Second Tier Review Recommendation for: H5 Data Center Quincy, WA

Air Quality Program
Washington Department of Ecology
Olympia, Washington

DEPARTMENT OF ECOLOGY
State of Washington

Contact Information

Air Quality Program

P.O. Box 47600
Olympia, WA 98504-7600
360-407-6800
https://ecology.wa.gov/contact

ADA Accessibility

The Department of Ecology is committed to providing people with disabilities access to information and services by meeting or exceeding the requirements of the Americans with Disabilities Act (ADA), Section 504 and 508 of the Rehabilitation Act, and Washington State Policy #188.

To request ADA accommodation, email gary.palcisko@ecy.wa.gov or call 360-407-7338, 711 (relay service), or 877-833-6341 (TTY).

Second Tier Review Recommendation for:

H5 Data Center

Quincy, WA

Air Quality Program
Washington Department of Ecology
Olympia, WA

DEPARTMENT OF ECOLOGY
State of Washington

This page is purposely left blank

Table of Contents

List of Tables and Figures

Page

Tables

Figures

Executive Summary

This document presents and summarizes a review of health risks from air pollutants emitted by 12 new emergency diesel-powered generators at H5 Data Center in Quincy, WA. In general, toxic air pollutant impacts in the area near H5 Data Center will not result in excessive cancer risk or cause serious short- or long-term health effects. Ecology concludes that the health risk is acceptable and recommends approval of the project.

H5 proposes to add twelve 2.25 megawatt diesel-fueled emergency generators to supply backup power at their data center in Quincy, WA. While the proposed engines will operate only during unplanned outages and up to 18 hours per year for planned maintenance and testing (per engine average not including stack testing or one-time commissioning) the engines may emit two toxic air pollutants—diesel engine exhaust particles and nitrogen dioxide—at rates triggering a requirement to prepare a health impact assessment. A health impact assessment describes the increased health risks from exposure to toxic air pollutants.

H5 hired Landau Associates to prepare a health impact assessment. Landau Associates estimated increased health risks associated with H5's diesel particle and other toxic air pollutant emissions.

Conclusions

- Long-term impacts:
    - H5's increased diesel particle emissions result in a maximum lifetime cancer risk of about nine in one million. The maximum risk occurs for residents at a property southeast of H5 Data Center. Ecology assumes residents are exposed to H5's increased emissions continuously over their entire lifetime when assessing cancer risk.
    - Lifetime exposure to "background" levels of diesel particles in the area results in a risk of about 33 in one million.
    - Exposure to diesel particles in the area is not likely to result in long-term non-cancer health effects.
- Short-term impacts:
    - Nitrogen dioxide emitted from H5 Data Center diesel-powered engines that operate during a power outage could rise to levels of short-term concern for people with respiratory problems. Emissions probably will not cause levels of concern at residential or other routinely occupied areas.
        - The highest short-term nitrogen dioxide impacts occur near the west side of the data center fenceline boundary. The wind and weather conditions conducive to producing higher nitrogen dioxide impacts need to coincide with high emissions during power outages to result in high concentrations. We do not expect power outages affecting H5 Data Center to occur frequently,

therefore concentrations responsible for these hazards probably will not occur frequently or last long.

Ecology's recommendation

Ecology recommends approval of the project because:

- Emission controls for the new and modified emission units represent best available control technology for toxics.
- The applicant demonstrated that the increase in emissions of toxic air pollutants is not likely to result in an increased cancer risk of more than one in one hundred thousand (10 in one million) which is the maximum risk allowed by a second tier review.
- The non-cancer hazard is acceptable.
- Grant County Public Utility District's power system is reliable.

Second Tier Review Processing and Approval Criteria

The health impacts assessment (HIA) of H5's proposed emissions was submitted by Landau Associates (Landau Associates, 2021a). The HIA is part of the second tier toxics review process under WAC 173-460. Ecology is responsible for processing and reviewing second tier review petitions statewide.

Second tier review processing requirements

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

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

(b) Emission controls contained in the preliminary NOC approval order represent at least best available control technology for toxics (tBACT).

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

(d) The ambient impact of the emissions increases of each toxic air pollutant (TAP) that exceed acceptable source impact levels (ASILs) has been quantified using refined air dispersion modeling techniques as approved in the HIA protocol.

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

Acting as the "permitting authority" for this project, Ecology's project permit engineer satisfied item (a) and verified item (b) above on October 8, 2021.[1] Ecology approved an HIA protocol (item (c)), and the final HIA (item (e)) was received by Ecology on July 16, 2021. Ecology's modeler determined that Landau Associates conducted the refined modeling (item (d)) appropriately.[2]

All five processing requirements above are satisfied.

Second tier review approval criteria

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

[1] Jenny Filipy, "RE: NOC – Application – H5 Data Centers, Quincy," email message with attachments, October 8, 2021.
[2] Ranil Dhammapala, "RE: NOC Application – H5 Data Centers, Quincy," email message, April 30, 2021.

(a) Determines that the emission controls for the new and modified emission units represent tBACT.

(b) The applicant demonstrates that the increase in emissions of TAPs is not likely to result in an increased cancer risk of more than one in one hundred thousand.

(c) Ecology determines that the non-cancer hazard is acceptable.

tBACT determination

Ecology's permit engineer determined that H5's proposed pollution control equipment satisfies the BACT and tBACT requirement for diesel engines powering backup generators (Ecology, 2021). BACT and tBACT for nitrogen oxides (NO_X) and diesel particles was determined to be met through restricted operation of EPA Tier-2 certified engines operated as emergency engines as defined in 40 C.F.R. 60.4219, and compliance with the operation and maintenance restrictions of 40 C.F.R. Part 60, Subpart IIII.

Health Impact Assessment Review

As described above, the applicant is responsible for preparing the HIA under WAC 173-460-090. Ecology's project team consisting of an engineer, a toxicologist, and a modeler review the HIA to determine if the methods and assumptions are appropriate for assessing and quantifying risks to the surrounding community from a new project.

For the H5 Data Center project, the HIA focused on health risks attributable to diesel engine exhaust particulate (DEEP) and nitrogen dioxide (NO_2) exposure because the modeled ambient air concentrations exceeded respective ASILs. Landau Associates briefly described emissions and exposure to other project-related TAPs that did not exceed ASILs, but these pollutants contributed very little to overall health risks estimated in the health impacts assessment.

Health effects summary

The HIA prepared by Landau Associates quantifies the non-cancer hazards and increased cancer risks attributable to H5's TAP emissions. The HIA focused on potential exposure to diesel particles and NO_2 as these were the two TAPs with emissions causing an exceedance of an ASIL.

DEEP health effects summary

Diesel engines emit very small fine (<2.5 micrometers [µm]) and ultrafine (<0.1 µm) particles. These particles can easily enter deep into the lung when inhaled. Mounting evidence indicates that inhaling fine particles can cause or contribute to numerous adverse health effects.

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

Nitrogen dioxide health effects summary

NO_2 is present in diesel exhaust. It forms when nitrogen, present in diesel fuel and as a major component of air, combines with oxygen to produce oxides of nitrogen.

NO_2 and other oxides of nitrogen are of concern for ambient air quality because they are part of a complex chain of reactions responsible for the formation of ground-level ozone. Additionally, exposure to NO_2 can cause both long-term (chronic) and short-term (acute) health effects.

Long-term exposure to NO_2 can lead to chronic respiratory illness such as bronchitis and increase the frequency of respiratory illness due to respiratory infections.

Short-term exposure to extremely high concentrations (>180,000 $\mu g/m^3$) of NO_2 may result in serious effects including death (National Research Council, 2012). Moderate levels (~ 30,000 $\mu g/m^3$) may severely irritate the eyes, nose, throat, and respiratory tract, and cause shortness of breath and extreme discomfort. Lower level NO_2 exposure (<1,000 $\mu g/m^3$), such as that experienced near major roadways, or perhaps downwind from stationary sources of NO_2, may cause increased bronchial reactivity in some asthmatics, decreased lung function in patients with chronic obstructive pulmonary disease, and increased risk of respiratory infections, especially in young children (CalEPA, 2008).

For H5's proposed project, emissions from emergency engines during a utility power interruption present the greatest potential for producing high enough short-term concentrations of NO_2 to be of concern for respiratory health effects. Landau Associates and Ecology calculated numerical estimates of exposure and hazard reported later in this document.

Toxicity reference values

Agencies develop toxicity reference values for use in evaluating and characterizing exposures to chemicals in the environment. As part of the HIA, Landau Associates identified appropriate toxicity values for DEEP and NO_2.

DEEP toxicity values

Landau identified toxicity values for DEEP from two agencies: the U.S. Environmental Protection Agency (EPA) (EPA, 2002; EPA, 2003), and California EPA's Office of Environmental Health Hazard Assessment (OEHHA) (CalEPA, 1998). These agencies derived toxicity values from studies of animals exposed to a known amount (concentration) of DEEP, or from epidemiological studies of exposed humans. These values represent a level at or below which we do not expect adverse non-cancer health effects and a metric by which to quantify increased risk from exposure to a carcinogen. Table 1 shows the appropriate DEEP non-cancer and cancer toxicity values identified by Landau Associates.

EPA based its reference concentration (RfC) and OEHHA based its reference exposure level (REL) for diesel engine exhaust (measured as DEEP) on dose-response data on inflammation and changes in the lung from rat inhalation studies. Each agency established a level of five $\mu g/m^3$ as the concentration of DEEP in air at which long-term exposure is unlikely to cause adverse non-cancer health effects.

EPA promulgated National Ambient Air Quality Standards (NAAQS) and other regulatory toxicological values for short- and intermediate-term exposure to particulate matter, but values specifically for DEEP exposure at these intervals do not currently exist.

OEHHA derived a unit risk factor (URF) for estimating cancer risk from exposure to DEEP. They based the URF on a meta-analysis of several epidemiological studies of humans occupationally exposed to DEEP. In these studies, researchers based exposure on measurements of elemental carbon and respirable particulate representing fresh diesel exhaust. Therefore, we define DEEP as the filterable fraction of particulate emitted by diesel engines.[3] The URF is expressed as the upper-bound probability of developing cancer, assuming continuous lifetime exposure to a substance at a concentration of one microgram per cubic meter (1 $\mu g/m^3$), and are expressed in units of inverse concentration [i.e., $(\mu g/m^3)^{-1}$]. OEHHA's URF for DEEP is 0.0003 per $\mu g/m^3$ meaning that a lifetime of exposure to one $\mu g/m^3$ of DEEP results in an increased

[3] Condensable particulate does not represent DEEP for the purposes assessing health risks from DEEP exposure; however, we consider both the filterable and condensable fractions of particulate when determining compliance with NAAQS for the purposes of the NOC application.

individual cancer risk of 0.03 percent or a population cancer risk of 300 excess cancer cases per million people exposed.

Nitrogen dioxide toxicity values

OEHHA developed an acute reference exposure level for NO_2 based on inhalation studies of asthmatics exposed to NO_2. These studies found that some asthmatics exposed to about 0.25 ppm (i.e., 470 µg/m^3) experienced increased airway reactivity following inhalation exposure to NO_2 (CalEPA, 2008). Not all exposed subjects experienced an effect.

The acute REL derived for NO_2 does not contain any uncertainty factor adjustment, and therefore does not provide any additional buffer between the derived value and the exposure concentration at which effects may occur in sensitive populations. This implies that exposure to NO_2 at levels equivalent to the acute REL (which is also the same as Ecology's ASIL) could result in increased airway reactivity in a subset of asthmatics. People without asthma or other respiratory disease are less likely to experience effects at NO_2 levels at or below the REL. OEHHA intended for acute RELs to be "for infrequent one hour exposures that occur no more than once every two weeks in a given year" (CalEPA, 2015).

Acute Exposure Guidance Levels (AEGLs) developed by the National Research Council (NRC) are also relevant to acute NO_2 exposures. Emergency planners and responders use AEGLs as guidance in dealing with rare releases of chemicals into the air. AEGLs are expressed as specific concentrations of airborne chemicals at which health effects, ranging from non-disabling to severe, may occur. The varying AEGL levels (1, 2, or 3) are dictated by the severity of the toxic effects caused by the exposure, with Level 1 being the least and Level 3 being the most severe. They are designed to protect the elderly and children, and other individuals who may be susceptible. The AEGL1 (non-disabling effects) for NO_2 is 940 µg/m^3. Potential effects include slight burning of the eyes, headache, and chest tightness or labored breathing with exercise in people with asthma.

Finally, EPA developed an annual and 1-hour NAAQS for NO_2. Landau Associated demonstrated compliance with these NAAQS as part of the NOC application process (Ecology, 2021).

Table 1: Toxicity Values or Comparison Values Considered in Assessing and Quantifying Non-cancer Hazard and Cancer Risk

Pollutant	Agency	Non-cancer	Cancer
DEEP	U.S. Environmental Protection Agency	RfC[1] = 5 µg/m^3	NA[2]
DEEP	California EPA–Office of Environmental Health Hazard Assessment	Chronic REL[3] = 5 µg/m^3	URF[4] = 0.0003 per µg/m^3
Nitrogen dioxide	California EPA–Office of Environmental Health Hazard Assessment	Acute REL = 470 µg/m^3	NA
Nitrogen dioxide	National Research Council – Committee on Acute Exposure Guideline Levels	AEGL[5] – 1 = 940 µg/m^3	NA

Pollutant	Agency	Non-cancer	Cancer
[1] RfC – Reference Concentration [2] EPA considers DEEP to be a probable human carcinogen, but has not established a cancer slope factor or unit risk factor. [3] REL – Reference Exposure Level [4] URF – Unit Risk Factor [5] AEGL – Acute Exposure Guidance Level			

Community/receptors

H5 Data Center is located in an industrially zoned area surrounded largely by agricultural land uses. Some rural residences are scattered around the facility with the nearest residential parcel adjacent to the facility's southeast property boundary. Air dispersion modeling indicated that proposed DEEP emissions result in long-term concentrations in excess of the ASIL at about 36 parcels with residential land use codes (Figure 1) [Ecology, 2019]. Relevant to short-term impacts, levels of NO_2 could exceed the ASIL over a small area on the west side of H5 Data Center's fenceline boundary (Figure 2).

For the purposes of assessing increased cancer risk and non-cancer hazards, Landau Associates identified receptor locations where the highest exposure to project-related air pollutants could occur: at or near the project fenceline boundary, nearby residences, and nearby commercial locations (Table 3, Figures 3 and 4). Landau Associates also evaluated exposures that occur at area schools and health care centers. None of these other sensitive receptors is located in areas where H5's ambient impacts exceed ASILs.

Ecology's review of the HIA found that Landau identified appropriate receptors to capture the highest H5 attributable exposures for commercial and other sensitive receptors. In the case of the residential receptor maximally impacted by diesel particles, Landau Associates chose a location on H5 Data Center's property outside their fenceline near a residential parcel. Ecology identified an alternative location for the maximally impacted residential receptor (MIRR) about 30 meters southwest within the residential parcel (Figure 3).

Table 2: Estimated Annual Average DEEP and Maximum 1-hr NO_2 Concentrations at Key Receptor Locations

Receptor	UTM Coordinates Zone 10N	Annual DEEP Concentration (μg/m^3)	UTM Coordinates Zone 11N	Maximum 1-hr NO_2 Concentration (μg/m^3)
MIRR – identified by Landau	(286900, 5236732.5)	0.03194	(286150, 5237370)	203
MIRR – identified by Ecology	(286912.5, 5236707.5)	0.02925	(286150, 5237370)	203
MIBR/PMI MICR	(286663.14, 5237242.09)	0.19203	(286524.18, 5237111.53)	919

MIRR – Maximally impacted residential receptor
MICR – Maximally impacted commercial receptor
MIBR/PMI – Maximally impacted boundary receptor/Point of Maximum Impact

Background concentrations of TAPs in ambient air

When reviewing increases in TAP emissions under second tier review, WAC 173-460-090 specifies that:

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

Landau Associates used the Quincy-wide interactive background map available on Ecology's website. This map presents gridded annual average diesel particulate and the 98th percentile of the daily maximum one-hour NO_2 levels attributable to regional and local sources. Table 3 shows the background levels of DEEP and NO_2 considered by Landau Associates in the HIA.

Table 3: Estimated "Background" Concentrations of Average DEEP and 1-hr NO_2 Levels near H5 Data Center

Receptor	Average Annual "Background" Diesel Particulate Concentration (g/m^3)	1-hr NO_2 "Background" Concentration ($\mu g/m^3$)
MIBR/MICR	0.11	55
MIRR	0.11	26

Increased cancer risk

Landau Associates assessed the increased risk of cancer from lifetime exposure to DEEP emitted from H5's engines. They characterized cancer risk in a manner consistent with EPA guidance for inhalation risk assessment (EPA, 2009) using the following equations:

Risk = IUR x EC

Where:

IUR $(\mu g/m^3)^{-1}$ = inhalation unit risk (i.e., unit risk factor); and

EC ($\mu g/m^3$) = exposure concentration

EC = (CA x ET x EF x ED)/AT

Where:

EC (EC ($\mu g/m^3$) = exposure concentration;

CA ($\mu g/m^3$) = contaminant concentration in air;

ET (hours/day) = exposure time;

EF (days/year) = exposure frequency;

ED (years) = exposure duration; and

AT (ED in years x 365 days/year x 24 hours/day) = averaging time

Cancer risk attributable to H5 DEEP and existing background emissions

Table 4, adapted from the HIA, shows the estimated H5-specific cancer risk per million for residential and commercial receptors. These receptors received the highest exposure of H5-related diesel emissions. Figure 3 shows the location of these receptors relative to H5. The highest increase in risks attributable to H5's emissions is 8.8 per million[4] for people living at the MIRR (identified by Ecology).

For commercial exposure scenarios, the maximally impacted commercial receptor (MICR) may have increased risks of up to 7.5 per million. Because the location chosen for the MICR is also the point of maximum impact along H5's fenceline, commercial receptor's exposure and risk is likely overestimated.

Exposure to existing "background" levels of DEEP in the area results in a risk of about 33 in one million for residential receptors.

Table 4: Estimated Increased Cancer Risk for Residential and Commercial Receptors Attributable to H5's DEEP Emissions

Exposure Parameter	MIRR-Landau	MIRR-Ecology	MICR
CA H5 – concentration in air from H5 emissions (μg/m^3)	0.03194	0.02925	0.19203
CA background – concentration in air from "background" sources (μg/m^3)	0.11	0.11	0.11
ET - Exposure Time (hours per day)	24	24	8
EF - Exposure Frequency (days per year)	365	365	250
ED - Exposure Duration (years)	70	70	40
AT - Averaging Time (hours)	613200	613200	613200
EC H5 - H5 Related Exposure Concentration (μg/$^{m3)}$	0.0319	0.0293	0.0251
EC background - Background source related Exposure Concentration (μg/m^3)	0.11	0.11	0.014
IUR - Inhalation Unit Risk (μg/m^3)-1	3.00E-04	3.00E-04	3.00E-04
Increased cancer risk from H5's emissions	**9.6E-06**	**8.8E-06**	**7.5E-06**
Cancer risk from "background" sources	3.3E-05	3.3E-05	4.3E-06
Total cancer risk from diesel particle exposures near H5	4.3E-05	4.2E-05	1.2E-05
Note: Landau Associates also evaluated exposures for other sensitive receptors, but we did not present them because the exposure and risk levels are much lower than those shown here.			

[4] Number per million represents an upper-bound theoretical estimate of the number of excess cancers that might result in an exposed population of one million people compared to an unexposed population of one million people. Alternatively, an individual's increase in risk of one in one million means a person's chance of getting cancer in their lifetime increases by one in one-million or 0.0001 percent.

Non-cancer hazard

Landau Associates assessed the acute and chronic non-cancer hazards from exposure to NO_2 and DEEP emissions from H5 and other local sources. They estimated non-cancer hazards consistent with EPA guidance for inhalation risk assessment (EPA, 2009) using the following equations:

HQ = EC/Toxicity Value

Where:

HQ (unitless) = hazard quotient;

EC (µg/m^3) = exposure concentration;

Toxicity Value (µg/m^3) = inhalation toxicity value (e.g., RfC, REL) that is appropriate for the exposure scenario (acute, subchronic, or chronic).

EC = CA

Where:

EC (µg/m^3) = exposure concentration;[5]

CA (µg/m^3) = contaminant concentration in air.

Landau Associates evaluated short-term (acute) exposures to NO_2 emitted during power outage scenarios and determined hazard quotients (HQs) could exceed unity (one) at a few locations (Table 5, Figure 4). This indicates that there is potential for short-term respiratory hazards from exposure to NO_2. We present and discuss the frequency of these potential occurrences under the "Other Considerations" heading of this document.

Table 5: Estimated Short-term NO_2 Non-cancer Hazards Attributable to H5 Emissions

Receptor	Project-related Max 1-hr NO_2 (µg/m^3)	Existing Background NO_2 Level (µg/m^3)	Cumulative maximum 1-hr NO_2 Level (µg/m^3)	Acute REL (µg/m^3)	HQ
MIBR/PMI MICR	919	62	981	470	2.1
MIRR	203	26	229	470	0.49
MIRR – Maximally impacted residential receptor MICR – Maximally impacted commercial receptor MIBR/PMI – Maximally impacted boundary receptor/Point of Maximum Impact					

[5] EPA's guidance allows for exposure frequency and exposure duration to be considered when determining exposure concentrations for chronic health effects, but for simplicity, Landau Associates assumed all receptors were exposed continuously to the average annual contaminant concentration in air at the relevant receptor locations.

Landau Associates also evaluated chronic non-cancer hazard associated with long-term exposure to DEEP emitted from H5's emergency engines. Long-term exposure to DEEP in the area results in HQs much lower than unity (Table 6). Additionally, HQs would remain low even when considering "background" exposures. This indicates that chronic non-cancer hazards are not likely to occur because of exposure to DEEP near H5.

Table 6: Estimated Long-term DEEP Non-cancer Hazards Attributable to H5 Emissions

Receptor	Project-related Annual Avg. DEEP Level (µg/m^3)	Existing Background DEEP Level (µg/m^3)	Cumulative Avg. DEEP Level (µg/m^3)	Chronic REL (µg/m^3)	HQ
MIBR/MICR	0.37	0.11	0.48	5	<0.1
MIRR	0.058	0.11	0.17	5	<0.1

Note: Annual concentration based on worst-case year emissions.
MIRR – Maximally impacted residential receptor
MIBR/MICR – Maximally impacted boundary receptor/Maximally impacted commercial receptor

Other Considerations

Short-term exposures to DEEP

Exposure to DEEP can cause both acute and chronic health effects. However, as discussed previously, reference toxicity values specifically for DEEP exposure at short-term or intermediate intervals do not currently exist. Therefore, Landau Associates did not quantify short-term risks or hazards from DEEP exposure. Generally, Ecology assumes that compliance with the 24-hour $PM_{2.5}$ NAAQS indicates acceptable short-term health effects from DEEP exposure. Ecology's Technical Support Document (TSD) for the draft preliminary NOC approval concludes that H5's emissions are not expected to cause or contribute to an exceedance of any NAAQS (Ecology, 2021).

Frequency of short-term NO_2 hazards

H5's emergency engines could emit a high rate of NO_X if required to supply power during a line power interruption. Generally, line power is reliable in Quincy as the public utilities district (PUD) reports[6] an average service availability index (ASAI) of greater than 99.98 percent, which equates to less than two hours of interrupted service per average customer per year. Additionally, the highest System Average Interruption Frequency Index (SAIFI) in the last five years of available data was 1.265, which means that the average customer experienced about one power disruption per year. The highest customer average interruption duration index (CAIDI) during that same period was 167.95 minutes (Landau Associates, 2021a) which means that when a power interruption does occur, it lasts an average of about 2 hours and 48 minutes.

As previously described, Landau Associates evaluated short-term H5 and background NO_X emissions as part of the second tier review. The analysis showed that while NO_2 levels could indeed rise to levels of concern[7] during a line power interruption, the interruption would have to occur at a time when the dispersion conditions were optimal for concentrating NO_2 at a given location.

Landau Associates estimated the combined probability of H5 Data Center experiencing a power outage that coincides with unfavorable meteorology. Table 7 shows the recurrence interval of concentrations exceeding either the ASIL (470 $\mu g/m^3$) at each key receptor location resulting from H5 data center power outage NO_X emissions. Assuming the data center experiences eight hours of line power interruption every year, the most frequent NO_2 impacts reaching levels of concern occur near the western boundary of H5 Data Center about once every 11 years. NO_x emissions probably will not impact residential locations at levels greater than the ASIL.

[6] Based on reported service reliability from 2007 through 2019.

[7] The level of concern in this case is 470 $\mu g/m^3$. This represents California OEHHA's acute reference exposure level of 470 $\mu g/m^3$.

Table 7: Estimated Years between Occurrence of NO_2 Levels > ASIL from Project-related and Background Emissions Assuming Eight Hours of Line Power Interruption at H5's Data Center, Quincy, WA

Hypothetical Average Annual Number of Hours per Year H5 Experiences Line Power Interruption (hr/yr)	Recurrence (yr) of NO_2 Levels > ASIL at Most Frequently Impacted Residence	Recurrence (yr) of NO_2 Levels > ASIL at Most Frequently Impacted Receptor Along Western Boundary of H5
8	NA	11 [9]
NA – NO_2 impacts from proposed H5 Data Center emissions and "background" emissions are not expected to cause an exceedance of the ASIL at residential locations Note: [Recurrence interval considering "background" emissions]		

Uncertainty

Many factors of the HIA are prone to uncertainty. Uncertainty relates to the lack of exact knowledge regarding many of the assumptions used to estimate the human health impacts of H5's emissions. The assumptions used in the face of uncertainty may tend to over- or underestimate the health risks estimated in the HIA. Key aspects of uncertainty in the HIA for H5's proposed data center are exposure assumptions, emissions estimates, air dispersion modeling, and toxicity of DEEP.

Table 8: Qualitative Summary of How Uncertainty Affects the Quantitative Estimate of Risks or Hazards Attributable to H5 Emissions

Source of Uncertainty	How Does it Affect Estimated Risk from this Project?
Exposure assumptions	Continuous lifetime exposure is likely an overestimate of DEEP exposure.
Emissions estimates	Possible overestimate of emissions because Landau used worst-case emission rate to estimate DEEP and NO_2 emissions.
Air modeling methods	Possible underestimate of average long-term ambient concentrations and overestimate of short-term ambient concentration.
Toxicity of DEEP at low concentrations	Possible overestimate of cancer risk, possible underestimate of non-cancer hazard for sensitive individuals.

Exposure uncertainty

We can only estimate the amount of time an individual will be exposed to H5's DEEP emissions. To ensure public health protection, Landau Associates and Ecology assumed a residential receptor is at one location for 24 hours per day, 365 days per year for 70 years. These assumptions tend to overestimate an individual's exposure and risk.

Emissions uncertainty

The exact amount of DEEP and NOx emitted from H5's diesel-powered generators is uncertain. Landau Associates estimated emissions assuming engines would operate at loads that produce the highest amounts, and that engines would operate for the full extent of hours allowed in the draft permit. In reality, the engines will operate at a variety of loads in which emissions may be lower (or cause lower impacts) than assumed, and H5 will probably use the engines less frequently than allowed in the draft permit. Landau Associates also attempted to account for higher emissions that would occur during initial start-up. We consider the resulting values an appropriately conservative estimate of DEEP and NOx emissions for the purposes of the ambient impact analysis.

Forecasting the amount of time H5 uses their data center engines under emergency conditions is also uncertain. While we cannot predict future outages, Quincy PUD reports a stable power supply, so we do not anticipate frequent use of these engines during unplanned power interruptions.[8]

Air dispersion uncertainty

The transport of pollutants through the air is a complex process. Agencies develop regulatory air dispersion models to estimate the transport and dispersion of pollutants as they travel through the air. They update these models when techniques that are more accurate become known. Generally, agencies develop these models to avoid underestimating the modeled impacts. Even if we confidently know all of the numerous input parameters to an air dispersion model, random effects found in the real atmosphere will introduce uncertainty. Typical of the class of modern steady-state Gaussian dispersion models, the AERMOD model used for the H5 project analysis may slightly overestimate the short-term (1-hour average) impacts and somewhat underestimate the annual concentrations.

Toxicity uncertainty

One of the largest sources of uncertainty in any risk evaluation is associated with the scientific community's limited understanding of the toxicity of most chemicals in humans following exposure to the low concentrations generally encountered in the environment. To account for uncertainty when developing toxicity values (e.g., RfCs), EPA and other agencies apply "uncertainty" factors to observed doses or concentrations that cause adverse non-cancer effects in animals or humans. Agencies apply these uncertainty factors so that they derive a toxicity value considered protective of humans including susceptible populations. In the case of DEEP exposure, EPA and OEHHA derived non-cancer reference values used in this assessment from animal studies. These reference values are probably protective of the majority of the population including sensitive individuals, but in the case of EPA's DEEP RfC, EPA acknowledges (EPA, 2002):

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

Quantifying DEEP cancer risk is also uncertain. Although EPA classifies DEEP as probably carcinogenic to humans, they have not established a URF for quantifying cancer risk. In their health assessment document, EPA determined that "human exposure-response data are too uncertain to derive a confident quantitative estimate of cancer unit risk based on existing studies." However, EPA suggested that a URF based on existing DEEP toxicity studies would range from $1x10^{-5}$ to 1×10^{-3} per µg/m^3. OEHHA's DEEP URF (3×10^{-4} per µg/m^3) falls within this range. Regarding the range of URFs, EPA states in their health assessment document for diesel exhaust (EPA, 2002):

---

[8] Grant County PUD reports an average service availability index (ASAI) of greater than 99.98 percent, which equates to less than two hours of interrupted service per average customer per year.

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

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

- Lack of knowledge about the underlying mechanisms of DEEP toxicity.
- The question of whether toxicity studies of DEEP based on older engines are relevant to current diesel engines.

Conclusions and Recommendation

The project review team has reviewed the HIA and determined that:

(a) The TAP emissions estimates presented by Landau Associates represent a reasonable estimate of the project's future emissions.

(b) Emission controls for the new and modified emission units meet the tBACT requirement.

(c) The ambient impact of the emissions increases of each TAP that exceeds ASILs has been quantified using appropriate refined air dispersion modeling techniques.

(d) The HIA submitted by Landau Associates on behalf of H5 adequately assesses project-related increased health risk attributable to TAP emissions.

In the HIA, Landau Associates estimated lifetime increased cancer risks attributable to H5-related DEEP and other toxic air pollutant emissions. DEEP emissions resulted in an increase cancer risk of about nine in one million at the maximally impacted residential receptor southeast of H5 data center's property.

Landau Associates also assessed chronic and acute non-cancer hazards attributable to the project's emissions and those from other nearby sources and determined that long-term adverse non-cancer health effects from exposure to DEEP are not likely to occur. Acute respiratory hazards, however, are possible from exposure to NO_2 during power outage scenarios that occur during periods of unfavorable pollutant dispersion. If they do happen, these impacts could occur for short periods at locations near H5. These impacts may affect sensitive individuals with existing respiratory conditions such as asthma resulting in chest tightness or labored breathing with exercise. Symptoms related to these high exposure episodes would improve once cleaner air conditions resume. Because we do not anticipate frequent or sustained power outages affecting H5 Data Center, we do not expect concentrations responsible for these hazards to occur frequently.

Finally, Landau Associates and Ecology assessed the cumulative health risk by adding estimated concentrations attributable to H5 emissions to an estimated background DEEP concentration. The maximum cumulative cancer risk from resident's exposure to DEEP near H5 is approximately 42 in one million.

Because the increase in cancer risk attributable to the new data center alone is less than the maximum risk allowed by a second tier review, which is 10 in one million, and the non-cancer hazard is acceptable, the project is approvable under WAC 173-460-090.

The project review team concludes that the HIA represents an appropriate estimate of potential increased health risks posed by H5 TAP emissions. The risk manager may recommend approval of the permit because:

- The cancer risk from H5's TAP emissions is less than the maximum risk (10 in one million) allowed by a second tier review.
- Ecology determined that the non-cancer hazard is acceptable.

- The likelihood of frequent or sustained power outages is low based on the reported reliability of the Quincy PUD power system.

References

CalEPA, California Environmental Protection Agency: Air Resources Board and Office of Environmental Health Hazard Assessment, Proposed Identification of Diesel Exhaust as a Toxic Air Contaminant, 1998, <http://www.arb.ca.gov/toxics/dieseltac/staffrpt.pdf>.

------, Office of Environmental Health Hazard Assessment, "Technical Support Document for Noncancer RELs Appendix D2: Acute RELs and toxicity summaries using the previous version of the Hot Spots Risk Assessment guidelines," December 2008, <http://www.oehha.ca.gov/air/hot_spots/2008/AppendixD2_final.pdf>.

------, Office of Environmental Health Hazard Assessment, "Risk Assessment Guidelines: Guidance Manual for Preparation of Health Risk Assessments," February 2015, <http://www.oehha.ca.gov/air/hot_spots/2015/2015GuidanceManual.pdf>.

Ecology, Washington State Department of Ecology, Concerns about Adverse Health Effects of Diesel Engine Emissions: White Paper, December 3, 2008, <https://fortress.wa.gov/ecy/publications/publications/0802032.pdf>.

------, Washington State Parcels Project: Digital Tax Parcel Information Containing Department of Revenue Land Use Codes, 2019.

-----, Technical Support Document for Draft NOC Approval Order No. 21AQ-E032, submitted by email October 8, 2021.

EPA, United States Environmental Protection Agency, Health Assessment Document for Diesel Exhaust, EPA/600/8-90/057F, May 2002.

------, Integrated Risk Information System record for Diesel Exhaust, last revised February 28, 2003, <http://cfpub.epa.gov/ncea/iris2/chemicalLanding.cfm?substance_nmbr=642>.

------, Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment), January 2009, <https://www.epa.gov/sites/production/files/2015-09/documents/partf_200901_final.pdf>.

------, United States Environmental Protection Agency, National Air Toxics Assessment: 2014 NATA: Assessment Results, Released August 2018, <https://www.epa.gov/national-air-toxics-assessment/2014-nata-assessment-results>.

Landau Associates, Second-Tier Health Impact Assessment Report: H5 Data Center, Quincy, WA, February 9, 2021. (2021a)

------, Notice of Construction Application Supporting Information Report: H5 Data Center, Quincy, WA, February 9, 2021. (2021b)

National Research Council: Committee on Acute Exposure Guideline Levels; Committee on Toxicology; Board on Environmental Studies and Toxicology; Division on Earth and Life Studies (2012), The National Advisory Committee for the Development of Acute Exposure Guideline Levels for Hazardous Substances (AEGL Committee), Acute Exposure Guideline Levels for Selected Airborne Chemicals: Volume 11,

<http://www.epa.gov/sites/production/files/2015-09/documents/nitrogen_oxides_volume_11_1.pdf>

Northwest International Air Quality Environmental Science and Technology Consortium (NW AIRQUEST), 2014-2017 Criteria Pollutant Design Value Lookup Tool, accessed February 2020, <https://arcg.is/1jXmHH>.

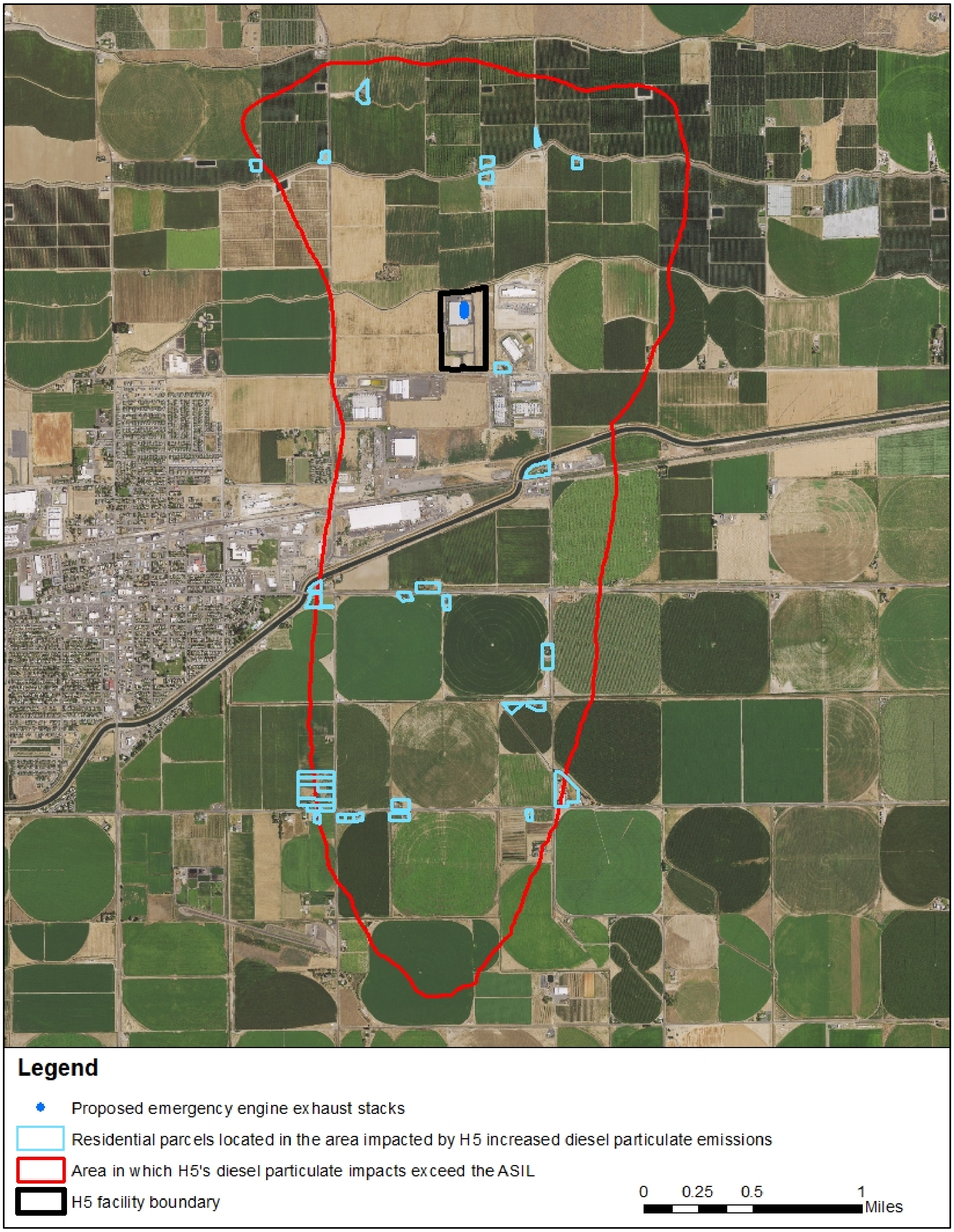

Figure 1: Residential parcels in the area where proposed H5 DEEP emissions may cause impacts that exceed the ASIL

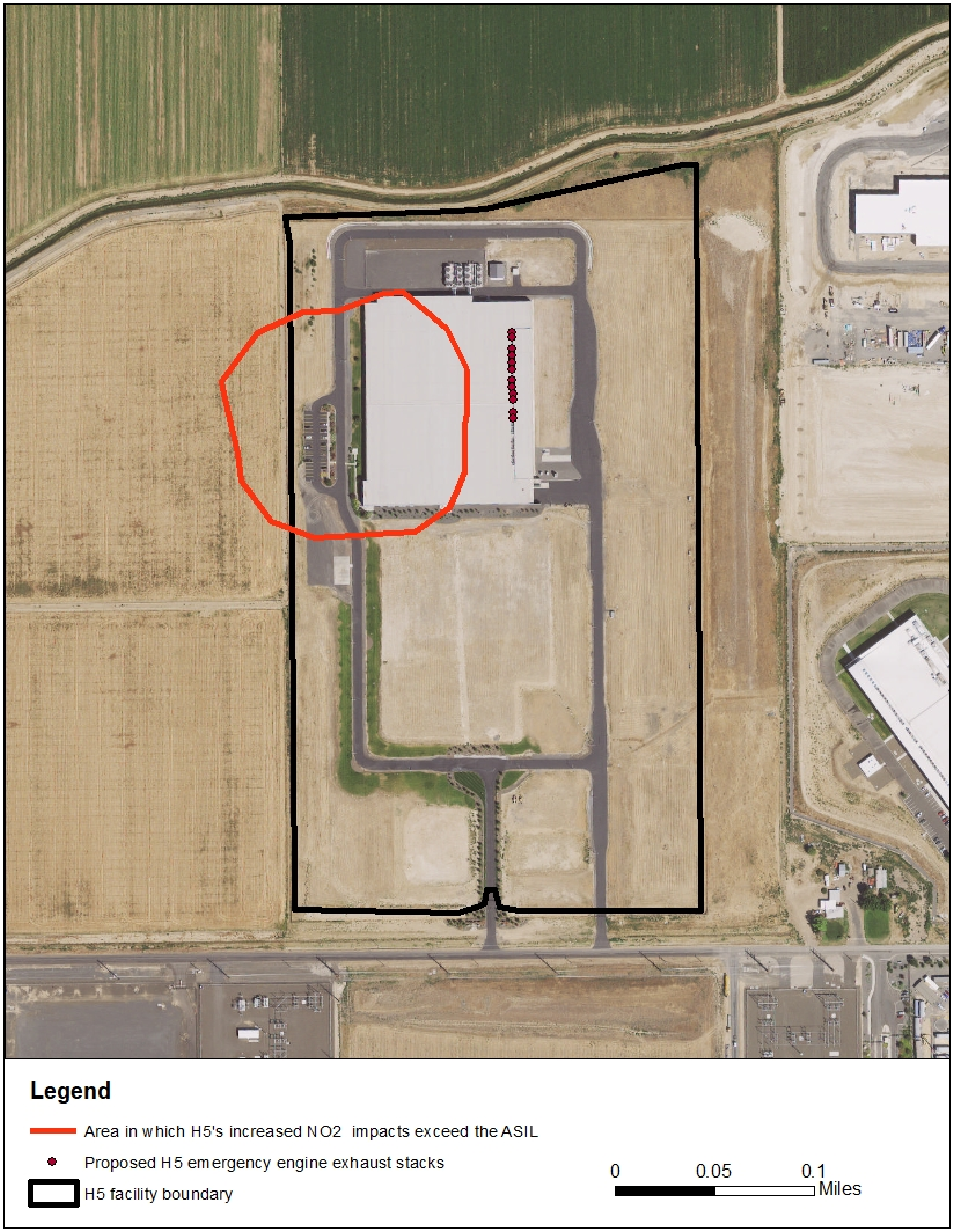

Figure 2: Residential parcels within the area where proposed H5 power outage related NO_2 concentrations could exceed the ASIL

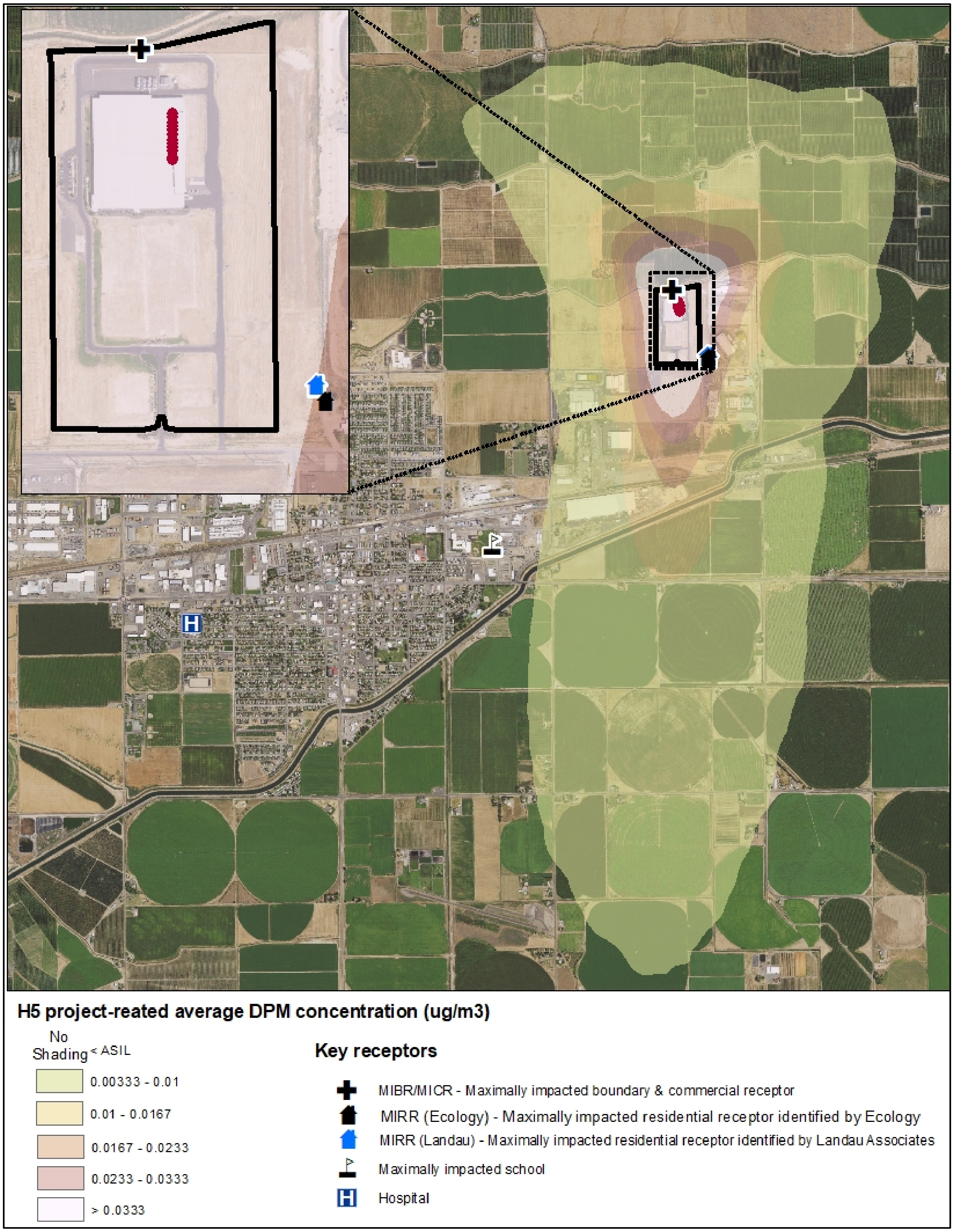

Figure 3: DEEP concentrations attributable to H5's engines and key receptor locations evaluated in the HIA

Figure 4: Maximum NO_2 concentrations attributable to H5 outage emissions and key receptor locations evaluated in the HIA