PROJECT REPORT

Sabey Data Center Properties > Quincy, WA

SABEY
Data Centers

Health Impact Assessment Report

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1. INTRODUCTION

Sabey Data Center Properties (Sabey) is proposing to construct two new data center buildings at Intergate Quincy (IGQ) data center campus in Quincy, Washington. The IGQ campus currently consists of three buildings (Building A, Building B [under construction], and Building C) operated by Sabey with multiple tenants.

As part of the IGQ project, two new data center buildings (Building D and Building E) will be constructed, with a total of 30 diesel-fired main generator sets (gensets) of up to 2,500 kW each. The main gensets will be used to provide standby electrical power to the data center during periods of interrupted power supply. There will also be 1 – 300 kW support genset per building for emergency lighting in the event of a complete power outage. In addition, each data center main genset will have a 2,000-gallon diesel belly tank, and there will be a total of 20 – 15,000-gallon stand-alone fuel storage tanks for the two buildings. Lastly, Sabey will install a total of 120 indirect evaporative cooling (IDEC) units for the new data center buildings.

In addition to the new proposed buildings, Sabey has submitted as-built information for existing buildings A, B, and C permitted under Approval Order 16AQ-E011[1]. Overall, Sabey is reducing the number of permitted gensets from Buildings A, B, and C from 44 to 37.

Sabey submitted a Notice of Construction (NOC) permit application for the project to the Washington Department of Ecology – Eastern Region (Ecology) on February 12, 2020. A revised NOC application was submitted to Ecology on March 27, 2020. The NOC application showed project emissions over the significant quantity emission rates (SQERs) for seven toxic air pollutants (TAPs): diesel engine exhaust particulate matter (DPM), nitrogen dioxide (NO_2), acrolein, carbon monoxide (CO), sulfur dioxide (SO_2), naphthalene, and benzene.

Air dispersion modeling presented in the NOC application showed compliance with the acceptable source impact level (ASIL) for acrolein, CO, SO_2, naphthalene, and benzene. However, the first tier review included in the NOC application showed modeled concentrations over the ASIL for DPM and NO_2. Therefore, a second tier review is being conducted to demonstrate that DPM and NO_2 emissions from the project do not have significant health impacts on the community. A health impact assessment (HIA) protocol for the second tier review was submitted to Ecology on March 2, 2020 and comments with general approval were received on March 12, 2020. The second tier review petition form required by Ecology was included in Appendix A of the HIA protocol, and the original signed form and $10,000 fee were submitted directly to Ecology's Cashiering Office. This report serves as the HIA report for the second tier review.

The HIA report includes the following elements:

- Section 2. Emission Estimates
- Section 3. Modeling Methodology
- Section 4. First Tier Modeling Results
- Section 5. Identification of Exposed Populations
- Section 6. Hazard Identification
- Section 7. Toxicity and Risk Assessment
- Section 8: Uncertainty Characterization
- Appendix A: Zoning Map
- Appendix B: Second Tier Modeling Files

[1] A construction extension was granted by Ecology on September 7, 2018 to allow installation of the remaining gensets through July 1, 2020.

2. EMISSION ESTIMATES

The Washington Department of Ecology (Ecology) regulates the emissions of TAPs from stationary sources through the provisions of Washington Administrative Code (WAC) 173-460. Regulated TAPs are listed in WAC 173-460-150, which also establishes a SQER and ASIL for each pollutant. These SQERs and ASILs represent project-based screening thresholds that are used to demonstrate compliance with Washington's TAPs program under the first tier review strategy established by WAC 173-460-080.

2.1. METHODOLOGY

Pursuant to WAC 173-460, Sabey estimated TAP emissions from the IGQ facility and, where necessary, assessed the ambient impacts of these emissions. Each generator will fire No. 2 ultra-low sulfur diesel fuel (ULSD) and will be used to provide standby electrical power to the data center during periods of interrupted power supply.

To estimate the maximum emissions of TAP that are classified as criteria pollutants (i.e., NO_2, CO, and SO_2) from the engines, vendor supplied emission data are reviewed. According to the specifications, all vendors confirm that the engines are Tier 2 certified[2] standby engines. The following information is provided by the vendors:

- Caterpillar provides the genset power at various loads (10%, 25%, 50%, 75%, and 100%), corresponding engine power, fuel consumption rate, and emission data in gram per horsepower-hr (g/hp-hr) and pound per hour (lb/hr) for PM, NO_X, CO, and hydrocarbons. A single Caterpillar model is assessed, CAT 3516C - 2500 kW.
- Cummins provides the genset power at various loads (10%, 25%, 50%, 75%, and 100%), corresponding engine power, fuel consumption rate, and guaranteed emission levels accounting for site variations in g/hp-hr for PM, NO_X, CO and hydrocarbons. Two Cummins models are assessed, DQKAF - 2250 kW and DQKAN - 2500 kW.
- Kohler provides the genset power at various loads (10%, 25%, 50%, 75%, and 100%), corresponding engine power, fuel consumption rate, and guaranteed emission levels accounting for site variations in g/kWh for PM, NO_X, CO and hydrocarbons. Two Kohler models are assessed, KD2250 – 2250 kW and KD2500 – 2500 kW.

An hourly emission rate is calculated based on the provided g/hp-hr or g/kWh emission data for each vendor, except for Caterpillar, which provides lb/hr data. For each genset, the maximum hourly emissions are calculated based on the following conservative approaches:

- Maximum performance data across all loads and vendors is used to determine the hourly emission rate for NO_X, CO, and PM.
- Maximum hydrocarbons (HC) performance data across all loads and vendors is used to determine the hourly emission rate for VOC. The HC emission rates are also conservatively assumed to estimate condensable particulate matter (CPM) emissions.
- PM_{10} and $PM_{2.5}$ emissions are the sum of filterable PM and CPM emissions determined above.
- An upper limit of 15 ppm sulfur content, per 40 CFR 80.510(b), is used to determine SO_2 emissions. Emission factors from Table 3.4-1, AP-42 and Table 3.3-1, AP-42 are used to calculate emissions of SO_2 from the main gensets and support gensets, respectively. The maximum engine power at 100% load is used.

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[2] Tier 2 certified engines to meet the emission standards set forth under 40 CFR Part 60, Subpart IIII.

- Cold-start emissions occurring during the first minute of engine start-up are calculated for VOC, NO_X, CO, and PM based on data from California Energy Commission (CEC) "Air Quality Implications of Backup Generators in California". Maximum emission rate calculations conservatively assume 28 cold-start periods per year. Each cold start assumes the first minute of operation is impacted by the cold-start and the remaining 59 minutes in an hour is normal emission rates Detailed cold-start emission calculations are provided in in the NOC application.

For other TAP emitted by the gensets, emission factors in the unit of pound per million British thermal unit (lb/MMBtu) are obtained from Tables 3.4-3 and 3.4-4, AP-42. The maximum hourly fuel consumption rate across all loads and vendors and the default diesel heat content of 0.137 MMBtu per gallon diesel fuel are used to determine the emission rates for each TAP.

To calculate daily and annual emissions, a maximum of 24 hours per day and 55 operating hours per year, respectively, per engine is used as a worst-case operating scenario.

2.2. SUMMARY

Table 2-1 presents the results of these potential emission calculations for each TAP and identifies the corresponding emission factor used in this evaluation. The resulting emission rates are compared to the SQER for each respective pollutant. As shown in Table 2-1, only DPM, NO_2, acrolein, CO, SO_2, naphthalene, and benzene exceed their respective SQERs. As such, modeling was conducted to compare ambient impacts of these pollutants to their corresponding ASILs. Specifically, a first tier AERMOD modeling analysis was conducted for DPM, NO_2, acrolein, CO, SO_2, naphthalene and benzene to determine ambient impacts from the facility. As described in the NOC application, the results of this first tier review demonstrated compliance with the ASIL for acrolein, CO, SO_2, naphthalene, and benzene, but showed exceedances of the ASIL for DPM and NO_2.

Based on the results of the first tier review, a second tier review is required for DPM and NO_2. In addition to the IGQ facility's emissions, this second tier review also considers a representative background concentration. Section 3 of this report contains information regarding the modeling methodology that is used for this second tier review. Section 4 contains the model results from the first tier review.

Table 2-1. TAP Emission Summary

Pollutant	CAS Number	Emission Factor (lb/MMBtu)		Averaging Period	De Minimis	SQER	Project Emissions	Modeling Required?
		Main Gensets	Support Gensets		(lb/averaging period)			
Acetaldehyde	75-07-0	2.52E-05	7.67E-04	year	3.00E+00	6.00E+01	1.25E+00	De Minimis
Acrolein	107-02-8	7.88E-06	9.25E-05	24-hr	1.30E-03	2.60E-02	1.49E-01	Yes
Benzene	71-43-2	7.76E-04	9.33E-04	year	1.00E+00	2.10E+01	3.08E+01	Yes
Benzo(a)anthracene	56-55-3	6.22E-07	1.68E-06	year	4.50E-02	8.90E-01	2.50E-02	De Minimis
Benzo(a)pyrene	50-32-8	2.57E-07	1.88E-07	year	8.20E-03	1.60E-01	1.01E-02	No
Benzo(b)fluoranthene	205-99-2	1.11E-06	9.91E-08	year	4.50E-02	8.90E-01	4.36E-02	De Minimis
Benzo(k)fluoranthene	207-08-9	2.18E-07	1.55E-07	year	4.50E-02	8.90E-01	8.60E-03	De Minimis
1,3-Butadiene	106-99-0	--	3.91E-05	year	2.70E-01	5.40E+00	1.36E-02	De Minimis
Chrysene	218-01-9	1.53E-06	3.53E-07	year	4.50E-01	8.90E+00	6.01E-02	De Minimis
Dibenz(a,h)anthracene	53-70-3	3.46E-07	5.83E-07	year	4.10E-03	8.20E-02	1.38E-02	No
Formaldehyde	50-00-0	7.89E-05	1.18E-03	year	1.40E+00	2.70E+01	3.50E+00	No
Indeno(1,2,3-cd)pyrene	193-39-5	4.14E-07	3.75E-07	year	4.50E-02	8.90E-01	1.64E-02	De Minimis
Naphthalene	91-20-3	1.30E-04	8.48E-05	year	2.40E-01	4.80E+00	5.13E+00	Yes
Propylene	115-07-1	2.79E-04	2.58E-03	24-hr	1.10E+01	2.20E+02	5.17E+00	De Minimis
Toluene	108-88-3	2.81E-04	4.09E-04	24-hr	1.90E+01	3.70E+02	4.87E+00	De Minimis
Xylenes	1330-20-7	1.93E-04	2.85E-04	year	8.20E-01	1.60E+01	7.67E+00	No
Diesel Engine Exhaust, Particulate	--	N/A [a]	N/A [a]	year	2.70E-02	5.40E-01	3.42E+03	Yes
SO_2	7446-09-05	N/A [a]	N/A [a]	1-hr	4.60E-01	1.20E+00	3.29E+00	Yes
CO	630-08-0	N/A [a]	N/A [a]	1-hr	1.10E+00	4.30E+01	5.39E+02	Yes
NO_2	10102-44-0	N/A [a]	N/A [a]	1-hr	4.60E-01	8.70E-01	2.01E+02	Yes

[a] Pollutant emission rates are detailed in the revised NOC application submitted on March 27, 2020.

This section describes the modeling methodology that is used for the second tier TAP analysis. The methodologies used in this analysis follows Ecology's TAP modeling guidance.[3]

3.1. DISPERSION MODELING SYSTEM

The American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC) modeling system, the most recent AERMOD dispersion model version 19191 with Plume Rise Model Enhancements (PRIME) advanced downwash algorithms, is used as the dispersion model in the air quality analysis.

3.2. METEOROLOGICAL DATA

Five years of surface meteorological data are taken from the nearest airport, Grant County International Airport (Station ID: KMWH; WBAN ID: 24110) using 1-min ASOS data. The data from the five most recent years (2014 through 2018) is used. The meteorological data is processed using AERMET version 18081. The 1-min wind data was processed using the latest version of AERMINUTE pre-processing tool (version 15272). Quality of the 1-minute data was verified by comparison to the hourly ISHD data from KMWH, which showed only small differences typical of 1-minute and hourly wind data comparisons. The "Ice-Free Winds Group" AERMINUTE option was selected due to the fact that a sonic anemometer was used at KMWH for the entire 2014-2018 period. Additionally, the 1-min wind speed threshold of 0.5 meter per second (m/s) is applied for the 1-min ASOS data according to EPA guidance.[4]

Trinity also reviewed the percentage of calm and missing data for the modeled period. Before applying the 0.5 m/s threshold for the 1-min ASOS data, the total percentage of calm wind data is 0.48%. The AERMOD-ready data shows 0.50% of calm wind data and 0.80% of missing data.

The upper air data is taken from the nearest upper air station in Spokane, Washington (OTX) for the corresponding period. All data is processed using regulatory default options.

3.3. COORDINATE SYSTEM

The location of the emission sources, structures, and receptors for this modeling analysis are represented in the Universal Transverse Mercator (UTM) coordinate system using the North American 1983, CONUS (NAD83) projection. The UTM grid divides the world into coordinates that are measured in north meters (measured from the equator) and east meters (measured from the central meridian of a particular zone, which is set at 500 km). UTM coordinates for this analysis are based on UTM Zone 11. The location of the proposed IGQ facility is approximately 5,236,150 meters Northing and 286,986 meters Easting in UTM Zone 11.

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[3] Department of Ecology State of Washington Guidance Document: First, Second, and Third Tier Review of Toxic Air Pollution Sources (Chapter 173-460 WAC), September 2010. Publication number: 08-02-025 (revised August 2015).

[4] EPA Memo *Use of ASOS meteorological data in AERMOD dispersion modeling*, March 8, 2013.

3.4. TERRAIN ELEVATIONS

Terrain elevations for receptors, buildings, and sources are determined using National Elevation Dataset (NED) supplied by the United States Geological Survey (USGS).[5] The NED is a seamless dataset with the best available raster elevation data of the contiguous United States. NED data retrieved for this model have a grid spacing of 1/3 arc-second or 10 m. The AERMOD preprocessor, AERMAP version 18081, is used to compute model object elevations from the NED grid spacing. AERMAP also calculates hill height data for all receptors. All data obtained from the NED files are checked for completeness and spot-checked for accuracy.

3.5. RECEPTOR GRID

Six (6) square Cartesian receptor grids are used in the analysis, in alignment with Ecology's guidance document for TAP reviews suggests a six (6) square Cartesian receptor grid for TAP analyses. The grid extends approximately 6,000 meters from the center of the facility for most pollutants.

- Two grids containing 12.5-meter spaced receptors and extending roughly 250 meters from the center of each of the new proposed buildings.
- A grid containing 25-meter spaced receptors extending from 250 meters to 800 meters from the center of the facility.
- A grid containing 50-meter spaced receptors extending from 800 meters to 1,500 meters from the center of the facility.
- A grid containing 100-meter spaced receptors extending from 1,500 meters to 2,100 meters from the center of the facility.
- A grid containing 300-meter spaced receptors extending from 2,100 meters to 4,400 meters from the center of the facility.
- A grid containing 600-meter spaced receptors extending from 4,400 meters to 10,000+ meters from the center of the facility.

In addition, 10-meter spaced receptors will be included along the property fenceline. The receptors are placed at 1.5 m flagpole height, as requested by Ecology, for the TAP analysis. NO_2 required extending the receptor grid an additional 2,000 meters in the West and North directions in order verify decreasing impacts occur at the edge of the receptor grid.

3.6. BUILDING DOWNWASH

Emissions from the generator stacks will be evaluated in terms of their proximity to nearby structures. The purpose of this evaluation is to determine if stack discharges might become caught in the turbulent wakes of these structures. Wind blowing around a building creates zones of turbulence that are greater than if the buildings were absent. The concepts and procedures expressed in the GEP Technical Support document, the Building Downwash Guidance document, and other related documents will be applied to all structures at the IGQ facility.

Figure 3-1 shows the location of the facility with respect to the modeled fenceline and buildings. Note that after the modeling was completed and NOC application submitted, it was determined by Sabey that the final design of Building D and the associated equipment will require Building D to be shifted 20 feet to the West. Since shifting

[5] NED data retrieved from the National Map website at https://viewer.nationalmap.gov/basic/. Data is converted to the GeoTIFF format for use in the AERMOD models.

the building will move the building more to the interior of the property, and it is a very small shift (less than the resolution of current receptor grid at the fenceline) it is expected that modeled impacts will be largely unimpacted and the current modeling analysis is expected to be a conservative demonstration. Revised modeling has not been conducted. Ecology provided concurrence that no re-modeling was required for this change on April 3, 2020.[6] This design change occurred after the March 27, 2020 submittal of the revised NOC application and is not noted in the March 27, 2020 NOC application.

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[6] Tesfamichael Ghidey (Ecology Modeling Group) provided email concurrence to Ashley Jones (Trinity Consultants) on April 3, 2020 that no re-modeling is required.

Figure 3-1. Modeled Buildings and Fenceline

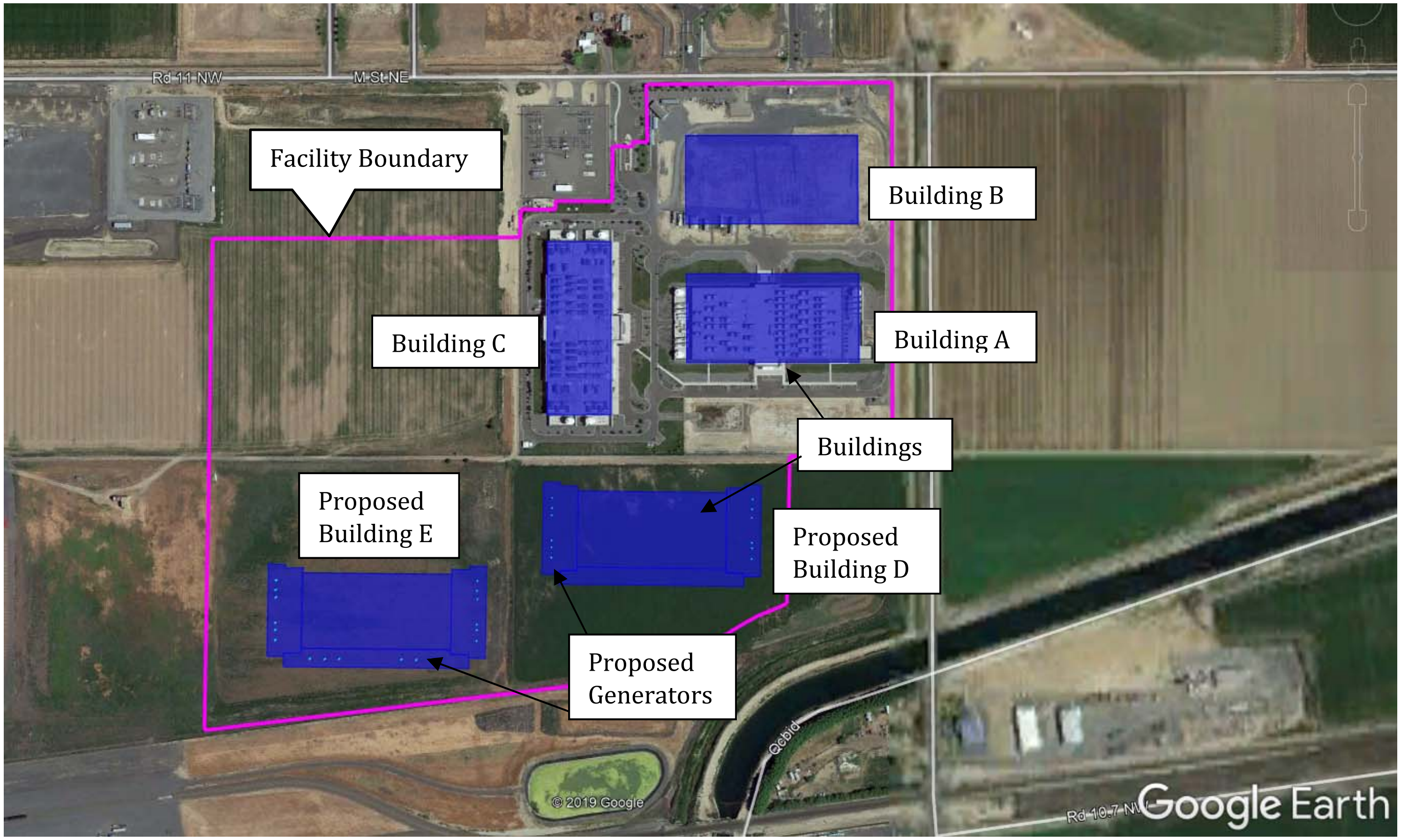

Figure 3-1 shows the model objects as they were modeled. Note Building D and associated equipment will be shifted 20 feet West.

3.7. EMISSION SOURCE PARAMETERS

The sources included for TAP modeling are the 32 gensets. Each of Buildings D and E will have utility yards on the east and west side of each building, with an option for a utility yard also on the south side of each building. One building will have 12 gensets and one building will have 18 gensets. The two support gensets will be located near the loading docks on the south side of each building. The site plan (Appendix B) shows the locations of the utility yards, loading docks and the position of the gensets. Table 6-1 shows the model ID and each genset's UTM location, as modeled. Note than in addition to the load analysis, a sensitivity analysis to which building configuration having more gensets was also completed, and the "worst case" configuration was determined for each pollutant and averaging period. The table below shows all possible genset locations regardless of configuration, as they were modeled. Note that actual building D source locations will be shifted 20 feet (6.1 meters West).

Table 3-1. Modeled Sources

Model Unit ID [1]	Description	UTM Easting (m)	UTM Northing (m)	Elevation (m)
D1	D1 - Building D	286,886.1	5,236,186.2	396.24
D2	D2 - Building D	286,885.8	5,236,175.6	396.15
D3	D3 - Building D	286,885.2	5,236,167.8	396.09
D4	D4 - Building D	286,883.9	5,236,141.4	395.9
D5	D5 - Building D	286,883.6	5,236,133.9	395.85
D6	D6 - Building D	286,883.0	5,236,123.0	395.76
D7	D7 - Building D	287,099.4	5,236,176.8	395.35
D8	D8 - Building D	287,098.7	5,236,166.2	395.25
D9	D9 - Building D	287,098.1	5,236,157.4	395.16
D10	D10 - Building D	287,096.9	5,236,130.8	394.87
D11	D11 - Building D	287,097.2	5,236,124.9	394.8
D12	D12 - Building D	287,095.9	5,236,113.9	394.7
D13*	D13 - Building D	286,919.3	5,236,101.7	395.37
D14*	D14 - Building D	286,934.9	5,236,101.4	395.28
D15*	D15 - Building D	286,950.6	5,236,101.0	395.22
D16*	D16 - Building D	287,016.4	5,236,097.6	394.89
D17*	D17 - Building D	287,032.0	5,236,096.4	394.83
D18*	D18 - Building D	287,047.7	5,236,095.4	394.74
E1	E1 - Building E	286,589.8	5,236,110.0	395.87
E2	E2 - Building E	286,589.0	5,236,099.8	395.78
E3	E3 - Building E	286,589.0	5,236,092.0	395.65
E4	E4 - Building E	286,587.8	5,236,065.3	395.33
E5	E5 - Building E	286,587.4	5,236,057.8	395.25
E6	E6 - Building E	286,587.0	5,236,046.9	395.14
E7	E7 - Building E	286,803.5	5,236,101.4	395.83
E8	E8 - Building E	286,803.1	5,236,090.8	395.73
E9	E9 - Building E	286,803.1	5,236,082.2	395.62
E10	E10 - Building E	286,801.5	5,236,055.5	395.32
E11	E11 - Building E	286,801.1	5,236,049.6	395.25

Model Unit ID [1]	Description	UTM Easting (m)	UTM Northing (m)	Elevation (m)
E12	E12 - Building E	286,800.7	5,236,038.2	395.08
E13*	E13 - Building E	286,622.9	5,236,025.8	394.83
E14*	E14 - Building E	286,638.7	5,236,024.9	394.82
E15*	E15 - Building E	286,654.1	5,236,024.5	394.81
E16*	E16 - Building E	286,720.1	5,236,021.5	394.88
E17*	E17 - Building E	286,735.9	5,236,020.7	394.88
E18*	E18 - Building E	286,751.3	5,236,019.8	394.87
S1	Support Generator 1	286,991.0	5,236,103.4	395.07
S2	Support Generator 2	286,693.3	5,236,028.0	394.94

[1] Note that Model IDs identified with an "*" are only included in a model scenario if the worst-case configuration for a pollutant and averaging period identifies its building (Building D or Building E) as worst case for the 18 genset configuration. Only one building will have 18 main gensets and the other building 12 main gensets for a total of 30 gensets.

3.8. LOAD ANALYSIS

A load analysis was performed for each pollutant to determine which load would result in the highest offsite concentration for each of the pollutants. The following load analysis was performed for the main gensets:

- For NO_X, CO, and SO_2, highest hourly emissions across all vendors are included for each generator at each of 10%, 25%, 50%, 75% and 100% loads. For each load, the worst-case (i.e., lowest) flow rate and temperature from vendor provided information is applied for all genset modeled at the specified load.
- For DPM, the load analysis was performed for CAT, Cummins, and Kohler at each load where the dispersion parameters are provided in the vendor specifications. The corresponding vendor emission rate, the flow rate and temperature are used.
- For acrolein, naphthalene, and benzene, the hourly maximum fuel consumption rate from all vendors at each load and corresponding worst-case parameters are used to represent the variations of resultant TAP emissions. TAP emissions are calculated based on the fuel consumption rates.

Since the support gensets may be operated separately from the main gensets, the following load analysis was performed for the support gensets, which mimics the main gensets:

- For NO_X, CO, and SO_2, highest hourly emissions across all vendors are included for each generator at each of 10%, 25%, 50%, 75% and 100% load. For each load, the worst-case (i.e., lowest) flow rate and temperature from vendor provided information is applied for all generators modeled at the specified load.
- For DPM, the load analysis was performed for CAT and Cummins at each load where the dispersion parameters are provided in the vendor specifications. The corresponding vendor emission rate, the flow rate and temperature are used.
- For acrolein, naphthalene, and benzene, the hourly fuel consumption rate at each load and corresponding worst-case parameters are used to represent the variations of resultant TAP emissions. TAP emissions are calculated based on the fuel consumption rates.

The load analysis results are summarized in Table 3-2. Stack parameters and emission rates for the TAP models are provided in Table 3-3. Based on the load analysis results, the following are used:

- For NO_2 1-hour, 100% load results in the maximum offsite concentration across all loads on a 1-hour basis. For the 1-hour standard the configuration with 12 main gensets at Building D and 18 gensets at Building E resulted in the maximum offsite concentration.

- For DPM, Cummins DQKAN 100% load results in the maximum annual averaged offsite concentration across all loads and vendors for the main gensets. This maximum occurs in the configuration with 18 main gensets at Building D and 12 main gensets at Building E. The maximum for the support gensets is the 50% load for Cummins.
- For CO, 25% load results in maximum offsite concentration across all loads on a 1-hour basis for the main gensets. This maximum occurs in the configuration with 12 main gensets at Building D and 18 main gensets at Building E. The maximum for the support gensets is the 50% load.
- For SO_2, 100% load results in maximum offsite concentration across all loads on a 1-hour basis. This maximum occurs in the configuration with 12 main gensets at Building D and 18 main gensets at Building E.
- For acrolein, 100% load results in maximum offsite 24-hour averaged concentration across all loads, occurring in the configuration with 12 main gensets at Building D and 18 main gensets at Building E.
- For naphthalene and benzene, 100% load results in maximum offsite annual averaged concentration across all loads, occurring in the configuration with 18 main gensets at Building D and 12 main gensets at Building E.

Table 3-2. Load Analysis Results

Pollutant	Averaging Period	Worst-Case Load		Worst-Case Configuration
NO_X	1-hr	Main Support	100% 100%	D12/E18
CO	1-hr	Main Support	25% 50%	D12/E18
SO_2	1-hr	Main Support	100% 100%	D12/E18
Acrolein	24-hr	Main Support	100% 100%	D12/E18
Benzene	year	Main Support	100% 100%	D18/E12
Naphthalene	year	Main Support	100% 100%	D18/E12
Diesel Engine Exhaust, Particulate	year	Main Support	100% - Cummins DQKAN 50% Cummins	D18/E12

Table 3-3. TAP Model Stack Parameters

Pollutant	Averaging Period	Genset Type	Stack Height (m)	Temp. (K)	Exit Velocity (m/s)	Diameter (m)	Emission Rate (g/s/engine)
NO_X	1-hr	Main	18.29	724.15	47.56	0.46	8.401E+00
		Support	3.66	770.48	58.97	0.15	8.632E-01
CO	1-hr	Main	18.29	659.26	18.63	0.46	1.593E+00
		Support	3.66	691.21	44.37	0.15	4.541E-01
SO_2	1-hr	Main	18.29	724.15	47.56	0.46	5.566E-03
		Support	3.66	770.48	58.97	0.15	1.240E-01
Acrolein	24-hr	Main	18.29	724.15	47.56	0.46	2.360E-05
		Support	3.66	770.48	58.97	0.15	3.684E-05
Benzene	year	Main	18.29	724.15	47.56	0.46	1.459E-05
		Support	3.66	770.48	58.97	0.15	1.555E-07
Naphthalene	year	Main	18.29	724.15	47.56	0.46	2.444E-06
		Support	3.66	770.48	58.97	0.15	2.120E-07
Diesel Engine Exhaust, Particulate	year	Main	18.29	823.15	52.52	0.46	1.631E-03
		Support	3.66	691.48	44.37	0.15	1.427E-04

3.9. NO_X TO NO_2 CONVERSION

NO_X is formed when nitrogen in ambient air is exposed to high temperatures during the combustion process. At these temperatures, some nitrogen is converted to NO and NO_2 (collectively referred to as NO_X). This project includes NO_X emitted from the gensets from IGQ facility. Emission factors for these units are for emissions of NO_X, while the ambient air quality objective is for NO_2. In order to estimate the amount of NO_2 concentration from the amount of emitted NO_X, the following modeling approaches are applied to AERMOD inputs[7]:

- Plume Volume Molar Ratio Method (PVMRM) in AERMOD;
- In-stack ratio (ISR) of 0.1 for all generators. The ISR is aligned with other recent approved data center analyses, and is a conservative value based on EPA's ISR data base for uncontrolled engines firing diesel or kerosene[8].
- Ozone background concentration of 52 ppb, based on NW-AIRQUEST at the site location.[9]

3.10. BACKGROUND CONCENTRATION

The second tier evaluation for DPM uses a representative background concentration estimated from the NATA database, provided by Ranil Dhammapala at Ecology on January 3, 2020, to account for impacts from local and regional nearby sources. Sabey uses a DPM background concentration of 0.19 μg/m^3.

The second tier evaluation for NO_2 uses a representative 1-hour background concentration of 68 μg/m^3 estimated from the Quincy NO_2 monitor, and provided by Ranil Dhammapala and further described in the NOC application.

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[7] Initial approval from Ecology through email on December 26, 2019.

[8] Filtered available entries in Excel file "NO2_ISR_database.xlsx", EPA NO_2/NO_X in-stack ratio database, available at https://www3.epa.gov/scram001/no2_isr_database.htm, accessed January 27, 2020. The average ISR for RICE firing diesel or kerosene is 0.07.

[9] Northwest Airquest data hosted by Idaho Department of Environmental Quality, available at https://idahodeq.maps.arcgis.com/apps/MapSeries/index.html?appid=0c8a006e11fe4ec5939804b873098dfe and provided by Ranil Dhammapala (Ecology) on January 3, 2020.

As previously described, a first tier TAP analysis was conducted using AERMOD to compare the impacts of DPM, NO_2, acrolein, CO, SO_2, naphthalene, and benzene to their respective ASILs. Table 4-1 presents the results of this first tier review.

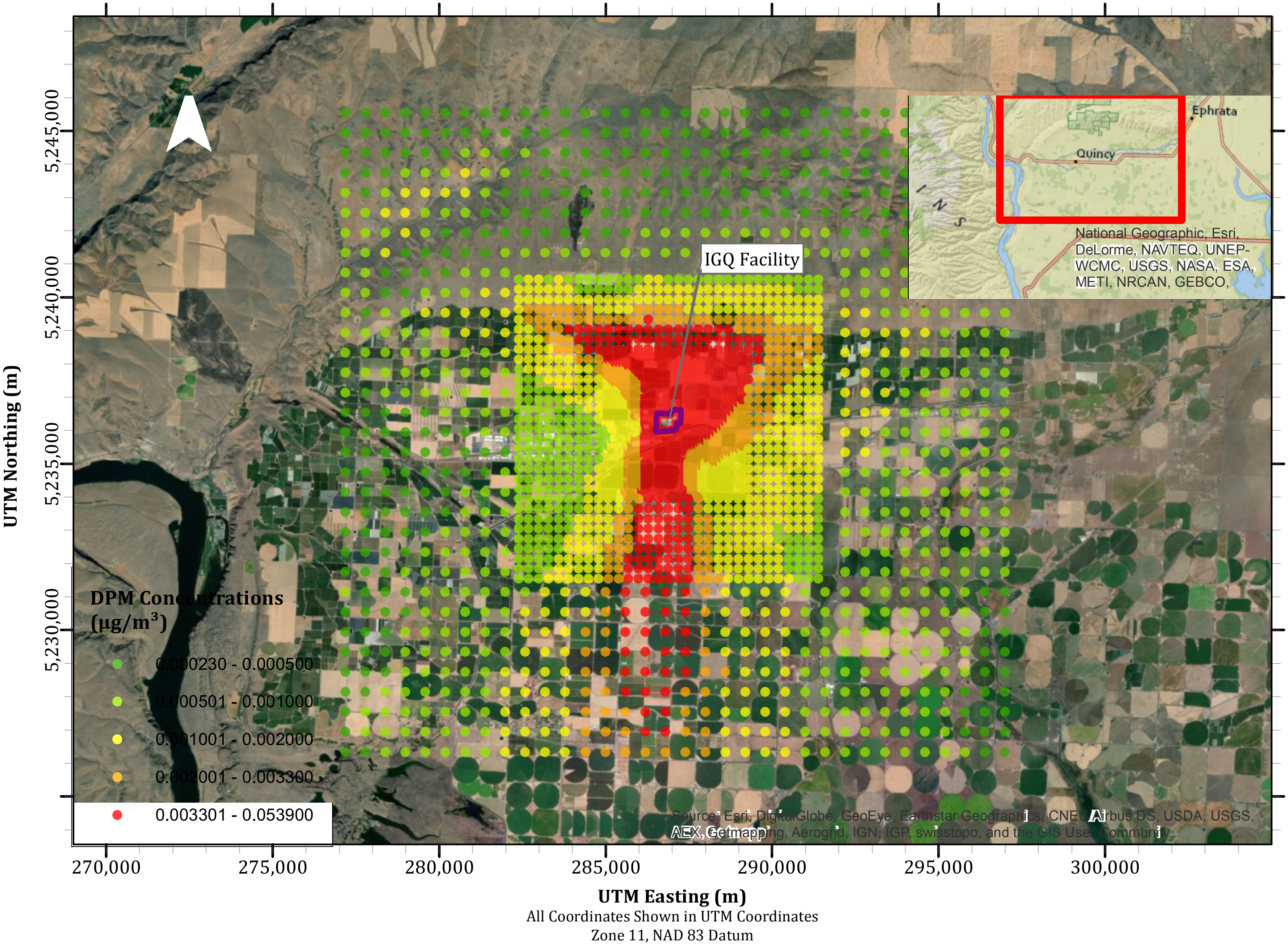
Table 4-1. Maximum Modeled TAP Concentrations

Year	Toxic Air Pollutant	Averaging Period	Maximum Modeled Concentration (μg/m³)	UTM Easting (m)	UTM Northing (m)	ASIL (μg/m³)	% of ASIL
2014	Acrolein	24-hr	1.41E-2	286,635.3	5,235,963.8	0.35	4.0%
2014	Benzene	year	5.10E-04	287,141	5,236,212	0.13	0.4%
2014	Naphthalene	year	9.00E-5	287,141	5,236,212	0.029	0.3%
2014	DPM	year	5.39E-2	287,141	5,236,212	0.0033	1,633.3%
2015	SO_2	1-hr	123.67	286,744.9	5,235,972.9	660	18.7%
2014	CO	1-hr	1,541.59	286,645.2	5,235,964.6	23,000	6.7%
2014	NO_2	1-hr	1,212.59	281,386	5,244,350	470	258.0%

As shown in Table 4-1, the project emissions of acrolein, CO, SO_2, naphthalene, and benzene are in compliance with their respective ASILs; however, the maximum DPM impact is 1,633.3% of its ASIL, and the maximum NO_2 impact is 258% of its ASIL. Figure 4-1 and Figure 4-2 show the areas exceeding the ASIL for DPM and NO_2, respectively. The values represented in Figures 4-1 and 4-2 are the highest concentrations for each individual receptor across all five years modeled. Receptors with a modeled concentration over a pollutant's given ASIL are analyzed and shown in more detail in Section 5 of this report.

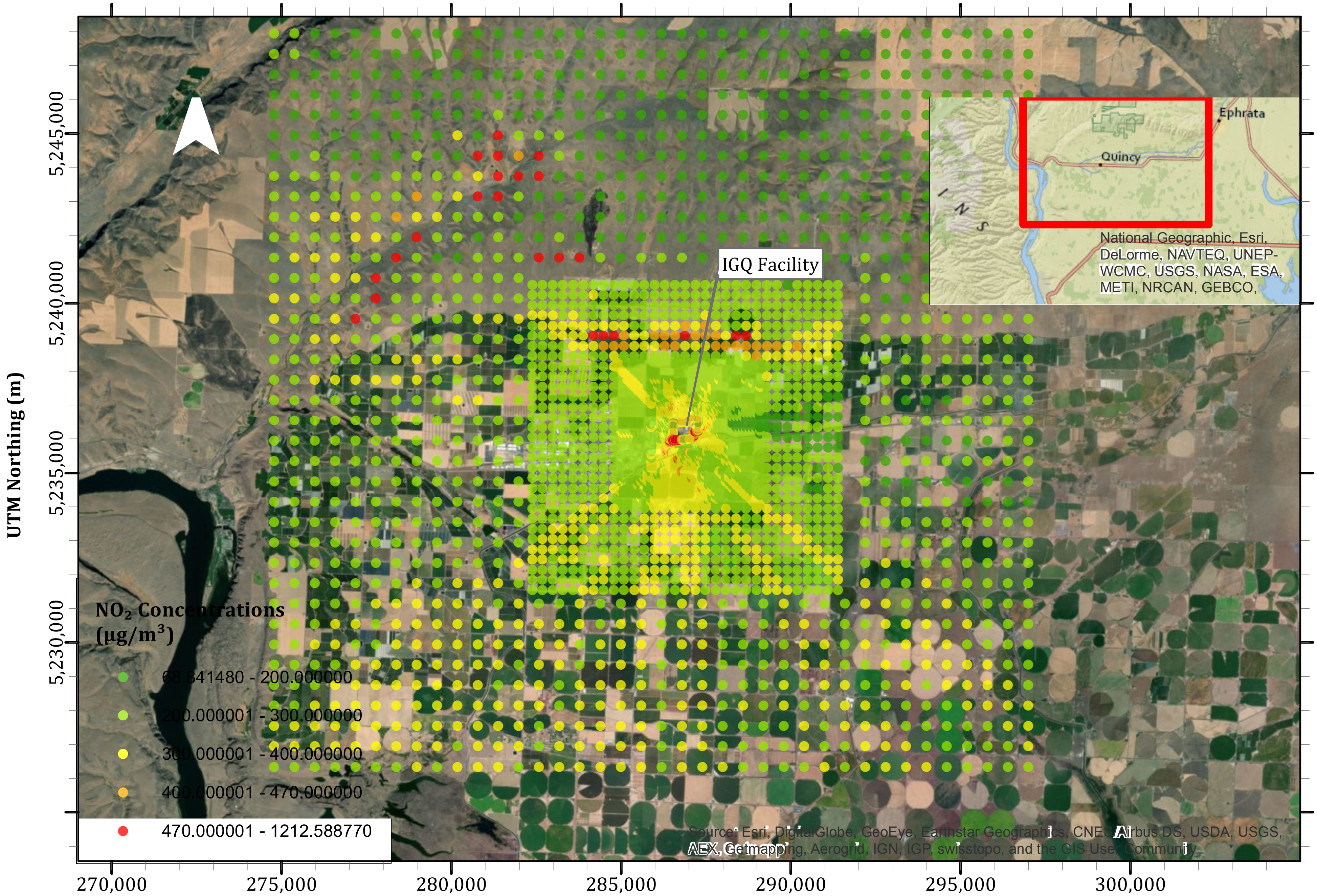
Sabey conducted a second tier review for DPM and NO_2 to demonstrate that the project does not have significant health impacts on the community. Section 5 of this report identifies exposed populations and sensitive receptors that are considered in this second tier review. Section 6 identifies the hazards associated with each modeled pollutant, and Section 7 includes toxicological modeling thresholds used as the basis for the HIA.

Figure 4-1. DPM First Tier Model Results



All Coordinates Shown in UTM Coordinates
Zone 11, NAD 83 Datum

Figure 4-2. NO_2 First Tier Modeling Results



All Coordinates Shown in UTM Coordinates
Zone 11, NAD 83 Datum

5. IDENTIFICATION OF EXPOSED POPULATIONS

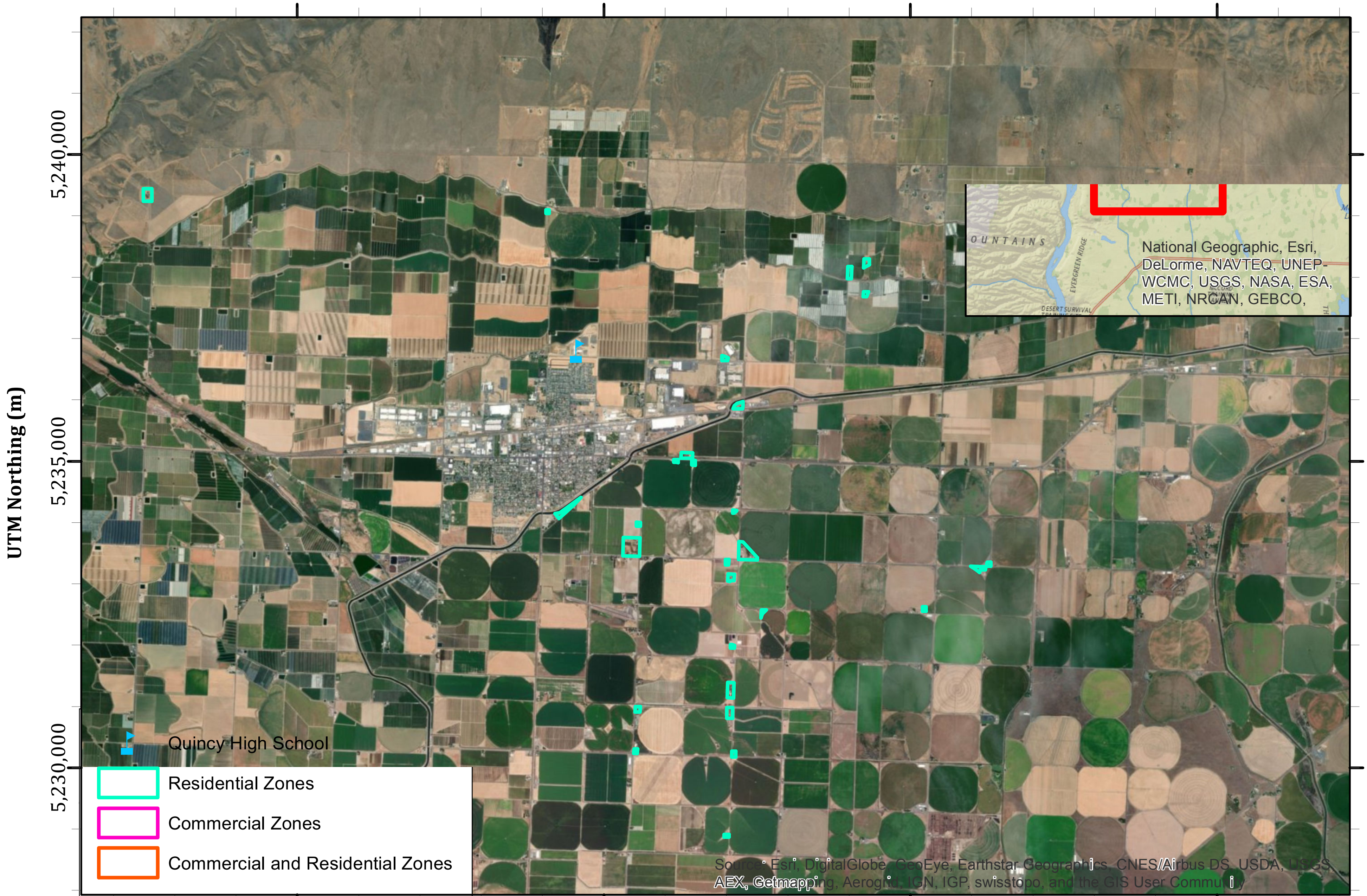
The IGQ facility is located in Quincy, WA. The zoning designation of the facility location is "City Industrial". The property is bordered on all sides by additional industrial zoning areas, either within Quincy city limits or in unincorporated Grant County industrial zones. Detailed zoning maps obtained from Grant County and the City of Quincy for the city and the surrounding area are provided in Appendix A.

Within the "Resource Lands - Agriculture (AG)" zoning area to the north and south of the IGQ facility and adjacent industrial zones, there are residential properties near the IGQ facility. Residential and commercial properties are provided in Figure 5-1.

Sensitive receptors typically included in the second tier analysis, including schools, hospitals, and churches, were not identified outside of the "Commercial and Residential Zones" identified in Figure 5-1. These "Commercial and Residential" zones, based on the zoning maps included in Appendix B, are made up of many smaller zones either in the city of Quincy or unincorporated Grant County that are either residential or commercial. Figures 5-2 to 5-5 below show the overlap of sensitive receptors and modeled ASIL exceedances, which were created by ArcGIS for overlap and proximity evaluation. Receptors in the following four maps identified in yellow are those that exceed the ASIL but do not overlap with sensitive zones. Modeled receptors identified by red dots are those that both exceed the ASIL and are sensitive receptors in either a residential or commercial zone. These overlapping receptors are carried through to the second tier analysis to determine the maximally impacted residential and commercial receptors. There are no ASIL-exceeding model locations that overlap with the "Commercial and Residential" zones, which contain the sensitive receptors for schools, hospitals, or churches.

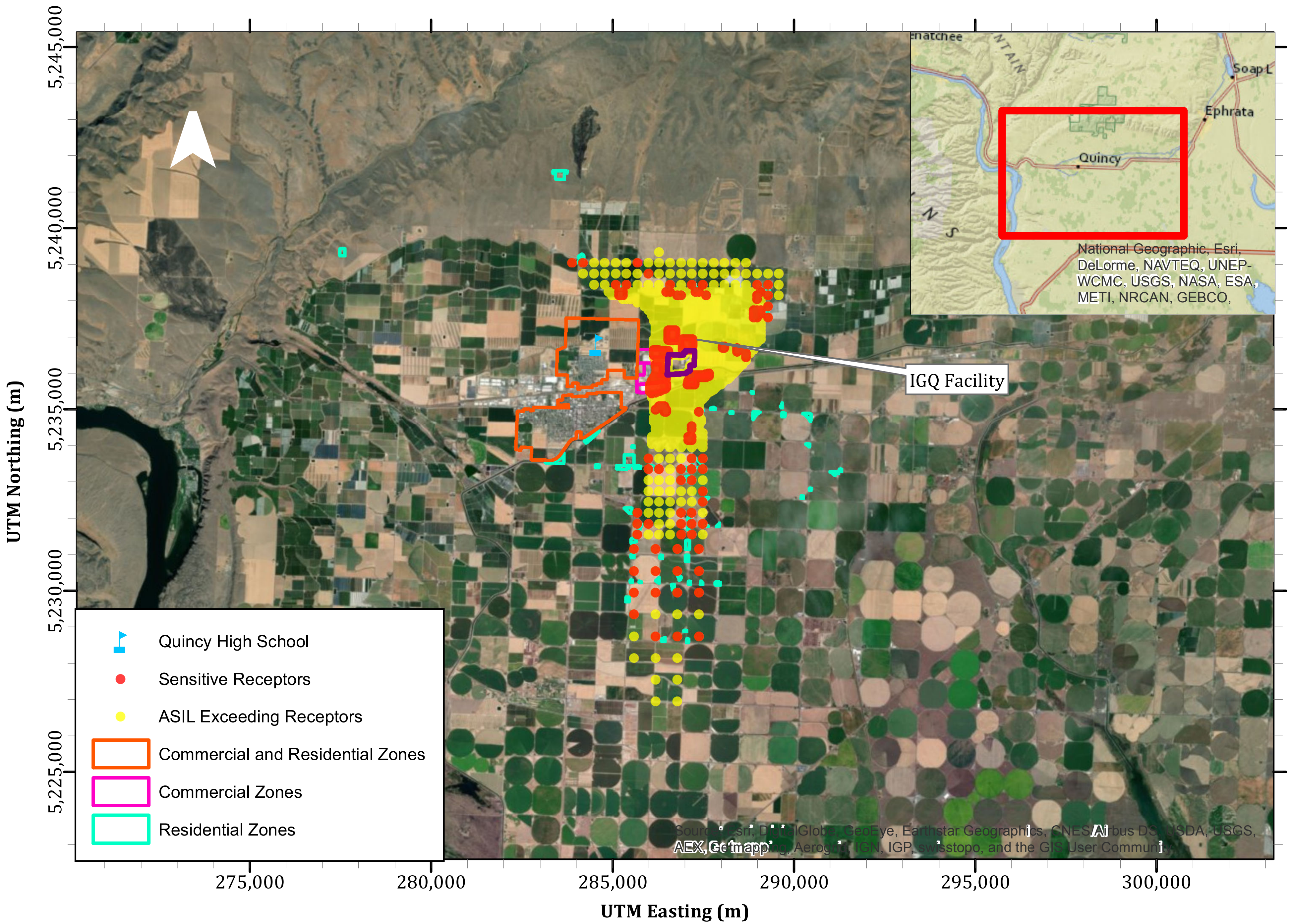
While it is anticipated that the highest-impact receptors (aside from boundary receptors) will be located in the commercial and residential zones immediately adjacent to IGQ facility (see Figures 5-3 and 5-5 for a zoomed-in view of the first tier analysis model results), the second tier review analyzes the model results at all ASIL-exceeding modeled receptors that were identified as sensitive receptors, including the maximum impacted boundary receptor (MIBR), maximum impact commercial receptor (MICR), and maximum impact residential receptor (MIRR). The maximum impact among those receptors overlapping with sensitive zones will be used to determine the health impacts from the IGQ facility. Note that the modeled impacts at the Quincy High School are below the Tier 1 acceptable source impact levels (ASILs), and not evaluated further in this Tier 2 analysis. Impacts at the school would be expected to be lower than any of the sensitive receptor impacts in this Tier 2 analysis.

Figure 5-1. Nearby Commercial and Residential Zones



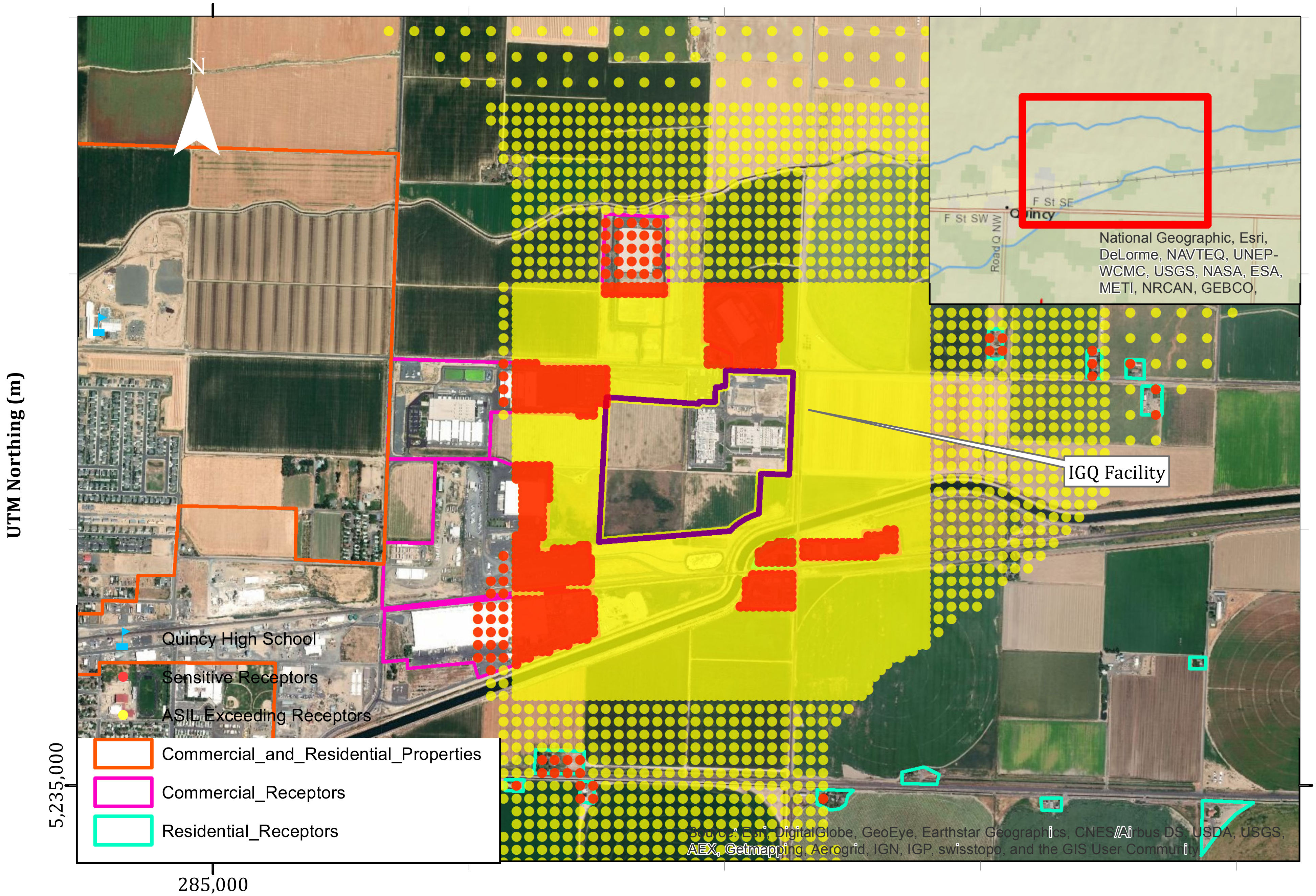
UTM Easting (m)
All Coordinates Shown in UTM Coordinates
Zone 11, NAD 83 Datum

Figure 5-2. DPM ASIL Exceedance Locations Overlapping with Sensitive Zones



All Coordinates Shown in UTM Coordinates
Zone 11, NAD 83 Datum

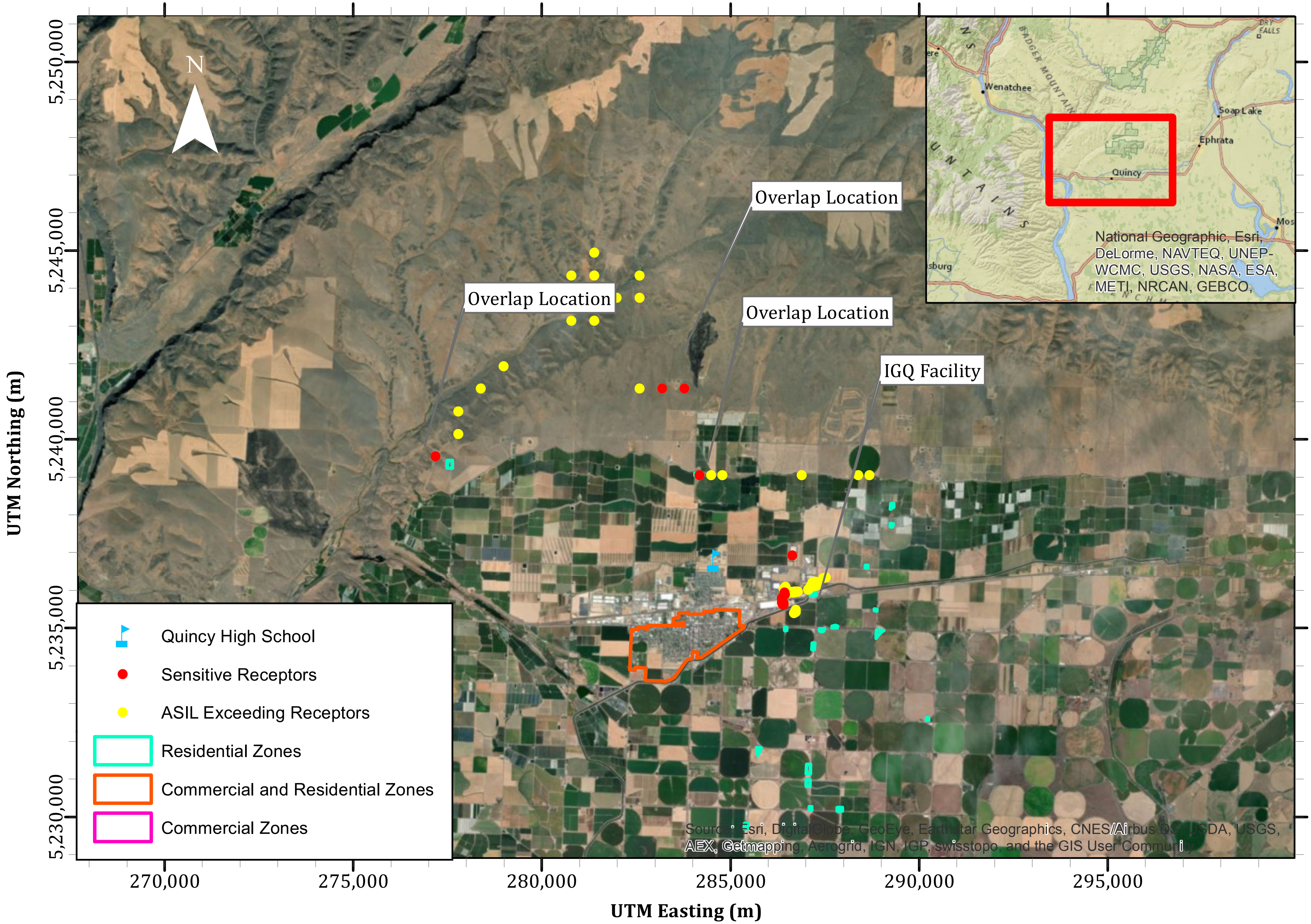
Figure 5-3. DPM ASIL Exceedance Locations Overlapping with Sensitive Zones (Zoomed-In)



UTM Easting (m)

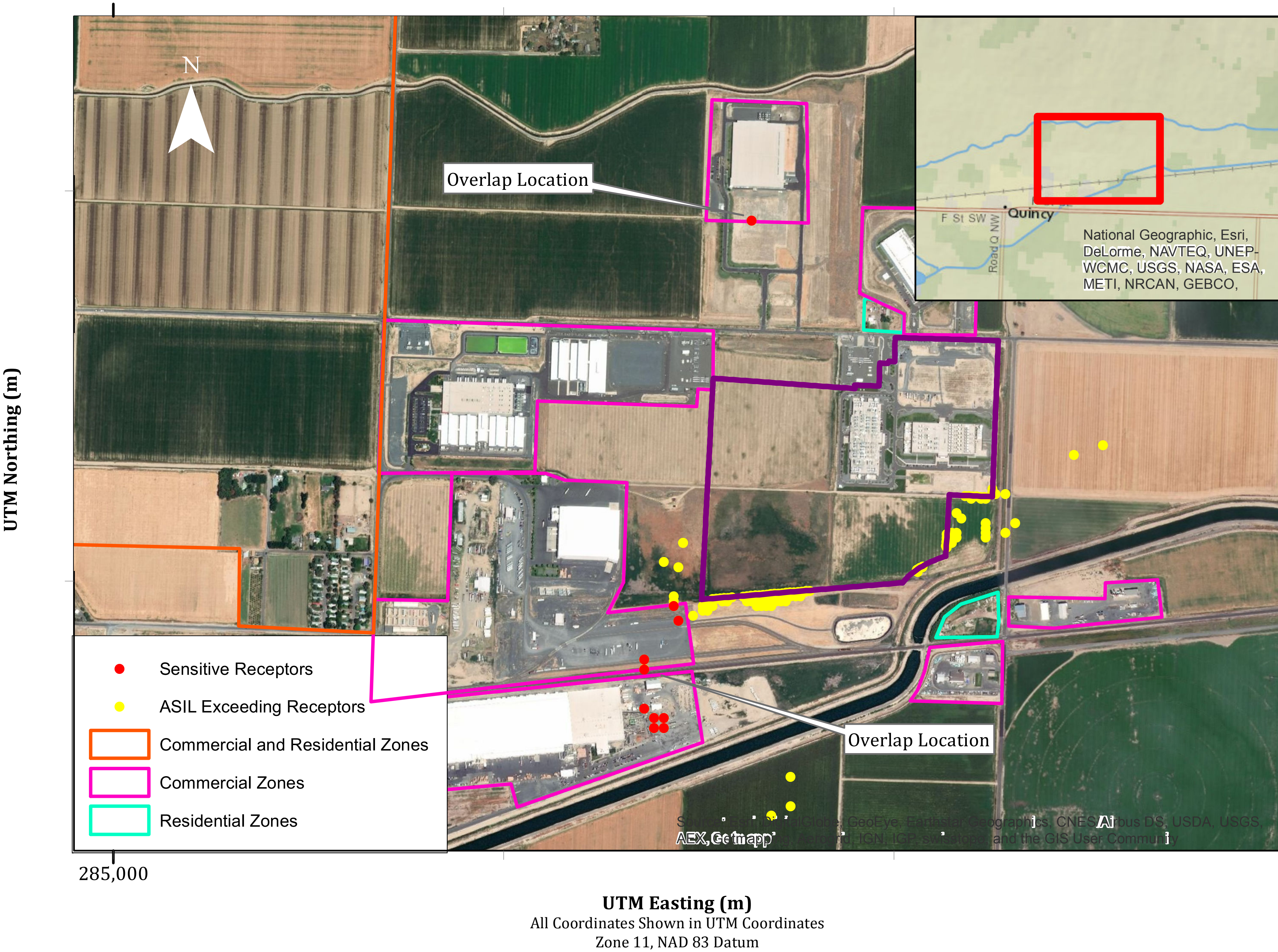
All Coordinates Shown in UTM Coordinates
Zone 11, NAD 83 Datum

Figure 5-4. NO_2 ASIL Exceedance Locations Overlapping with Sensitive Receptors



All Coordinates Shown in UTM Coordinates
Zone 11, NAD 83 Datum

Figure 5-5. NO_2 ASIL Exceedance Locations Overlapping with Sensitive Receptors (Zoomed-In)



This section describes the tissues and organs that may be impacted by DPM, NO_2, acrolein, CO, SO_2, naphthalene, and benzene and the potential acute and chronic health impacts associated with these pollutants. Only health impacts from these seven TAPs are described here, since they are the only TAPs whose emissions exceed the SQER. The primary exposure pathway for each of these pollutants is through inhalation or direct contact with air. Therefore, health impacts due to cross-media transport into water and soil have not been considered in this analysis.

6.1. DIESEL PARTICULATE MATTER

Diesel exhaust consists of gases (including NO_x, CO, and speciated hydrocarbons) and fine particulate matter (DPM). Approximately 94% of the solid particles (by mass) emitted from diesel engines are less than 2.5 microns in diameter. [10]

DPM targets the eyes and respiratory system and can cause adverse short-term and chronic health effects. Some of the short-term effects associated with DPM exposure are the following: [9]

- Increased cough;
- Labored breathing;
- Chest tightness;
- Wheezing; and
- Eye and nasal irritation.

In addition to the short-term effects listed above, DPM exposure is also associated with the following chronic effects: [9]

- Chronic bronchitis;
- Reductions in pulmonary function; and
- Inflammation of lung tissue.

Additionally, human epidemiological studies have shown an increased lung cancer risk associated with DPM exposure. [9]

6.2. NITROGEN DIOXIDE

The combustion of fossil fuels results in the formation of nitrogen oxides, primarily nitric oxide (NO) and NO_2. NO_2 targets the respiratory system and can have acute and chronic health impacts. Short-term exposure to NO_2 can cause the following health effects:[11]

- Pulmonary edema;

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[10] California Office of Environmental Health Hazard Assessment (OEHHA), "Findings of the Scientific Review Panel on the Report on Diesel Exhaust." April 22, 1998.

[11] California Office of Environmental Health Hazard Assessment (OEHHA), Technical Supporting Document for Noncancer RELs, Appendix D2, "Acute RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines (OEHHA 1999)."

- Pneumonitis;
- Bronchitis; and
- Bronchiolitis obliterans.

OEHHA has not established a chronic reference exposure level (REL) for NO_2.

6.3. ACROLEIN

Acrolein is a speciated hydrocarbon that is emitted during diesel fuel combustion. Acrolein targets the skin, eyes, and mucous membranes of the respiratory system.[12] Acute exposure to acrolein is associated with the following short-term health impacts:[11]

- Mucous hypersecretion;
- Exacerbation of allergic air way response; and
- Eye, nose, and throat irritation.

Chronic exposure to acrolein is associated with lesions in the nasal mucosa and pulmonary inflammation.

6.4. CARBON MONOXIDE

The incomplete combustion of fossil fuels results in the formation of carbon monoxide. Carbon monoxide targets the cardiovascular system.[10] Acute exposure to carbon monoxide is associated with the following short-term health impacts: [10]

- Headache;
- Breathlessness;
- Irritability;
- Fatigue; and
- Aggravation of cardiovascular diseases (e.g., angina).

Exposure to carbon monoxide is not expected to have chronic health impacts.

6.5. SULFUR DIOXIDE

The combustion of sulfur-containing components in fossil fuels results in the formation of sulfur dioxide. Carbon monoxide targets the respiratory system.[10] Acute exposure to sulfur dioxide is associated with the following short-term health impacts: [10]

- Increased airway resistance in asthmatics;
- Bronchoconstriction; and
- Irritability if exposed with other irritants.

Exposure to sulfur dioxide is not expected to have chronic health impacts.

[12] California Office of Environmental Health Hazard Assessment (OEHHA), "Draft Reference Exposure Level for Acrolein." November 25, 2008.

6.6. NAPHTHALENE

Naphthalene is present in diesel fuels. Naphthalene targets the respiratory system.[13] Naphthalene is associated with chronic effects:

- Nasal inflammation;
- Olfactory epithelial metaplasia; and
- Respiratory epithelial hyperplasia.

In addition to the chronic effects, naphthalene is considered a possible carcinogenic to humans.[14]

6.7. BENZENE

Benzene is a speciated hydrocarbon that is emitted as a byproduct of incomplete combustion of diesel fuel. Benzene targets the reproductive system, immune system, and hematologic system.[10] Acute exposure to benzene is associated with the following short-term health impacts: [10]

- Headache;
- Nausea;
- Eye irritation; and
- Respiratory tract inflammation.

In addition to the short-term effects listed above, benzene exposure is also associated with the following chronic effects:[15]

- Peripheral lymphocytopenia;
- Pancytopenia; and
- Aplastic anemia.

Additionally, human epidemiological studies have shown an increased cancer risk associated with benzene exposure. [9]

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[13] California Office of Environmental Health Hazard Assessment (OEHHA), Appendix D.3 Chronic RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines (OEHHA 1999). https://oehha.ca.gov/media/downloads/crnr/appendixd3final.pdf

[14] California Office of Environmental Health Hazard Assessment (OEHHA), Adoption of a Unit Risk Value for Naphthalene. https://oehha.ca.gov/air/report/adoption-unit-risk-value-naphthalene

[15] California Office of Environmental Health Hazard Assessment (OEHHA), Technical Support Document for Noncancer RELs, Appendix D1, "Summaries using this version of the Hot Spots Risk Assessment guidelines." (Updated July 2014).

7.1. TOXICITY VALUES

The toxicity values proposed for this second tier review are obtained from the California Office of Environmental Health Hazard Assessment (OEHAA). OEHHA establishes reference exposure levels (RELs) for acute and chronic non-carcinogenic health hazards. OEHHA also establishes unit risk factors (URF) for carcinogenic health hazards. Per Ecology guidance, the non-carcinogenic and carcinogenic risks need to be evaluated for all pollutants in excess of their SQERs to account for potential cumulative impacts among pollutants with the same averaging period and target organs. Since DPM, NO_2, acrolein, CO, SO_2, naphthalene, and benzene all target the respiratory system, toxicity values have been obtained for all five pollutants to evaluate cumulative impacts. Table 7-1 lists the non-carcinogenic and carcinogenic toxicity values for these three pollutants.

Table 7-1. Toxicity Values

TAP	Chronic REL ($\mu g/m^3$)	Acute REL ($\mu g/m^3$)	Cancer URF $(\mu g/m^3)^{-1}$
DPM	5	N/A	3×10^{-4}
NO_2	N/A	470	N/A
Acrolein	0.35	2.5	N/A
CO	N/A	23,000	N/A
SO_2	N/A	660	N/A
Naphthalene	9	N/A	3.4 X 10-5
Benzene	3	27	2.9×10^{-5}

7.2. NON-CARCINOGENIC RISK ASSESSMENT

7.2.1. Chronic Noncancer Hazard

To quantify the chronic non-carcinogenic impacts from the project, the RELs and the maximum modeled concentrations are used to calculate hazard quotients (HQ) at the maximally impacted commercial and residential receptors identified in Section 5. The chronic HQs for each pollutant are calculated using the following equations:

$$Chronic\ HQ = \frac{Conc. of\ TAP\ \left(\frac{\mu g}{m^3}\right) (Annual\ Avg.\ Period)}{Chronic\ REL\ (\frac{\mu g}{m^3})}$$

A cumulative chronic HQ is calculated by summing the individual chronic HQs for DPM, acrolein, naphthalene and benzene, which are the only TAP that have a chronic REL in Table 7-1. A HQ of less than one indicates that adverse health effects are unlikely to occur.

The annual modeled concentrations for DPM, acrolein, and benzene are summarized in Table 7-2, which also calculates the chronic noncancer risks at these specified locations.

Table 7-2. Project Chronic Noncancer Risks

Receptor	Maximum Modeled Annual Concentration (µg/m³)				Calculated Chronic Noncancer Hazard Quotient				Total Chronic Noncancer Hazard Index
	DPM	Benzene	Acrolein	Naphthalene	DPM	Benzene	Acrolein	Naphthalene	
MIBR	5.39E-02	5.10E-04	5.59E-03	9.00E-05	1.08E-02	1.70E-04	1.60E-02	1.00E-05	2.69E-02
MICR/ MIRR [1]	1.83E-02	1.80E-04	2.87E-03	3.00E-05	3.66E-03	6.00E-05	8.20E-03	3.33E-06	1.19E-02

[1] The maximum impacted business and residential receptors are conservatively assumed to be equivalent in modeled concentration to the sensitive receptor with the overall maximum modeled concentration for DPM, the pollutant with the highest modeled concentration of the four pollutants that have the potential for chronic noncancer risk.

As shown in Table 7-2, the project total chronic noncancer HI at all locations are well below one, which indicates that chronic adverse health effects are unlikely to occur.

7.2.2. Acute Noncancer Hazard

To quantify the acute non-carcinogenic impacts from the project, the RELs and the maximum modeled concentrations are used to calculate HQ at the maximum-impact sensitive receptors. The acute HQs for each pollutant are calculated using the following equation:

$$Acute\ HQ = \frac{Conc. of\ TAP\ \left(\frac{\mu g}{m^3}\right)(Hourly\ Avg.\ Period)}{Acute\ REL\ (\frac{\mu g}{m^3})}$$

A cumulative acute noncancer HI is also calculated by summing the HQs for NO_2, acrolein, CO, SO_2, and benzene, which have acute RELs listed in Table 7-1. Table 7-3 summarizes the modeled concentrations for these TAPs as well as the calculated HQs and total HI.

Table 7-3. Project Acute Noncancer Risks

Receptor	Maximum Modeled 1-hr Concentration (µg/m³)					Calculated Acute Noncancer Hazard Quotient					Total Acute Noncancer Hazard Index
	NO_2	Acrolein	CO	SO_2	Benzene	NO_2	Acrolein	CO	SO_2	Benzene	
MIBR	9.54E+02	1.35E-02	1.30E+03	1.11E+02	1.90E-04	2.03E+00	5.39E-03	5.63E-02	1.68E-01	7.04E-06	2.21E+00
MICR/ MIRR 1	1.03E+03	2.00E-04	1.04E+02	1.10E+00	1.00E-05	2.20E+00	8.00E-05	4.54E-03	1.67E-03	3.70E-07	2.26E+00

[1] The maximum impacted business and residential receptors are conservatively assumed to be equivalent in modeled concentration to the sensitive receptor with the overall maximum modeled concentration for NO_2, the pollutant with the highest modeled concentration of the five pollutants that have the potential for acute noncancer risk.

As shown in Table 7-3, the total acute noncancer HI at the MIBR, MICR, and MIRR are above one. This is largely attributed to the NO_2 concentrations at these locations. The combined HI at MIBR and MICR/MIRR from acrolein, CO, SO_2 and benzene are at 0.01and 0.23, respectively, both of which are well below one. Additionally, while other TAPs target respiratory systems, CO does not have any adverse effect on respiratory systems, as discussed in Section 6.4. Therefore, it is expected that the acute noncancer hazard will be driven by NO_2 concentrations.

7.2.3. Frequency Analysis for NO_2

As discussed in Section 7.2.2, the project acute noncancer HI will exceed one and will be driven by NO_2 concentrations. A HI exceeding one does not mean adverse health effect will occur; rather, the more the HI increases above one, the more likely it is that adverse health effects will occur. A very high concentration that is comparable to the modeled concentrations at the maximum impact receptors is a combined effect of poor meteorological condition for air dispersion and power outage occurring at the same time which requiring all 30 main engines to be operated at the maximum load. Both events have to happen at the same time in order to result in such high ambient NO_2 concentrations.

A frequency analysis is conducted to determine the probability of there being a NO_2 concentration exceeding the ASIL. This frequency analysis is performed for 14 sensitive receptors, which are identified as ASIL-exceeding receptors that overlap with the sensitive commercial and/or residential zones identified in section 5, which are the locations mostly affected by the project. The frequency analysis is additionally conducted for the MIBR.

In this frequency analysis, the number of exceedances of the modeled 5-year period when modeled 1-hr NO_2 concentration exceeding 402 μg/m^3 are evaluated,[16] to account for a background concentration of 68 μg/m^3 existed in the ambient air as discussed in Section 3.10. Then the expected probability of NO_2 concentrations exceeding the threshold in any hour adjusted for the permitted number of hours for the engines (P_{hr}) is calculated. This calculated probability occurring in any hour is then used to estimate how often this event could happen on average per year:

$$Probability\ of\ when\ all\ engines\ are\ operated\ but\ not\ resulted\ in\ high\ concentration\ in\ any\ hour = 1 - P_{hr}$$

$$Probability\ of\ when\ all\ engines\ are\ operated\ but\ not\ resulted\ in\ high\ concentration\ in\ any\ hour\ of\ a\ year = (1 - P_{hr})^{8760}$$

$$Probability\ of\ when\ all\ engines\ are\ operated\ but\ resulted\ in\ high\ concentration\ in\ any\ hour\ of\ a\ year = 1 - (1 - P_{hr})^{8760}$$

This calculated probability means an average likelihood that a NO_2 exceedance event (greater than 402 μg/m^3) would occur in any year. This probability could also be interpreted as recurrence interval, meaning that the NO_2 exceedance event will not likely to occur again within the recurrence interval:

$$Expected\ reccuring\ event\ interval = \frac{1}{Probability\ of\ seeing\ a\ NO_2\ exceedance\ in\ any\ hour\ of\ a\ year} = \frac{1}{1 - (1 - P_{hr})^{8760}}$$

The calculated metrics of the frequency analysis at each of the 14 sensitive receptors are provided in Table 7-4. As shown in Table 7-4, the expected recurrence intervals are below 200 years for 2 of the 14 sensitive receptors. For the remaining receptors, the recurrence intervals are even greater. These numbers indicate that at the most likely receptors to experience an acute impact from a NO_2 concentration exceeding 402 μg/m^3, the instance is expected to take place 200 years apart. Therefore, no adverse impact is expected at any sensitive receptors. In

[16] 402 μg/m^3 represents the 470 μg/m^3 REL minus the background concentration of 68 μg/m^3.

the case of the MIBR, the expected recurrence interval is approximately 3 years, but no sensitive receptors are located on Sabey's fenceline.

Table 7-4. Frequency Analysis Summary

Location	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	MIBR	Reference
UTM X (m)	286448.5	286436	286361	286361	286361	286386	286411	286411	286636	286386	284186	277186	283186	283786	286764.8	
UTM Y (m)	5235900	5235938	5235675	5235775	5235800	5235625	5235625	5235650	5236925	5235650	5239050	5239550	5241350	5241350	5235974.6	
Total modeled 5-year period (hrs)	43824	43824	43824	43824	43824	43824	43824	43824	43824	43824	43824	43824	43824	43824	43824	A: determined from modeling files
Total number of hours exceeding 402 μg/m³ due to poor meteorological conditions (hrs)	2	4	2	1	1	3	2	4	1	2	2	1	1	1	393	B: determined from modeling files
Estimated fraction of time in any hour with poor meteorological conditions	0.0046%	0.0091%	0.0046%	0.0023%	0.0023%	0.0068%	0.0046%	0.0091%	0.0023%	0.0046%	0.0046%	0.0023%	0.0023%	0.0023%	0.8968%	C = B/A
Proposed maximum operation in 5-year period (hrs)	275	275	275	275	275	275	275	275	275	275	275	275	275	275	275	D: proposed in NOC application
Expected fraction of time when power outage occurs in a 5-year period	0.6275%	0.6275%	0.6275%	0.6275%	0.6275%	0.6275%	0.6275%	0.6275%	0.6275%	0.6275%	0.6275%	0.6275%	0.6275%	0.6275%	0.6275%	E = D/A
Probability of exceedance occurring in any hour (i.e., during power outage when poor meteorological condition occurs)	2.86E-07	5.73E-07	2.86E-07	1.43E-07	1.43E-07	4.30E-07	2.86E-07	5.73E-07	1.43E-07	2.86E-07	2.86E-07	1.43E-07	1.43E-07	1.43E-07	5.63E-05	$P_{hr} = E * C$
Overall probability of exceedance in any hour of a year	2.51E-03	5.00E-03	2.51E-03	1.25E-03	1.25E-03	3.76E-03	2.51E-03	5.00E-03	1.25E-03	2.51E-03	2.51E-03	1.25E-03	1.25E-03	1.25E-03	3.89E-01	$F = 1-(1-P_{hr})^{8760}$
Recurrence interval (years)	399	200	399	798	798	266	399	200	798	399	399	798	798	798	3	G = 1/F

Note that these recurrence intervals are calculated assuming there could be 55 hours per year of power outage (i.e., 275 hrs per 5-year period) when all engines operating at the same time is required. In actual operations, the power supply in Quincy is reliable and annual operation per year is expected to be much less than 55 hours. Since 2015, there has been one instance when the Sabey Quincy facility experienced an unplanned utility interruption, which occurred in January 2017. The approximate interruption duration was one hour. Therefore, the actual recurrence intervals are expected to be much more spread out than 200 years at the MICR/MIRR, indicating that adverse acute health effect is unlikely due to this proposed project.

7.3. CARCINOGENIC RISK ASSESSMENT

The lifetime (70 year) increased cancer risk for DPM, benzene, and naphthalene is evaluated in the HIA. Per WAC 173-460-090, the second tier review must demonstrate that the increase in TAP emissions will not result in an increased cancer risk of more than 1 in 100,000. The increase in cancer risk from the project is calculated using the following formula,

$$Risk = \frac{Conc.of\ TAP\ \left(\frac{\mu g}{m^3}\right) \times URF\ \times EF1\ \times EF2\ \times ED}{AT}$$

where EF1 is the exposure frequency in days/year, EF2 is the exposure frequency in hours/day, ED is the exposure duration in years, and AT is the averaging time in hours (613,200 hours for a 70-year average). The exposure frequencies for each receptor type are presented in Table 7-5, based on second tier reviews conducted for other facilities on Ecology's website.[17] Since only residence and business receptors were identified in the area exceeding the ASIL, only these receptor types are provided in Table 7-5 below.

Table 7-5. Exposure Frequencies

Parameter	Receptor Type	
	Residence	Business
EF1	365	250
EF2	24	8
ED	70	40

The total increase in cancer risk from the project is calculated by summing the individual increases in cancer risk for DPM, naphthalene, and benzene. In addition to calculating the project-related increase in cancer risk, the cumulative cancer risk from DPM will be calculated using the background concentration identified in Section 3.10.

The maximum annual modeled concentrations at sensitive receptors are conservatively approximated using the concentrations at the receptor with the highest modeled concentration for DPM, the pollutant that contributes the largest increase in cancer risk of the three. The maximum modeled concentration at the boundary is also analyzed. Concentrations for DPM, benzene, and naphthalene are shown in Table 7-6, which also calculates the increase in cancer risk from the proposed project. As shown in Table 7-6, the total project increase in cancer risk

[17] The exposure frequencies presented in Table 7-5 were approved by Ecology for use in the Second Tier Risk Analysis for Diesel Engine Exhaust Particulate Matter for the Microsoft Project Oxford Data Center in Quincy, Washington (issued June 13, 2014).

is well below 10 per million at each of the receptors of concern. The total risk to residential receptors from DPM, benzene, and naphthalene is at 5.50 per million, which is below 10 per million. Note that the exposure frequency at residences at 365 days per year, 24 hours per day for 70 years tends to overestimate the exposure, which results in a conservative estimate in the cancer risk increase from the project.

Table 7-6. Project Chronic Cancer Risks

Receptor Type	Maximum Annual Concentration at Receptor μg/m³ [1]			Increase in Cancer Risk (per million)			Total Increase in Cancer Risk (per million)
	DPM	Benzene	Naphthalene	DPM	Benzene	Naphthalene	
MIBR	5.39E-02	5.10E-04	9.00E-05	0.40	3.62E-04	7.49E-05	0.40
MIRR	1.83E-02	1.80E-4	3.00E-05	5.50	5.22E-03	8.70E-04	5.50
MICR	1.83E-02	1.80E-4	3.00E-05	0.72	6.81E-04	1.14E-04	0.72

[1] Residential and business receptors conservatively used the maximum modeled concentration at any receptor offsite that overlaps with a residential or commercial zone.

Cancer risk attributable to DPM is summarized in Table 7-7, which includes the background DPM concentration as well as the maximum DPM concentration increase from the project (i.e., modeled concentrations). The post-project maximum cancer risk would occur at a residential receptor that exhibited the maximum DPM modeled concentrations at 62.50 per million and the majority (approximately 91%) is attributable to the existing background.

Table 7-7. Chronic Cancer Risks Attributable to DPM

Receptor Type	Maximum DPM Annual Concentration at Receptor (μg/m³)		Cancer Risk Attributable to DPM (per million)	
	Project	Project + Background	Project	Project + Background
Boundary	5.39E-02	2.44E-01	0.40	1.79
Residential	1.83E-02	2.08E-01	5.50	62.50
Business	1.83E-02	2.08E-01	0.72	8.15

8.1. EMISSION ESTIMATES

NO_2 and DPM emissions for all engines are calculated based on the NTE values provided by the vendor, which are higher than the expected actual emission levels because there are variations when the engines are being tested. These engines are Tier 2, which indicates that actual emissions should be much lower than the emission estimates presented in this assessment.

Additionally, the annual emissions assume 55 hours per year operation of all engines. However, the actual power outage time is expected to be much less because the power source in Quincy is expected to be "exceptionally reliable".[18] There has only be one-hour since 2015 that Sabey has been required to operate due to an unplanned utility interruption. Therefore, actual impact of NO_2 and DPM is expected to be lower than the results presented in this assessment.

8.2. MODEL RESULTS

The model results are generated by AERMOD, the EPA approved and recommended steady-state plume model. AERMOD is periodically updated to refine the dispersion calculations and provide more accurate results with the intention to avoid underestimating the impacts. Although it is impossible to perfectly estimate the resultant air concentrations from the emission sources and the unforeseen weather conditions in the future, the modeled results from AERMOD are considered reliable for this assessment.

Furthermore, the NO_2 concentrations predicted by AERMOD are based on an ISR of 0.1 and background ozone concentration of 52 ppb using the PVMRM approach. The PVMRM approach is still considered as a screening technique according to Section 4.2.3.4 of Appendix W to CFR Part 51 – *Guideline on Air Quality Models* (January 17, 2017), which is intended to produce conservative model results.

Lastly, the modeled results presented in this assessment are based on the worst-case load corresponding to the relevant averaging periods. Actual operations may be in different loads than modeled, indicating the modeled results overestimate the actual impact.

8.3. TOXICITY DATA

The toxicity data, in this case the RELs and URFs, are the basis for performing the quantitative risk assessment. EPA and other agencies developing the toxicity data for risk assessments apply uncertainty factors to derive the doses or concentrations from various studies. The uncertain factors usually include interspecies extrapolation, possible human variability in sensitivity etc., which are intended to result in protective doses or concentrations.

The DPM's chronic noncancer RfC of 5 $\mu g/m^3$ is considered medium in a range of low to high confidence according to EPA's review.[19] Regarding the chronic cancer URF, EPA found that DPM has the potential to pose cancer hazard "to humans at anticipated levels of environmental exposure", "a confident dose-response relationship based on occupational exposure levels is currently lacking".[23] Therefore, EPA did not derive a

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[18] *Second Tier Review Technical Support Document* for Blackrock and Sabey Data Centers, issued on October 5, 2010.

[19] EPA Chemical Assessment Summary from Integrated Risk Information Systems (IRIS). Available at https://cfpub.epa.gov/ncea/iris/iris_documents/documents/subst/0642_summary.pdf#nameddest=rfd.

quantitative estimate of carcinogenic risk from inhalation exposure. Additional uncertainties regarding the chronic carcinogenicity of DPM EPA noted include:

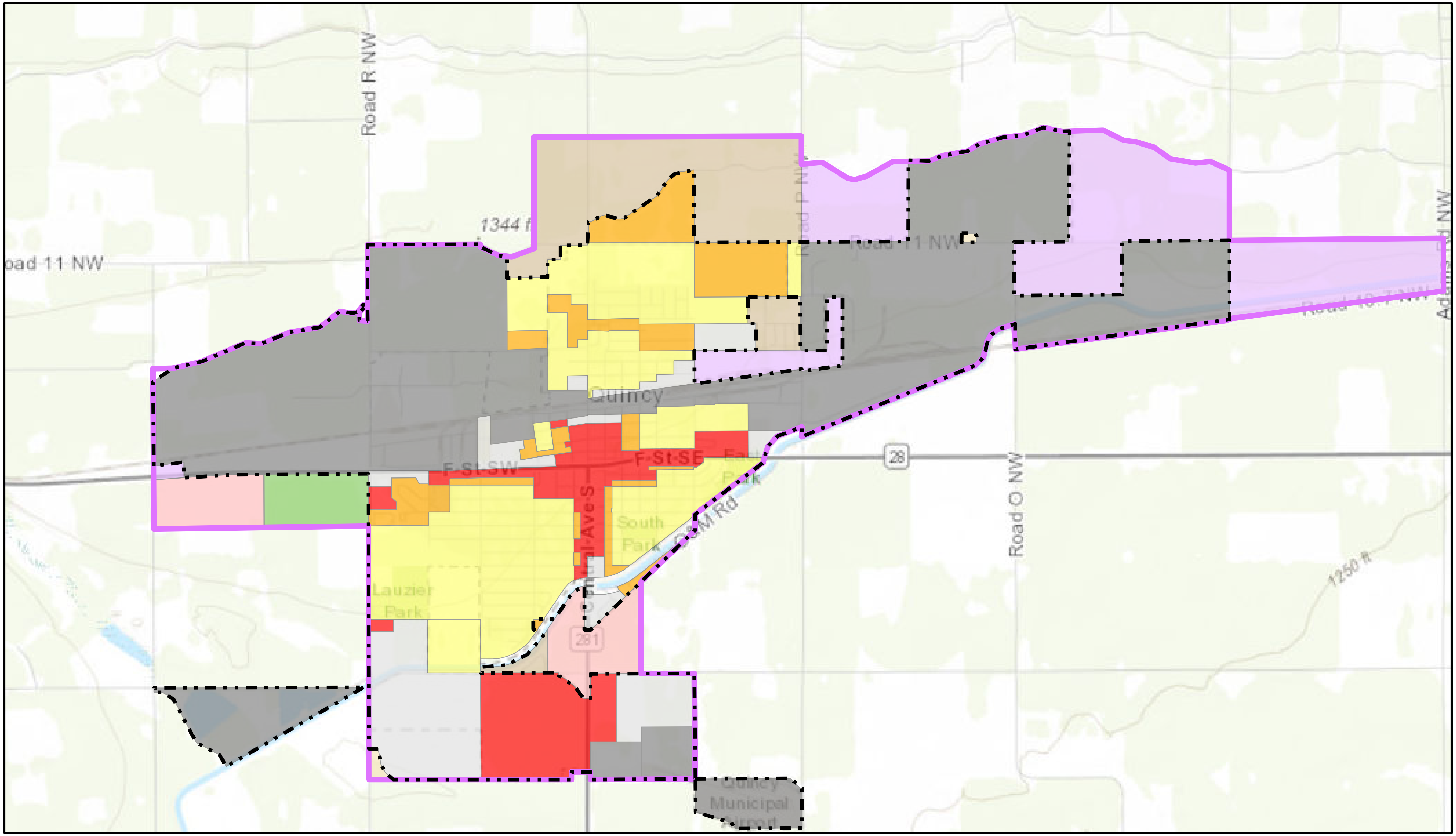
- Lack of DPM exposure data and controls in the available epidemiologic studies;
- Underlying carcinogenic effects from various constituents in DPM are unknown;
- General population and vulnerable subgroups are not well represented in available studies.

OEHHA determined an URF of 3×10^{-4} $(\mu g/m^3)^{-1}$ for DPM based additional epidemiologic studies that were available OEHHA and the range of a unit risk is 1.3×10^{-4} to 2.4×10^{-3} $(\mu g/m^3)^{-1}$, which suggests uncertainties associated with the calculated cancer risk based on the OEHHA URF that may overestimate the cancer risk.[14]

The NO_2 acute REL was also derived by OEHHA based on controlled-exposure studies of asthmatics, and the REL was established to protect the sensitive humans.[14] Therefore, a risk assessment based on this REL is considered conservative to estimate the potential acute risks for general population.

APPENDIX A: ZONING MAPS

City of Quincy



2/25/2020, 4:04:53 PM

City Limits

UGA

Zoning

City Business

City Industrial

City Light Industrial

City Residential 1

City Residential M

Grant County Commercial

Grant County Industrial

Grant County Residential High

Grant County Urban Reserve

<all other values>

1:57,831

0 0.33 0.65 1.3 mi

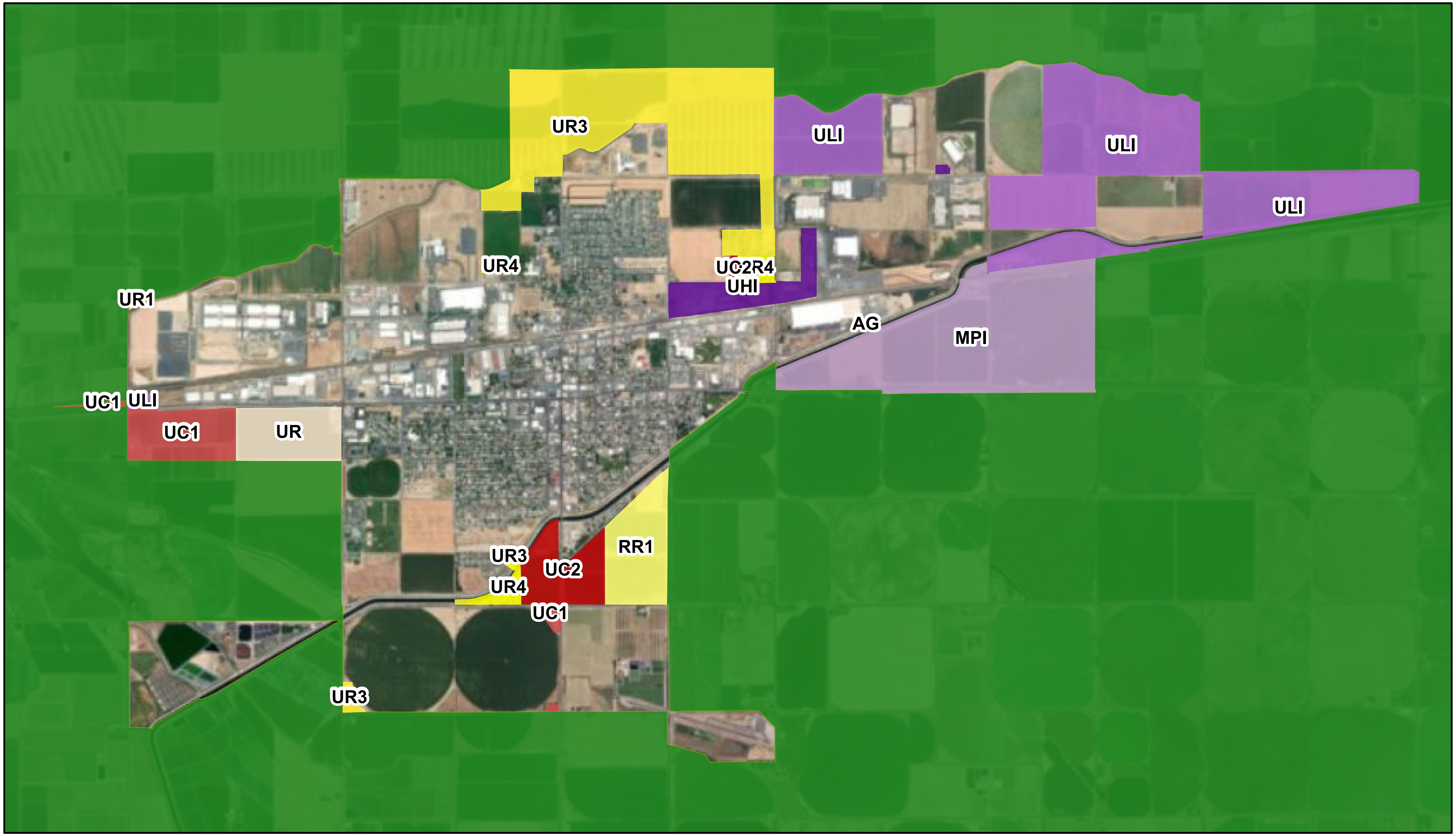
0 0.5 1 2 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

City of Quincy

Bureau of Land Management, Esri Canada, Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA |

Grant County, WA



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Land Use - Zoning

- Resource Lands - Agricultural
- Master Planned Industrial
- Rural Lands - Rural Residential 1
- UGA - Urban Commercial 1
- UGA - Urban Commercial 2
- UGA - Urban Heavy Industrial
- UGA - Urban Light Industrial
- UGA - Urban Reserve
- UGA - Urban Residential 1
- UGA - Urban Residential 3
- UGA - Urban Residential 4

1:57,831

0 0.33 0.65 1.3 mi

0 0.5 1 2 km

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Web AppBuilder for ArcGIS

APPENDIX B: TIER 2 MODEL FILES

Files are attached electronically. A directory of files is provided below.

File Name	Description
NTC1418_frequency.ami	Model input file for frequency analysis for 14 sensitive receptors.
No2_all_1-hr.pst	Post file output for frequency analysis for 14 sensitive receptors.
NTC1418_frequency_MIBR.ami	Model input file for frequency analysis for the MIBR.
No2_all_1-hr_MIBR.pst	Post file output for frequency analysis for the MIBR.