DEPARTMENT OF
ECOLOGY
State of Washington

Technical Support Document for Second Tier Review

Sabey Data Center
Quincy, Washington

June 22, 2011

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1. EXECUTIVE SUMMARY

1.1. Proposal Summary

Sabey Corporation (Sabey) proposes a multi-unit data server facility to be called the Sabey Intergate-Quincy Data Center. It will be located in the northeast quadrant of Quincy, (Grant County) Washington. The project will consist of three main buildings to house server equipment and a total of 44 diesel-powered backup generator sets each rated at 1.5 to 2.0 electrical megawatts (MWe). Each engine will use its own 48-foot vertical exhaust stack.

Up to eight independent tenants will lease space in three buildings that will comprise the Sabey Datacenter. Each tenant will use one or more of the proposed generators. Sabey's revised February 2011 application clarified that Sabey will transfer ownership of each tenant's generators to the tenant before that tenant's generators are installed, so each individual tenant will be responsible and liable for emissions from their generators. Sabey's application requests that Sabey will only be responsible and liable for any generators that are installed and operated by Sabey. Sabey will not be liable for the emissions from any tenant's facility.[1] Each independent tenant will be issued an approval order based on the parameters established in the preliminary Notice of Construction approval order, dated May 10, 2011.

Potential emissions of diesel engine exhaust particulate (DEEP) and nitrogen dioxide (NO_2) from the proposed backup engines exceed regulatory trigger levels called Acceptable Source Impact Levels (ASILs). Therefore, Sabey is required to submit a second tier petition per Chapter 173-460 Washington Administrative Code (WAC).

The Washington State Department of Ecology's Headquarters Office (Ecology) determined that a community-wide approach to permitting data centers was warranted for the Quincy urban growth area (UGA) because of the relatively close geographic proximity of existing and planned large data centers in Quincy. As part of the community-wide approach, Ecology considered the cumulative impacts of DEEP from existing permitted data centers and other nearby sources of diesel engine emissions.

1.2. Health Impacts Evaluation

Sabey retained ICF International (ICF) to prepare a Health Impact Assessment (HIA) to evaluate the potential health risks attributable to operation of the diesel-powered generators from the data center project. The HIA demonstrated that emissions of DEEP from the proposed project could result in an increased cancer risk of up to 6.3 in one million (6.3×10^{-6}) at the maximally impacted residential yard near the northeast corner of Sabey property, which is in an industrial-zoned area immediately to the northeast of Sabey. Despite the zoning, a residence is present at this location. The emissions of DEEP from the proposed project could result in an increased cancer risk of up to 5.83 in one million for occupants of the existing dwelling. If another dwelling is built at a spot in the yard nearer Sabey, its occupants could have added cancer risk of up to 6.3 in one million. Because the increase in cancer risks attributable to the proposed Sabey

[1] See para. 3, of p. 1-1 of the February 23 revised NOC application and Sections 31 and 32 of "Itemized-IGQ-response-letter_3-22-2011.doc."

Data Center itself at nearby locations, is less than the maximum risk allowed by a second tier review (10 in one million), the project can be approvable under WAC 173-460-090.

The analysis also indicates the potential for Sabey's NO_2 emissions to induce breathing problems in sensitive people under certain circumstances. It is possible that some of the people with asthma near the Sabey Data Center will occasionally experience acute breathing impairment primarily due to NO_2 from background sources and Sabey. Currently, there is no numerically defined acceptable limit of noncancer adverse health risks. Given the low lifetime risk of severe asthma symptoms from Sabey NO_2 emissions and the probably infrequent recurrence of high NO_2 exposure situations, Ecology concludes that additional mitigation measures are unnecessary; however, Ecology will need routine reports of power failures from Sabey to determine the veracity of assumptions in this analysis.

1.3. Cumulative Health Risks

Ecology also evaluated emissions from other nearby emission sources to determine the cumulative long-term health impacts associated with DEEP. Ecology estimates the maximum potential cumulative cancer risk posed by DEEP emitted from Sabey and other nearby sources to be approximately 18.2 in one million at the maximally impacted residential yard near the northeast corner of Sabey property. The cumulative risk to occupants of the existing dwelling on this parcel is 17.5 in one million. The additional cumulative diesel exhaust-associated cancer risk at all other existing buildings near Sabey and dominated by its emissions are lower than at the residence in question.

1.4. Conclusions and Recommendation

Given records of past power failures at data centers in the Grant County Public Utility District (PUD) system and the 8-hour/year limit on diesel generator operation for emergencies, the chance of severe asthma effects occurring will be very low.

Therefore, based on the technical analysis described below, and provided (1) health risks posed by Sabey operations are communicated to new residences, which will be built in more heavily impacted areas near the Sabey Data Center, (2) the generators are operated no more than described herein, and (3) Sabey communicates with its closest neighbors and the local land-use zoning authorities about potential diesel engine exhaust impacts, the additional health risks attributable to Sabey's DEEP and NO_2 emissions will be permissible under Chapter 173-460 WAC.

Given the possible flexibility of land-use zoning enforcement, Ecology recommends that Sabey be required to communicate health risks posed by its emissions to potential new homeowners at adjacent undeveloped parcels or to the Grant County/City of Quincy (local regulatory agency) responsible for zoning and development in the affected area.

Ecology recommends approval of the proposed project because project-related health risks are permissible under WAC 173-460-090, and the cumulative risk from diesel engine emissions in

Quincy is less than the cumulative risk goal established by Ecology for permitting data centers in Quincy (i.e., 100 per million). The remainder of this document describes the technical review performed by Ecology.

2. PERMITTING PROCESS OVERVIEW

2.1. The Regulatory Process

The requirements for performing a toxics screening are established in Chapter 173-460 WAC. This regulatory code requires a review of any increase in toxic air pollutant emissions for all new or modified stationary sources in the state of Washington.

2.1.1. The Three Tiers of Permitting Toxic Air Pollutants

The objectives of permitting toxic air pollutants (TAPs) are 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 as will protect human health and safety.

There are three levels of review when processing a new or modified emissions unit emitting TAPs: (1) first tier review (toxics screening), (2) second tier review (health impact assessment), and (3) third tier review (risk management decision).

All projects are required to undergo a toxics screening (first tier review) as required by WAC 173-460-040. There are two ways to perform a first tier review. If proposed emissions are below the Small Quantity Emission Rates (SQERs) found in WAC 173-460-150, no further analysis is required. If emissions are greater than the SQERs, those emissions must be modeled and the resultant ambient concentration compared against the appropriate ASIL. If the ambient concentration is below the ASIL, then no further analysis is required.

A second tier review, required by WAC 173-460-090, is a site-specific health impact assessment. The objective of a second tier review is to quantify the increase in lifetime cancer risk for persons exposed to the increased concentration of any carcinogenic TAP and to quantify other increased health hazards from any TAP in ambient air that would result from the proposed project. Once quantified, the cancer risk is compared to the maximum risk allowed under a second tier review, which is one in one hundred thousand, and the concentration of any TAP that would result from the proposed project is compared to noncancer health risk-based concentration values (RBC).

If the emission of a TAP results in additional cancer risk greater than one in one hundred thousand, or Ecology finds that other health hazards are not acceptable, an applicant may request Ecology perform a third tier review. A third tier review is a risk management decision made by the director of Ecology about whether or not the health risks posed by a project are acceptable. The decision is based on a determination that emissions will be maximally reduced through available preventive measures, assessment of environmental benefits, disclosure of risks at a public hearing, and related factors associated with the facility and the surrounding community.

The proposed Sabey Data Center triggers second tier review, because the project's diesel engines could emit DEEP and NO_2 at levels that exceed their ASIL.

2.1.2. Second Tier Review Processing Requirements

Processing requirements for second tier petitions are found in WAC 173-460-090(2). Ecology shall evaluate a source's second tier petition only if:

(i) The permitting authority submits to Ecology a preliminary order of approval that addresses all applicable new source review issues with the exception of the outcome of second tier review, State Environmental Policy Act review, public notification, and Prevention of Significant Deterioration (PSD) review (if applicable);

(ii) Emission controls contained in the preliminary approval order represent at least Best Available Control Technology for Toxics (tBACT);

(iii) The applicant has developed a HIA protocol that has been approved by Ecology;

(iv) The ambient impact of the emissions increase of each TAP that exceeds its ASIL has been quantified using refined air dispersion modeling techniques as approved in the HIA protocol; and

(v) The second tier petition contains a HIA conducted in accordance with the approved HIA protocol.

Ecology received several documents (Table 1) including second tier risk assessments for diesel particulate matter, nitrogen dioxide (NO_2), and diesel particulate matter electronically on February 23, 2010, January 5, 2011, and revised assessment documents on April 15, 2011. ICF also submitted to Ecology sequential editions of the project's Notice of Construction Support Document on February 23, 2010, January 5, 2011, March 4, 2011, and April 14, 2011.

Table 1. Documents Received By WDOE from Sabey and ICF for the Proposed Sabey Data Center

Document or Event	Date
Sabey Quincy HIA completeness checklist received from Jim Wilder	After December 30, 2010
Sabey-IGQ-HIA-Protocol_12-30-10.doc	After December 30, 2010
Sabey-IGQ_DPM-Checklist for HIA_12-30-10.pdf	After December 30, 2010

Document or Event	Date
Sabey-IGQ_NO2-Checklist for HIA_12-30-10.pdf	After December 30, 2010
Notice of Construction Support Document (Revised February 2011) Intergate-Quincy Data Center Quincy, Washington	February 23, 2010
Second Tier Risk Assessment for Diesel Particulate Matter (DPM) (Revised February 2011) Intergate-Quincy Data Center Quincy, Washington	February 23, 2010
Second Tier Risk Assessment for Nitrogen Dioxide (NO_2) (Revised February 2011) Intergate-Quincy Data Center Quincy, Washington	February 23, 2010
Sabey Quincy Pre-application Meeting at Ecology HQ	November 23, 2010
Sabey-Quincy Kickoff (2).pdf	November 23, 2010
FigXX_1st-high_24hr_PM-during 24--hr outage (2).pdf	January 3, 2011
FigXX_1st-high_24hr_PM-during 8-hr outage (2).pdf	January 3, 2011
FigXX_1st-high_1hr_PM.pdf	January 3, 2011
Notice of Construction Support Document Intergate-Quincy Data Center Quincy, WA	January 5, 2011
Second Tier Risk Assessment for Diesel Particulate Matter (DPM) Intergate-Quincy Data Center Quincy, Washington	January 5, 2011
Second Tier Risk Assessment for Nitrogen Dioxide (NO_2) Intergate-Quincy Data Center Quincy, Washington	January 5, 2011
Appendices Sabey Intergate-Quincy Data Center Air Quality Application	January 10, 2011
20110125084821709.pdf (Sabey Incompleteness Letter) sent	January 25, 2011
PM2.5 NAAQS Demonstration.doc	February 11, 2011
Technical Support Document, Notice of Construction Approval Order No. 11aq-E3xx, Sabey Intergate Quincy, Llc , Intergate-Quincy Data Center, First Draft March 4, 2011	March 4, 2011
Itemized-IGQ-response-letter_3-22-2011.doc	March 24, 2011
Attachments to response-letter_3-22-2011.doc	March 24, 2011
Itemized Responses to Ecology Comments from January 25, 2011 “Incompleteness Letter”	March 30, 2011
4 files containing increased run-time calculation spreadsheets	April 6, 2011
Sabey IGQ_NOC-Report_02182011.doc	April 14, 2011
NO2_SecondTierAssess_Revised_02182011.doc	April 15, 2011
DPM-Second Tier-SabeyIGQ_Revised_02182011.doc	April 15, 2011
E-mail from Wilder (ICF) re: Sabey-Quincy: Reduced DEEP cancer risk	June 3, 2011

Document or Event	Date
AERMOD to Ecology_06-03-11.zip	June 3, 2011
NTE-DPM Memo_6-03-2011.pdf	June 3, 2011
Sabey NTE DPM Risk 6-03-2011.doc	June 3, 2011
Sabey-IGQ-NTE-DPM_6-03-2011.xls	June 3, 2011

Ecology prepared a preliminary Notice of Construction (NOC) Order of Approval for the project on May 10, 2011. The preliminary order of approval satisfies items (i) and (ii) above.

On June 3, 2011, Sabey proponents altered their proposal by using a lower emission factor for diesel engine particulate matter. Ecology accepted this and revised the risk assessment. The documents and electronic files submitted by ICF as of June 3, 2011, contained sufficient information to perform a health impacts review in accordance with standard risk assessment procedures.

Together, the HIA and supporting files presented overviews of air dispersion modeling and health hazard assessments and predictions about subsequent health risks for the Sabey Data Center. Accordingly, Ecology decided item (v) above is immaterial in this case.

In summary, Sabey satisfied four of the five requirements listed above.

3. FACILITY INFORMATION

3.1. Facility Location

The Sabey Data Center is located east of Quincy, on a parcel zoned by Grant County as industrial near the Intuit and Yahoo data centers in Grant County. Figure 1 shows the data center in relation to the surrounding area. The Sabey Data Center will occupy two buildings measuring 186,600-foot^2 and another building measuring 137,257-foot^2 (Figure 2). The buildings are being prepared for occupancy by several data storage and processing companies.

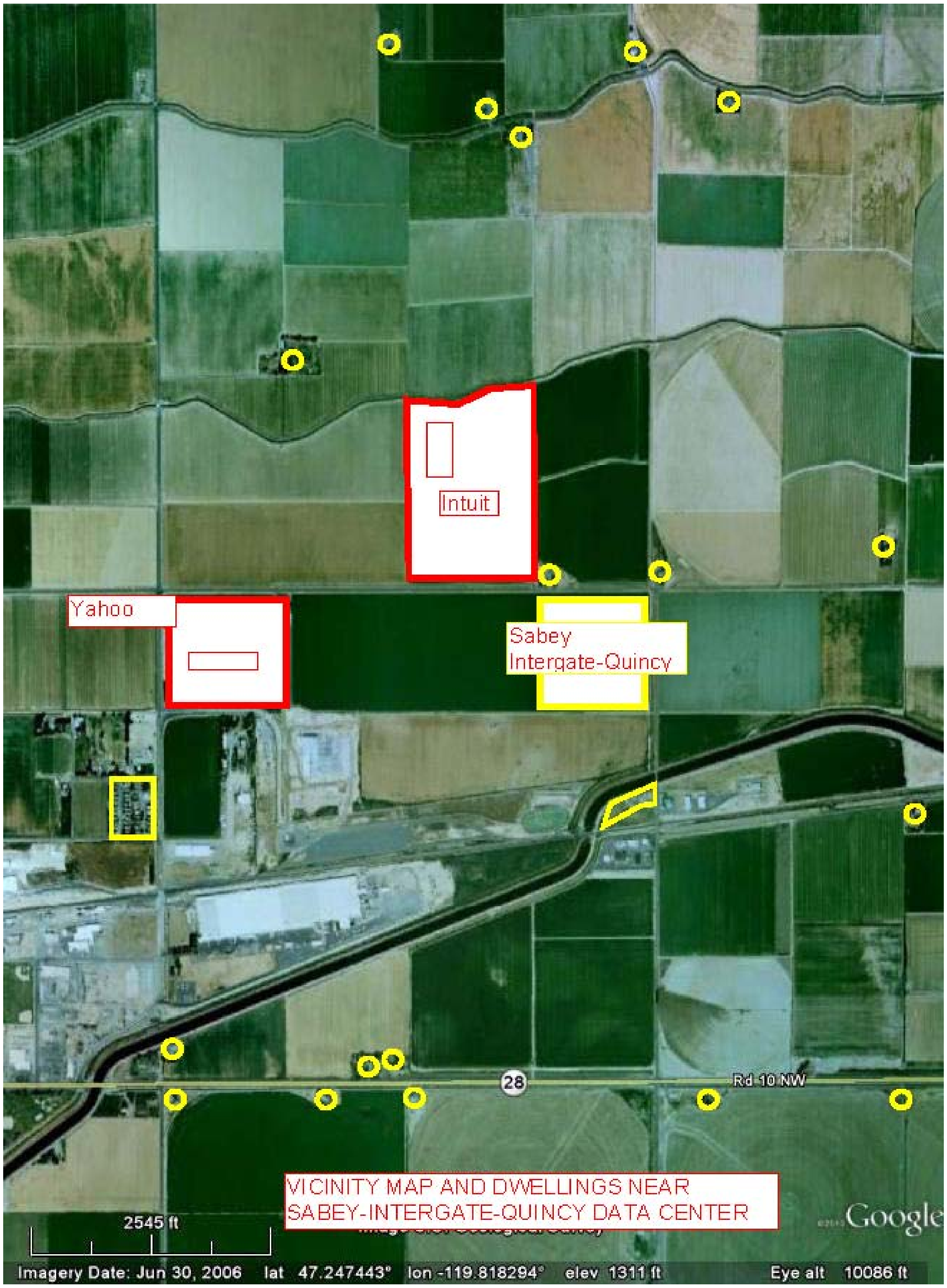

Figure 1. Satellite photo of east Quincy showing where the Sabey Data Center will be located and nearby residential structures
(Source: ICF)

As shown in Figure 1, several residential dwellings are in the general vicinity of the site.

3.2. Permitting History

The Sabey Data Center in Quincy will be a new facility.

3.3. The Proposed Project

The new Sabey Data Center is to be provided with emergency electrical power by newly installed diesel-fueled 1500 to 2000 kilowatt (kWe) engines. These engine/generator sets will be owned and operated by the data center tenants. Annual operations will be restricted by fuel consumption limitations and limits on hours of operation.

The data center will be constructed in three phases. Phase 1 (in Building C) construction is expected to be completed in 2011. Building C includes 12 generators. The construction dates for Phases 2 and 3 are to be determined. Both Phase 2 and Phase 3 include 16 generators each. Therefore, the full build-out for combined Phases 1, 2, and 3 includes forty-four (44) generators. The current health impacts evaluation is for the potential full build-out configuration (44 generators).

The proposed diesel engines for the facility are Caterpillar emergency diesel engines that will meet the EPA Tier 2 emission control technology standard to reduce emissions of particulate matter, oxides of nitrogen (NO_X), including NO_2, unburned hydrocarbons, and other pollutants.

There was no other project equipment that required review under the state and federal air quality requirements.

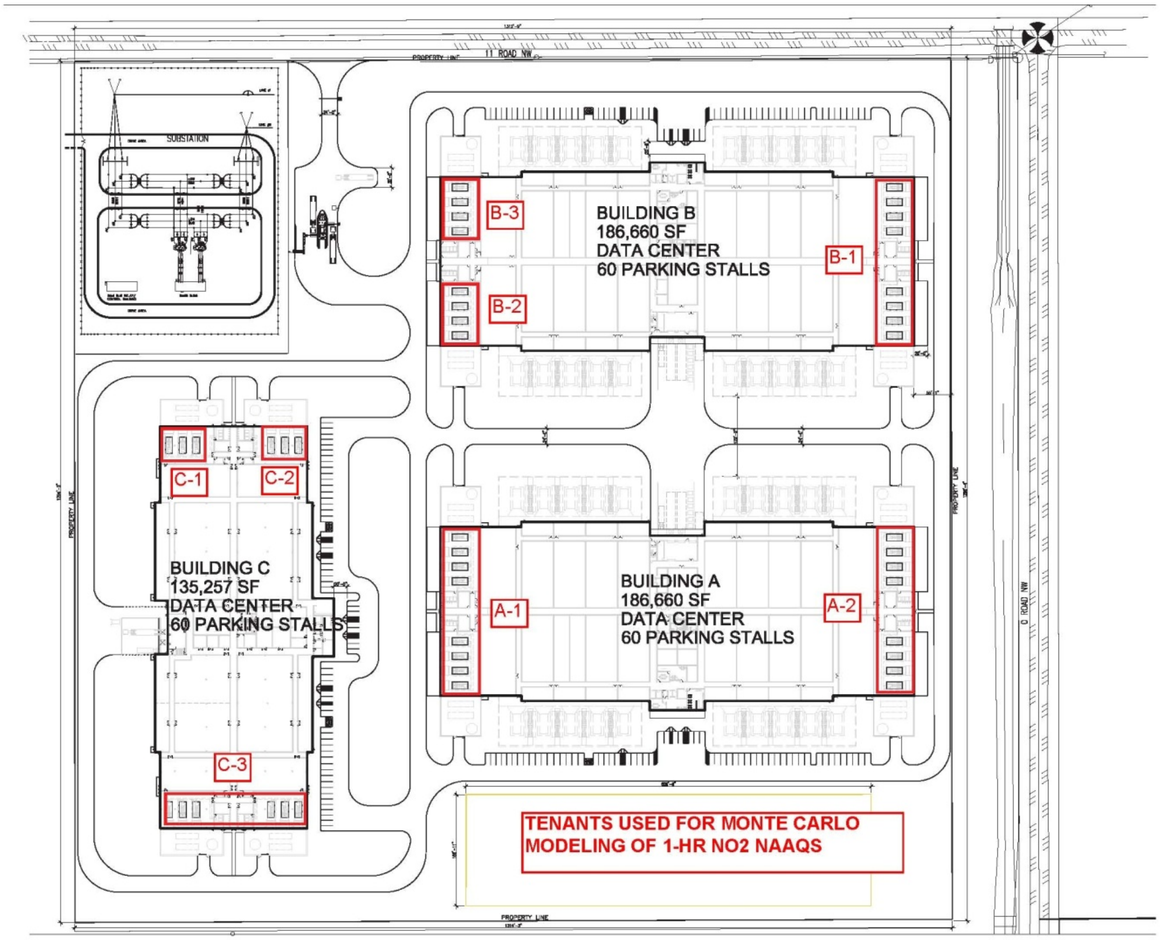

Figure 2. Sabey Data Center site plan
(Source: ICF)

Sabey stated in its application that operation of the engines would fall into five categories: monthly pre-scheduled tests, annual load bank tests, corrective tests, main switchgear and transformer tests, and emergency operation to provide power to the facility during unplanned electricity outages.

Table 2. Forecast Generator Engine Usage for the Sabey Data Center

		Generator Size	Power Outages		Monthly Tests			Annual Load Bank Tests		Corrective Tests		Main Switchgear & Transformer Tests		Total Engine Runtime
Gen #	Gen Area	kWe	% load	Hrs/yr	% load	Hrs/test	Tests/yr	% load	Hrs/yr	% load	Hrs/yr	% load	Hrs/yr	Hrs/year/per engine
A01	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A02	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A03	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A04	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A05	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A06	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A07	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A08	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A09	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A10	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A11	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A12	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A13	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A14	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A15	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
A16	Bldg A	2000	75	8	50	1	11	100	4	50	10	75	14	47
B01	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B02	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B03	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B04	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B05	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B06	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B07	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B08	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B09	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B10	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47

		Generator Size	Power Outages		Monthly Tests			Annual Load Bank Tests		Corrective Tests		Main Switchgear & Transformer Tests		Total Engine Runtime
Gen #	Gen Area	kWe	% load	Hrs/yr	% load	Hrs/test	Tests/yr	% load	Hrs/yr	% load	Hrs/yr	% load	Hrs/yr	Hrs/year/per engine
B11	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B12	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B13	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B14	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B15	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
B16	Bldg B	2000	75	8	50	1	11	100	4	50	10	75	14	47
C01	Bldg C	2000	75	8	50	1	11	100	4	50	10	75	14	47
C02	Bldg C	2000	75	8	50	1	11	100	4	50	10	75	14	47
C03	Bldg C	2000	75	8	50	1	11	100	4	50	10	75	14	47
C04	Bldg C	2000	75	8	50	1	11	100	4	50	10	75	14	47
C05	Bldg C	2000	75	8	50	1	11	100	4	50	10	75	14	47
C06	Bldg C	2000	75	8	50	1	11	100	4	50	10	75	14	47
C07	Bldg C	2000	75	8	50	1	11	100	4	50	10	75	14	47
C08	Bldg C	2000	75	8	50	1	11	100	4	50	10	75	14	47
C09	Bldg C	2000	75	8	50	1	11	100	4	50	10	75	14	47
C10	Bldg C	2000	75	8	50	1	11	100	4	50	10	75	14	47
C11	Bldg C	2000	75	8	50	1	11	100	4	50	10	75	14	47
C12	Bldg C	2000	75	8	50	1	11	100	4	50	10	75	14	47

(Source: "Dec Notice of Construction Support Document, Intergate Quincy Data Center," February 2011, ICF 00756.10)

As summarized in Table 2, Sabey's protocol for scheduled testing and unplanned outages involves:

- Monthly testing for 1 hour per test, with each engine running at 50% load or less. Each tenant would conduct its own monthly testing independently, according to their own schedule.
- Annual load-bank testing, with each engine tested one at a time while running at approximately 100% load. Each tenant would conduct its own load bank testing independently, according to its own schedule.
- Corrective engine testing, consisting of a nominal average of 10 hours per year, per engine, to conduct additional diagnostic tests and repairs on an as-needed basis for any generator that exhibits problems during the monthly or annual tests. In any given year, most engines would presumably not need this type of testing, but in some years, multiple engines might require this testing depending on the outcome of the routine diagnostic tests. Depending on the type of repairs required, this testing could consist of a range of loads from idle up to 100% load. For purposes of estimating emissions and fuel usage, the average generator load during the nominal 10 hours of corrective testing was set at the midpoint of that range, and was assumed to be 50% load.
- Occasional pre-scheduled electrical switchgear and electrical transformer bypass maintenance in which individual tenants would occasionally perform maintenance tests on their electrical subsystem. Not all data center operators use their generators for this type of scheduled maintenance. If this type of work is done at all by any given tenant, it would probably be done no more frequently than every other year or perhaps every three years. In that case, each tenant would work on only a subset of their own electrical system and they would activate only their own generators. In no case would the combined tenants use more than three to eight generators at any given time for this activity.
- Unplanned emergency operation in which the facility would experience up to 8 hours of power outage every year, but spread over two calendar days. During a full unplanned power outage, which could occur any time during the day or night, all 44 of the generators would activate at a 75% design load.

Approval Condition 3.5 of the preliminary NOC approval order requires all scheduled engine maintenance testing, bypass operations, and load testing to be conducted during daylight hours. Additionally, Sabey has not requested to run their engines for "storm avoidance" as is common in some data center operations.

The proposed engines will primarily be operated for "emergency" purposes. While Ecology's technical analysis assumes the proposed engines will serve as "emergency generators", Ecology is not making a determination that the proposed diesel engines qualify as "emergency engines" as defined in U.S. Environmental Protection Agency (EPA) regulations. Rather, Ecology's review of the health impact assessment is based on the estimated worst-case emissions from engine use.

4. POLLUTANT SCREENING

4.1. Emissions

Diesel engine exhaust contains thousands of gas, particle, and particle-bound constituents, including carbon dioxide (CO_2), carbon monoxide (CO), water vapor, nitrogen oxides (NO_X), saturated and unsaturated aldehydes and ketones, alkanes, alkenes, monocyclic aromatic hydrocarbons, carbon-core particles, metals, and gas- and particle-phase polycyclic aromatic hydrocarbons (PAHs) and PAH derivatives.[2]

Using emission factors for diesel-fueled engine electric generators published in AP-42,[3] 40 CFR §89.112 and asserted by the engine manufacturer, ICF estimated TAP emissions from the proposed Sabey Data Center. The emission rates in Table 3 are consistent with the preliminary NOC approval order.

Emissions of five TAPs (DEEP, acrolein, benzene, CO, and NO_2) exceed their SQERs.

> *Table 6-5 compares the forecast daily and annual emission rates for each toxic air pollutant to its Small Quantity Emission Rate (SQER). The forecast emission rates for the following toxic air pollutants exceed their SQERs: DPM, $\underline{NO_2}$; carbon monoxide (CO); benzene; and acrolein.*
>
> *Ecology regulations require facilities to conduct a first-tier screening analysis of toxic air pollutant impacts by modeling the first-highest 1-hour, first -highest 24-hour, and annual impacts at the project boundary, then comparing the modeled values to the ASILs. The first-tier screening analysis is summarized in Table 6-6. The impacts for all toxic air pollutants other than DPM and $\underline{NO_2}$ exceed their respective ASILs.*

[2] http://www.arb.ca.gov/toxics/dieseltac/part_a.pdf
[3] http://www.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf

Table 3. Comparison of Sabey's Forecast Maximum TAP Emission Rates to Small Quantity Emission Rates (SQERs)

Toxic Air Pollutant	CASRN	SQER	Units	Emission	SQER Ratio
Diesel Exhaust Particulate	None	0.639	lbs/yr	1262	1975
CO	630-08-0	50.2	lbs/1-hour	559.7	11.2
SO_2		1.45	lbs/1-hour	0.72	0.50
Primary NO_2	10102-44-0	1.03	lbs/1-hour	99.2	96.3[4]
Benzene	71-43-2	6.62	lbs/yr	19.7	3.0
Toluene	108-88-3	657	lbs/24-hr day	1.46	2.22E-03
Xylenes	95-47-6	58	lbs/24-hr day	1.00	1.73E-02
1,3-Butadiene	106-99-0	1.13	lbs/yr	0.50	0.44
Formaldehyde	50-00-0	32	lbs/yr	2.01	6.27E-02
Acetaldehyde	75-07-0	71	lbs/yr	0.64	9.02E-03
Acrolein	107-02-8	0.00789	lbs/24-hr day	4.10E-02	5.19
Benzo(a)Pyrene	50-32-8	0.174	lbs/yr	3.27E-03	1.88E-02
Benzo(a)anthracene	56-55-3	1.74	lbs/yr	1.58E-02	9.09E-03
Chrysene	218-01-9	17.4	lbs/yr	3.89E-02	2.24E-03
Benzo(b)fluoranthene	205-99-2	1.74	lbs/yr	2.82E-02	1.62E-02
Benzo(k)fluoranthene	207-08-9	1.74	lbs/yr	2.77E-03	1.59E-03
Dibenz(a,h)anthracene	53-70-3	0.16	lbs/yr	4.40E-03	2.75E-02
Ideno(1,2,3-cd)pyrene	193-39-5	1.74	lbs/yr	5.26E-03	3.02E-03
Propylene	115-07-1	394	lbs/24-hr day	14.5	0.036
Napthalene	91-20-3	5.64	lbs/yr	3.30	0.59

Note: Shaded cells indicate exceedance of SQER.

(Source: "Dec Notice of Construction Support Document, Intergate Quincy Data Center' February 2011 ICF 00756.10)

Source: "Attachments to response-letter_3-22-2011.doc"

[4] Emission Rates Table in appendix of "Itemized Response…" Mar 30 submittal says NO_2 ER is 99.15-lbs/h, which is higher

4.2. Best Available Control Technology for Toxics (tBACT)

As the permitting authority, Ecology was responsible for establishing BACT and tBACT for the new diesel generators. The proposed generators will use EPA Tier 2 combustion controls to reduce emissions of particulate matter, NO_X, including NO_2, unburned hydrocarbons, and other pollutants. Ecology has determined that these EPA-mandated Tier 2 combustion controls constitute tBACT for DEEP and NO_2 emissions from the generators.

Additional tBACT requirements proposed by Ecology include:

- Use of good combustion practices;
- Use of EPA Tier 2 certified engines if the engines are installed and operated as emergency engines, as defined at 40 CFR§60.4219; or applicable emission standards found in 40 CFR Part 89.112 Table 1 and 40 CFR Part 1039.102 Tables 6 and 7 if Model Year 2011 or later engines are installed and operated as non-emergency engines;
- Compliance with the operation and maintenance restrictions of 40 CFR Part 60, Subpart IIII; and
- Use of an engine design that incorporates fuel injection timing retard, turbocharger and a low-temperature aftercooler;

Ecology has also proposed the following restrictions to NO_2 and DEEP emissions (Table 4):

Table 4. Proposed NO_2 and DEEP Short-Term Emission Limits

Proposed NO_2 Emission Rate Limits		
Operating Scenario	**Operating Load**	**Emissions Limit per engine in lb/hr**
Annual Load Testing	100%	4.19
Electrical Bypass	100%	4.19
Monthly Maintenance	50% 10%	1.53 0.65
Corrective Testing	50%	1.53
Power Outages	75%	2.25
Proposed DEEP Emission Rate Limits		
Operating Scenario	**Operating Load**	**Emissions Limit per engine in lb/hr[1]**
Annual Load Testing	100%	0.23
Electrical Bypass	100%	0.23
Monthly Maintenance	50% 10%	0.27 0.45
Corrective Testing	50%	0.27
Power Outages	75%	0.22

* DEEP emissions from all 44 engines combined shall not exceed 0.809 tons per year (1618 pounds per year).

* Limiting NO_2 emissions from all 44 engines combined shall not exceed 99 pounds per hour and 2.95 tons per year.

4.3. Air Dispersion Modeling

ICF conducted air dispersion modeling for Sabey Data Center generators. The generators were modeled as multiple discharge points. ICF used EPA's AERMOD (Version 09292), with EPA's PRIME algorithm for building downwash, to determine worst-case ambient air quality impacts caused by emissions from the proposed generators at the property line and beyond, and at the rooftop of the commonly occupied data center building. AERMOD is an EPA "preferred" model (40 CFR Part 51, Appendix W, Guideline on Air Quality Models). In addition, in accordance with current Ecology guidelines, the Plume Volume Molar Reaction Model (PVMRM) module was used for NO_2 modeling.

The AERMOD model used the following data and assumptions:[5]

a) Meteorological inputs were generated using the AERMET meteorological processor. Five years of sequential hourly meteorological data (2004-2008) from Quincy were used.

b) Twice-daily upper air data from Spokane were used to define mixing heights.

c) Digital topographical data (in the form of Digital Elevation Model files) for the vicinity were obtained from the Micropath Corporation.

d) Dispersion is sensitive to the stack parameters (i.e., stack height, exit velocity, and exhaust temperature). These parameters were set to values corresponding to the engine loads for testing and/or power outages. The data center building was included to account for building downwash.

e) The receptor grid for the AERMOD modeling was established using a 10-meter (m) grid spacing along the facility boundary extending to a distance of 300 m from the north and south sides of the facility boundary, and about 200 m from the east and west sides of the facility boundary (i.e., within approximately a 350-m range of all generators). A second grid with 50 m spacing extended out to approximately 1400 m in all cardinal directions.

f) Upon full buildout, the data center will be occupied by several independent tenants. Ecology has indicated each tenant within the facility is considered a sensitive receptor. Therefore, modeling receptors were placed at the rooftops at each end of

[5] See NOC application and second tier petition support documents.

each building to represent the ventilation intake equipment that feeds outdoor air to the interior of each building, where the on-site data center workers will spend the vast majority of their time. In addition, ground-level receptors were placed in the parking lots near the entrances to each building, to represent the locations where tenants might congregate while walking from their cars to the buildings.

g) As shown in Figure 1, the project site is surrounded by unoccupied/agricultural land, commercial businesses, and scattered dwellings. Several of the surrounding buildings were identified as Reasonable Maximum Exposure (RME) receptors for the following categories:

   i. Maximally impacted extra-boundary receptor (MIBR), which is at unoccupied agricultural land on the east boundary.

   ii. Maximally impacted residential receptor (MIRR), which is the home adjacent to the northeast corner of the data center.

   iii. Maximally impacted commercial receptor (MICR), which for NO2 is the Columbia Cold Storage facility southwest of the data center, and which for DEEP is the CHS Inc–Bottled Gas company. to the SE of the SE corner of Sabey.

   iv. Maximum impact on-site tenant represented by rooftop receptors and ground-level parking lot receptors.

h) One-hour NO_2 concentrations were modeled using the PVMRM module, with default concentrations of 40 parts per billion (ppb) of ozone, and an equilibrium NO_2/NO_X ambient ratio of 90 percent. For purposes of modeling NO_2 impacts, the primary NO_X emissions were assumed to consist of 10 percent NO_2 and 90 percent nitric oxide (NO) by mass.

i) The stack temperature and stack exhaust velocity at each generator stack were set to values corresponding to the engine loads for each type of testing and power outage.

j) Testing activity is restricted from 7:00 a.m. to 7:00 p.m., while power outages are assumed to occur anytime of the day. It was assumed that the entire Sabey Data Center would lose power for a maximum of eight hours each year, spread over a maximum of four days.

k) For annual DPM and 1-hour NO_2 ASIL compliance modeling, the first highest concentrations from the following operating scenarios were evaluated, assuming that all 44 backup engines are run at their assigned loads (see Table 2). Though there are only a maximum of four days without power in any year, including all 365 days in the model allows for plume impacts to be evaluated under many different meteorological conditions.

i. NO_2: Only emissions during a full power outage (higher than all testing modes) were considered.

ii. DEEP: Emissions from power outages and all test modes were lumped together. Total annual emissions from each testing mode are "amortized" over the daytime hours of the whole year (i.e., no testing between 7:00 p.m. and 7:00 a.m., although emissions from outages are spread over all 8760 hours of the year).

l) National Ambient Air Quality Standards (NAAQS) compliance modeling was conducted by mixing the emissions outlined below, with all possible variations in meteorology experienced in five years:

i. $PM_{2.5}$ daily NAAQS: The standard is based on the 8th highest daily concentration each year. Recall that the highest emitting mode will be the power outages, which are expected to occur on two days of the year. Therefore, the 6th highest day impacts from the highest emitting test mode would in fact be the NAAQS compliance design value. However, ICF used the maximum impacts from the highest emitting generator test mode to demonstrate compliance with the 24-hour $PM_{2.5}$ NAAQS, which is in fact the 3rd highest day of the year.

ii. NO_2 1-hour NAAQS: Demonstrating compliance with an hourly NAAQS is a challenge that modelers across the nation have been contending with. Typically, modelers would, by trial and error, find the day of week that resulted in highest modeled impacts. Meteorology from those days alone was then used to model the impacts from the operating mode that was likely to result in the 8th highest impacts. Unfortunately, this ignores the distribution of meteorological conditions occurring throughout the year.

Ecology worked closely with ICF to put together a statistical method to handle this concern. The concept was based on ideas put forward repeatedly at previous meetings of federal, state, local and regional modelers.

Briefly, the process involves modeling all operating modes as though they emit continuously throughout five years, aggregating the impacts from all modes on randomly chosen days and calculating the 98th percentile thereof, and repeating the randomized day-selection 1000 times to come up with a distribution of the 98th percentiles at each receptor. The median of the 98th percentiles is a rather robust and reproducible estimate of the NO_2 1-hour impacts.

iii. Other criteria pollutants: These were modeled in a single simulation with a unit emission rate, but the results were scaled to reflect the actual emissions of each pollutant during power outages. As criteria pollutants have differing averaging periods, the model was configured to report 3-hour, 8-hour, 24-hour, and annual average impacts.

m) 2001 National Land Cover (NLCD2001) land use data.

All receptor grid points were centered on the facility. Ecology requires that receptor grid points be placed at publicly accessible areas outside of Sabey property.

4.4. Points of Compliance

The multi-tenant Sabey Data Center building's breathing air intake(s) and all publically accessible ground-level land outside the Sabey Data Center fence line are possible points of maximum public exposure (nearest point of ambient air) to the proposed emissions. ICF submitted most of the data required for answering questions about where and how high the maximum TAP concentrations could be (Tables 4 and 5). The necessary data are on ICF's AERMOD output compact disk.

4.5. Maximum TAP Concentrations

The predicted maximum emissions of DEEP, NO_2, benzene, CO, and acrolein from the Sabey Data Center exceed their SQERs (see Table 3). ICF provided AERMOD predictions of DEEP and NO_2 concentrations at the Sabey Data Center property boundary and beyond. These predictions, plotted in Figures 3 and 4, show maximum concentrations occur at different points outside the Sabey property boundary.

Ecology estimated the concentration of benzene by multiplying the benzene concentration at the boundary disclosed in Table 6-3 of the NOC Support Document by the ratio of the DEEP extra-boundary concentration to the DEEP boundary concentration. Likewise, Ecology estimated the concentration of CO by multiplying its concentration at the boundary by the ratio of the NO_2 extra-boundary concentration to the NO_2 boundary concentration.

Acrolein has a 24-hour time-weighted concentration averaging interval. This is between the 1-hour and 1-year time-weighted average (TWA) intervals of NO_2 and DEEP. Therefore, Ecology assumed acrolein's extra-boundary/boundary concentration ratio would be intermediate between these ratios. Based on the results, it appears the maximum extra boundary acrolein concentrations may be about one-tenth of its ASIL. ICF's reported TAP concentrations and Ecology's estimates are shown in Table 5.

Table 5. TAP Concentrations at Sabey Property Boundary and Beyond

TAP	Concentration TWA Period	ASIL	Maximum Boundary (μg/m^3)	Maximum Extra-Boundary (μg/m^3)	Extra-Boundary > ASIL? (μg/m^3)
Acrolein	24-hr	0.06	3.71E-03*	3.71E-03[a]	No
Benzene	1-yr	0.0345	2.1E-03*	2.1E-03[a]	No
CO	1-hr	23000	1104**	1104[a]	No
DEEP	1-yr	0.00333		0.04154	Yes
NO_2	1-hr	470		812**	Yes

Source: ICF, p. 31 of 51 in file “Attachments to response-letter_3-22-2011.doc”
*Source: Sabey IGQ_NOC-Report_02182011.docx table 6-6
Estimated based on Extra-Boundary/Boundary ratios of other TAPs. The acrolein Acute Reference Exposure Level (AREL) is 2.5-μg/m^3, 1-hr TWA.
**Notice of Construction Support Document (revised February 2011) Intergate-Quincy Data Center, Quincy, Washington. NAAQS Compliance at Facility Boundary (No Regional Background). ICF’s submittal doesn’t say if this concentration is the maximum that occurs anywhere along the boundary or beyond it or just at anywhere along the boundary.
[a]Ecology estimates that the maximum concentration occurs at the property boundary.

Only those TAPs that exceeded their SQERs are shown in Table 5. The highest modeled off-site concentration of each TAP is compared to its respective ASIL.

Table 6. Comparison of Emission Rates to SQER

Toxic Air Pollutant	Mode of Operation	Modeled Ambient Conc. (ug/m^3) 1-Hr	24-Hr	Annual	ASIL (ug/m^3) 1-Hr	24-Hr	Annual	Fraction of Allowable, and Avg. Time	
Total NO_2	Max day, 8-hr outage	812	--	--	470	--	--	173%	1-hr
DPM	Worst-year, 8-hr outage + all testing*	--	--	0.04154	--	--	3.33E-03	1247%	Annual
Benzene	Worst-year, 8-hr outage	--	--	2.1E-03	--	--	3.45E-02	6.04%	Annual
Toluene	Max day, 8-hr outage	--	0.13	--	--	5000	--	0.003%	24-hr
Xylenes	Max day, 8-hr outage	--	0.09	--	--	221	--	0.04%	24-hr
1,3-Butadiene	Worst-year, 8-hr outage	--	--	5.25E-05	--	--	5.88E-03	0.89%	Annual
Formaldehyde	Worst-year, 8-hr outage	--	--	2.12E-04	--	--	0.17	0.13%	Annual
Acetaldehyde	Worst-year, 8-hr outage	--	--	6.77E-05	--	--	0.37	0.02%	Annual
Acrolein	Max day, 8-hr outage	--	3.71E-03	--	--	0.06	--	5.28%	24-hr
Benzo(a)Pyrene	Worst-year, 8-hr outage	--	--	3.45E-07	--	--	9.09E-04	0.04%	Annual
Benzo(a)anthracene	Worst-year, 8-hr outage	--	--	1.67E-06	--	--	9.09E-03	0.02%	Annual
Chrysene	Worst-year, 8-hr outage	--	--	4.11E-06	--	--	9.09E-02	0.005%	Annual
Benzo(b)fluoranthene	Worst-year, 8-hr outage	--	--	2.98E-06	--	--	9.09E-03	0.03%	Annual
Benzo(k)fluoranthene	Worst-year, 8-hr outage	--	--	2.93E-07	--	--	9.09E-03	0.003%	Annual
Dibenz(a,h)anthracene	Worst-year, 8-hr outage	--	--	4.65E-07	--	--	9.09E-04	0.05%	Annual
Ideno(1,2,3-cd)pyrene	Worst-year, 8-hr outage	--	--	5.56E-07	--	--	9.09E-03	0.006%	Annual

Note: Shaded cells indicate exceedance of ASIL.

Source: ICF NOCSD

* DPM annual impacts were modeled with 8 hours of outages, + all the test modes, each with its own #of operational hours. DPM emissions from outages are amoritized over all hours of the year, while those from testing are spread over the daytime hours of the year. But, NO_2 and the other pollutants listed in this table are only modeled during outages.

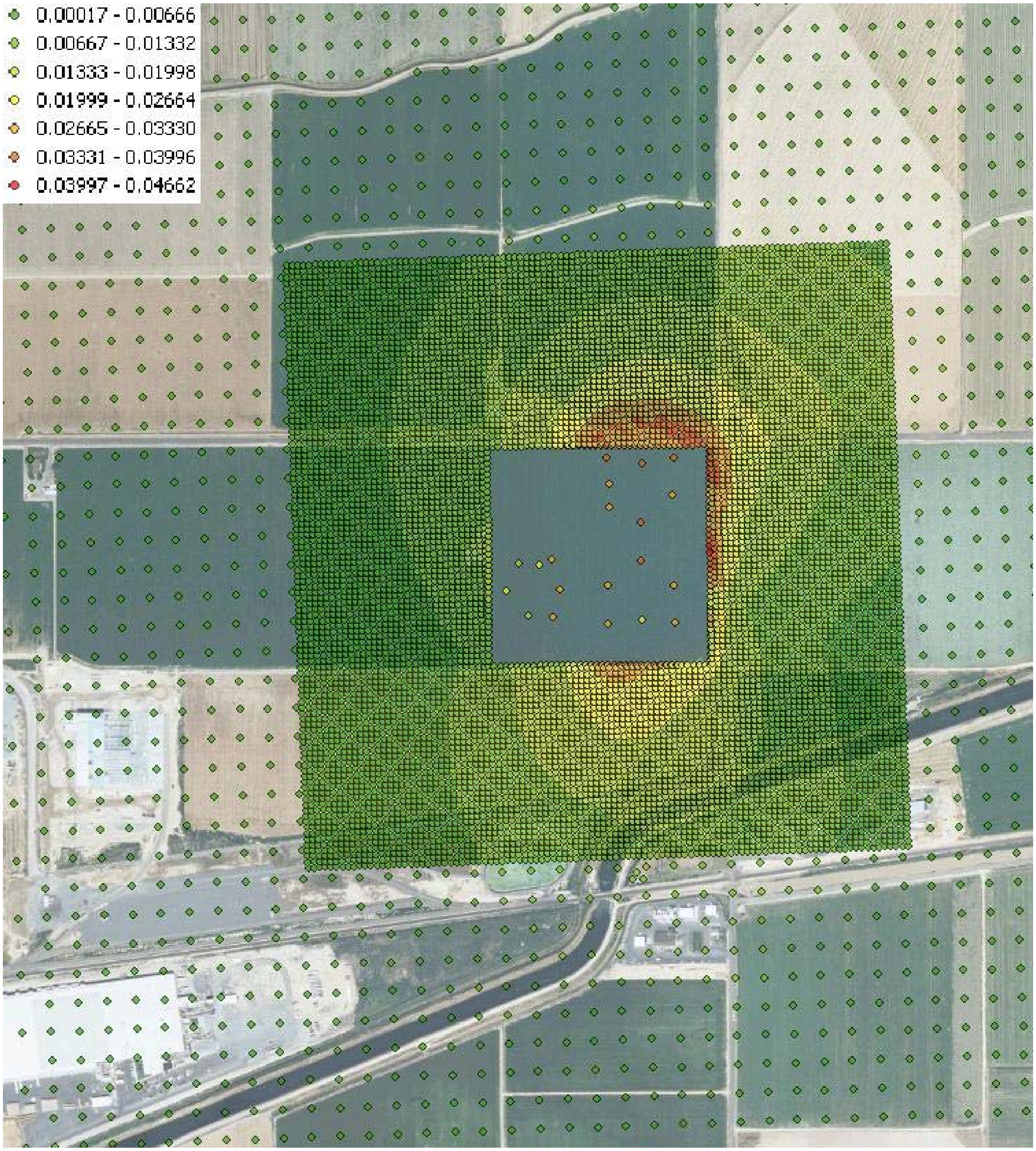

Figure 3. Sabey-attributable DEEP 1-year time weighted average concentration gradient

Figure 3 shows the average DEEP concentration gradient attributable to Sabey that could occur in the single worst year among five recent years. Likewise, Figure 4 shows the places where the highest 1-hour average of NO_2 concentrations attributable to Sabey could occur.

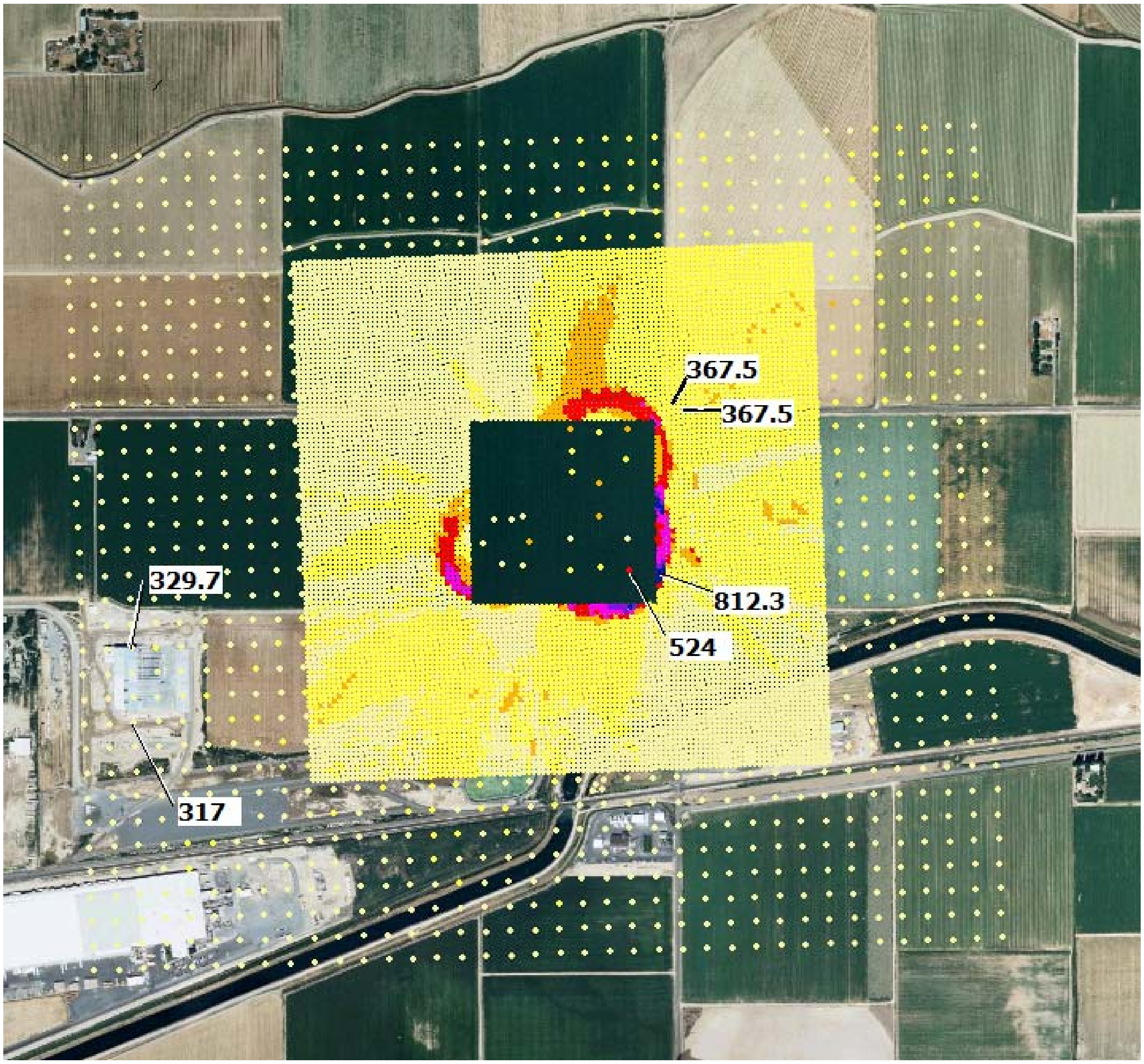

Figure 4. Sabey-attributable 1-hour time weighted average NO_2 concentration extremes

4.6. Pollutants Requiring Second Tier Review

As shown in Table 6, DEEP and NO_2 are the TAPs that prompt second tier review. The air dispersion modeling analysis presented in the Sabey permit application predicts that in a 1-year averaging period, the off-site or extra-boundary concentration of DEEP would exceed its ASIL, and that maximum off-site concentration of NO_2 would exceed its ASILs in more than one 1-hour concentration averaging period. Acrolein, benzene, and CO emissions will be more than their SQERs. Therefore, AQP evaluated the hazards from Sabey's Acrolein, benzene, and CO emissions as well.

5. HEALTH IMPACT ASSESSMENT

5.1. Introduction

Information pertaining to potential impacts of DEEP and NO_2 emitted from Sabey's diesel generators was prepared by ICF. The information was reviewed by an Ecology Air Quality Program engineer, meteorologist and toxicologist. Ecology used the information to prepare an assessment of public health risk associated with exposure to Sabey's planned emissions.

Ecology's assessment follows the requirements promulgated in Chapter 173-460 WAC. The analysis is not a complete risk assessment, but it follows the four steps of the standard health risk assessment approach proposed by the National Academy of Sciences (NAS, 1983, 1994):[6,7] (1) hazard identification, (2) exposure assessment, (3) dose-response assessment, and (4) risk characterization.

5.2. Hazard Identification

The hazard identification step of this risk analysis involves assessing information on potential adverse health effects associated with TAPs that exceed their SQERs. Table 7 summarizes the potential health effects of these TAPs.

Table 7. Potential Adverse Effects of TAPs to be Emitted in Amounts Above SQERs

TAP Emissions That Exceed SQERs	Potential Effects and Hazard Index Targets
Diesel Engine Exhaust Particulates	A range of mild to life-threatening effects has been associated with exposure of various durations and concentrations of DEEP.[8] Exposure to DEEP in controlled laboratory animal studies has demonstrated its carcinogenicity. Epidemiological evidence among occupationally exposed people, although lacking in well-quantified exposure levels, suggests diesel exhaust may cause lung and bladder cancer. The International Agency for Research on Cancer (IARC) designated DEEP as a probable (Group 2A) carcinogen in humans based on sufficient evidence in experimental animals and limited evidence in humans (IARC, 1989).[9] In the *Health Assessment Document for Diesel Engine Exhaust*, EPA Office of

[6] NAS, 1983, National Academy of Sciences, Risk Assessment in the Federal Government: Managing the Process, National Research Council, National Academy Press, Washington, D.C.
[7] NAS, 1994, National Academy of Sciences, Science and Judgment in Risk Assessment, National Research Council, National Academy Press, Washington, D.C.
[8] Ecology report, "Concerns about Adverse Health Effects of Diesel Engine Emissions," available at http://www.ecy.wa.gov/pubs/0802032.pdf
[9] International Agency for Research on Cancer, 1989, Diesel and Gasoline Engine Exhausts and some Nitroarenes, IARC Monographs on the Evaluation of Carcinogenic Risks to Humans: Vol 46, World Health Organization, Lyon, France

TAP Emissions That Exceed SQERs	Potential Effects and Hazard Index Targets
	Research and Development (ORD) states that diesel exhaust is a probable human carcinogen.[10] At exposure levels significantly higher than those that may cause cancer, DEEP can cause a range of other toxic effects including respiratory illnesses, reproductive, developmental, and immune system impairments. Specifically: * eye, nose, and throat irritation along with coughing, labored breathing, chest tightness, and wheezing associated with inflammation and irritation * worsening of allergic reactions to inhaled allergens * increased likelihood of respiratory infections * asthma attacks and worsening of asthma symptoms * decreased lung function * impaired lung growth in children * heart attack and stroke in people with existing heart disease * male infertility * birth defects
Nitrogen dioxide	NO_2 reacts with water in the respiratory tract to form nitric acid, a corrosive irritant. It can react with and damage lung cells, including immune system cells. This damage can affect breathing and may increase the risk of respiratory infections. Brief exposure to NO_2 of less than 1,000 μg/m^3, such as that experienced near major roadways, or downwind from stationary sources, may cause increased bronchial reactivity in some asthmatics, impaired lung function in people with chronic obstructive pulmonary disease and increased risk of respiratory infections, especially in young children (CalEPA, 2008).[11] Persons with asthma and other pre-existing pulmonary diseases, especially Reactive Airways Dysfunction Syndrome (RADS), may be more sensitive to the effects of NO_2 than the general population. NO_2 probably also increases allergic responses to inhaled pollen. Long-term exposure to NO_2 can lead to chronic respiratory illness such as bronchitis and increase the frequency of respiratory infections.
Acrolein	Acrolein is a strong eye and respiratory tract irritant. Exposure by inhalation can alter breathing patterns by narrowing airway openings (airway constriction), and can damage cells lining the airways, prompting white blood cells to enter the lungs (CalEPA, 2008).[12]
Benzene	At high exposure levels, adverse effects would involve multiple organs and biological processes. The acute hazard index targets are reproductive and developmental organs, immune system, hematologic system; chronic hazard index targets are hematopoietic system, development, nervous system. In addition, benzene is a known human carcinogen.
Carbon Monoxide	High exposure levels reduce oxygen delivery throughout the body by the cardiovascular system.

[10] "Health Assessment Document for Diesel Engine Exhaust," U.S. Environmental Protection Agency, Office of Research and Development, National Center for Environmental Assessment, Washington, D.C., EPA/600/8-90/057F, 2002, available at http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=29060.
[11] http://www.oehha.ca.gov/air/hot_spots/2008/AppendixD2_final.pdf#page=209, accessed on October 27, 2010.
[12] http://www.oehha.ca.gov/air/hot_spots/2008/AppendixD1_final.pdf#page=42, accessed on October 27, 2010.

5.2.1. DEEP and NO_2

Emissions of DEEP and NO_2 are subject to second tier review based on their critical effects, cancer, and acute respiratory impairment, respectively. In addition to evaluating cancer risk, the potential for DEEP to cause acute respiratory tract impairment is evaluated in subsequent analysis with additional effects from NO_2 and acrolein, which may also cause acute toxicity to the respiratory tract. NO_2 and acrolein are not known or suspected to be carcinogenic.

5.2.2. Acrolein

As shown in Table 3, the estimated maximum possible extra-boundary acrolein concentration attributable to Sabey is likely to be less than 3.71E-03 µg/m^3, 1-day TWA. Acrolein exposure can cause eye and upper respiratory tract irritation at low exposure levels. DEEP is an aerosol, and since, like NO_2, acrolein is a gas at ambient temperatures, its effects are not likely included as part of the DEEP risk assessments on which the chronic reference exposure level (CREL) and reference concentration (RfC) are based. Ecology therefore included acrolein in the risk assessment. As noted in Table 6, Sabey-attributable acrolein concentrations are likely to be 5.28 percent or less of the ASIL. Acrolein will increase the upper airway irritation hazard index of DEEP and NO_2 by 5.28 percent or less. Because ICF did not provide detailed estimates of acrolein concentrations that could occur at receptors near Sabey, Ecology added by 5.28 percent to the DEEP and NO_2 hazard index in the subsequent analysis.

5.2.3. Benzene

As shown in Table 6, the estimated maximum annual average benzene concentration beyond the Sabey property boundary is 2.1E-03-µg/m3, which is less than the ASIL. Given average air pollutant dispersion conditions, a 1-hour TWA concentration of 0.02625-µg/m3 could be expected over a longer interval when the generators are operated at full capacity.[13] A concentration of 0.02625-µg/m^3 is less than the OEHHA chronic inhalation REL (60-µg/m^3, long-term average concentration) and far less than the acute inhalation reference exposure level (1300-µg/m^3, 1-hour TWA).[14] Even if full capacity generator operation occurred during an interval in which worst-case dispersion conditions persisted, it is unlikely the benzene concentration would exceed the inhalation RELs at that time. This indicates adverse noncancer health risks attributable to benzene emissions from Sabey are unlikely to occur.

Benzene is a known human carcinogen. OEHHA published an inhalation cancer unit risk factor of 0.000029 (µg/m^3)$^{-1}$.[15] If a house was built and then occupied by residents for 70 years at the location where the maximum annual average benzene concentration (2.1E-03-µg/m^3) may occur, the additional cancer risk could be up to 6.08E-8 (~6 in a 100 million), which is nearly 16-fold less than 1.0E-6 (one in a million).

[13] Based on USEPA, 1995, Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised EPA-450/R-92-019 annual average concentrations of nonreactive air pollutants are approximately 0.08 fold lower than average 1-hour concentrations due to variable dispersion conditions.
[14] See Section 5.4.1 for descriptions of inhalation reference exposure levels.
[15] http://www.oehha.ca.gov/air/hot_spots/tsd052909.html, accessed on October 27, 2010.

Given the lack of noncancer health effects risk and minimal additional cancer risk posed by Sabey-attributable benzene emissions, Ecology did not evaluate benzene further.

5.2.4. Carbon Monoxide

As shown in Table 4, the estimated maximum possible extra-boundary carbon monoxide (CO) concentration attributable to Sabey is 1104-µg/m^3, 1-hour TWA concentration, which is 4.8 percent of its acute reference exposure level (AREL) 23,000-µg/m^3 1-hour TWA concentration.[16] Given the low CO concentration likely to result from Sabey emissions, even under worst-case air pollutant dispersion conditions, and given that the effects of CO at higher exposures are on the cardiovascular system, Ecology did not evaluate CO further.

5.2.5. Environmental Fate

The World Health Organization International Programme on Chemical Safety report–Diesel Fuel and Exhaust Emissions[17] cites information on the topics of environmental transport, distribution, and transformation of diesel exhaust:

> *"The compartment first affected by diesel exhaust emissions is the atmosphere. The hydrosphere and geosphere are contaminated indirectly by dry and wet deposition. The environmental fate of the individual constituents of diesel exhaust is generally well known: Particles behave like (non-reacting) gas molecules with regard to their mechanical transport in the atmosphere; they may be transported over long distances and even penetrate the stratosphere. The overall removal rate of diesel particles is estimated to be low, resulting in an atmospheric lifetime of several days. During aging, particles may coagulate, with higher fall-out rates, thus reducing the total airborne level. The elemental carbon of diesel particulates may act as a catalyst in the formation of sulfuric acid by oxidation of sulfuric dioxide. The organic components adsorbed on elemental carbon may undergo a number of physical and chemical reactions with other atmospheric compounds and during exposure to sunlight."*[11]
>
> *"The major fraction (50-80%) of the particulate emissions of diesel engines is in the submicron size, ranging from 0.02 to 0.5 µm ... Once particles have been emitted, their mechanical transport in the atmosphere is like that of gas molecules (nonreactive). Together with carbon particles from other combustion processes, they may be transported over long distances and even penetrate the stratosphere (Muhlbaier Dasch & Cadle, 1989)."*

[16] http://www.oehha.ca.gov/air/hot_spots/2008/AppendixD2_final.pdf#page=41, accessed on October 27, 2010.
[17] United Nations Environment Programme, International Labour Organisation, World Health Organization, International Programme on Chemical Safety, "Environmental Health Criteria 171, Diesel Fuel and Exhaust Emissions," World Health Organization, Geneva, 1996, http://www.inchem.org/documents/ehc/ehc/ehc171.htm, accessed December 3, 2008.

> *"The hydrosphere and geosphere may be affected indirectly by diesel exhaust emissions after dry or wet deposition of particulate matter or individual constituents."*[11]
>
> *"Atmospheric removal of airborne carbon particles consists mainly of dry deposition and scavenging by precipitation (wet deposition). The rate of wet removal is directly correlated to the ratio of organic to elemental carbon and is low for small ratios (Muhlbaier Dasch & Cadle, 1989).*[18] *As the overall removal rate of diesel particulates is estimated to be low, the atmospheric life-time is several days (Jaenicke, 1986)."*

The wide range of chemical constituents in diesel engine exhaust has an even wider range of atmospheric fates. Diesel exhaust's constituents can react with atmospheric radicals to form new species, combine with other substances to form more complex species, and be deposited onto surfaces.

The two most important processes affecting diesel exhaust particles in the atmosphere are (1) dry and wet deposition (physical removal) of the particles, and (2) atmospheric transformations of species adsorbed to the particles.[19] A particle's atmospheric lifetime due to dry deposition is a function of its diameter.[20] Diesel exhaust particles, generally smaller than 1-µm,[21] are expected to remain in the atmosphere from five to 15 days. Rain results in almost complete wash-out of particles 0.1 to 10 µm in diameter from the atmosphere.[22,23,24] Thus some of the DEEP will deposit on the surfaces of objects, soils, etc., near Sabey.

Organic chemicals, notably PAH derivatives, in the particles in the exhaust stream may be protected from photolysis and/or chemical reactions. Organic chemicals coating the surface of the particles are expected to primarily react with sunlight (through photolysis), ozone (O_3), gaseous nitric acid (HNO_3), and NO_2. Some of the organic chemicals coating the surface of the particles also volatilize off of the particles. Once volatilized into gas phase air, they are more susceptible to photolysis and chemical reactions. Five or more ringed PAHs and nitro-PAHs have low volatility and mostly remain bound to larger particles.[25] The 5+ ringed PAHs and PAH

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[18] Muhlbaier Dasch J & Cadle SH, 1989, Atmospheric carbon particle in the Detroit urban area: Wintertime sources and sinks, Aerosol Sci Technol, 10: 236-248 (as cited in 11).
[19] http://www.arb.ca.gov/toxics/dieseltac/part_a.pdf
[20] Graedel, T. E. and C. J. Weschler, 1981, Chemistry within aqueous atmospheric aerosols and Raindrops, *J. Geophys Res*., 19, 505-539.
[21] Pierson W.R., Gorse R.A., Jr., Szkariate A.C., Brachaczek W.W., Japar S.M., Lee F.S.C., Zweidinger R.B. and L.D. Claxton, 1983. Mutagenicity and chemical characteristics of carbonaceous particulate matter from vehicles on the road. Environ. Sci. Technol., 17, 31-44
[22] Leuenberger, C., Ligocki, M. P., and J. F. Pankow, 1985. Trace organic compounds in rain. 4. Identities, concentrations and scavenging mechanisms for phenols in urban air and rain. Environ. Sci. Technol., 19, 1053-1058.
[23] Ligocki M. P., Leuenberger C., and J.F. Pankow, 1985a. Trace organic compounds in rain - III. Particle scavenging of neutral organic compounds. *Atmos. Environ*., 19, 1619-1626.
[24] Ligocki M.P., Leuenberger C., and J.F. Pankow, 1985b. Trace organic compounds in rain - II. Gas scavenging of neutral organic compounds. *Atmos. Environ*., 19, 1609-1617
[25] http://www.arb.ca.gov/toxics/dieseltac/part_a.pdf

derivatives tend to be carcinogenic, whereas ones with fewer aromatic rings are not likely to be carcinogenic.

A literature search did not yield information about the fate of DEEP deposited in terrestrial and aquatic environmental compartments.

5.3. Exposure Assessment

In order for pollutants to cause harm, people must be exposed. The exposure assessment step of risk assessment involves measuring or estimating concentrations, durations, and frequencies of exposures to agents present in the environment, and the estimation of hypothetical exposures that might arise from the release of TAPs into the air outside of space controlled by the permit applicant. To the practical extent possible, the current exposure assessment characterizes past, current, and expected TAP exposures. Ambient air is publicly accessible air in the vicinity of a proposed project. Inhalation will be the dominant exposure route of humans to Sabey's diesel exhaust particulate and gaseous emissions. Small exposures via ingestion and skin contact will also occur.

5.3.1. Multi-Route Exposures

The following paragraph and Table 8 are from the California OEHHA's *Air Toxics Hotspots Risk Assessment Guidance*.[26]

> *"Table [7] shows the multipathway substances that, based on available scientific data, can be considered for each non-inhalation exposure pathway. The exposure pathways that are evaluated for a substance depend on two factors: 1) whether the substance is considered a multipathway substance for the Hot Spots Program (Table 5.1), and 2) what the site-specific conditions are. A multipathway substance may be excluded from a particular exposure pathway because its physical-chemical properties can preclude significant exposure via the pathway. For example, some water-soluble chemicals do not appreciably bioaccumulate in fish; therefore, the fish pathway is not appropriate. In addition, if a particular exposure pathway is not impacted by the facility or is not present at the receptor site, then the pathway is not evaluated. For example, if surface waters are not impacted by the facility, or the water source is impacted but never used for drinking water, then the drinking water pathway is not evaluated."*

[26] The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, Office of Environmental Health Hazard Assessment, California Environmental Protection Agency, August 2003.

Table 8. Specific Pathways to be Analyzed for Each Multi-Pathway Substance

Substance	Ingestion Pathway									
	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

It is possible that levels of PAHs and the few other persistent chemicals in DEEP will build up in food crops, soil, and drinking water sources near Sabey; however, quantifying exposure to these chemicals from these media is impractical, given the lack of available information, and very unlikely to yield significant concerns. Inhalation is the only route of exposure to DEEP that has received sufficient scientific study to be useful in human health risk assessment. The only significant route of exposure to airborne NO_2 and acrolein is inhalation.

5.3.2. Identification of Exposed Populations

To assess exposure to TAPs and ultimately estimate potential health risks to people exposed to Sabey diesel engine emissions, ICF identified key locations where people might be exposed, including some of the buildings near the data center. ICF identified all the buildings on lots adjacent to Sabey's property (see Table 9 and Figure 9). However, ICF did not identify buildings near Sabey where sensitive populations are likely to be concentrated.

5.3.3. Demographic Estimates

The Sabey Data Center is near U.S. Census Bureau Tract 9806, of Grant County[27] (Figure 5). The U.S. Census Bureau reported year 2000 demographic profile highlights of Quincy North as cited in Table 9 along with characteristics of the entire U.S. for comparison.

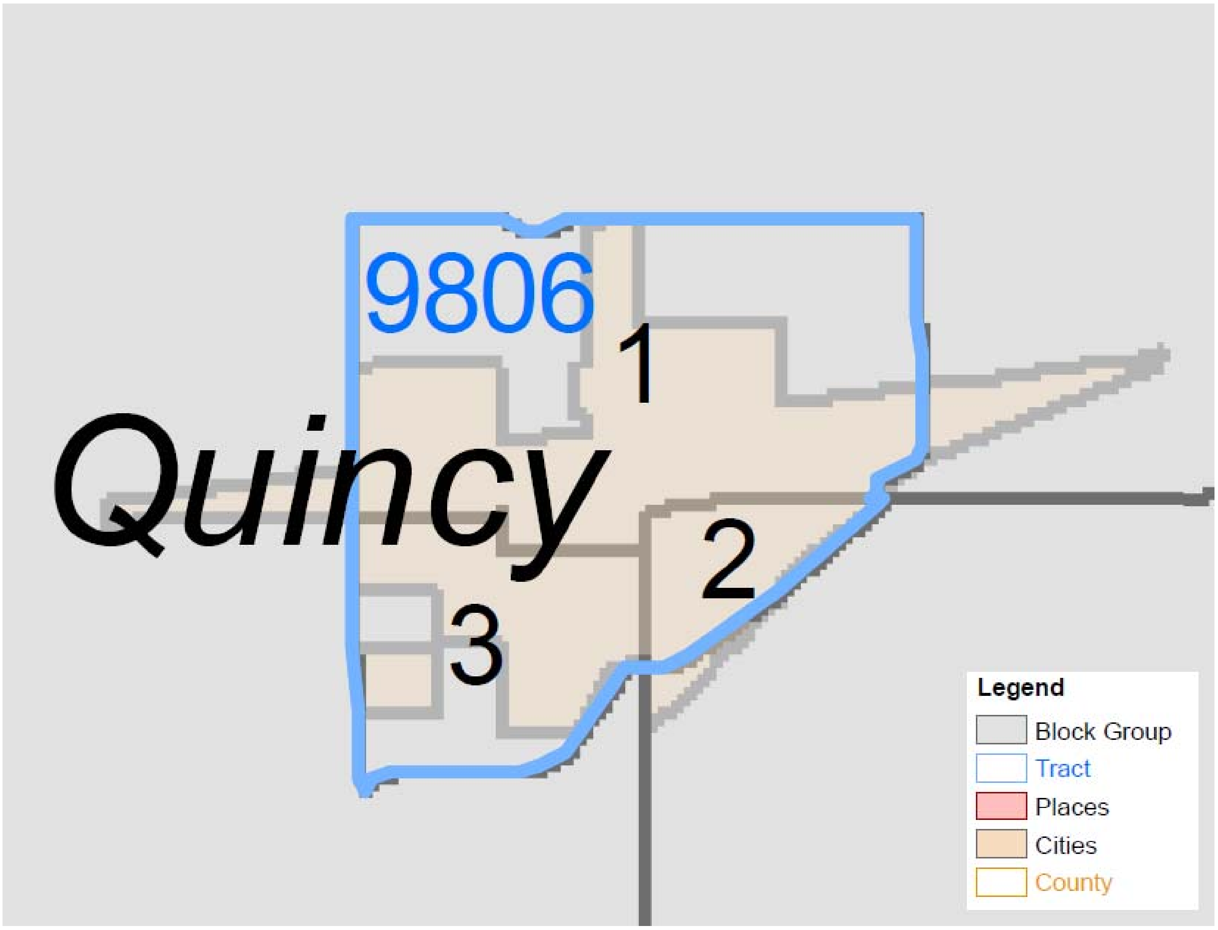

Figure 5. Quincy 2000 census tracts and vicinity map
(Source: [http://www.ofm.wa.gov/pop/smallarea/maps/bg2000/pdf/northcentralbg.pdf., accessed 5-3-2011](http://www.ofm.wa.gov/pop/smallarea/maps/bg2000/pdf/northcentralbg.pdf))

[27] http://www.ofm.wa.gov/pop/smallarea/maps/bg2000/pdf/northcentralbg.pdf

Table 9. Quincy 2000 Demographic Profile Contrasts

	Quincy	U.S.
Male	51.5%	49.1%
Female	48.5%	50.9%
Under 5 years	10.9%	6.8%
18 years and over	64.0%	74.3%
65 years and over	9.0%	12.4%
Average household size	3.38	2.59
Families below poverty level	18.4	9.2

(Source: http://factfinder.census.gov/servlet/SAFFFacts?_event=Search&geo_id=16000US5347280&_geoContext=01000US%7C04000US53%7C16000US5347280&_street=&_county=quincy&_cityTown=quincy&_state=04000US53&_zip=&_lang=en&_sse=on&ActiveGeoDiv=geoSelect&_useEV=&pctxt=fph&pgsl=160&_submenuId=factsheet_1&ds_name=DEC_2000_SAFF&_ci_nbr=null&qr_name=null&reg=null%3Anull&_keyword=&_industry=, accessed May 3, 2011)

In consideration of the possibility that new buildings will be constructed and occupied in the DEEP and NO_2 affected area near Sabey, Ecology examined current land-use zoning. The area within the 1.0E-6 additional cancer risk isopleth of Sabey's DEEP emissions is zoned for industrial use but contains several residences. The zoning boundaries are illustrated in the Grant County zoning map (Figure 6).

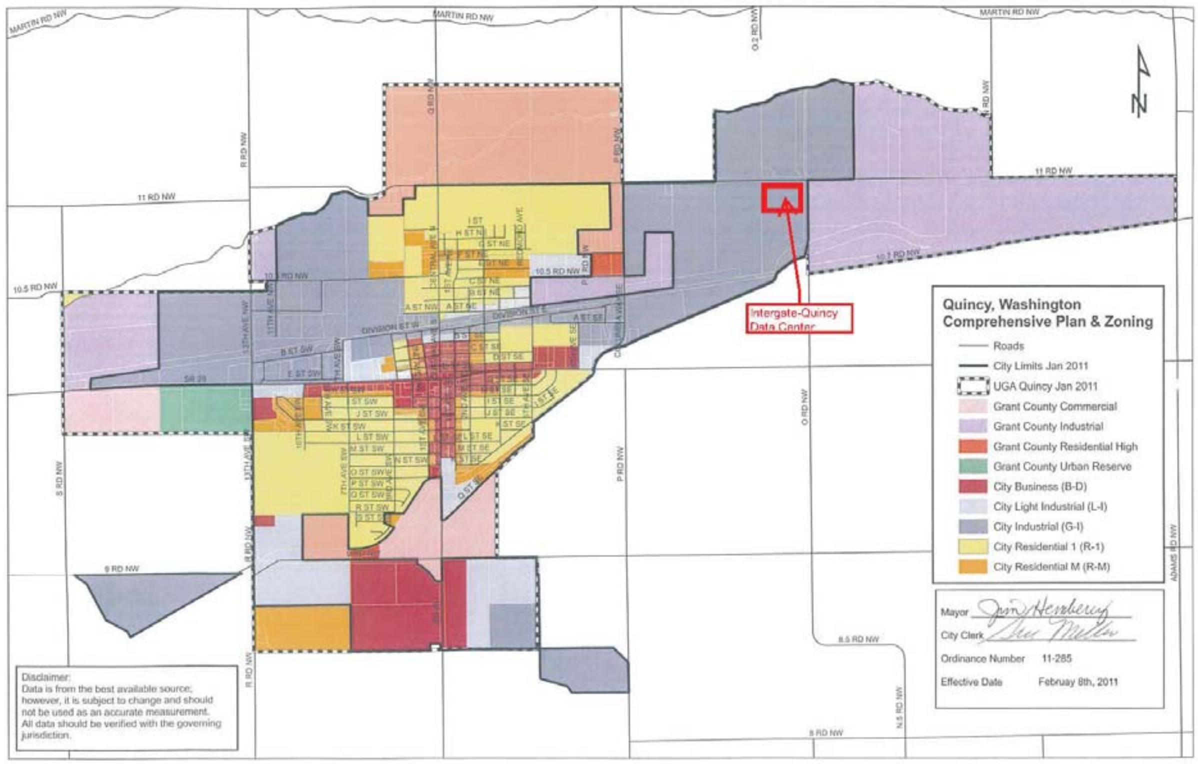

Figure 6. Section of Grant County land-use zoning map
(Source: ICF Itemized-IGQ-response-letter_3-22-2011.doc)

ICF identified some of the buildings in the area nearest the data center. These are shown in Figures 7, 8, and Table 10. Among these buildings, the MIRRs and MICRs would experience highest average DEEP and NO_2 concentrations according to AERMOD results. ICF also identified outdoor locations, beyond the access controlled by Sabey, where simulated DEEP 1-year average and NO_2 1-hour average concentration maxima occur (the MIBR). The MIRRs, MICRs, and MIBRs attributable to the data center's DEEP and NO_2 emissions are noted in Table 11.

Table 10. Building Inventory Within 0.00333 μg/m³ DEEP Contour Around Sabey Intergate-Quincy Data Center, Quincy, WA, February 15, 2010

1. Intuit Inc.–Data Center	1711 NE M St
2. Private Residence	11443 NW RD P
3. Yahoo! Inc–Data Center	1010 NE Yahoo Way
4. Columbia Colstor Inc–Freezer house	80 Columbia Way
5. Perez Trucking Inc–Trucking Company	10493 RD P NW
6. Quincy Foods LL–Frozen Foods	222 Columbia Way
7. Private Residence	15582 W Hwy 28
8. JR Simplot Co–Food Processor	10472 NW RD O
9. Legacy Farms I LLC–Farm	14987 W Hwy 28
10. Ann Van Dyke Land Company LLC	14337 W Hwy 28
11. Private Residence	14236 W Hwy 28
12. CHS Inc–Bottled Gas company	10555 NW RD O
13. Private Residence	14157 NW RD 11
14. Private Residence	0NW RD 11
15. Private Residence	14524 NW RD 11
16. Private Residence	14994 NW RD 11
17. Grant County PUD #2 Substation[28]	Rd P NW
18. Columbia Colstor Inc–Cold Storage	614-820 Intermodal Way
19. Grant County PUD #2 Substation[29]	Rd P NW
20. Private Residence & Farm	15661 W Hwy 28
21. Private Residence & Farm	15481 W Hwy 29
22. Countywide Funding–Farm	9726 NE RD O
23. Private Residence[30]	10472 NW RD O[31]
24. Private Residence & Farm	14477 NW RD 10.7
25. Private Residence & Farm	14524 NW RD 11
26. Evergreen Mortgage Corp.	14194 NW RD 11
Source: ICF	

[28] ICF listed locations #17 and #19 as "Grant County PUD #2 Substation."
[29] Ibid.
[30] http://grantwa.taxsifter.com/Search/results.aspx?q=200340001, accessed 5/4/2011.
[31] ICF identified this as a Commercial Building. Grant County identifies this parcel as a Residential Mobile Home at 10572 NW RD O.

Figure 7. Property parcels near Sabey

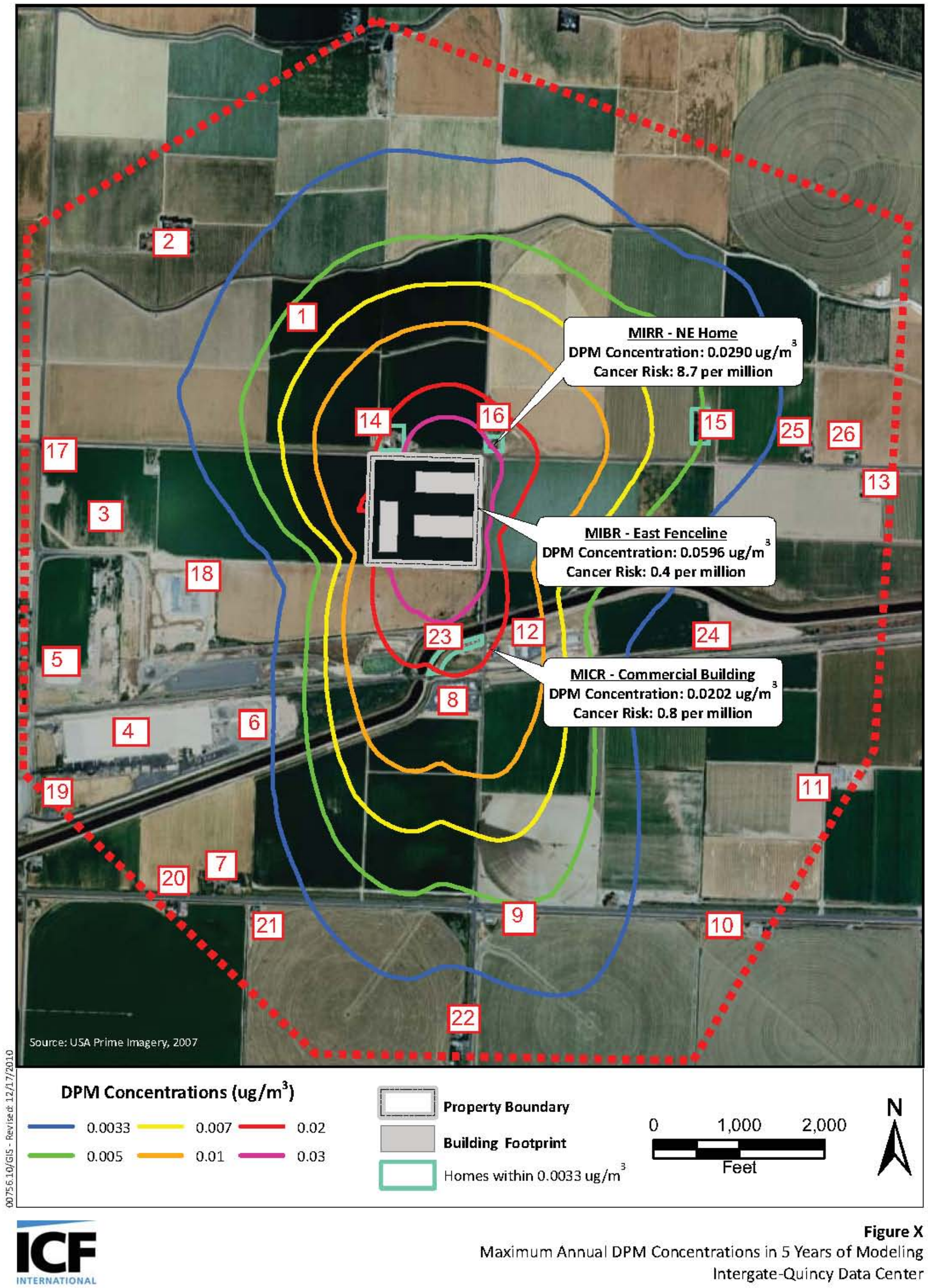

Figure 8. Occupied impact receptor locations near Sabey
(Source: ICF Itemized-IGQ-response-letter_3-22-2011.doc)

Table 11. Sabey-Attributable DEEP and NO_2 Maximally Exposed Receptor Locations

	DEEP	NO_2[32]
MIRR	In both the DPM and NO_2 HIAs, ICF states the MIRR is the Thomas G & Ann L Downs–Residence at 14994 NW RD 11.	ICF table on p. 38 of 51 in file “Attachments to response-letter_3-22-2011.doc” says the MIRR is 70 m north of the northeast corner
MICR	In the DPM HIA, ICF states the receptor is the “*agricultural supply yard southeast of the site*. (p. 2-3) and the “*Columbia Cold Storage facility southwest of the data center.*” Figure 5-1 of the DPM HIA points to the MICR location. The “*Attachments to response-letter_3-22-2011.doc*” identifies the location as “*CHS Inc – Bottled Gas company, 10555 NW RD O*” ; However the attachment states the MICR is the “*Columbia Colstor Inc- Cold Storage, 614-820 Intermodal Way*” Despite the confusion, it appears the true DEEP MICR is *CHS Inc – Bottled Gas company, 10555 NW RD O* ICF also notes *“Maximum impact onsite tenant, represented by rooftop receptors.”*	*Columbia Cold Storage facility southwest of the* [proposed] *data center.* *ICF. table on p. 38 of 51 in file* “Attachments to response-letter_3-22-2011.doc” says the MICR is 820 m south of the south west corner, and that the max conc there could be 335 ICF also notes *“Maximum impact onsite tenant, represented by rooftop receptors.* *ICF. table on p. 38 of 51 in file* “Attachments to response-letter_3-22-2011.doc” says the conc at building A SE parking could be 535
MIBR	In both the DPM and NO_2 HIAs, ICF states the MIBR is “*along the west fenceline in agricultural land zoned for Commercial development. And “at unoccupied agricultural land on the east boundary.”* The DEEP HIA indicates the MIBR for both TAPs is a point along Sabey’s east property line.	The response letter says the NO_2 MIBR is 10 m east of the east fence, 70m north of the southeast corner[33]

[32] ICF’s *May-2011-NO2_SecondTierReport_clean_5-4-2011.doc*

[33] *Source: ICF. table on p. 38 of 51 in file* “Attachments to response-letter_3-22-2011.doc” *i.e.,*

Intergate-Quincy Air Quality Permitting Analysis (03-09-2011) With INCREASED RUNTIME AND RAISED STACKS (48 feet)

G:\Seattle\PNWProjects\Sabey_Corp\00756.10 Intergate-Quincy Data Center\03_Reports and Analyses\AERMOD Results\[AERMOD Results_030911.xls]1hr NO2_Outage

Maximum 1-hour NO2 from Power Outage

	2004 Conc. (ug/m3)	2005 Conc. (ug/m3)	2006 Conc. (ug/m3)	2007 Conc. (ug/m3)	2008 Conc. (ug/m3)	Max Conc. (ug/m3)	Time	East(X)	North(Y)	Location
MIBR	798	812	785	805	800	812	5111602	287270	5236310	10 m east of E Fence, 80 m north of SE corner
MIRR	350	347	333	344	353	353	8013119	287320	5236660	70 m northeast of NE corner
MICR	335	324	283	278	320	335	4062605	286280	5235730	820 m southwest of SW corner
Tenant	518	524	532	520	521	532	6112103	287197	5236304	Building A SE parking

Assumptions:
2,000 kWe generators (44 total generators)
Vendor-guaranteed emission data
75% load during power outage
1-hour NO2 by PVMRM using NOx emission (10% NO2, 90% NOx Ratio, 40 ppb ozone background)

5.3.4. Estimates of Exposure Durations of Identified Populations

Cancer risk from exposure to DEEP is estimated by determining the DEEP concentration at each receptor point. These concentrations are multiplied by the DEEP unit risk factor (URF). Because URFs are based on a continuous exposure over a 70-year lifetime, exposure duration and exposure frequency are considered.

People who work at commercial locations near Sabey are likely only to be exposed for up to the duration of their workday (e.g., eight hours per day). Residents living near the data center have the potential to be exposed for a longer period (e.g., 24 hours per day). A person who lived at a MIRR, worked at the MICR, and was frequently at the MIBR location would have the highest conceivable exposure.

In order to estimate the exposure times of various populations to the TAPs of concern, standard values were used. These values are estimates of how much time people using the MIBR, MICR, and MIRR. In this assessment:

- A continuous exposure 24 hr/day for 365 days/yr for 70 years is assumed for people in the MIRR.
- Repeated exposures of 8 hr/day for 250 days/yr for 40 years are assumed for people in the MICR.
- Repeated exposures of 2 hr/day for 250 days/yr for 30 years are assumed for people in the MIBR.

5.3.5. TAP Concentration Estimates

To assess human exposure to DEEP and NO_2 attributable to the data center's diesel engine generators, ICF used AERMOD to calculate average annual concentrations and 1-hour TWA maximum concentrations, respectively, in breathing zone air at each of the grid points in modeling domains. The model used emissions rate estimates combined with recent meteorological data. The results are estimates of DEEP and NO_2 concentrations at grid points outside the Sabey facility property boundary. ICF examined the estimates of concentrations at grid points to locate the points of highest concentrations. Ecology gathered these estimates into Tables 12 and 13 from figures and tables in documents and e-mails submitted by ICF.

Table 12. Maximum NO_2 and DEEP Concentrations Attributable to the Sabey Data Center Alone

Maximally Impacted	NO_2 1-hour Average ($\mu g/m^3$)[34]	Revised DEEP Concentration Estimates
Extra-boundary location	812.3	0.04154**
Off-site commercial bldg.	329.7[35]	0.0113**
Off-site commercial bldg. parcel	317	0.01341*
Sabey tenant area	524	0.0389**
Residence	367.5	0.0221**
Residence (yard)	367.5	0.0239**

(Source: ICF)
Note: Sabey_NTE_max_DPM_impacts.csv from Ranil Dhammapala, June 7, 2011. The file Ranil prepared for the review team in response to ICF's revised-revised modeling and not-to-exceed emissions factors documents received May 24 and/or June 3.
* Pre-revised revision concentration estimate x (0.04154 / 0.06187).
** On June 3, 2011, Sabey/ICF sent several documents concerning use and concentration modeling results obtained by a lower DEEP emission factor than in their previous project proposal. It also corrected the emission rates from generator testing operations by spreading them over the daytime hours of the year. The results of remodeled concentrations, as asserted by ICF, are quoted in Table 12. The corresponding figure submitted by Sabey/ICF is below.

[34] ICF reported some NO_2 concentration maxima as higher or lower than those shown in this table (see previous footnote).
[35] The off-site MICR (at 329.7- $\mu g/m^3$) may be in the area cattycorner to the southeast of Yahoo, if it is now a building (the satellite photo layer is from 2006).

Table 13. DEEP Concentration Estimates Given Sabey/ICF, June 3, 2011, Project Proposal Emission Factors

Intergate-Quincy Air Quality Permitting Analysis (06-02-2011)	Annual DPM from All Operation Modes - 48 feet Stack Height	Power Outage - 24 hours	All Tests - 7 am to 7 pm		
	MIBR (Indust Zoning)	MIRR -House	MIRR-Yard	MICR	Tenant
2004 Conc. (ug/m3)	0.03538	0.0183	0.02	0.0105	0.0352
2005 Conc. (ug/m3)	0.03394	0.0165	0.0182	0.0113	0.03394
2006 Conc. (ug/m3)	0.03835	0.0194	0.0213	0.00875	0.03768
2007 Conc. (ug/m3)	0.03926	0.0204	0.0224	0.00747	0.0389
2008 Conc. (ug/m3)	0.04154	0.0221	0.0239	0.00744	0.03714
Max-Year Conc. (ug/m3)	0.04154	0.0221	0.0239	0.0113	0.0389
5-Year Average Conc. (ug/m3)	0.037694	0.01934	0.02116	0.009092	0.036572
East(X)	287263	287310		287310	287204
North(Y)	5236435	5236650		5235950	5236591
Location	along E fence, 210 m north of SE corner	70 m northeast of NE corner		east of mobile homes, 300 m south of SE corner	NE parking lot of Building B

(Source: Sabey NTE DPM Risk 6-03-2011.doc, received June 03, 2011)

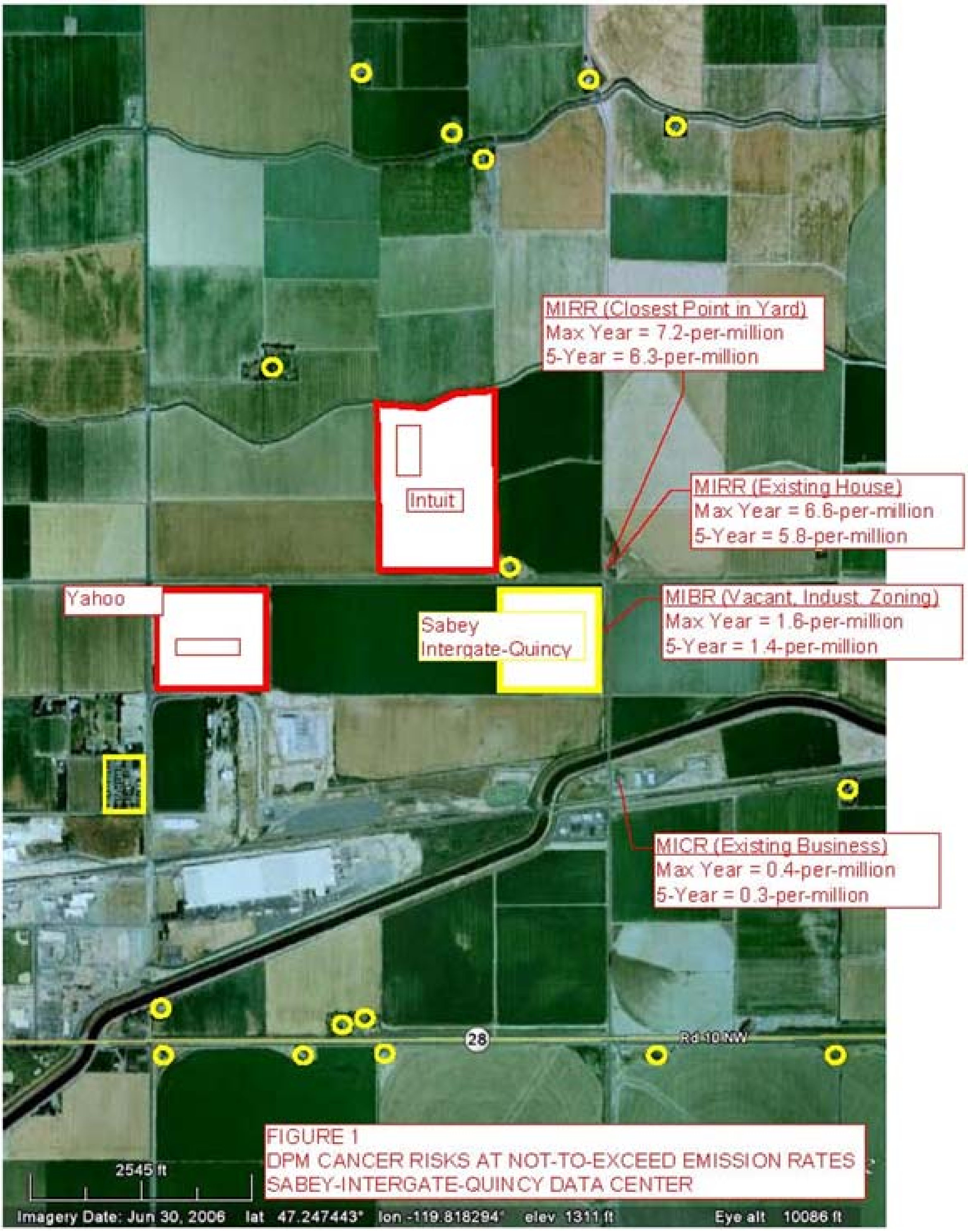

Figure 9. DEEP concentrations estimates given Sabey/ICF, June 3, 2011, project proposal emission factor
(Source: Sabey NTE DPM Risk 6-03-2011.doc, received June 03, 2011)

Ecology verified that the DEEP and NO_2 concentrations at the maximally impacted extra-boundary, commercial building, and residential receptor locations reported by ICF in AERMOD output were correct. Ecology also confirmed the geographic locations of these receptors given the AERMOD results.

Among these receptor locations, the highest simulated DEEP 1-year TWA concentration is at an open air point close to the east side Sabey Data Center property boundary. The highest simulated NO_2 1-hour TWA concentration is also at an open air point close to the east side Sabey Data Center property boundary.

In accordance with 173-460-090(5), Ecology considered background concentrations of DEEP and NO_2 as part of this second tier review. Existing levels of these pollutants near the Sabey facility result from emissions by motor vehicles and other diesel engine equipment, significantly including nearby Yahoo! and Intuit Data Centers' generators and, to a lesser extent, the railway running east-west through Quincy to the south of the proposed data center, and the Microsoft and Dell Data Centers ~3.2-km to the west of the proposed data center. NO_2 is also emitted from other points of high temperature combustion including Celite. Such sources are ostensibly included in the latest estimates of DEEP and NO_2 concentrations in the EPA's National-Scale Air Toxics Assessment (NATA) and other available data on ambient concentrations. To consider background concentrations, Ecology used the NATA DEEP concentrations estimates for the census tract in which the Sabey Data Center is located, and Ecology's estimate of NO_2 background in the Quincy area, as further discussed below.

5.3.5.1. Existing Background Levels

Ecology considered "background" DEEP, NO_2, and acrolein concentrations in the current review. WAC 173-460-090 second tier review part 5 states:

> *"(5) Background concentrations of TAPs will be considered as part of a second tier review. Background concentrations can be estimated using: (a) The latest National Ambient Toxics Assessment data for the appropriate census tracts; or (b) Ambient monitoring data for the project's location; or (c) Modeling of emissions of the TAPs subject to second tier review from all stationary sources within 1.5 kilometers of the source location."*

DEEP, NO_2, and acrolein are released into the atmosphere by various human activities. Sabey emissions will add to the existing levels. Knowledge of currently existing levels is needed for predicting how much exposure there will be from both existing and proposed emissions. Quantities of DEEP, NO_2, and acrolein in ambient air can be measured by sampling and laboratory analyses (monitoring) or calculated by using information on process rates, emissions factors (emissions inventories), and meteorological conditions.

Ecology is unaware of any DEEP, NO_2, or acrolein monitoring anywhere in Grant County. In the absence of monitoring data, the median concentrations reported in recent NATA reports, and the emissions dispersion modeling reviewed by Ecology for other data centers, Celite, and railway traffic are the only available estimates of DEEP and NO_2 in the Sabey area. NATA includes estimates of DEEP and acrolein but not NO_2 concentrations.

NO_2 is not measured near Sabey, but Ecology has performed AERMOD simulations that include the other data centers, railway, etc. to estimate possible NO_2 “background” concentrations. The gridded 1-hour average NO_2 concentrations were computed.

The NATA contains calculated concentrations of DEEP and 177 Federal Clean Air Act-listed Hazardous Air Pollutants (but not NO_2) in most U.S. census tracts. NATA contains estimates for the census tract nearest where the propose data center will be located (tract 9806, Quincy, Grant County) and other census tracts. The estimates were derived with emissions inventory information and EPA’s Assessment System for Population Exposure Nationwide (ASPEN) model.[36] The estimates are aggregates of pollutant concentrations resulting from emissions from various source categories such as road vehicles and equipment, and vehicles used for nonroad purposes. These are shown in Table 14.

Table 14. NATA DEEP and Acrolein Concentration Estimates for Census Tract 9806 in Grant County, WA, Nearest the Sabey Data Center

		NATA Year 2005		Exposure Conc. ÷ Ambient Conc.
		Ambient Conc.	**Exposure Conc.**	
DEEP	Onroad	0.01270	0.00950	0.75
	Nonroad	0.02631	0.01331	0.51
	Total	**0.03901**	**0.02281**	**0.58**
Acrolein	Nonpoint	0.00026	0.00025	0.96
	Nonroad	0.00044	0.00048	1.09
	Onroad	0.00014	0.00018	1.29
	Background	0.00281	0.00141	0.50
	Total	**0.00365**	**0.00231**	**0.63**
Note: Concentration estimates are µg/m^3.				

The other data centers in the Quincy area were constructed after 2005. Therefore, DEEP and acrolein originating from their generators have not yet been included in NATA to date.

The facility-attributable TAP emission impacts were added to recent estimates of impacts from other diesel engines such as other data centers and railroad engines in order to estimate the overall concentrations of DEEP that could exist at each receptor after Sabey’s generators begin operating. These estimates, along with Sabey’s percentages of total DEEP concentrations that could exist at off-site receptor locations following completion of the project are shown in Table 15.

[36] ASPEN is the computer simulation model used to estimate toxic air pollutant concentrations for NATA. For details, see http://www.epa.gov/ttn/atw/nata/aspen.html.

Table 15. Maximum Off-Site 1-Year Average DEEP Concentrations Attributable to Sources near Sabey

Receptor	X UTM	Y UTM	Intuit	BNSF	HWY	Microsoft	Yahoo!	Dell
Extra-boundary location	287262	5236434	0.019375	0.020308	0.0001	0.001255	0.003241	<0.00147
Off-site commercial building (existing)	287310	5235930	0.019123	0.075312	0.0001	0.001216	0.002165	<0.00147
Off-site commercial parcel	287290	5235970	0.02012	0.059717	0.0001	0.001233	0.002252	<0.00147
Sabey tenant area	287142	5236481	0.028901	0.018337	0.0001	0.001319	0.003742	<0.00147
MIRR dwelling	287320	5236660	0.016915	0.015655	0.000099	0.001307	0.003654	<0.00147
MIRR yard	287310	5236640	0.017	0.015896	0.000099	0.001302	0.003624	<0.00147
Residence near NW corner of Sabey	286911	5236665	0.08697	0.014608	0.000109	0.001502	0.006306	<0.00147

Notes: Estimates of DEEP concentration ([DEEP]) based on 2005 meteorological records.
Concentrations are interpolated from the cumulative modeling that includes emissions from:

- BNSF (2005)
- HWYs (2005)
- Intuit (allowable)
- Microsoft (allowable based on 2010 permit)
- Yahoo! (allowable based on 2011 permit)
- Dell's contribution is lower than this, but the easternmost portion of their grid was about one mile west of the nearest Sabey receptor. This concentration is the highest among the grid points in the easternmost portion of their grid.

From these estimates, the percent impact attributable to each source was calculated in Table 16.

Table 16. DEEP Attributable to Sabey and Other Sources

	X UTM	Y UTM	Worst-Case [DEEP]	Source	Percent of Total [DEEP] by Source	TWA Interval
Residence dwelling	287320	5236660	0.016915	Intuit	28.9%	2005
"	287320	5236660	0.015655	BNSF	26.8%	2005
"	287320	5236660	0.000099	HWY	0.2%	2005
"	287320	5236660	0.001307	Microsoft	2.2%	2005
"	287320	5236660	0.003654	Yahoo!	6.3%	2005
"	287320	5236660	<0.00147	Dell	2.5%	2005
MIRR–House 70 m NE of NE corner*	287310	5236650	0.01934**	SABEY	33.1%	2004-8 5-Y
Residence dwelling	287320	5236660	0.02212	SABEY	-	Max year (2008)
Residence yard	287310	5236640	0.017	Intuit	28.1%	2005
"	287310	5236640	0.015896	BNSF	26.3%	2005
"	287310	5236640	0.000099	HWY	0.2%	2005
"	287310	5236640	0.001302	Microsoft	2.2%	2005
"	287310	5236640	0.003624	Yahoo!	6.0%	2005
"	287310	5236640	<0.00147	Dell	2.4%	2005
MIRR Yard*	ND	ND	0.02116	SABEY	35.0%	2004-8 5-Y
Residence yard	287310	5236660	0.02282	SABEY	-	Max year (2008)
Residence near NW corner of Sabey	286911	5236665	0.08697	Intuit	67.4%	2005
"	286911	5236665	0.014608	BNSF	11.3%	2005
"	286911	5236665	0.000109	HWY	0.1%	2005
"	286911	5236665	0.001502	Microsoft	1.2%	2005
"	286911	5236665	0.006306	Yahoo!	4.9%	2005
"	286911	5236665	<0.00147	Dell	1.1%	2005
"	286990	5236680	0.01811**	SABEY	14.0%	Max year (ND)

	X UTM	Y UTM	Worst-Case [DEEP]	Source	Percent of Total [DEEP] by Source	TWA Interval
Sabey tenant parking area	287142	5236481	0.028901	Intuit	32.0%	2005
"	287142	5236481	0.018337	BNSF	20.3%	2005
"	287142	5236481	0.0001	HWY	0.1%	2005
"	287142	5236481	0.001319	Microsoft	1.5%	2005
"	287142	5236481	0.003742	Yahoo!	4.1%	2005
"	287142	5236481	<0.00147	Dell	1.6%	2005
Tenant NE parking lot of Bldg. B*	287204	5236591	0.036572	SABEY	40.4%	2004-8 5-Y
Sabey tenant parking area	287142.6	5236482	0.03714	SABEY	-	Max year(2007)
Off-site commercial bldg. (existing)	287310	5235930	0.019123	Intuit	17.6%	2005
"	287310	5235930	0.075312	BNSF	69.4%	2005
"	287310	5235930	0.0001	HWY	0.1%	2005
"	287310	5235930	0.001216	Microsoft	1.1%	2005
"	287310	5235930	0.002165	Yahoo!	2.0%	2005
"	287310	5235930	<0.00147	Dell	1.3%	2005
MICR east of mobile homes, 300 m south of SE Sabey corner*	287310	5235950	0.009092**	SABEY	8.4%	2004-8 5-Y
Off-site commercial bldg. (existing)	287310	5235940	0.0111	SABEY	-	Max year (2005)
Off-site commercial parcel	287290	5235970	0.02012	Intuit	20.8%	2005
"	287290	5235970	0.059717	BNSF	61.7%	2005
"	287290	5235970	0.0001	HWY	0.1%	2005

	X UTM	Y UTM	Worst-Case [DEEP]	Source	Percent of Total [DEEP] by Source	TWA Interval
"	287290	5235970	0.001233	Microsoft	1.3%	2005
"	287290	5235970	0.002252	Yahoo!	2.3%	2005
"	287290	5235970	<0.00147	Dell	1.5%	2005
"	287300	5235960	0.01184**	SABEY	12.2%	Max year
Extra-boundary location	287262	5236434	0.019375	Intuit	23.2%	2005
"	287262	5236434	0.020308	BNSF	24.3%	2005
"	287262	5236434	0.0001	HWY	0.1%	2005
"	287262	5236434	0.001255	Microsoft	1.5%	2005
"	287262	5236434	0.003241	Yahoo!	3.9%	2005
"	287262	5236434	<0.00147	Dell	1.7%	2005
MIBR along E fence, 210 m N of SE Sabey corner*	287263	5236435	0.037694	SABEY	45.2%	2004-8 5-Y
"	287262	5236434	0.04154	SABEY	-	Max year (2008)

* Evidently, ICF used different grid point locations in its 6/3/2011 AERMOD DEEP post-file submittal than in its prior AERMOD submittal. Given these discrepancies, Ecology found the highest DEEP concentration in the bounds of each key receptor, despite non-matching coordinates, and entered them in this set of calculations.

** Avg. 5-yr concentration for neither the previous submittal coordinates nor was the last submittal coordinates disclosed by ICF. Therefore, maximum year concentration from the last submittal was used for calculation.

ND = Not disclosed by ICF.

5.3.5.2. Estimating Cumulative Maximum NO_2 Levels During Simultaneous Power Outage

Ecology modeled a simultaneous power outage to estimate the cumulative short-term NO_2 impact assuming a system-wide power outage. The purpose of this effort was to identify worst-case exposure scenarios in the event of a system-wide power outage in Quincy.

Ecology modeled NO_2 emissions during simultaneous power outage from existing (Microsoft, Yahoo!, and Intuit) and proposed (Dell and Sabey) data centers in Quincy. This model assumed:

- Continuous simultaneous outage emissions for all data center engines.
- Each engine operates at loads specified in permits (for existing data centers) or permit applications (for those data centers not yet permitted).
    - Emissions and stack parameters from Sabey were based on those submitted to Ecology on January 5, 2011. Short-term emission rates did not change since this submittal but stacks were raised by about 10 feet in the March 30, 2011 submittal.

The model used a single year of meteorology (2005) and also included emissions from nearby Celite Corporation.

Figure 10 shows the maximum 1-hour NO_2 concentrations that could occur in Quincy if all data centers operate simultaneously under emergency conditions. Although the NO_2 level of interest is 470 $\mu g/m^3$, the figure shows only those concentrations that exceed 441 $\mu g/m^3$ because Ecology assumes that a prevailing NO_2 concentration of 29 $\mu g/m^3$ exists in Quincy at any given time. It is important to note that the maximum 1-hour concentrations shown in this figure do not all occur at the same time. The figure displays the worst-case concentration at each location in Quincy.

Table 17 shows the maximum 1-hour NO_2 concentrations at various receptors attributable to Sabey emissions and cumulative emissions from all sources. Worst-case scenarios could result in concentrations above the NO_2 REL at locations near Sabey and other data centers in Quincy.

There is at least one discrepancy where maximum cumulative impacts near the Sabey boundary are estimated to be lower than Sabey-only impacts. This discrepancy could be due to the fact that the modeling grid used to produce cumulative estimates was coarser than that used by ICF to model impacts near Sabey. Additionally, ICF used five years of meteorological data to model Sabey's emissions but Ecology modeled all sources' emissions using only 2005 meteorology.

Table 17. Maximally Exposed Receptors–Cumulative 1-Hour NO_2

Attributable to:	Maximum 1-Hour NO_2 Concentration ($\mu g/m^3$) at Various Receptor Locations			
	Boundary Receptor	**Current Residence**	**Sabey Tenant**	**Commercial**
Sabey only[a]	812	353	532	335
Cumulative impacts near Sabey[b]	~581	~604	~688	<441
Sabey	~248	~90.1	~673	
Yahoo!	~31.6	~105.5	~1.4	
Intuit	~10.0	~0.02	~3.1	
Microsoft	~265	~373	~10.9	
Dell	~26.7	~35.5	~1.1	

a. Sabey-only concentrations based on results obtained by ICF using finer receptor grid and five years meteorology.
b. Maximum Sabey-only impacts and maximum cumulative impacts do not necessarily occur at the same time or date.
~ Denotes that concentrations are estimated using interpolation.

Figure 10 shows the maximum that could occur anywhere in the Quincy area. The maximum at any given location depends on the wind direction during a full outage event. Thus the impacts shown in the figure could not occur simultaneously in any given hour.

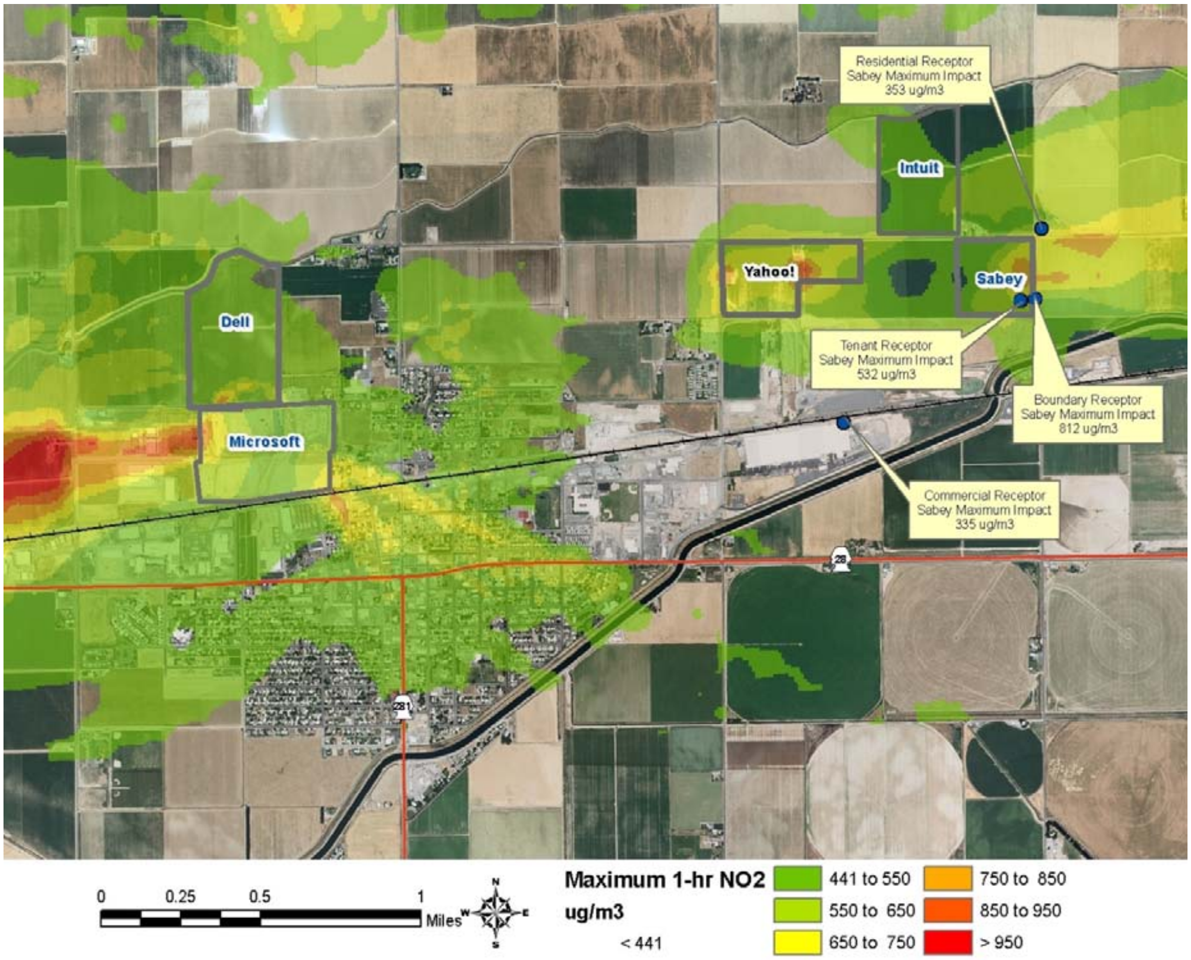

Figure 10. Maximum cumulative 1-hour NO_2 levels assuming simultaneous outage emissions

5.3.5.3. Frequency That NO_2 Levels Could Exceed 441-µg/m^3 During a Year

Ecology also analyzed the frequency (# of hours) meteorological conditions could result in a NO_2 concentration > 441 µg/m^3 across the Quincy modeling domain. Figure 11 displays these results graphically. This figure shows how frequently cumulative NO_2 concentrations could exceed 441 µg/m^3 assuming data center engines operate continuously throughout the year. In reality, Sabey requested only eight hours per year for emergency outage conditions. According to Grant County PUD, the average total outage time for customers that experience an outage throughout PUD's service area is only about 143 minutes per year. The corresponding expected average recurrence interval is shown for each location in Figure 12 given infrequent backup power proposed generator operation.

Table 18. Number of Hours/Year That Concentrations Could Exceed 441 µg/m^3 at Selected Receptors (Assuming Continuous Outage Operation)

Attributable to:	Number of Hours per Year That NO2 Concentrations Could Exceed 441 µg/m^3 at Various Receptor Locations			
	Boundary Receptor[a]	Current Residence	Sabey Tenant	Commercial
Sabey only	84	0	Not reported	0
Cumulative impacts near Sabey	81	45	134	0
a. Sabey-only hours per year averaged from five years of meteorology.				

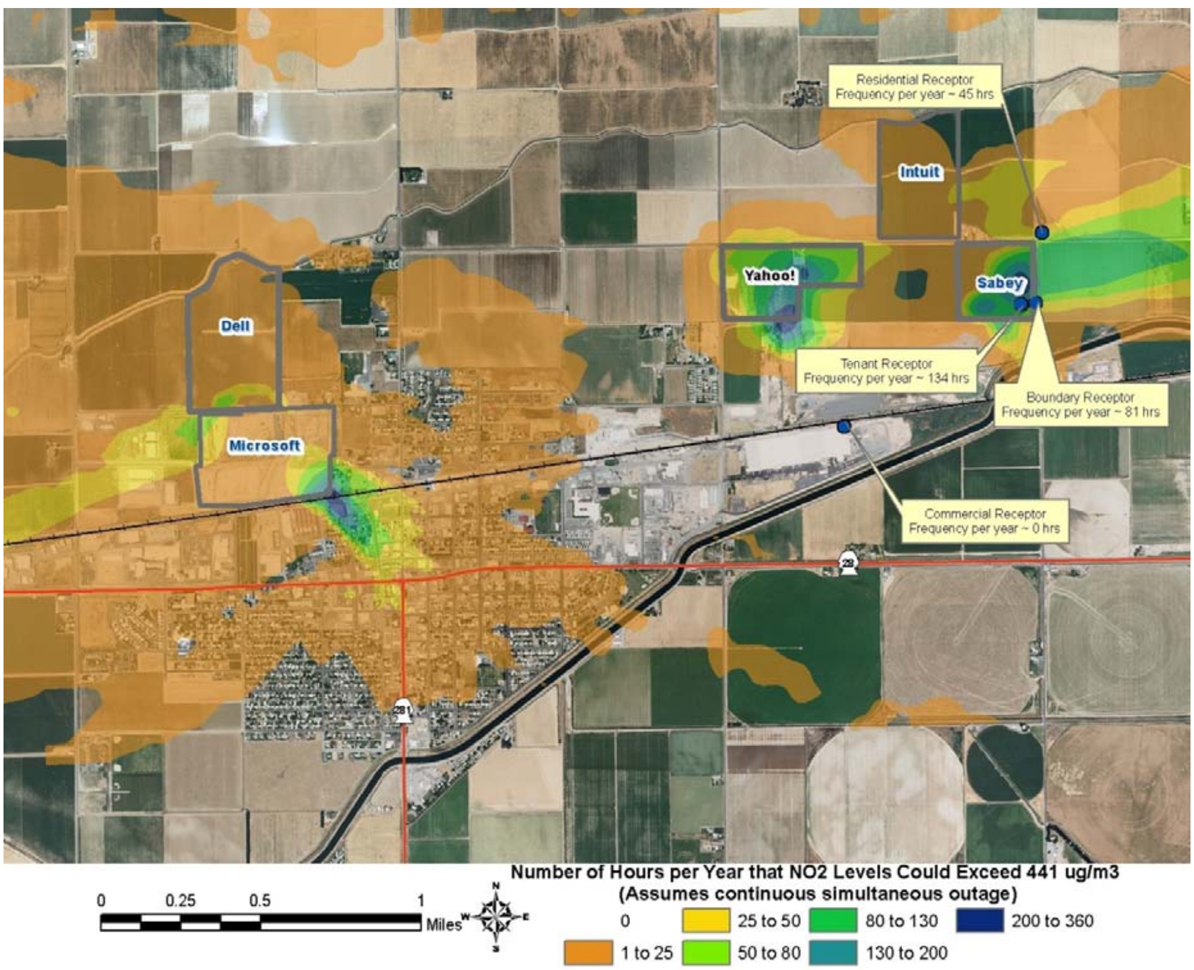

Figure 11. Number of hours/year that NO_2 levels could exceed 441 µg/m^3 (assuming continuous outage conditions)

To account for infrequent intermittent emergency outages, Ecology further evaluated the modeling data to determine the probability of meteorological conditions necessary to result in ambient NO_2 concentrations in excess of the ASIL, combined with estimates of the probability that a system-wide outage requires simultaneous emergency engine operation. The results of this analysis are summarized in Tables 18 and 19.

Table 19. Recurrence Interval NO_2 Levels Could Exceed 441 µg/m3 (assuming 8 hours of outage operation per year)

Attributable to:	Recurrence Interval (Years)			
	Boundary Receptor[a]	Current Residence	Sabey Tenant	Commercial
Sabey only	~14	~Never	Not reported	~Never
Cumulative impacts near Sabey	~14	~24	~8	~Never
a. Sabey-only hours per year averaged from five years of meteorologic records.				

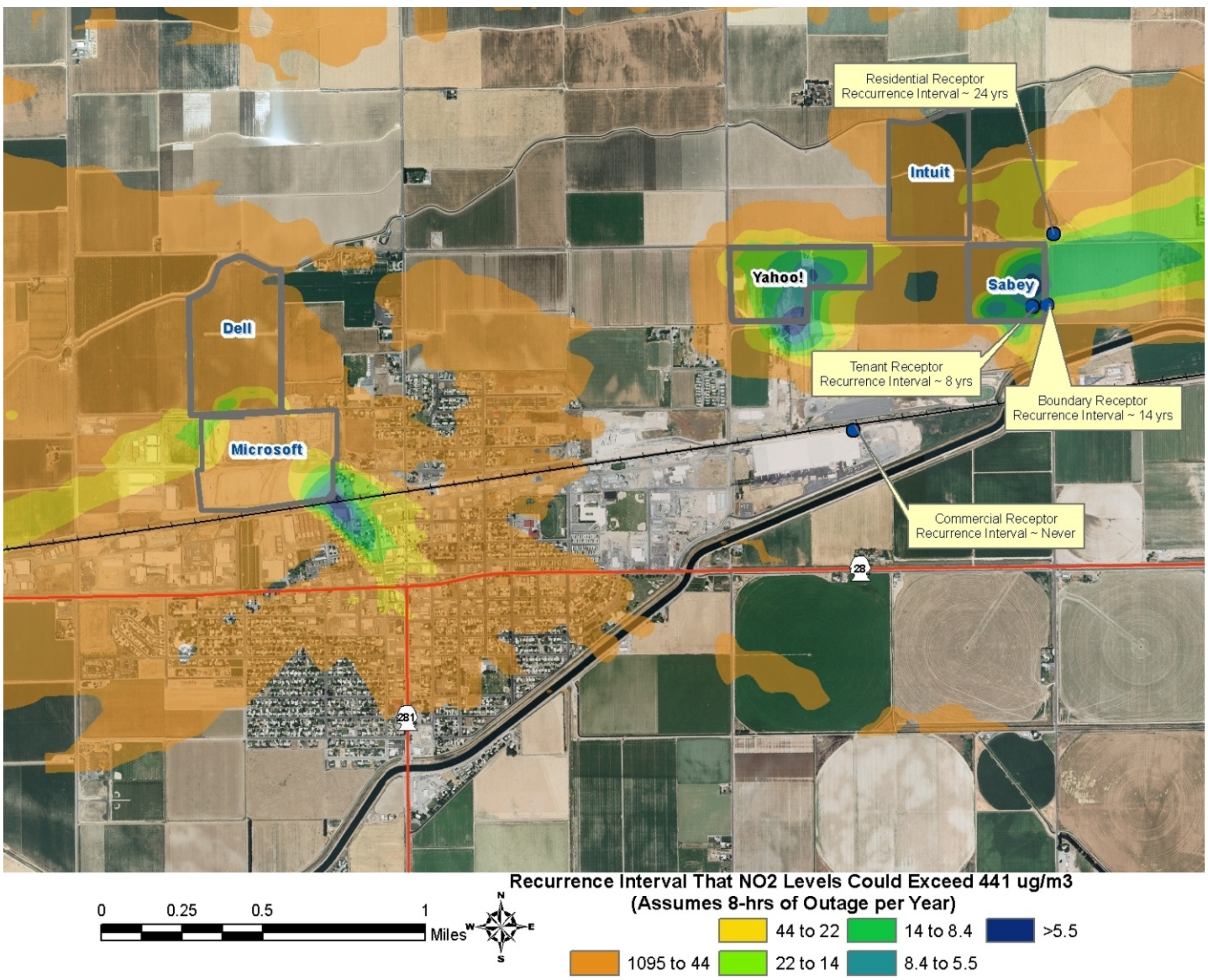

Figure 12. Recurrence intervals (years) that NO_2 levels might exceed 441 µg/m^3 (assuming 8 hours of outage per year)

5.4. Exposure-Response Assessment

Exposure-response assessment is the process of characterizing the potential incidence of adverse health effects in humans resulting from exposure and uptake of toxicants. The process often involves establishing risk-based toxicity values or criteria to use in assessing potential health risk from each toxicant. Exposure-response assessment attempts to consider time-changing exposure magnitudes in whole populations and in theoretically maximally exposed individuals.

5.4.1. Risk-Based Concentrations for Exposed Populations

From laboratory studies of humans and other animals, from data gathered from human epidemiological studies, EPA, California Office of Environmental Health Hazard Assessment (OEHHA), and the U.S. Department of Health and Human Services Agency for Toxic Substances and Diseases Registry (ATSDR) have developed toxicological values, or risk-based concentrations (RBCs) for some of the TAPs evaluated in this project. The RBCs for the TAPs of potential concern near Sabey (identified in Section 5.2) are shown in Table 20.

Table 20. Risk-Based Concentration Values for Comparison With the Modeled DEEP Concentrations

Agency	Type	RBC
EPA[a]	RfC	5 µg/m^3
	URF	1 x 10^{-3} to 1 x 10^{-5} per µg/m^3
OEHHA[b]	CREL	5 µg/m^3
	URF	3.0 x 10^{-4} per µg/m^3

a. The EPA *Health Assessment Document for Diesel Engine Exhaust* (EPA ORD, 2002) gives a possible range of upper-bound risk of 1 x 10-3 (µg/m^3)$^{-1}$ to 1 x 10^{-5} (µg/m^3)$^{-1}$ for lifetime diesel exhaust exposure. However, to date, EPA has not promulgated a specific point unit risk factor.

b. Listed by ARB as "Particulate Matter from Diesel-Fueled Engines," Scientific Review Panel unit risk "reasonable estimate" = 3.0 E^{-4} (µg/m^3)$^{-1}$. Range of unit risks in TAC document was 1.3 E-4 – 2.4 E-3 (µg/m^3)$^{-1}$. *California Environmental Protection Agency, Part B: Health Risk Assessment for Diesel Exhaust for the Proposed Identification of Diesel Exhaust as a Toxic Air Contaminant*, California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxicology and Epidemiology Section, Oakland, May 1998.

Some of the RBCs used in the current analysis were derived from data on adverse health effects other than cancer. EPA inhalation RfCs and OEHHA RELs are derived by methods that are believed to yield exposure concentrations for specified time frames below which noncancer toxic effects are not expected to happen. The lack of such effects in all humans at these exposure concentrations cannot be confirmed. However, the closer a chemical concentration is to an RfC or REL, the closer it may be to a toxic effect threshold level.

There are also toxicological values derived for estimating toxicant-exposure-enhanced cancer risk. The additional risk of cancer posed by exposure to TAPs to be emitted by the project is calculated using these URFs. The Sabey-attributable risk is in addition to the risk of getting cancer for any reason. Nearly a third of all people develop some form of cancer at some time in their lives.

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. Even though DEEP is believed to be more acutely toxic than ordinary ambient PM, only risks from chronic exposure to DEEP can be quantified given existing information.

Reflecting uncertainty in their estimates, the DEEP cancer unit risk factors published by EPA, California EPA, IARC, and individual researchers are not identical. The unit risk factors range from 1.4E-2 to 3.9E-4 per μg/m^3. The narrowness of this range shows there is consistency among the estimates relative to unit risk factor estimates for many other chemicals.

The OEHHA's *Technical Support Document for Noncancer RELs,* June 2008, Appendix D2, Nitrogen Dioxide, pp. 209-214[37] states:

> *"Controlled acute exposure studies with asthmatics show an increase in airway reactivity in response to NO_2 concentrations between 0.25 and 0.50 ppm (0.47 and 0.9 mg/m^3). Bauer et al. (1986) reported that NO_2 potentiated exercise-induced bronchospasm and airway reactivity to cold air provocation in asthmatics following exposure to 0.3 ppm (0.6 mg/m^3) for 30 minutes. Exposure to NO_2 while at rest resulted in no significant change in pulmonary function. Following 10 minutes of exercise, significant reductions in FEV1 ($p<0.01$) and partial expiratory flow rates at 60% of total lung capacity were observed. One hour after NO_2 exposure and exercise, pulmonary function returned to baseline. Mohsenin (1987) reported an increase in airway reactivity in normal subjects following exposure to 0.5 ppm (0.9 mg/m^3) NO_2 for 1 hour. Other studies have reported the absence of airway reactivity in asthmatics at these concentrations (Rubinstein et al., 1990; Avol et al., 1988; Roger et al., 1990).*
>
> *Additional controlled-exposure studies of asthmatics demonstrate an increase in nonspecific airway reactivity following exposure at or below 0.25 ppm (0.47 mg/m^3) NO_2. Jorres et al. (1990) report an increase in airway reactivity to hyperventilation of 0.75 ppm SO_2 without altering airway tone following exposure to 0.25 ppm NO_2 for 30 minutes. Kleinman et al. (1983) report an increase in airway reactivity in 2/3 of 31 subjects exposed to 0.2 ppm (0.4 mg/m^3) NO2 for two hours. Orehek et al. (1976) report increased airway reactivity in 13 of 20 subjects exposed to 0.1 ppm (0.2 mg/m^3) for one hour. Other investigators report no increase in airway reactivity in asthmatics following NO_2 exposure at or below 0.25 ppm (0.47 mg/m^3) (Hazucha et al., 1983; Jorres et al., 1991). Results from*

[37] http://www.oehha.ca.gov/air/hot_spots/2008/AppendixD2_final.pdf#page=209, accessed October 28, 2010.

> *these studies suggest that a sensitive subgroup of asthmatics with increased airway reactivity following inhalation exposure to NO_2 may be present in the general population, and that they contribute to the wide range of responsiveness present among asthmatics to inhaled NO_2 (Utell, 1989).”*

As noted in Section 5.2, acrolein is a strong respiratory tract irritant.

5.5. Risk Characterization

In the risk characterization, conclusions about hazards and exposure responses are integrated with the exposure assessments conclusions. Noncancer health hazards and cancer risks are quantified and attempts are made to estimate increased likelihoods of these effects in populations exposed to anticipated TAP emissions. In addition, confidence about these conclusions, including information about the uncertainties associated with each aspect of the assessment, is highlighted.

5.5.1. Estimating Cancer Risks

Additional cancer risk may be estimated by estimating the concentrations of a given carcinogen in a location (receptor point) multiplied by the carcinogen’s URF. A URF is expressed as the upper-bound probability of developing cancer assuming continuous lifetime exposure to an agent at a concentration of one microgram per cubic meter [*i.e.*, (μg/m$^{3)-1}$].

Some URFs are derived from epidemiological human population data. Others are derived from laboratory animal studies involving doses or concentrations higher than likely to be encountered in the environment. When certain assumptions are made, animal data may be used to derive a URF by extrapolation of the cancer potency obtained from a high-dose study to an expected exposure.

Because URFs are usually calculated as continuous lifelong exposure (70 years), it may be necessary to factor different exposure durations and exposure frequencies to estimate risk for people exposure primarily in occupational or other less than continuous lifelong exposure scenarios. In general, the formula for determining cancer risk is as follows:

$$\textit{Additional Cancer Risk} = \frac{\textit{CAIR } (\mu g/m^3) \textit{ x } \sum \textit{Exposure time}}{\textit{URF } (\mu g/m^3)^{-1}}$$

Where: CAir = Concentration in air at place(s) where people will be exposed to each carcinogen (μg/m^3); ∑Exposure time = (hours/24 hours) x (days/7 days) x (weeks/52 weeks) x (years/70 years); URF = Cancer Unit Risk Factor (μg/m^3)$^{-1}$ based on continuous lifelong (70-year) exposure to 1-μg/m^3.

5.5.2. Cancer Risk

Cancer risks are reported using scientific notation. The values quantify the increased cancer risk for hypothetically maximally exposed people. For example, a cancer risk of 1.0E-06 means that if 1,000,000 people were exposed to a carcinogen at the given concentration, one additional cancer case might occur in that population. Each person in an evenly exposed population would have their chance of getting cancer increase by 0.0001 percent. Note that these estimates are of cancer risks that might result in addition to those normally expected in an unexposed population. Cancer risks quantified in this document are an upper-bound theoretical estimate.

Ecology did not estimate the number of additional cancers that might result in the exposed population because the number of people who live in the vicinity of the data center is small. When small populations are exposed to low levels of a carcinogen, resulting population risk estimates are extremely small. For example, if 100 people were exposed to a carcinogen at a level estimated to cause an additional individual lifetime cancer risk of 1.0E-4, the expected number of additional cancer cases would be 0.01. In such situations, individual risk estimates, but not population risk estimates, are usually more meaningful for decision makers. The number of additional cancer cases in a given population is not an actuarial prediction of cases in the population. Actuarial predictions are statistics based on much empirical data.

Table 21. Exposure Time-Adjusted Increased DEEP-Associated Cancer Risk (Per Million) for People Exposed via Outdoor Air

	Sabey Alone	Sabey + Background
Maximally Sabey-Impacted Residence dwelling near NE corner of Sabey	5.8	17.5
Maximally Sabey-Impacted Residence yard near NE corner of Sabey	6.3	18.2
Second highest Residence impact from Sabey, dwelling near NW corner of Sabey	5.4	38.7
Sabey tenant Building B NE parking lot	0.3	0.7
Off-site commercial building (existing)	0.4	4.3
Off-site commercial parcel	0.5	3.8
Maximally Sabey-Impacted extra boundary area, 210 m north of SE corner of Sabey modeling grid, along E "fence"	0.3	0.6

Notes: Estimates are based on exposure to Sabey-attributable DEEP and other DEEP sources near the Sabey data center, The additional cancer risk is expressed as cancer risk (per million) for people exposed via outdoor air at each location given 70-yr total exposure for resident;[a] 9.156-yr total exposure for commercial building worker;[b] and 1.715-yr total exposure for outdoor worker.[c]

a. A continuous exposure 24 hr/day for 365 days/yr for 70 years is assumed for the MIRR. Based on such an exposure, the additional cancer risk that would occur if the average concentration of DEEP continued to occur in the MIRR location.
b. Repeated exposures of 8 hr/day for 250 days/yr for 40 years are assumed for the MICR. Based on this frequency, the additional cancer risk that would occur if the average concentration of DEEP occurred every time a maximally exposed person was in an MICR location.
c. Repeated exposures of 2 hr/day for 250 days/yr for 30 years are assumed for the MIBR. Based on this frequency, the additional cancer risk that would occur if the average concentration of DEEP occurred every time a maximally exposed person was in the MIBR location.

Figure 13. Approximate locations of receptors given in Table 20

Additional cancer risks that result from exposure to regulated TAPs of less than the 1.0E-5 (10 per million) are considered acceptable in Chapter 173-460-090 WAC. At all receptor locations for which information is available, cancer risks attributable to Sabey emissions alone are less than 10 per million. The highest estimated cancer risk attributable to Sabey emissions alone is 5.8E-6 (5.8 per million) for residents of the MIRR. Given the emissions of Sabey generators and other diesel engines near Sabey, 38.7E-6 is the highest estimate of additional cancer risk that could occur for any person exposed continuously for 70 years to outdoor air at the location where the maximally exposed existing residence now stands near Sabey. However, such a lifelong continuous outdoor exposure is extremely unlikely.

In the NATA, EPA tried to account for the movements and time spent by people in different microenvironments such as home, work, vehicle travel, etc. In contrast to the NATA ambient concentration estimate for census tract 9806, EPA derived estimates of a range of likely population exposures using the ASPEN derived ambient concentration estimates followed by a second model (HAPEM). For people engaging in daily activities in tract 9806, median background source DEEP exposure would be about 0.58-fold lower than their exposure would be if they remained fixed in one place for 70 years breathing outdoor air the entire time (see Table 14). Thus Ecology assumes actual exposure to diesel exhaust by area residents will be about 58 percent of the estimated outdoor DEEP concentration. Assuming the URF is accurate and that the estimates of the background DEEP concentration in the Sabey area are accurate and will continue to be so for 70 years, the cancer risk posed by Sabey's emissions together with the existing DEEP sources, at a Sabey-dominated receptor, will be highest at the MIRR, as shown in Table 21. The highest reasonable additional cancer risk estimate is 58 percent of 18.2 per million, which is 10.6 E-6 (10.6 per million).

5.5.3. Hazard Quotients/Hazard Index

Many air pollutants can harm health in ways other than by causing cancer. Common "noncancer effects" include problems such as eye and throat irritation, cough, and headache. Effects less common include more severe problems such as bronchitis, shortness of breath, and heart arrhythmias, for example. In addition to these, most other organ systems can be affected by some type of air pollutant too.

To determine if Sabey's TAP emissions will pose any significant noncancer effect risks, Ecology screened the TAPs that will be emitted in amounts greater than their SQERs. Ecology limited the screening to TAPs that can affect the same organs as can be affected by TAPs that exceed their ASILs (i.e., NO_2 and DEEP). The organs and organ systems that can be affected by low concentrations of NO_2, DEEP, and acrolein are in the respiratory tract (see Section 5.2 above).

The screening procedure entailed calculating a hazard quotient (HQ) for each TAP at each exposure concentration likely to occur for given durations. Ecology used the basic equation:

$$\textit{Hazard Quotient} = \frac{\textit{Time-weighted average concentration } (\mu g/m^3)}{\textit{Risk-based concentration } (\mu g/m^3)}$$

The TAP that poses the greatest respiratory effect hazard is NO_2. The NO_2 HQ at each key receptor is shown in Table 22.

Table 22. ASIL Relative to Maximum NO_2 Concentrations Attributable to the Sabey Data Center Alone

Maximally Impacted	NO_2 1-Hour Average ($\mu g/m^3$)	Acute Resp. Hazard (Sabey-Attributable Concentration Increase Divided by ASIL: 470-$\mu g/m^3$) Excluding Background NO_2
Extra-boundary location	812.3	1.7
Off-site commercial building	329.7	0.7
Off-site commercial parcel	317	0.7
Sabey tenant area	524	1.1
Residence dwelling	367.5	0.8
Residence yard	367.5	0.8

In Table 17, the estimate of cumulative exposure to data centers attributable NO_2 (581-$\mu g/m^3$) and nondata centers attributable NO_2 (29-$\mu g/m^3$) yields a HQ of 1.3. If the estimate of 812-$\mu g/m^3$ is more likely than the estimate of 581 in the cumulative modeling analysis, the NO_2 HQ would be 3 = (812 + 248 + 31.6 + 10.0 + 265 + 26.7 + 29)/470. However, this extreme is not feasible as demonstrated in Figure 10.

Except for benzene and CO, the TAPs emitted by Sabey at rates higher than their SQER may cause broncoconstriction or respiratory epithelium lesions. Ecology screened the combined risk of these effects that may be posed by exposure to these TAPs at the maximally exposed extra-boundary, commercial, and residential receptor locations in relation to Sabey.

The screening procedure entailed calculation of a hazard index (HI) for increasing exposure durations. In each case, the HI for effects in these organs and tissues was the sum of HQs for each TAP. Ecology calculated these separately for maximum 1-hour and long-term (1 yr) TWA hazards using the basic equation:

$$Hazard\ Index_{effect} = HQ_{chemcal}\ a + \cdots + HQ_{chemcal}\ z$$

Tables 23, 24, and 25 show modeled concentrations, RBCs, and HQs at each receptor point. All predicted concentrations and risk-based concentrations are in $\mu g/m^3$. The HI for each location is the sum of 1-hour TWA HQs for NO_2 and acrolein, and the chronic HQ of DEEP. These summed HIs are shown at the end of each receptor's table section.

Table 23. Noncancer Hazards of Sabey Emissions at the Maximally Exposed Extra-Boundary Receptor

Nitrogen dioxide conc.	812.3 (max. 1-hour TWA)		
RBC	REL 470		
HQ	1.73		
DEEP conc.		0.04154 (max. 1-yr TWA)	
RBC		RfC 5	REL 5
HQ		0.00831	0.00831
Acrolein conc.	≈0.01 (max. 24-hour TWA)		
RBC	REL 2.5		
HQ	4.1E-3		
Hazard Index	Max. 1-hour acute hazard	Max. chronic hazard	Summed HIs
	1.73	0.00831	1.73

Table 24. Noncancer Hazards of Sabey Emissions at the Maximally Exposed Commercial Receptor

Nitrogen dioxide conc.	329.7 (max. 1-hour TWA)		
RBC	REL 470		
HQ	0.70		
DEEP conc.		9.9E-4 (max. 1-yr TWA)	
RBC		RfC 5	REL 5
HQ		2.0E-4	2.0E-4
Acrolein conc.	≈4.2E-3 (max. 1-hour TWA)		
RBC	REL 2.5		
HQ	1.7E-3		
Hazard Index	Max. 1-hour acute hazard	Max. chronic hazard	Summed HIs
	0.70	2.0E-4	0.70

Table 25. Noncancer Hazards of Sabey Emissions at the Maximally Exposed Residential Receptor

Nitrogen dioxide conc.	367.5 (max. 1-hour TWA)		
RBC	REL 470		
HQ	0.78		
DEEP conc.		0.02282 (max. 1-yr TWA)	
RBC		RfC 5	REL 5
HQ		1.9E-3	1.9E-3
Acrolein conc.	4.7E-3 (max. 1-hour TWA)		
RBC	REL 2.5		
HQ	1.9E-3		
Hazard Index	Max. 1-hour acute hazard	Max. chronic hazard	Summed HIs
	0.78	1.9E-3	0.78

ICF didn't disclose acrolein concentrations at the MIRR and MICR; however, Ecology estimated these concentrations are approximately [NO_2] x 1.268E-05 based on the ratios of acrolein concentrations relative to NO_2 concentrations estimated in previous data center projects permit applications. 1.268E-05 is the highest observed ratio of [acrolein] to [NO_2]. Ecology's addition HQs based on intervals for TWA concentrations that are not the same as each other (i.e., acute + chronic hazards is likely to overestimate hazards of the chemicals in question). Nonetheless, given the lack of appropriate data and concern for public health, Ecology stressed diligence and declined to require further delays to obtain greater accuracy in this review.

5.5.4. Hazard Indexes Discussion

The information reviewed suggests that acute health effects are possible at certain infrequent times. The primary hazard is from NO_2. At times when unfavorable air dispersion conditions occur coincident with electrical grid transmission failure to Sabey, NO_2 HQs may exceed one. If the HQ is less than one, then the risk is generally considered acceptable. The more the HQ increases above one, the more likely it is that adverse health effects will occur by some undefined amount (due in part, to how the risk-based concentration is derived).

In light of data from independently replicated controlled laboratory studies of people with asthma, if and when conditions at Sabey give rise to an HI of 1.73 (i.e., HI>1) at the MIBR, if NO_2-sensitive asthmatic people are in those locations, they will be more likely than not to experience asthma symptoms. The maximally impacted areas are outdoors in the vicinity of Sabey, near the east edge of the AERMOD facility grid domains.

Exposure to NO_2 at concentrations equivalent to the AREL could increase airway reactivity in some people with asthma. The OEHHA developed an AREL for NO_2 based on inhalation studies of people with asthma. These studies found that some subjects exposed to about 0.25 ppm (470 µg/m^3) experienced increased airway reactivity following exposure (CalEPA, 2008).[38] Not all subjects experienced apparent effects. Like NO_2, DEEP and acrolein may interact with airways in the respiratory tract. Simultaneous exposure to the NO_2, DEEP, and acrolein components of Sabey's diesel engine exhausts is likely to result in a higher risk of adverse respiratory effects than exposure to the NO_2 component alone. Asthma severity can worsen over time for genetically susceptible people who have repeated exposures to elevated concentrations, because NO_2 and other asthmagens cause changes in airway sensitivity and remodeling. Asthma is a progressive chronic disease that results in potentially recurrent episodes of acute breathing difficulty.

5.6. Uncertainty Characterization

Uncertainty may be defined as imperfect knowledge concerning the present and future conditions of a system under consideration. In risk assessments undertaken in support of regulatory decisions, many uncertainties are encountered. Knowledge of these uncertainties allows us to assess the dependability of decisions.

Evaluating potential impacts of the Sabey project involves several key elements including emissions rate assumptions, air dispersion and fate modeling, estimates of resulting environmental concentrations, exposure modeling to estimate received doses, and exposure-response relationships to estimate the possibilities of different types of health impacts. Each of these elements is encumbered by uncertain science and measurement variability that prevents absolute confidence in predictions about adverse health impacts of this project.

To the extent that people may be exposed to emissions of TAPs from the proposed data center, and despite the uncertainties in concentration estimates, exposure estimates, cancer potency estimates, and irritation hazards, the potential health risks appear to be acceptable. Quantitative assessments of the effects of data center diesel generators' emission impacts on human health cannot be made with greater confidence. As in any risk assessment, the current risk assessment involves circumstances of incomplete scientific information. Overall risk uncertainties are summarized in Table 26.

[38] http://www.oehha.ca.gov/air/hot_spots/2008/AppendixD2_final.pdf#page=209, accessed October 27, 2010.

Table 26. Summary of how the Uncertainty Affects the Quantitative Estimate of Risks or Hazards

Source of Uncertainty	How Does it Affect Estimated Risk From This Project?
Emissions estimates	Likely to overestimate risk initially but to underestimate risk in coming decades
Concentration modeling	Possible underestimate of long-term risks and possible overestimate of acute risks
Exposure assumptions	Likely to overestimate risk slightly
Toxicity of DEEP at low concentrations	Possible overestimate of cancer risk, possible underestimate of noncancer hazards for extremely sensitive people

The largest sources of uncertainty and variability are:

5.6.1. Emissions Uncertainty

Emissions uncertainty includes measurement uncertainty and process variability. The emissions factors used to estimate emission rates from the proposed new generators are estimates of central tendency of measured emissions from comparable diesel engines. Sabey used the EPA Tier 2 average emission limit as emission factors for DEEP and NO_2. The Tier 2-based emission factor is a weighted average of measured emissions from a full engine cycle (five engine loads). At high engine loads, such as occur during emergency operation, emissions of products of incomplete combustion (CO, DEEP, and organic compounds such as acrolein and benzene) are low, while the NO_2 emission factor is relatively high. Conversely, at low loads, such as occur during maintenance testing, emissions of products of incomplete combustion (CO, DEEP, and organic compounds such as acrolein and benzene) are high, while the NO_2 emission factor is relatively low.

The emission factors (EFs) are governed by low-load conditions where generators run poorly, so the EFs for the products of incomplete combustion (e.g., DEEP) are high. As a result, the emission factor for DEEP is likely to be conservative and overestimate DEEP emissions while the EF for NO_2 is likely to underestimate NO_2 emissions.

EFs for organic compounds and other TAPs emitted from large diesel engines are listed in EPA's AP-42. These EFs are just as likely to underestimate as to overestimate emissions. No quantitative description of uncertainty and variability consistent with available data are available.

Further uncertainty in the diesel generators emissions estimates comes from uncertainty in the assumption that dispersion and power failure conditions are independent from each other in Quincy. It is possible that weather extremes will trigger power failures in the future. Weather and climatic conditions can damage equipment used for the generation, transmission, or utilization of electrical power. Distribution equipment and transmission lines sometimes fail due to severe weather, ice storms, lightening, as well as human-caused accidents. Various components such as transformers, fuses, switches, insulators, and other system components periodically fail due to aging or other factors. The failure of one sometimes causes cascading overloads in neighboring grid control points.

Emergency operation of the data center diesel generators will be more likely to occur as increasing demand[39,40,41] coincides with increasingly uncertain generation capacity from diminishing stream flows resulting from climate change,[42] and with diminishing reserves of fossil fuel. Consistent hydroelectric power production over the next century in eastern Washington is uncertain. According to a study by UW scientists:[43]

> ". . . *substantial changes in the amount and seasonality of energy supply and demand in the PNW are likely to occur over the next century in response to warming, precipitation changes, and population growth. For the 2020s, regional hydropower production increases by 0.5-4% in winter, decreases by 9-11% in summer, with annual reductions of 1-4%. Slightly larger increases in winter, and summer decreases, are projected for the 2040s and 2080s*."

In general, it appears that the overall risk of emergency generator operation is low now and that it will increase over time. Some of these weather and climate change problems are directly related to DEEP, NO_2, and acrolein dispersion conditions. Ecology evaluated all available information to characterize the risk of power failures and coincident atmospheric conditions that would cause the 1-hour TWA NO_2 concentration to reach or exceed a toxic level at the current location at greatest risk (*i.e.,* the MIRR).

ICF presented the range and frequency of NO_2 concentrations possible at the MIBR that they obtained from AERMOD simulations. These data are summarized in Figure 14. AERMOD-derived maximum 1-hour NO_2 concentrations at various locations are presented in Table 27.

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[39] In May 2001 the Bonneville Power Administration asked ten aluminum smelters in the Pacific Northwest to close for two years, to reduce electricity consumption in the area. Reported in The Outlook, WALL ST. J ONLINE, May 21, 2001.
[40] http://openjurist.org/126/f3d/1158/association-of-public-agency-customers-inc-v-bonneville-power-administration-and-utility-reform-proj
[41] Effects of projected climate change on energy supply and demand in the Pacific Northwest and Washington State Hamlet, A.F., S.Y. Lee, K.E.B. Mickelson, and M.M. Elsner, 2009, Effects of projected climate change on energy supply and demand in the Pacific Northwest and Washington State, Chapter 4 in *The Washington Climate Change Impacts Assessment: Evaluating Washington's Future in a Changing Climate*, Climate Impacts Group, University of Washington, Seattle, Washington, http://www.cses.washington.edu/db/pdf/wacciach4energy647.pdf.
[42] Ibid.
[43] Ibid.

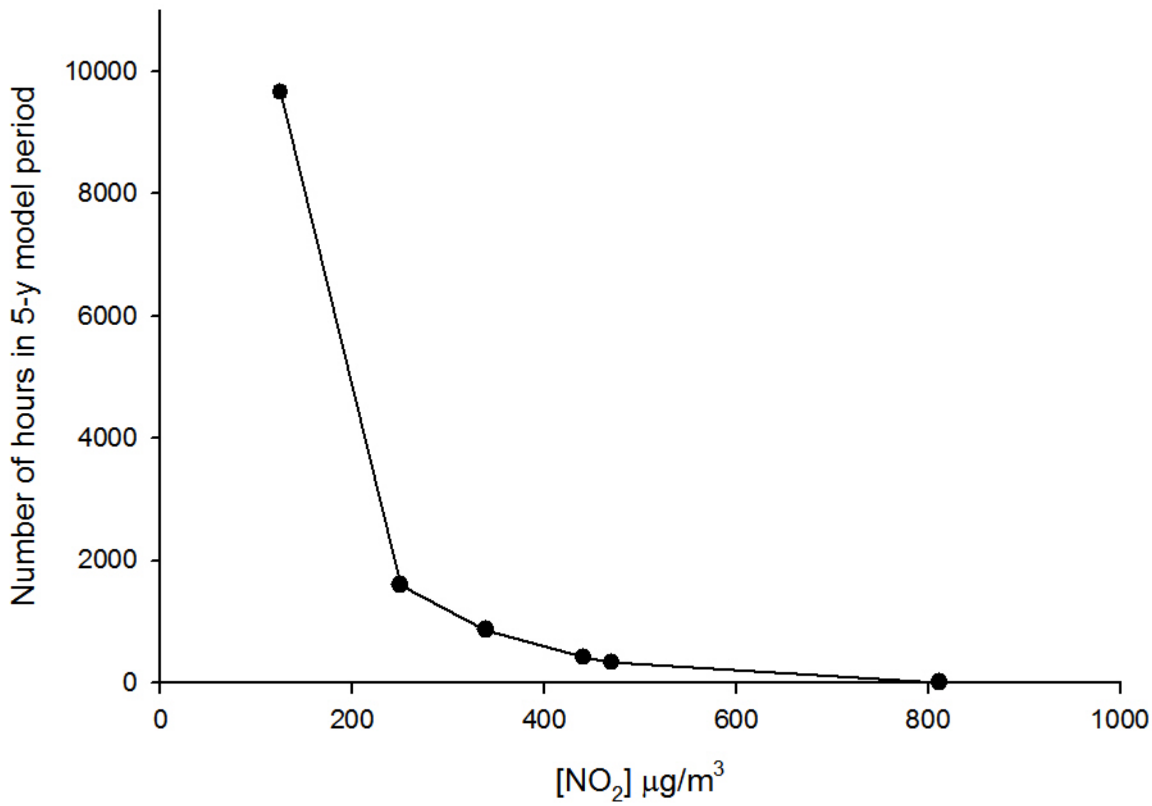

Figure 14. Number of hours per year the 1-hour average NO_2 concentration would have reached 441 µg/m^3 given concentrations at the MIBR if the Sabey Quincy Data Center generators had run continuously from the beginning of 2004 to the end of 2008

(Data source: ICF, Itemized-IGQ-response-letter_3-22-2011.doc)

According to the data reported on page 40 of 51 in the "appendices…Mar 22," there would have been 419 times in the 5-year period modeled that NO_2 reached an average concentration of 441 µg/m^3 for an hour at the MIBR. This is slightly less than one percent of the time:

$$419/43848 = 0.9555\%$$

Table 27. AERMOD-Derived Maximum 1-Hour NO_2 Impact (µg/m^3)

RME Receptor	Maximum 1-Hour NO_2 (µg/m^3)	Number of 1-Hour Exceedances of 441 µg/m^3 in 5 Years Assuming Continuous Generator Operation
NE home (MIRR)	353	None
Off-site MICR (Columbia Cold Storage)	335	None
Maximum on-site tenant (parking lot south of Bldg. B)	532	329[a]
MIBR (eastern fence line)	812	419

Source: NO2_SecondTierAssess_Revised_02182011.doc
a. This value is uncertain given ICF's incomplete reporting of their revised modeling results.

ICF conducted a brief statistical analysis of the duration of each event exceeding 441 µg/m^3 at the MIBR boundary receptor, and the time intervals between those exceedance events. The results were as follows:

Number of AERMOD modeled hours:	43,840
Number of hours in 5 years exceeding 441 µg/m^3:	419
Number of events with 2 sequential hours of NO_2 > 441 µg/m^3:	88
Number of events with 3 or more sequential hours of NO_2 > 441 µg/m^3:	None
Number of events with 3 hours in any 5-hour period with NO_2 > 441 µg/m^3:	178
Median interval between hours with NO_2 > 441 µg/m^3:	33 hours

(Source: NO2_SecondTierAssess_Revised_02182011.doc)
Note: No instances of three or more hours in a row are anticipated by the Ecology modeler.

About 10 percent of Washingtonians are diagnosed with asthma. A subset of these people are sensitive to NO_2. At the forecasted exposure levels, mild to moderate effects are possible, but life threatening effects of NO_2-triggered asthma symptoms are unlikely. Severe asthma effects are relatively rare among people with asthma.

5.6.2. TAP Concentration Modeling Uncertainty

TAP concentration modeling uncertainty results from uncertainties about future meteorology, and the measurement variability and applicability of past meteorological conditions of the air data used for the current analyses. Additionally, TAP concentrations uncertainty arises from uncertainty in the precision and accuracy of the air quality dispersion model used: EPA's AERMOD and associated pre- and post-processors. The results of TAP concentration modeling in the data center situation are just as likely to be underestimates as to overestimates. The results are central estimates of long-term concentrations and of extreme of short-term concentrations. AERMOD used a nonzero emission rate during the nighttime hours even though Sabey generator testing at night will not be allowed. Use of a nonzero emission rate during the nighttime hours in modeling effectively spread emissions throughout the 24-hour day instead of concentrating them between 7:00 a.m. and 7:00 p.m. In any given year, most of the hours characterized by poor dispersion occur at night. As a result, the modeled annual DEEP impacts might be slightly higher than expected.

Additional uncertainty arises in our estimate of NO_X to NO_2 conversion in the atmosphere.[44] Sabey used the PVMRM model to estimate NO_2 concentrations based on an initial NO_2 to NO_X ratio of 10 percent and an equilibrium NO_X to NO_2 atmospheric conversion rate of 90 percent. Also, due to lack of reliable ozone monitoring data near the data center, ICF assumed a constant background ozone concentration of 40 ppb. These assumptions may have underestimated or overestimated actual NO_2 concentrations resulting from Sabey's operations. Also, aggregating the impacts from all generator operation modes on 1000 randomly chosen days to estimate maximum concentrations at each receptor is a statistically robust procedure but there is a chance that the highest possible concentrations were missed since all available data were not examined.

As can be observed in Table 12, natural variation in meteorological conditions from year to year will also change the concentrations of the emitted TAPs. For the DEEP risk assessment, an estimate of the 70-year average concentration would be ideal, but the reliability of such a long-term estimate would be very uncertain. In the interest of protecting public health, Ecology instead used the highest concentration impact year among the five modeled years for the DEEP risk assessment.

5.6.3. Background TAP Concentration Estimates Uncertainties

Ecology estimated future background levels of the DEEP and NO2 from diesel engines in the Quincy area by modeling potential concentrations of these pollutants under worst case conditions. We added Sabey's proposed emissions to these worst case scenarios. Given that maximum allowed generator operation time limits were used to model concentrations, and that actual operation times are likely to be less frequent and of shorter duration, the overall worst case impacts are likely to be overestimates.

Background TAP concentration estimates uncertainties result from the uncertainty about the validity of EPA's ASPEN model, and from the possibility that toxic air emissions have changed since 2002 and 2005 (the most recent NATA years). Further uncertainty arises from the geographic scale of the NATA concentration model, which is too large to provide precise results at single census tract scale. NATA results are most reliable when analyzed on a national or state

[44] Most of the NO_X emitted from diesel engines is nitric oxide (NO), which is itself toxic but not considered a TAP in Chapter 173-460 WAC.

scale and have increasing uncertainty at smaller county and census tract levels. Therefore, concentration estimates of acrolein at the census tract level may be misleading. The NATA background concentrations estimates are unlikely to exist at steady levels but are likely to generally increase or decrease in long-term trends. The overall effect of these uncertainties is to reduce confidence in estimates of existing and future TAP concentrations in the vicinity of Sabey.

Another limitation is that, while EPA has issued Maximum Achievable Control Technology (MACT) standards that are expected to reduce emissions of air toxics from stationary sources, other source categories emissions are generally increasing.

No quantitative descriptions of uncertainty and variability consistent with available data are available. The effects of these uncertainties may be underestimates or overestimates of TAP concentrations that will result.

5.6.4. Exposure Uncertainty

Exposure uncertainty results from potential inaccuracies of assumptions about the time people will spend in various locations. Concerning locations that will be affected by Sabey's emissions, Ecology assumes a defined intermittent exposure pattern for a hypothetical worker entering the MIBR locations routinely. Ecology also assumes a defined intermittent exposure pattern for workers entering the MICRs, and that a person occupying the MIRR will have continuous lifelong exposure at that location. The need to ensure that uncertainty and variability are addressed is met by ensuring that the maximal exposures are not underestimated. Conversely, each exposure pattern assumption may overestimate what will actually occur.

5.6.5. Toxicity Uncertainty

Toxicity uncertainty results from potential inaccuracies in the risk-based concentrations used in a risk assessment. RBCs are based on inherently variable experimental toxicology and epidemiological studies. In the process of developing RBCs, there are uncertainties in the assumptions used to extrapolate these data, especially for chemicals with little or no human exposure-response data. Many RBCs are based on animal studies at high levels of exposure.

DEEP is a probable human carcinogen based on evidence from controlled laboratory animal studies that demonstrated its carcinogenicity, and epidemiological evidence among occupationally exposed people that suggests it may cause lung and bladder cancer. The OEHHA URF[45] used in the current analysis may be inaccurate. To avoid underestimating DEEP's true cancer potency, OEHHA based the URF on upper confidence limits of response data. In this way, they attempted to ensure that uncertainty and variability were addressed and to avoid underestimating actual risks. Thus, the cancer risks quantified in this technical analysis are

[45] A URF is the upper-bound of a confidence interval around, most typically, a mean of expected carcinogenic response at a given concentration. The 95 percent confidence interval for a mean is the range of values that will contain the true population mean 95 percent of the time.

upper-bound theoretical estimates. The estimates of increased cancer risk are the best possible estimates of the upper extremes. The estimates are of cancer cases that might result in addition to those normally expected in a population not exposed to DEEP.

Other sources of uncertainty cited in EPA's health assessment document for diesel exhaust are the lack of knowledge about the underlying mechanisms of DEEP toxicity, and the question of whether toxicity studies of DEEP based on older engines are relevant to emissions from current technology diesel engines.

Ecology's screening of potential noncancer adverse health effects risks involved comparisons of possible exposures to RBCs, which are estimates of inhalation exposures for humans including sensitive subgroups likely to be without appreciable risks of adverse effects for defined durations. This assessment evaluated the possibility that specific noncaner health risks could arise due to Sabey-attributable DEEP, NO_2, and acrolein exposure. Diesel engine exhaust contains thousands of gas, particle, and particle-bound constituents, however only a few of these have been specifically evaluated in this risk assessment. Current Ecology policy is to evaluate only those chemicals listed in WAC 173-460-150. Other chemicals in diesel exhaust may or may not intensify or reduce overall toxic effects risks. Despite the uncertainties in RBCs developed for the TAPs that were evaluated, it is possible that unusually sensitive people will suffer respiratory irritation-induced airway reactivity when in maximally exposed commercial receptor or outdoor areas during unfavorable air dispersion conditions coincident with emergency operation of Sabey's generators for an hour or more.

6. CONCLUSION

Sabey's proposed emissions of DEEP could reasonably be expected to increase lung, bladder and other forms of cancer risk by up to 5.8E-6 (5.8 in one million) for people living full-time for 70 years at the maximally impacted commercial location *(i.e.,* the MIRR). The increased cancer risks from Sabey for people using other maximally impacted areas are less than 5.8 in one million. The maximum potential cumulative cancer risk posed by DEEP emitted from Sabey and other nearby sources may be approximately 38.7 per million at the residence near the NW corner of Sabey where Intuit accounts for ~2/3 of the DEEP exposure. The potential cumulative cancer risk posed by DEEP emitted from Sabey, itself, is 18.2 in one million at the maximally impacted residential yard near the NE corner of Sabey property. The cumulative risk to occupants of the existing dwelling on this parcel is 17.5 in one million. Considering that DEEP exposures to people engaged in normal activities are believed to be lower than what they would experience if outdoors in one location for 70 years, the highest reasonable additional cancer risk estimate for diesel engine emission from Sabey and other nearby sources is 58 percent of 18.2 per million, which is 10.6 E-6 (10.6 per million).

Sabey's emissions are unlikely to result in excessive cancer risk but may, on certain infrequent occasions, result in adverse airway symptoms among people with NO_2-sensitive asthma. Other types of adverse noncancer health problems among people at nearby areas are unlikely. People at existing nearby residences are unlikely to experience noncancer health effects from Sabey-attributable emissions but, on very rare occasions, may experience respiratory irritation from cumulative exposure to Sabey and other diesel engine emissions. This irritation may exacerbate asthma in some people.

Based on the above analysis, the increased DEEP emissions cancer risks from the proposed Sabey project, are permissible because they fall within the limits defined in WAC 173-460-090(7).

Given the low lifetime risk of severe asthma symptoms from Sabey emissions and the evidently infrequent recurrence of high NO_2 exposure situations, Ecology concludes that additional mitigation measures are unnecessary; however, Ecology will need routine reports of power failures from Sabey to determine the veracity of assumptions in this analysis. Ecology may also use the records to determine applicant compliance with permit restrictions on emergency operations.

Future decisions about development and use of the land area around the data center should consider potential impacts of data center emissions on human health.

Therefore, based on the technical analysis described herein, and provided (1) health risks posed by Sabey operations are communicated to potential new householders in more heavily impacted areas near the Sabey Data Center and/or the local regulatory agency responsible for zoning and development in the affected area, (2) the generators are operated no more than described herein, and (3) Sabey routinely reports its power failures to Ecology, the additional health risks attributable to Sabey's DEEP, acrolein, and NO_2 emissions will be permissible under Chapter 173-460 WAC. The project review team recommends approval of the proposed project in accordance with WAC 173-460-090(7), subject to implementation of the above recommendations.

7. LIST OF ACRONYMS AND ABBREVIATIONS

AERMOD	Air dispersion model
AREL	Acute Reference Exposure Level
ASIL	Acceptable Source Impact Level
ATSDR	Agency for Toxic Substances and Diseases Registry
BACT	Best Available Control Technology
C	Celsius
CO	Carbon Monoxide
Conc.	Concentration
CAir	Concentration in air
CREL	Chronic Reference Exposure Level
DEEP	Diesel Engine Exhaust Particulates
DPM	Diesel Particulate Matter
Ecology	Washington State Department of Ecology, Headquarters Office
EPA	United States Environmental Protection Agency
ERO	Washington State Department of Ecology, Eastern Regional Office
HIA	Health Impact Assessment
HQ	Hazard Quotient
hr	Hour(s)
ICF	ICF International
Max.	Maximum
MIBR	Maximally Impacted Boundary Receptor
MICR	Maximally Impacted Commercial Receptor
MIRR	Maximally Impacted Residential Receptor
$\mu g/m^3$	Micrograms per Cubic Meter
MRL	ATSDR Minimal Risk Level
NAD27	North American Data of 1927
NATA	National-scale Air Toxics Assessment
NO_2	Nitrogen Dioxide
NOC	Notice of Construction Order of Approval
NO_X	Oxides of Nitrogen

NWS	National Weather Service
OEHHA	California’s Office of Environmental Health Hazard
PSD	Prevention of Significant Deterioration
RBC	Risk-Based Concentration
REL	OEHHA Reference Exposure Level
RfC	Reference Concentration
Sabey	Sabey Datacenter
SQER	Small Quantity Emission Rate
TAP	Toxic Air Pollutant
tBACT	Best Available Control Technology for Toxics
TWA	Time-weighted Average
UF	Uncertainty Factor
URF	Unit Risk Factor
WAC	Washington Administrative Code
Y or yr	Year(s)