Updated Report
Second-Tier Risk Analysis for
Diesel Engine Exhaust Particulate Matter
Sabey Intergate-Quincy Data Center
Quincy, Washington

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Prepared for

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LIST OF ABBREVIATIONS AND ACRONYMS

$\times 10^{-6}$	Per Million
$\mu g/m^3$	Micrograms per Cubic Meter
$(\mu g/m^3)^{-1}$	Inverse Micrograms per Cubic Meter
µm	Micrometers
AERMOD	American Meteorological Society/EPA Regulatory Model
ASIL	Acceptable Source Impact Level
BACT	Best Available Control Technology
CalEPA	California Environmental Protection Agency
CO	Carbon Monoxide
C-#	Commercial Property of Concern (numbered)
CFR	Code of Federal Regulations
DE	Diesel Exhaust
DEEP	Diesel Engine Exhaust Particulate Matter
DPF	Diesel Particulate Filter
DPM	Diesel Particulate Matter
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ft	Feet
kWe	Kilowatts of Electrical Output
HI	Hazard Index
HIA	Health Impact Assessment
HQ	Hazard Quotient
m	Meter
MIBR	Maximally Impacted Boundary Receptor
MICR	Maximally Impacted Commercial Receptor
MIRR	Maximally Impacted Residential Receptor
MPI	Master Planned Industrial
NAAQS	National Ambient Air Quality Standards
NO_2	Nitrogen Dioxide
NOC	Notice of Construction
NO_x	Nitrogen Oxides
OEHHA	California Office of Environmental Health Hazard Assessment
PAH	Polycyclic Aromatic Hydrocarbon
$PM_{2.5}$	Particulate Matter with an Aerodynamic Diameter Less Than or Equal to 2.5 Microns
R-#	Residential Property of Concern (numbered)
RBC	Risk-Based Concentration
REL	Reference Exposure Level
RfC	Inhalation Reference Concentration
Sabey	Sabey Quincy LLC
SCR	Selective Catalytic Reduction
SQER	Small-Quantity Emission Rate
SR	State Route
TAP	Toxic Air Pollutant
tBACT	Toxics Best Available Control Technology
UGA	Urban Growth Area
URF	Unit Risk Factor
WAC	Washington Administrative Code

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1.0 EXECUTIVE SUMMARY

Sabey Quincy LLC (Sabey) has submitted to the Washington State Department of Ecology (Ecology) a *Revised Request for Approval Order Revisions (NOC Order No. 11AQ-E424)* for the Sabey Intergate-Quincy Data Center in Quincy, Washington (Landau Associates 2015). This Health Impact Assessment (HIA) report updates the second-tier risk analysis for diesel engine exhaust particulate matter (DEEP) based on the corresponding changes to facility emission rates related to those revisions. The table below summarizes the key changes in comparison to the previous 2011 HIA.

Item	Previous 2011 HIA	This 2015 Updated HIA
Number of new generators evaluated above baseline	44, each 2,000 kWe	44, each 2,000 kWe
DEEP emissions used to evaluate cancer risk	0.31 tons/year	0.467 tons/year
Generator loads at which emissions occur	Variety of loads from 10% to 100%	All DEEP is emitted at 25% load
Emissions from initial generator commissioning and periodic stack testing	Not included in cancer risk modeling	Included
"Black puff" cold-start emission adjustments	Not included in emission calculations	Included
Emissions used to evaluate maximum-year chronic non-cancer risk	0.31 tons/year, same as for cancer risk calculations	1.39 tons/year, "maximum theoretical year," assuming that the entire permitted emissions for a 3-year rolling period could occur in a single year
Maximally Impacted Residential Receptor (MIRR) location	Existing house northeast of the data center. Sabey-only DEEP cancer risk was 7 per million.	House northwest of the data center (the house evaluated in 2011 has been demolished). DEEP cancer risk is 9 per million.
Maximally Impacted Commercial Receptor (MICR) location	Business ¼ mile south of the data center. Sabey-only DEEP cancer risk was 0.4 per million.	Onsite tenant parking lot. DEEP cancer risk is 4 per million.
1^{st}-highest hourly nitrogen oxides (NO_x) emissions evaluated in nitrogen dioxide (NO_2) Second Tier HIA	991 lbs/hour during a facility-wide power outage	No change compared to 2011. Therefore, an NO_2 Second Tier HIA is not required.

1.1 PROPOSED PROJECT

Sabey Corporation operates the Intergate-Quincy Data Center in Quincy, Washington. Permitted air pollutant emission sources include emergency diesel generators, and drift particulate emissions from rooftop cooling units. Sabey applied for a Notice of Construction (NOC) air quality permit in February through June 2011 by providing a series of formal application reports and several addenda to revise the generator runtime estimates and generator emission estimates. The data center was proposed to be constructed in phases. Phase 1 consists of tenants and equipment in Building C, and future Phases 2 and 3 will consist of tenants and equipment in Buildings A and B.

Ecology issued NOC Order 11AQ-E424 on August 5, 2011 with provision that the construction approval would be rescinded for any generators whose construction did not begin within 18 months after issuance of the permit. Construction of the data center has proceeded smoothly, but more slowly than Sabey anticipated. Sabey has now constructed most of the generators and cooling units for Phase 1 (Building C). The 18-month construction deadline specified by the permit has now lapsed, but Sabey has not yet begun construction of Buildings A and B. Additionally, Sabey evaluated air quality impacts associated with the proposed changes in the aforementioned Revised Request for Approval Order Revisions submitted to Ecology's Eastern Regional Office (Landau Associates 2015). As documented, potential emissions of DEEP from the full-buildout emergency diesel generators (44 combined generators, including the existing and proposed future generators) may cause ambient air impacts that exceed the Washington State Acceptable Source Impact Level (ASIL). Based on that modeled exceedance, Sabey is required to submit a second-tier petition per Chapter 173-460 of the Washington Administrative Code (WAC).

Ecology has implemented a cumulative approach to evaluating health impacts from Quincy data centers because the engines are within close proximity to other background sources of DEEP. As part of the cumulative approach, this Second-Tier HIA report considers the cumulative impacts of DEEP from the proposed generators, nearby existing permitted sources, and other background sources including highways and a nearby railroad.

1.2 HEALTH IMPACTS EVALUATION

This HIA demonstrates that the ambient cancer risks and non-cancer risks caused by emissions of DEEP from the proposed project are less than Ecology's approval limits. Under worst-case exposure assumptions involving residents standing outside their homes for 70 continuous years, the 44 emergency diesel engine generators could cause an increased cancer risk of up to 9 per million (9×10^{-6}) at the maximally impacted residence. Because the increase in cancer risk attributable to the proposed project alone would be less than the maximum risk allowed by a second-tier review, which is 10 per million (10×10^{-6}), the project is permissible under WAC 173-460-090.

Based on the cumulative maximum DEEP concentration at a residential location near the Sabey Data Center, the estimated maximum potential cumulative cancer risk posed by DEEP emitted from the proposed project and background sources within the area would be approximately 47 per million (47×10^{-6}) at the most impacted residential receptor. Most of the DEEP cancer risk at that location would be caused by currently-permitted emissions from the existing Intuit Data Center and Vantage Data Center.

1.3 CONCLUSIONS

Project-related health risks are within permissible limits under WAC 173-460-090. Therefore, the project is approvable under WAC 173-460-090.

2.0 INTERGATE-QUINCY DATA CENTER PROJECT

2.1 DESCRIPTION OF PROPOSED DEVELOPMENT OF SABEY DATA CENTER

Sabey has proposed to develop the Intergate-Quincy Data Center in Quincy, Washington. A vicinity map is provided as Figure 2-1. The maximum DEEP concentrations are modeled to occur at the parking lot of one of the onsite tenant buildings. The site layout and the proposed location of the backup diesel engine generators are shown on Figure 2-2. The data center will be constructed in three phases. Phase 1 is complete and included 12 of the originally proposed 44 emergency diesel generators, which are installed inside of Building C. Construction of Buildings A and B with 32 remaining diesel generators (Phases 2 and 3) will be market-driven as the multi-facility permit covers options for several information technology tenants to lease space in the three buildings of the Intergate-Quincy Data Center.

Each building (Buildings A and B) will be constructed with 16 Tier 2-certified backup diesel engine generators. It is assumed that all generators in Buildings A and B will have an electrical capacity of 2,000 kilowatts of electrical output (kWe), rated at 2,937 brake horsepower, while most of the installed emergency generators at Building C (installed during Phase 1) are 1,500 kWe. Each diesel engine generator will have its own 48-foot-tall (above ground) vertical exhaust stack emitting from the rooftop of their respective buildings. Air intake is collected from the air handling units on the rooftops of each building, so Ecology has specified that all of the individual tenants within the facility must be considered public receptors, in which case the National Ambient Air Quality Standards (NAAQS) and the ASILs apply within the facility boundary.

2.2 FORECAST EMISSION RATES

Air pollutant emission rates were calculated for the sources identified in Section 2.1 in accordance with WAC 173-460-050. Emission rates were quantified for criteria pollutants and toxic air pollutants (TAPs). Detailed emission calculation spreadsheets were provided with the Revised Request for Approval Order Revisions (Landau Associates 2015). Table 2-1 lists the maximum facility-wide TAP emission rates based on those calculations. The emission estimates presented in this report have been conservatively calculated for diesel engine generators that meet U.S. Environmental Protection Agency (EPA) Tier 2 emission limits.

This HIA assumes an emission baseline of zero for the Intergate-Quincy Data Center, so the emissions from the entire data center (44 combined generators) are evaluated rather than only the incremental increased emissions for the 32 future generators. Two sets of DEEP emission rates were used to evaluate potential health risks:

- Cancer risks were evaluated using the 70-year average emission rate (0.467 tons per year), including initial generator commissioning and periodic stack emission testing, and including "black puff" cold-start adjustment factors.
- Chronic non-cancer risks were evaluated using the theoretical maximum emission rate (1.39 tons per year), assuming all of the permitted emissions within a 3-year rolling period would occur in a single year.

2.3 LAND USE AND ZONING

Land uses in the vicinity are presented on Figure 2-3. The parcel on which the data center is located is zoned as an Urban Growth Area (UGA), and is surrounded on all sides by other parcels that are zoned for Master Planned Industrial (MPI), UGA, or Agriculture (see Figure 2-4). Most of the parcels are agricultural land, but currently developed parcels include three existing data centers (Intuit, Vantage, and Yahoo!), commercial businesses, and two residential parcels (the key residential receptor is at the existing house at the northwest corner of the Intergate-Quincy Data Center, and a second house is located approximately ½ mile to the south).

2.4 SENSITIVE RECEPTORS

The land use zoning areas and notable developments on properties surrounding the Intergate-Quincy Data Center are listed in Table 2-2. The surrounding reasonable maximum exposure receptors for the DEEP health impact analysis consist of two homes to the northwest (R-1) and southeast (R-2), three neighboring data centers (Intuit, Vantage, and Yahoo!), and Columbia Colstor's food storage warehouse (C-1) to the southwest. The project site is also surrounded by undeveloped commercial or agricultural land.

In the original 2011 HIA for DEEP (associated with the original approval order), a single-family residence was located to the northeast of the facility and identified as the receptor of primary interest (Ecology 2011). This house has since been vacated and demolished. Therefore, the key residential receptor used for this HIA is now the existing house at the northwest corner of the Intergate-Quincy Data Center. There are no schools, hospitals, or commercial daycare facilities located near enough to the project site to be potentially exposed to project-related annual-average DEEP concentrations higher than the ASIL.

Each onsite building will house tenants (independent of other tenants within the facility) where employees may spend their working hours, and therefore was included as a sensitive onsite receptor (C-2) in this analysis. Modeling receptors were placed on the rooftop of each onsite building and in the ground-level parking lots at each building.

3.0 PERMITTING REQUIREMENTS FOR NEW SOURCES OF TOXIC AIR POLLUTANTS

3.1 OVERVIEW OF THE REGULATORY PROCESS

The requirements for conducting a toxics screening are established in Chapter 173-460 WAC. This rule requires a review of any non-*de minimis*[1] increase in TAP emissions for all new or modified stationary sources in Washington State. Sources subject to review under this rule must apply Best Available Control Technology (BACT) for toxics (tBACT) to control emissions of all TAPs subject to review.

There are three levels of review when processing an NOC application for a new or modified emissions unit emitting TAPs in excess of the *de minimis* levels: 1) first-tier (toxic screening); 2) second-tier (health impact assessment); and 3) third-tier (risk management decision).

All projects with emissions exceeding the *de minimis* levels are required to undergo a toxics screening (first-tier review) as required by WAC 173-460-080. The objective of the toxics screening is to establish the systematic control of new sources emitting TAPs in order to prevent air pollution, reduce emissions to the extent reasonably possible, and maintain such levels of air quality to protect human health and safety. If modeled emissions exceed the trigger levels called ASILs, a second-tier review is required.

As part of a second-tier petition, described in WAC 173-460-090, the applicant submits a site-specific HIA. The objective of an HIA is to quantify the increase in lifetime cancer risk for persons exposed to the increased concentration of any carcinogen, and to quantify the increased health hazard from any non-carcinogen that would result from the proposed project. Once quantified, the cancer risk is compared to the maximum risk allowed by a second-tier review, which is 10 in 1 million, and the concentration of any non-carcinogen that would result from the proposed project is compared to its effect threshold concentration.

In evaluating a second-tier petition, background concentrations of the applicable TAPs must be considered. If the emissions of a TAP result in an increased cancer risk of greater than 10 in 1 million (equivalent to 1 in 100,000), then an applicant may request that Ecology conduct a third-tier review. For non-carcinogens, a similar path exists, but there is no specified numerical criterion to indicate when a third-tier review is triggered.

[1] If the estimated increase of emissions of a TAP or TAPs from a new or modified project is below the *de minimis* emissions threshold(s) found in WAC 173-460-150, the project is exempt from review under Chapter 173-460 WAC.

3.2 BACT AND TBACT FOR THE SABEY DATA CENTER

Ecology is responsible for determining BACT and tBACT for controlling criteria pollutants and TAPs emitted from the proposed project. On behalf of Sabey, Landau Associates conducted an updated BACT/tBACT analysis as presented in the revised permit application (Landau Associates 2015). This analysis identified four technically feasible add-on control technologies: a urea-based selective catalytic reduction system (SCR), a diesel oxidation catalyst, a catalyzed-diesel particulate filter (DPF), and an integrated control package with the SCR and catalyzed-DPF combined. The BACT/tBACT analysis concluded that each of the add-on control technologies failed the BACT cost-effectiveness evaluation. Therefore, none of the add-on controls should be considered BACT. Instead, the BACT requirement should be emission controls inherent to EPA Tier 2-certified diesel engines. These proposed BACT and tBACT determinations are summarized in Tables 3-1 and 3-2, respectively. Additional restrictions proposed in the Revised Request for Approval Order Revisions (Landau Associates 2015) include:

- Limits on the total number of hours that the emergency diesel engines operate per year (based on a 3-year rolling average)
- Use of ultra-low sulfur diesel fuel (15 parts per million sulfur content)
- Compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart IIII.

3.3 FIRST-TIER TOXICS SCREENING REVIEW FOR SABEY DATA CENTER

The first-tier TAP assessment compares the expected emission rates to their specific Small-Quantity Emission Rate (SQERs) and compares the maximum predicted ambient air impacts that may occur outside the property boundary to the corresponding ASIL. Table 3-3 compares estimated emission rates for each TAP expected to the respective SQERs. These SQER values are emission thresholds below which Ecology does not require an air quality impact assessment for the listed TAP.

Seven TAPs [DEEP, nitrogen dioxide (NO_2), carbon monoxide (CO), benzene, 1,3-butadiene, acrolein, and naphthalene] could theoretically be emitted from the Sabey emergency diesel engines at a rate predicted to exceed their SQER; therefore, an ambient air impact assessment was required for those TAPs. This involved atmospheric dispersion modeling to estimate the 1st-highest 1-hour, 1st-highest 24-hour, or annual (based on the averaging period listed for the respective TAP in WAC 173-460-150) ambient air impacts at or beyond the property line and comparison of the modeling results to the TAP-specific ASILs (WAC 173-460-080).

For first-tier screening, the ambient impacts were predicted based on a worst-case operational scenario with the ambient concentrations predicted using the American Meteorological Society/EPA Regulatory Model (AERMOD). Table 3-4 presents the first-tier ambient air concentration screening analysis for these seven TAPs. DEEP and NO_2 are the only TAPs with emissions expected to exceed the

ASIL and, therefore, those two pollutants require a second-tier HIA. This report presents the Intergate-Quincy Data Center second-tier risk analysis for DEEP emission rates predicted from operating conditions described in the Revised Request for Approval Order Revisions (Landau Associates 2015). The requested revisions do not increase the currently-permitted limits for maximum 1-hour NO_2 emissions. Sabey will continue to meet the same permit conditions related to NO_2 emissions as agreed to in the original approval order. Therefore, a new HIA for NO_2 is not required.

3.4 SECOND-TIER REVIEW PROCESSING REQUIREMENTS

In order for Ecology to review the second-tier petition, each of the following regulatory requirements under WAC 173-460-090 must be satisfied:

(a) The permitting authority has determined that other conditions for processing the NOC Order of Approval have been met, and has issued a preliminary approval order.

(b) Emission controls contained in the preliminary NOC approval order represent at least tBACT.

(c) The applicant has developed an HIA protocol that has been approved by Ecology.

(d) The ambient impact of the emissions increase of each TAP that exceeds ASILs has been quantified using refined air dispersion modeling techniques as approved in the HIA protocol.

(e) The second-tier review petition contains an HIA conducted in accordance with the approved HIA protocol.

3.5 SECOND-TIER REVIEW APPROVAL CRITERIA

As specified in WAC 173-460-090(7), Ecology may recommend approval of a project that is likely to cause an exceedance of the ASIL for one (or more) TAPs only if:

- Ecology determines that the emission controls for the new and modified emission units represent tBACT
- The applicant demonstrates that the increase in emissions of TAPs, caused solely by project emissions, is not likely to result in an increased cancer risk of more than 1 in 100,000 population ($10x10^6$ cancer risk)
- Ecology determines that the non-cancer hazard is acceptable.

The remainder of this document discusses the HIA for DEEP conducted by Landau Associates.

4.0 HEALTH IMPACT ASSESSMENT

This HIA was conducted according to the requirements of WAC 173-460-090 and guidance provided by Ecology. The HIA addresses the public health risk associated with exposure to DEEP from Sabey's proposed emergency diesel engine generators and existing sources of DEEP in the vicinity. While the HIA is not a complete risk assessment, it generally follows the four steps of the standard health risk assessment approach proposed by the National Academy of Sciences (NAS 1983, 1994). These four steps are (1) hazard identification, (2) exposure assessment, (3) dose-response assessment, and (4) risk characterization. As described later in this document, the HIA did not consider exposure pathways other than inhalation.

4.1 HAZARD IDENTIFICATION

Hazard identification involves gathering and evaluating toxicity data on the types of health injury or disease that may be produced by a chemical, and on the conditions of exposure under which injury or disease is produced. It may also involve characterization of the behavior of a chemical within the body and the interactions it undergoes with organs, cells, or even parts of cells. This information may be of value in determining whether the forms of toxicity known to be produced by a chemical agent in one population group or in experimental settings are also likely to be produced in human population groups of interest. Note that risk is not assessed at this stage. Hazard identification is conducted to determine whether and to what degree it is scientifically correct to infer that toxic effects observed in one setting will occur in other settings (e.g., are chemicals found to be carcinogenic or teratogenic in experimental animals also likely to be so in adequately exposed humans?).

Although the second-tier HIA is triggered solely by potential ambient air impacts of DEEP, the toxicity of other TAPs with emission rates exceeding the SQERs was also reviewed to consider whether additive toxicological effects should be considered in the HIA.

4.1.1 OVERVIEW OF DEEP TOXICITY

Diesel engines emit very small, fine [smaller than 2.5 micrometers (µm)] and ultrafine (smaller than 0.1 µm) particles. These particles can easily be inhaled deep into the lung tissue. Mounting evidence indicates that inhaling fine particles can cause numerous adverse health effects.

Studies of humans and animals specifically exposed to DEEP show that diesel particles can cause both acute and chronic health effects including cancer. Ecology has summarized these health effects in a document titled *Concerns about Adverse Health Effects of Diesel Engine Emissions* (Ecology 2008).

The following health effects have been associated with exposure to very high concentrations of diesel particles, primarily in industrial workplace settings (e.g., underground mines that use diesel equipment) with concentrations much higher than the ambient levels that will be caused by the Intergate-Quincy Data Center:

- Inflammation and irritation of the respiratory tract
- Eye, nose, and throat irritation along with coughing, labored breathing, chest tightness, and wheezing
- Decreased lung function
- Worsening of allergic reactions to inhaled allergens
- Asthma attacks and worsening of asthma symptoms
- Heart attack and stroke in people with existing heart disease
- Lung cancer and other forms of cancer
- Increased likelihood of respiratory infections
- Male infertility
- Birth defects
- Impaired lung growth in children.

It is important to note that the estimated levels of DEEP emissions from the proposed project that could potentially impact people will be much lower than levels associated with many of the health effects listed above. For the purpose of determining whether Sabey's project-related and cumulative DEEP impacts are acceptable, (i) non-cancer hazards and (ii) cancer risks are evaluated and presented in the remaining sections of this document.

4.2 EXPOSURE ASSESSMENT

An exposure assessment involves estimating the extent that the public is exposed to a chemical substance emitted from a facility. The local public is similarly exposed to background DEEP from vehicle emissions at roadways and railroad and to DEEP emission from other nearby data centers. Ecology has implemented a cumulative approach to evaluating health impacts from Quincy data centers because the engines are within close proximity to other data center with existing DEEP emission sources. As part of the cumulative approach, this second-tier HIA considers the cumulative impacts of DEEP from the proposed generators, nearby existing permitted sources, and other background sources including highways and the nearby railroad. This HIA for DEEP involves:

- Identifying routes of exposure
- Estimating long- and/or short-term offsite pollutant concentrations
- Identifying reasonable maximum exposure receptors (from project-related emissions)

- Estimating the duration and frequency of receptors' exposure
- Evaluating cumulative exposure levels and the quantifying increased health risk.

4.2.1 Identifying Routes of Potential Exposure

Humans can be exposed to chemicals in the environment through inhalation, ingestion, or dermal contact. The primary route of exposure to most air pollutants is inhalation; however, some air pollutants may also be absorbed through ingestion or dermal contact. Ecology uses guidance provided in California's *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* (CalEPA 2003) to determine which routes and pathways of exposure to assess for chemicals emitted from a facility. Chemicals for which Ecology assesses multiple routes and pathways of exposure are presented in Table 4-1.

DEEP consists of ultra-fine particles (approximately 0.1 to 1 micron in size) that behave like a gas and do not settle out of the downwind plume by gravity. DEEP particles will eventually be removed from the atmosphere and can be slowly deposited onto the ground surface by either molecular diffusion or by being incorporated into rain droplets, but that deposition process is slow and will likely occur many miles downwind of the Intergate-Quincy Data Center. At those far downwind distances, the resulting DEEP concentrations in the surface soil will likely be indistinguishable from regional background values.

It is possible that very low levels of polycyclic aromatic hydrocarbons (PAHs) and the few other persistent chemicals in DEEP will build up in food crops, soil, and drinking water sources downwind of the Intergate-Quincy Data Center. However, given the very low levels of PAHs and other multi-exposure route-type TAPs that will be emitted from the proposed project, quantifying exposures via pathways other than inhalation is very unlikely to yield significant concerns. Furthermore, inhalation is the only route of exposure to DEEP that has received sufficient scientific study to predict human health risk. Therefore, only inhalation exposure to DEEP is evaluated in this HIA.

4.2.2 Estimating Particulate Concentrations

Two sets of DEEP emission rates were used to evaluate potential health risks:

- Cancer risks were evaluated using the 70-year average emission rate (0.467 tons per year), including initial generator commissioning and periodic stack emission testing.
- Chronic non-cancer risks were evaluated using the theoretical maximum emission rate (1.39 tons per year), assuming that all of the permitted emissions within a 3-year rolling period would occur in a single year.

To estimate project-related DEEP concentrations at locations beyond the facility boundary, Landau Associates conducted air dispersion modeling. This incorporated project-specific emission rates with meteorological, geographical, and terrain information to estimate pollutant concentrations downwind of the project site. Each of the proposed diesel generators were modeled as an individual emission source.

DEEP ambient air impacts from the Sabey project were modeled using the following air dispersion model inputs:

- AERMOD with the Plume Rise Model Enhancements algorithm for building downwash (Version 12345).
- Five years of sequential hourly meteorological data from Grant County International Airport (2001 to 2005).
- Twice-daily upper air data from Spokane, Washington (2001 to 2005) to define mixing heights.
- Grant County area digital topographical data in the form of Digital Elevation Model files (which describe local topography and terrain).
- Grant County area digital land classification files (which describe local topography).
- The emissions for each diesel engine were modeled with stack heights of 48 feet (ft) for the Intergate-Quincy Data Center, 20 to 30 ft (Yahoo! Data Center), 40 ft (Intuit Data Center), and 41 ft (Vantage Data Center) above ground level.
- The building dimensions for the surrounding buildings (at the project site, Yahoo! Data Center, Intuit Data Center, and Vantage Data Center) were included in order to account for building downwash dispersion effects.
- The receptor grid for the AERMOD modeling domain at or beyond the facility boundary was established using a variable Cartesian grid:
  - 10-meter (m) spacing from emission source to 350 m
  - 25-m spacing from 350 m to 800 m
  - 50-m spacing from 500 m to 2,000 m
  - 100-m spacing beyond 2,000 m.

For cumulative risk analysis, the local background emissions of DEEP from permitted diesel generators at neighboring data centers—as well as emission rates for the highways and the nearby railroad—were taken from previous estimates shown in Ecology's *Sabey Data Center Second-Tier Risk Report* (Ecology 2011). Since the time of publication, the Vantage Data Center has been permitted to install diesel emergency generators. The local background emission estimates from the Vantage Data Center—used in this HIA—were previously derived in that project's HIA (ICF 2012).

4.2.3 IDENTIFYING REASONABLE MAXIMUM EXPOSURE RECEPTORS

There are several different reasonable maximum exposure receptors within the general vicinity of the Intergate-Quincy Data Center. In order to capture worst-case exposure scenarios, Ecology typically considers ambient impact levels at maximally impacted (i) Boundary, (ii) Residential, and (iii) Business and Commercial areas as risk receptors. These are evaluated in addition to sensitive receptors such as hospital, church and schoolyard, or daycare facilities. Those vicinity-specific locations where people may potentially be exposed to project-related DEEP emission are shown on Figure 2-3 and discussed in Section 2.4.

4.2.3.1 Maximally Impacted Receptors

The 70-year annual-average DEEP concentrations near the Intergate-Quincy Data Center were modeled based on allowable emissions from the proposed project. Figure 4-1 is a color-coded contour map that shows these predicted 70-year annual-average concentrations. On Figure 4-1, the blue contour line represents concentrations expected to be at or below the DEEP-specific ASIL [0.0033 micrograms per cubic meter ($\mu g/m^3$)]. The area outside this blue contour line was predicted to be exposed to concentrations less than the ASIL.

The project-related ambient impacts at each reasonable maximum exposure receptors (discussed in Section 2.4) are detailed on Figure 4-1 and summarized in Table 4.2. These consist of:

- The maximally impacted boundary receptor (MIBR) on the northern property boundary
- The maximally impacted residential receptor (MIRR) at the northwest home (R-1)
- The maximally impacted commercial receptor (MICR) at the onsite tenant's northwest parking lot to Building A.

The 70-year average exposure concentration at each of these three maximally impacted receptors was used to estimate the potential for both carcinogenic and non-cancer health impacts from project-related DEEP emissions.

4.2.4 Exposure Frequency and Duration

The likelihood that someone would be exposed to DEEP from the Intergate-Quincy Data Center depends on local wind patterns, the frequency of engine testing, and how much time people spend in the immediate area. As discussed previously, the air dispersion model uses emission and meteorological information (and other assumptions) to determine ambient DEEP concentrations in the vicinity of the Intergate-Quincy Data Center.

This analysis considers the land use surrounding the proposed Intergate-Quincy Data Center to estimate the amount of time a given receptor could be exposed. For example, people are more likely to be exposed frequently and for a longer duration if the source impacts residential locations because people spend much of their time at home. People working at industrial or commercial properties in the area are likely exposed to project-related emissions only during the hours that they spend working near the facility.

This analysis uses simplified assumptions about receptors' exposure frequency and duration and assumes that people located at residential receptors are potentially continuously exposed, meaning they never leave their property. These behaviors are not typical; however, these assumptions are intended to avoid underestimating exposure so that public health protection is ensured. Workplace and other non-residential exposures are also considered, but adjustments are often made because the amount of time that people spend at these locations is more predictable than time spent at their homes. These adjustments (described in Section 4.4.2) were used to estimate cancer risk with intermittent exposure to DEEP.

4.2.5 Background Exposure to Pollutants of Concern

In accordance with WAC 173-460-090, background concentrations of DEEP were considered as part of this second-tier review. The word "background" is often used to describe exposures to chemicals that come from existing sources, or sources independent of but within the vicinity of the proposed project.

Regional background DEEP concentrations from the EPA's National Air Toxics Assessment database are sometimes used, but not in this case because Ecology has concluded that site-specific modeling of the local highways and railroads provides a more realistic spatial determination of regional background concentrations. To estimate DEEP background concentrations, ambient air impacts from the railroad, State Route (SR) 28, SR 281, the Yahoo! Data Center, Intuit Data Center, and Vantage Data Center were evaluated according to methodology described in Section 4.2.2.

4.2.6 Cumulative Exposure to DEEP

As discussed previously, this HIA considers the cumulative impacts of DEEP—from the proposed generators, nearby data centers, and other background sources including highways and the railroad—for evaluating cancer risk. Therefore, the predicted project-related impacts, at each of the maximally impacted receptors, were summed with the background concentrations of DEEP from each location. Table 4-3 shows results based on a conservatively high assumption that DEEP emissions from the Sabey generators consist of the total particulate matter (filterable "front-half" plus condensable "back-half" emissions).

Using this conservative calculation method, the maximum 70-year cumulative concentration at the MIBR, MIRR, and MICR is estimated to be 0.152, 0.156, and 0.180 $\mu g/m^3$ respectively. The MIBR is found at the northern property line, while the MICR is located at the onsite receptor in the northwest parking lot of Building A.

It is important to note that the estimated ambient levels of DEEP are based on allowable (permitted) emissions instead of actual emissions. Actual emissions are likely to be lower than what the facilities are permitted for, but worst-case emissions were evaluated in order to avoid underestimating cumulative DEEP exposure concentrations. Additionally, it is not likely that the tenant employees would spend all of their working hours in the parking lot of the facility (at the MICR), but this evaluation will be conservatively protective to consider the health impact risk in the traditional exposure duration for commercial receptors.

4.3 DOSE-RESPONSE ASSESSMENT

Dose-response assessment describes the quantitative relationship between the amounts of exposure to a substance [dose, which in this case is inhalation concentration as micrograms per cubic meter ($\mu g/m^3$)] and the occurrence of injury (response). The process involves establishing a toxicity value or dose level as a criterion to compare use in assessing potential health risk. In this HIA, a calculated ambient impact expected from project-related emissions is compared to a threshold level for anticipated carcinogenic or toxic response.

4.3.1 DOSE-RESPONSE ASSESSMENT FOR DEEP

Based on the assumption that thresholds exist for certain toxic effects, the EPA has estimated a toxicological threshold level [Inhalation Reference Concentration (RfC)] for DEEP and other toxic substances (EPA 2002; EPA website 2013). In general, the RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily inhalation exposure (during an estimated 70-year lifespan) to the human population (including sensitive subgroups like children, elderly, and pregnant women) that is likely to be without an appreciable risk of deleterious health effects. The threshold level for DEEP was derived from highly variable human epidemiological studies, as well as, controlled animal laboratory test studies with known exposure concentrations to DEEP.

The California Office of Environmental Health Hazard Assessment (OEHHA) has likewise estimated concentration threshold levels, analogous to the RfC, called Reference Exposure Levels (RELs; CalEPA 1998). Both agencies consider 5 $\mu g/m^3$ as the ambient concentration of DEEP at which long-term exposure is not expected to cause adverse health effects. NAAQS and other regulatory toxicological values for short- and intermediate-term exposure to particulate matter have been promulgated, but values specifically for DEEP exposure at these intervals do not currently exist.

OEHHA has also derived unit risk factors (URF) to estimate cancer risk from exposure to carcinogenic substances. The URF for DEEP is based on a meta-analysis of several epidemiological studies of humans occupationally exposed to DEEP. URFs are expressed as the upper-bound probability of developing cancer, assuming continuous lifetime exposure to a substance at a concentration of 1 $\mu g/m^3$, and are expressed in units of inverse concentration [i.e., $(\mu g/m^3)^{-1}$]. OEHHA's URF for DEEP is 0.0003 $(\mu g/m^3)^{-1}$ meaning that a lifetime of exposure to 1 $\mu g/m^3$ of DEEP is expected to result in an increased individual cancer risk of 0.03 percent. In other words, for a human population of 10,000 exposed to 1 μg/m^3 of DEEP over a 70-year lifespan, 3 excess cancer cases could theoretically be expected to occur.

Table 4-4 summarizes the carcinogenic and non-cancer health effect levels for DEEP, as well as those TAPs identified in the first-tier (toxic screening) as TAPs emitted above the SQER.

4.4 RISK CHARACTERIZATION

Risk characterization involves the integration of data analyses from each step of the HIA to determine the likelihood that the human population in question will experience any of the various health effects associated with a chemical under its known or anticipated conditions of exposure. Chemical exposure may have harmful or toxic effects (non-cancerous), as well as carcinogenic effects. Several chemicals have both acute (short-term exposure) and chronic (long-term exposure) impacts; meaning that a low dose over time may be as harmful as a sudden heavy dose.

This analysis addresses:

- First, the non-cancer adverse health risks for chronic DEEP exposure, along with the added impact from other TAPs emitted in diesel exhaust.
- Then it will assess the chronic carcinogenic effects and added impact from other TAPs emitted in diesel exhaust.
- Acute exposure to DEEP, at these concentration levels, is not expected to be carcinogenic.
- Finally, this HIA will predict the cumulative cancer risk for Sabey's project-related DEEP emissions with ambient background concentrations of DEEP (summed with background DEEP concentrations caused by the surrounding data center DEEP emissions and railroad/roadways).

4.4.1 EVALUATING NON-CANCER HAZARDS

This section addresses the potential for adverse health effects (toxic but non-cancer health impacts) from project-related emissions. This analysis was evaluated based on the conservatively high emission rates during the maximum theoretical 12-month period (with all of the permitted 3-year rolling emissions occurring in a single year). In order to evaluate the potential for non-cancer health effects that may result from exposure to DEEP, the modeled concentrations predicted to occur at each receptor location of concern are identified as the MIBR, MIRR, and MICR (see Section 4.2.3.1). There are no schools or hospitals within the modeling domain that are expected to be impacted by project-related DEEP at a level that would exceed the ASIL.

The DEEP concentrations at the MIBR, MIRR, and MICR due to project-related emissions were compared to the relevant non-cancer toxicological values (listed in Table 4-4). If a predicted ambient impact at these locations is expected to be greater than the health effect threshold levels (i.e., RfC, REL) the potential for deleterious health effects is anticipated.

The Hazard Quotient (HQ) at each maximally impacted receptor was derived using the equation below. This compares the magnitude of the ambient impact to the threshold concentration.

$$HQ = \frac{\text{Concentration of pollutant in air } (\mu g/m^3)}{\text{RfC or REL}}$$

A HQ of 1 or less indicates that the exposure to a substance is not likely to result in adverse health effects and the associated projected emissions may be considered permissible. A HQ greater than 1 indicates only a potential for adverse health effects. As the HQ increases above 1, the increased health risk cannot (not necessarily for every chemical) be assumed to be proportionally linear. Without extensive scientific research (to derive a slope factor or other extrapolation parameters), the degree of added potential is unknown.

It should also be noted that, considering the degree of uncertainty in estimating the reference dose (RfC or REL), an HQ above 1 may not necessarily result in adverse health impacts. These toxicological threshold values were derived with several safety factors when extrapolating laboratory animal data and to account for individual human variation of toxicological response, they are estimated conservatively high in the interest of protecting human health.

4.4.1.1 Hazard Quotient – DEEP

HQs were calculated at each maximally impacted receptor. Because chronic toxicity values (RfCs and RELs) are based on a continuous exposure, an adjustment is sometimes necessary or appropriate to account for shorter receptor exposure periods (i.e., people working at business/commercial properties who are exposed for only 8 hours per day, 5 days per week). While EPA risk assessment guidance recommends adjusting to account for periodic instead of continuous exposure, OEHHA does not employ this practice. For the purpose of this evaluation, an RfC or REL of 5 $\mu g/m^3$ was used as the chronic risk-based concentration for all scenarios where receptors could be exposed frequently (e.g., residences, work places, or schools). Therefore, the chronic HQ for DEEP exposure was based on the worst-case scenario (if the maximum emissions for a 3-year rolling period were emitted in a single year) and calculated using following equation:

$$\text{Chronic HQ} = \frac{\text{theoretical maximum-year project-related impact } (\mu g/m^3)}{5\ \mu g/m^3}$$

Table 4-5 shows these chronic HQs attributable solely to DEEP exposure from Sabey’s diesel generators at each maximally impacted receptor. The calculated HQs at every maximally impacted receptor are well below 0.10. This indicates that (non-cancer) adverse health effects are not likely to result from chronic exposure to project-related DEEP at these locations.

4.4.1.2 Combined Hazard Quotient for All TAPs Whose Emission Rates Exceed SQERs

The non-cancer health impacts were evaluated based on conservatively high emission rates during the maximum theoretical 12-month period. This considers that a 3-year rolling average permit limit allows the potential for emitting the 3-year rolling maximum entirely within a single year. This unlikely but possible event is considered the ultra-worst case scenario for project-related emissions from the emergency diesel generators. Six TAPs other than DEEP (NO_2, CO, benzene, 1,3-butadiene, acrolein, and naphthalene) to be emitted by Sabey's diesel generators have emission rates exceeding their respective SQERs and, therefore, are subject to further evaluation. NO_2 is the only other project-related TAP that exceeds the ASIL and triggers a second-tier risk assessment. The corresponding HIA for NO_2 was conducted in 2011 as a supplement to the original approval order. Sabey has requested that Ecology retain the current maximum 1-hour NO_x and NO_2 emission limits, so Sabey's requested changes will not increase the maximum 1-hour NO_2 concentrations.

The receptor locations of concern have been identified as the MIBR, MIRR, and MICR. Table 4-6 shows modeled concentrations, risk-based concentrations (RBCs), and HQs for each maximally impacted receptor. All modeled concentrations and RBCs are reported in $\mu g/m^3$. The chronic HQ for each location is the ultra-worst case scenario based on the maximum theoretical annual emissions, discussed previously. The acute hazard index (HI) for each location is the sum of the 1-hour time-weighted average HQs for all TAPs expected to exceed the SQER. Table 4-6 shows those impacts at each maximally impacted receptor.

The chronic (annual-average) combined pollutant HI at each maximally impacted receptor is well below 0.10. This suggests that chronic (non-cancer) health effects are not likely to occur under the estimated worst-case conditions for project-related diesel generator emissions (even if the maximum emissions for a 3-year rolling period were emitted in a single year).

The acute (1-hour average) combined pollutant HI at the MIBR and MICR is 1.63 and 1.20, respectively. These HIs are almost entirely as a result of the 1st-highest 1-hour NO_2 emissions during a power outage and, in the 2011 HIA for NO_2, Ecology concluded that—although project-related NO_2 emissions, under the worst-case scenario, would exceed the ASIL—the frequency of occurrence of such conditions is so low that NO_2 emissions were not considered significant enough to contribute to adverse impacts to the community. Considering that the requested revisions associated with this HIA do not alter conditions for NO_2 emissions and that Sabey is prepared to meet the same permit conditions related to NO_2 emissions as agreed to in the original approval order, the project-related emissions, due to requested revisions related to this HIA, are not expected to increase the 1st-highest NO_2 emission rate or exacerbate the NO_2 issue. For this consideration, the final line item in Table 4-6 shows the combined pollutant HI for the remaining six TAPs (without considering NO_2 emissions) and that the HI at each of the maximally impacted receptors is well below 1. Therefore, neither chronic nor acute adverse health effects are likely, even under ultra-worst case conditions.

4.4.2 Quantifying Increased Cancer Risk

4.4.2.1 Cancer Risk from Exposure to DEEP

In this document, cancer risks are reported using scientific notation to quantify the increased cancer risk of an exposed person, or the number of excess cancers that might result in an exposed population. For example, a cancer risk of 1×10^{-6} means that if 1 million people are exposed to a carcinogen, one excess cancer might occur, or a person's chance of getting cancer in their lifetime increases by 1 in 1 million or 0.0001 percent. Note that these estimates are for excess cancers that might result in addition to those normally expected in an unexposed population. Cancer risks quantified in this document are upper-bound theoretical estimates. In other words, each is the estimate of the plausible upper limit, or highest likely true value of the quantity of risk.

Based on recommendations in Chapter 173-460 WAC, Ecology may approve a project if the applicant demonstrates that the increase in emissions of TAPs (caused solely by project-related emissions) is not likely to result in an increased cancer risk of more than 10 per million (10×10^{-6}). Table 4-8 shows the estimated worst-case increased cancer risks at the MIBR, MIRR, and MICR that are attributable to DEEP emissions from the Intergate-Quincy Data Center. These values use the conservatively high assumption that 70-year average DEEP emissions from the Sabey generators (including initial commissioning and periodic stack testing) consist of the total particulate matter (filterable "front-half" plus condensable "back-half" emissions). These concentration impact levels are listed in Table 4-3.

Current regulatory practice assumes that a very small dose of a carcinogen will give a very small cancer risk. Cancer risk estimates are, therefore, not yes or no answers but measures of chance (probability). Such measures, however uncertain, can be used to determine the magnitude of a cancer threat because any level of a carcinogenic contaminant carries an associated risk. The validity of this approach for all cancer-causing chemicals is not clear. Some evidence suggests that certain chemicals considered carcinogenic must exceed a threshold of tolerance before initiating cancer. For such chemicals, risk estimates are not appropriate. Guidelines on cancer risk from the EPA reflect the potential that thresholds for some carcinogenesis exist. However, the EPA still assumes no threshold unless sufficient data indicate otherwise.

Cancer risk is evaluated by multiplying the URF by the concentration of DEEP at each maximally impacted receptor.

The formula used to determine cancer risk is as follows:

$$\frac{\text{Risk} = C_{Air} \times URF \times EF1 \times EF2 \times ED}{AT}$$

Because URFs are based on a continuous exposure over a 70-year lifetime, exposure duration and exposure frequency are important to consider. Exposure frequencies will vary depending on the receptor type being evaluated in the HIA. For example, the duration and frequency of time spent by the occupants of a home over a 70-year life span is much greater than that for a commercial warehouse or office.

Exposure frequencies used in this HIA are based on Ecology's judgment from review of published risk evaluation guidelines. These values are shown below. Using these exposure frequency factors, Table 4-7 lists the corrected unit risk factors for each maximally impacted receptor evaluated in this HIA.

EXPOSURE FREQUENCIES FOR EACH RECEPTOR TYPE

Parameter	Description	Value Based on Receptor Type						Units
		Residential	Worker	School-Staff	School-Student	Hospital	Boundary	
C_{Air}	Concentration in air at the receptor	See Table 4-3						µg/m^3
URF	Unit Risk Factor	0.0003						(µg/m^3)$^{-1}$
EF1	Exposure Frequency	365	250	200	180	365	250	Days/Year
EF2	Exposure Frequency	24	8	8	8	24	2	Hours/Day
ED	Exposure Duration	70	40	40	7 (Elem) 4 (HS & College)	1	30	Years
AT	Averaging Time	613,200						Hours

Table 4-8 shows the estimated cancer risks associated with predicted project-related concentrations (Table 4-2) and the URFs (Table 4-7). Although the highest annual-average concentration was predicted to occur at the MICR, the highest cancer risk was estimated at the MIRR (the residential home to the northwest of the Intergate-Quincy Data Center). This is due to considerations of duration and frequency of potential exposure incorporated in the unit risk factors. The calculated 70-year average cancer risk at the MIRR is 9 increased cancer cases per million population (9.1×10^{-6}). This is less than 10×10^{-6}, which is the recommended permissible level under Chapter 176-460 WAC.

As part of the second-tier risk evaluation, Ecology will consider cumulative impacts of DEEP emissions in the project vicinity. Note that Chapter 173-460 WAC does not currently contain a numerical limit on allowable cumulative cancer risks. However, Ecology has indicated that new sources of DEEP may not be approved to locate in Quincy if the resulting cumulative cancer risk is above 100 per million (100×10^{-6}).

Also indicated in Table 4-8 are the cumulative cancer risks for each maximally impacted receptor. This accounts for permitted DEEP emissions from neighboring data centers, railroad and roadway diesel traffic emissions, and project-related emissions from Sabey. The cumulative cancer risk at the MIRR is approximately 47 per million (46.9×10^{-6}). The maximum cumulative cancer risk at each maximally impacted receptor is below 100 per million and there are no schools, hospitals, or commercial daycare facilities located near enough to the project site for increased cancer risk associated with project-related emissions.

4.4.2.2 Cancer Risk from Exposure to All Potential Substances

Ecology uses the SQERs as screening threshold emission rates below which the Chapter 173-460 WAC regulation indicates there is negligible potential for ambient air quality impacts. Despite the negligibility, this HIA assesses cancer risks from all seven TAPs expected to exceed the SQER (DEEP, NO_2, CO, benzene, 1,3-butadiene, acrolein, and naphthalene) in project-related emissions. The results of this assessment are shown in Table 4-9 where the corresponding cancer risk from each TAP is summed to a total risk per million of 9 at the MIRR (9.1×10^{-6}), 1 at the MIBR (0.5×10^{-6}), and 4 at the MICR (3.9×10^{-6}). This is the estimated 70-year average lifetime exposure to project-related emissions at those locations.

As indicated in Table 4-9, the cancer risk associated with DEEP alone at the MIRR is 9.1 per million (9.1×10^{-6}). The other recognized carcinogenic compounds contribute negligibly to the overall cancer risk (i.e., 0.03 per million). The combined cancer risk caused by all constituents is 9.13 per million (9.13×10^{-6}).

5.0 UNCERTAINTY CHARACTERIZATION

Many factors of the HIA are prone to uncertainty. Uncertainty relates to the lack of exact knowledge regarding many of the assumptions used to estimate the human health impacts of DEEP emissions from the proposed project and "background" sources of DEEP. The assumptions used in the face of uncertainty may tend to overestimate or underestimate the health risks estimated in the HIA.

5.1 EMISSION FACTOR AND EXPOSURE UNCERTAINTY

One of the major uncertainties is the emission factors for TAPs emitted by diesel engines. The forecast emission rates for particulate matter used for this analysis were based on the upper range of vendor estimates for emissions capable of achieving the emission standards set by the Tier 2 emission regulation. For this analysis, it was conservatively assumed that all of the particulate matter emitted from diesel engine generators (including both the filterable "front-half" plus condensable "back-half" emissions) is DEEP, with the highest level of cancer potency. The forecast emission rates for NO_2 were based on the conservatively high assumption that NO_2 comprised 10 percent of the emitted NO_x. The emission rates for the other TAPs were based on published emission factor data from the EPA, which are believed to be conservatively high because they were developed based on historical testing of older-technology engines.

It is difficult to characterize the amount of time that people will be exposed to DEEP emissions from the proposed Intergate-Quincy Data Center. For simplicity, this analysis assumed that a residential receptor is at one location for 24 hours per day, 365 days per year for 70 years. These assumptions tend to overestimate exposure.

The duration and frequency of power outages is also uncertain. While the high level of historical reliability in Quincy, Washington provides some assurance that power service is relatively stable, Sabey cannot predict future outages with complete certainty. Sabey has accepted a limit of 57.5 hours per year per generator (3-year rolling average) for total generator operations, and estimates that this limit should be more than sufficient to meet demands for the use of emergency generators at the Sabey Intergate-Quincy Data Center. It is expected that estimates of cancer risks will be significantly overestimated by assuming diesel engine generators will operate annually at the maximum permitted level for 70 consecutive years.

5.2 AIR DISPERSION MODELING UNCERTAINTY

The transport of pollutants through the air is a complex process. Regulatory air dispersion models have been developed to estimate the transport and dispersion of pollutants as they travel through the air. The models are frequently updated as techniques that are more accurate become known, but are developed to avoid underestimating the modeled impacts. Even if all of the numerous input parameters to an air dispersion model are known, random effects found in the real atmosphere will introduce uncertainty. Typical of the class of modern steady-state Gaussian dispersion models, the AERMOD model used for the Intergate-Quincy Data Center analysis will likely slightly overestimate the short-term (24-hour average) impacts and somewhat underestimate the annual pollutant concentrations. The expected magnitude of the uncertainty is probably similar to the emissions uncertainty and much lower than the uncertainty related to toxicity.

5.3 TOXICITY UNCERTAINTY

One of the largest sources of uncertainty in any risk evaluation is associated with the scientific community's limited understanding of the toxicity of most chemicals in humans following exposure to the low concentrations generally encountered in the environment. To account for uncertainty when developing toxicity values (e.g., RfCs), the EPA and other agencies apply "uncertainty" factors to doses or concentrations that were observed to cause non-cancer effects in animals or humans. The EPA applies these uncertainty factors so that it derives a toxicity value that is considered protective of humans including susceptible populations. In the case of the DEEP RfC, the EPA acknowledges (EPA 2002):

> … the actual spectrum of the population that may have a greater susceptibility to diesel exhaust is unknown and cannot be better characterized until more information is available regarding the adverse effects of diesel particulate matter in humans.

Quantifying DEEP cancer risk is also uncertain. Although the EPA classifies DEEP as probably carcinogenic to humans, it has not established a URF for quantifying cancer risk. In its health assessment document, the EPA determined that "human exposure-response data are too uncertain to derive a confident quantitative estimate of cancer unit risk based on existing studies" (EPA 2002). However, the EPA suggested that a URF based on existing DEEP toxicity studies would range from $1x10^{-5}$ to $1x10^{-3}$ per $\mu g/m^3$. OEHHA's DEEP URF ($3x10^{-4}$ per $\mu g/m^3$) falls within this range. Regarding the range of URFs, the EPA states in its health assessment document for diesel exhaust (EPA 2002):

> Lower risks are possible and one cannot rule out zero risk. The risks could be zero because (a) some individuals within the population may have a high tolerance to exposure from [diesel exhaust] and therefore not be susceptible to the cancer risk from environmental exposure, and (b) although evidence of this has not been seen, there could be a threshold of exposure below which there is no cancer risk.

Other sources of uncertainty cited in the EPA's health assessment document for diesel exhaust are:

- Lack of knowledge about the underlying mechanisms of DEEP toxicity.
- The question of whether historical toxicity studies of DEEP based on older engines is relevant to current diesel engines. It is likely that the mixture of pollutants emitted by new-technology diesel engines (such as those proposed by Sabey) is different from older technology engines.

- Table 5-1 presents a summary of how the uncertainty affects the quantitative estimate of risks or hazards.

6.0 OTHER CONSIDERATIONS

6.1 SHORT-TERM EXPOSURE TO DEEP AND $PM_{2.5}$

As discussed previously, exposure to DEEP can cause both acute and chronic health effects. However, reference toxicological values specifically for DEEP exposure at short-term or intermediate intervals (e.g., 24-hour values) do not currently exist. Therefore, short-term risks from DEEP exposure are not quantified in this assessment. Regardless, not quantifying short-term health risks in this document does not imply that they have not been considered. Instead, it was assumed that compliance with the 24-hour NAAQS for particulate matter with an aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$) is an indicator of acceptable short-term health effects from DEEP exposure. In this analysis, it was assumed that all DEEP emissions are equivalent to $PM_{2.5}$ emissions. The Revised Request for Approval Order Revisions (Landau Associates 2015) concludes that emissions from the proposed project are not expected to cause or contribute to an exceedance of any NAAQS.

6.2 SHORT-TERM EXPOSURE TO OTHER TOXIC AIR POLLUTANTS

The impacts of short-term emission rates of other TAPs from the Intergate-Quincy Data Center have not been evaluated in detail in this document because only DEEP and NO_2 emissions from the project exceed the ASIL. Because emissions of other TAPs from the project are below the ASIL, no further review was required for those pollutants. Emissions below the ASIL suggest that increased health risks from these project-related pollutants are acceptable.

Although the 1^{st}-highest 1-hour ambient NO_2 impact exceeds the ASIL during a hypothetical power outage, Sabey is not requesting an increase in the allowable 1^{st}-highest NO_2 emission rate. Ecology evaluated ambient NO_2 impacts in 2011, and concluded the impacts were acceptable due to the low frequency of occurrence of power outages (Ecology 2011).

7.0 DISCUSSION OF ACCEPTABILITY OF RISK WITH REGARD TO SECOND-TIER REVIEW GUIDELINES

7.1 PROJECT-ONLY CANCER RISKS ARE LOWER THAN 10-PER-MILLION

As noted above, the modeled worst-case TAP concentrations at the facility boundary caused solely by emissions from the proposed project are less than the ASIL values established by Ecology for all pollutants, with the exception of DEEP and NO_2. The worst-case emission rates are less than the SQERs for most pollutants, with the exception of DEEP, NO_2, CO, benzene, 1,3-butadiene, acrolein, and naphthalene. The long-term cancer risks at the nearby residences, businesses, and sensitive receptor locations range from 1 to 9 per million for DEEP and are considerably lower for the other TAPs considered in this analysis. The overall cancer risk at any of the maximally impacted receptors (MIBR, MIRR, or MICR), caused solely by emissions from the proposed project, was predicted to cause less than the 10-per-million threshold established by Ecology‘s second-tier review criteria.

7.2 CUMULATIVE CANCER RISK

The MIRR is the existing house northeast of the data center, and the MICR is the parking lot for onsite Sabey tenants. The total 70-year average cumulative DEEP cancer risks (expressed as cancer risk per million) for the maximally exposed home, business, and sensitive receptors are as follows:

Sabey-only cancer risk [northern property line (MIBR)]:	0.5
Background DEEP cancer risk:	0.6
Cumulative DEEP cancer risk:	1.1
Sabey-only cancer risk [NW residence (MIRR)]:	9.1
Background DEEP cancer risk:	37.8
Cumulative DEEP cancer risk:	46.9
Sabey-only cancer risk [onsite tenant employee exposure (MICR)]:	3.9
Background DEEP cancer risk:	2.9
Cumulative DEEP cancer risk:	6.8

7.3 NON-CANCER RISK HAZARD QUOTIENT IS ACCEPTABLE

As described previously, based on using the theoretical maximum 12-month emission rates under ultra-worst case conditions, the maximum HQ related to Sabey-only annual-average DEEP impacts at any maximally impacted receptor is 0.06. The maximum HI for cumulative impacts caused by combined TAP emissions of (DEEP, CO, benzene, 1,3-butadiene, acrolein, and naphthalene) is 0.33.

The HQs associated with NO_2 emissions are addressed in the 2011 HIA for NO_2 (Ecology 2011). This concludes that emissions from Sabey's proposed project are unlikely to cause (non-cancer) adverse health effects.

8.0 SIGNATURES

This document has been prepared under the supervision and direction of the following key staff.

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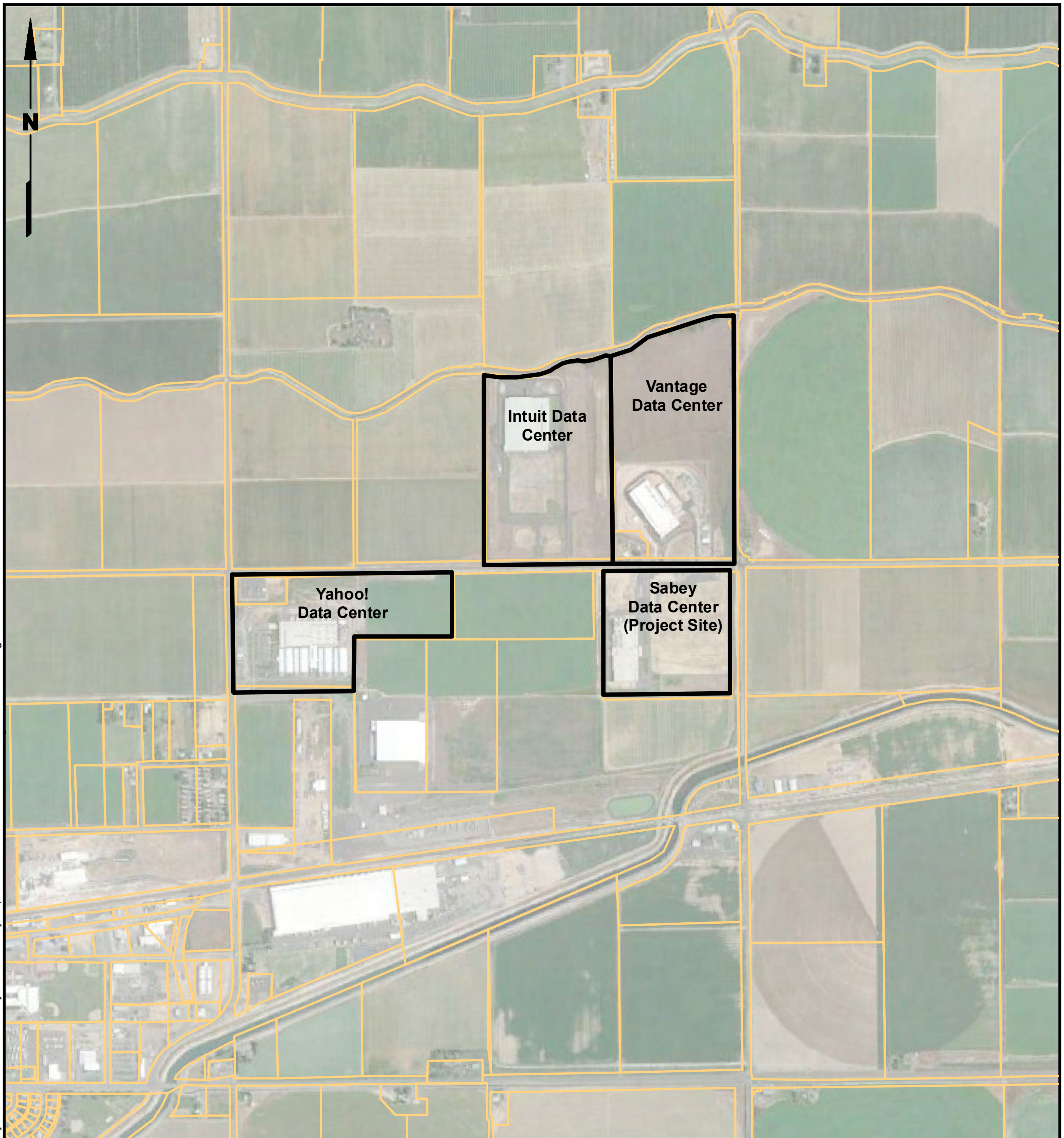

Legend

Subject Property

Parcels

0 1,500 3,000

Scale in Feet

Data Sources: Grant County GIS; Google Earth Pro
Imagery Date: 07/2013

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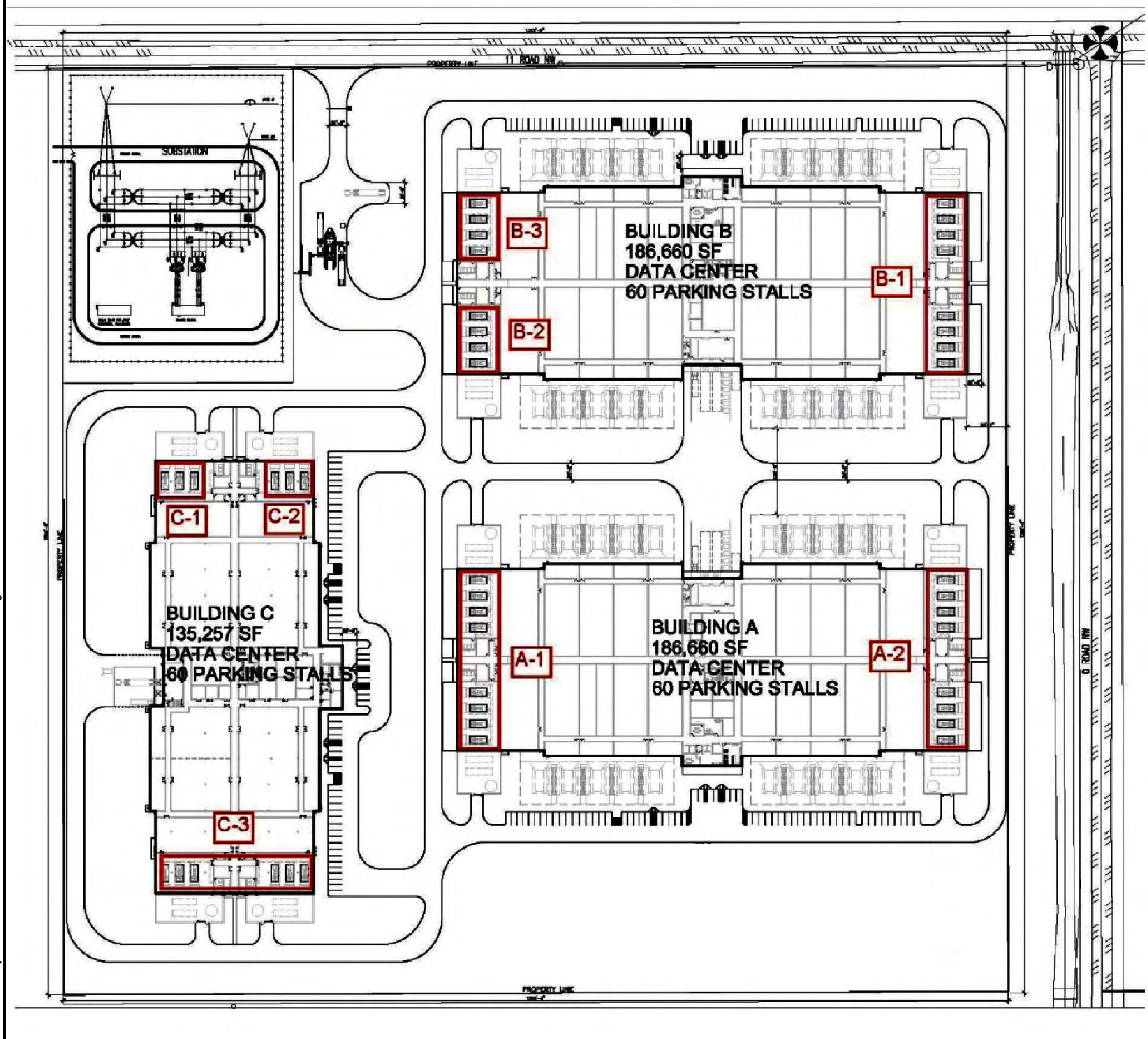
Sabey Intergate- Quincy Data Center Quincy, Washington	**Vicinity Map**	Figure 2-1



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Data Source: ICF, 2012

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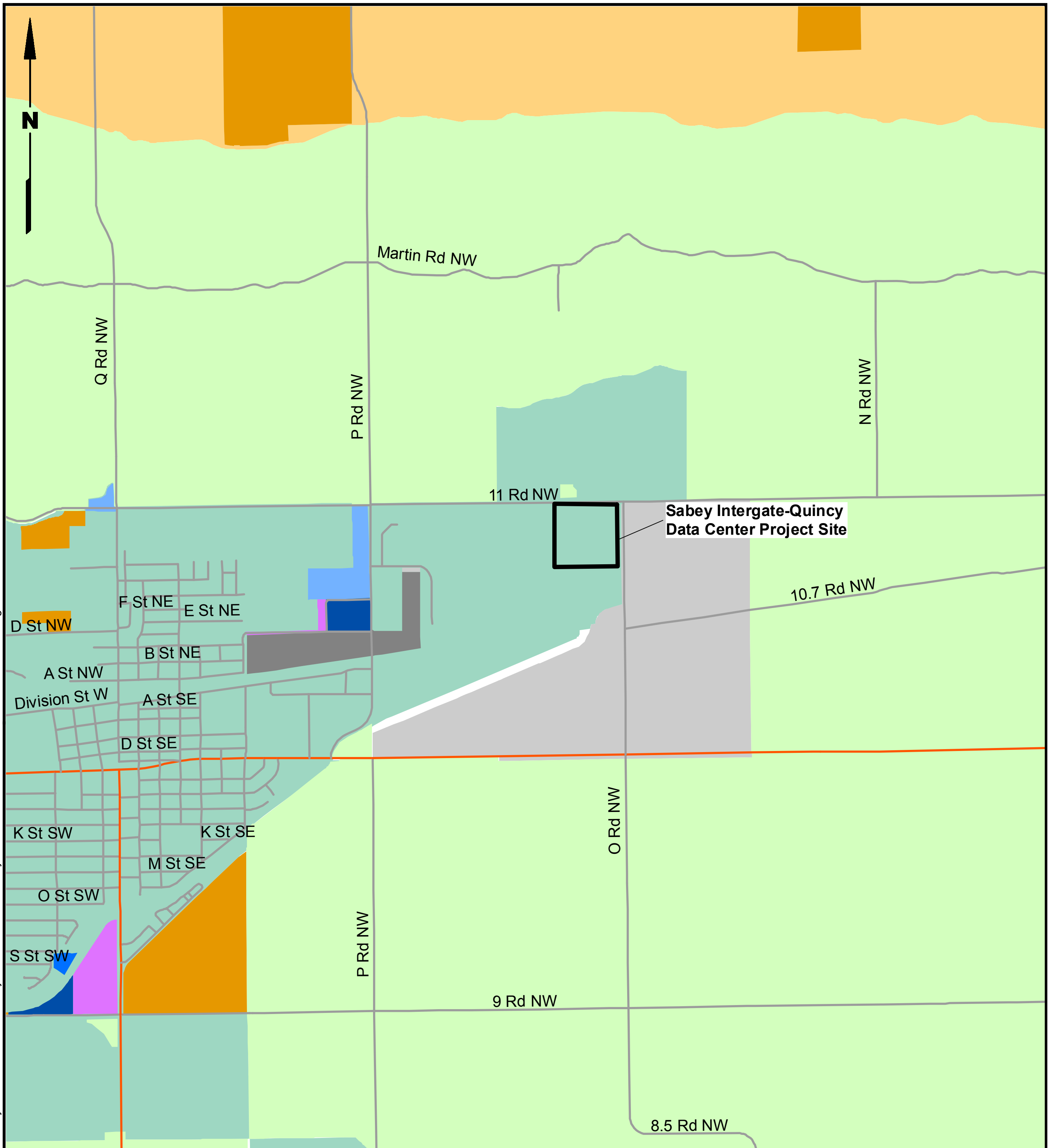
Sabey Intergate- Quincy Data Center Quincy, Washington	**Site Plan**	Figure 2-2



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Legend

- Subject Property
- Agriculture
- Rural Residential 2
- Rural Residential 3
- Urban Commercial 2
- Master Planned Industrial
- Urban Heavy Industrial
- Urban Residential 2
- Urban Residential 3
- Urban Residential 4
- Urban Growth Area

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

0 3,000 6,000

Scale in Feet

Data Sources: Grant County GIS

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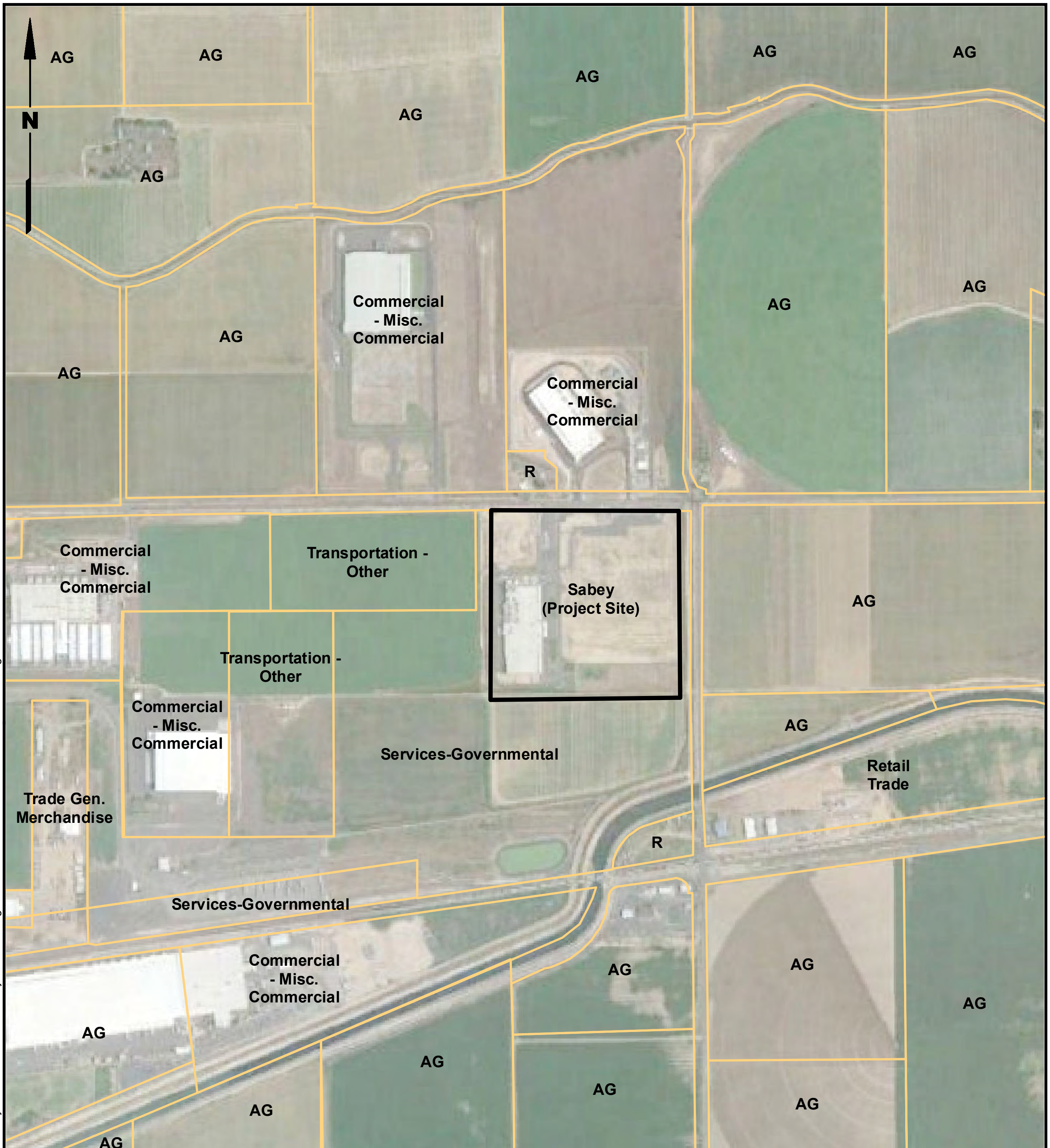
Sabey Intergate-Quincy Data Center Quincy, Washington	**Land Use in the Vicinity of the Intergate-Quincy Data Center**	Figure 2-3



Legend
Subject Property
Parcels/Land Use

0 1,000 2,000
Scale in Feet

Notes
1. AG = Agriculture
R = Residential
2. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Grant County GIS; Google Earth Pro
Imagery Date: 07/2013

G:\Projects\1362\004\010\Sabey Intergate Quincy Data Center Risk Study\F02-4Zoning.mxd 3/2/2015 NAD 1983 StatePlane Washington South FIPS 4602 Feet

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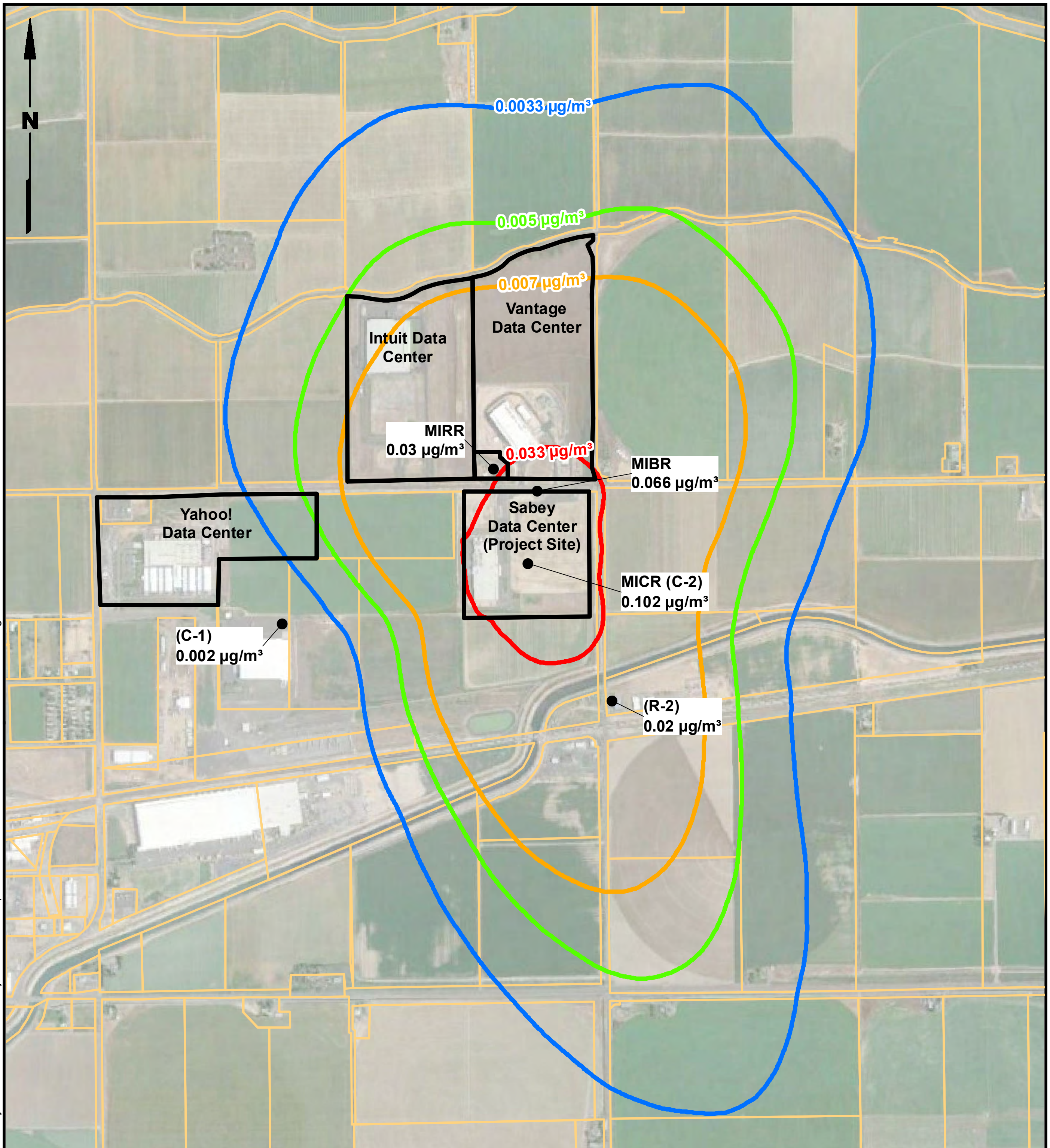
Sabey Intergate-Quincy Data Center
Quincy, Washington

Zoning in the Vicinity of the Intergate-Quincy Data Center

Figure
2-4



Legend

DEEP Concentrations

- 0.0033 µg/m³
- 0.005 µg/m³
- 0.007 µg/m³
- 0.033 µg/m³

Subject Property

Parcels

0 1,500 3,000

Scale in Feet

Note

1. Black and white reproduction of this color original may reduce its effectiveness and lead to incorrect interpretation.

Data Sources: Grant County GIS; Google Earth Pro
Imagery Date: 07/2013

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LANDAU ASSOCIATES

Sabey Intergate-Quincy Data Center Quincy, Washington	**70-Year Average DEEP Concentrations Caused Solely by Project-Related Emissions**	Figure 4-1

TABLE 2-1
MAXIMUM FACILITY-WIDE GENERATOR EMISSION RATES
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Pollutant	Maximum Emission Rates (Total)		
	(lbs/hr)	(lbs/day)	Routine Annual (not increased by 3x for theoretical maximum) (tons/year)
NO_X	832	28,690	23.9
$PM_{2.5}$/DEEP (70-year average)	15.4	531.3	0.467
CO	414	14,269	13.0
VOCs	50	1,715	1.49
SO_2	1.3	44.3	0.037
Primary Nitrogen Dioxide (NO_2)	83	2,869	2.4
Benzene	6.5E-01	1.6E+01	1.9E-02
Toluene	2.4E-01	5.7E+00	6.8E-03
Xylenes	1.6E-01	3.9E+00	4.6E-03
1,3-Butadiene	1.6E-02	3.9E-01	4.7E-04
Formaldehyde	6.6E-02	1.6E+00	1.9E-03
Acetaldehyde	2.1E-02	5.1E-01	6.1E-04
Acrolein	6.6E-03	1.6E-01	1.9E-04
Benzo(a)pyrene	1.1E-04	2.6E-03	3.1E-06
Benzo(a)anthracene	--	1.3E-02	1.5E-05
Chrysene	--	3.1E-02	3.7E-05
Benzo(b)fluoranthene	--	2.2E-02	2.7E-05
Benzo(k)fluoranthene	--	2.2E-03	2.6E-06
Dibenz(a,h)anthracene	--	3.5E-03	4.2E-06
Ideno(1,2,3-cd)pyrene	--	4.2E-03	5.0E-06
Propylene	0.0	56.1	0.067
Naphthalene	0.0	2.6	0.0031

TABLE 2-2
GENERAL LAND USE ZONES NEAR THE SABEY INTERGATE-QUINCY DATA CENTER
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Direction From Sabey Intergate-Quincy Data Center	City/County Zoning	Notable Development
East	MPI	Agricultural Land
Northeast	UGA	Agricultural Land
North	UGA	Vantage Data Center
Northwest	UGA	Intuit Data Center
Northwest	Agricultural	Residential home (R-1)
West	UGA	Yahoo! Data Center
Southwest	UGA	Warehouse (C-1)
South	UGA & MPI	undeveloped land zoned for commercial use
Southeast	MPI	Residential home (R-2)
(On Site)	UGA	Sabey Tenants (C-2)

MPI = Master Planned Industrial
UGA = Urban Growth Area

TABLE 3-1
SUMMARY OF BACT DETERMINATION FOR EMERGENCY DIESEL ENGINES
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Pollutant(s)	BACT Determination
Particulate matter (PM)	Use of good combustion practices;
	Use of EPA Tier 2-certified engines; and
	Compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart IIII
Nitrogen oxides (NO_x)	Use of good combustion practices;
	Use of EPA Tier 2-certified engines; and
	Compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart IIII
Carbon monoxide (CO) and volatile organic compounds (VOCs)	Use of good combustion practices;
	Use of EPA Tier 2-certified engines; and
	Compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart IIII
Sulfur dioxide (SO_2)	Use of ultra-low sulfur diesel fuel containing no more than 15 parts per million by weight of sulfur

TABLE 3-2
SUMMARY OF TBACT DETERMINATION FOR EMERGENCY DIESEL ENGINES
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Toxic Air Pollutant(s)	tBACT Determination
DEEP	Compliance with the PM BACT requirement
Carbon monoxide (CO), benzene, 1,3-butadiene, acrolein, and naphthalene	Compliance with the VOC BACT requirement
Nitrogen dioxide (NO_2)	Compliance with the NO_x BACT requirement
Sulfur dioxide (SO_2)	Compliance with the SO_2 BACT requirement

TABLE 3-3
SMALL-QUANTITY EMISSION RATES COMPARISON FOR TOXIC AIR POLLUTANTS
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Pollutant	CAS Number	SQER		Emission		SQER Ratio	SQER Exceeded?
DEEP (Maximum 12-month Period)	None	0.639	lbs/yr, max year of 3-year period	2,778	lbs/yr, max year of 3-year period	4,347	**Yes**
CO	630-08-0	50.2	lbs/1-hour	848	lbs/1-hour	17	**Yes**
Sulfur Dioxide (SO_2)	--	1.45	lbs/1-hour	1.16	lbs/1-hour	0.80	No
Primary Nitrogen Dioxide (NO_2)	10102-44-0	1.03	lbs/1-hour	991	lbs/1-hour	962	**Yes**
Benzene	71-43-2	6.62	lbs/yr, max year of 3-year period	112	lbs/yr, max year of 3-year period	17	**Yes**
Toluene	108-88-3	657	lbs/24-hr day	5.60	lbs/24-hr day	0.01	No
Xylenes	95-47-6	58	lbs/24-hr day	3.88	lbs/24-hr day	0.07	No
1,3-Butadiene	106-99-0	1.13	lbs/yr, max year of 3-year period	3	lbs/yr, max year of 3-year period	3	**Yes**
Formaldehyde	50-00-0	32	lbs/yr, max year of 3-year period	10.26	lbs/yr, max year of 3-year period	0.32	No
Acetaldehyde	75-07-0	71	lbs/yr, max year of 3-year period	3.28	lbs/yr, max year of 3-year period	0.05	No
Acrolein	107-02-8	0.00789	lbs/24-hr day	0	lbs/24-hr day	20	**Yes**
Benzo(a)pyrene	50-32-8	0.174	lbs/yr, max year of 3-year period	0.02	lbs/yr, max year of 3-year period	0.10	No
Benzo(a)anthracene	56-55-3	1.74	lbs/yr, max year of 3-year period	0.08	lbs/yr, max year of 3-year period	0.05	No
Chrysene	218-01-9	17.4	lbs/yr, max year of 3-year period	0.20	lbs/yr, max year of 3-year period	0.01	No
Benzo(b)fluoranthene	205-99-2	1.74	lbs/yr, max year of 3-year period	0.14	lbs/yr, max year of 3-year period	0.08	No
Benzo(k)fluoranthene	207-08-9	1.74	lbs/yr, max year of 3-year period	0.01	lbs/yr, max year of 3-year period	0.01	No
Dibenz(a,h)anthracene	53-70-3	0.16	lbs/yr, max year of 3-year period	0.02	lbs/yr, max year of 3-year period	0.14	No
Ideno(1,2,3-cd)pyrene	193-39-5	1.74	lbs/yr, max year of 3-year period	0.03	lbs/yr, max year of 3-year period	0.02	No
Propylene	115-07-1	394	lbs/24-hr day	56.10	lbs/24-hr day	0.14	No
Naphthalene	91-20-3	5.64	lbs/yr, max year of 3-year period	19	lbs/yr, max year of 3-year period	3	**Yes**

Note: Shaded cells indicate exceedance of the SQER

TABLE 3-4
FIRST-TIER AMBIENT IMPACT ASSESSMENT FOR TOXIC AIR POLLUTANTS
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Toxic Air Pollutant	Mode of Operation	Modeled Ambient Conc. (μg/m³)			ASIL (μg/m³)			Fraction of ASIL	
		1-Hr	24-Hr	Annual	1-Hr	24-Hr	Annual		
Total NO2	Max hour power outage	960	--	--	470	--	--	204%	1-hr
DEEP (on-site)	Worst 1-yr of 3-yr rolling period	--	--	0.307	--	--	3.33E-03	9214%	Annual
CO (1-hr)	Max hour power outage	6,223	0	0	23,000	0	0.00E+00	27%	1-hr
Benzene	Worst 1-yr of 3-yr rolling period	--	--	1.24E-02	--	--	3.45E-02	36%	Annual
1,3-Butadiene	Worst 1-yr of 3-yr rolling period	--	--	3.12E-04	--	--	5.88E-03	5%	Annual
Acrolein	Max day, 23-hr outage	--	0.0170	--	--	0.06	--	28%	24-hr
Naphthalene	Worst 1-yr of 3-yr rolling period	--	--	2.08E-03	--	--	9.09E-03	23%	Annual

Note: Shaded cells indicate exceedance of ASIL.

TABLE 4-1
CALIFORNIA'S AIR TOXICS HOTSPOTS RISK ASSESSMENT GUIDANCE ON SPECIFIC PATHWAYS TO BE ANALYZED FOR EACH MULTI-PATHWAY SUBSTANCE SOURCE IMPACT LEVEL COMPLIANCE AT FACILITY BOUNDARY
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

	Ingestion Pathway									
Substance	**Soil**	**Dermal**	**Meat, Milk & Egg**	**Fish**	**Exposed Vegetable**	**Leafy Vegetable**	**Protected Vegetable**	**Root Vegetable**	**Water**	**Breast Milk**
4,4'-Methylene dianiline	X	X		X	X	X	X	X	X	
Creosotes	X	X	X	X	X	X			X	
Diethylhexylphthalate	X	X		X	X	X	X	X	X	
Hexachlorocyclohexanes	X	X		X	X	X			X	
PAHs	X	X	X	X	X	X			X	
PCBs	X	X	X	X	X	X	X	X	X	X
Cadmium & compounds	X	X	X	X	X	X	X	X	X	
Chromium VI & compounds	X	X	X	X	X	X	X	X	X	
Inorganic arsenic & compounds	X	X	X	X	X	X	X	X	X	
Beryllium & compounds	X	X	X	X	X	X	X	X	X	
Lead & compounds	X	X	X	X	X	X	X	X	X	
Mercury & compounds	X	X		X	X	X	X	X	X	
Nickel	X	X	X		X	X	X	X	X	
Fluorides (including hydrogen fluoride)	To be determined									
Dioxins & furans	X	X	X	X	X	X	X		X	X

TABLE 4-2
MAXIMALLY EXPOSED RECEPTORS,
70-YEAR AVERAGE DEEP, PREDICTED AMBIENT AIR QUALITY IMPACTS
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Receptor Type	ID	Direction From Nearest Project-Specific DEEP Emission Source	Estimated Distance From Nearest Project-Specific DEEP Emission Source		Project related (70-Year Average) DEEP Impacts at each Maximally Impacted Receptor
			Feet	Meters	($\mu g/m^3$)
Maximally Impacted Boundary Receptor (MIBR)	-	Northern boundary	266	81	0.067
Maximally Impacted Residentail Receptor (MIRR)	R-1	Northwest	469	143	0.030
Maximally Impacted Commercial Receptor (MICR)	C-2	On Site (a)	n.a.	n.a.	0.103

(a) Note: Conventionally the maximally impacted receptors are identified at locations beyond the property boundary, but considering that Sabey will be housing independent tenants (with potential to expose workers to ambient DEEP), onsite receptors were also evaluated in this HIA.

TABLE 4-3
CUMULATIVE DEEP AMBIENT IMPACTS FROM LOCAL SOURCES
(BASED ON 70-YEAR AVERAGE CONCENTRATIONS)
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Emission Sources	DEEP Concentration (µg/m^3) at Maximally Impacted Receptors			
	MIBR	MIRR		MICR (onsite)
DEEP Caused Solely by Sabey Emissions	0.067	0.030		0.103
Railroad	0.020	0.015	(a)	0.018
Highways	0.000	0.000	(a)	0.000
Yahoo!	0.003	0.006	(a)	0.004
Intuit	0.019	0.087	(a)	0.029
Vantage	0.042	0.018	(b)	0.026
Approximate Regional Background	0.085	0.126		0.077
Cumulative DEEP Concentration	0.152	0.156		0.180

(a) Source: Table 16 from Sabey Data Center Second-Tier Risk Report (Ecology 2011).

(b) Source: Table 4-3 from Vantage Data Center Second-Tier Risk Report (ICF 2012).

TABLE 4-4
TOXICITY VALUES USED TO ASSESS AND QUANTIFY NON-CANCER HAZARD AND CANCER RISK
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Pollutant	Agency	Non-Cancer REL (µg/m^3)	Carcinogenic URF (µg/m^3)$^{-1}$
DEEP	Acute (1-hr average)	n.a.	3.0x10^{-4}
	Chronic (12-month average)	5	
NO_2	Acute (1-hr average)	470	N/A
	Chronic (12-month average)	n.a.	
CO	Acute (1-hr average)	23,000	N/A
	Chronic (12-month average)	n.a.	
Benzene	Acute (1-hr average)	27	2.9x10^{-5}
	Chronic (12-month average)	3	
1,3-Butadiene	Acute (1-hr average)	660	1.7x10^{-4}
	Chronic (12-month average)	2	
Acrolein	Acute (1-hr average)	2.5	N/A
	Chronic (12-month average)	0.35	
Naphthalene	Acute (1-hr average)	n.a.	3.4x10^{-5}
	Chronic (12-month average)	9	

Source: California Office of Environmental Health Hazard Assessment (OEHHA)
N/A = Not applicable to this toxic air pollutant

TABLE 4-5
DEEP CHRONIC NON-CANCER HAZARD QUOTIENTS
(BASED ON THE THEORETICAL MAXIMUM ANNUAL IMPACTS)
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Emission Sources	DEEP Chronic Hazard Quotients (HQ) at Maximally Impacted Receptors		
	MIBR	MIRR	MICR (onsite)
DEEP Caused Solely by Sabey Emissions	0.040	0.018	0.062
Approximate Regional Background	0.004	0.003	0.004
Cumulative (post-project)	0.044	0.021	0.065

Note: The theoretical max annual impact assumes the absolute worst case scenario that the 3-year rolling average permit limit is emitted entirely within a single year.

TABLE 4-6
NON-CANCER HAZARD QUOTIENTS
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Pollutant	Maximally Impacted Boundary Receptor		Maximally Impacted Residential Receptor		Maximally Impacted Commercial Receptor	
	Chronic Hazard. (theoretical maximum year annual-average)	Acute Hazard (1-hr average)	Chronic Hazard. (theoretical maximum year annual-average)	Acute Hazard (1-hr average)	Chronic Hazard. (theoretical maximum year annual-average)	Acute Hazard (1-hr average)
DEEP						
Ambient Concentration, µg/m^3	0.20	N/A	0.09	N/A	0.31	N/A
OEHHA Risk-Based Concentration, µg/m^3	5	N/A	5	N/A	5	N/A
Hazard Quotient	0.04	N/A	0.02	N/A	0.06	N/A
NO_2						
Ambient Concentration, µg/m^3	n.a.	610	N/A	292	N/A	450
OEHHA Risk-Based Concentration, µg/m^3	n.a.	470	N/A	470	N/A	470
Hazard Quotient	n.a.	1.3	N/A	0.6	N/A	1.0
CO						
Ambient Concentration, µg/m^3	n.a.	3,035	N/A	1,451	N/A	2,238
OEHHA Risk-Based Concentration, µg/m^3	n.a.	23,000	N/A	23,000	N/A	23,000
Hazard Quotient	n.a.	0.13	N/A	0.06	N/A	0.10
Benzene						
Ambient Concentration, µg/m^3	0.01	4.77	0.004	2.28	0.01	3.52
OEHHA Risk-Based Concentration, µg/m^3	3	27	3	27	3	27
Hazard Quotient	0.003	0.18	0.001	0.08	0.004	0.13
1,3-Butadiene						
Ambient Concentration, µg/m^3	0.0002	0.12	0.0001	0.06	0.0003	0.09
OEHHA Risk-Based Concentration, µg/m^3	2	660	2	660	2	660
Hazard Quotient	0.0001	0.0002	0.00005	0.0001	0.0002	0.0001
Acrolein						
Ambient Concentration, µg/m^3	0.0001	0.05	0.00004	0.02	0.0001	0.04
OEHHA Risk-Based Concentration, µg/m^3	0.35	2.5	0.35	2.5	0.35	2.5
Hazard Quotient	0.0002	0.02	0.0001	0.01	0.0004	0.01
Naphthalene						
Ambient Concentration, µg/m^3	0.0014	N/A	0.0006	N/A	0.0021	N/A
OEHHA Risk-Based Concentration, µg/m^3	9	N/A	9	N/A	9	N/A
Hazard Quotient	0.0002	N/A	0.0001	N/A	0.0002	N/A
Combined Pollutant Hazard Index	0.04	1.63	0.02	0.78	0.07	1.20
Combined Pollutant Hazard Index (without NO_2)	-	0.33	-	0.16	-	0.24

Note: The theoretical maximum annual impact assumes the worst-case scenario that the 3-year rolling average permit limit is emitted entirely within a single year.
N/A = Not applicable to this toxic air pollutant.

TABLE 4-7
EXPOSURE ASSUMPTIONS AND UNIT RISK FACTORS FOR DEEP RISK ASSESSMENT
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Receptor Type	Annual Exposure	Exposure Duration	Diesel Particulate Matter Cancer Unit Risk Factor (risk per million, per annual µg/m^3 DEEP)
Unoccupied Land	2 hours/day 250 days/year	30 years	7.3-per-million cancer risk per µg/m^3 DEEP
Residences	24 hours/day 365 days/year	70 years	300-per-million cancer risk per µg/m^3 DEEP
Businesses	8 hours/day 250 days/year	40 years	38-per-million risk per µg/m^3 DEEP

TABLE 4-8
CUMULATIVE DEEP INHALATION CANCER RISK
(BASED ON 70-YEAR AVERAGE CONCENTRATIONS)
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Emission Sources	Cancer risk per million population at Maximally Impacted Receptors		
	MIBR	**MIRR**	**MICR (onsite)**
DEEP Cancer Risk Unit Risk Factor $(\mu g/m^3)^{-1}$	7.3	300	38.0
Project-Related Cancer Risk caused solely by Sabey (70-year average) emissions	0.5	9.1	3.9
Regional Background Cancer Risk caused by highways, railroads, and neighboring data centers (Vantage, Intuit, and Yahoo!)	0.6	37.8	2.9
Cumulative DEEP Cancer Risk	1.1	46.9	6.8

TABLE 4-9
LIFETIME CANCER RISK (70-YEAR AVERAGE)
CAUSED BY PROJECT-RELATED EMISSIONS OF CARCINOGENIC COMPOUNDS
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Carcinogen	70-Year Average Emission Rate (Tons per Year)	ASIL ($\mu g/m^3$)	Cancer Risk at Key Receptors (per Million)		
			MIBR	MIRR	MICR
DEEP	0.467	0.0033	0.486	9.1	3.91
Naphthalene	0.003	0.0294	3.7E-04	6.89E-03	3.0E-03
Benzene	0.019	0.0345	1.9E-03	3.51E-02	1.9E-04
1,3-Butadiene	0.0005	0.0059	2.8E-04	5.18E-03	1.9E-04
Formaldehyde	1.9E-03	1.7E-01	3.9E-05	7.24E-04	1.9E-04
Acetaldehyde	6.1E-04	3.7E-01	5.7E-06	1.06E-04	1.9E-04
Benzo(a)pyrene	3.1E-06	9.1E-04	1.2E-05	2.20E-04	1.9E-04
Benzo(a)anthracene	1.5E-05	9.1E-03	5.7E-06	1.07E-04	1.9E-04
Chrysene	3.7E-05	9.1E-02	1.4E-06	2.62E-05	1.9E-04
Benzo(b)fluoranthene	2.7E-05	9.1E-03	1.0E-05	1.90E-04	1.9E-04
Benzo(k)fluoranthene	2.6E-06	9.1E-03	1.0E-06	1.87E-05	1.9E-04
Dibenz(a,h)anthracene	4.2E-06	9.1E-04	1.6E-05	2.96E-04	1.9E-04
Ideno(1,2,3-cd)pyrene	5.0E-06	9.1E-03	1.9E-06	3.55E-05	1.9E-04
Total Lifetime Cancer Risk	--	--	0.489	9.13	3.914

TABLE 5-1
QUALITATIVE SUMMARY OF THE EFFECTS OF UNCERTAINTY ON QUANTITATIVE ESTIMATES OF RISKS OR HAZARDS
SABEY INTERGATE-QUINCY DATA CENTER
QUINCY, WASHINGTON

Source of Uncertainty	How Does it Affect Estimated Risk From This Project?
Exposure assumptions	Likely overestimate of exposure
Emissions estimates	Possible overestimate of emissions
AERMOD air modeling methods	Possible underestimate of average long-term ambient air concentrations and overestimate of short-term ambient air concentration
Toxicity of DEEP at low concentrations	Possible overestimate of cancer risk, possible underestimate of non-cancer hazard for sensitive individuals