Technical Support Document for the Second Tier Analysis
T-Mobile Polaris Data Center
Emergency Backup Generators Project
Wenatchee, Washington
July 17, 2008

1. EXECUTIVE SUMMARY

Proposed nitric oxide (NO) emissions from the T-Mobile West Corporation Polaris Data Center (T-Mobile) exceed a regulatory trigger level called an Acceptable Source Impact Level (ASIL). The project was therefore required to undergo a Second Tier analysis per Chapter 173-460 Washington Administrative Code (WAC).

Based on the Second Tier analysis described here and the modeled NO concentrations, the Washington State Department of Ecology's Headquarters Office (Ecology Headquarters) has determined the health risks are within the acceptable range. Therefore, Ecology Headquarters may approve the proposed new sources of Toxic Air Pollutants (TAP) under Chapter 173-460 WAC.

Below is the technical analysis performed by Ecology Headquarters.

2. THE PROCESS

2.1 The Regulatory Process

The requirements for performing a toxics screening are established in Chapter 173-460 WAC. These rules require a review of any increase in toxic emissions for all new or modified stationary sources in the State of Washington.

2.1.1 The Three Tiers of Toxic Air Permitting

The objectives of Toxics Air Permitting are to establish the systematic control of new sources emitting toxic air pollutants 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) Tier One (toxic screening), (2) Tier Two (health impacts assessment), and (3) Tier Three (risk management decision).

All projects are required to undergo a toxic screening (Tier One analysis) as required by WAC 173-460-040. There are two ways to perform a Tier One analysis. If proposed emissions are below the Small Quantity Emission Rate (SQER) tables, no further analysis is required. If emissions are greater than the SQER table or no value exists in the SQER table, 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 Tier Two analysis, promulgated in WAC 173-460-090, is a site-specific health impacts assessment. The objective of a Tier Two analysis is to quantify the increase in lifetime cancer risk for persons exposed to the increased concentration of any Class A TAP and to quantify the increased health hazard from any Class B TAP in ambient air that would result from the proposed project. Once quantified, the cancer risk is compared to the maximum risk allowed by a Tier Two analysis, which is one in one hundred thousand, and the concentration of any Class B TAP that would result from the proposed project is compared to a Risk Based Concentration (RBC).

If the emissions of a Class A toxic pollutant result in a cancer risk of greater than one in one hundred thousand, then an applicant may request Ecology Headquarters perform a Tier Three analysis. A Tier Three analysis is basically a risk management decision in which the director of Ecology makes a decision that the risk of the project is acceptable based on determination that emissions will be maximally reduced through available preventive measures, assessment of environmental benefit, disclosure of risk at a public hearing, and related factors associated with the facility and the surrounding community.

Since Class B TAPs are not confirmed carcinogens, there is no Tier Three analysis performed. Rather, all risks are evaluated in the Tier Two analysis.

2.1.2 Processing Requirements

Ecology Headquarters shall evaluate a source's Second Tier analysis only if:

- The authority (or in this case Ecology's Central Regional Office (CRO)) has advised Ecology Headquarters that other conditions for processing the Notice of Construction (NOC) have been met,
- Emission controls contained in the conditional Notice of Construction represent at least Best Available Control Technology for Toxics (T-BACT), and
- Ambient concentrations exceed acceptable source impact levels after using more refined emission quantification and air dispersion modeling techniques.

CRO submitted the three items listed above to Ecology Headquarters on April 15, 2008.

2.2 T-BACT Verification

T-BACT is required for any new or modified emission unit that has an increase in emissions of toxic air pollutants. See Section 3.4.3 for details on T-BACT for this project.

2.2.1 Ambient Concentration of Toxic Air Pollutants

Ecology Headquarters reviewed the application and verified the emission estimates. Emissions of NO exceed the ASILs and a Second Tier analysis must be performed.

3. THE PROJECT

3.1 Permitting History

T-Mobile is a Greenfield Source. There are no existing permits associated with this facility.

3.2 The Proposed Project

T-Mobile has proposed to construct and operate a data center in a leased building within a 28-acre parcel on the outskirts of East Wenatchee, Washington. The data center will hold banks of computers, called servers. A new substation will be constructed adjacent to the building to provide electrical power from the Douglas County Public Utility District. Twenty 2,000-kilowatt Caterpillar Model 3516C-TA diesel-powered electric generators will supply backup power. Because the total power electrical demand for the data center is approximately 30,000 kilowatts, T-Mobile plans to operate no more than 18 generators at any time. Prescheduled diagnostic testing of each generator is not expected to exceed 76 hours per year. T-Mobile has requested a federally enforceable limit on the number of gallons of diesel fuel the generators will use each year. This 211,245-gallon limit equates to approximately 113 hours per year of reduced load operation for each generator.

3.3 NOC Processing Timelines

CRO received the application on March 31, 2008. CRO provided a new draft of the NOC to Ecology Headquarters on April 15, 2006. Additional information was received May 5, 2008 and June 11, 2008.

3.4 Site Description

The facility is located on the Southwest Quarter of Section 10, Township 22 North, Range 21 East Willamette Meridian. The physical address is 4406 Building A, Grant Road, East Wenatchee, Washington 98802 in Douglas County, Washington. An aerial map of the facility and the receptors is shown below:


N
W
E
S
Maximum impacted area
1-hr maximum concentration
Outhouse
Distributor
Maximum impacted area
24-hr maximum concentration
T - Mobile
Building
Sabey
Building
Apple Storage
Residence 1
Residence 2
0
250
500
1,000
1,500
Feet

3.5 Emissions

T-Mobile has estimated its emissions from the project and they are compared to the SQER tables below:

Pollutant	Class A or B Pollutant?	T-Mobile Data Center		SQER		Emissions Above SQER Yes or No?
		Lb/hr	Lb/yr	Lb/hr	Lb/yr	
Nitric oxide	B	250	25,140	2	17,500	Yes
Benzene	A	0.28	28	-	20	Yes
Toluene	B	0.1	10	5	43,748	No
Xylenes	B	0.069	6.8	5	43,748	No
1,3-Butadiene	A	0.01	0.7	-	0.5	Yes
Formaldehyde	B	0.03	2.8	1.2	10,500	No
Acetaldehyde	A	0.01	0.9	-	50	No
Acrolein	B	0.003	0.28	0.02	175	No
Benzo(a)Pyrene	A	0.000046	0.0046	-	-	Yes

Emissions of NO, Benzene, 1,3-Butadiene, and Benzo(a)Pyrene exceed the values listed in SQER tables. These emissions were modeled and they are compared to their respective ASILs in Section 5.6.

3.5.1 Point of Compliance

Assessment of potential health risks from the project were based on the maximum modeled concentration of NO, Benzene, 1,3-Butadiene, and Benzo(a)Pyrene at an assumed point of public exposure (nearest point of ambient air). The maximum concentration is assumed to be at the property fence line and the distance to the nearest residence 1,300 feet southeast of the Polaris building.

3.5.2 Emissions Concentrations

Below is the modeling results of the pollutants that exceeded the SQERs compared to the ASILs.

Pollutant	Class A or Class B TAP?	Highest Modeled Concentration (μg/m^3)	ASIL (μg/m^3)	Emissions Above ASIL Yes or No?
Nitric oxide	B	564	100	Yes
Benzene	A	0.00178	0.12 (annual avg.)	No
1,3-Butadiene	A	0.0000448	0.0036	No
Benzo(a)Pyrene	A	0.000000294	0.00048	No

3.5.3 Pollutants Subject to Second Tier Analysis

Modeled emissions of Benzene, 1,3-Butadiene, and Benzo(a)Pyrene are below their ASILs. Therefore, only NO is subject to review under this Second Tier analysis.

3.5.4 Background Emissions

NO is produced during combustion and has been found in urban atmospheres, as well as indoor environments. It normally converts to the more toxic nitrogen dioxide (NO_2) readily in the presence of ozone and oxygen. High levels of NO are found immediately downwind of combustion sources, especially during stagnant conditions, and near heavy traffic. Ambient NO concentrations in urban areas are typically two to three orders of magnitude higher than in rural and remote areas (approximately 20 parts per billion (ppb) vs. 0.2 ppb vs. 0.02 ppb).[1] Background NO levels in East Wenatchee are not expected to be significant because the proposed source is located in an area with few other sources of NO.

3.5.5 T-BACT

T-BACT is contained in the proposed NOC Order No. 08AQ-C075 and consists of: (1) certified to 40 CFR 89 Tier II emission levels for non-road engines, (2) a limit of 211,245 gallons per consecutive 12-month period of on-road specification No. 2 distillate fuel oil, and (3) an NO emission limit of 3.8 g/kW from each diesel engine. Many of the conditions in the proposed decision are BACT/T-BACT for a particular activity. Ecology Headquarters concurs with CRO's T-BACT.

3.5.6 Air Dispersion Modeling

The air quality modeling used for this project was performed using the Environmental Protection Agency's (EPA's) AERMOD dispersion model, with EPA's PRIME algorithm for building downwash. Five years of sequential hourly meteorological data (2001 through 2005) from Pangborn field airport were used. Ground surface data (1992 State Land Cover Data) were obtained from USGS Seamless Server website to define surface roughness and albedo. Digital topographical data (in the form of digital Elevation Model files) for the vicinity were obtained from Microsoft Corporation.

4. GENERIC HEALTH IMPACTS ASSESSMENT PROCESS

A Health Impacts Assessment was prepared by the applicant and was reviewed and approved by Ecology Headquarters. A team was assigned to this project consisting of an engineer, a toxicologist, and a modeler.

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[1] National Research Council, 1991 *Rethinking the Ozone Problem in Urban and Regional Air Pollution*. National Academy Press, Washington, DC.

Below are descriptions of the content of each part of the Health Impacts Assessment.

4.1 Hazard Identification

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

4.2 Exposure Assessment

This step involves describing the nature and size of the various populations exposed to a chemical agent in the vicinity of the proposed project. The evaluation could include past exposures, current exposures, or exposures expected in the future.

4.3 Dose-Response Assessment

Dose-response assessment is the process of characterizing the relationship between exposure to a chemical and incidence of an adverse health effect in exposed populations. This step involves the identification of the toxicological profiles of all toxic air pollutants that exceed the ASIL. It includes a discussion of the toxicological effects of hazardous substances, chemicals, and compounds. Each profile includes an examination, summary, and interpretation of available toxicological and epidemiological data evaluations on the hazardous substance.

4.4 Risk Characterization

This step involves the integration of data analyses from each step of the health impact assessment to determine the likelihood that the human population of interest will experience any of the various forms of toxicity associated with a chemical under its known or anticipated conditions of exposure.

4.5 Uncertainty Characterization

In almost all risk assessments undertaken in support of regulatory decisions, especially concerning chronic hazards, risk assessors are required to go beyond available data and make inferences about risks expected for conditions of exposure under which direct evidence of risk cannot now be collected. When scientific uncertainty is encountered in a risk assessment, the integration of any assumptions is required to fill information gaps. The following are examples of components that constitute gaps in the scientific basis for assessing human cancer risk:

- How relevant are the data to humans?
- How relevant to humans are results from animal studies using a different route of exposure?
- How relevant are results from studies using an exposure regimen (in terms of frequency and duration) that differs from the human situation?
- Which species/strains of animals are most appropriate for dose response assessment in humans?
- How should risk estimates be developed?
- Using most sensitive species/strain/sex?
- Combining incidents of benign and malignant tumors?
- Using pooled tumor incidence (tumor bearing animals)?
- Can results of an animal study that does not extend over a lifetime be extrapolated to lifetime?
- How does the dose-response relation relate to the unobservable dose-response relation in the dose region of concern for the human population under study?
- How should low-dose risk be modeled?
- Do agents operate by threshold or non-threshold mechanisms?

5. HEALTH IMPACTS ASSESSMENT

5.1 Introduction

NO emissions exceeded screening values indicating that a second tier analysis was necessary. The Second Tier analysis described below was conducted according to the requirements promulgated in Chapter 173-460 WAC. It addressed the public health risk associated with exposure to NO emissions from the data center in the health effects assessment prepared by the consultant (Jones & Stokes) for T-Mobile.

5.2 Hazard Identification

NO is a colorless gas with a sharp, sweet odor. It turns brown in the air at high concentrations. Its molecular weight is 30 g/mole and its vapor pressure is 26,000 millimeters of mercury. NO's boiling point is -241^{0}F and it is not combustible. NO is an off-gas produced from the use of diesel-powered emergency generators. NO emissions from this facility are not expected to have impacts on the soil or water.

5.2.1 Acute and Chronic Effects

Acute health effects are the primary concern with NO exposure. However, chronic exposure to nitrogen oxides (NO_X), along with other common pollutants, is associated with increased risk of respiratory infections in children. Populations that may be particularly sensitive to NO_X include asthmatics and those with chronic obstructive pulmonary disease or heart disease.

At NO and NO_2 concentrations commonly measured in ambient air, epidemiological studies have reported associations with incidences of respiratory infections and croup (a type of respiratory disease that usually affects children), exacerbation of asthma, bronchitis, ischemic cardiac diseases (restriction of blood flow), and cerebrovascular diseases (pertaining to blood flow to the brain). Because nitrogen dioxide is usually present concurrently with NO, it is difficult to differentiate NO effects from NO_2 in exposed people. It is generally accepted, however, that the primary mechanisms of toxicity for NO and NO_2 are different, and that NO_2 is more toxic at lower levels than NO[2].

Acute effects of NO are primarily related to the formation of methemoglobin in the blood potentially resulting in methemoglobinemia (an effect that occurs when blood is unable to deliver oxygen to the tissues) whereas NO_2 can cause a variety of health effects and impair respiratory function at relatively low levels.[3] Although it is unlikely that people will be exposed to NO without being exposed to NO_2 in the environment, NO_2 is not currently regulated under Chapter 173-460 WAC.

The NO levels resulting in increased levels of methemoglobin (slight to clinically significant) in exposed humans ranged from 20 to 512 ppm (25,000 to 630,000 µg/m^3). At NO exposure levels below 20 ppm, no significant increase in methemoglobin is expected unless an individual has a deficiency in enzymes that reduce methemoglobin. Because of NO's ability to induce methemoglobinemia, the American Council of Government Industrial Hygienists (ACGIH) developed an occupational threshold limit value (TLV) 25 ppm (~30,000 µg/m^3). The TLV is intended to protect workers from health effects related to increased levels of methemoglin over the course of an 8-hr workday. This means that ACGIH considers it acceptable for a healthy worker to be exposed to an average NO concentration of 25 ppm over the course of an 8-hr workday. Ecology Headquarters used this TLV to derive its ASIL. Uncertainty factors (so called "safety" factors) were applied to the TLV to account for sensitive individuals and the

[2] National Advisory Committee for Acute Exposure Guideline Levels for Hazardous Substances. 2006a. *Interim Technical Support Document Acute Exposure Guideline Levels (AEGLs) for Nitric Oxide.* Available at URL http://www.epa.gov/oppt/aegl/pubs/tsd309.pdf.

[3] Hazardous Substances Data Bank [Internet]. Bethesda (MD): National Library of Medicine (US); [Last Revision Date June 24, 2005; cited 2008 May 20]. Nitric Oxide; Hazardous Substances Databank Number: 1246; Available from http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB.

possibility of continuous exposure without a recovery period. This process involves much uncertainty but is intended to protect the public from adverse health effects from air pollution.

In addition to the potential for causing methemoglobinemia, NO can cause vasodilation (widening of blood vessels resulting from relaxation of the muscular wall of the vessels) of the pulmonary blood vessels. For this reason, NO has been used for treating respiratory distress syndrome and persistent pulmonary hypertension of the newborn. Therapeutic levels are typically between 10-20 ppm (12,000 to 24,000 $\mu g/m^3$) for short time periods.

There is currently very little information from animal or human studies about NO's ability to cause cancer. Some bioassays (experiments on living cells or organisms) have shown mutagenic potential likely caused by the formation of peroxynitrite (a radical derivative that can damage cells). How this translates to its ability to cause cancer is unclear as NO is not classified as a carcinogen by the U.S. Environmental Protection Agency or the International Agency for Research on Cancer (IARC).

5.2.2 Reproductive/Developmental Effects

Methemoglobin inducers such as NO have the potential to affect the supply of oxygen to the fetus. As described previously, only exposure to relatively high levels (much higher than the modeled concentrations observed from this project) of NO is likely to result in methemoglobinemia.

5.2.3 Terrestrial Fate

NO is a gas, not a solid or liquid. Its terrestrial deposition and fate are therefore not significant.

5.2.4 Aquatic Fate

NO is relatively insoluble in water. Its transport and fate in environmental media are predominantly within the atmospheric medium.

5.2.5 Atmospheric Fate

NO converts to NO_2 in the presence of ozone and/or oxygen. The rate of conversion can be rapid, but is dependent on the ambient concentrations of NO, oxygen, and ozone. In the case of NO emissions from T-Mobile's generators, the conversion is not likely to occur at a rate that would significantly degrade NO in a timeframe relevant to impacts on nearby receptors.[4]

[4] http://www.branchenv.com/nox/nox_info.asp

5.3 Exposure Assessment

In order for NO to cause harm, people first must be exposed. To assess exposure, it is important to identify locations where people might be exposed, estimate the concentration of NO at places where people might be exposed, and estimate how much time and how long they might be at a location. In the case of T-Mobile emergency generator emissions, inhalation is the only route of exposure evaluated because NO is not likely to build up in food, soil, and water, or adhere to skin.

5.3.1 Estimating Concentration

Air modeling as described in section 3.5.4 was used to estimate maximum 1-hr, 8-hr, and 24-hr averaged concentrations of NO in air near T-Mobile. These maximum concentrations occur under worst-case meteorological conditions assuming the generators are operating continuously.

5.3.2 Identification of Exposed Populations

Current aerial photographs and land use designations are useful for identifying potentially exposed populations. The table below shows the distances to the sensitive receptors, businesses, and residences.

#	Facility	Facility Type	Estimated Distance in Feet	Estimated Distance in Meters
Maximum Offsite	Maximum Offsite Concentration	Unoccupied Hillside Fence Line	≈ 600[5]	≈ 180
	Sabey Tenant building	Office building	200	61
C1	Outhouse distributor	Commercial	400	122
C2	Apple Storage	Commercial	800	244
R1	Residence	Residence	1,300	396
R2	Residence	Residence	1,800	549

5.3.3 Discussion of TAP Exposure Concentrations

Air modeling was used to estimate concentrations of NO at the point of highest concentration (i.e., the fence line and unoccupied hillside) and three commercial properties (Sabey Building, Outhouse Distributor, and Apple Storage). Maximum 1-hr, 8-hr, and 24-hr concentrations are presented at each receptor point in the following table.

[5] These values have been estimated from the scale on maps provided by Jones & Stokes.

#	Facility	Maximum 1-hr Concentration ($\mu g/m^3$)	Maximum 8-hr Concentration ($\mu g/m^3$)	Maximum 24-hr Concentration ($\mu g/m^3$)
N/A	Sabey Tenant building	923	N/A	524
Maximum Offsite	Highest Concentration	9,746	1,076	563
C1	Outhouse distributor	892	N/A	314
C2	Apple Storage	866	N/A	241
R1	Residence 1	798	N/A	123
R2	Residence 2	713	N/A	173

5.3.4 Discussion of Exposure Duration

Exposure duration has implications with regard to health risk that a chemical poses on human health. In most cases, a person continuously exposed to a chemical cannot tolerate as high of concentrations as a person that is exposed for only a short time. Having identified potentially exposed populations, it is also important to consider the amount of time a person might be exposed. People who work at commercial or industrial locations near the Polaris Data Center are likely only to be exposed for up to the duration of their workday (assumed eight hours per day). Residents living near the Polaris Data Center have the potential to be exposed for a longer period (assumed 24 hours per day). Residents and occupants of commercial properties both have the opportunity to be exposed for short-term durations (assumed to be one hour).

5.4 DOSE-RESPONSE ASSESSMENT

Dose-response assessment describes the quantitative relationship between the amounts of exposure to a substance (the dose) and the incidence or occurrence of injury (the response). The process often involves establishing a toxicity value or criterion to use in assessing potential health risk.

The modeled concentrations in the previous table are intended to represent worst-case episodes in which NO emissions from T-Mobile's emergency generators impact areas of interest. The next step is to determine whether the maximum1-hr, 8-hr, and/or 24-hr concentrations at each receptor point exceed a level of concern. To determine a level of concern, existing toxicological data are examined to derive risk-based concentrations (RBCs). An RBC is an exposure concentration at or below which there is little concern for adverse human health effects. In addition to exposure concentration, exposure duration is important for determining risk-based concentrations.

5.4.1 Risk-Based Concentrations for Exposed Populations

Limited toxicological data on NO are available for use in quantifying risks to humans at the levels relevant to this project. As mentioned previously, the 24-hr ASIL (103 $\mu g/m^3$)

was derived from an 8-hr time-weighted average occupational TLV designed to protect workers from acute effects of NO exposure. Uncertainty factors were applied to consider sensitive individuals (as opposed to healthy workers) and the fact that people continuously exposed do not have a recovery period. This derivation is shown below.

24-hr ASIL = TLV (30,900 $\mu g/m^3$) / sensitive individual factor (10) / non-recovery factor (10) * work day to full day conversion (8/24)

ASIL = 30,900 $\mu g/m^3$ / 300 = 103 $\mu g/m^3$

For shorter exposure durations, California's 1-hr Reference Exposure Level (REL) for NO_2 was used to approximate an acute RBC for NO based on the assumption that NO_2 is five times more toxic than NO.

NO_2 REL = 470 $\mu g/m^3$
NO 1-hr RBC = 470 $\mu g/m^3$ x 5 = 2,350 $\mu g/m^3$

Finally, an additional RBC was developed for exposures expected only to occur intermittently for durations of 40 hours or less. This removes the non-recovery factor from the 24-hr ASIL (1,030 $\mu g/m^3$). To determine intermittent RBCs for exposure durations between one hour and 40 hours (e.g., eight hours or 12 hours), a linear interpolation was used to estimate RBCs. The following linear equation approximates NO RBCs from 1-hr to 40-hr exposure durations. For exposure durations > 40-hr, the RBC is the ASIL.

RBC = mx + b
Where m = (1,030-2,350)/23 = -57.4
X= Exposure duration (between 1 and 40 hours)
B = 2,407

Scenario	RBC ($\mu g/m^3$)	Hours	Basis
All	2,350	1	1-hr Reference exposure level for NO_2 (470-$\mu g/m^3$) x 5:1[6]
Residential	103	24	RBC if power outage lasts for more than 40 hours at a time (equal to 24-hr ASIL)[7]
	1,030	24	RBC if power outage lasts for 24 hours (equal to 24-hr ASIL x 10)
Workers at commercial/industrial properties	1,950	8	Linear interpolation from 1-hr REL to 24-hr ASIL without a non-recovery factor[8]

5.5 Risk Characterization

In this step, modeled NO concentrations are compared to RBCs that are developed through dose-response assessment to determine if possible health hazards exist.

5.5.1 Hazard Quotient

Hazard quotients were calculated for different scenarios and averaging periods depending on land use and varying durations of exposure. A hazard quotient (HQ) is the ratio of the potential exposure to a substance compared to the exposure level that is considered "safe" (i.e., risk-based concentration).

$$HQ = \frac{\text{maximum 1-hr, 8-hr, or 24-hr average concentration } (\mu g/m^3)}{\text{Corresponding 1-hr, 8-hr, or 24-hr RBC } (\mu g/m^3)}$$

A HQ of one or less indicates that adverse health effects are not expected to result from exposure to emissions of that substance. As the HQ increases above one, the probability of human health effects increases by an undefined amount. However, it should be noted that a HQ above one is not necessarily indicative of health impacts due to the application of uncertainty factors in deriving toxicological reference values (e.g., ASILs, risk-based concentrations).

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[6] The 1-hr reference exposure limit (REL)-equivalent for nitric oxide derived from the 5:1 ratio based on the NIOSH Immediately Dangerous to Life or Health values of 20-ppm for NO_2 and 100-ppm for nitric oxide.

[7] The applicant proposed use of a 24-hr ASIL without a non-recovery factor because the generators are only permitted to operate during an unplanned outage for a total of 44 hours per year. While it is likely that the generators will only operate for short durations, there are no restrictions on the length of time the generators can operate during a power-outage. Therefore, it is possible that the generators can operate for more than 24 hours at one time not allowing residential receptors a period of recovery.

[8] The nitric oxide ASIL multiplied by a factor of 10 to remove the non-recovery factor to obtain a 24-hr risk-based concentration (RBC) = 3100-$\mu g/m^3$ x (8/24) / 10 [for healthy worker to sensitive pop].

The following table shows modeled concentrations, RBCs, and HQs at each receptor point. In most cases, HQs are less than one, and therefore of no concern. The 24-hr HQs for the two residences (assuming exposure will continue over successive days) slightly exceed one (1.2 and 1.7). If exposure is not continuous over the course of successive days, then the HQ will be less than one. The highest 1-hr HQ, 4.2, occurs at the unoccupied hillside north of the source.

NO Hazard Quotients for Residents					NO Hazard Quotients for Workers at Commercial/Industrial Properties			
Averaging Time Exposure Duration	Resident R-1		Resident R-2		Sabey Tenant Building	Outhouse Distributor C-1	Apple Storage C-2	Point of Maximum Concentration
	NR[9]	R[10]	NR	R				
24-Hr Concentration (µg/m^3)	123	123	173	123	524	314	241	563
24-Hr RBC (µg/m^3)	103	1,030	103	1,030	NA	NA	NA	NA
24-Hr Hazard Quotient	1.2	0.1	1.7	0.1	NA	NA	NA	NA
8-Hr Concentration (µg/m^3)	ND		ND		ND	ND	ND	1,076
8-Hr RBC (µg/m^3)	N/A		N/A		1,950	1,950	1,950	1,950
8-Hr Hazard Quotient								**0.6**
1-Hr Concentration (µg/m^3)	798		713		923	892	866	9,764
1-Hr RBC (µg/m^3)	2,350		2,350		2,350	2,350	2,350	2,350
1-Hr Hazard Quotient	0.3		0.3		0.4	0.4	0.4	**4.2**

NA – not applicable.
ND – not determined. 8-hr hazard quotients for these commercial / industrial receptors are expected to be less than one.

[9] NR stands for No recovery and assumes continuous exposure for more than 40 hours.
[10] R stands for Recovery and assumes exposure is only one full day.

5.5.2 Discussion of Hazard Quotients that Exceed One

- Residential Scenario

The HQs at the two closest residential receptors are 1.2 and 1.7 assuming exposure occurs during successive days. As previously noted, a HQ above one is not necessarily indicative of health impacts due to the application of uncertainty factors in deriving toxicological reference values. In the case of NO, the RBC used for the residential scenario is based on assumptions containing a large amount of uncertainty. The majority of the toxicological data for NO relates to concentrations many times higher than the ASIL. The NO ASIL is likely to be much lower than levels necessary to result in adverse effects.

Depending on what assumptions are used, the HQ at residences may in fact be lower than one. If it is assumed that the power outage is not likely to last in excess of 40 hours at one time, then a risk-based concentration 10 times higher than the ASIL can be used (a factor of 10 accounting for non-recovery is removed from the ASIL). According to Douglas County Public Utilities District, the average length of power disruption per customer from 2000-2004 was 0.6-1.7 hours per year. Furthermore, no power outages were reported on the power line that provides power to T-Mobile. Although possible, an extended power outage at T-Mobile is not likely.

An unlikely extended power outage coupled with infrequent worst-case meteorological conditions further reduces the likelihood of unacceptable impacts on residences. Based on the meteorological data from 2001-2005, there is only a 2-10% chance that meteorological conditions would result in a 24-hr concentration at residences exceeding 100 $\mu g/m^3$ (assuming generators were operating continuously).

Finally, T-Mobile has accepted an operational restriction of 44 hours per year of full generator operation during unplanned power outage. This ensures that prolonged operation of generators is not likely to occur.

The protectiveness of the ASIL coupled with the extremely low probability of a prolonged power outage occurring during a time of worst-case meteorological conditions and T-Mobile's willingness to accept operational restrictions of 44 hours per year during unplanned outages results in an acceptable impact on nearby residences.

- Unoccupied Hillside

The 1-hr HQ at the unoccupied hillside is 4.2. Again, there is much uncertainty with regard to how the 1-hr RBC was calculated. The 1-hr RBC was calculated based on a general assumption that NO is five times less toxic than NO_2. The NO RBC was derived by multiplying the NO_2 REL (470 $\mu g/m^3$) by a factor of five.

Currently, Chapter 173-460 WAC is undergoing modifications in part to update the ASILs. When these modifications take effect, NO will no longer be regulated as a toxic air pollutant. However, NO_2 will be added to the list of ASILs.

Not considered in this evaluation, but important to highlight nonetheless, is the fact that NO_2 is also emitted from the diesel generators. In fact, NO_2 levels are likely to be a factor of 0.6 times the NO levels. This means that maximum 1-hr NO_2 levels on the hillside could reach 6,000 $\mu g/m^3$. Given that California's Acute REL and the National Advisory Committee's Acute Exposure Guidance Level for NO_2 have been established at 470 $\mu g/m^3$ and 940 $\mu g/m^3$, respectively,[11] [12] the potential impacts on the hillside are significant. Depending on which value would be used as a RBC, the HQ for NO_2 at the unoccupied hillside would range from six to 13.

Although this area is currently unoccupied, the current zoning does not prohibit it from being developed in the future. Future land use in this area is an important consideration with regard to potential future impacts on human health.

5.6 Uncertainty Characterization

To the extent that an individual will be exposed to emissions of NO from this proposed project, the applicant submitted the following uncertainty analysis:

There is much toxicological uncertainty with regard to NO. The 24-hr ASIL is based on occupational standards with applied safety factors intended to be protective of the public. The mechanisms by which NO is acutely toxic at very high levels may not apply at levels as low as the ASIL.

In this evaluation, RBCs were derived to fit different exposure scenarios. Because duration of exposure is important toxicologically, it was necessary to approximate risk-based concentrations for people that might be exposed for less than 24 hours. These risk-based concentrations were derived by linearly interpolating between the adjusted 1-hr REL (adjusted from the NO_2 acute REL assuming NO_2 is five times more toxic than NO) and the adjusted 24-hr ASIL (without non-recovery factor). This process involves much uncertainty.

The possibility of a long-term power outage exists but is unlikely based on records from Douglas County Public Utilities District. The likelihood that the generators will be used for more than a couple hours during a single power outage is low.

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[11] http://www.oehha.ca.gov/air/acute_rels/pdf/10102440A.pdf
[12] http://www.epa.gov/oppt/aegl/pubs/tsd308.pdf

6. CONCLUSION

Under current land use configurations, the project will not have adverse impacts on air quality. Future development on hillside north of the source could result in unacceptable short-term impacts on receptors. Ecology Headquarters recommends notifying the local health department and the county planning department of our evaluation of this proposed project.

After notifying the agencies listed above, we have determined the health risks are within the acceptable range. Therefore, Ecology Headquarters may approve the proposed new sources of TAPs under Chapter 173-460 WAC.

For additional information, please contact:

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7. LIST OF ABBREVIATIONS

ACGIH	American Council of Government Hygienists
ASIL	Acceptable Source Impact Level
BACT	Best Available Control Technology
CRO	Washington State Department of Ecology, Central Regional Office
Ecology Headquarters	Washington State Department of Ecology, Headquarters Office
EPA	United States Environmental Protection Agency
F	Fahrenheit
HQ	Hazard Quotient
hr	Hour(s)
IARC	International Agency for Research on Cancer
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_X	Oxides of Nitrogen
NOC	Notice of construction as defined in chapters 173-400 & 460 WAC
ppb	Parts Per Billion
RBC	Risk Based Concentration
REL	Reference Exposure Level
SQER	Small Quaintly Emission Rate
TAP	Toxic Air Pollutants
T-BACT	Best Available Control Technology for Toxics
TLV	Threshold Limit Value
µg/m3	Micrograms per Cubic Meter
USGS	United States Geological Survey
WAC	Washington Administrative Code