

March 7, 2021

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**CLEANER AIR OREGON RISK ASSESSMENT DOCUMENTATION
SI PORL2, LLC (SOURCE ID 34-0245)**

Dear Kristen,

Ramboll US Consulting, Inc. (Ramboll) is submitting the enclosed Cleaner Air Oregon (CAO) risk assessment documentation to the Oregon Department of Environmental Quality (ODEQ) on behalf of our client, SI PORL2, LLC (STACK), who is proposing to construct and operate a new data center facility located at 4735 NE Starr Boulevard in Hillsboro, Oregon (Source ID 34-0245). The enclosed documentation includes the following:

- **Revised Modeling Protocol and Risk Assessment Work Plan:** The previously submitted Modeling Protocol and Risk Assessment Work Plan has been revised to include a modified operating scenario that includes emissions from commissioning. Proposed operating scenarios are described in Section 4.1 of the report.
- **Modeling Report and Risk Assessment Analysis:** The Modeling Report and Risk Assessment Analysis includes a summary analysis of the risk assessment results.

Thank you in advance for your prompt review of the enclosed information. If you have any questions regarding this information, please contact me at your convenience.

Sincerely,



Laura Cottrell
Managing Consultant
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Enclosures:

Modeling Protocol and Risk Assessment Work Plan (Revised)
Modeling Report and Risk Assessment Analysis

Intended for
Oregon Department of Environmental Quality

Date
September 2020
Revised March 2021

CLEANER AIR OREGON LEVEL 3 MODELING PROTOCOL AND RISK ASSESSMENT WORK PLAN

SI PORL2, LLC
HILLSBORO, OREGON

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1. INTRODUCTION

Ramboll US Consulting, Inc. (Ramboll)¹ is submitting this air dispersion modeling protocol and health risk assessment (HRA) work plan to the Oregon Department of Environmental Quality (ODEQ) on behalf of SI PORL2, LLC ("STACK"), which is proposing to construct and operate diesel-fired emergency generators at their data center ("Facility") in Hillsboro, Washington County, Oregon. The centroid of the facility is located at a latitude of 45° 33' 11.8353" N and a longitude of 122° 56' 20.2869 W (UTM Zone 10 Easting 504763.69 m and Northing 5044418.44 m; NAD 1983 Datum). The location of the proposed Facility is shown in Figure 1.1.

Primary power to the Facility will be supplied by the local electrical utility. Emergency backup power will be provided to the Facility by 49 diesel-fired emergency generators, each with an electrical output of 3.0 megawatts (MW). In accordance with federal New Source Performance Standards (NSPS) Subpart IIII, each emergency generator will be certified to meet United States Environmental Protection Agency (USEPA) Tier 2 emissions standards and will burn only ultra-low sulfur diesel (ULSD) fuel. The proposed emergency generators will not be used for demand response, peak shaving, or local reliability programs.

Under the Cleaner Air Oregon rules (OAR-340-245), new sources are required to conduct a health risk assessment of all non-exempt Toxic Emission Units (TEUs) at the Facility and demonstrate the Facility can operate at or below the applicable new source Risk Action Levels (RALs).

¹ Formerly Ramboll US Corporation

Figure 1.1: Facility Location



2. MODELING COMPONENT OVERVIEW

2.1 Process Overview

STACK proposes to construct a new data center facility in Hillsboro, Washington County, Oregon. Primary power will be provided to the facility by the local electric utility. Emergency backup power will be provided by diesel-fired emergency generators. Emissions from these generators will include certain air toxics that are regulated under the Cleaner Air Oregon program, as described in more detail below.

2.2 TEU Descriptions

The risk assessment will account for emissions from 49 diesel-fired emergency generators. Each generator will be USEPA Tier 2 certified and will burn ultra-low sulfur diesel fuel. Figure 1.2 depicts the proposed generator locations and Table 2.1 provides a summary of proposed generator specifications. There will be no other non-exempt TEUs associated with this project.

Table 2.1: Summary of Toxic Emission Units

TEU Description	Fuel Type	Maximum Fuel Consumption Rate
49x3MW emergency generators	ULSD	211 gallons/hour/generator

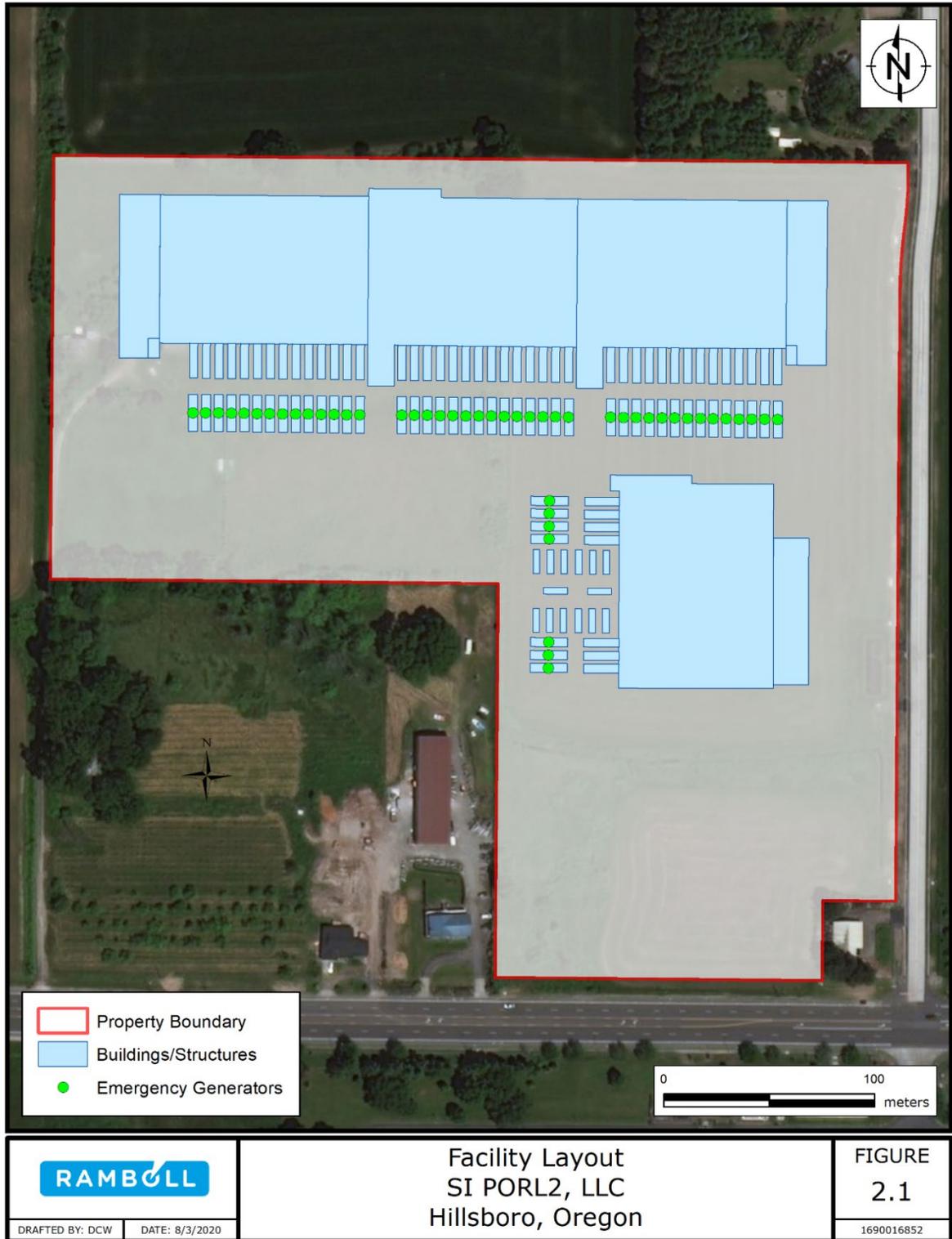
2.3 Compounds Emitted

Table 2.2 summarizes the toxics air pollutant emitted from the Facility. A total of 24 compounds were identified in the emissions inventory process.

Table 2.2: Toxic Pollutants Emitted from Diesel Combustion

CAS Number	Chemical Name
75-07-0	Acetaldehyde
107-02-8	Acrolein
7664-41-7	Ammonia
7440-38-2	Arsenic and compounds
71-43-2	Benzene
106-99-0	1,3-Butadiene
7440-43-9	Cadmium and compounds
18540-29-9	Chromium VI, chromate and dichromate particulate
7440-50-8	Copper and compounds
DPM	Diesel Particulate Matter
100-41-4	Ethyl benzene
50-00-0	Formaldehyde
110-54-3	Hexane
7647-01-0	Hydrochloric acid
7439-92-1	Lead and compounds
7439-96-5	Manganese and compounds
7439-97-6	Mercury and compounds
91-20-3	Naphthalene
--	Nickel compounds, insoluble
--	Polycyclic aromatic hydrocarbons (PAHs)
50-32-8	Benzo[a]pyrene
7782-49-2	Selenium and compounds
108-88-3	Toluene
1330-20-7	Xylene (mixture), including m-xylene, o-xylene, p-xylene

Figure 2.1: Facility Layout



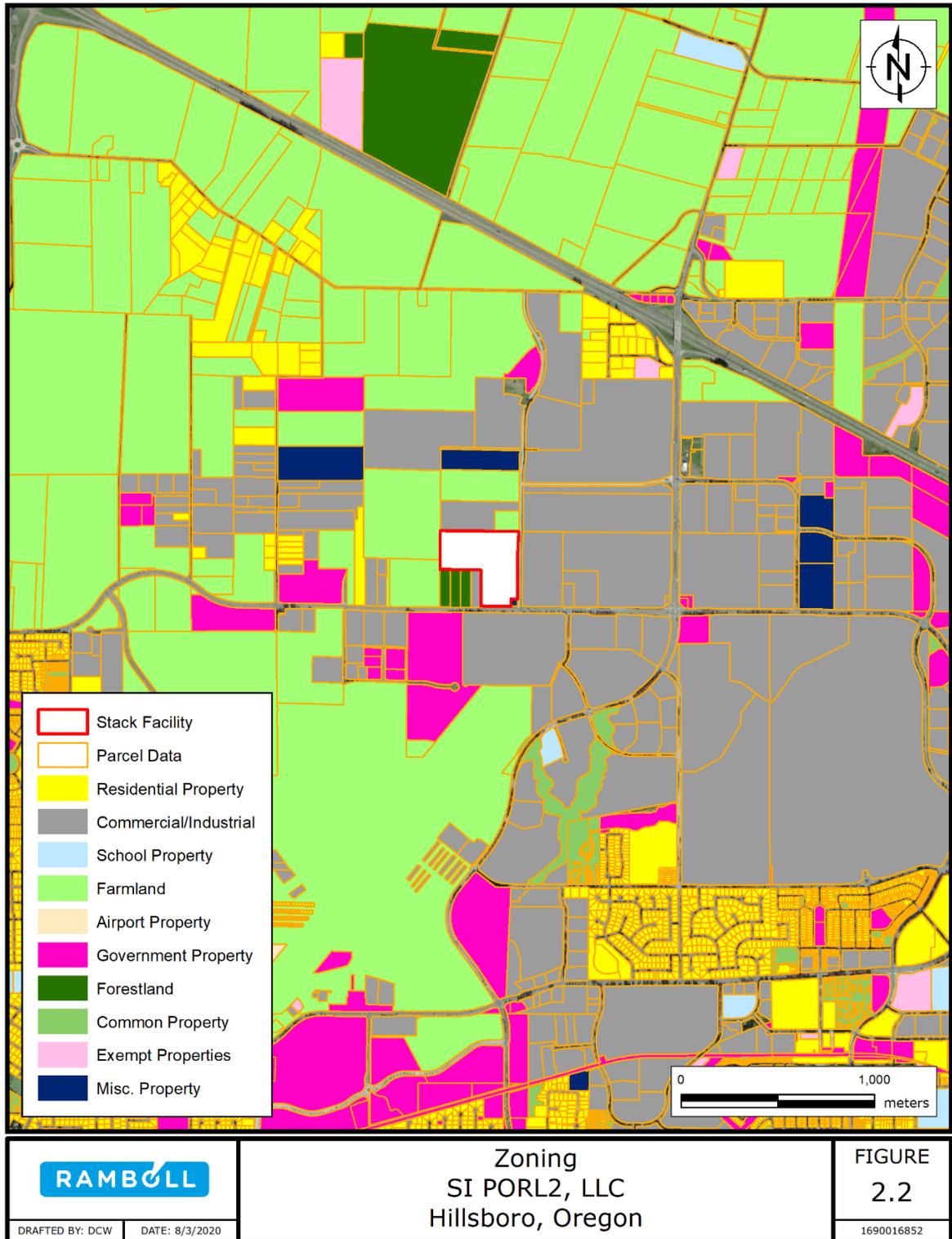
2.4 Receptor Locations and Classification

For the initial characterization of the receptor locations, a shapefile of the land parcel data with land classification codes was used. These data were provided through direct communication with Washington County Information Technology Services. The data set contains 98 parcel use classifications, which for assigning receptor types were categorized into two basic categories; residential and worker. The residential bin includes parcels with any form of residential zoning including mixed-use categories. In addition, parcels nearby the project that are zoned for non-residential uses were assessed to determine whether a residential categorization was appropriate given the presence of a residence on the property. In cases where parcels have a residence, receptors representing the residential locations were categorized as residential.

After the initial analysis, receptor locations for Oregon K-12 public and private schools, colleges, universities, and career schools were assigned in a school category from a dataset from the Oregon Spatial Data Library (https://spatialdata.oregonexplorer.info/geoportal/search;q=*schools*). For schools, both a discrete receptor at the centroid of the facility and any gridded receptors intersecting the school properties were assigned to a category of schools. Daycare centers were also included using a data set from Homeland Infrastructure Foundation-Level Data (HIFLD) website (<https://hifld-geoplatform.opendata.arcgis.com/datasets/child-care-centers>). Additional searches were performed to augment the daycare center data with facilities not included in the HIFLD dataset. As a conservative approach, all non-residential non-school, and non-daycare gridded receptors are considered as worker receptors. The acute analysis will conservatively include all gridded and discrete receptors.

Figure 2.2 shows the zoning categories around the Facility. The Facility is located in an area zoned for industrial use, and is surrounded by parcels categorized as industrial, commercial, forestland, farmland, and miscellaneous. There are residences located on parcels to the southwest and north of the property. These represent the nearest residences to the Facility. The nearest child exposure location is a daycare facility, KLA Schools of Hillsboro, located approximately 1.5 kilometers (km) to the south of the Facility. Liberty High School, located approximately 2.6 km to the east-northeast of the Facility, is the nearest school location.

Figure 2.2: Zoning Classification



3. MODELING METHODOLOGY, SETTINGS, AND INPUTS

The following sections establish the proposed methodologies that will be relied upon in the dispersion modeling analysis that will be submitted as part of the Facility's Risk Assessment Report. The dispersion modeling will be conducted in accordance with ODEQ's Draft Recommended Procedures for Air Quality Modeling (2020), as described in more detail below.

3.1 Model Selection and Settings

To estimate ambient air concentrations of pollutants, the applicant will use the latest version of the AERMOD modeling system (19191), which is the USEPA's recommended air dispersion model. AERMOD is appropriate for use in estimating ground-level ambient air concentrations resulting from non-reactive buoyant emissions from sources located in simple and complex terrain.

Modeled impacts will be estimated using AERMOD in conjunction with information about the Facility, the locations of the emitting stacks, representative meteorological data, and nearby receptors. The North American Datum of 1983 (NAD83) of the Universal Transverse Mercator (UTM) Coordinate System was used, which provides a constant distance relationship anywhere on the map or domain. The units of the coordinates are in meters.

3.2 Source Emission Rates and Operational Restrictions

Each generator will be modeled using a one gram per second (g/s) emission rate. The resulting unit-based concentrations (i.e., dispersion factors) will be scaled to pollutant-specific concentrations based on the pollutant-specific emission rates summarized in the Emission Inventory (AQ405CAO). Annual concentrations will be based on the annual average across five years, and 24-hour concentrations will be based on the first high 24-hour average across five years. The proposed emission rates in AQ405CAO are consistent with those suggested by ODEQ for diesel combustion.² Specifically, the emission rates are based on Ventura County Air Pollution Control District and South Coast Air Quality Management District AB2588 reporting documents, with the exception of diesel particulate matter (DPM), which is conservatively estimated as the maximum of the sum of manufacturer-provided particulate matter and hydrocarbon emission rates for any load.

The planned maintenance and testing schedule for the generators will require no more than nine hours of operation per generator per year and no more than two to four hours of operation per generator per day. To allow for additional operational flexibility beyond the planned maintenance and testing schedule, STACK will be requesting operational limitations that ensure adequate operational flexibility while not exceeding the Toxics Lowest Available Emission Rate (TLAER) risk thresholds, as described in more detail in Section 4.1. Emergency operations are not regulated by ODEQ and are not included in the HRA.

3.3 Modeled Sources and Release Parameters

Sources modeled as part of this analysis will include the 49 emergency generators. The generators are described in Section 2 and their release parameters are summarized in Table 3.1. Air toxic emissions for the generators are provided in the CAO Air Toxics Reporting Form (AQ405CAO). Each generator will be characterized as a point source exhausting vertically upward without obstruction. Each building (including Buildings 1,2A, 2B, and 2C), as well as the related structures and stacks, have the same base elevation derived from elevation data of the Facility.

² <https://www.oregon.gov/deq/air/cao/Pages/faq-step2.aspx>

Table 3.1: Release Parameters

Parameter	Building 1 Generators	Building 2A Generators	Building 2B Generators	Building 2C Generators
Release Height (m)	8.53	8.53	8.53	8.53
Temperature (K)	756.45	756.45	756.45	756.45
Flow Rate (ACFM)	22,806.2	22,806.2	22,806.2	22,806.2
Exit Velocity (m/s)	36.88	36.88	36.88	36.88
Stack Diameter (m)	0.61	0.61	0.61	0.61
Elevation (m)	62.96	63.18	63.79	62.82

3.4 Building Downwash

The AERMOD model incorporates Plume Rise Modeling Enhancements (PRIME) to account for downwash. The direction-specific building downwash dimensions used as inputs were determined by the latest version (04274) of the Building Profile Input Program, PRIME (BPIP PRIME). BPIP PRIME uses building downwash algorithms incorporated into AERMOD to account for the plume dispersion effects of the aerodynamic wakes and eddies produced by buildings and structures.

The applicant proposes to evaluate onsite buildings at the proposed Facility for downwash effects on each modeled point source. Since some onsite buildings will have multi-tiered roofs, the tiered sections were treated as separate buildings for this modeling demonstration. The modeled parameters for the buildings and associate structures is provided in Table 3.2.

Table 3.2: Building and Structure Parameters

Structure	ID	Height (m)	Elevation (m)
Building 1 Main	B1X_MAIN	6.4	62.96
Building 1 Tier 1	B1X_ADD1	6.4	62.96
Building 1 Enclosures	B1X_GE##	4.88	62.96
Building 1 UPS	B1X_UPS##	4.88	62.96
Building 1 Chillers	B1X_CH##	2.4	62.96
Building 2A Main	B2A_MAIN	13.72	63.18
Building 2A Tier 1	B2A_ADD1	13.72	63.18
Building 2A Tier 2	B2A_ADD2	16.15	63.18
Building 2A Enclosures	B2A_GE##	4.88	63.18
Building 2A UPS	B2A_UPS##	4.88	63.18
Building 2B Main	B2B_MAIN	13.72	63.79
Building 2B Tier 1	B2B_ADD1	13.72	63.79
Building 2B Enclosures	B2B_GE##	4.88	63.79
Building 2B UPS	B2B_UPS##	4.88	63.79
Building 2C Main	B2C_MAIN	13.72	62.82
Building 2C Tier 1	B2C_ADD1	13.72	62.82
Building 2C Tier 2	B2C_ADD2	16.15	62.82
Building 2C Enclosures	B2C_GE##	4.88	62.82
Building 2C UPS	B2C_UPS##	4.88	62.82

3.5 Good Engineering Practice Stack Height Analysis

The USEPA has promulgated regulations that limit the maximum stack height one may use in a modeling analysis to no more than the Good Engineering Practice (GEP) stack height. The purpose of this requirement is to prevent the use of excessively tall stacks to reduce the modeled concentrations of a pollutant. GEP stack height is impacted by the heights of nearby structures. In general, the maximum value for GEP stack height is 65 meters. The stack heights for the proposed generator stacks will not exceed the GEP stack height.

3.6 Receptor Grid

The approximate Facility boundary is illustrated in Figure 3.1. Ground level receptors were placed along the boundary at approximately 10-meter intervals, resulting in 159 boundary receptors. Beyond the Facility boundary, a variable density, discrete Cartesian receptor grid was used for the modeling assessment, as outlined in Table 3.3. These nested receptor grids represent a total of 7478 receptors. In addition, 152 discrete receptors representing school facility centroids and daycare centers were also modelled. Receptor classifications are described in Section 2.4.

Table 3.3. Minimum Discrete Receptor Spacing

Distance from Fence Line	Receptor Spacing
Along fence line	10 meters
0 – 500 meters	25 meters
500 – 1,000 meters	50 meters
1,000 – 2,000 meters	100 meters
2,000 – 5,000 meters	200 meters
5,000 – 10,000 meters	500 meters

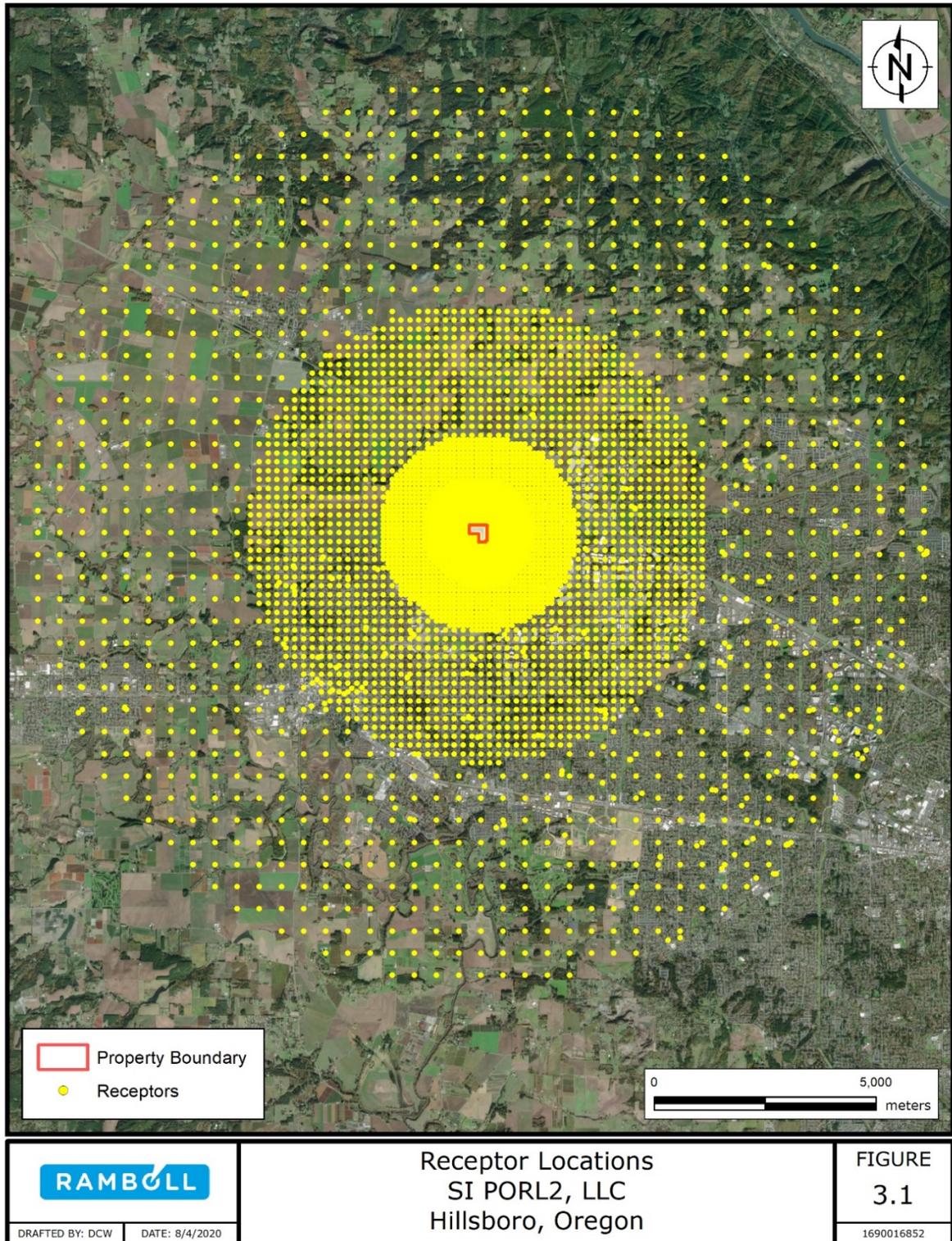
3.7 Terrain Data and Land Use

In accordance with USEPA guidance, terrain elevations were incorporated into the model using the most recent version (18081) of AERMAP, AERMOD's terrain preprocessor. Terrain elevation data for the entire modeling domain was extracted from 1/3 arc second National Elevation Data (NED) files with a resolution of approximately 10 meters. The NED files were obtained from the United States Geological Survey (USGS) Multi-Resolution Land Characteristics Consortium (MRLC).³ AERMAP was configured to assign elevations for the sources, buildings, property line receptors, gridded receptors, and discrete receptors in the modeling domain.

Land use classification determines the type of area to be modeled. The different classifications, urban or rural, incorporate distinct pollutant dispersion characteristics and will affect the estimation of downwind concentrations when used in the model. Based on the land use around the proposed facility, the urban boundary layer option in the model was not selected.

³ <http://www.mrlc.gov>

Figure 3.1: Receptor Locations



3.8 Meteorological Data

A representative meteorological data set was developed using a combination of surface data from the National Weather Service (NWS) station at the Hillsboro Airport (KHIO, located approximately 1.3 km southwest of the Facility) and NWS upper air data from Salem, Oregon (KSLE, located approximately 65 km south of the Facility).

Five years of representative meteorological data will be used for this analysis. Hourly and one-minute wind speed and wind direction data from January 2015 through December 2019 were processed using the latest version of AERMINUTE (version 15272) and AERMET (version 19191). The meteorological data was processed using the ADJ_U* option that reduces overprediction of modeled concentrations that occur in stable conditions with low wind speeds due to underprediction of the surface friction velocity (u^*). Underprediction of u^* results in an underestimation of the mechanical mixing height and thus overprediction of ambient concentrations. The ADJ_U* option is now considered a regulatory default option with the recent update to 40 CFR Part 51 Appendix W.

Additional meteorological variables and geophysical parameters are required for use in the AERMOD dispersion modeling analysis to estimate the surface energy fluxes and construct boundary layer profiles. Surface characteristics including albedo, Bowen ratio, and surface roughness length were determined for the area surrounding the Hillsboro Airport meteorological station using the AERMET surface characteristic preprocessor, AERSURFACE (version 20060), and the USGS 1992 National Land Cover (NLCD92) land use data set. The NLCD92 data set used in the analysis has a 30-meter resolution and 21 land use categories. Monthly surface parameters were determined using AERSURFACE according to USEPA guidance.

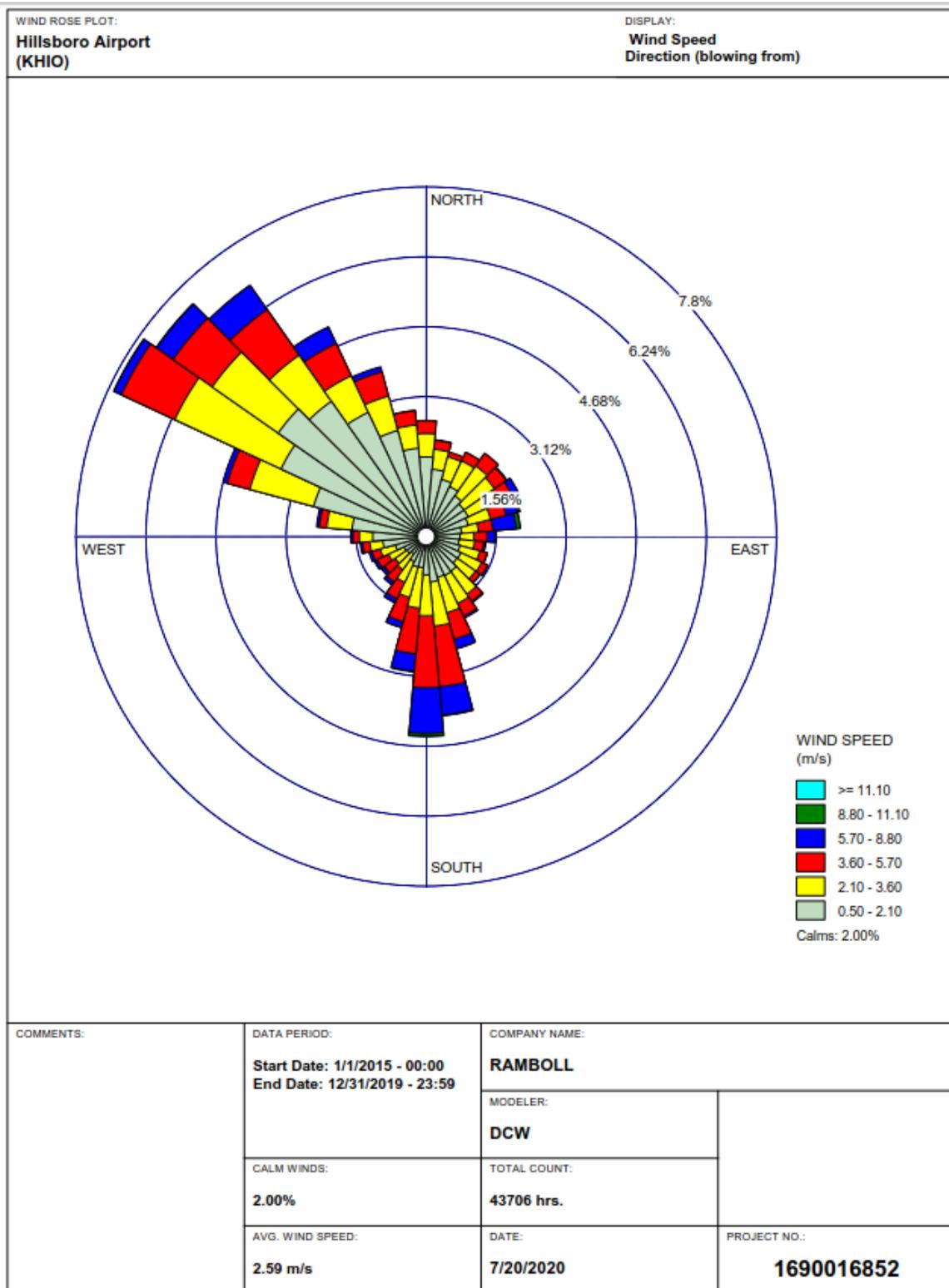
Monthly albedo and Bowen ratio values were based on averaging over a 10-km by 10-km region centered on the Hillsboro Airport meteorological site. Monthly surface roughness values were calculated for twelve 30-degree sectors within 1 km of the Hillsboro Airport meteorological station.

The AERSURFACE input file requires the user to provide additional location and climatological information regarding the primary meteorological site (KHIO). The following information was used to process monthly surface parameters for the meteorological site:

- The site was assumed to not have continuous snow cover most of the winter. There is typically little or no lasting snowfall near the Hillsboro Airport, where the meteorological station is located. The annual average total snowfall for Redmond, Oregon is 5.3 inches with an average snow depth of 0 inches during the month of January.
- The site is located at an airport.
- The site was not assumed to be located in an arid region.
- The monthly surface moisture conditions at the site were based on a comparison of the monthly precipitation with the 30-year monthly climatology at that station. Monthly precipitation values below the 30th percentile were classified as dry, above the 70th percentile, wet, and between the 30th and 70th percentiles, the surface moisture content was considered average. In addition, all months with precipitation less than 0.5 inches were classified as dry, regardless of comparison to percentiles.

The windrose for the period including 2015 - 2019 is shown in Figure 3.2.

Figure 3.2: Hillsboro Airport (KHIO) Windrose



4. RISK ASSESSMENT WORK PLAN

This HRA work plan describes the methodology required to conduct the HRA to evaluate the potential human health risks and hazards associated with the emergency generator emissions from the proposed Facility. Consistent with recommended procedures outlined in the USEPA's Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual (USEPA 1989) and with ODEQ's Recommended Procedures for Toxic Air Contaminant Health Risk Assessment (ODEQ 2020), this HRA includes the following elements:

- Identification of Chemicals of Potential Concern (COPC);
- Exposure assessment;
- Toxicity assessment; and
- Risk characterization

In addition, the approaches for uncertainty analysis and data quality assessment will be briefly discussed.

4.1 Methodology Overview for Conducting a Level 3 CAO HRA

The methodology proposed in this work plan follows the risk assessment framework and methodology as recommended by ODEQ CAO HRA Guidance (ODEQ 2020) for a Level 3 HRA. As shown in Figure 4.1, the recommended Level 3 CAO HRA process uses toxic pollutant emission rates described in the CAO Emission Inventory (AQ405CAO), the 24-hr and annual average dispersion factors for each generator and receptor, the default risk-based concentrations (RBCs) as recommended in the ODEQ CAO HRA Guidance (ODEQ 2020), and zoning/land use designations, to estimate the excess lifetime cancer risk, noncancer chronic and acute hazard indices (HI) at every modelled receptor, as described in more detail in the following sections.

The following scenarios will be evaluated for the HRA:

Chronic (annual):

- **Default Scenario:** Each of the 49 generators operate for 20 hours per year.
- **Alternative Scenario:** The generators will operate up to 530 hours per year *in aggregate*. This alternative scenario will allow for flexibility to conduct commissioning, maintenance, or testing runs that may exceed 20 hours per year for a single generator, if needed. This risk associated with this scenario will be evaluated as follows:
 - Using the results of the default scenario described above (i.e., all engines operating 20 hours per year), the applicant will identify the single "worst-case" engine that has the maximum annual average impact for any receptor.
 - Emissions from 530 hours of operation will be assumed to exhaust from the single "worst-case" engine. This is a simplistic and conservative approach that will slightly overestimate the maximum chronic risk for this scenario since it is based on a single "worst-case" engine.

Acute (24-hour):

- **Default scenario:** Each of the 49 generators will operate for two hours per day.
- **Alternative scenario:** The generators will operate up to 90 hours per day *in aggregate*. Similar to the alternative scenario described above, this scenario will allow for flexibility to conduct occasional commissioning, maintenance, or testing runs that may exceed two hours per day for a single generator. This risk associated with this scenario will be evaluated as follows:
 - Using the results of the default scenario described above (i.e., all engines operating two hours per day), the applicant will identify the single “worst-case” engine that has the maximum 24-hour impact for any receptor.
 - Emissions from 90 hours of operation will be assumed to exhaust from the single “worst-case” engine.

Given the HRA scenarios described above, the applicant proposes the permit conditions summarized below to reflect these limitations. Consistent with permits issued recently for other data center facilities in Hillsboro, the proposed limits are expressed in terms for fuel use. These fuel use limits are derived from the operational hours described above and the maximum fuel consumption rate for each engine (211 gallons per hour).

Proposed permit conditions:

To ensure risk from this facility does not exceed the levels demonstrated in the risk assessment, the permittee must comply with the following conditions:

- A. *Fuel use associated with non-emergency operations will not exceed 4,220 gallons per engine per 12-month period, except as noted in Condition B.*
- B. *Fuel associated with non-emergency operations may exceed 4,220 gallons per engine per 12-month period provided that the combined fuel use for all permitted engines does not exceed 111,830 gallons per 12-month period for non-emergency purposes.*
- C. *Fuel use associated with non-emergency operations will not exceed 422 gallons per engine per 24-hour period, except as noted in Condition D.*
- D. *Fuel associated with non-emergency operations may exceed 422 gallons per engine per 24-hour period provided that the combined fuel use for all permitted engines does not exceed 18,990 gallons per 24-hour period for non-emergency purposes.*

4.1.1 Identification of COPCs

The toxics air pollutant emitted from the facility, as discussed in Section 2.2, will be included as the COPCs to be quantitatively evaluated in the HRA. The toxic air pollutants are summarized in Table 2.2.

Figure 4.1: Level 3 Refined Risk Assessment

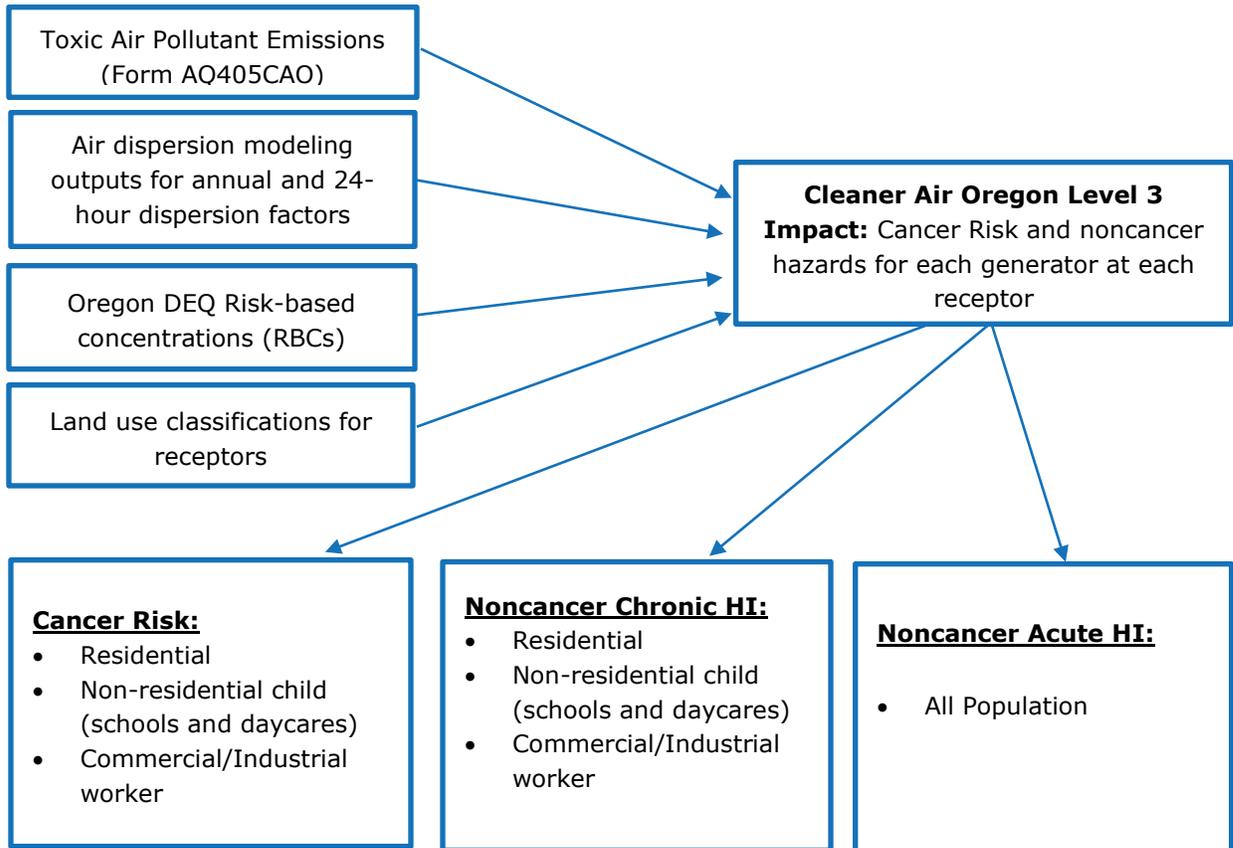


Figure 4.2: Receptor Classification

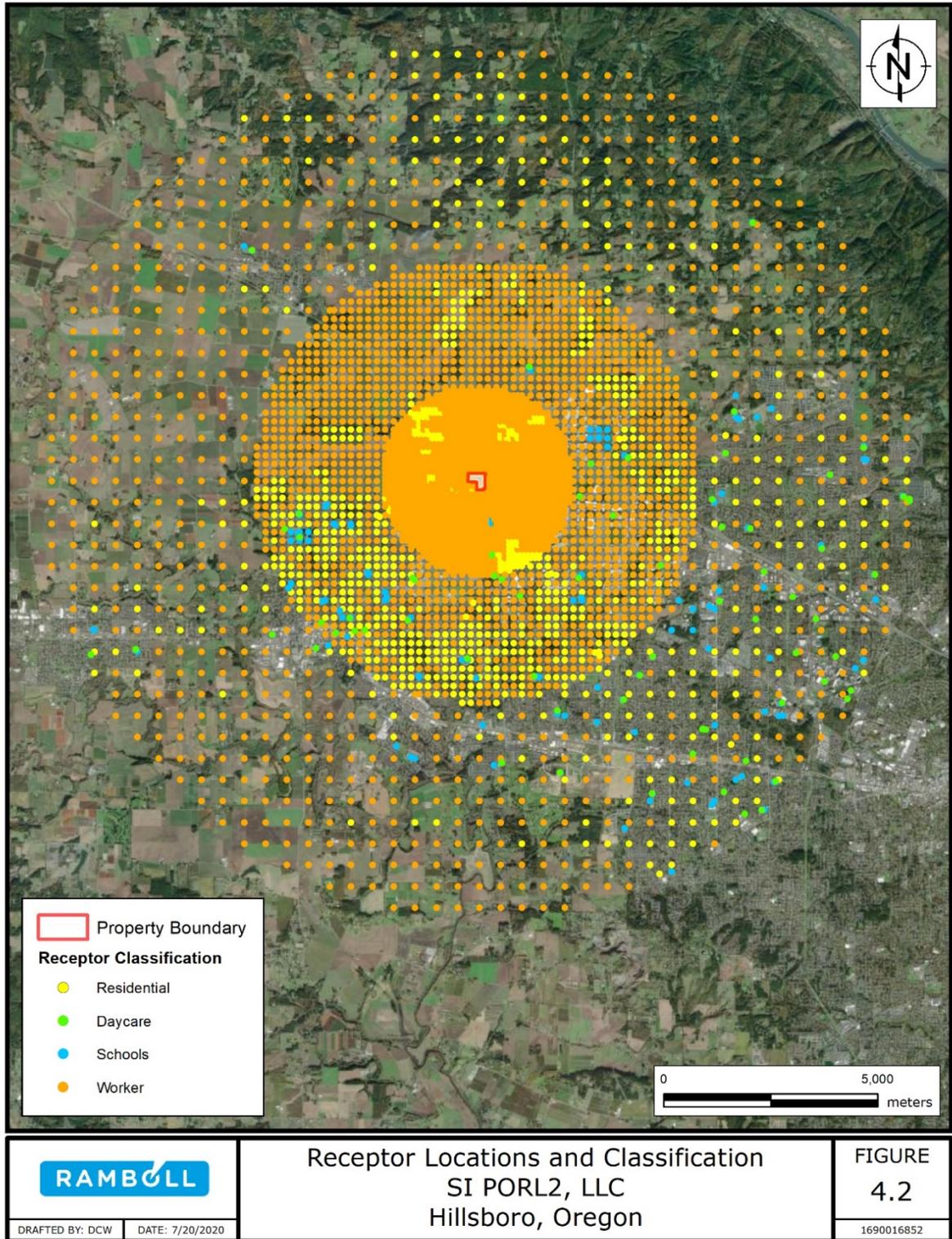
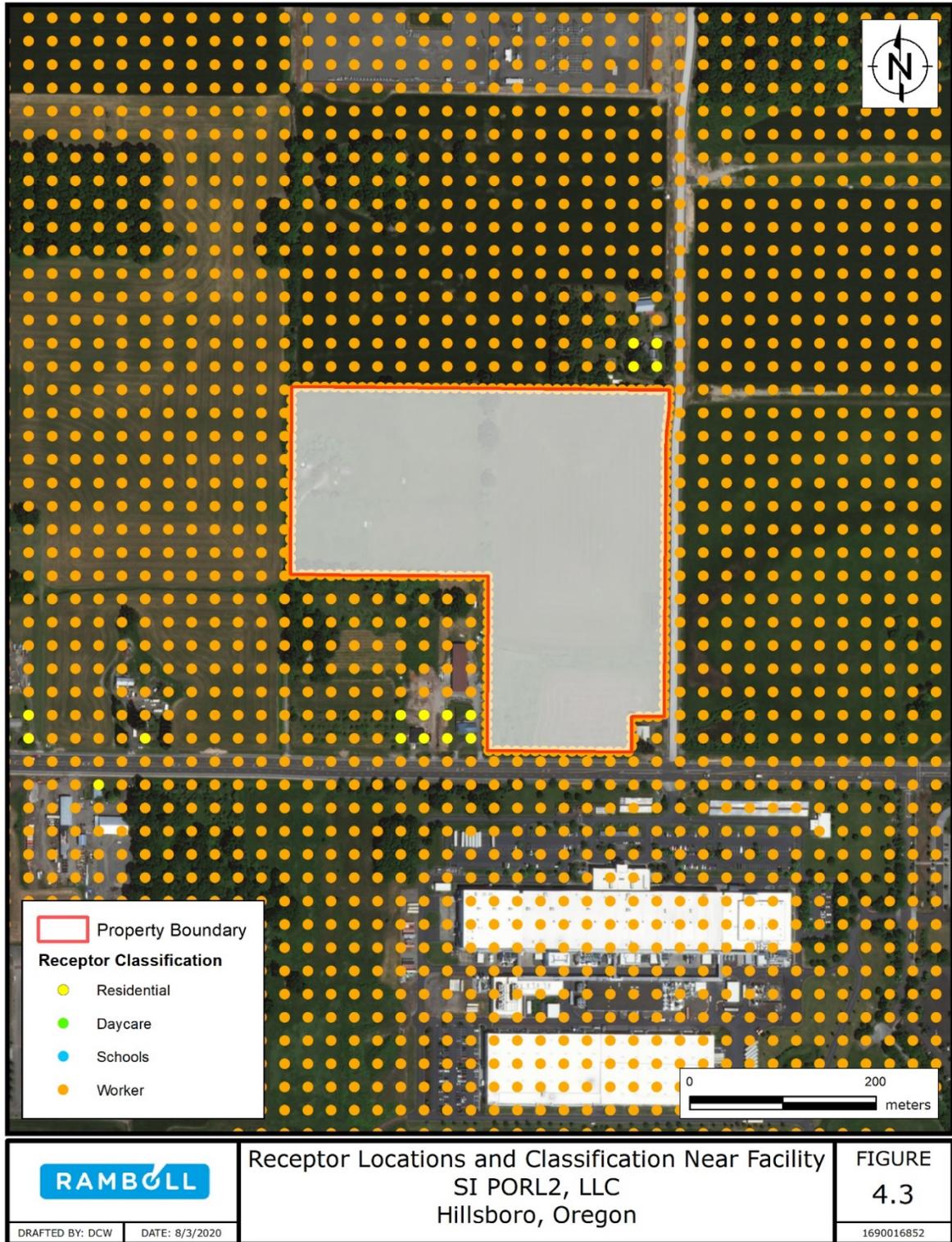


Figure 4.3: Receptor Classification – Near Facility



4.1.2 Exposure Assessment

According to USEPA (1989) and ODEQ (2020) HRA guidance, to evaluate the human health risks posed by a site, it is necessary to identify the populations that may potentially be exposed to the chemicals present and to determine the pathways by which these exposures may occur.

The land use classifications are applied to receptors around the facility to define the exposure class for the chronic exposures (i.e. the cancer risk and chronic HI). The off-site receptor populations to be included in this evaluation are listed as below and shown in Figure 4.2 and Figure 4.3:

- Resident;
- Worker; and
- School/Daycare child.

Acute HI based on 24-hour exposures will be evaluated at all modelled receptor locations regardless of receptor types.

Both inhalation and non-inhalation pathways (multi-pathways) will be considered in the proposed HRA. The RBCs that underlie the proposed analysis account for both inhalation and non-inhalation pathways as applicable (ODEQ 2020).

4.1.3 Toxicity Assessment

The toxicity assessment characterizes the relationship between the magnitude of exposure and the nature and magnitude of adverse health effects that may result from such exposure. For purposes of calculating exposure criteria to be used in risk assessments, adverse health effects are classified into two broad categories – cancer and noncancer endpoints. Toxicity values used to estimate the likelihood of adverse effects occurring in humans at different exposure levels are identified as part of the toxicity assessment component of a risk assessment.

The estimated excess lifetime cancer risks for all three receptor types will be calculated using RBCs provided by ODEQ, shown in Table 4.1. The chronic RBCs used at a receptor is a function of the zoning and land use at that receptor and is based on whether zoning or land use is residential, worker, or child (schools/daycares). Additional discussion on receptor classification is provided in Section 2.4. ODEQ developed these RBCs using Toxicity Reference Values, and they adjusted them as needed. These adjustments are for 1) a scenario-specific consideration of exposure frequency and duration, 2) exposure routes other than inhalation alone, which is a multi-pathway adjustment, and 3) early-life exposure to toxic air contaminants. These adjustments are reflected in the chronic RBCs listed in Table 4.1, which are from Oregon Administrative Rules (OAR) 340-245-8040 Table 4.

4.1.4 Risk Characterization

For informational purposes, the chronic risk values will be grouped by exposure type (residential, non-residential child, and worker) from which the maximum risk will be determined (see Table 4.1).

Estimation of Cancer Risks

Excess lifetime cancer risks are estimated as the upper-bound incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens. They are estimated by comparing the estimated annual average air concentration at each receptor to the ODEQ chemical-specific cancer risk-based concentrations (RBCs). The target risk for the RBCs is

set at an excess cancer risk of one in one million. The equation that will be used to calculate excess lifetime cancer risk at each receptor (in units of excess risk per one million) is as follows, where *Annual Concentration_{ij}* is the long-term (annual) concentration of toxic air contaminant *i* from emission source *j*:

$$\text{Cancer Risk} = \sum_{j=1}^{TEU\ m} \sum_{i=1}^{\text{chemical } n} \frac{\text{Annual Concentration}_{ij}}{\text{Cancer RBC}_i}$$

Estimation of Noncancer Chronic HQ/HI

The potential for exposure to result in chronic noncancer effects is evaluated by comparing the estimated annual average air concentration at each receptor to the ODEQ chemical-specific noncancer RBCs. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient (HQ). To evaluate the potential for adverse chronic noncancer health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals are summed, yielding a hazard index (HI). The equation that will be used to calculate chronic HI at each is as follows:

$$\text{Chronic HI} = \sum_{j=1}^{TEU\ m} \sum_{i=1}^{\text{chemical } n} \frac{\text{Annual Concentration}_{ij}}{\text{Noncancer RBC}}$$

Estimation of Noncancer Acute HQ/HI

The potential for exposure to result in acute noncancer effects is evaluated by comparing the estimated 24-hour air concentration to the chemical-specific noncancer acute RBCs. When calculated for a single chemical, the comparison yields a HQ. To evaluate the potential for adverse acute noncancer health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals are summed, yielding an HI. The equation that will be used to calculate the acute HI is as follows, where *24-hr Concentration_{ij}* is the short-term (24-hr) concentration of toxic air contaminant *i* from emission source *j*:

$$\text{Acute HI} = \sum_{j=1}^{TEU\ m} \sum_{i=1}^{\text{chemical } n} \frac{24\text{-Hour Concentration}_{ij}}{\text{Acute RBC}}$$

Noncancer chronic hazards will be conservatively evaluated as if all evaluated chemicals target the same organ. Acute hazards will be evaluated for each target organ individually using the acute HI equation described above and accounting for the chemicals that affect each specific target organ. Pollutant-specific target organs will be identified using the target organ system summary tables in Appendix F of the ODEQ HRA Guidance (2020).

The calculated excess lifetime cancer risk, noncancer chronic HI and acute HI will be compared with the Risk Action Levels (RALs) as recommended by ODEQ (OAR 340-245-8010 Table 1) for new and reconstructed sources. The applicable RALs to use for the proposed HRA are summarized in Table 4.2.

Table 4.1: Risk-Based Concentrations

CAS #	Compound	Chronic Cancer RBC			Noncancer RBC			
		Residential (µg/m³)	Child (µg/m³)	Worker (µg/m³)	Residential (µg/m³)	Child (µg/m³)	Worker (µg/m³)	Acute (µg/m³)
75-07-0	Acetaldehyde	0.45	12	5.5	140	620	620	470
107-02-8	Acrolein	--	--	--	0.35	1.5	1.5	6.9
7664-41-7	Ammonia	--	--	--	500	2200	2200	1200
7440-38-2	Arsenic and compounds	2.40E-05	0.0013	0.00062	0.00017	0.0024	0.0024	0.2
71-43-2	Benzene	0.13	3.3	1.5	3	13	13	29
106-99-0	1,3-Butadiene	0.033	0.86	0.4	2	8.8	8.8	660
7440-43-9	Cadmium and compounds	0.00056	0.014	0.0067	0.005	0.037	0.037	0.03
18540-29-9	Chromium VI, chromate and dichromate particulate	0.000031	0.00052	0.001	0.083	0.88	0.88	0.3
7440-50-8	Copper and compounds	--	--	--	--	--	--	100
DPM	Diesel Particulate Matter	0.1	2.6	1.2	5	22	22	--
100-41-4	Ethyl benzene	0.4	10	4.8	260	1100	1100	22000
50-00-0	Formaldehyde	0.17	4.3	2	9	40	40	49
110-54-3	Hexane	--	--	--	700	3100	3100	--
7647-01-0	Hydrochloric acid	--	--	--	20	88	88	2100
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
91-20-3	Naphthalene	0.029	0.76	0.35	3.7	16	16	200
	Nickel compounds, insoluble	0.0038	0.1	0.046	0.014	0.062	0.062	0.2
PAH	Polycyclic aromatic hydrocarbons (PAHs)	4.30E-05	0.0016	0.003	--	--	--	--
50-32-8	Benzo[a]pyrene	4.30E-05	0.0016	0.003	0.002	0.0088	0.0088	0.002
7782-49-2	Selenium and compounds	--	--	--	--	--	--	2
108-88-3	Toluene	--	--	--	5000	22000	22000	7500
1330-20-7	Xylene (mixture), including m-xylene, o-xylene, p-xylene	--	--	--	220	970	970	8700

Table 4.2: Risk Action Levels

Applicability	Risk Action Level	Excess Cancer Risk per Million	Noncancer HI
New and Reconstructed Source	Source Permit Level	0.5	0.5
	Community Engagement Level	5	1
	TLAER Level	10	1
	Permit Denial Level	25	1

4.2 Uncertainty Analysis

As indicated in the USEPA and ODEQ Guidelines (USEPA 1989; ODEQ 2020b), it is important to evaluate such uncertainties so that the results of a risk assessment can be placed into the proper perspective. CAO rules require that a quantitative or qualitative uncertainty evaluation be included in a Level

3 and Level 4 risk assessment. Uncertainties are associated with the calculations and assumptions used in an HRA. The overall approach that will be used in this HRA is expected to be conservative and overestimate potential exposure. In addition to uncertainties in the emission estimates and air dispersion modeling, key uncertainties associated with the estimated exposures for potentially exposed populations in the vicinity of the Facility that will be discussed, including the following aspects:

- Emission rates estimation
- COPC selection
- Toxicity values
- Estimation of concentrations
- Exposure assumptions

The key assumptions and rationale for those assumptions, their effect on estimates of health effects, will also be discussed.

5. REFERENCES

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[AirQualityModeling.pdf](https://www.oregon.gov/deq/qaq/cao/Documents/CAORP-AirQualityModeling.pdf)

Intended for
Oregon Department of Environmental Quality

Date
March 2021
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CLEANER AIR OREGON LEVEL 3 MODELING REPORT AND RISK ASSESSMENT ANALYSIS

SI PORL2, LLC

HILLSBORO, OREGON

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Appendix A: Risk Assessment Results
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1. INTRODUCTION

Ramboll US Consulting, Inc. (Ramboll) is submitting this modeling report and risk assessment analysis to the Oregon Department of Environmental Quality (ODEQ) on behalf of SI PORL2, LLC ("STACK"), which is proposing to construct and operate diesel-fired emergency generators at a new data center in Hillsboro, Washington County, Oregon (Facility).

Primary power to the Facility will be supplied by the local electrical utility. Emergency backup power will be provided to the Facility by 49 identical diesel-fired emergency generators, each with an electrical output of 3 megawatts (MW). In accordance with federal New Source Performance Standards (NSPS) Subpart IIII, each emergency generator will be certified to meet United States Environmental Protection Agency (USEPA) Tier 2 emissions standards and will burn only ultra-low sulfur diesel (ULSD) fuel. The proposed emergency generators will not be used for demand response, peak shaving, or local reliability programs.

Under the Cleaner Air Oregon rules (OAR-340-245), new sources are required to conduct a health risk assessment of all non-exempt Toxic Emission Units (TEUs) at the Facility and demonstrate that the Facility can operate at or below the applicable new source Risk Action Levels (RALs). The following sections describe STACK's air quality modeling and health risk assessment (HRA) results, as required under OAR-340-245.

2. FACILITY OVERVIEW

2.1 Facility Location

STACK proposes to construct a new data center facility in Hillsboro, Washington County, Oregon. The location of the proposed facility is a combined 28.71 acre lot at 4735 NE Starr Blvd in northeast Hillsboro. The centroid of the facility is located at a latitude of 45° 33' 11.8353" N and a longitude of 122° 56' 20.2869 W (UTM Zone 10 Easting 504763.69 m and Northing 5044418.44 m; NAD 1983 Datum). The location of the proposed Facility is shown in Figure 2.1.

Primary power will be provided to the facility by the local electric utility. Emergency backup power will be provided by 49 diesel-fired emergency generators. Emissions from these generators will include certain air toxics that are regulated under the Cleaner Air Oregon (CAO) program, as described in more detail below.

2.2 Project Description

The risk assessment will account for emissions from 49 diesel-fired emergency generators. Figure 2.2 depicts the generator locations and Tables 2.1 and 2.2 provide a summary of generator specifications and locations. There will be no other non-exempt TEUs associated with this project.

Table 2.1: Summary of Toxic Emission Units

TEU Description	Fuel Type	Maximum Fuel Consumption Rate
49x3MW emergency generators	ULSD	211 gallons/hour/generator

Table 2.2: Toxics Emission Unit Locations

Source ID	Source Description	UTMX (m)*	UTMY (m)*
B1X_EG01	Building 1 Emergency Generator 01 Stack	504768.28	5044413.74
B1X_EG02	Building 1 Emergency Generator 02 Stack	504768.24	5044407.72
B1X_EG03	Building 1 Emergency Generator 03 Stack	504768.19	5044401.62
B1X_EG04	Building 1 Emergency Generator 04 Stack	504768.15	5044395.52
B1X_EG05	Building 1 Emergency Generator 05 Stack	504767.94	5044346.42
B1X_EG06	Building 1 Emergency Generator 06 Stack	504767.89	5044340.32
B1X_EG07	Building 1 Emergency Generator 07 Stack	504767.85	5044334.22
B2A_EG01	Building 2A Emergency Generator 01 Stack	504797.35	5044453.44
B2A_EG02	Building 2A Emergency Generator 02 Stack	504803.45	5044453.36
B2A_EG03	Building 2A Emergency Generator 03 Stack	504809.55	5044453.28
B2A_EG04	Building 2A Emergency Generator 04 Stack	504815.65	5044453.21
B2A_EG05	Building 2A Emergency Generator 05 Stack	504821.75	5044453.13
B2A_EG06	Building 2A Emergency Generator 06 Stack	504827.85	5044453.05
B2A_EG07	Building 2A Emergency Generator 07 Stack	504833.95	5044452.98
B2A_EG08	Building 2A Emergency Generator 08 Stack	504840.05	5044452.90
B2A_EG09	Building 2A Emergency Generator 09 Stack	504846.15	5044452.82
B2A_EG10	Building 2A Emergency Generator 10 Stack	504852.25	5044452.74

Source ID	Source Description	UTMX (m)*	UTMY (m)*
B2A_EG11	Building 2A Emergency Generator 11 Stack	504858.35	5044452.67
B2A_EG12	Building 2A Emergency Generator 12 Stack	504864.45	5044452.59
B2A_EG13	Building 2A Emergency Generator 13 Stack	504870.55	5044452.51
B2A_EG14	Building 2A Emergency Generator 14 Stack	504876.65	5044452.44
B2B_EG01	Building 2B Emergency Generator 01 Stack	504698.05	5044454.54
B2B_EG02	Building 2B Emergency Generator 02 Stack	504704.15	5044454.46
B2B_EG03	Building 2B Emergency Generator 03 Stack	504710.25	5044454.38
B2B_EG04	Building 2B Emergency Generator 04 Stack	504716.35	5044454.31
B2B_EG05	Building 2B Emergency Generator 05 Stack	504722.45	5044454.23
B2B_EG06	Building 2B Emergency Generator 06 Stack	504728.55	5044454.15
B2B_EG07	Building 2B Emergency Generator 07 Stack	504734.65	5044454.08
B2B_EG08	Building 2B Emergency Generator 08 Stack	504740.75	5044454.00
B2B_EG09	Building 2B Emergency Generator 09 Stack	504746.85	5044453.92
B2B_EG10	Building 2B Emergency Generator 10 Stack	504752.95	5044453.84
B2B_EG11	Building 2B Emergency Generator 11 Stack	504759.05	5044453.77
B2B_EG12	Building 2B Emergency Generator 12 Stack	504765.15	5044453.69
B2B_EG13	Building 2B Emergency Generator 13 Stack	504771.25	5044453.61
B2B_EG14	Building 2B Emergency Generator 14 Stack	504777.35	5044453.54
B2B_EGX1	Building 2B Emergency Generator X1 Stack	504783.45	5044453.04
B2C_EG01	Building 2C Emergency Generator 01 Stack	504598.85	5044455.64
B2C_EG02	Building 2C Emergency Generator 02 Stack	504604.95	5044455.56
B2C_EG03	Building 2C Emergency Generator 03 Stack	504611.05	5044455.48
B2C_EG04	Building 2C Emergency Generator 04 Stack	504617.15	5044455.41
B2C_EG05	Building 2C Emergency Generator 05 Stack	504623.25	5044455.33
B2C_EG06	Building 2C Emergency Generator 06 Stack	504629.35	5044455.25
B2C_EG07	Building 2C Emergency Generator 07 Stack	504635.45	5044455.18
B2C_EG08	Building 2C Emergency Generator 08 Stack	504641.55	5044455.10
B2C_EG09	Building 2C Emergency Generator 09 Stack	504647.65	5044455.02
B2C_EG10	Building 2C Emergency Generator 10 Stack	504653.75	5044454.94
B2C_EG11	Building 2C Emergency Generator 11 Stack	504659.85	5044454.87
B2C_EG12	Building 2C Emergency Generator 12 Stack	504665.95	5044454.79
B2C_EG13	Building 2C Emergency Generator 13 Stack	504672.05	5044454.71
B2C_EG14	Building 2C Emergency Generator 14 Stack	504678.15	5044454.64
B2C_EGX1	Building 2C Emergency Generator X1 Stack	504684.25	5044454.14
* All coordinates presented as Universal Transverse Mercator (UTM) Zone 10, NAD83 Datum			

Figure 2.2: Facility Layout



- Property Boundary
- Buildings/Structures
- Emergency Generators

FACILITY LAYOUT

FIGURE 2.2

0 50 100 Meters

Stack
Hillsboro, OR

RAMBOLL US CORPORATION
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3. EMISSIONS INVENTORY

STACK has included their proposed Emissions Inventory (Form AQ405CAO) with the Risk Assessment Work Plan (RAWP) and Modeling Protocol (revised March 2021). The emission factors that underlie the emission rates in Form AQ405CAO are consistent with those suggested by ODEQ for diesel combustion.¹ Specifically, the emission rates are based on Ventura County Air Pollution Control District and South Coast Air Quality Management District AB2588 reporting documents, with the exception of diesel particulate matter (DPM), which is conservatively estimated as the maximum of the sum of manufacturer-provided particulate matter and uncontrolled hydrocarbon emission rates for any load. The emission rates are based on the default and alternate operating scenarios outlined in Section 4.1 of the RAWP and Modeling Protocol.

4. AIR QUALITY MODELING METHODOLOGY

The following sections outlines the methodologies that were followed in the dispersion modeling analysis. The dispersion modeling will be conducted in accordance with ODEQ's 2020 Draft Recommended Procedures for Air Quality Modeling, as described in more detail below.

4.1 Model Selection and Settings

To estimate ambient air concentrations of pollutants, the latest version of the AERMOD modeling system (19191), the USEPA's recommended air dispersion model, was used. AERMOD is appropriate for use in estimating ground-level ambient air concentrations resulting from non-reactive buoyant emissions from sources located in simple and complex terrain.

Modeled impacts were estimated using AERMOD in conjunction with information about the Facility, the locations of the emitting stacks, representative meteorological data, and nearby receptors. The North American Datum of 1983 (NAD83) of the Universal Transverse Mercator (UTM) Coordinate System was used, which provides a constant distance relationship anywhere on the map or domain. The units of the coordinates are in meters.

4.2 Source Characterization

Sources modeled as part of this analysis included the 49 identical emergency generators. The generators and associated emissions are described in Sections 2 and 3, and their release parameters are summarized in Table 4.1. Each generator will be characterized as a POINT source exhausting vertically upward without obstruction. All stacks have the same base elevation derived from the elevation of the Facility centroid.

Table 4.1: Emission Point Release Parameters

Parameter	Building 1 Gen Sets	Building 2A Gen Sets	Building 2B Gen Sets	Building 2C Gen Sets
Release Height (m)	8.53	8.53	8.53	8.53
Temperature (K)	756.45	756.45	756.45	756.45
Flow Rate (ACFM)	22,806.2	22,806.2	22,806.2	22,806.2
Exit Velocity (m/s)	36.88	36.88	36.88	36.88
Stack Diameter (m)	0.61	0.61	0.61	0.61
Elevation (m)	62.96	63.18	63.79	62.82

¹ <https://www.oregon.gov/deq/air/cao/Pages/faq-step2.aspx>

4.3 Land Use

Land use classification determines the type of area to be modeled. The different classifications, urban or rural, incorporate distinct pollutant dispersion characteristics and will affect the estimation of downwind concentrations when used in the model. Based on the land use around the proposed Facility, the default rural boundary layer option was selected in the model.

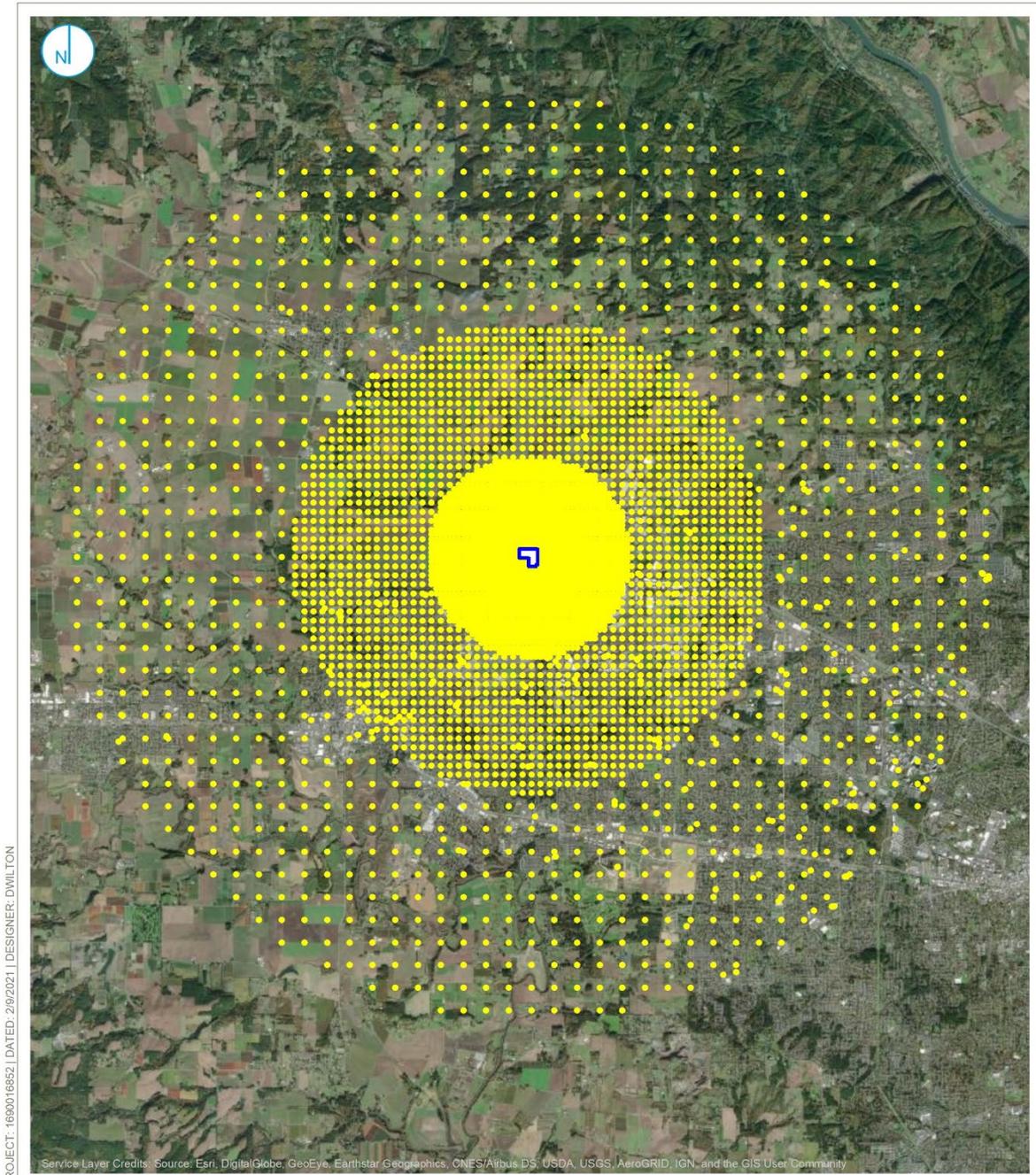
4.4 Receptor Grid

Ground level receptors were placed along the boundary at approximately 10-meter intervals, resulting in 159 boundary receptors. Beyond the Facility boundary, a variable density, discrete Cartesian receptor grid was used for the modeling assessment, as outlined in Table 4.2. These nested receptor grids represent a total of 7,478 receptors. In addition, 152 discrete receptors representing school facility centroids and daycare centers were also modeled. AERMAP was configured to assign elevations for the property line receptors, gridded receptors, and discrete sensitive receptors in the modeling domain using 1/3 arc-second terrain data with an approximate resolution of 10 m. The modeling domain, including all receptors, is shown in Figure 4.1.

Table 4.2. Minimum Discrete Receptor Spacing

Distance from Fence Line	Receptor Spacing
Along fence line	10 meters
0 – 500 meters	25 meters
500 – 1,000 meters	50 meters
1,000 – 2,000 meters	100 meters
2,000 – 5,000 meters	200 meters
5,000 – 10,000 meters	500 meters

Figure 4.1: Receptor Locations



- Property Boundary
- Receptors

RECEPTOR LOCATIONS

FIGURE 4.1

0 2,500 5,000 Meters

Stack
Hillsboro, OR

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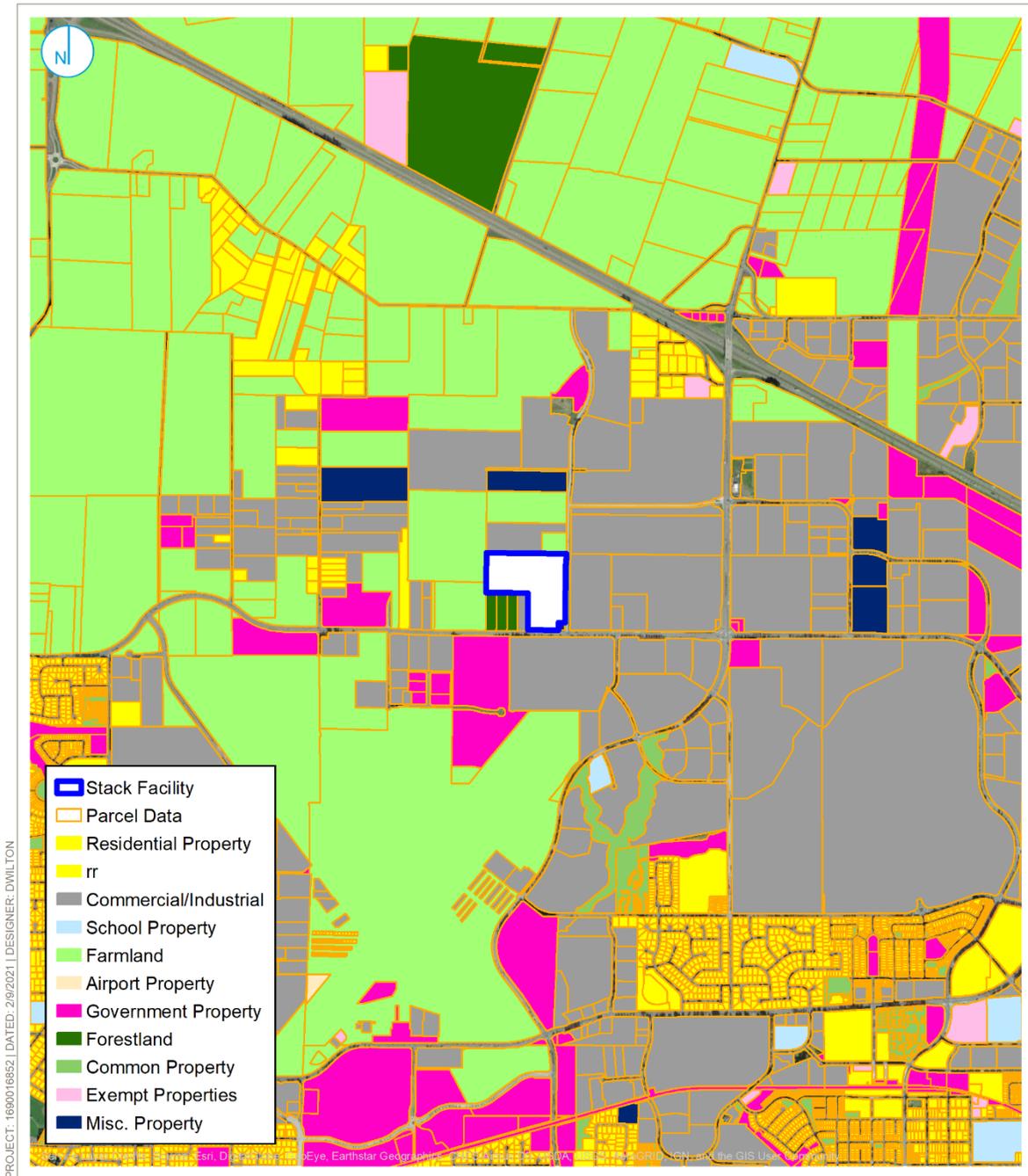
4.5 Receptor Classification

For the initial characterization of the receptor locations, a shapefile of the land parcel data with land classification codes was used. These data were provided through direct communication with Washington County Information Technology Services. The data set contains 98 parcel use classifications, which for assigning receptor types were categorized into two basic categories; residential and worker. The residential bin includes parcels with any form of residential zoning including mixed-use categories. In addition, parcels nearby the project that are zoned for non-residential uses were assessed to determine whether a residential categorization was appropriate given the presence of a residence on the property. In cases where parcels have a residence, receptors representing the residential locations were categorized as "residential".

After the initial analysis, receptor locations for Oregon K-12 public and private schools, colleges, universities, and career schools were assigned in a school category from a dataset from the Oregon Spatial Data Library (https://spatialdata.oregonexplorer.info/geoportal/search;q=*schools*). For schools, both a discrete receptor at the centroid of the facility and any gridded receptors intersecting the school properties were assigned to a category of schools. Daycare centers were also included using a data set from Homeland Infrastructure Foundation-Level Data (HIFLD) website (<https://hifld-geoplatform.opendata.arcgis.com/datasets/child-care-centers>). Additional searches were performed to augment the daycare center data with facilities not included in the HIFLD dataset. As a conservative approach, all non-residential, non-school, and non-daycare gridded receptors are considered as worker receptors. The acute analysis will conservatively include all gridded and discrete receptors.

Figure 4.2 shows the zoning categories around the Facility. The Facility is located in an area zoned for industrial use, and is surrounded by parcels categorized as industrial, commercial, forestland, farmland, and miscellaneous. Adjacent parcels containing homes to the north and west of the Facility represent the nearest residences to the Facility. The nearest child exposure location is a daycare facility, KLA Schools of Hillsboro, located approximately 1.5 kilometers to the south of the facility. Liberty High School, located approximately 2.6 km to the east-northeast of the facility, is the nearest school location.

Figure 4.2: Parcel Zoning Near Facility



PARCEL ZONING

FIGURE 4.2

0 500 1,000
Meters

Stack
Hillsboro, OR

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4.6 Meteorological Data

A representative meteorological data set was developed using a combination of surface data from the National Weather Service (NWS) station at the Hillsboro Airport (KHIO, located approximately 1.6 km southwest of the Facility) and NWS upper air data from Salem, Oregon (KSLE, located approximately 65 km south of the Facility).

Five years of representative meteorological data were used for this analysis. Hourly and one-minute wind speed and wind direction data from January 2015 through December 2019 were processed using the latest version of AERMINUTE (version 15272) and AERMET (version 19191). The meteorological data was processed using the ADJ_U* option that reduces overprediction of modeled concentrations that occur in stable conditions with low wind speeds due to underprediction of the surface friction velocity (u^*). Underprediction of u^* results in an underestimation of the mechanical mixing height and thus overprediction of ambient concentrations. The ADJ_U* option is now considered a regulatory default option with the recent update to 40 CFR Part 51 Appendix W.

Additional meteorological variables and geophysical parameters are required for use in the AERMOD dispersion modeling analysis to estimate the surface energy fluxes and construct boundary layer profiles. Surface characteristics including albedo, Bowen ratio, and surface roughness length were determined for the area surrounding the Hillsboro Airport meteorological station using the AERMET surface characteristic preprocessor, AERSURFACE (version 20060), and data from Multi-Resolution Land Characteristics (MRLC) Consortium. The data sets used in the analysis included the 2016 National Land Cover Database (NLCD 2016), the 2016 Urban Imperviousness data set, and the 2016 Tree Canopy data set. Monthly surface parameters were determined using AERSURFACE according to USEPA guidance.

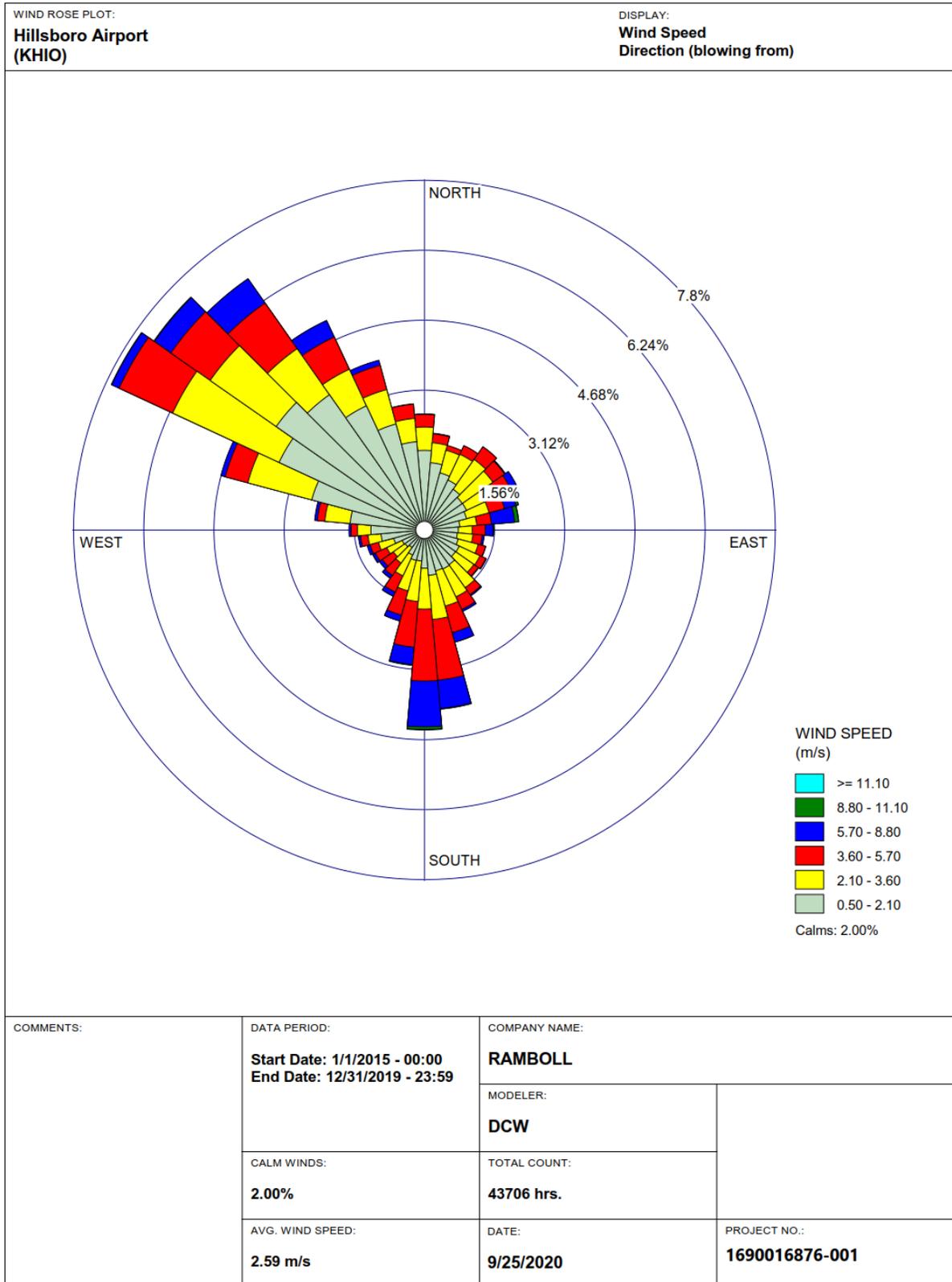
Monthly albedo and Bowen ratio values were based on averaging over a 10-km by 10-km region centered on the Hillsboro Airport meteorological site. Monthly surface roughness values were calculated for twelve 30-degree sectors within 1 km of the Hillsboro Airport meteorological station.

The AERSURFACE input file requires the user to provide additional location and climatological information regarding the primary meteorological site (KHIO). The following information was used to process monthly surface parameters for the meteorological site:

- The site was assumed to have no continuous snow cover most of the winter. There is typically little or no lasting snowfall near the Hillsboro Airport, where the meteorological station is located. The annual average total snowfall for Redmond, Oregon is 5.3 inches with an average snow depth of 0 inches during the month of January.
- The site is located at an airport.
- The site is in a non-arid region.
- The monthly surface moisture conditions at the site were based on a comparison of the monthly precipitation with the 30-year monthly climatology at that station. Monthly precipitation values below the 30th percentile were classified as dry, above the 70th percentile, wet, and between the 30th and 70th percentiles, the surface moisture content was considered average. In addition, all months with precipitation less than 0.5 inches were classified as dry, regardless of comparison to percentiles.

The windrose for the period including 2015 - 2019 is shown in Figure 4.3.

Figure 4.3: Hillsboro Airport (KHIO) Windrose



4.7 Meteorological Data Representativeness

The city of Hillsboro and surroundings are located in the Tualatin Basin. This relatively flat area slowly rises to the Tualatin Hills approximately 10 km northeast of the Facility site. The Hillsboro Airport meteorological station (KHIO) is located approximately 1.0 km to the southwest of the Facility site. There is very little terrain variation within the basin, and the average elevations of the Facility site and the Hillsboro Airport, including the primary surface meteorological site, are within a few meters of each other.

With no intervening terrain to influence wind patterns and the proximity of the meteorological station to the Facility site, the Hillsboro Airport meteorological station (KHIO) would be representative of the wind flow patterns experienced at the Facility site.

The annual surface roughness length (z_0) for the airport site is 0.028 m (open flat terrain, grass, few isolated obstacles), whereas the same value for the Facility site is 0.101 m (low crops, occasional large obstacles). These values are relatively consistent with each other considering the limited features located at an airport site. The approximate surface roughness length of a suburban location is 1.0 m, an order of magnitude greater than that of the site.

Another feature of data suitability is the requirement that processed meteorological data meets the minimum 90% data completeness by quarter. In terms of data completeness, all quarters of 2015-2019 have less than 10% missing data. The first quarter of 2016 contains the most missing data at 4.30% (95.6% complete), whereas the average of the missing data for all quarters is approximately 0.74% (99.26% complete).

4.8 Building Downwash and Stack Height

All onsite buildings at the proposed Facility were evaluated for direction-specific downwash effects on each modeled point source as determined by the latest version (04274) of the Building Profile Input Program, PRIME (BPIP PRIME). As the main onsite buildings have multi-tiered roofs, the tiered sections were treated as separate buildings for this modeling demonstration. The modeled parameters for the buildings and associate structures is provided in Table 4.3.

None of the stack heights for the proposed generator stacks will exceed the GEP stack height.

Table 4.3. Building and Structure Parameters

Structure	ID	Height (m)	Elevation (m)
Building 1 Main	B1X_MAIN	6.4	62.96
Building 1 Addition	B1X_ADD1	6.4	62.96
Building 1 Enclosures	B1X_GE##	4.88	62.96
Building 1 UPS	B1X_UPS##	4.88	62.96
Building 1 Chillers	B1X_CH##	2.4	62.96
Building 2A Main	B2A_MAIN	13.72	63.18
Building 2A Addition 1	B2A_ADD1	13.72	63.18
Building 2A Addition 2	B2A_ADD2	16.15	63.18
Building 2A Enclosures	B2A_GE##	4.88	63.18
Building 2A UPS	B2A_UPS##	4.88	63.18
Building 2B Main	B2B_MAIN	13.72	63.79
Building 2B Addition 1	B2B_ADD1	13.72	63.79
Building 2B Enclosures	B2B_GE##	4.88	63.79
Building 2B UPS	B2B_UPS##	4.88	63.79
Building 2C Main	B2C_MAIN	13.72	62.82
Building 2C Addition 1	B2C_ADD1	13.72	62.82
Building 2C Addition 2	B2C_ADD2	16.15	62.82
Building 2C Enclosures	B2C_GE##	4.88	62.82
Building 2C UPS	B2C_UPS##	4.88	62.82

4.9 Modeled Emission Rates

In order to address the multiple emission rates from multiple toxic air contaminants, the χ/Q (chi-over-Q) modelling approach was employed. In this method, all unique sources were modelled individually using a unit emission rate for the applicable averaging periods. The resulting dispersion factors for each averaging period (in units of $\mu\text{g}/\text{m}^3/(\text{g}/\text{s})^2$) were multiplied by their respective emission rates to calculate concentrations, which in turn were employed in the risk assessment.

Modeling files are included in Appendix B (electronic files).

5. RISK ASSESSMENT ANALYSIS

This section describes the methodology used to conduct a Level 3 CAO HRA to evaluate the potential human health risks and hazards associated with the emergency generator emissions from the proposed Facility. This section also discusses the results of the HRA analysis and associated uncertainties. Consistent with recommended procedures outlined in the USEPA's 1989 Risk Assessment Guidance for Superfund: Volume I—Human Health Evaluation Manual and with ODEQ's 2020 Recommended Procedures for Toxic Air Contaminant Health Risk Assessment, this HRA includes the following elements:

- Identification of Chemicals of Potential Concern (COPCs);
- Exposure assessment;
- Toxicity assessment; and
- Risk characterization

These elements are described in further detail in Section 5.1. The health risk results are discussed in Section 5.2; the uncertainties associated with the HRA are discussed in Section 5.3.

² Micrograms per cubic meter divided by grams per second.

5.1 Methodology Overview for Conducting a Level 3 CAO HRA

The methodology follows the risk assessment framework as recommended by ODEQ CAO HRA Guidance for a Level 3 HRA. As shown in Figure 5.1, the recommended Level 3 CAO HRA process uses toxic pollutant emission rates described in the CAO Emission Inventory (Form AQ405CAO), the 24-hr and annual average dispersion factors for each generator and receptor, the default risk-based concentrations (RBCs) as recommended in the ODEQ CAO HRA Guidance, and zoning/land use designations, to estimate the excess lifetime cancer risk and noncancer chronic and acute hazard indices (HI) at every modelled receptor, as described in more detail in the following sections.

The following scenarios were evaluated for the HRA. The underlying emission rates for each scenario are included in Form AQ405CAO:

Chronic (cancer risk and noncancer chronic HI based on modeled annual average concentrations):

- **Default Scenario:** Each of the 49 generators operate for 20 hours per year.
- **Alternative Scenario:** The generators will operate up to 530 hours per year *in aggregate*. This alternative scenario will allow for flexibility to conduct commissioning, maintenance, or testing runs that may exceed 20 hours per year for a single generator, if needed. This risk associated with this scenario will be evaluated as follows:
 - Using the results of the default scenario described above (i.e., all engines operating 20 hours per year), the applicant will identify the single "worst-case" engine that has the maximum annual average impact for any receptor.
 - Emissions from 530 hours of operation will be assumed to exhaust from the single "worst-case" engine. This is a simplistic and conservative approach that will slightly overestimate the maximum chronic risk for this scenario since it is based on a single "worst-case" engine.

Acute (acute risk based on modeled 24-hour maximum concentrations):

- **Default scenario:** Each of the 49 generators will operate for two hours per day.
- **Alternative scenario:** The generators will operate up to 90 hours per day *in aggregate*. Similar to the alternative scenario described above, this scenario will allow for flexibility to conduct occasional commissioning, maintenance, or testing runs that may exceed two hours per day for a single generator. This risk associated with this scenario will be evaluated as follows:
 - Using the results of the default scenario described above (i.e., all engines operating two hours per day), the applicant will identify the single "worst-case" engine that has the maximum 24-hour impact for any receptor.
 - Emissions from 90 hours of operation will be assumed to exhaust from the single "worst-case" engine.

Figure 5.1: Level 3 Refined Risk Assessment

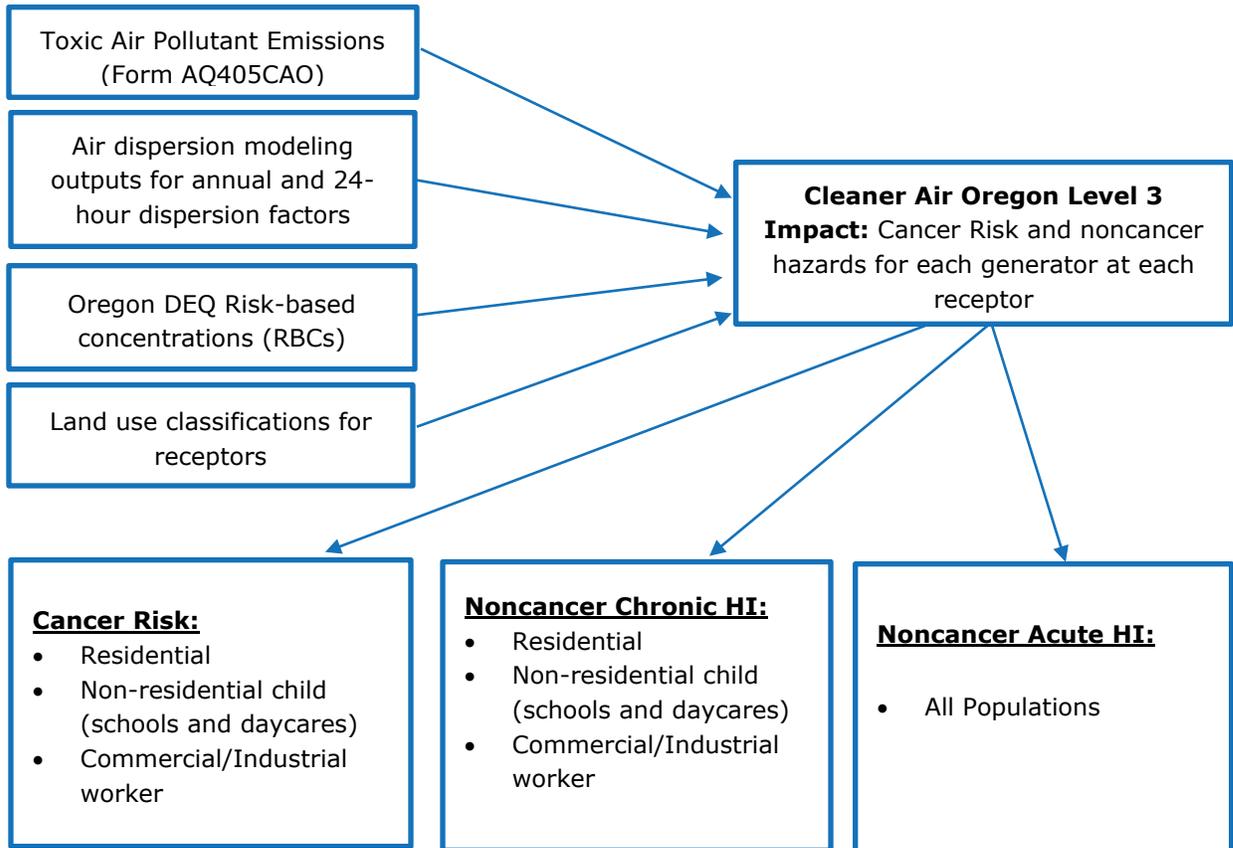
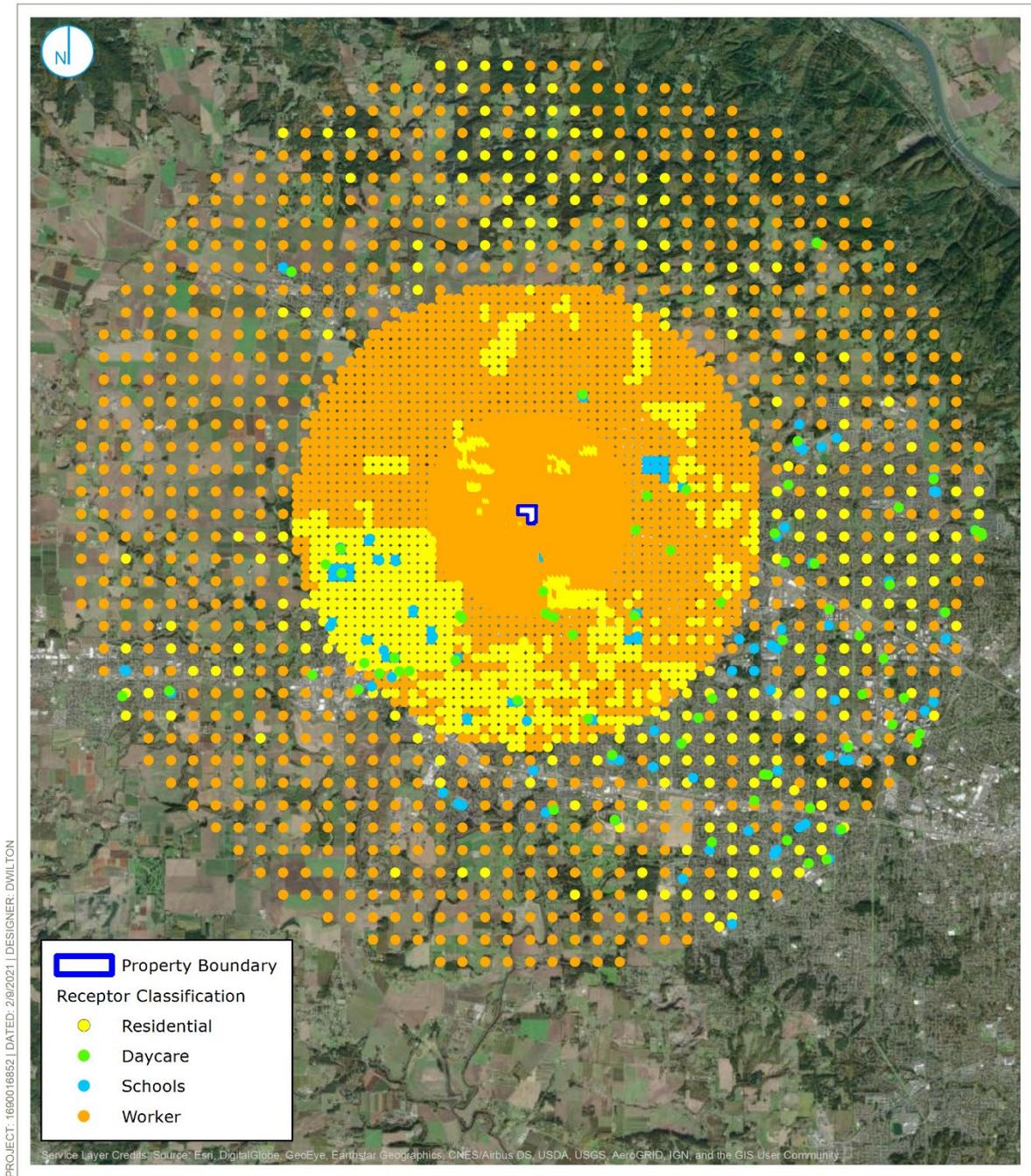


Figure 5.2: Receptor Classification



RECEPTOR LOCATIONS AND CLASSIFICATION

FIGURE 5.2

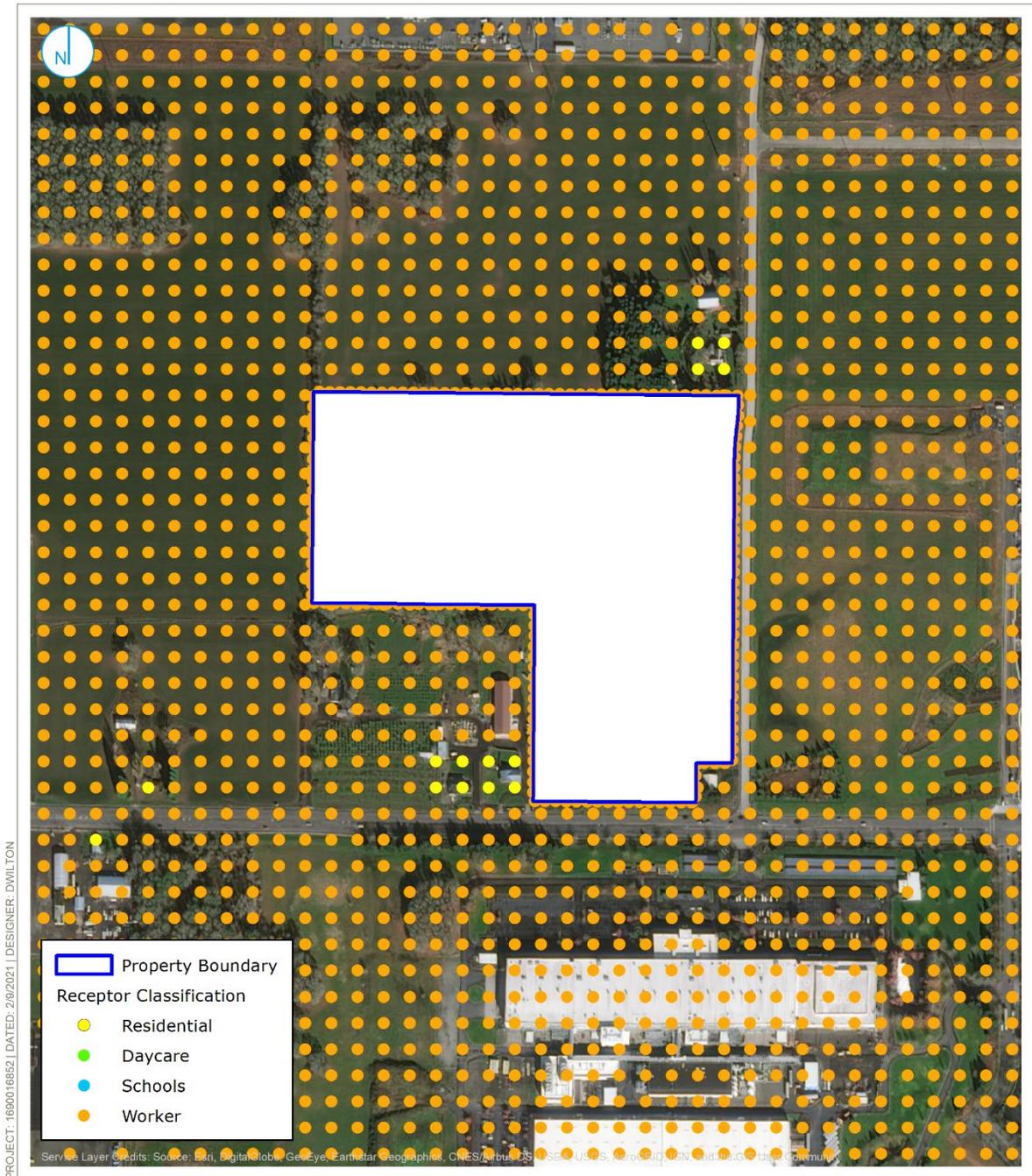
0 2,500 5,000 Meters

Stack
Hillsboro, OR

RAMBOLL US CORPORATION
A RAMBOLL COMPANY



Figure 5.3: Receptor Classification – Near Facility



NEAR FACILITY
RECEPTOR LOCATIONS
AND CLASSIFICATION

FIGURE 5.3

0 100 200 Meters

Stack
Hillsboro, OR

RAMBOLL US CORPORATION
A RAMBOLL COMPANY



5.1.1 Identification of COPCs

The toxic air pollutants emitted from the Facility are summarized in Form AQ405CAO and were included as the COPCs to be quantitatively evaluated in the HRA.

5.1.2 Exposure Assessment

To evaluate the human health risks posed by a site, it is necessary to identify the populations that may potentially be exposed to the chemicals present and to determine the pathways by which these exposures may occur.

The land use classifications were applied to receptors around the facility to define the exposure class for the chronic exposures (i.e. the cancer risk and chronic HI). The off-site receptor populations included in this evaluation are listed as below and shown in Figure 5.2 and Figure 5.3:

- Resident;
- Worker; and
- Child (Daycares and Schools)

Acute HI based on 24-hour exposures was evaluated at all modelled receptor locations regardless of receptor types.

The RBCs that underlie the proposed analysis account for both inhalation and non-inhalation pathways as applicable. As such, both inhalation and non-inhalation pathways (multi-pathways) were considered in the proposed HRA.

5.1.3 Toxicity Assessment

The toxicity assessment characterizes the relationship between the magnitude of exposure and the nature and magnitude of adverse health effects that may result from such exposure. For purposes of calculating exposure criteria to be used in risk assessments, adverse health effects are classified into two broad categories – cancer and noncancer endpoints. Toxicity values used to estimate the likelihood of adverse effects occurring in humans at different exposure levels are identified as part of the toxicity assessment component of a risk assessment.

The estimated excess lifetime cancer risks for all three receptor types were calculated using RBCs provided by ODEQ, shown in Table 5.1. The chronic RBCs used at a receptor were a function of the zoning and land use at that receptor and were based on whether zoning or land use is residential, worker, or child (schools/daycares). Additional discussion on receptor classification is provided in Section 4.5. ODEQ developed these RBCs using Toxicity Reference Values, and they adjusted them as needed. These adjustments are for 1) a scenario-specific consideration of exposure frequency and duration, 2) exposure routes other than inhalation alone, which is a multi-pathway adjustment, and 3) early-life exposure to toxic air contaminants. These adjustments are reflected in the chronic RBCs listed in Table 5.1.

5.1.4 Risk Characterization

The chronic risk values were grouped by exposure type (residential, non-residential child, and worker) from which the maximum risk was determined (see Table 5.1).

Estimation of Cancer Risks

Excess lifetime cancer risks are estimated to be the upper-bound incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens. They were estimated by comparing the estimated annual average air concentration at each receptor to the ODEQ chemical-specific cancer risk-based concentrations (RBCs). The target risk for the RBCs

was set at an excess cancer risk of one in one million. The equation that was used to calculate excess lifetime cancer risk at each receptor (in units of excess risk per one million) is as follows, where *Annual Concentration_{ij}* is the long-term (annual) concentration of toxic air contaminant *i* from emission source *j*:

$$\text{Cancer Risk} = \sum_{j=1}^{\text{TEU } m} \sum_{i=1}^{\text{chemical } n} \frac{\text{Annual Concentration}_{ij}}{\text{Cancer RBC}_i}$$

Estimation of Noncancer Chronic HQ/HI

The potential for exposure to result in chronic noncancer effects was evaluated by comparing the estimated annual average air concentration at each receptor to the ODEQ chemical-specific noncancer RBCs. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient (HQ). To evaluate the potential for adverse chronic noncancer health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals are summed, yielding a HI. The equation that was used to calculate chronic HI at each receptor is as follows:

$$\text{Chronic HI} = \sum_{j=1}^{\text{TEU } m} \sum_{i=1}^{\text{chemical } n} \frac{\text{Annual Concentration}_{ij}}{\text{Noncancer RBC}}$$

Estimation of Noncancer Acute HQ/HI

The potential for exposure to result in acute noncancer effects was evaluated by comparing the estimated 24-hour air concentration to the chemical-specific noncancer acute RBCs. When calculated for a single chemical, the comparison yields a HQ. To evaluate the potential for adverse acute noncancer health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals are summed, yielding an HI. The equation that was used to calculate the acute HI is as follows, where *24-hr Concentration_{ij}* is the short-term (24-hr) concentration of toxic air contaminant *i* from emission source *j*:

$$\text{Acute HI} = \sum_{j=1}^{\text{TEU } m} \sum_{i=1}^{\text{chemical } n} \frac{24\text{-Hour Concentration}_{ij}}{\text{Acute RBC}}$$

Noncancer acute hazards were evaluated for each target organ individually. Pollutant-specific target organs were identified using the target organ system summary tables in Appendix F of the 2020 ODEQ HRA Guidance.

The calculated excess lifetime cancer risk, noncancer chronic HI and acute HI were compared with the Risk Action Levels (RALs) as recommended by ODEQ (OAR 340-245-8010 Table 1) for new and reconstructed sources. The applicable RALs used for the HRA are summarized in Table 5.2.

Table 5.1: Risk-Based Concentrations

CAS #	Compound	Chronic Cancer RBC			Chronic Noncancer RBC			Acute RBC ($\mu\text{g}/\text{m}^3$)
		Residential ($\mu\text{g}/\text{m}^3$)	Child ($\mu\text{g}/\text{m}^3$)	Worker ($\mu\text{g}/\text{m}^3$)	Residential ($\mu\text{g}/\text{m}^3$)	Child ($\mu\text{g}/\text{m}^3$)	Worker ($\mu\text{g}/\text{m}^3$)	
75-07-0	Acetaldehyde	0.45	12	5.5	140	620	620	470
107-02-8	Acrolein	--	--	--	0.35	1.5	1.5	6.9
7664-41-7	Ammonia	--	--	--	500	2200	2200	1200
7440-38-2	Arsenic and compounds	2.40E-05	0.0013	0.00062	0.00017	0.0024	0.0024	0.2
71-43-2	Benzene	0.13	3.3	1.5	3	13	13	29
106-99-0	1,3-Butadiene	0.033	0.86	0.4	2	8.8	8.8	660
7440-43-9	Cadmium and compounds	0.00056	0.014	0.0067	0.005	0.037	0.037	0.03
18540-29-9	Chromium VI, chromate and dichromate particulate	0.000031	0.00052	0.001	0.083	0.88	0.88	0.3
7440-50-8	Copper and compounds	--	--	--	--	--	--	100
--	Diesel Particulate Matter	0.1	2.6	1.2	5	22	22	--
100-41-4	Ethyl benzene	0.4	10	4.8	260	1100	1100	22000
50-00-0	Formaldehyde	0.17	4.3	2	9	40	40	49
110-54-3	Hexane	--	--	--	700	3100	3100	--
7647-01-0	Hydrochloric acid	--	--	--	20	88	88	2100
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
91-20-3	Naphthalene	0.029	0.76	0.35	3.7	16	16	200
--	Nickel compounds, insoluble	0.0038	0.1	0.046	0.014	0.062	0.062	0.2
--	Polycyclic aromatic hydrocarbons (PAHs)	4.30E-05	0.0016	0.003	--	--	--	--
50-32-8	Benzo[a]pyrene	4.30E-05	0.0016	0.003	0.002	0.0088	0.0088	0.002
7782-49-2	Selenium and compounds	--	--	--	--	--	--	2
108-88-3	Toluene	--	--	--	5000	22000	22000	7500
1330-20-7	Xylene (mixture), including m-xylene, o-xylene, p-xylene	--	--	--	220	970	970	8700

Table 5.2: Risk Action Levels

Applicability	Risk Action Level	Excess Cancer Risk per Million	Noncancer HI
New and Reconstructed Source	Source Permit Level	0.5	0.5
	Community Engagement Level	5	1
	TLAER Level	10	1
	Permit Denial Level	25	1

5.2 Risk Assessment Results

Using the receptor categorization based on zoning and aerial imagery detailed in Section 4.2, the maximum risk for each population was compared against the RALs, as listed in the CAO Rules at OAR 340-245-8010 for a new or reconstructed source. The results are summarized in Table 5.3, with further detail included in Appendix A and Appendix B. The results demonstrate that the proposed Facility is below the TLAER RAL of 10 in a million for excess cancer risk and below the community engagement RAL of 1 for noncancer HI.

Table 5.3: Risk Summary

Population	Maximum Modeled Risk			Coordinates of Location with Maximum Modeled Risk	
	Excess Cancer Risk per Million	Chronic HI	Acute HI	UTMx	UTMy
Resident	9	0.1	--	504900	5044600
Worker	0.5	0.02	--	504738	5044576
Child	0.06	0.003	--	505100	5043550
All Populations	--	--	0.96	504728	5044577

5.3 Uncertainty Analysis

It is important to evaluate uncertainties so that the results of a risk assessment can be placed into the proper perspective. CAO rules require that a quantitative or qualitative uncertainty evaluation be included in a Level 3 and Level 4 risk assessment. Uncertainties are associated with the calculations and assumptions used in an HRA. The overall approach that was used in this HRA is expected to be conservative and provides an overestimate of potential exposure. Key uncertainties associated with the this HRA include:

- Estimation of exposure point concentrations:** Since discrepancies might exist between the actual emissions characteristics of a source and its representation in the model, exposure concentrations used in this assessment represent approximate exposure concentrations based on conservative emission rates and conservative operating scenarios. Additionally, the estimation of the acute (24-hour) concentrations using the maximum 24-hour dispersion factor across five years represents a worst-case scenario that is unlikely to occur during typical operating scenarios and meteorological conditions.
- Chemicals of potential concern selection:** For this HRA, the COPC list consists of emissions from the generators. The cancer risks for total PAHs were conservatively evaluated using the cancer RBC for benzo(a) pyrene which tends to overestimate the cancer risks associated with total PAHs.

- **Exposure assumptions:** The ODEQ residential RBCs assume continual exposure for 70 years. For workers and children, 8 hours per day and 250 days per year were assumed in the development of the RBCs. Accordingly, the actual risks to these populations are expected to be lower than those calculated in this assessment.
- **Toxicity values:** This HRA uses standard RBCs established by ODEQ, based on values developed by agencies such as the USEPA and the Agency for Toxic Substances and Disease Registry. These values are derived by applying health-protective assumptions that are intended to protect the most sensitive individuals in potentially exposed populations. To derive toxicity criteria that are health-protective, the agencies make several conservative assumptions that tend to result in toxicity criteria that lead to significant overestimates of the actual risk/hazard to human health.
- **Risk characterization:** An individual's risk not only depends on the individual's exposure to a specific chemical but also on his or her genetic background, health, diet, lifestyle choices and other environmental and workplace exposures. Although it is difficult to quantify the uncertainties associated with all the assumptions made in this risk assessment, the use of conservative assumptions is likely to result in substantial overestimates of exposure, and hence, risk. Additionally, for the chronic HI analysis, target organ systems were not evaluated separately; therefore, our results are estimated as if all evaluated chemicals target the same organ, which is again conservative.

6. REFERENCES

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Oregon Department of Environmental Quality. April 2020. *Recommended Procedures for Air Dispersion Modeling*. [https://www.oregon.gov/deq/aq/cao/Documents/CAORP-](https://www.oregon.gov/deq/aq/cao/Documents/CAORP-AirQualityModeling.pdf)

[AirQualityModeling.pdf](https://www.oregon.gov/deq/aq/cao/Documents/CAORP-AirQualityModeling.pdf)

APPENDIX A: RISK ASSESSMENT RESULTS

Risk Assessment Results
SI PORL2, LLC
34-0245

Default Scenario

Hours of operation (each generator)
 Per year: 20
 Per day: 2

CAS	Chemical Name	Annual Emission Rate (g/s/gen) ¹	Chronic Health Risk Results - Default Scenario																	
			Chronic Cancer									Chronic Noncancer								
			Residential			Non-Residential Child			Worker			Residential		Non-Residential Child		Worker				
Max Annual X/Q (ug/m ³)/(g/s)	Cancer RBC (ug/m ³) ²	Excess Lifetime Cancer Risk (in 1 million)	Max Annual X/Q (ug/m ³)/(g/s)	Cancer RBC (ug/m ³) ²	Excess Lifetime Cancer Risk (in 1 million)	Max Annual X/Q (ug/m ³)/(g/s)	Cancer RBC (ug/m ³) ²	Excess Lifetime Cancer Risk (in 1 million)	Max Annual X/Q (ug/m ³)/(g/s)	Noncancer RBC (ug/m ³) ²	Chronic HI	Max Annual X/Q (ug/m ³)/(g/s)	Noncancer RBC (ug/m ³) ²	Chronic HI	Max Annual X/Q (ug/m ³)/(g/s)	Noncancer RBC (ug/m ³) ²	Chronic HI			
75-07-0	Acetaldehyde	5.03E-05		0.45	1.56E-02		12	1.56E-04		5.5	2.50E-03		140	5.01E-05		620	3.01E-06		620	2.21E-05
107-02-8	Acrolein	2.18E-06		--	--		--	--		--	--		0.35	8.67E-04		1.5	5.39E-05		1.5	3.96E-04
7664-41-7	Ammonia	4.86E-05		--	--		--	--		--	--		900	1.35E-05		2200	8.19E-07		2200	6.02E-06
7440-38-2	Arsenic and compounds	9.71E-08		2.40E-05	5.64E-01		0.0013	2.77E-03		0.00062	4.27E-02		0.00017	7.96E-02		0.0024	1.50E-03		0.0024	1.10E-02
71-43-2	Benzene	1.20E-05		0.13	1.28E-02		3.3	1.35E-04		1.5	2.18E-03		3	5.56E-04		13	3.42E-05		13	2.51E-04
106-99-0	1,3-Butadiene	1.40E-05		0.033	5.90E-02		0.86	6.03E-04		0.4	9.52E-03		2	9.73E-04		8.8	5.89E-05		8.8	4.33E-04
7440-43-9	Cadmium and compounds	9.10E-08		0.00056	2.27E-02		0.014	2.41E-04		0.0067	3.71E-03		0.005	2.54E-03		0.037	9.13E-05		0.037	6.71E-04
1854-02-99	Chromium VI	6.07E-09		0.000031	2.73E-02		0.00052	4.33E-04		0.001	1.66E-03		0.083	1.02E-05		0.88	2.56E-07		0.88	1.88E-06
7440-50-8	Copper and compounds	2.49E-07		0.1	5.09E-01		2.6	5.21E-03		1.2	8.30E-02		5	1.02E-02		22	6.16E-04		22	4.53E-03
7440-50-8	Diesel exhaust particulates (PM 2.5)	3.65E-04		0.4	2.44E-04		10	2.60E-06		4.8	3.98E-05		260	3.75E-07		1100	2.36E-08		1100	1.74E-07
100-41-4	Ethyl benzene	7.00E-07		0.17	9.13E-02		4.3	9.61E-04		2	1.52E-02		9	1.73E-03		40	1.03E-04		40	7.60E-04
50-00-0	Formaldehyde	1.11E-04	139.4	--	--	37.1	--	--	272.7	--	--	139.4	700	3.44E-07	37.1	3100	2.07E-08	272.7	3100	1.52E-07
110-54-3	Hexane	1.73E-06		--	--		--	--		--	--		20	8.34E-05		88	5.05E-06		88	3.71E-05
7647-01-0	Hydrochloric acid	1.20E-05		--	--		--	--		--	--		0.15	4.68E-04		0.66	2.83E-05		0.66	2.08E-04
7439-92-1	Lead and compounds	5.04E-07		--	--		--	--		--	--		0.09	2.91E-04		0.4	1.75E-05		0.4	1.28E-04
7439-96-5	Manganese and compounds	1.89E-07		--	--		--	--		--	--		0.077	2.20E-04		0.63	7.15E-06		0.63	5.26E-05
7439-97-6	Mercury and compounds	1.21E-07		--	--		--	--		--	--		3.7	4.77E-05		16	2.94E-06		16	2.16E-05
91-20-3	Naphthalene	1.27E-06		0.029	6.08E-03		0.76	6.18E-05		0.35	9.86E-04		0.014	2.36E-03		0.062	1.42E-04		0.062	1.04E-03
7440-02-0	Nickel and compounds	2.37E-07		0.0038	8.68E-03		0.1	8.78E-05		0.046	1.40E-03		0.002	1.59E-04		0.0088	9.61E-06		0.0088	7.06E-05
--	PAHs (excluding Naphthalene)	2.33E-06		4.30E-05	7.54E+00		0.0016	5.39E-02		0.003	2.11E-01		--	--		--	--		--	--
50-32-8	Benzo[a]pyrene	2.28E-09		--	--		--	--		--	--		5000	1.89E-07		22000	1.14E-08		22000	8.39E-08
7782-49-2	Selenium and compounds	1.34E-07		--	--		--	--		--	--		220	1.73E-06		970	1.04E-07		970	7.66E-07
108-88-3	Toluene	6.77E-06		--	--		--	--		--	--		--	--		--	--		--	--
1330-20-7	Xylenes	2.72E-06		--	--		--	--		--	--		--	--		--	--		--	--
Total Risk:				9		0.1		0.4		0.4		1E-01		3E-03		2E-02		>1		>1
Community Engagement Threshold:				>5		>5		>5		>5		>1		>1		>1		>1		>1
TLAER Threshold:				>10		>10		>10		>10		>1		>1		>1		>1		>1

CAS	Chemical Name	24-hr Emission Rate (g/s/gen) ¹	Max 24-hr X/Q (ug/m ³)/(g/s)	RBC (ug/m ³) ²	Acute HI Results - Default Scenario																
					Acute HI by Target Organ ³																
					Kidney	Liver	Blood	Endo	Musc	Eyes	Skin	Nerv	Cardio	Immuno	Resp	Gastro	Develop	Repro			
75-07-0	Acetaldehyde	1.84E-03		470	--	--	--	--	--	8.74E-03	--	--	--	--	8.74E-03	--	--	--	--	--	--
107-02-8	Acrolein	7.95E-05		6.9	--	--	--	--	--	--	--	--	--	--	2.58E-02	--	--	--	--	--	--
7664-41-7	Ammonia	1.77E-03		1200	--	--	--	--	--	3.30E-03	--	--	--	--	3.30E-03	--	--	--	--	--	--
7440-38-2	Arsenic and compounds	3.54E-06		0.2	--	--	--	--	--	--	--	--	--	--	--	--	3.96E-02	--	--	--	--
71-43-2	Benzene	4.37E-04		29	--	--	--	--	--	--	--	--	--	3.37E-02	--	--	--	--	--	--	--
106-99-0	1,3-Butadiene	5.10E-04		660	--	--	--	--	--	--	--	--	--	--	--	--	1.73E-03	--	--	--	--
7440-43-9	Cadmium and compounds	3.32E-06		0.03	--	--	--	--	--	--	--	--	--	--	2.48E-01	--	--	--	--	--	--
1854-02-99	Chromium VI	2.22E-07		0.3	--	--	--	--	--	--	--	--	--	--	1.65E-03	--	--	--	--	--	--
7440-50-8	Copper and compounds	9.08E-06		100	--	--	--	--	--	--	--	--	--	--	2.03E-04	--	--	--	--	--	--
7440-50-8	Diesel exhaust particulates (PM 2.5)	1.33E-02		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
100-41-4	Ethyl benzene	2.56E-05		22000	--	--	--	--	--	--	2.60E-06	--	--	--	--	--	--	--	--	--	--
50-00-0	Formaldehyde	4.07E-03	2235.8	49	--	--	--	--	--	--	--	--	--	--	1.86E-01	--	--	--	--	--	--
110-54-3	Hexane	6.31E-05		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
7647-01-0	Hydrochloric acid	4.37E-04		2100	--	--	--	--	--	--	--	--	--	--	4.65E-04	--	--	--	--	--	--
7439-92-1	Lead and compounds	1.84E-05		0.15	--	--	--	--	--	--	--	--	--	--	--	--	2.74E-01	--	--	--	--
7439-96-5	Manganese and compounds	6.87E-06		0.3	--	--	--	--	--	--	5.12E-02	--	--	--	--	--	--	--	--	--	--
7439-97-6	Mercury and compounds	4.43E-06		0.6	--	--	--	--	--	--	1.65E-02	--	--	--	--	--	1.65E-02	--	--	--	--
91-20-3	Naphthalene	4.62E-05		200	--	--	--	--	--	--	--	--	--	--	5.16E-04	--	--	--	--	--	--
7440-02-0	Nickel and compounds	8.64E-06		0.2	--	--	--	--	--	--	--	--	--	9.66E-02	--	--	--	--	--	--	--
--	PAHs (excluding Naphthalene)	8.49E-05		--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
50-32-8	Benzo[a]pyrene	8.32E-08		0.002	--	--	--	--	--	--	--	--	--	--	--	--	9.30E-02	9.30E-02	--	--	--
7782-49-2	Selenium and compounds	4.87E-06		2	--	--	--	--	--	5.45E-03	5.45E-03	5.45E-03	--	--	5.45E-03	--	--	--	--	--	--
108-88-3	Toluene	2.47E-04		7500	--	--	--	--	--	--	7.37E-05	--	--	--	--	--	--	--	--	--	--
1330-20-7	Xylenes	9.94E-05		8700	--	--	--	--	--	--	2.55E-05	--	--	--	2.55E-05	--	--	--	--	--	--
Total Risk:										0.02	0.01	0.07		0.1	0.5		0.4		0.1		
Community Engagement Threshold:				>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1
TLAER Threshold:				>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1

Notes

¹Emissions rates are from Form AQ405CAO
²Risk-Based Concentrations (RBCs) are from OAR 340-245-8010, Table 1, <https://www.oregon.gov/deq/Rulemaking%20Docs/CAOdiv245Tables.pdf>
³Affected target organs are consistent with Recommended Procedures for Toxic Air Contaminant Health Risk Assessments, Appendix F Table F-2, https://www.oregon.gov/deq/aa/cao/Documents/CAO_HRAProcedures.pdf

Alternative Scenario

Pooled hours of operation (all generators combined)
 Per year: 530
 Per day: 90

Chronic Health Risk Results - Alternative Scenario																				
CAS	Chemical Name	Annual Emission Rate (g/s/gen) ¹	Chronic Cancer						Chronic Noncancer											
			Residential			Non-Residential Child			Worker			Residential			Non-Residential Child			Worker		
			Max Annual X/Q (ug/m ³)/(g/s)	Cancer RBC (ug/m ³) ²	Excess Lifetime Cancer Risk (in 1 million)	Max Annual X/Q (ug/m ³)/(g/s)	Cancer RBC (ug/m ³) ²	Excess Lifetime Cancer Risk (in 1 million)	Max Annual X/Q (ug/m ³)/(g/s)	Cancer RBC (ug/m ³) ²	Excess Lifetime Cancer Risk (in 1 million)	Max Annual X/Q (ug/m ³)/(g/s)	Noncancer RBC (ug/m ³) ²	Chronic HI	Max Annual X/Q (ug/m ³)/(g/s)	Noncancer RBC (ug/m ³) ²	Chronic HI	Max Annual X/Q (ug/m ³)/(g/s)	Noncancer RBC (ug/m ³) ²	Chronic HI
75-07-0	Acetaldehyde	1.33E-03	0.45	1.59E-02	12	1.34E-04	5.5	3.14E-03	140	5.10E-05	620	2.59E-06	620	2.78E-05	620	2.78E-05	620	2.78E-05		
107-02-8	Acrolein	5.77E-05	--	--	--	--	--	--	0.35	8.82E-04	1.5	4.63E-05	1.5	4.98E-04	1.5	4.98E-04	1.5	4.98E-04		
7664-41-7	Ammonia	1.29E-03	--	--	--	--	--	--	500	1.38E-05	2200	7.04E-07	2200	7.56E-06	2200	7.56E-06	2200	7.56E-06		
7440-38-2	Arsenic and compounds	2.57E-06	2.40E-05	5.74E-01	0.0013	2.38E-03	0.00062	5.37E-02	0.00017	8.10E-02	0.0024	1.29E-03	0.0024	1.39E-02	0.0024	1.39E-02	0.0024	1.39E-02		
71-43-2	Benzene	3.17E-04	0.13	1.31E-02	3.3	1.16E-04	1.5	2.73E-03	3	5.66E-04	13	2.94E-05	13	3.15E-04	13	3.15E-04	13	3.15E-04		
106-99-0	1,3-Butadiene	3.70E-04	0.033	6.00E-02	0.86	5.18E-04	0.4	1.20E-02	2	9.90E-04	8.8	5.06E-05	8.8	5.44E-04	8.8	5.44E-04	8.8	5.44E-04		
7440-43-9	Cadmium and compounds	2.41E-06	0.00056	2.30E-02	0.014	2.07E-04	0.0067	4.66E-03	0.005	2.58E-03	0.037	7.85E-05	0.037	8.43E-04	0.037	8.43E-04	0.037	8.43E-04		
1854-02-99	Chromium VI	1.61E-07	0.000031	2.78E-02	0.00052	3.72E-04	0.001	2.08E-03	0.083	1.04E-05	0.88	2.20E-07	0.88	2.36E-06	0.88	2.36E-06	0.88	2.36E-06		
7440-50-8	Copper and compounds	6.59E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
--	Diesel exhaust particulates (PM 2.5)	9.68E-03	0.1	5.18E-01	2.6	4.48E-03	1.2	1.04E-01	5	1.04E-02	22	5.30E-04	22	5.69E-03	22	5.69E-03	22	5.69E-03		
100-41-4	Ethyl benzene	1.85E-05	0.4	2.48E-04	10	2.23E-06	4.8	5.00E-05	260	3.82E-07	1100	2.03E-08	1100	2.18E-07	1100	2.18E-07	1100	2.18E-07		
50-00-0	Formaldehyde	2.95E-03	0.17	9.29E-02	4.3	8.26E-04	2	1.91E-02	9	1.75E-03	40	8.88E-05	40	9.54E-04	40	9.54E-04	40	9.54E-04		
110-54-3	Hexane	4.58E-05	--	--	--	--	--	--	700	3.50E-07	3100	1.78E-08	3100	1.91E-07	3100	1.91E-07	3100	1.91E-07		
7647-01-0	Hydrochloric acid	3.17E-04	--	--	--	--	--	--	20	8.48E-05	88	4.34E-06	88	4.66E-05	88	4.66E-05	88	4.66E-05		
7439-92-1	Lead and compounds	1.34E-05	--	--	--	--	--	--	0.15	4.76E-04	0.66	2.43E-05	0.66	2.62E-04	0.66	2.62E-04	0.66	2.62E-04		
7439-96-5	Manganese and compounds	4.99E-06	--	--	--	--	--	--	0.09	2.96E-04	0.4	1.50E-05	0.4	1.61E-04	0.4	1.61E-04	0.4	1.61E-04		
7439-97-6	Mercury and compounds	3.22E-06	--	--	--	--	--	--	0.077	2.23E-04	0.63	6.14E-06	0.63	6.60E-05	0.63	6.60E-05	0.63	6.60E-05		
91-20-3	Naphthalene	3.35E-03	0.029	6.19E-03	0.76	5.31E-05	0.35	1.24E-03	3.7	4.85E-05	16	2.52E-06	16	2.71E-05	16	2.71E-05	16	2.71E-05		
7440-02-0	Nickel and compounds	6.27E-06	0.0038	8.83E-03	0.1	7.55E-05	0.046	1.76E-03	0.014	2.40E-03	0.062	1.22E-04	0.062	1.31E-03	0.062	1.31E-03	0.062	1.31E-03		
--	PAHs (excluding Naphthalene)	6.16E-05	4.30E-05	7.67E+00	0.0016	4.63E-02	0.003	2.66E-01	--	--	--	--	--	--	--	--	--	--		
50-32-8	Benzo[a]pyrene	6.04E-08	--	--	--	--	--	--	0.002	1.61E-04	0.0088	8.26E-06	0.0088	8.87E-05	0.0088	8.87E-05	0.0088	8.87E-05		
7782-49-2	Selenium and compounds	3.54E-06	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--		
108-88-3	Toluene	1.79E-04	--	--	--	--	--	--	5000	1.92E-07	22000	9.81E-09	22000	1.05E-07	22000	1.05E-07	22000	1.05E-07		
1330-20-7	Xylenes	7.22E-05	--	--	--	--	--	--	220	1.76E-06	970	8.95E-08	970	9.62E-07	970	9.62E-07	970	9.62E-07		
Total Risk:			9	6E-02	>5	>5	>5	>5	0.5	0.1	2E-03	2E-03	2E-03	2E-03	2E-02	2E-02	2E-02	2E-02		
Community Engagement Threshold:			>5	>5	>5	>5	>5	>5	>5	>1	>1	>1	>1	>1	>1	>1	>1	>1		
TLAER Threshold:			>10	>10	>10	>10	>10	>10	>10	>1	>1	>1	>1	>1	>1	>1	>1	>1		

Acute HI Results - Alternative Scenario																		
CAS	Chemical Name	24-hr Emission Rate (g/s/gen) ¹	Max 24-hr X/Q (ug/m ³)/(g/s)	RBC (ug/m ³) ²	Acute HI by Target Organ ³													
					Kidney	Liver	Blood	Endo	Musc	Eyes	Skin	Nerv	Cardio	Immuno	Resp	Gastro	Develop	Repro
75-07-0	Acetaldehyde	8.26E-02	470	--	--	--	--	--	--	1.75E-02	--	--	--	--	1.75E-02	--	--	--
107-02-8	Acrolein	3.58E-03	6.9	--	--	--	--	--	--	--	--	--	--	5.17E-02	--	--	--	--
7664-41-7	Ammonia	7.98E-02	1200	--	--	--	--	--	--	6.63E-03	--	--	--	6.63E-03	--	--	--	--
7440-38-2	Arsenic and compounds	1.60E-04	0.2	--	--	--	--	--	--	--	--	--	--	--	7.96E-02	--	--	--
71-43-2	Benzene	1.97E-02	29	--	--	--	--	--	--	--	--	--	6.76E-02	--	--	--	--	--
106-99-0	1,3-Butadiene	2.29E-02	660	--	--	--	--	--	--	--	--	--	--	--	3.47E-03	--	--	--
7440-43-9	Cadmium and compounds	1.50E-04	0.03	--	--	--	--	--	--	--	--	--	--	4.97E-01	--	--	--	--
1854-02-99	Chromium VI	9.97E-06	0.3	--	--	--	--	--	--	--	--	--	--	3.32E-03	--	--	--	--
7440-50-8	Copper and compounds	4.09E-04	100	--	--	--	--	--	--	--	--	--	--	4.08E-04	--	--	--	--
--	Diesel exhaust particulates (PM 2.5)	6.00E-01	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
100-41-4	Ethyl benzene	1.15E-03	22000	--	--	--	--	--	--	5.22E-06	--	--	--	--	--	--	--	--
50-00-0	Formaldehyde	1.83E-01	49	--	--	--	--	--	--	--	--	--	3.73E-01	--	--	--	--	--
110-54-3	Hexane	2.64E-03	2100	--	--	--	--	--	--	--	--	--	9.34E-04	--	--	--	--	--
7647-01-0	Hydrochloric acid	1.97E-02	0.15	--	--	--	--	--	--	--	--	--	--	5.50E-01	--	--	--	--
7439-92-1	Lead and compounds	8.27E-04	0.3	--	--	--	--	--	--	--	--	--	--	--	3.32E-02	--	--	--
7439-96-5	Manganese and compounds	3.09E-04	0.6	--	--	--	--	--	--	1.03E-01	--	--	--	--	--	--	--	--
7439-97-6	Mercury and compounds	1.99E-04	200	--	--	--	--	--	--	3.32E-02	--	--	--	--	1.04E-03	--	--	--
91-20-3	Naphthalene	2.08E-03	0.2	--	--	--	--	--	--	--	--	--	1.94E-01	--	--	--	--	--
7440-02-0	Nickel and compounds	3.89E-04	0.2	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
--	PAHs (excluding Naphthalene)	3.82E-03	0.002	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
50-32-8	Benzo[a]pyrene	3.74E-06	2	--	--	--	--	--	--	1.09E-02	1.09E-02	1.09E-02	--	1.09E-02	--	--	1.87E-01	1.87E-01
7782-49-2	Selenium and compounds	2.19E-04	7500	--	--	--	--	--	--	1.48E-04	--	--	--	--	--	--	--	--
108-88-3	Toluene	1.11E-02	8700	--	--	--	--	--	--	5.13E-05	--	--	--	5.13E-05	--	--	--	--
1330-20-7	Xylenes	4.47E-03	8700	--	--	--	--	--	0.04	0.01	0.1	0.3	0.96	0.85	0.2	0.2	0.2	
Community Engagement Threshold:			>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1
TLAER Threshold:			>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1	>1

Notes

¹Emissions rates are from Form AQ405CAO

²Risk-Based Concentrations (RBCs) are from OAR 340-245-8010, Table 1, <https://www.oregon.gov/deq/Rulemaking%20Docs/CAODiv245Tables.pdf>

³Affected target organs are consistent with Recommended Procedures for Toxic Air Contaminant Health Risk Assessments, Appendix F Table F-2, https://www.oregon.gov/deq/qaq/cao/Documents/CAO_HRAProcedures.pdf

APPENDIX B: ELECTRONIC FILES