UCRI	UC Rural Industrial	IndustCom
LDR	Low-density Res.	RES	VHDR	Very High-density Res.	RES
MA	Mineral and Aggregate	IndustCom	VLDR	Very Low-density Res.	RES
MDR	Medium-density Res.	RES			

* DEQ recommended exposure as Residential for house, Worker for barnyards, acute-only for fields

Figure 5-2: Receptor Exposure Classes

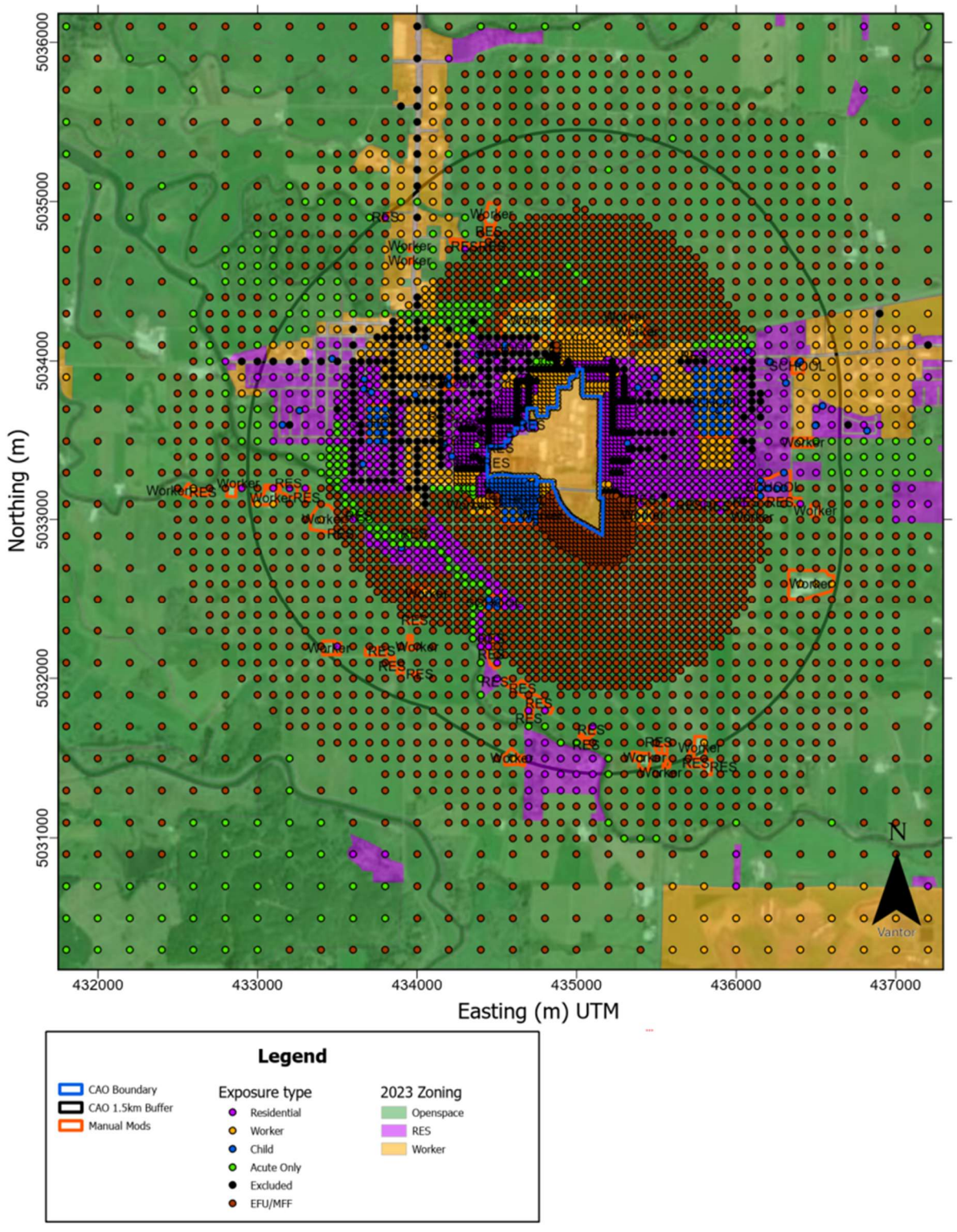


Figure 5.3: Near Field Receptor Exposure Classes

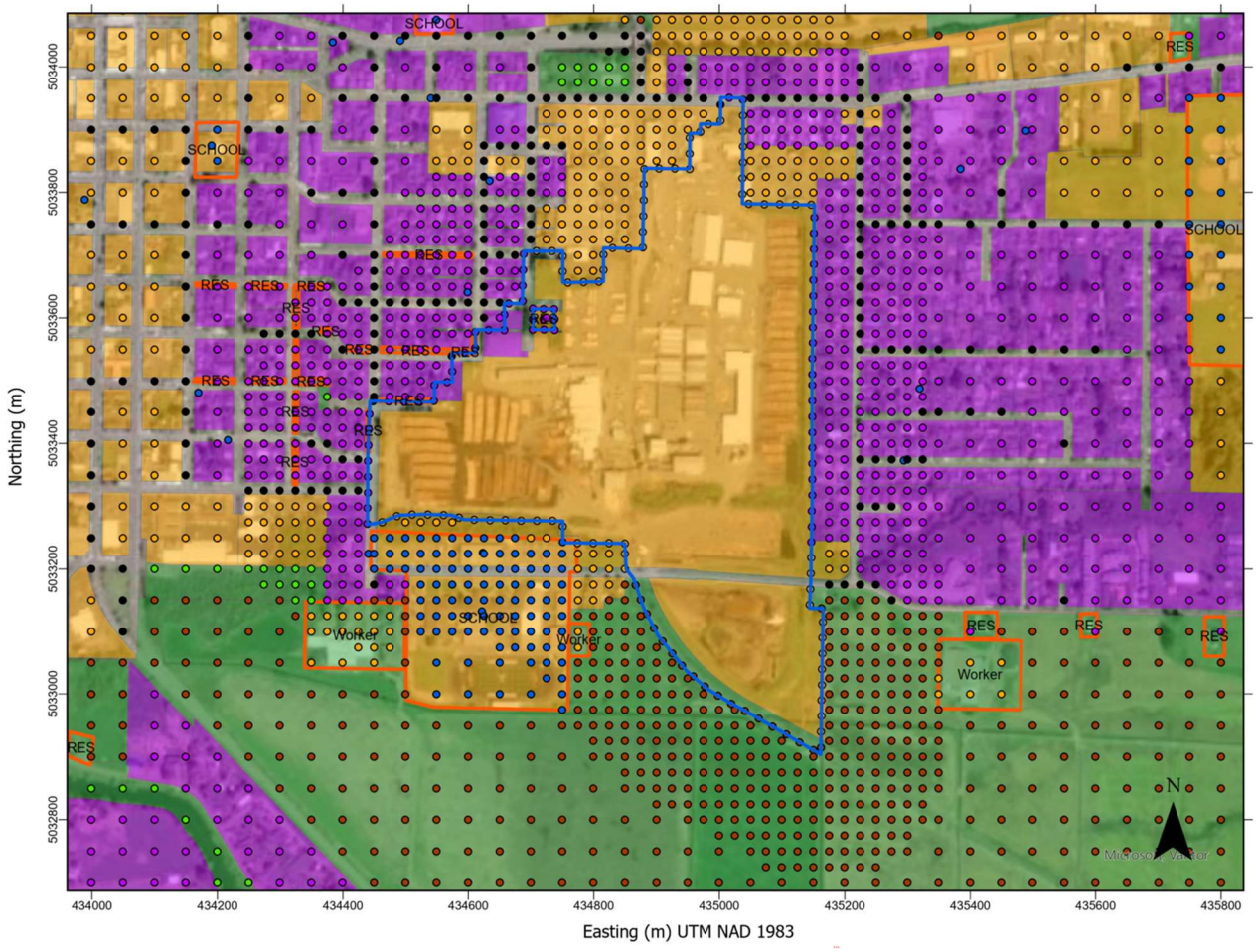


Table 5-2: School and Childcare Locations

Institution	TYPE	ID	X (m)	Y (m)	DIST (km)
Emily Hunt Home Daycare	DC	1	435320	5033488	0.320225
YAYA Child Care	DC	2	435294.4	5033373	0.320575
Imagination Education Creation Daycare	DC	3	434599	5033641	0.425067
Tillamook Bay Community College	SCH_OR	4	434623.2	5033226	0.47
Davianie Sanchez Home Daycare	DC	5	434634	5033819	0.485507
Bailey Branscum Home Daycare	DC	6	435385	5033837	0.511658
Tillamook High School	SCH_OR	7	434621.8	5033132	0.53
Tillamook Head Start Center	DC	8	434441.3	5033225	0.622941
Rachel Bradeen Home Daycare	DC	9	435489	5033898	0.630496
Tillamook Early Learning Center- Wilson Site	DC	10	434540.6	5033950	0.643139
Tillamook SD 9	SCH_OR	11	434550.1	5034075	0.73
Little Clipper Preschool and Kindergarten	DC	12	434492	5034042	0.742681
Smart Start Academy	DC	13	434217.2	5033406	0.788431
Savonnah Platchek Home Daycare	DC	14	434384	5034039	0.818521
Jessica Vazquez Home Daycare	DC	15	434170	5033481	0.830217
Pacific Christian School	SCH_OR	16	434191.5	5033875	0.89
East Elementary School	SCH_OR	17	435890.8	5033691	0.91
Tillamook Junior High School	SCH_OR	18	435892.2	5033812	0.95
PRIV Tillamook	DC	19	436041.9	5033504	1.041857
Yasmeen Kateb Home Daycare	DC	20	433989	5033789	1.051495
The Imagination Station	DC	21	434050	5034090	1.118302
Ocean Breeze Baptist School	SCH_OR	22	434498.7	5032479	1.14
Tillamook YMCA Youth Development Programs	DC	23	433843.4	5033689	1.171937
Holly Waggerby Home Daycare	DC	24	436072	5034063	1.210848
Liberty Elementary Preschool	DC	25	433782.8	5033503	1.217217
Liberty Elementary School	SCH_OR	26	433785	5033550	1.22
PRIV Tillamook	DC	27	433904.5	5032825	1.286874
Tillamook Adventist School	SCH_OR	28	436255.4	5033195	1.29
Rising Stars Childcare	DC	29	436214	5033994	1.310661
M Isabel Orozco Home Daycare	DC	30	433714	5033808	1.322369
Nora Webster Home Daycare	DC	31	433660	5033356	1.347715
Brew Neva-Weggen Home Daycare	DC	32	436312	5033863	1.361291
Candy's Child Care	DC	33	433666.6	5033826	1.372731
Desiree Brotherton Home Daycare	DC	34	433667	5033889	1.3886
Tillamook Bay Community College	SCH_OR	35	436390.2	5033987	1.47
Julia Tatom Home Daycare	DC	36	436498	5033596	1.501073
Sandra Sandoval Home Daycare	DC	37	436541	5033722	1.556909
Marilyn's Daycare	DC	38	433469	5034014	1.614979
Jaclyn Rodriguez Home Daycare	DC	39	433261	5033691	1.749458
Maribel Orozco Rodriguez Home Daycare	DC	40	436821	5033565	1.82216
PRIV Tillamook	DC	41	433157.5	5033600	1.845256

5.3 Risk Calculation

Using the 24-hr and annual emission rates from ATEI, the 24-hr and annual average concentration files from AERMOD runs, the RBCs (Table 5-3), and the exposure designations at each receptor, the chronic cancer, chronic non-cancer, and acute hazard index risk will be found at every receptor. The risk at each receptor from source ($R_{r,s}$) is given by:

$$R_{r,s} = \chi_{r,s}\, C \sum_{p} \frac{Q_p\, TO_{p,o}}{RBC_{p,L(r)}}$$

where $\chi_{r,s}$ is the unit concentration for source *s* at receptor *r*, C is a constant to convert g/s to either lbs/day or lbs/year, Q_p is the pollutant emission rate from the CAO emission inventory, $TO_{p,o}$ is the target organ factor (0 or 1) for pollutant p and organ o, and $RBC_{p,L(r)}$ is the RBC for pollutant *p* and exposure type *L* at the receptor *r*. For cancer risk, the target organ factor is always 1. For non-cancer risk, different pollutants impact different parts of the body, so the non-cancer risk is not additive. When applied, the target organ factor is set to 1 for pollutants that impact a particular organ and zero otherwise. The target organ analysis will only be done if the non-cancer risk exceeds the Source Permit Level. The analysis will be conducted for the two highest target organ risks.

Each receptor will have three risk numbers for each source: chronic cancer risk, chronic non-cancer risk, and acute risk. For informational purposes, the chronic risk values will be grouped by exposure type (residential, nonresidential child, and nonresidential worker) from which the maximum risk will be determined. This results in seven risk levels being determined. The risk levels will be compared to the Risk Action Levels (RALs) for existing sources (Table 5-4).

If the facility non-cancer risk exceeds the non-cancer Community Engagement RAL of 1, then the Risk Determination Ratio (RDR) will be explicitly calculated. The RDR is the combined risk for HI3 chemicals/3 plus the combined risk for HI5 chemicals/5. All TACs are HI3 TACs except acrolein, aluminum, propionaldehyde, and silica, which are HI5 TACs.

The risk calculations will be made in an Excel spreadsheet. The spreadsheet will have tabs for the RBCs, the target organ assignments, annual and 24-hr emissions, annual and 24-hr unit concentrations, receptors, seven risk evaluations, and a final summary. The spreadsheet will be provided as part of the risk assessment submittal.

Table 5-3: TAC RBCs (ug/m^3)

CAS	Pollutant	Residential Cancer RBC	Child Cancer RBC	Worker Cancer RBC	Res. Non-cancer RBC	Child Non-cancer	Worker Non- cancer	Acute Non-cancer
75-07-0	Acetaldehyde	0.45	140	12	620	5.5	620	470
67-64-1	Acetone	--	31000	--	140000	--	140000	62000
107-02-8	Acrolein	--	0.35	--	1.5	--	1.5	6.9
7429-90-5	Aluminum and compounds	--	5	--	22	--	22	--
7664-41-7	Ammonia	--	500	--	2200	--	2200	1200
7440-36-0	Antimony and compounds	--	0.3	--	1.3	--	1.3	1
7440-38-2	Arsenic and compounds	0.000024	0.00017	0.0013	0.0024	0.00062	0.0024	0.2
71-43-2	Benzene	0.13	3	3.3	13	1.5	13	29
7440-41-7	Beryllium and compounds	0.00042	0.007	0.011	0.031	0.005	0.031	0.02
117-81-7	Bis(2-ethylhexyl) phthalate (DEHP)	0.08	--	11	--	5	--	--
74-83-9	Bromomethane (Methyl bromide)	--	5	--	22	--	22	3900
106-99-0	1,3-Butadiene	0.033	2	0.86	8.8	0.4	8.8	660
78-93-3	2-Butanone (Methyl ethyl ketone)	--	5000	--	22000	--	22000	5000
7440-43-9	Cadmium and compounds	0.00056	0.005	0.014	0.037	0.0067	0.037	0.03
56-23-5	Carbon tetrachloride	0.17	100	4.3	440	2	440	1900
7782-50-5	Chlorine	--	0.15	--	0.66	--	0.66	170
108-90-7	Chlorobenzene	--	50	--	220	--	220	--
67-66-3	Chloroform	--	300	--	1300	--	1300	490
74-87-3	Chloromethane (Methyl chloride)	--	90	--	400	--	400	1000
18540-29-9	Chromium VI, chromate and dichromate particulate	0.000031	0.083	0.00052	0.88	0.001	0.88	0.3
7440-48-4	Cobalt and compounds	--	0.1	--	0.44	--	0.44	--
7440-50-8	Copper and compounds	--	--	--	--	--	--	100
74-90-8	Cyanide, Hydrogen	--	0.8	--	3.5	--	3.5	340
106-46-7	p-Dichlorobenzene (1,4-Dichlorobenzene)	0.091	60	2.4	260	1.1	260	12000
75-09-2	Dichloromethane (Methylene chloride)	59	600	620	2600	1200	2600	2100
78-87-5	1,2-Dichloropropane (Propylene dichloride)	--	4	--	18	--	18	230
112-34-5	Diethylene glycol monobutyl ether	--	0.1	--	0.44	--	0.44	--
121-14-2	2,4-Dinitrotoluene	0.011	--	0.29	--	0.13	--	--
100-41-4	Ethyl benzene	0.4	260	10	1100	4.8	1100	22000
107-06-2	Ethylene dichloride (EDC, 1,2-Dichloroethane)	0.038	7	1	31	0.46	31	--
C239	Fluorides	--	2.3	--	20	--	20	240
50-00-0	Formaldehyde	0.17	9	4.3	40	2	40	49
110-54-3	Hexane	--	700	--	3100	--	3100	--
7647-01-0	Hydrochloric acid	--	20	--	88	--	88	2100
7664-39-3	Hydrogen fluoride	--	2.1	--	19	--	19	16
67-63-0	Isopropyl alcohol	--	200	--	880	--	880	3200
98-82-8	Isopropylbenzene (Cumene)	--	400	--	1800	--	1800	--
7439-92-1	Lead and compounds	--	0.15	--	0.66	--	0.66	0.15
7439-96-5	Manganese and compounds	--	0.09	--	0.4	--	0.4	0.3
7439-97-6	Mercury and compounds	--	0.077	--	0.63	--	0.63	0.6
67-56-1	Methanol	--	4000	--	18000	--	18000	28000
108-10-1	Methyl isobutyl ketone (MIBK, Hexone)	--	3000	--	13000	--	13000	--
91-20-3	Naphthalene	0.029	3.7	0.76	16	0.35	16	200
C365	Nickel compounds, insoluble	0.0038	0.014	0.1	0.062	0.046	0.062	0.2
87-86-5	Pentachlorophenol	0.2	--	5.1	--	2.4	--	--
108-95-2	Phenol	--	200	--	880	--	880	5800
1336-36-3	Polychlorinated biphenyls (PCBs)	0.00053	--	0.02	--	0.0092	--	--
C646	Polychlorinated dibenzo-p-dioxins (PCDDs) & dibenzofurans (PCDFs) TEQ	1E-09	0.00000013	0.00000009	0.000026	4.2E-08	0.000026	--
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1E-09	0.00000013	0.00000009	0.000026	4.2E-08	0.000026	--
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	1E-09	0.00000013	0.00000009	0.000026	4.2E-08	0.000026	--
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.00000001	0.0000013	0.0000009	0.00026	0.00000042	0.00026	--
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.00000001	0.0000013	0.0000009	0.00026	0.00000042	0.00026	--
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.00000001	0.0000013	0.0000009	0.00026	0.00000042	0.00026	--
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	0.0000001	0.000013	0.000009	0.0026	0.0000042	0.0026	--
3268-87-9	Octachlorodibenzo-p-dioxin (OCDD)	0.0000034	0.00042	0.0003	0.085	0.00014	0.085	--
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TcDF)	0.00000001	0.0000013	0.0000009	0.00026	0.00000042	0.00026	--
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	3.4E-08	0.0000042	0.000003	0.00085	0.0000014	0.00085	--
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	3.4E-09	0.00000042	0.0000003	0.000085	0.00000014	0.000085	--
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.00000001	0.0000013	0.0000009	0.00026	0.00000042	0.00026	--
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.00000001	0.0000013	0.0000009	0.00026	0.00000042	0.00026	--
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.00000001	0.0000013	0.0000009	0.00026	0.00000042	0.00026	--
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.00000001	0.0000013	0.0000009	0.00026	0.00000042	0.00026	--
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.0000001	0.000013	0.000009	0.0026	0.0000042	0.0026	--
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.0000001	0.000013	0.000009	0.0026	0.0000042	0.0026	--
39001-02-0	Octachlorodibenzofuran (OCDF)	0.0000034	0.00042	0.0003	0.085	0.00014	0.085	--
C401	Polycyclic aromatic hydrocarbons (PAHs)	0.000043	--	0.0016	--	0.003	--	--
56-55-3	Benz[a]anthracene	0.00021	--	0.0078	--	0.015	--	--
50-32-8	Benzo[a]pyrene	0.000043	0.002	0.0016	0.0088	0.003	0.0088	0.002
205-99-2	Benzo[b]fluoranthene	0.000053	--	0.002	--	0.0038	--	--
191-24-2	Benzo[g,h,i]perylene	0.0047	--	0.17	--	0.34	--	--
205-82-3	Benzo[j]fluoranthene	0.00014	--	0.0052	--	0.01	--	--

CAS	Pollutant	Residential Cancer RBC	Child Cancer RBC	Worker Cancer RBC	Res. Non-cancer RBC	Child Non-cancer	Worker Non- cancer	Acute Non-cancer
207-08-9	Benzo[k]fluoranthene	0.0014	--	0.052	--	0.1	--	--
218-01-9	Chrysene	0.00043	--	0.016	--	0.03	--	--
53-70-3	Dibenz[a,h]anthracene	0.0000043	--	0.00016	--	0.0003	--	--
206-44-0	Fluoranthene	0.00053	--	0.02	--	0.038	--	--
193-39-5	Indeno[1,2,3-cd]pyrene	0.00061	--	0.022	--	0.043	--	--
123-38-6	Propionaldehyde	--	8	--	35	--	35	--
107-98-2	Propylene glycol monomethyl ether	--	7000	--	31000	--	31000	--
7782-49-2	Selenium and compounds	--	--	--	--	--	--	2
7631-86-9	Silica, crystalline (respirable)	--	3	--	13	--	13	--
100-42-5	Styrene	--	1000	--	4400	--	4400	21000
127-18-4	Tetrachloroethene (Perchloroethylene)	3.8	41	100	180	46	180	41
108-88-3	Toluene	--	5000	--	22000	--	22000	7500
71-55-6	1,1,1-Trichloroethane (Methyl chloroform)	--	5000	--	22000	--	22000	11000
79-01-6	Trichloroethene (TCE, Trichloroethylene)	0.2	2.1	3.5	9.2	2.9	9.2	2.1
88-06-2	2,4,6-Trichlorophenol	0.05	--	1.3	--	0.6	--	--
7440-62-2	Vanadium (fume or dust)	--	0.1	--	0.44	--	0.44	0.8
75-01-4	Vinyl chloride	0.11	100	0.22	440	2.7	440	1300
1330-20-7	Xylene (mixture), including m-xylene, o-xylene, p-xylene	--	220	--	970	--	970	8700

Table 5-4: Existing Facility Risk Action Levels

	Existing Source	
	Cancer	Non-Cancer
Source Permit Level	5	0.5
Community Engagement Level	25	1
TBACT Level	50	3*/5** or RDR of 1
Risk Reduction Level	200	6*/10** or RDR of 2
Immediate Curtailment Level	500	12*/20** or RDR of 4

* For pollutant identified as HI3 in OAR 340-245-8010, Table 2.

** For pollutant identified as HI5 in OAR 340-245-8010, Table 2.

RDR: Risk Determination Ratio = (Combined Risk for HI3 chemicals / 3) + (Combined Risk for HI5 chemicals / 5)

5.4 Uncertainty Analysis

CAO rules require that a quantitative or qualitative uncertainty evaluation be included in a Level 3 risk assessment.

Toxicity Risk Values (TRVs) form the basis for the RBCs. Both the TRVs and RBCs consider scientific uncertainty for safety, particularly in sensitive populations. Often the exact level of exposure that causes health effects in people is unknown because: 1) experiments are rarely conducted on people; 2) science experiments can only reflect the doses tested; and 3) different people have different sensitivities to the same dose. The greater the scientific uncertainty in determining potential harm, the more scientists add safety buffers to the TRV and RBC values.

Only a portion of the total reportable pollutants have RBCs. However, DEQ has determined that it has captured the most toxic contaminants in the current RBC list. Thus, incorporating a new TAC into the RBC list would have a small potential to increase risk.

Another source of uncertainty is in the emission calculations. Sources can rely on existing literature (e.g., AP-42), mass balance approaches, or another source's testing for characterizing emissions from a process. In some cases, the existing data is dated, often based on older and less efficient equipment or controls. Often, conservative assumptions are used, thus overestimating the potential impacts.

AERMOD is designed to predict the overall maximum impact within a domain. However, it is well documented that the model often cannot accurately predict the actual concentration at a specific location. Localized variations in winds, trees, and terrain can influence when and where the worst-case impact may occur around a facility. For example, the downwash algorithm in AERMOD is a simplification of reality, treating all buildings as rectangular boxes. Wind tunnel studies have documented that for long buildings, modeled downwash is greatly overestimated downwind of the site. Downwash is also not well characterized when the winds are approaching a building from a diagonal direction (e.g., toward a corner). Thus, AERMOD has the potential to underpredict or overpredict at a particular location.

A chronic exposure location is defined in the CAO rules in terms of residential locations and nonresidential locations. For residential locations, the rule indicates that the location is considered residential based on whether "… people may reasonably be present for most hours of each day over a period of many years" (OAR 340-245-0020 (43)). For the chronic nonresidential location, the rules state such a location is where "… people may reasonably be present for a few hours several days per week, possibly over a period of several years" (OAR 340-245-0020 (36)). In practice, both of these chronic cancer exposure locations assume a continuous exposure duration of 70 consecutive years, which is expected to overestimate chronic cancer exposures and, therefore, risk.

For acute exposures, the CAO regulation requires the use of the maximum 24-hr concentration that the computer model predicts using five years of meteorological data (1,826 days). Thus, the acute risk can be driven by the one "bad" meteorological day, regardless of whether such an impact would actually occur when the public is present or at the same time that the facility is emitting from all of its all TEU's at maximum capacity. Thus, using the 24-hr maximum provides a very conservative risk estimate as it assumes that someone will be present at a time when there is perfect alignment between worst-case meteorological conditions and maximum facility emissions.