INL/EXT-20-58533

Air Dispersion Modeling for the Idaho National Laboratory Permit to Construct P-2015.0023 Facility Emission Cap Revision Request

A. Jeffrey Sondrup

May 2020

Idaho National Laboratory

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http://www.inl.gov

Prepared for the
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DOE Idaho Operations Office

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ACRONYMS

AAC	Acceptable Ambient Concentrations
AACC	Acceptable Ambient Concentrations for Carcinogens
AMDV	Acceptable Model Design Value
AMWTP	Advanced Mixed Waste Treatment Project
ATR	Advanced Test Reactor
BAE	baseline actual emission
BLM	Bureau of Land Management
Btu	British thermal unit
CAP	criteria air pollutant
CFA	Central Facilities Area
CO	carbon monoxide
DEQ	Idaho Department of Environmental Quality
DOE-ID	U.S. Department of Energy, Idaho Operations Office
EBR	Experimental Breeder Reactor
EL	Emission Level
EPA	Environmental Protection Agency
FEC	facility emissions cap
gpm	gallons per minute
ICE	internal combustion engine
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IWTU	Integrated Waste Treatment Unit
MFC	Material and Fuels Complex
NAAQS	National Ambient Air Quality Standards
NAD	North American Datum
NLCD	National Land Cover Data
NOAA	National Oceanic and Atmospheric Administration
NO_2	nitrogen dioxide
NO_X	nitrogen oxides
NRF	Naval Reactors Facility
OV&G	operational variability and growth
PAE	projected actual emission
PM	particulate matter

POM	polycyclic organic matter
PTC	Permit to Construct
PTE	potential to emit
RWMC	Radioactive Waste Management Complex
SIL	Significant Impact Level
SMC	Specific Manufacturing Capability
SO_2	sulfur dioxide
TAN	Test Area North
TAP	toxic air pollutant
UTM	Universal Transverse Mercator

Air Dispersion Modeling for the Idaho National Laboratory Permit to Construct P-2015.0023 Facility Emission Cap Revision Request

1. SUMMARY

The U.S. Department of Energy Idaho Operations Office (DOE-ID) is seeking to modify permit to construct (PTC) P-2015.0023 issued to U S Dept. of Energy – Idaho National Laboratory (INL) on January 11, 2018 by the Idaho Department of Environmental Quality (DEQ). This PTC allowed INL to become a synthetic minor source of air pollutants using a facility emission cap (FEC).

At the time of the original application, INL requested operational variability and growth components for air emissions that were reasonable for their current and anticipated future operations, construction, and modification to stationary sources of air pollutions. Since issuance of the original permit, changes have occurred to anticipated INL Site projects due to congressional action. As a result, INL is proposing modifications to the FEC limits set out in the original permit. Specifically, INL is requesting FEC limits for criteria air pollutants (CAPs) be raised to 90 T/year for carbon monoxide (CO), 90 T/year for particulate matter (PM) [85 T/year for PM-10, PM-2.5 and condensables], and 70 T/year for sulfur dioxide (SO_2). The limit of 95 T/year for nitrogen oxides (NO_X) in the original permit will remain the same.

Air-dispersion modeling was performed as part of the permit-revision application process to demonstrate that the modifications will comply with the National Ambient Air Quality Standards (NAAQS). This report documents the modeling methodology and complete results for the air dispersion impact analysis and is supplied as an appendix to the permit-revision request, *Idaho National Laboratory Permit to Construct P-2015.0023 Facility Emission Cap Revision Request* (DOE-ID 2020). All CAPs regulated under Section 109 of the Clean Air Act were modeled with the exception of lead (Pb) and ozone, which are not required to be modeled by DEQ. Consistent with the original permit application, modeling was not performed for toxic air pollutants (TAPs) as uncontrolled emissions did not exceed screening emission levels for carcinogenic and non-carcinogenic TAPs. This is explained in Section 3.

Modeling for CAPs was performed with the most recent version of the U.S. Environmental Protection Agency (EPA)-approved AERMOD dispersion modeling system (Version 19191) (EPA 2019a) and five years (2013-2017) of meteorological data. The meteorological data files were supplied by DEQ and produced with the AERMET (Version 18081) (EPA 2019b). Onsite meteorological data from the Grid 3 Mesonet tower, located near the center of the INL Site, were used for surface wind directions and wind speeds and supplemented with data from a weather station in Idaho Falls. Surface data (i.e., land-use data that defines roughness, albedo, Bowen ratio, and other parameters) were processed using the AERSURFACE utility (Version 13016) (EPA 2013).

Baseline emissions were modeled as point sources using actual stack locations, dimensions, flow rates and exit temperatures, and are based on the design operating capacity of each source. Emission increases up to FEC limits that are attributable to operational variability and growth (OV&G)[1] were modeled by releasing the entire OV&G increase for each pollutant from a single source at each facility one at a time. OV&G emissions were assumed to be released from an existing boiler stack at each facility. For facilities without a boiler stack, OV&G emissions were assumed to be released from a generic, conservative stack at a location near an existing non-boiler source. All structures close enough to produce an area of wake

[1] Determination of operational variability and growth components up to FEC limits as defined in IDAPA 58.01.01.176.03.e and f, is explained in Section 4.2 of the application (DOE-ID 2020).

effect were included for all sources. For multi-tiered structures, the heights of the tiers were included, or the entire building height was assumed to be equal to the height of the tallest tier.

Concentrations were calculated at 1,352 receptor locations provided by DEQ. The receptors are spaced approximately every 500 meters around the INL Site boundary and along highways that transect the INL Site. Finer spacing (~100 meters) was used near facilities where concentrations may be higher (i.e., along Highway 20/26 near Central Facilities Area [CFA], from Highway 20 to the Materials and Fuels Complex [MFC] guard gate, and along Highway 33 near the entrance to Specific Manufacturing Capability [SMC]). Finer spacing was also used in gridded areas around Experimental Breeder Reactor (EBR)-I (~40 m) and Atomic City (~200 meters). All receptors were considered for each pollutant and averaging period.

Acceptable model design values (concentrations) for each CAP and averaging period were summed with average background concentrations and compared to NAAQS. The results demonstrate the impacts of requested FEC limits for CAPs are less than applicable standards and demonstrate emissions up to FEC limits will not cause a violation of ambient air quality standards.

1.1 Report Format

This report is a stand-alone document describing the air dispersion modeling for the permit revision request. The format of this report follows the template provided by DEQ for documenting air modeling analyses (DEQ 2014). Checklist statements preceded by a blank underlined spaced at the front of the statement are part of the provided template and have been included to demonstrate compliance with applicable rules and policies.

1.2 Summary of Modeling Differences from Original Protocol

A conference call was held on October 16, 2019, to discuss air-dispersion modeling requirements for the revised-permit application. During the call, DEQ agreed that a revised modeling protocol would not be required so long as the modeling for the revised permit was performed consistent with the approved modeling protocol for the original permit (Sondrup and Verdoorn 2015) subject to the following conditions:

- The modeling must be performed with the most recent version of AERMOD
- The same meteorological data may be used so long as it is processed with the most recent version of AERMET
- All deviations from the original modeling protocol must be highlighted in the revised modeling report.

All of these conditions have been satisfied. Modeling was performed with the most recent version of AERMOD (Version 19191). Updated model-ready meteorological data files provided by DEQ were used. These were not the same meteorological data files used for the original permit, but DEQ asked they be used after the conference call on October 16, 2019. All deviations from the original modeling protocol are highlighted in the bullets below and further explained in the body of the report. The original protocol, the DEQ approval letter of the original protocol (with comment resolutions), and DEQ approved minutes of the October 16, 2019 conference call are provided in Appendix D of the revised permit application (DOE-ID 2020).

To satisfy the last of DEQs conditions, a list of all deviations from the original protocol and modeling performed for the revised permit request is provided below:

1. Modeling was performed with the most recent version of AERMOD (Version 19191). This is discussed in Section 5.1.

2. Modeling was performed with meteorological data for the 5-year period 2013–2017, processed with AERMET Version 18081. Model-ready meteorological data files were provided by DEQ. This is discussed in Section 5.2.
3. CAP baseline actual emissions (BAEs) for all sources and projected actual emissions (PAEs) for Integrated Waste Treatment Unit (IWTU) operations were modified. Projected BAEs are discussed in Section 3.2.1 and potential to emit (PTE) is discussed in Section 4.1.2.1.
4. The PTE for Naval Reactors Facility (NRF) boilers was modified due to older boilers being replaced with newer more efficient boilers since the original permit was issued. This is discussed in Section 3.2.1 and Section 4.1.2.1.
5. Nonroad mobile equipment sources at TSA-RE, WMF-1617 and WMF-1621 are no longer included [see letter from Dan Pitman (DEQ), to Mark Verdoorn (INL) 2-24-20].
6. The 2 MMBtu/hr boiler at the Advanced Mixed-Waste Treatment Project (AMWTP) included in the original permit has been replaced with a 0.5 MMBtu/hr propane boiler. The replacement boiler is not significant according to IDAPA 58.01.01.317(b)i(5) and is not included in the BAEs or the PTE CAP modeling.
7. A 1514 hp emergency internal combustion engine (ICE) was put into service since the original permit was issued and this ICE is included in the BAE calculation (see Section 3.2.1) and the PTE CAP modeling (see Section 4.1.2.1). Several other ICE additions/removals have occurred since the original application, but these are all <500 hp and are not included.
8. A new random run schedule for emergency stationary ICEs was employed. The new schedule was necessary due to the use of more recent meteorological data files provided by DEQ. The run schedule was generated by DEQ modeling staff based on the same testing frequency and duration information employed for the original modeling. This is discussed in Section 4 and more specifically in Sections 4.1.2.3 and 4.1.4.
9. Average background concentrations for CAPs were updated with new models utilizing more recent data. This is discussed in Section 5.8.
10. Modeling was performed with increased FEC limits for SO_2, CO and PM. The FEC limit for NO_X did not change. The requested limits are shown in Table 1 for both the original and the revised permit. This is further explained in Section 4.1.2.2.
11. Acceptable model design values (AMDVs) for each CAP and averaging period were added to background concentrations for comparison to NAAQS. The original permit used the most-conservative model value (1st highest maximum) for all comparisons except 1-hour SO_2 and nitrogen dioxide (NO_2) which used the 4th highest maximum and 8th highest maximum values, respectively. The 4th highest maximum 1-hour SO_2 and the 8th highest maximum 1-hour NO_2 model concentrations used in the original permit were still greater than the AMDVs.

Table 1. CAP FEC limits (T/year) for the original permit and the permit revision.

Criterial Air Pollutant	SO_2	NO_X	CO	PM[a]
Original Permit FEC Limit	16.9	95	17.6	5.6
Permit Revision Requested FEC Limit	70	95	90	85

a. PM-10, PM-2.5 and condensable PM

2. GENERAL FACILITY/PROJECT DESCRIPTION

There are currently seven major facility areas at the INL Site that are potential sources of pollutant emissions that were considered for this analysis. They are:

- Advanced Mixed Waste Treatment Project (AMWTP), which includes the neighboring Radioactive Waste Management Complex (RWMC)
- Advanced Test Reactor (ATR) Complex
- Central Facilities Area (CFA)
- Idaho Nuclear Technology and Engineering Center (INTEC)
- Materials and Fuels Complex (MFC)
- Naval Reactors Facility (NRF)
- Test Area North (TAN), which includes the Specific Manufacturing Capability (SMC) facility.

The facility area locations are shown in Figure 1, and a description of air pollution sources at each facility area is included in Section 3 of the revised permit application (DOE-ID 2020).

Non-radiological regulated emissions for INL come primarily from fuel burning equipment and remediation projects. Table 2 lists the sources of regulated emission sources that are currently permitted. Sources that could be exempted from permitting under IDAPA 58.01.01.220-223 exemption regulations are identified as such.

Table 2. Regulated sources of air pollution at the INL Site.

Facility	Source Description	Emission Controls	IDAPA 58.01.01.220 Exemptible[a]
INTEC	CPP-606, 36.4 MMBtu/hr boiler	Good combustion control	No
INTEC	CPP-606, 36.4 MMBtu/hr boiler	Good combustion control	No
INTEC	CPP-606, 36.4 MMBtu/hr boiler	Good combustion control	No
INTEC	CPP-606, 36.4 MMBtu/hr boiler	Good combustion control	No
INTEC	CPP-1696, Integrated Waste Treatment Unit	Process HEPA filter system	No
SMC	TAN-679-067a, 25 MMBtu/hr boiler	Good combustion control	No
SMC	TAN-679-068, 25 MMBtu/hr boiler	Good combustion control	No
AMWTP	WMF-676-004A, 12.55 MMBtu/hr boiler	Good combustion control	Yes
AMWTP	WMF-676-005B, 12.55 MMBtu/hr boiler	Good combustion control	Yes
AMWTP	WMF-676-006C, 12.55 MMBtu/hr boiler	Good combustion control	Yes
ATR Complex	670-M-42 emergency ICE[b]	None	Yes
ATR Complex	670-M-43 emergency ICE[b]	None	Yes
ATR Complex	674-M-6 emergency ICE[b]	None	Yes

a. Unit under its rated capacity or current operation would qualify for an exemption from permitting requirements in accordance with IDAPA 58.01.01.220.

b. Unit began operation as an emergency stationary internal combustion engine (ICE) April 30, 2015.

Btu = British thermal unit

HEPA = high efficiency particulate air

In addition to the regulated sources, additional sources of BAE air pollution include sources that predate prevention of significant deterioration regulations, exemptible boilers, ICEs, analytical and research laboratories, maintenance shops, storage tanks, and various remediation projects not subject to air regulations. A description of emissions and source characteristics for modeled sources is contained in Sections 3 and 4.

2.1 Location of Project

The INL Site occupies approximately 2,305 km^2 (890 mi^2) in southeastern Idaho, extending approximately 63 km (36 mi) from north to south and approximately 58 km (36 mi) from east to west at its broadest point. It is located on the eastern Snake River Plain, west of the Snake River and encompasses portions of five Idaho counties: Bingham, Bonneville, Butte, Clark, and Jefferson (see Figure 2). Population centers near the INL Site are Idaho Falls to the east, Blackfoot to the southeast, Pocatello to the south-southeast, and Arco to the west.

DOE-ID controls all activities within the INL Site boundary. The Site has no permanent residents and ingress and egress of Site personnel and visiting personnel are strictly controlled. No casual visits are permitted, except for persons driving through the INL Site on one of five public highways and visitors to EBR-I, a national historic monument, which is open during the summer months. Security forces may interrupt traffic on INL Site roads or public roads that transect the INL Site during emergencies and at other times to support operations of the laboratory.

Land use on the INL Site is associated with facility operations, agriculture, and recreation. INL Site operations are performed within the Site's primary facility areas. A 345,000-acre security and safety buffer surround the developed areas. Approximately 6% of the INL Site (i.e., 34,000 acres) is devoted to utility rights of way and public roads. Up to 340,000 acres of the INL Site are leased for cattle and sheep grazing; grazing permits are administered by U.S. Bureau of Land Management (BLM). However, grazing is not permitted within 1/2 mile of any primary facility boundary or within 2 miles of any nuclear facility (see Figure 1). Recreational uses of the INL Site include public tours of the general facility areas and EBR-I. Controlled hunting also is permitted on the INL Site, but it is restricted to specific locations (see Figure 1).

The dominant land uses in the area surrounding the INL Site are agriculture and open land, each type accounting for 45% of the area, with the remaining 10% occupied by urban/built land and water (see Figure 3). About 75% of the land immediately adjacent to the INL site is owned by the federal government and is administered by BLM. Uses of the federally owned land consist of grazing, wildlife management, mineral and energy production, and recreation. The state of Idaho owns approximately 1% of the adjacent land. These state-owned lands are used for grazing, wildlife management, and recreation. Private lands near the INL Site are used primarily for grazing and farming. Irrigated farmlands make up the remaining 24% of the land bordering the INL Site. Livestock produced on land surrounding the INL Site includes sheep, beef cattle, dairy cattle, hogs, and poultry. The major crops produced on the surrounding lands include wheat, alfalfa, barley, potatoes, oats, corn, and sugar beets.

The INL Site is situated on a high desert plain with relatively flat terrain. Facility elevations range from 1460 m (4790 ft) above mean sea level at TAN to 1532 m (5025 ft) above mean sea level at AMWTP/RWMC. The climate of the INL Site is affected by the surrounding mountains and its location in the eastern Snake River Plain. Because of the northeast-southwest orientation of the eastern Snake River Plain between the surrounding mountains, the prevailing wind is southwesterly. The Centennial and Bitterroot mountain ranges to the north act as a barrier to movement of most of the cold winter air masses passing to the south out of Canada. Air masses entering the INL Site are typically dry because heavy precipitation usually has occurred while crossing nearby mountain barriers. Therefore, annual rainfall is light, cloud cover is sparse, and the air is relatively dry.

Winds at the INL Site typically blow from the southwest, moving up the eastern Snake River Plain. Winds from the northeast also are common, especially at night when movement of cool air back down the eastern Snake River Plain reverses the daytime flows. Continuous measurements are made from 30 weather stations in and around the INL Site by the U.S. National Oceanic and Atmospheric Administration (NOAA). The meteorological stations simultaneously measure the spatial variation of several meteorological parameters, such as temperature, wind speed, and wind direction up to a height of 76 m (250 ft). Telemetered wind measurements, usually at 15 m (50 ft) above ground, also are collected at those stations. Meteorological data from the GRID 3 weather station located just north of INTEC was used for the modeling because it is the most centrally located station among the major facilities.

The natural vegetation of the INL Site consists of a shrub overstory with a forb and grass understory. General plant communities include shadescale-steppe vegetation with sagebrush and grass-dominated communities. Sagebrush communities are the dominant vegetation occupying approximately 80% of the INL Site.

The INL Site is located in Universal Transverse Mercator (UTM) Zone 12 and UTM coordinates for all source locations are provided in Section 4. The air quality status of the INL Site is designated as unclassifiable as described on the DEQ webpage http://www.deq.idaho.gov/air-quality/monitoring/attainment-versus-nonattainment.aspx and in IDAPA 58.01.01.006.128.

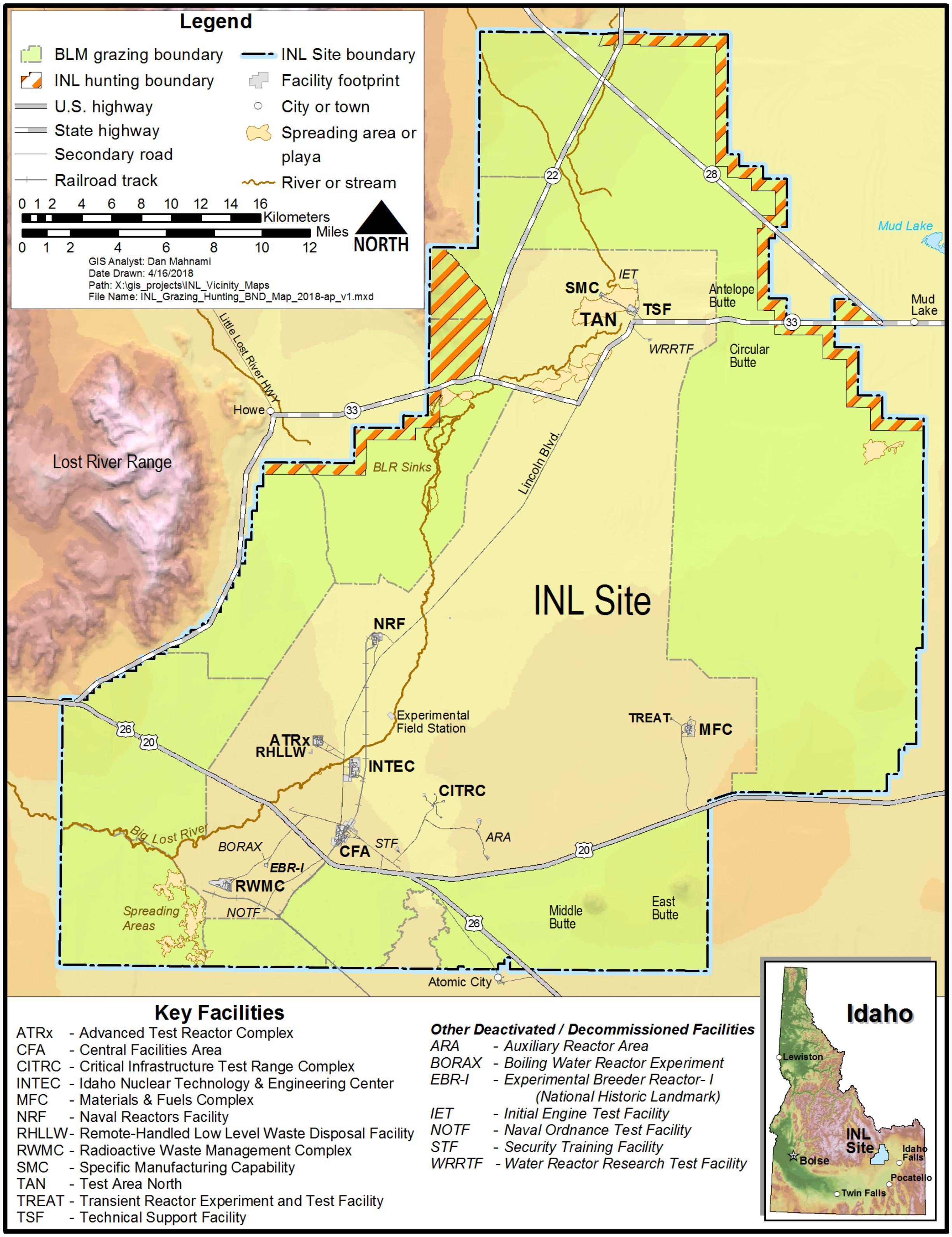

Figure 1. Idaho National Laboratory Site and major facilities.

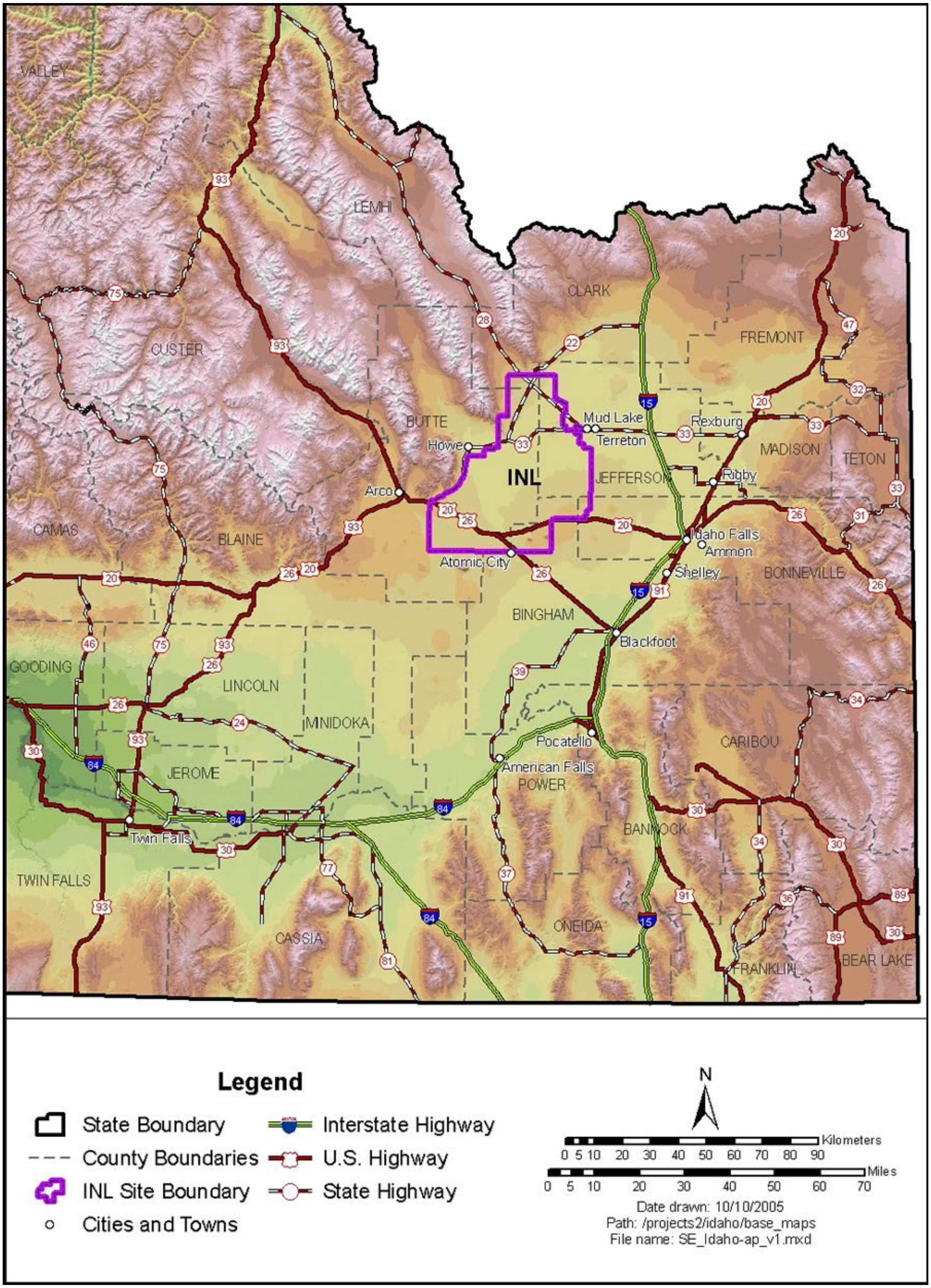

Figure 2. Populations centers near the INL Site.

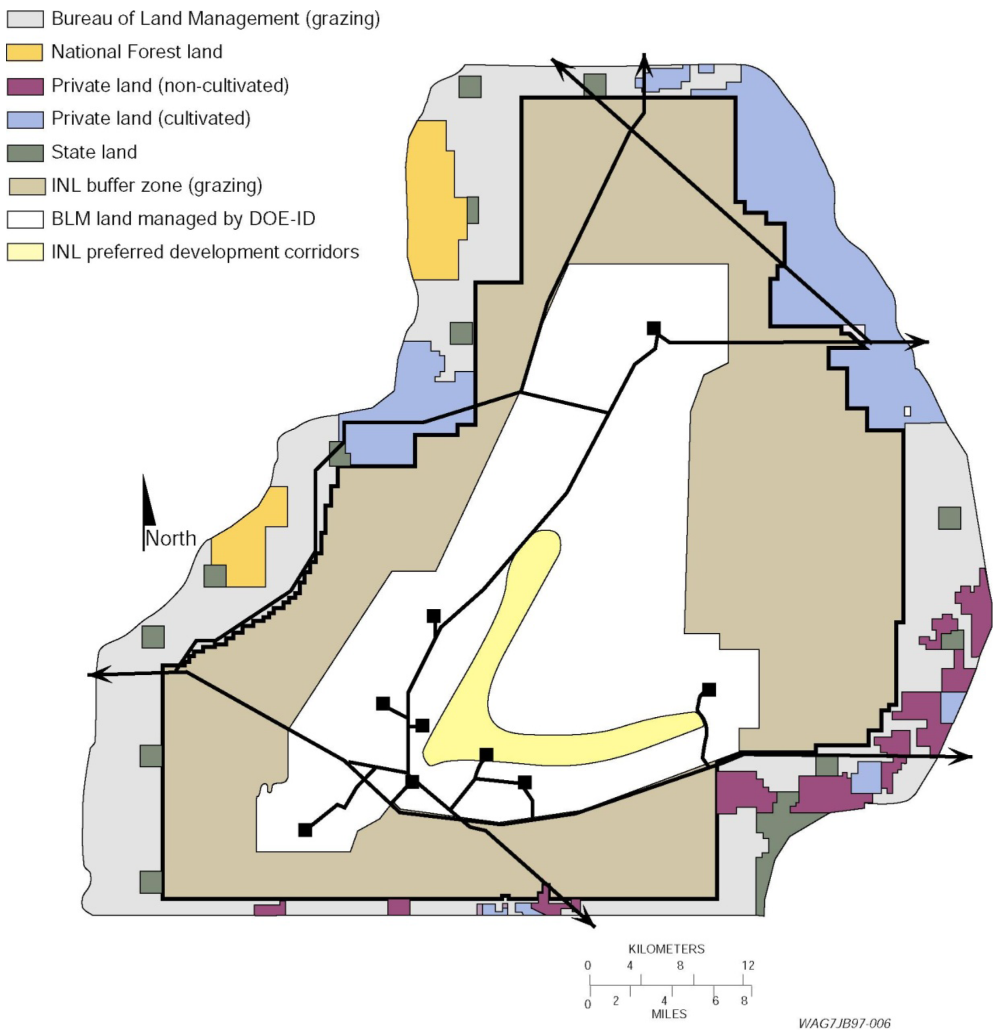

Figure 3. Land ownership distribution in the vicinity of the INL Site.

CHECKLIST
_____A map showing the geographical location of the facility is provided in this section or a reference is provided to another location in the permit application where a map is provided.

2.2 Existing Permits and Modeling Analyses Performed

INL is currently regulated under PTC P-2015.0023 which allows INL to be a synthetic minor source of air pollutants using an FEC. Air-quality modeling performed to support the original permit application is documented in Sondrup (2015). INL seeks to modify the permit by proposing modifications to the FEC limits. This report documents air quality modeling performed in support of the permit-revision request.

CHECKLIST
_____Any existing air-quality permits are listed and described in this section, and any associated air quality modeling analyses have been described and referenced and submitted if appropriate.

3. MODELING ANALYSES APPLICABILITY AND PROTOCOL

Section 3.1 identifies the applicable standards and Sections 3.2 and 3.3 provide the basis for pollutants that were included or excluded in the modeling analysis.

3.1 Applicable Standards

NAAQS for CAPs are listed in Table 3, along with significant impact levels (SILs). However, an SIL analysis was not performed, and modeling for cumulative impacts was performed for all CAP emissions required to be modeled. All CAPs regulated under Section 109 of the Clean Air Act were modeled with the exception of lead (Pb) and ozone, which are not required to be modeled by DEQ. In all cases, the acceptable modeled design value (Table 3, last column) was used for the cumulative impact analysis.

TAPs identified in the emissions inventory are identified in Table 4. The table also includes screening emission levels (ELs) and 24-hour acceptable ambient concentrations (AACs) or acceptable ambient concentrations for carcinogens (AACCs). Section 3.3 compares emission increases to ELs to identify pollutants to be modeled.

Table 3. Applicable regulatory limits for CAPs.

Pollutant	Averaging Period	Significant Impact Levels[a] (μg/m^3)[b]	Regulatory Limit[c] (μg/m^3)	Acceptable Modeled Design Value[d]
PM_{10}[e]	24-hour	5.0	150[f]	Maximum 6th highest[g]
$PM_{2.5}$[h]	24-hour	1.2	35[i]	Mean of maximum 8th highest[j]
	Annual	0.3	12[k]	Mean of maximum 1st highest[l]
Carbon monoxide (CO)	1-hour	2,000	40,000[m]	Maximum 2nd highest[n]
	8-hour	500	10,000[m]	Maximum 2nd highest[n]
Sulfur Dioxide (SO_2)	1-hour	3 ppb[o] (7.8 μg/m^3)	75 ppb[p] (196 μg/m^3)	Mean of maximum 4th highest[q]
	3-hour	25	1,300[m]	Maximum 2nd highest[n]
	24-hour	5	365[m]	Maximum 2nd highest[n]
	Annual	1.0	80[r]	Maximum 1st highest[n]
Nitrogen Dioxide (NO_2)	1-hour	4 ppb (7.5 μg/m^3)	100 ppb[s] (188 μg/m^3)	Mean of maximum 8th highest[t]
	Annual	1.0	100[r]	Maximum 1st highest[n]
Lead (Pb)	3-month[u]	NA	0.15[r]	Maximum 1st highest[n]
	Quarterly	NA	1.5[r]	Maximum 1st highest[n]
Ozone (O_3)	8-hour	40 TPY VOC[v]	75 ppb[w]	Not typically modeled

a. Idaho Air Rules Section 006 (definition for significant contribution) or as incorporated by reference as per Idaho Air Rules Section 107.03.b.
b. Micrograms/cubic meter.
c. Incorporated into Idaho Air Rules by reference, as per Idaho Air Rules Section 107.
d. The maximum 1st highest modeled value is always used for the significant impact analysis unless indicated otherwise. Modeled design values are calculated for each ambient air receptor.
e. Particulate matter with an aerodynamic diameter less than or equal to a nominal 10 micrometers.
f. Not to be exceeded more than once per year on average over 3 years.
g. Concentration at any modeled receptor when using five years of meteorological data.
h. Particulate matter with an aerodynamic diameter less than or equal to a nominal 2.5 micrometers.
i. 3-year mean of the upper 98th percentile of the annual distribution of 24-hour concentrations.
j. 5-year mean of the 8th highest modeled 24-hour concentrations at the modeled receptor for each year of meteorological data modeled. For the SIL analysis, the 5-year mean of the 1st highest modeled 24-hour impacts at the modeled receptor for each year.
k. 3-year mean of annual concentration.
l. 5-year mean of annual averages at the modeled receptor.
m. Not to be exceeded more than once per year.
n. Concentration at any modeled receptor.
o. Interim SIL established by EPA policy memorandum.
p. 3-year mean of the upper 99th percentile of the annual distribution of maximum daily 1-hour concentrations.
q. 5-year mean of the 4th highest daily 1-hour maximum modeled concentrations for each year of meteorological data modeled. For the significant impact analysis, the 5-year mean of 1st highest modeled 1-hour impacts for each year is used.
r. Not to be exceeded in any calendar year.
s. 3-year mean of the upper 98th percentile of the annual distribution of maximum daily 1-hour concentrations.
t. 5-year mean of the 8th highest daily 1-hour maximum modeled concentrations for each year of meteorological data modeled. For the significant impact analysis, the 5-year mean of maximum modeled 1-hour impacts for each year is used.
u. 3-month rolling average.
v. An annual emissions rate of 40 ton/year of VOCs is considered significant for O_3.
w. Annual 4th highest daily maximum 8-hour concentration averaged over three years.
x. Only modeled receptors outside the INL Site boundary considered for annual averaging periods.

Table 4. TAP screening ELs and AACs/AACCs.

TAP	Non-Carcinogen or Carcinogen	Screening EL[a] (lb/hr)	AAC or AACC[b] ($\mu g/m^3$)
1,1,1-Trichloroethane	Non-Carcinogen	1.27E+02	9.55E+04
1,4-Dichlorobenzene	Non-Carcinogen	3.00E+01	2.25E+04
1,2-Dichloropropane	Non-Carcinogen	2.31E+01	1.74E+04
2-Butanone	Non-Carcinogen	3.93E+01	2.95E+04
2,2,4-Trimethyl pentane	Non-Carcinogen	2.33E+01	1.75E+04
Acrolein	Non-Carcinogen	1.70E−02	1.25E+01
Chlorobenzene	Non-Carcinogen	2.33E+01	1.75E+04
Copper	Non-Carcinogen	6.7E-02	5.0E+01
Cresols (m, p & o)	Non-Carcinogen	1.47E+00	1.10E+03
Cyanide	Non-Carcinogen	3.33E-01	2.50E+02
Ethyl Benzene	Non-Carcinogen	2.9E+01	2.18E+04
Manganese	Non-Carcinogen	6.70E−02	5.00E+01
Methanol	Non-Carcinogen	1.73E+01	1.30E+04
Methyl isobutyl ketone	Non-Carcinogen	1.37E+01	1.03E+04
Naphthalene	Non-Carcinogen	3.33E+00	2.50E+03
Nitrobenzene	Non-Carcinogen	3.33E-01	2.50E+02
Selenium	Non-Carcinogen	1.30E−02	1.00E+01
Styrene	Non-Carcinogen	6.67E+00	1.00E+03
Toluene	Non-Carcinogen	2.50E+01	1.88E+04
Xylene	Non-Carcinogen	2.90E+01	2.18E+04
Zinc	Non-Carcinogen	6.67E−01	5.00E+01
1,1,2,2-Tetrachloroethane	Carcinogen	1.10E-05	1.70E-02
1,1,2-Trichloroethane	Carcinogen	4.20E-04	6.20E-02
1,3-Butadiene	Carcinogen	2.40E-05	3.60E-03
1,3-Dichloropropene	Carcinogen	1.90E-07	2.90E-06
1,1-Dichloroethane	Carcinogen	2.50E-04	3.80E-02
1,1-Dichloroethylene	Carcinogen	1.3E-04	2.00E-02
1,2-Dichloroethane	Carcinogen	2.50E-04	3.80E-02
1,4 Dioxane	Carcinogen	4.80E-03	7.10E-01
Acetaldehyde	Carcinogen	3.00E-03	4.50E-01
Arsenic	Carcinogen	1.50E-06	2.30E-04
Benzene	Carcinogen	8.00E-04	1.20E-01
Beryllium	Carcinogen	2.80E-05	4.20E-03
Cadmium	Carcinogen	3.70E-06	5.60E-04
Carbon Tetrachloride	Carcinogen	4.40E-04	6.70E-02
Chloroform	Carcinogen	2.80E-04	4.30E-02
Chromium	Carcinogen	5.60E-07	8.30E-05
Ethylene Dibromide	Carcinogen	3.00E-05	4.50E-03
Formaldehyde	Carcinogen	5.10E-04	7.70E-02
Hexachlorobenzene	Carcinogen	1.30E-05	2.00E-03
Hexachloroethane	Carcinogen	1.70E-03	2.50E-01
Methylene Chloride	Carcinogen	1.60E-03	2.40E-01
Naphthalene	Carcinogen	9.10E-05	1.40E-02
Nickel	Carcinogen	2.70E-05	4.20E-03
Polycyclic Aromatic Hydrocarbons	Carcinogen	9.10E-05	1.40E-02
Polycyclic Organic Matter	Carcinogen	2.00E-06	3.00E-04
Tetrachloroethylene	Carcinogen	1.30E-02	2.10E+00
Trichloroethylene	Carcinogen	5.10E-04	7.70E-01
Vinyl Chloride	Carcinogen	9.40E-04	1.40E-01

a. ELs from Idaho Air Rules Section 585 and 586 in lb/hr.
b. AAC or AACC from Idaho Air Rules Section 585 and 586. AACs converted from mg/m^3 in Section 585 to $\mu g/m^3$.

CHECKLIST

_____All TAPs identified in the emissions inventory for the project are listed in the TAPs EL and AAC/AACC Table in this section.

3.2 Criteria Pollutant Modeling Applicability

All CAPs regulated under Section 109 of the Clean Air Act were modeled with the exception of lead (Pb) and ozone which are not required to be modeled by DEQ. Section 4 contains emission rates used in modeling for each CAP which are based on the design operating capacity of each source. However, a discussion of BAEs for CAPs is presented here because some of the information is applicable to determining the emission rate for TAPs used in the screening analysis presented in Section 3.3. The information on CAP BAEs is also used to determine the OV&G emission increases for each CAP presented in Section 4.1.2.2.

3.2.1 Baseline Actual Emissions for CAPs

Baseline emissions are estimated using the BAE from existing emissions units and PAE for units that do not yet have existing emissions data. BAE for CAPs are calculated in accordance with the definition in IDAPA 58.01.01.007.02.b. This estimate is required by both IDAPA 58.01.01.177.01 for FECs and 58.01.01.202.01.a.i for PTCs.

The consecutive 24-month period of calendar years 2011 and 2012 was chosen for calculating emissions from boilers for all pollutants. Sulfur oxides are calculated using ultra-low sulfur distillate oil containing 15 ppm sulfur that meets the requirements of 40 CFR 80.510(b) for nonroad diesel fuel. This fuel is used in both emergency stationary ICEs and distillate fired boilers at INL.

Emissions from emergency stationary ICEs operating at INL were calculated from annual fuel use determined from the engines' typical frequency and duration of operation during testing and maintenance.

For sources subject to Resource Conservation and Recovery Act and Comprehensive Environmental Response, Compensation, and Liability Act operations, BAE is estimated based on maximum throughput, PTC exemption levels, or actual emissions from the selected BAE averaging period when available. Hydrochloric acid from OU 7-08, Vapor Vacuum Extraction, uses calendar years 2013 and 2014. Fugitive HAP emissions from the SDA are estimated using Landfill Gas Emissions Model (LandGEM) Version 3.02, using site-specific data. The model assumed that no vacuum extraction or waste exhumation has occurred, and no credit was taken for drum containment.

The baseline was calculated and includes all significant sources at INL with the following exceptions:

1. Emissions data from boilers located in CFA-671 are not included. These boilers were shut down in November of 2014 and no longer contribute to INL Site baseline emissions. These boilers were not included in the original permit application.
2. Propane-fired water heaters and residential style propane-fired furnaces less than 1 MMBtu/hr used for heating individual office spaces are not included in this baseline.
3. Emissions from the non-emergency stationary ICEs operating at the ATR Complex are omitted because the sources began operations as emergency stationary ICEs on April 30, 2015, as part of a project to install an uninterruptable power supply at ATR. This action is taken to meet the requirements of the Voluntary Consent Order – Case No. E-2012.0012. This adjustment is made because the non-emergency stationary ICEs operation will cease and will not contribute to INL Site baseline emissions as of that date. Two of these stationary ICEs, 670-M-42 and 670-M-43, predate prevention of significant deterioration regulations. Although not included in the BAE estimates, these sources are included in the permit modeling.

The IWTU emissions are calculated in accordance with the PAE definition in IDAPA 58.01.01.007.08.a. This projection is required by IDAPA 58.01.01.177.01 for FECs and 58.01.01.202.01.a.i for PTCs.

The IWTU is anticipated to complete sodium-bearing waste treatment within three to seven years once the unit begins regular operations. A conservative, non-specific period of three calendar years from

2021 to 2023 was chosen for calculating PAE for IWTU CAPs. Projected emissions for the IWTU are based on preliminary emissions data conducted on the processing of simulated sodium-bearing waste at regular operations (EDF-11238 2020). As such, the PAE for the IWTU reflects the nominal throughput and supersedes previous emissions estimates for CAPs. This projection does not include the increased emissions caused by IWTU from the INTEC boilers separately; these emissions will be captured in the total INTEC boiler emission.

There are no sources of regulated fugitive or secondary emissions at INL.

All emissions were calculated using emission and conversion factors from the EPA AP 42, Fifth Edition, *Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources*, unless otherwise noted.

Table 5 lists the sources included in the calculation of BAEs for the INL Site. The list includes both sources regulated by the proposed permit and exempted and/or grandfathered sources that contribute significantly to BAEs that are not subject to PTC requirements.

CAP source changes from the original permit include:

- Temporary mobile equipment sources at TSA-RE, WMF-1617 and WMF-1621 are no longer included [see letter from Dan Pitman (DEQ), to Mark Verdoorn (INL) 2-24-20].
- The 2 MMBtu/hr boiler at AMWTP included in the original permit has been replaced with a 0.5 MMBtu/hr propane boiler. According to IDAPA 58.01.01.317(b)i(5), combustion sources less than 5 MMBtu/hr exclusively using propane are deemed insignificant. Therefore, this boiler is not included in the modeling for the permit-revision request.
- The original permit modeling included two existing 52.4 MMBtu/hr diesel boilers and one proposed new 29.3 MMBtu/hr diesel boiler at NRF. Since that time, the two 52.4 MMBtu/hr diesel boilers have been removed from service and replaced with two new 29.3 MMBtu/hr diesel boilers. The two new boilers are the same as the proposed new boiler in the original permit. The PTE for the two new NRF boilers (Boilers 4 and 5) is included in the revised modeling as (see Section 4.1.2.1), but the BAEs for NRF boilers were not changed (see Table 6).
- A 1514 hp emergency ICE was put into service since the original permit was issued and this ICE is included in the BAE calculation and the CAP modeling (see Section 4.1.2.1).

Table 5. Sources considered for the BAE calculation.

Facility	Source Description
AMWTP	WMF-676-004A, 12.55 MMBtu/hr boiler (propane)
AMWTP	WMF-676-005B, 12.55 MMBtu/hr boiler (propane)
AMWTP	WMF-676-006C, 12.55 MMBtu/hr boiler (propane)
AMWTP	WMF-636 TSA-RE, and Process Emissions[b]
AMWTP	WMF-676 Advanced Mixed Waste Treatment Facility, Process Emissions[b]
CFA	CFA-608, 1.5 MMBtu/hr boiler (diesel)
CFA	CFA-609-005, 2.1 MMBtu/hr boiler (diesel)
INL Site	Emergency Stationary ICE Testing and Maintenance[a]
INTEC	CPP-606, 36.4 MMBtu/hr boiler (diesel)
INTEC	CPP-606, 36.4 MMBtu/hr boiler (diesel)
INTEC	CPP-606, 36.4 MMBtu/hr boiler (diesel)
INTEC	CPP-606, 36.4 MMBtu/hr boiler (diesel)
INTEC	CPP-1696, Integrated Waste Treatment Unit[b,c]
INTEC	CPP-659, Repack[b]
INTEC	CPP-666, Repack and Sodium Distillation[b]
INTEC	CPP-708, INTEC Main Stack[b]
NRF	Boiler No. 4, 29.3 MMBtu/hr boiler (diesel)[d]
NRF	Boiler No. 5, 29.3 MMBtu/hr boiler (diesel)[d]
RWMC	OU 7-08, Vapor Vacuum Extraction[b]
SMC	TAN-679-067a, 25 MMBtu/hr boiler (diesel)
SMC	TAN-679-068, 25 MMBtu/hr boiler (diesel)

a. Includes all emergency ICE. ICE sources > 500 hp included in the modeling are described in Section 4.1.2.
b. Treatment and/or remediation source.
c. Emissions are based on PAEs. All other sources used BAEs.
d. NRF Boilers 1 and 3 have removed from service since the original permit and replaced with 2 boilers equivalent to the proposed new boiler in the table. Although BAEs from the 2 new boilers are less than BAEs from Boilers 1, 3 and the proposed new boiler, the BAE was not changed from the values in the original permit (see Table 6).

Table 6 summarizes the INL Site baseline emissions by source for CAPs. These rates are used to determine OV&G emission increases (see Section 4.1.2.2). The emission rates are presented in Appendix C of the revised permit application (DOE-ID 2020) and calculated in the Excel spreadsheet "EE_App C (5-18-20).xlsx" in the worksheet "INL Summary."

The only significant change to baseline emissions from the original permit involves IWTU operations. The original permit listed the boiler demand from IWTU treatment operations as a separate item in Table 6. For the revised permit, PAEs due to the IWTU demand on INTEC boilers is included with the INTEC boilers. Overall, the PAEs from INTEC boilers due to IWTU demand have decreased based on actual fuel usage during IWTU simulant test runs. The other change involves emissions for IWTU treatment operations. The updated PAEs for the treatment process are about the same for NO_X, but less for SO_2, CO, and PM. These new emissions are based on measurements obtained during off-gas sampling during IWTU simulant test runs (EDF-11238 2020).

Table 6. INL Site baseline emissions (T/year) for CAPs.

Emission Unit	SO_2	NO_X	CO	PM[a]-10/2.5 and Condensable
AMWTP Boilers	0.15	1.34	0.77	0.07
CFA Boilers	0.002	0.21	0.05	0.02
INTEC Boilers[b]	0.07	6.24	1.56	0.72
NRF Boilers[c]	0.05	4.58	1.14	0.53
SMC Boilers	0.02	1.74	0.43	0.20
INL Emergency ICE	0.24	7.20	1.75	0.33
* INTEC Boilers[b]	0.008	0.725	0.181	0.083
* IWTU – Treatment	0.34	50.21	0.34	0.03
CPP-666	0.05	0	0.02	-
Remediation Mobile Sources[d]	Removed			0.08
INL Site Total	0.93	72.2	6.24	2.06

a. PM = particulate matter.

b. BAEs for INTEC boilers include emissions from process steam demand due to IWTU operations.

c. BAEs for NRF boilers is based on the 2011–2012 operation of two 52.4 MMBtu/hr boilers and a 29.3 MMBtu/hr boiler being proposed at the time of the original permit. Since the original permit, the two 52.4 MMBtu/hr boilers have been replaced with two more efficient 29.3 MMBtu/hr boilers. BAEs for the two new boilers are less than the original boilers, but the BAE was not changed.

d. Temporary mobile-equipment sources removed since original permit application include sources at TSA-RE, WMF-1617 and WMF-1621.

CHECKLIST

_____Explanations/documentation why modeling was or was not performed for each criteria pollutant are provided in this section.

_____Emissions calculations that clearly show how the modeling applicability determination was performed are provided in this section.

3.3 TAP Modeling Applicability

TAPs were evaluated in accordance with IDAPA 58.01.01.210.05 and 09. Contribution of treatment and remediation sources were not included in the net emission increase calculations per IDAPA 58.1.01.007.06.c.iii.

In accordance with IDAPA 58.01.01.210.20, compliance demonstrations need not include TAPs that are regulated by an applicable new-source performance standard or national emission standard for hazardous air pollutant. DEQ has determined that all TAPs from ICEs are regulated by 40 CFR 60, Subpart IIII, "Standards of Performance for Stationary Compression Ignition Internal Combustion Engines,"; 40 CFR 60, Subpart JJJJ, "Standards of Performance for Stationary Spark Ignition Internal Combustion Engines"; and 40 CFR 63 Subpart ZZZZ, "National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines". Additionally, DEQ has determined that mercury, polycyclic organic matter (POM), arsenic, beryllium, cadmium, chromium, manganese, nickel, ethylene dioxide, polychlorinated biphenyls, acetaldehyde, acrolein, dioxins, formaldehyde, and benzene emissions from boilers are regulated by 40 CFR 63 Subpart JJJJJJ, "National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources."

For applicable non-carcinogenic and carcinogenic TAPs, post-project emission rates were calculated and compared to screening ELs to determine whether they should be modeled. Emission rates were calculated assuming all existing boilers at the INL Site operate concurrently at the design-capacity fuel-consumption rates Site (Table 7) and the appropriate emission factors (Table 8) using the formula:

$$ER\left(\frac{lb}{hr}\right) = \frac{FR\left(\frac{gal}{hr}\right) EF\left(\frac{lb}{1000\ gal}\right)}{1000\ \left(\frac{gal}{1000\ gal}\right)}$$

where

ER = emission rate

FR = design rated fuel consumption rate

EF = emission factor

HV= heating value of fuel oil (140,000 Btu/gal)

Calculation results contained in Table 8 show the proposed emissions or emission increases do not exceed non-carcinogenic screening ELs from IDAPA 58.01.01.585 or carcinogenic ELs form IDAPA 58.01.01.86. Therefore, no TAPs were modeled.

Table 7. Design capacity fuel consumption rates for diesel boilers.

Facility	Boiler	Rated Capacity (MMBtu/hr)	Design Capacity Fuel Consumption Rate (gal/hr)
CFA	CFA-608	1.5	10.7
CFA	CFA-609-005	2.1	15
INTEC	CPP-606-061	36.4	216
INTEC	CPP-606-062	36.4	216
INTEC	CPP-606-063	36.4	216
INTEC	CPP-606-064	36.4	216
NRF	Boiler No. 4	29.3	209
NRF	Boiler No. 5	29.3	209
SMC	TAN-679-067a	25	167.5
SMC	TAN-679-068	25	167.5
		Total	**1642.7**

Table 8. Non-carcinogenic and carcinogenic TAP emission factors and screening.

TAP	2015 Application 24-hr Average Emissions Rate (lb/hr)	No. 2 Diesel Emission Factor[a] (lb/1000 gal)	Revised Application 24-hour Average Emissions Rate[b] (lb/hr)	Change in 24-hr Average Emissions Rates for Units at the Facility (lb/hr)	Non-Carcinogenic Screening Emission Level (lb/hr)	Emission Rate Exceeds Screening Level? (Yes/No)
Non-Carcinogenic						
1,1,1-TCA	5.66E-04	2.36E-04	3.88E-04	-1.78E-04	1.27E+02	No
Copper	2.01E-03	8.40E-04	1.38E-03	-6.30E-04	6.70E-02	No
Ethyl Benzene	1.52E-04	6.36E-05	1.04E-04	-4.75E-05	2.90E+01	No
Naphthalene	2.71E-03	1.13E-03	1.86E-03	-8.54E-04	3.33E+00	No
Selenium	5.04E-03	2.04E-03	3.35E-03	-1.69E-03	1.30E-02	No
Toluene	1.49E-02	6.20E-03	1.02E-02	-4.72E-03	2.50E+01	No
Xylene	2.61E-04	1.09E-04	1.79E-04	-8.19E-05	2.90E+01	No
Zinc	1.34E-03	5.60E-04	9.20E-04	-4.20E-04	6.67E-01	No
Carcinogenic						
Naphthalene	2.35E-03	1.13E-03	1.86E-03	-4.94E-04	9.10E-05	No

a. AP-42: Table 1.3.9. Emission Factors for Speciated Organic Compounds from Fuel Oil Combustion: Oil Fired Boilers (EPA 2009)
b. Summed over all sources.

CHECKLIST
_____Explanation/documentation on why modeling was or was not performed for emissions of each TAP identified in the emissions inventory of the permit application are provided in this section.

3.4 Modeling Protocol

A conference call was held on October 16, 2019, to discuss air-dispersion modeling requirements for the revised-permit application. During the call, DEQ agreed that a revised modeling protocol would not be required so long as the modeling for the revised permit was performed consistent with the original modeling protocol (Sondrup and Verdoorn 2015) with a few conditions. Those conditions and all deviations from the original protocol are described in Section 1.2. Both the original protocol and DEQ-approved minutes of the conference call are provided in Appendix D of the revised-permit application (DOE-ID 2020).

Project modeling and required impact analyses were generally conducted using data and methods described in the original protocol and are consistent with the *State of Idaho Guideline for Performing Air Quality Impact Analyses* (DEQ 2013).

CHECKLIST
_____If a protocol was submitted to DEQ prior to performing the modeling analyses, the protocol and DEQ's conditional protocol approval notice is included in Attachment ___ of this Modeling Report.

_____Concerns identified by DEQ in the protocol approval notice have been addressed in the analyses performed and in this Modeling Report.

4. MODELED EMISSIONS SOURCES

This section presents the modeled emission rates and release parameters for all sources. All emission sources considered are stack sources and were modeled as point sources using actual stack locations and dimensions. Emission rates, stack flow rates (exit velocities) and stack exit temperatures were based on the design operating capacity (maximum fuel consumption rate) of each source. Emissions up to FEC limits were modeled assuming the OV&G emissions for each pollutant are released from each facility one at a time. The OV&G emissions were assumed to be released from an existing boiler stack at each facility, or for facilities without a boiler stack, the emissions were assumed to be released from a generic, conservative stack at a location near an existing non-boiler source. All sources were assumed to operate continuously except for the emergency stationary ICE sources, which were operated on a random testing schedule based on their testing frequency and duration. This schedule was determined by DEQ modeling staff, and no restrictions were placed on the times or conditions under which they could be tested.

A significant impact level analysis was not performed. All CAPs were considered in the cumulative impact analysis, and TAPs were not considered because they were screened out using screening ELs. Nevertheless, the sections regarding SILs from the template were left in the report.

CHECKLIST
_____The modeling emissions inventory and the emissions inventory presented in other parts of the permit application are consistent, and if they are not identical numbers, it is clearly shown, with calculations submitted, how the modeled value was derived from the value provided in the emissions inventory.

4.1 Criteria Air Pollutants

4.1.1 Modeled Emissions Rates for Significant Impact Level Analyses

This section is omitted because a SIL analysis was not performed. All CAP emissions were modeled for cumulative impacts.

CHECKLIST
_____Calculation of modeled emissions are thoroughly documented in this section, and any unique handling of emissions in the model have been described.

4.1.2 Modeled Emissions Rates for Cumulative Impact Analyses

This section presents the design capacity emission rates first, followed by the OV&G emission rates.

4.1.2.1 Design Capacity Emission Rates for CAP sources

Table 9 lists all existing and proposed sources of CAPs included in the modeling. This list includes all sources listed in Table 5, except non-CAP emission sources (CPP-659, CPP-708, OU 7-08, and AMWTP process sources) are excluded. The list also includes all ICEs greater than 500 hp, per the modeling protocol (Sondrup and Verdoorn 2015). Emission rates for these sources are presented in this section for boilers, followed by remediation sources, then ICEs. OV&G emission rates are not shown in Table 9 but are presented in Section 4.1.2.2.

Table 9. CAP sources included in the modeling.

Facility	Source ID	Description
Boilers		
AMWTP	WMF-676-004A	12.55 MMBtu/hr boiler (propane)
AMWTP	WMF-676-005B	12.55 MMBtu/hr boiler (propane)
AMWTP	WMF-676-006C	12.55 MMBtu/hr boiler (propane)
CFA	CFA-608	1.5 MMBtu/hr boiler (diesel)
CFA	CFA-609-005	2.1 MMBtu/hr boiler (diesel)
INTEC	CPP-606-001	36.4 MMBtu/hr boiler (diesel)
INTEC	CPP-606-002	36.4 MMBtu/hr boiler (diesel)
INTEC	CPP-606-003	36.4 MMBtu/hr boiler (diesel)
INTEC	CPP-606-004	36.4 MMBtu/hr boiler (diesel)
NRF	Boiler No. 4[a]	29.3 MMBtu/hr boiler (diesel)
NRF	Boiler No. 5[b]	29.3 MMBtu/hr boiler (diesel)
SMC	TAN-679-067a	25 MMBtu/hr boiler (diesel)
SMC	TAN-679-068	25 MMBtu/hr boiler (diesel)
Remediation Sources		
INTEC	CPP-666	Sodium distillation and treatment process emissions
INTEC	CPP-1696	Integrated Waste Treatment Unit process emissions
Emergency Stationary ICE > 500 hp		
AMWTP	WMF-734	Caterpillar Model 3412, 745 hp
AMWTP	BGEN-812-001	Cummins/Onan Model QSX15-G9, 755 hp
AMWTP	BGEN-812-002	Cummins/Onan Model VTA-28-05, 900 hp
ATR Complex	619-10	Detroit Diesel-Allison Model 71237300, 558 hp
ATR Complex	670-M-42	Enterprise Model, DSQ-38, 2118 hp
ATR Complex	670-M-43	Enterprise, DSQ-38, 2118 hp
ATR Complex	674-M-6	Caterpillar Model 3516, 2132 hp
ATR Complex	786-M-1	Caterpillar Model 3516B TA, 2593 hp
INTEC	GEN-WCS-002	Caterpillar Model 3516 Quad Turbo, 2304 hp
INTEC	GEN-WCS-004	Caterpillar Model 3516 Quad Turbo, 2304 hp
INTEC	GEN-WCS-006	Caterpillar Model 3516 Quad Turbo, 2304 hp
MFC	ANL-785-017	Waukesha Model EM200, 525 hp
MFC	ANL-768-003	Waukesha Model VLRPD, 741 hp
NRF	686-016	Caterpillar Model 3512, 1,445 hp
NRF	686-017	Caterpillar Model 3512, 1,445 hp
NRF	686-018	Caterpillar Model 3512, 1,445 hp
NRF	686-019	Caterpillar Model 3512, 1,445 hp
SMC	TAN 675-010	Caterpillar Model 3408, 598 hp
SMC	TAN 679-012	Caterpillar Model 3412, 890 hp
SMC	GEN-HP-960[b]	Generac Model MD1000GEM, 1514 hp

a. Source included in original permit as a proposed source.
b. New source added since original permit.

Table 10 contains the CAP-emission rates for boiler sources based on the rated design-capacity fuel-consumption rates found in Appendix A, Addendum to Form EU5 of the revised-permit application (DOE-ID 2020). The emission rates are presented in Appendix C of the revised-permit application (DOE-

ID 2020) and calculated in the Excel spreadsheet "EE_App C (5-18-20).xlsx" in the worksheet "Maximum Hourly Boiler Emissions." They were calculated using the formula:

$$ER\left(\frac{lb}{hr}\right) = \frac{FR\left(\frac{gal}{hr}\right) EF\left(\frac{lb}{1000\ gal}\right)}{1000\ \left(\frac{gal}{1000\ gal}\right)}$$

Table 11 contains the CAP emission rates for remediation sources. Maximum hourly emissions for CPP-666 come from EDF-10422 (2015), *Air Permitting Applicability Determination (APAD) for Sodium Distillation and Treatment at CPP-666*. Maximum hourly emissions from waste-treatment operations at CPP-1696, IWTU, are based on conservative estimates obtained from measurements obtained during off-gas sampling during IWTU simulant test runs. Waste-treatment operations are expected to be conducted at a nominal waste feed rate of 1.6 gpm. The values in Table 11 are scaled up to the maximum allowable feed rate of 2.5 gpm. Additionally, the NO_X emission was increased 25% in order to allow IWTU operational flexibility and reflects upper-bound emissions under worst-case conditions. Compared to the original permit, modeled IWTU emissions for the revised permit are higher by about a factor of 3 for NO_X. SO_2, and CO, and PM emissions are much lower for the revised-permit modeling because the original permit scaled the increase for these CAPs from the expected increase in NO_X. Simulant treatment testing indicates that this was a very conservative method for estimating emissions.

Table 10. Emission rates for INL Site boiler sources.

Boiler Source	Rated Capacity	Design Capacity Fuel Consumption Rate[a]	SO_2 (lb/hr)	NO_X (lb/hr)	CO (lb/hr)	PM 10 + Condensable PM (lb/hr)
			Emission Factor[b] (lb/1000gal)			
Propane	(MMBtu/hr)	(gal/hr)	1.5[f]	13	7.5	0.7
WMF-676-004A	12.55	138.7	2.08E-01	1.80E+00	1.04E+00	9.71E-02
WMF-676-005B	12.55	138.7	2.08E-01	1.80E+00	1.04E+00	9.71E-02
WMF-676-006C	12.55	138.7	2.08E-01	1.80E+00	1.04E+00	9.71E-02
			Emission Factor[c, d, e] (lb/1000gal)			
#2 Diesel	(MMBtu/hr)	(gal/hr)	0.213[g]	20	5	2.3
CFA-608	1.5	10.7	2.28E-03	2.14E-01	5.35E-02	2.46E-02
CFA-609	2.1	15	3.20E-03	3.00E-01	7.50E-02	3.45E-02
CPP-606-061	36.4	216	4.60E-02	4.32E+00	1.08E+00	4.97E-01
CPP-606-062	36.4	216	4.60E-02	4.32E+00	1.08E+00	4.97E-01
CPP-606-063	36.4	216	4.60E-02	4.32E+00	1.08E+00	4.97E-01
CPP-606-064	36.4	216	4.60E-02	4.32E+00	1.08E+00	4.97E-01
NRF Boiler No. 4	29.3	209	4.45E-02	4.18E+00	1.05E+00	4.81E-01
NRF Boiler No. 5	29.3	209	4.45E-02	4.18E+00	1.05E+00	4.81E-01
TAN 679-067a	25	167.5	3.82E-02	3.59E+00	8.98E-01	4.13E-01
TAN 679-068	25	167.5	3.82E-02	3.59E+00	8.98E-01	4.13E-01

a. Idaho National Laboratory Permit to Construct P-2015.0023 Facility Emission Cap Revision Request, Appendix A, Addendum to Form EU5.
b. AP-42: Table 1.5-1 Criteria Pollutant Emission Factors for Liquified Petroleum Gas Combustion: External Combustion Sources – Propane (EPA 2009).
c. AP-42: Table 1.3-1 Criteria Pollutant Emission Factors for Liquified Petroleum Gas Combustion: External Combustion Sources, Boilers < 100 MMBtu/hr, Distillate oil (EPA 2009).
d. AP-42: Sum of Table 1.3-2 Condensable Particulate Matter Emission Factors for Oil Combustion (1.3 lb/1000 gal for No. 2 oil fired) and Table 1.3-6 Cumulative Particle Size Distribution and Size-Specific Emission Factors for Uncontrolled Industrial Boiler firing Distillate Oil (0.25 lb/1000 gal for PM2.5) for a total of 1.55 lb/1000 gal (EPA 2009).
e. AP-42: Sum of Table 1.3-2 Condensable Particulate Matter Emission Factors for Oil Combustion (EPA 2009).
f. SO_2 emission factors for propane boilers based on 15 gr/100 scf, Gas Processors Association Engineering Data Book (Ninth Edition, 1972), Figure 15-50 (GPA Liquefied Petroleum Gas Specifications, rev. 1979).
g. SO_2 emission factor for diesel boilers based on fuel oil sulfur content of 15 ppm.

Table 11. Emission rates for INL Site remediation sources (lb/hr).

Source	SO_2	NO_X	CO	PM
CPP-666, Sodium Distillation and Repack	1.20E-02	3.42E-07	3.84E-03	NA
CPP-1696, Integrated Waste Treatment Unit[a]	0.189	37	0.188	0.014

a. EDF-11238 (2020), Table 1.

Table 12 contains the CAP emission rates for emergency stationary ICE sources greater than 500 hp, based on the maximum hourly fuel-consumption rates. These fuel-consumption rates are found in Appendix A, Addendum to Form EU1 of the revised-permit application (DOE-ID 2020). The emission rates are presented in Appendix C of the revised-permit application (DOE-ID 2020) and calculated in the Excel spreadsheet "EE_App C (5-18-20).xlsx" in the worksheet "Hourly Engine Emissions >500 hp." ICE emissions were calculated using the formula:

$$ER\left(\frac{lb}{hr}\right) = FR\left(\frac{gal}{hr}\right)HV\left(\frac{Btu}{gal}\right)EF\left(\frac{lb}{MMBtu}\right)\left(\frac{MMBtu}{10^6 Btu}\right)$$

where

ER = emission rate

FR = maximum fuel rate

HV= heating value of fuel oil (140,000 Btu/gal)

EF = emission factor

Table 12. Emission rates for INL Site ICE sources greater than 500 hp.

Source ID	Testing Frequency	Testing Duration (hrs)	Maximum Fuel Rate (gal/hr)	SO_2 (lb/hr)	NO_X (lb/hr)	CO (lb/hr)	PM[a] (lb/hr)
Emission Factors for ICE ≤ 600 hp (lb/MMBtu)				0.29	4.41	0.95	0.31
ANL-785-017	Quarterly	2.5[c]	28[f]	1.14E+00	1.73E+01	3.72E+00	1.22E+00
TAN 675-010	Monthly	1	31.2[g]	1.27E+00	1.93E+01	4.15E+00	1.35E+00
619-10	Weekly	0.5[b]	26	1.06E+00	1.61E+01	3.46E+00	1.13E+00
	Annually	2	26				
Emission Factors for ICE > 600 hp (lb/MMBtu)				1.52E-03	3.2	0.85	6.97E-02
WMF-734	Monthly	0.25[b]	39.4	8.36E-03	1.77E+01	4.69E+00	3.84E-01
BGEN-812-001	Monthly	0.25[b]	27.1	5.75E-03	1.21E+01	3.22E+00	2.64E-01
BGEN-812-002	Monthly	0.25[b]	44.2	9.37E-03	1.98E+01	5.26E+00	4.31E-01
670-M-42	Monthly	1	44[d]	9.33E-03	1.97E+01	5.24E+00	4.29E-01
	Quarterly	3	44[d]				
670-M-43	Monthly	1	44[d]	9.33E-03	1.97E+01	5.24E+00	4.29E-01
	Quarterly	3	44[d]				
674-M-6	Monthly	1	44[d]	9.33E-03	1.97E+01	5.24E+00	4.29E-01
	Quarterly	3	44[d]				
786-M-1	Quarterly	8	123.1	2.61E-02	5.51E+01	1.46E+01	1.20E+00
GEN-WCS-002	Monthly	1	119.2	2.53E-02	5.34E+01	1.42E+01	1.16E+00
GEN-WCS-004	Monthly	1	119.2	2.53E-02	5.34E+01	1.42E+01	1.16E+00
GEN-WCS-006	Monthly	1	119.2	2.53E-02	5.34E+01	1.42E+01	1.16E+00
ANL-768-003	Quarterly	3.34[d]	32[f]	6.79E-03	1.43E+01	3.81E+00	3.12E-01
686-016	Monthly	1	69.7	1.48E-02	3.12E+01	8.29E+00	6.80E-01
686-017	Monthly	1	69.7	1.48E-02	3.12E+01	8.29E+00	6.80E-01
686-018	Monthly	1	69.7	1.48E-02	3.12E+01	8.29E+00	6.80E-01
686-019	Monthly	1	69.7	1.48E-02	3.12E+01	8.29E+00	6.80E-01
TAN 679-012	Monthly	1	44.8[g]	9.50E-03	2.01E+01	5.33E+00	4.37E-01
GEN-HP-960	Monthly	0.5[b]	62.6	1.33E-02	2.80E+01	7.45E+00	6.11E-01

a. Includes PM-10, PM-2.5 and condensable PM.
b. Testing duration rounded up to 1 hour for modeling.
c. Testing duration rounded up to 3 hours for modeling.
d. Testing duration rounded up to 4 hours for modeling.
e. Actual fuel rate. Units do not have loads connected to them that are capable of using the maximum design fuel rate.
f. Value is estimated.
g. Value changed from original permit modeling.

4.1.2.2 Facility Emissions Cap Increase Emission Rates for CAPs

For CAPs, INL is requesting emission increases as defined in IDAPA 58.01.01.176.03.e that will limit allowable emissions to less than the requested FEC limits in Table 13. Modeled OV&G emissions were assumed to be released from a single point source at each major facility one at a time in separate model runs. The modeled OV&G emissions in Table 13 are shown in units of T/year, lb/hr and g/s assuming continuous operation. Units of g/s were used in the AERMOD model input files.

Table 13. Modeled OV&G emission rates

Emissions Component	SO_2	NO_X	CO	PM
Requested FEC limit (T/year)	70	95[a]	90	85
Total sitewide BAEs/PAEs (T/year)	0.93	72.2	6.24	0.07
Requested OV&G emission increase (T/year)	69.1	22.8	83.8	83.0
Modeled OV&G emission assigned to each facility (T/year)	69.1	22.8	83.8	83.0
Modeled OV&G emission assigned to each facility (lb/hr)	15.8	5.20	19.1	18.9
Modeled OV&G emission assigned to each facility (g/s)	1.99	0.655	2.41	2.38

4.1.2.3 Modeled Emission Rates for all CAP Sources

Table 14 lists all the modeled CAP sources and their respective emission rates in lb/hr and g/s. Emission rates in g/s are presented because those units are used in the model input files. Since AERMOD limits source names to eight characters and no dashes, the AERMOD SourceID is also listed for convenience. As explained previously, boiler and remediation sources are assumed to run continuously, OV&G emission sources are assumed to run continuously, but emissions are only released from one facility at a time. This is done by making separate computer runs for each facility. Emissions from ICE sources are released according to a random run schedule that is consistent with the testing frequency and durations listed in Table 12.

Table 14. Emission rates for all INL Site sources.

Source Name	AERMOD SourceID	SO_2 (lb/hr)	NO_X (lb/hr)	CO (lb/hr)	PM (lb/hr)	SO_2 (g/s)	NO_X (g/s)	CO (g/s)	PM (g/s)
WMF-676-004A	AMWBOIA	2.08E-01	1.80E+00	1.04E+00	9.71E-02	2.62E-02	2.27E-01	1.31E-01	1.22E-02
WMF-676-005B	AMWBOIB	2.08E-01	1.80E+00	1.04E+00	9.71E-02	2.62E-02	2.27E-01	1.31E-01	1.22E-02
WMF-676-006C	AMWBOIC	2.08E-01	1.80E+00	1.04E+00	9.71E-02	2.62E-02	2.27E-01	1.31E-01	1.22E-02
CFA-608	CFBOI608	2.28E-03	2.14E-01	5.35E-02	2.46E-02	2.87E-04	2.70E-02	6.74E-03	3.10E-03
CFA-609-005	CFBOI609	3.20E-03	3.00E-01	7.50E-02	3.45E-02	4.03E-04	3.78E-02	9.45E-03	4.35E-03
CPP-606-001	INTBOI1	4.60E-02	4.32E+00	1.08E+00	4.97E-01	5.80E-03	5.44E-01	1.36E-01	6.26E-02
CPP-606-002	INTBOI2	4.60E-02	4.32E+00	1.08E+00	4.97E-01	5.80E-03	5.44E-01	1.36E-01	6.26E-02
CPP-606-003	INTBOI3	4.60E-02	4.32E+00	1.08E+00	4.97E-01	5.80E-03	5.44E-01	1.36E-01	6.26E-02
CPP-606-004	INTBOI4	4.60E-02	4.32E+00	1.08E+00	4.97E-01	5.80E-03	5.44E-01	1.36E-01	6.26E-02
CPP-1696 IWTU	IWTUTMT	1.89E-01	3.70E+01	1.88E-01	1.40E-02	2.38E-02	4.66E+00	2.37E-02	1.76E-03
CPP-666	CPP666	1.20E-02	3.42E-07	3.84E-03	0.00E+00	1.51E-03	4.32E-08	4.83E-04	0.00E+00
Boiler No. 4	NRFBOI4	4.45E-02	4.18E+00	1.05E+00	4.81E-01	5.61E-03	5.27E-01	1.32E-01	6.06E-02
Boiler No. 5	NRFBOI5	4.45E-02	4.18E+00	1.05E+00	4.81E-01	5.61E-03	5.27E-01	1.32E-01	6.06E-02
TAN-679-067a	SMCBOI67	3.57E-02	3.35E+00	8.38E-01	3.85E-01	4.50E-03	4.22E-01	1.06E-01	4.85E-02
TAN-679-068	SMCBOI68	3.57E-02	3.35E+00	8.38E-01	3.85E-01	4.50E-03	4.22E-01	1.06E-01	4.85E-02
AMWTP FEC Src	AMWFEC[a]	1.58E+01	5.20E+00	1.91E+01	1.89E+01	1.99E+00	6.55E-01	2.41E+00	2.38E+00
ATR FEC Src	ATRFEC[a]	1.58E+01	5.20E+00	1.91E+01	1.89E+01	1.99E+00	6.55E-01	2.41E+00	2.38E+00
CFA FEC	CFAFEC[a]	1.58E+01	5.20E+00	1.91E+01	1.89E+01	1.99E+00	6.55E-01	2.41E+00	2.38E+00
INTEC FEC Src	INTFEC[a]	1.58E+01	5.20E+00	1.91E+01	1.89E+01	1.99E+00	6.55E-01	2.41E+00	2.38E+00
MFC FEC Src	MFCFEC[a]	1.58E+01	5.20E+00	1.91E+01	1.89E+01	1.99E+00	6.55E-01	2.41E+00	2.38E+00
NRF FEC Src	NRFFEC[a]	1.58E+01	5.20E+00	1.91E+01	1.89E+01	1.99E+00	6.55E-01	2.41E+00	2.38E+00
SMC FEC Src	SMCFEC[a]	1.58E+01	5.20E+00	1.91E+01	1.89E+01	1.99E+00	6.55E-01	2.41E+00	2.38E+00
WMF-734	WMF734	8.36E-03	1.77E+01	4.69E+00	3.84E-01	1.05E-03	2.22E+00	5.91E-01	4.84E-02
BGEN-812-001	812001	5.75E-03	1.21E+01	3.22E+00	2.64E-01	7.24E-04	1.53E+00	4.06E-01	3.33E-02
BGEN-812-002	812002	9.37E-03	1.98E+01	5.26E+00	4.31E-01	1.18E-03	2.50E+00	6.63E-01	5.43E-02
619-10	61910	1.06E+00	1.61E+01	3.46E+00	1.13E+00	1.33E-01	2.02E+00	4.36E-01	1.42E-01
670-M-42	670M42	9.33E-03	1.97E+01	5.24E+00	4.29E-01	1.18E-03	2.48E+00	6.60E-01	5.41E-02
670-M-43	670M43	9.33E-03	1.97E+01	5.24E+00	4.29E-01	1.18E-03	2.48E+00	6.60E-01	5.41E-02
674-M-6	674M6	9.33E-03	1.97E+01	5.24E+00	4.29E-01	1.18E-03	2.48E+00	6.60E-01	5.41E-02
786-M-1	786M1	2.61E-02	5.51E+01	1.46E+01	1.20E+00	3.29E-03	6.95E+00	1.85E+00	1.51E-01
GEN-WCS-002	WCS002	2.53E-02	5.34E+01	1.42E+01	1.16E+00	3.19E-03	6.73E+00	1.79E+00	1.47E-01
GEN-WCS-004	WCS004	2.53E-02	5.34E+01	1.42E+01	1.16E+00	3.19E-03	6.73E+00	1.79E+00	1.47E-01
GEN-WCS-006	WCS006	2.53E-02	5.34E+01	1.42E+01	1.16E+00	3.19E-03	6.73E+00	1.79E+00	1.47E-01
ANL-785-017	785017	1.14E+00	1.73E+01	3.72E+00	1.22E+00	1.43E-01	2.18E+00	4.69E-01	1.53E-01
ANL-768-003	768003	6.79E-03	1.43E+01	3.81E+00	3.12E-01	8.55E-04	1.81E+00	4.80E-01	3.93E-02
686-016	686016	1.48E-02	3.12E+01	8.29E+00	6.80E-01	1.86E-03	3.93E+00	1.05E+00	8.57E-02
686-017	686017	1.48E-02	3.12E+01	8.29E+00	6.80E-01	1.86E-03	3.93E+00	1.05E+00	8.57E-02
686-018	686018	1.48E-02	3.12E+01	8.29E+00	6.80E-01	1.86E-03	3.93E+00	1.05E+00	8.57E-02
686-019	686019	1.48E-02	3.12E+01	8.29E+00	6.80E-01	1.86E-03	3.93E+00	1.05E+00	8.57E-02
TAN 675-010	675010	1.27E+00	1.93E+01	4.15E+00	1.35E+00	1.60E-01	2.43E+00	5.23E-01	1.71E-01
TAN 679-012	679012	9.50E-03	2.01E+01	5.33E+00	4.37E-01	1.20E-03	2.53E+00	6.72E-01	5.51E-02
GEN-HP-960	HP960	1.33E-02	2.80E+01	7.45E+00	6.11E-01	1.67E-03	3.53E+00	9.39E-01	7.70E-02

a. Sources named ***FEC are hypothetical sources for OV&G emissions.

CHECKLIST

_____Emissions rates in (g/s) in Table 14 are identical to those in the model input files for the cumulative NAAQS impact analyses.

_____Calculation of modeled emissions are thoroughly documented in this section, and any unique handling of emissions in the model have been described.

4.1.3 NO_2/NO_X Ratio for NO_X Chemistry Modeling

NO_X chemistry was not considered in the modeling. The NO_2 concentrations reported are the NO_X concentrations, based on NO_X emissions and assuming 100% conversion to NO_2 (i.e., no credit was taken for reduction or conversion of NO_X to NO_2).

4.1.4 Special Methods for Modeling Criterial Pollutant Emissions

For modeling, all CAP sources were assumed to operate continuously except for emergency stationary ICEs, which were operated on a random schedule based on their testing frequency and duration. External files containing the run schedule and emission rates for each CAP were generated by DEQ modeling staff and provided in a zip file (ICE_hourly_run_schedule_from_DEQ.inl.zip). No restrictions were placed on the times or conditions under which the ICE could be tested. These are not the same files used in the original-permit modeling because the files had to be regenerated for the more recent meteorological data set (2013–2017).

For 1-hr NO_X modeling, emergency stationary ICE sources were not included according to guidance in *State of Idaho Guideline for Performing Air Quality Impact Analyses* (DEQ 2013). This was done by setting the emission rates to zero and making separate computer runs.

4.2 Toxic Air Pollutants

TAPs were not modeled, based on the evaluation presented in Section 3.3 that determined uncontrolled emissions for regulated TAPS were less than the ELs in IDAPA 58.01.01.585 and less than the EL increments in IDAPA 58.01.01.586. Therefore, no compliance demonstration is required.

4.3 Emissions Release Parameters

Table 15 contains the location (coordinates) and release parameters for all sources modeled. All of the modeled sources are stacks and were modeled as individual point sources.

For the OV&G emission sources listed in Table 15 (SourceID = ***FEC), emissions were assumed to be released from an existing boiler stack at facilities with a boiler (AMWTP, CFA, INTEC, NRF and SMC). For facilities without a boiler (ATR and MFC), emissions were assumed to be released from a hypothetical stack at a location near an existing non-boiler source. The hypothetical stack was assigned generic conservative stack parameters based on an evaluation of actual stack parameters. OV&G emissions were assumed to be from a stack because any future emission sources constructed at the INL Site are likely to be a boiler or a process unit like IWTU and would likely require a stack of some kind.

Table 16 lists the minimum, maximum, and average stack parameters included in the baseline emissions for the 35 stack sources included in the modeling. The last row contains the proposed parameters for modeling the OV&G emissions for facilities where it was not assigned to an existing boiler source. The proposed stack height of 5 m is less than one-half the average stack height of all stacks considered. The proposed exit velocity is 5 times less than the average velocity, and the assumed release temperature of 366 K (200°F) is nearly one-half the average exit temperature and relatively cool for any type of combustion source.

Table 15. Modeled source locations and release parameters.

AERMOD SourceID	UTM Easting (m)	UTM Northing (m)	Source Elevation (m)	Stack Height[a] (m)	Stack Exit Temperature[a] (K)	Stack Exit Velocity[a] (m/sec)	Stack Diameter[a] (m)	Stack Orientation (H/V)	Raincap (Y/N)
AMWBOIA	335280	4817969	1530	15.40	450	9.39	0.56	V	N
AMWBOIB	335280	4817969	1530	15.40	450	9.39	0.56	V	N
AMWBOIC	335280	4817969	1530	15.40	450	9.39	0.56	V	N
CFBOI608	342456	4821112	1506	10.52	436	6.94[b]	0.305	V	Y
CFBOI609	342471	4821114	1506	7.90	436	6.94[b]	0.254	V	Y
INTBOI1	343727	4826295	1499	15.40	464	23.1	0.62	V	N
INTBOI2	343737	4826295	1499	15.40	464	23.1	0.62	V	N
INTBOI3	343748	4826295	1499	15.40	464	23.1	0.62	V	N
INTBOI4	343756	4826295	1499	15.40	464	23.1	0.62	V	N
IWTUTMT	344111	4826077	1498	36.60	398	18	1.52	V	N
CPP666	343721	4826050	1499	48.80	297	10.8	1.65	V	N
NRFBOI4	345427	4834681	1479	6.81	509	20[b]	0.61	V	Y
NRFBOI5	345438	4834667	1479	6.81	509	20[b]	0.61	V	Y
SMCBOI67	360896	4857581	1460	16.20	422	8.93[b]	0.61	V	Y
SMCBOI68	360894	4857577	1460	16.20	422	8.93[b]	0.61	V	Y
AMWFEC[d]	335280	4817969	1530	15.40	450	9.39	0.56	V	N
ATRFEC[d]	341579	4828097	1501	5.00	366	5	0.305	V	N
CFAFEC[d]	342456	4821112	1506	10.52	436	6.94[b]	0.305	V	Y
INTFEC[d]	343727	4826295	1499	15.40	464	23.1	0.62	V	N
MFCFEC[d]	366235	4828352	1562	5.00	366	5	0.305	V	N
NRFFEC[d]	345440	4834677	1479	9.14	533	8.58	1.07	V	N
SMCFEC[d]	360894	4857577	1460	16.20	422	8.93[b]	0.61	V	Y
WMF734	335209	4817972	1530	3.51	877	62	0.203	V	Flapper
812001	335300	4817993	1530	3.66	739	47.6	0.19	V	Flapper
812002	335301	4817964	1530	3.58	775	1.50	2.01	V	N
61910	341600	4828095	1501	6.40	716	61.7	0.19	V	Flapper
670M42	341324	4828032	1502	9.14	647	25.3	0.439	V	N
670M43	341319	4828032	1502	9.14	647	25.3	0.439	V	N
674M6	341321	4828039	1502	3.35	763	68.4[b]	0.34[c]	H	N
786M1	341683	4828099	1501	4.11	704	1.24	2.63	V	N
WCS002	343985	4826058	1500	4.88	778	52	0.406	V	N
WCS004	343979	4826058	1500	4.88	778	52	0.406	V	N
WCS006	343973	4826058	1500	4.88	778	52	0.406	V	N
785017	366301	4828336	1562	9.14	811	27.9	0.254	V	Flapper
768003	366241	4828182	1562	12.20	811	22.6[b]	0.305	V	Y
686016	345273	4834554	1479	7.32	749	55.1[b]	0.305[c]	H	N
686017	345257	4834554	1479	7.32	749	55.1[b]	0.305[c]	H	N
686018	345257	4834552	1479	7.62	749	55.1[b]	0.305[c]	H	N
686019	345273	4834552	1479	7.62	749	55.1[b]	0.305[c]	H	N
675010	361018	4857558	1460	4.88	794	109[b]	0.152[c]	H	N

AERMOD SourceID	UTM Easting (m)	UTM Northing (m)	Source Elevation (m)	Stack Height[a] (m)	Stack Exit Temperature[a] (K)	Stack Exit Velocity[a] (m/sec)	Stack Diameter[a] (m)	Stack Orientation (H/V)	Raincap (Y/N)
679012	360901	4857565	1460	3.96	789	55.9[b]	0.254[c]	H	N
HP960[e]	360873	4857660	1460	4.06	751	56.8	0.287	V	Flapper

a. References for stack parameters (location, dimensions, exit velocity, temperature) for ICE and boiler sources is provided in Appendix A of the revised permit application, Addendum for Form EU1-Emssion Units Industrial IC Engine Information, and Addendum for Form EU5-Industrial Boiler Information. References for remediation source parameters are provided with the application.
b. Exit velocity for horizontal stacks or stacks with rain caps set to 0.001 m/s in AERMOD per DEQ modeling guidelines (DEQ 2013).
c. Diameter for horizontal stacks set to 0.001 m in AERMOD to prevent stack tip downwash effects per DEQ modeling guidelines (DEQ 2013).
d. Sources named ***FEC are hypothetical sources for OV&G emissions.
e. New ICE added since original permit.

Table 16. Statistical parameters for all modeled stacks.

Stack Statistical Value	Stack Height (m)	Stack Diameter (m)	Exit Temperature (K)	Exit Velocity (m/s)
Minimum Value	3.4	0.15	297	1.24
Average Value	10.8	0.58	623	33.2
Maximum Value	48.8	2.63	877	109
Parameters Assigned to OV&G emission sources[a]	5.0	0.305	366	5.0

a. Only at facilities with no existing boiler or boiler stack (ATR Complex and MFC).

CHECKLIST

_____Thorough justification/documentation of release parameters for all modeled sources is provided in this section.

_____The specific methods used to determine/calculate given release parameters is described in this section.

_____The release orientation of all point source stacks (horizontal, rain-capped, or uninterrupted vertical release) has been verified and is documented in this section.

5. MODELING METHODOLOGY

5.1 Model Selection

Dispersion modeling was performed with the latest version of the EPA-approved AERMOD dispersion modeling system (Version 19191) (EPA 2019a). AERMOD was run with regulatory default options and 5 years of meteorological data processed with the AERMET (Version 19081) meteorological-data preprocessor for AERMOD (EPA 2019b). Stack heights for actual stacks modeled are less than heights defined by good engineering practice. Building wake-effect parameters for actual stacks were determined with the EPA Building Profile Input Program with Plume Rise Enhancement (BPIP-PRIME) (EPA 2004), Version 04274, designed for use with the AERMOD model. BPIP-PRIME was run under the BEEST for Windows platform (BEE-Line Software, Version 9.95).

CHECKLIST

_____The current versions of all models and associated programs were used in analyses, or alternate versions were specifically approved by DEQ.

_____Any non-default model options used were approved by DEQ in advance.

5.2 Meteorological Data

Modeling was performed using model-ready meteorological data files processed with AERMET (Version 18081) and provided by DEQ. DEQ-provided file sets were processed with and without the METHOD STABLEBL ADJ_U* option in AERMET. The modeling was performed with the files processed using the METHOD STABLEBL ADJ_U* option.

The meteorological data files were processed using onsite meteorological data from the Grid 3 tower at the INL Site. The Grid 3 tower is part of the INL Mesonet network operated by NOAA (see https://www.noaa.inel.gov/projects/INLMet/INLMet.htm) and is the most centrally located tower amongst INL Site facilities. It is located north of INTEC (43.6049ºN, 112.9067ºW) near the Experimental Field Station shown in Figure 1.

Onsite meteorological data were supplemented with National Weather Service (NWS) surface data from the Idaho Falls airport (Station ID 725785-24145), downloaded from the National Climatic Data Center (NCDC) website (http://www.ncdc.noaa.gov) in standard Integrated Surface Hourly Data (ISHD) format for the same period, 2013–2017. Upper air soundings required by AERMET were taken from the Boise airport station (ID 24131), and were downloaded from the radiosonde data website (https://esrl.noaa.gov) in standard FSL format. A summary of the meteorological data processing provided by DEQ is contained in Appendix A.

CHECKLIST

_____Meteorological data files are provided with the permit application.

_____If meteorological data used for modeling were not provided by DEQ, then a detailed discussion of the data is provided along with documentation of the processing steps.

5.3 Effects of Terrain

Terrain data in AERMOD are processed using the AERMAP preprocessor. The processed data consists of terrain elevation and hill heights for each defined receptor. These data were generated by DEQ modeling staff using AERMAP (Version 11103) and provided to INL in the file *AERMAP723.rcf* for the 1,352 receptor locations (see Section 5.7). Receptor locations are defined in UTM coordinates (Zone 12) based on datum North American Datum (NAD) 83. The terrain data were extracted from 1 arc-second seamless National Elevation Database files covering the area between -112.005 and -113.644 degrees longitude and 42.967 and 44.287 degrees north latitude. All coordinates and elevations are in meters. The provided file *AERMAP723.rcf* is a text file written in AERMOD format and was used in each AERMOD input file.

Land surface data (e.g., roughness height, albedo, and terrain) were processed for the Grid 3 station using the AERSURFACE utility (Version 13016) (EPA 2013). Land-use data in 1992 National Land Cover Data (NLCD) format were collected from the Multi-Resolution Land Characteristics Consortium data retrieval site (http://www.mrlc.gov/viewerjs/). The NLCD data are derived from the early to mid-1990s Landsat Thematic Mapper satellite data and have a 21-class land-cover classification scheme applied consistently over the United States.

Moisture content was assessed for the last thirty years using precipitation data at Idaho Falls airport. The year 2013 was assessed as average moisture content, defined as within the 30th percentile of the 30-year mean of 15.5 inches. Years 2014 and 2015 were assessed as wet years and 2016 and 2017 were assessed as dry years. Continuous snow cover was assumed for winter months based on examination of local climatological records for the years 2013–2017. AERSURFACE input parameters are presented in Table 17.

Table 17. AERSURFACE input parameters.

Parameter	Value	Units and comments
Coordinate type	Latitude-Longitude	Decimal degrees (43.6049ºN, 112.9067ºW)
Datum	NAD 83	NA
Study radius	1.0	kilometers
Vary by sector (Yes/No)	Yes	NA
Number of sectors	12	Twelve, 30-degree sectors
Temporal resolution	Seasonal	NA
Continuous snow cover	Yes	During winter months
Airport	No	NA
Surface moisture	2013 Average 2014-2015 Wet 2016-2017 Dry	NA

CHECKLIST

_____The datum of terrain data, building corner locations, emissions sources, and the ambient air boundary are specified and are consistent such that the modeled plot plan accurately represents the facility and surroundings.

5.4 Facility Layout

Figure 4 through Figure 10 show the locations of each of the sources listed in Table 15. See Figure 1 for location of all facilities.

Figure 4. Sources locations at AMWTP facilities.

Figure 5. Source locations at ATR Complex.

Figure 6. Source locations at CFA.

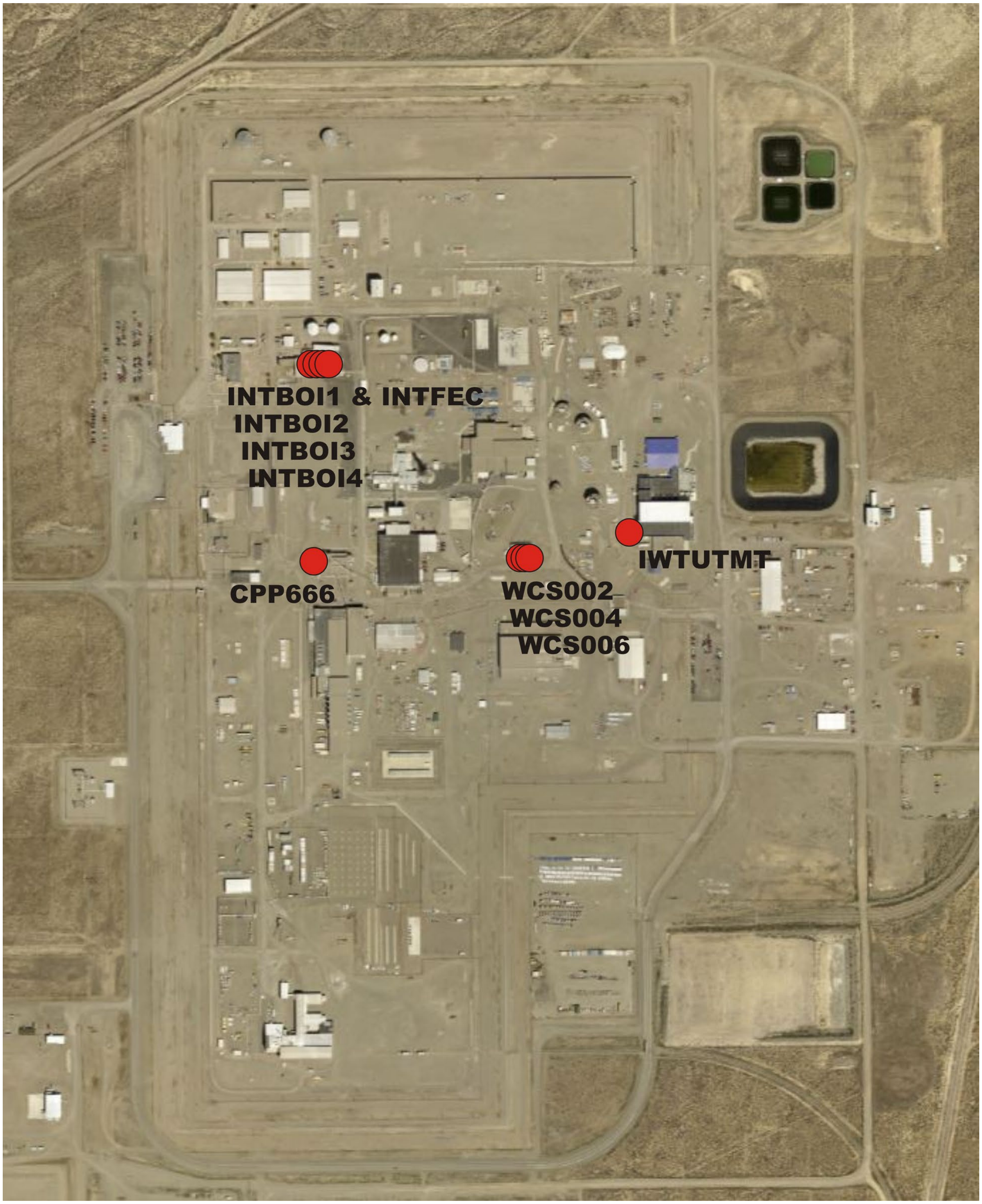

Figure 7. Source locations at INTEC.

Figure 8. Source locations at MFC.

Figure 9. Source locations at NRF.

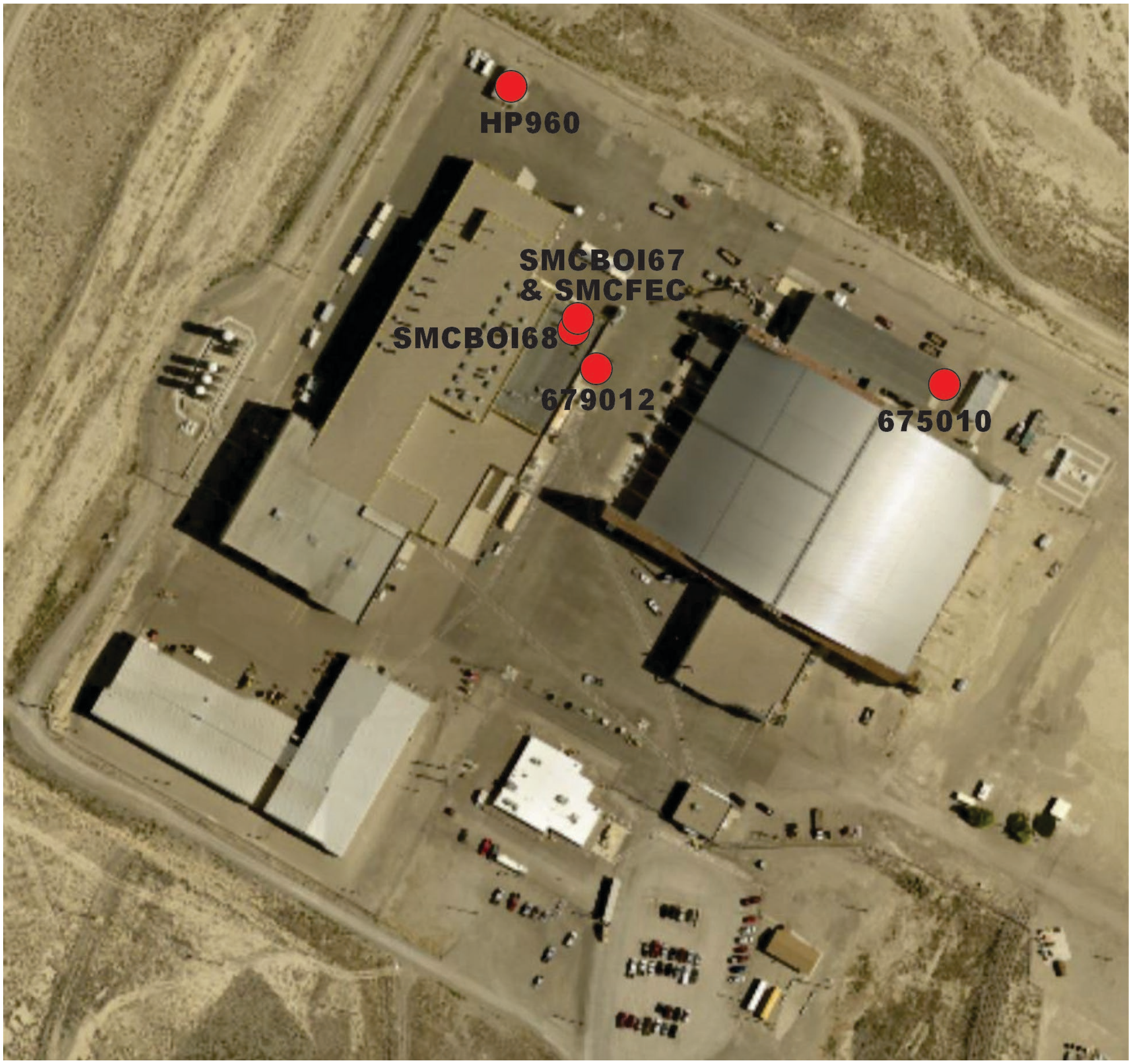

Figure 10. Source locations at SMC facility.

CHECKLIST

_____The facility layout plot plan is provided in this section that clearly and accurately depicts buildings, emissions points, and the ambient air boundary.

_____This section of the Modeling Report has thoroughly described how locations of emissions sources, building corners, and the ambient air boundary were determined, specifying the datum used.

5.5 Building Wake Effects

Stack heights for actual stacks modeled are less than heights defined by good engineering practice. Therefore, building wake-effect parameters for modeled stacks were determined using the EPA Building Profile Input Program with Plume Rise Enhancement (BPIP-PRIME) (EPA 2004), Version 04274, designed for use with the AERMOD model. BPIP-PRIME was run under the BEEST for Windows platform (BEE-Line Software, Version 9.95).

Wake-effects parameters were obtained by importing facility maps with building/structure/tank outlines into the BEEST program. The facility maps were generated using the INL iMAP application (https://maps.inl.gov). iMAP is a web-based geographic information system (GIS) application that provides access to map layers and other information about INL. Figure 11 shows the facility map for the AMWTP facility with building outlines from iMAP. Maps for each facility or a portion of a facility were imported into BEEST and positioned (georeferenced) using UTM coordinates. Building, tank, and other structure outlines were created within BEEST.

Building heights were determined using the measuring tools and the Pictometry feature in iMAP. Pictometry is a patented aerial image-capture process that produces imagery showing the fronts and sides of buildings and locations on the ground. This method was determined to be accurate to within a foot by measuring stacks and comparing to known stack heights. All structures close enough to produce an area of wake effect were included for each stack considered. According to the BPIP user guide (EPA 2004); structures produce an area of wake effect that extends to a distance of 5L where L is the lesser of the building height or projected building width. For this analysis, all structures within 5L were included.

Figure 12 through Figure 22 show 3D wireframe building and tank images from the BEEST software for each stack source modeled. These images are created from stack and building locations and dimensions entered for calculating building-wake effects. Stack sources are shown in red and labeled. Facility maps with building outlines are shown in the corner of each image. For multitiered structures, the tiers were included, or the entire building height was assumed to be equal to the height of the tallest tier. This was very conservative for some buildings.

Figure 11. Facility map of AMWTP with buildings highlighted.

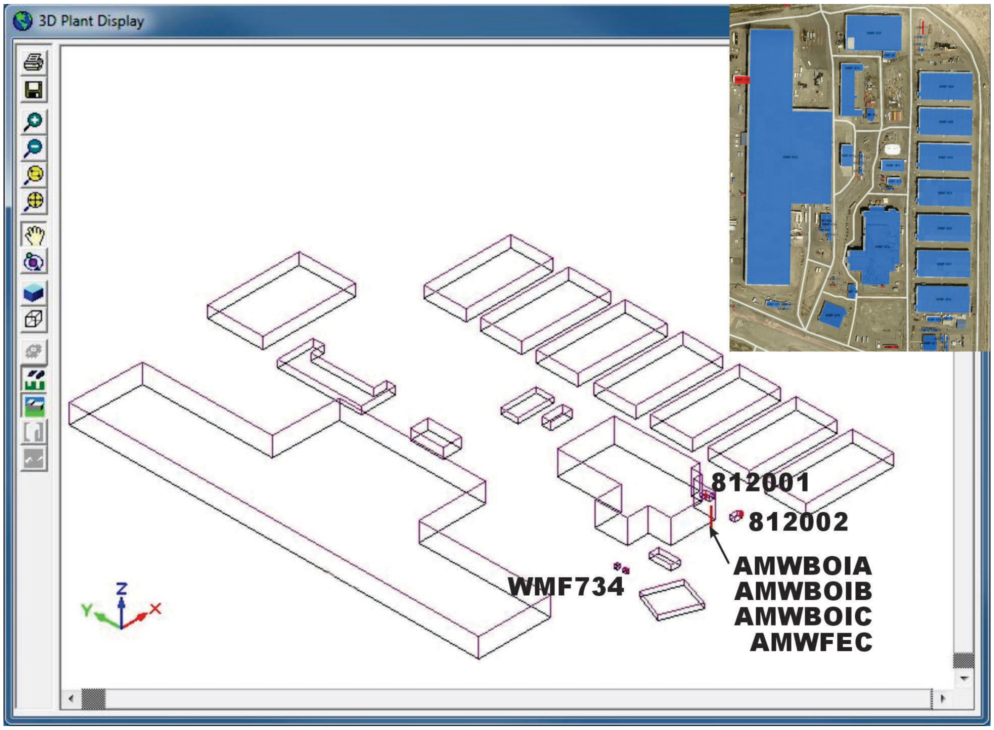

Figure 12. Wireframe image of buildings at AMWTP for calculating wake effects for boiler sources AMWBOIA, AMWBOIB, AMWBOIC, AMWBOI2; remediation source AMWTSARE; ICE sources WMF734, 812001, 812002 and OV&G source AMWFEC. Facility plot map shown in upper right corner.

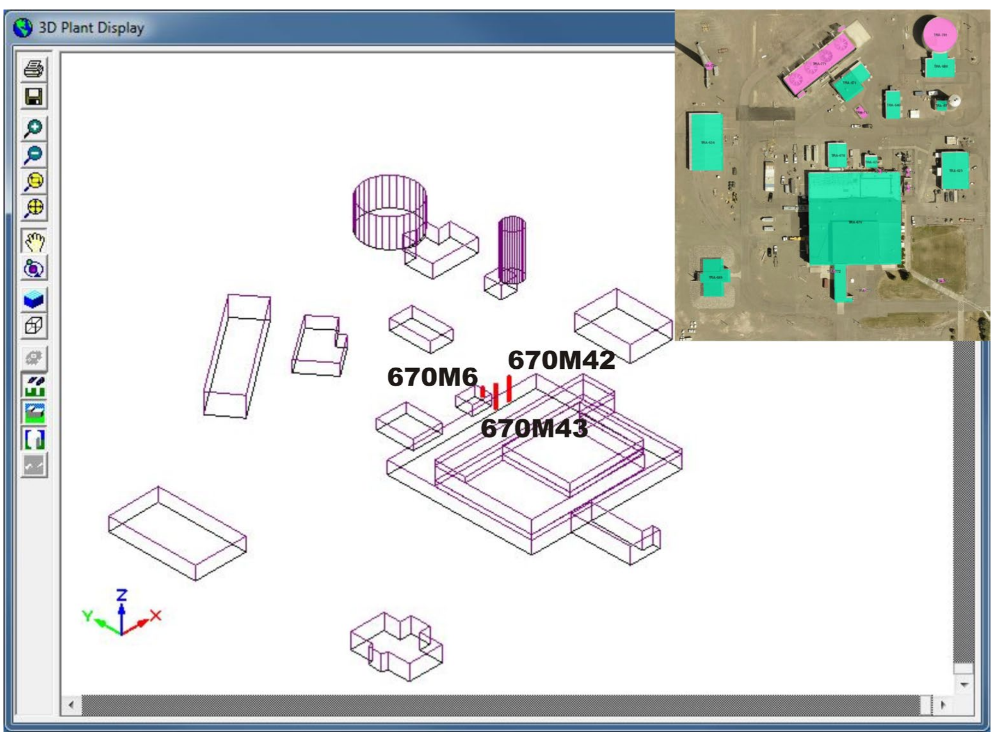

Figure 13. Wireframe image of buildings and tanks at the ATR Complex for calculating wake effects for ICE sources 670M6, 670M42 and 670M43. Facility plot map shown in upper right corner.

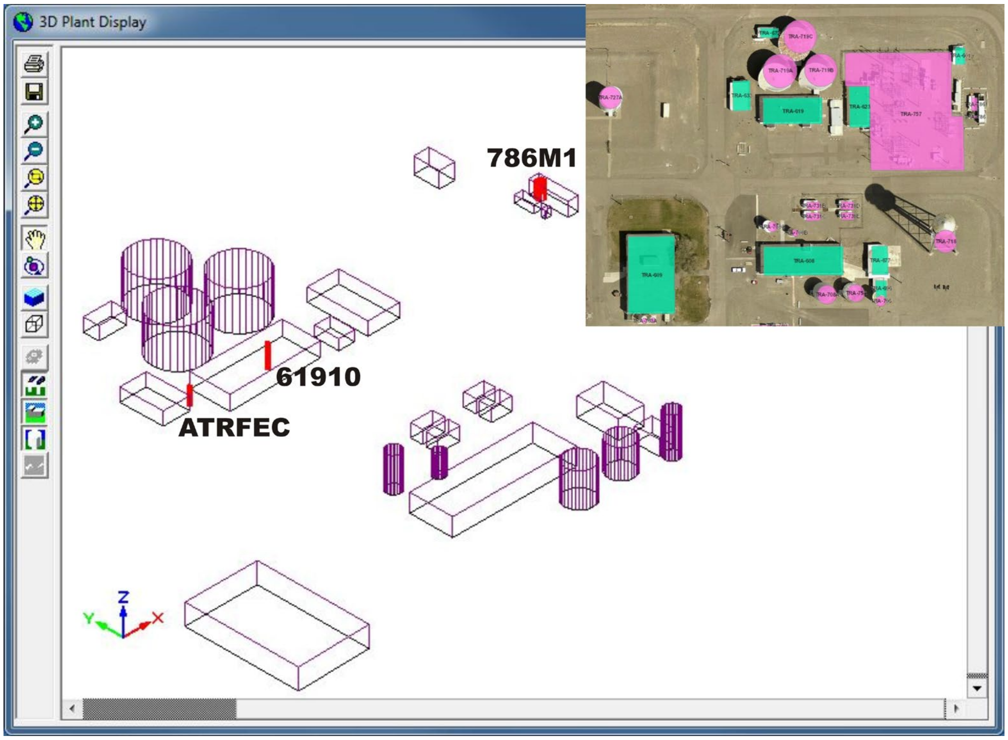

Figure 14. Wireframe image of buildings and tanks at the ATR Complex for calculating wake effects for ICE sources 61910, 786M1 and OV&G source ATRFEC. Facility plot map shown in upper right corner.

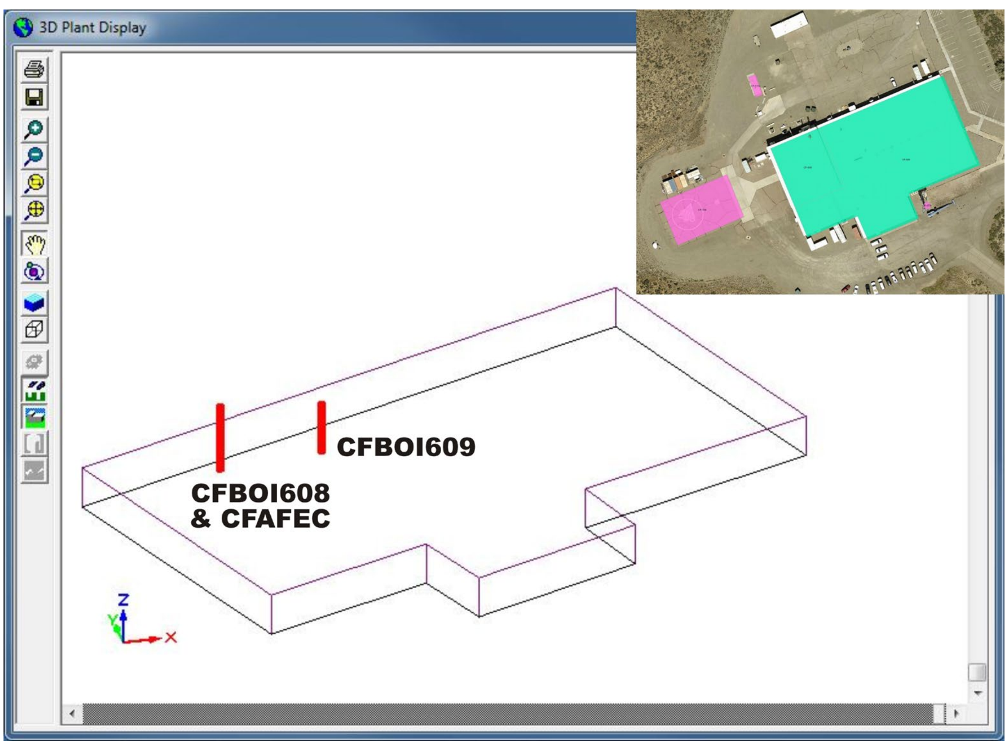

Figure 15. Wireframe image of buildings at CFA for calculating wake effects for boiler sources CFBOI608, CFBOI609 and OV&G source CFAFEC. Facility plot map shown in upper right corner.

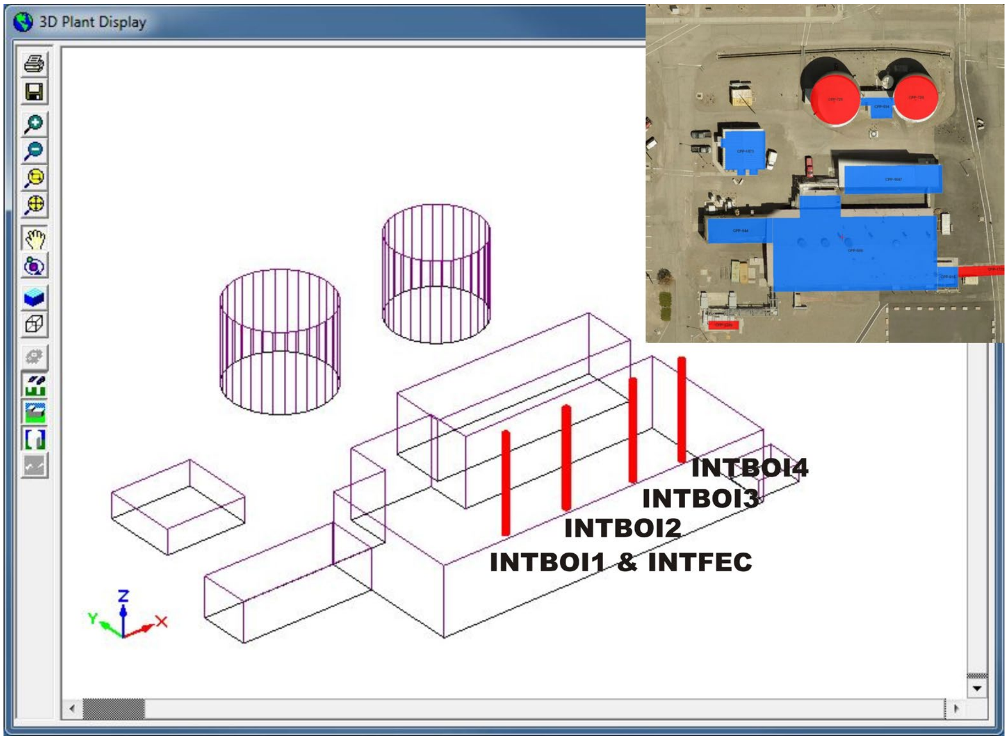

Figure 16. Wireframe image of buildings and tanks at INTEC for calculating wake effects for boiler sources INTBOI1, INTBOI2, INTBOI3, INTBOI4 and OV&G source INTFEC. Facility plot map shown in upper right corner.

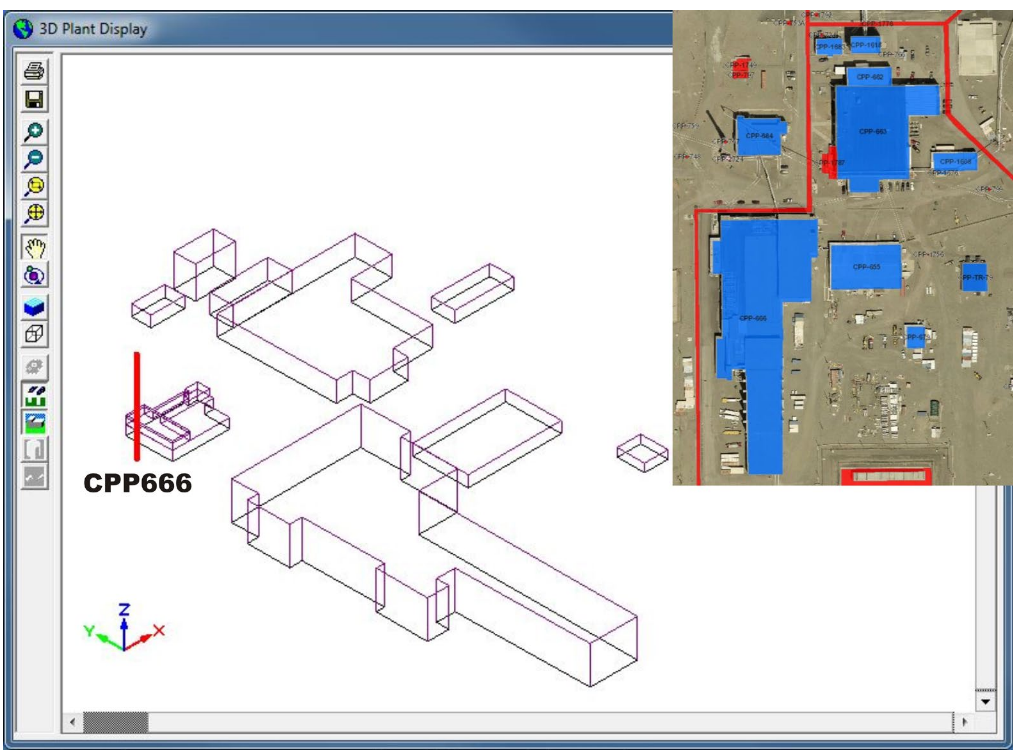

Figure 17. Wireframe image of buildings at INTEC for calculating wake effects for remediation source CPP666. Facility plot map shown in upper right corner.

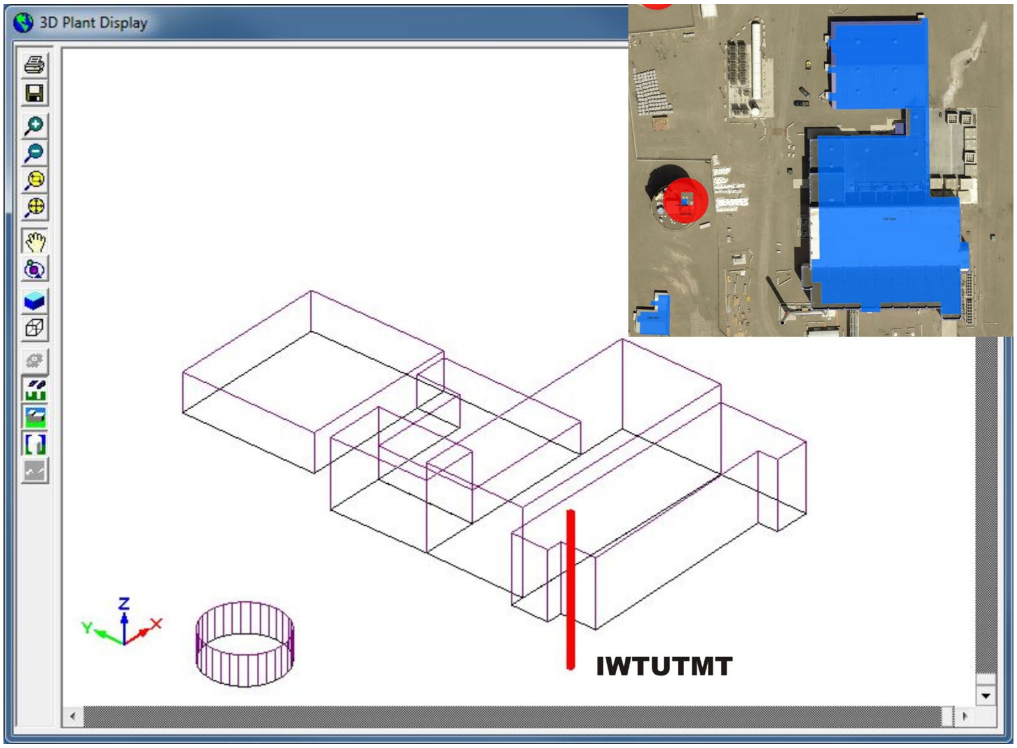

Figure 18. Wireframe image of buildings and tanks at INTEC for calculating wake effects for remediation source IWTUTMT. Facility plot map shown in upper right corner.

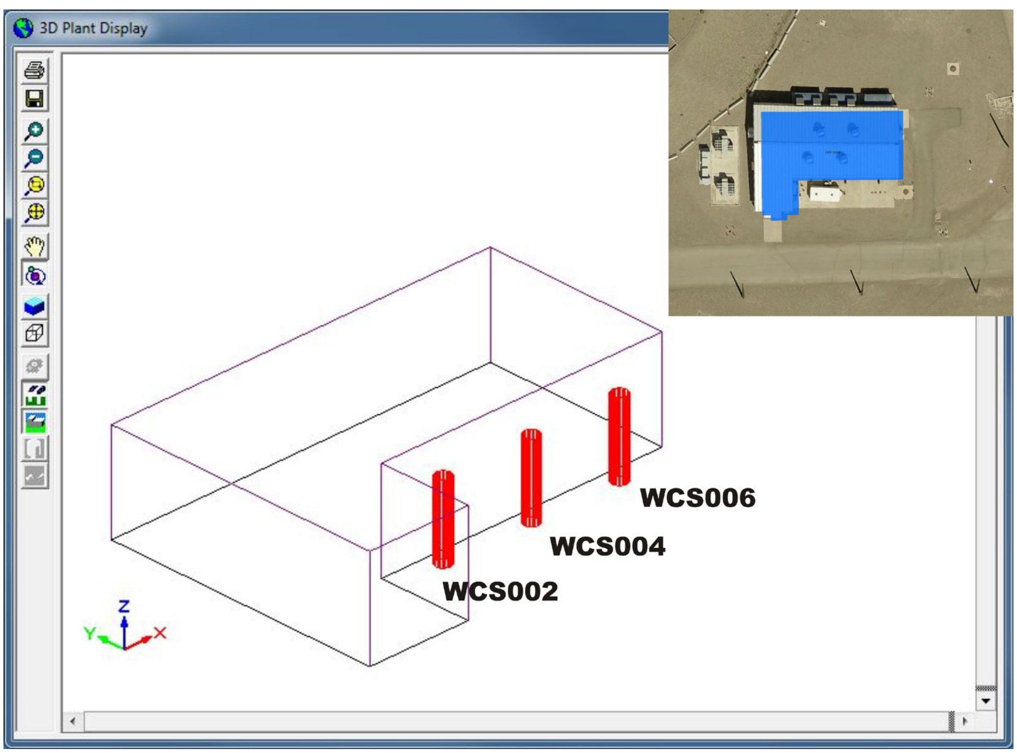

Figure 19. Wireframe image of buildings at INTEC for calculating wake effects for ICE sources WCS002, WCS004 and WCS006. Facility plot map shown in upper right corner.

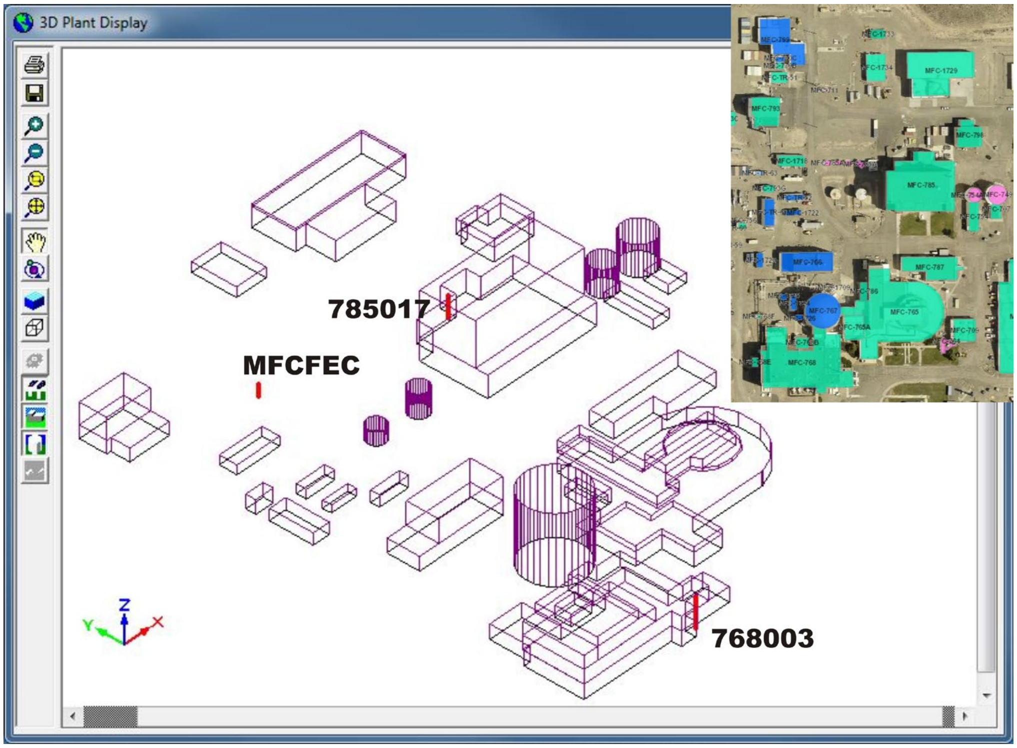

Figure 20. Wireframe image of buildings and tanks at MFC for calculating wake effects for ICE sources 785017, 768003 and OV&G source MFCFEC. Facility plot map shown in upper right corner.

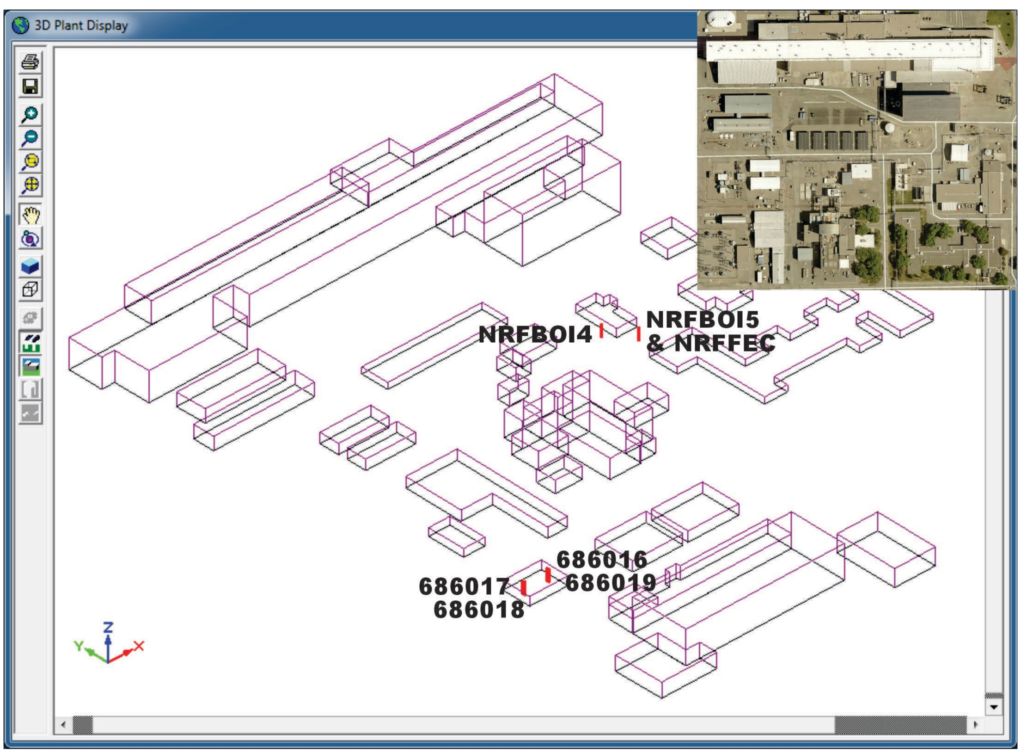

Figure 21. Wireframe image of buildings at NRF for calculating wake effects for boiler sources NRFBOI4, NRFBOI5, ICE sources 686016, 686017, 686018, 686019 and OV&G source NRFFEC. Facility plot map shown in upper right corner.

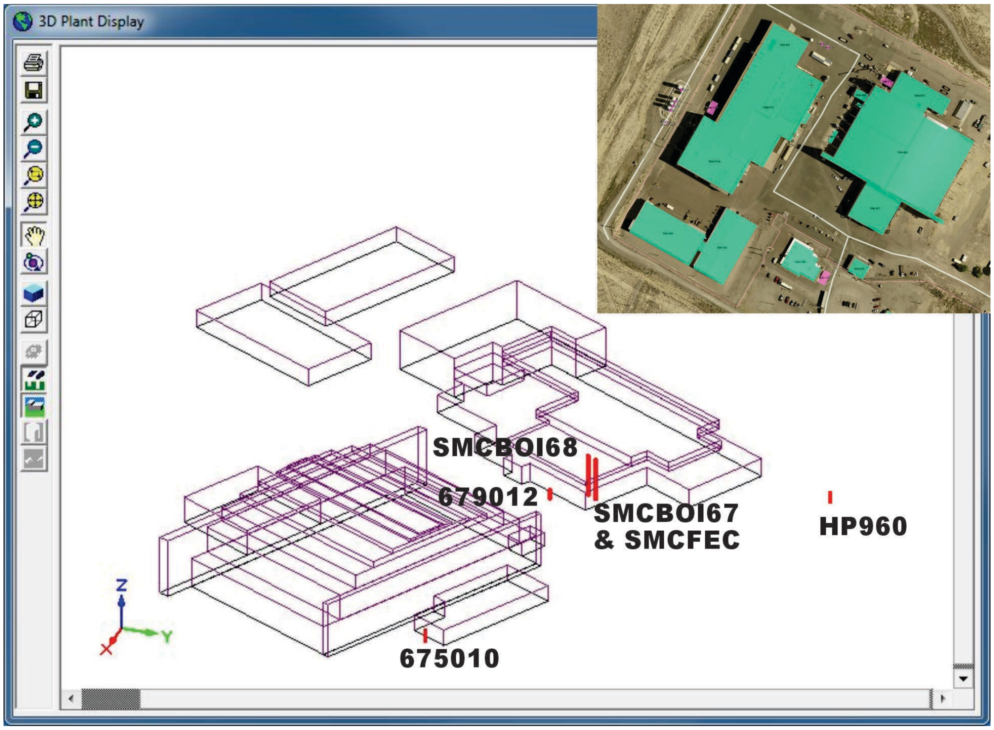

Figure 22. Wireframe image of buildings at SMC for calculating wake effects for boiler sources SMCBOI67, SMCBOI68, ICE sources 675010, 679012 and OV&G increase SMCFEC. Facility plot map shown in upper right corner.

5.6 Ambient Air Boundary

As described in Section 2, DOE-ID controls all activities within the INL Site boundary. The Site has no permanent residents, and ingress and egress of Site personnel and visiting personnel are strictly controlled. No casual visits are permitted, except for persons driving through the INL Site on one of five public highways (20, 22, 26, 28 and 33) and visitors to EBR-I, a national historic monument, which is open during the summer months. Security forces may interrupt traffic on INL roads or public roads that transect the INL Site during emergencies and other times to support operations of the Laboratory.

For the purposes of this assessment, ambient air on the INL Site is defined by areas occupied by the public highways, short roads up to the entry gates at each facility, and the area around EBR-I. Ambient air off the INL Site is any area outside the INL Site boundary.

CHECKLIST

_____If any of the following apply, the effect on areas excluded from ambient air is thoroughly described in this section: a river/stream bisecting the facility; the facility is on leased property or is leasing property to another entity; the facility is not completely fenced; there are right-of-way areas on the facility; the nature of business is such that the general public have access to part or all of the facility.

_____This section thoroughly describes how the facility can legally preclude public access (and practically preclude access) to areas excluded from ambient air in the modeling analyses.

5.7 Receptor Network

Receptor locations defined in UTM coordinates based on datum NAD 83, were provided by DEQ modeling staff in the file *AERMAP723.rcf*. This is a text file written in AERMOD format and was used directly in each AERMOD input file. The 1,352 receptor locations shown in Figure 23 are spaced approximately every 500 meters around the INL Site boundary and along highways that transect the INL Site. Finer spacing (~100 meters) was used near facilities where concentrations may be higher (i.e. along Highway 20/26 between AMWTP and CFA, from Highway 20 to the MFC guard gate, and along Highway 33 near the entrance to SMC. Finer spacing was also used in gridded areas around EBR-I (~40 m) and Atomic City (~200 meters). All receptors were considered for each pollutant and averaging period for determining maximum impacts.

CHECKLIST

_____This section of the Modeling Report provides justification that receptor spacing used in the air impact analyses was adequate to reasonably resolve the maximum modeled concentrations to the point that NAAQS or TAP compliance is assured.

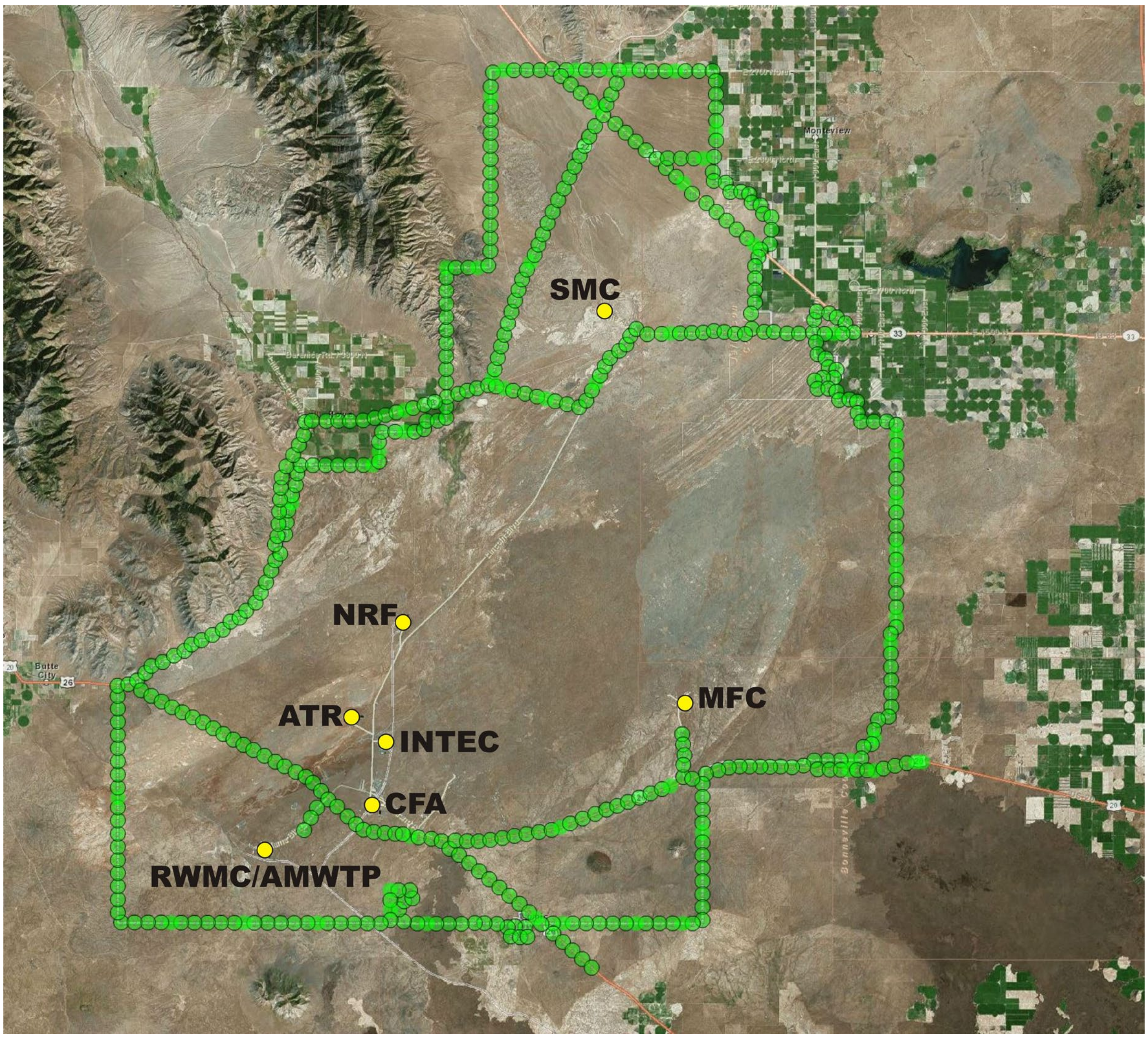

Figure 23. Receptor locations (green circles) for INL Site AERMOD modeling. Most circles indicate two locations.

5.8 Background Concentrations

Background concentrations for CAPs were obtained using the NW-AIRQUEST web-based retrieval tool developed by Idaho DEQ, Oregon DEQ, and Washington State Department of Ecology (https://arcg.is/1jXmHH). The tool estimates criteria pollutant concentrations (design values) following EPA methodology for use as background concentrations for permit modeling. The tool combines multiyear monitoring data (July 2014 through June 2017) with model data and interpolation methods to estimate design values on a 4-km grid over the northwest United States.

Design values from 143 points on or inside the INL Site boundary (see Figure 24) were used to estimate average background concentrations on the INL Site. Table 18 shows the minimum, maximum, average and standard deviation for the 143 locations. The relatively small standard deviation indicates very little variation across the 143 locations. For the cumulative impact analysis, the average background concentrations in Table 18 were added to maximum modeled concentrations for comparison to NAAQS.

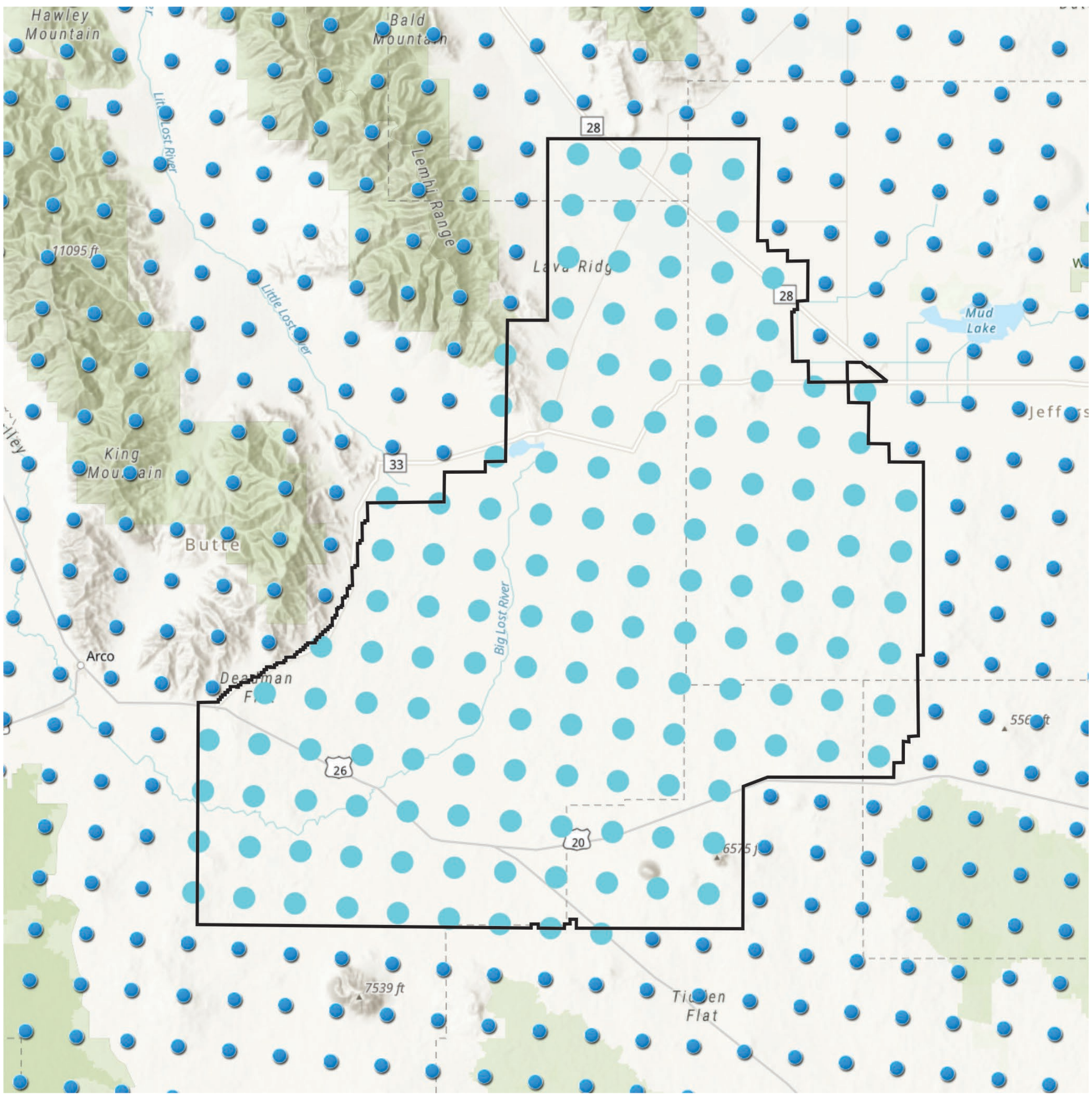

Figure 24. Map showing grid locations where CAP background concentrations are estimated using the NW-AIRQUEST web-based tool. Data from the 143 larger light-blue locations were used for estimating INL Site background concentrations.

Table 18. CAP background concentration (µg/m³) summary for the INL Site.

Pollutant	Averaging Time	Minimum Concentration[a]	Maximum Concentration[a]	Average Concentration[a]	Standard Deviation[a]
SO_2	1 hr	12.1	12.6	12.3	0.07
	3 hr	16.8	17.0	16.8	0.02
	24 hr	6.3	6.8	6.5	0.10
	Annual	1.3	1.3	1.3	0.0
NO_2	1 hr	2.6	20.3	6.2	2.1
	Annual	0.6	3.6	1.2	0.4
CO	1 hr	2015	2084	2043	16.2
	8 hr	1122	1156	1130	8.4
$PM_{2.5}$	24 hr	10.1	12.9	11.2	0.5
	Annual	2.9	4.1	3.3	0.2
PM_{10}	24 hr	71	81	77	2.9

a. NW-AIRQUEST web-based tool provides SO_2, NO_2 and CO concentrations in ppb. Conversion to µg/m³ was performed assuming an ideal gas with a molar volume of 22.4 L/mol.

CHECKLIST

_____Background concentrations have been thoroughly documented and justified for all criteria pollutants where a cumulative NAAQS impact analysis was performed.

5.9 NO_X Chemistry

As discussed in Section 4.1.3, NO_X chemistry was not considered in the modeling. The results conservatively assume 100% of the NO_X concentrations convert to NO_2 and no credit was taken for reduction or conversion to NO_2.

CHECKLIST

_____If OLM or PVMRM was used to address NO_X chemistry, reasons for selecting one algorithm over the other are provided in this section.

6. RESULTS AND DISCUSSION

6.1 Criteria Air Pollutant Cumulative NAAQS Impact

Table 19 presents the maximum modeled concentrations, based on design-capacity emissions, and the maximum modeled concentrations, based on design-capacity plus OV&G emissions. For each pollutant and averaging period, the maximum modeled concentration based on design-capacity plus OV&G emissions was added to the average background concentration to estimate the total ambient impact which was compared to the NAAQS.

The modeling results show all predicted CAP impacts are less than applicable standards and will not cause a NAAQS violation. The highest pollutant concentration (as a percent of the NAAQS) is the 1-hr SO_2 (99% of the standard). The next highest are the 24-hr PM concentrations (85% and 73% for $PM_{2.5}$ and PM_{10} respectively). However, the PM concentrations are inflated because the emissions include total PM plus condensable PM. Additionally, the PM background concentrations are a significant portion of the estimated impact.

Because the maximum 1-hr SO_2 concentration was 99% of the NAAQS, DEQ requested additional receptors around the location of maximum concentration to ensure the maximum concentration was captured by the modeling. These additional receptors resulted in no increase to the maximum modeled concentration shown in Table 19. This is discussed in Appendix B.

The greatest impact of adding the OV&G increase occurred when it was released at CFA. This is the result of CFA being closer to receptors (< 1.3 km from Highway 20/26) than other facilities. The next highest concentrations occurred when the OV&G emission increase was placed at MFC or SMC depending on the CAP and averaging period.

There are multiple conservatisms considered in the CAP analysis that help build confidence that the standards will not be exceeded. These include:

- NO_X chemistry was not considered in the modeling; the model results assume 100% of the NO_X concentrations convert to NO_2
- Many of the OV&G emission sources were assigned to an existing boiler stack which lessens potential dispersion by collocating it with an existing source
- OV&G emission sources not assigned to an existing boiler were assigned a conservative stack height, exit velocity, and exit temperature
- The emission rate for $PM_{2.5}$ and PM_{10} was assumed to be total PM plus condensable PM
- Deposition was not considered for PM emissions
- Tiers of some multi-tiered buildings were not explicitly included when determining wake effects, and the entire building height was assumed equal to the tallest tier of the building
- All receptor locations were considered for determination of ambient impacts for all averaging periods; this is extremely conservative for annual averaging periods.

CHECKLIST

_____Model input and output files for the cumulative NAAQS impact analyses are provided with the permit application.

_____If there were modeled NAAQS violations, all violations were analyzed and clearly show that the project did not significantly contribute to those modeled violations.

Table 19. Cumulative NAAQS impact analyses results.

CAP	Averaging Period (Acceptable Model Design Value Used)	Maximum Modeled Concentration Based on Design Capacity (µg/m³)	Maximum Modeled Concentration Based on Design Capacity + OV&G Increase (µg/m³)	Facility Where Adding OV&G Increase Resulted in Maximum Concentration	Average Background Concentration (µg/m³)	Maximum Total Ambient Impact (Includes OV&G Increase) (µg/m³)	NAAQS (µg/m³)	Total Impact as a Percent of NAAQS
SO_2	1-hr (mean max 4th highest)	0.9	181	CFA	12.3	194	196	99%
	3-hr (max 2nd highest)	0.54	150	CFA	16.8	167	1,300	13%
	24-hr (max 2nd highest)	0.12	39	CFA	6.5	45.5	365	12%
	Annual (max 1st highest)	0.02	2.5	CFA	1.3	3.8	80	5%
NO_2[a]	1-hr (mean max 8th highest)[b]	18.9	58	CFA	6.2	64	188	34%
	Annual (max 1st highest)	0.39	1.2	CFA	1.2	2.4	100	2%
CO	1-hr (max 2nd highest)	9.6	287	CFA	2043	2330	40,000	6%
	8-hr (max 2nd highest)	2.3	107	CFA	1130	1237	10,000	12%
$PM_{2.5}$[c]	24-hr (mean max 8th highest)	0.17	19	CFA	11.2	29.7	35	85%
	Annual (mean max 1st highest)	0.03	3.0	CFA	3.3	6.3	12	52%
PM_{10}[c]	24-hr (max 6th highest)	0.29	33	CFA	77	110	150	73%

a. No credit taken for reduction or conversion of NO_X to NO_2.
b. 1-hr NO_2 results do not include emergency stationary ICE according to DEQ (2013).
c. $PM_{2.5}$ and PM_{10} emissions include total PM and condensable PM.

6.2 Toxic Air Pollutant Impact

TAPs were not modeled based on the evaluation presented in Section 3.3 that determined uncontrolled emissions for regulated TAPS were less than the ELs in IDAPA 58.01.01.585 for non-carcinogens and less than the EL increments in IDAPA 58.01.01.586 for carcinogens. Therefore, no compliance demonstration was performed, and concentrations are expected to be less than applicable standards for all TAPs.

7. QUALITY ASSURANCE/CONTROL

The air dispersion analyses documented in this report were prepared and peer-reviewed by qualified air-quality professionals experienced in modeling. The modeling and required impact analyses are consistent with protocols and methodologies from the *State of Idaho Guideline for Performing Air Quality Impact Analyses* (DEQ 2013).

All computer code modeling and spreadsheet calculations for this report were performed on a Dell Precision 7820 computer (Intel Xeon Silver 4110 CPU @ 2.10 GHz) running Microsoft Windows 10 Enterprise. All electronic files including computer code input, output, executable files, and spreadsheet files will be provided to DEQ with the revised permit application (DOE-ID 2020).

8. REFERENCES

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Appendix A

Summary of Meteorological Data Processing of Model-Ready Data Files Provided by Idaho Department of Environmental Quality

Meteorological Data Processing Summary for INL/Grid3 Mesowest site for the period 2013-2017

An updated meteorological data set—from the latest 5-year period (2013–2017) from the GRID3 Mesowet monitor site (WMO ID 463502) located within the INL facility west of Idaho Falls, Idaho—that can be utilized by the AERMOD modeling system has been created and is now available for use for air-quality modeling in the locale of INL. The site is located at LatLong 43.589N and 112.94W.

Onsite meteorological data were downloaded from the Mesowest website (http://www/mesowest/utah.edu) for the period 2013–2017. These data were supplemented with National Weather Service (NWS) surface data from KIDAI, Station ID 725785-24145, downloaded from the NCDC website *(http://www.ncdc.noaa.gov)* in standard ISHD format for the same period, 2013–2017. The upper air soundings required by AERMET were also taken from the Boise airport Station (ID 24131), and were downloaded from the *ESRL.noaa.gov* radiosonde data site in standard FSL format.

Land-use data were collected in 1992 NLCD format from the MRLC Consortium data retrieval site: *http://www.mrlc.gov/viewerjs/*. (AERSURFACE currently only supports data in 1992 format.)

The latest versions of the modeling programs were used. They were :

: AERMET Version 18081
: AERMINUTE Version 15271
: AERSURFACE Version 13016.

Moisture content was assessed for the last thirty years of data at Idaho Falls airport. The year 2013 was assessed as average moisture content, defined as within the 30th percentile of the 30 year mean of 15.5 inches. Two years, 2014 and 2015, were assessed as wet years. The years 2016 and 2017 were assessed as dry years. Therefore, AERSURFACE was run for average conditions for year 2013; AERSURFACE was run for “wet” conditions for the years 2014 and 2015, and “dry” conditions for 2016 and 2017. Continuous snow cover for extended periods were evident from examination of local climatological records for the years 2013–2017 and, therefore, were assessed in the processing.

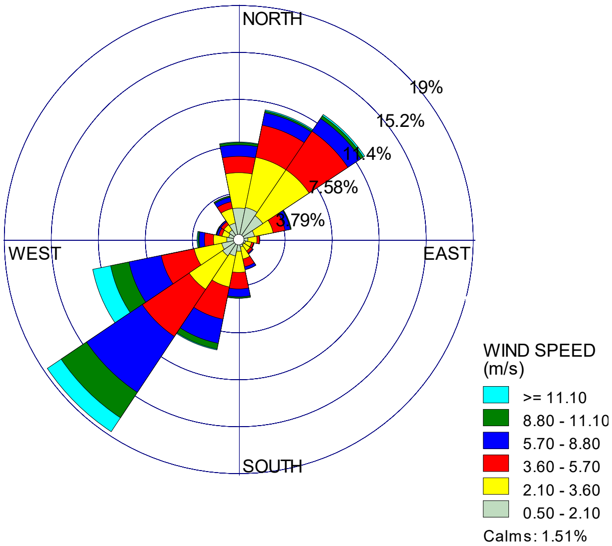
Table A-1. Idaho Falls annual precipitation and moisture.

	Inches	Year	Yearly Inches	Rating
30 Year Mean	15.54	2013	13.45	Avg
Mean -30 percentile	12.19	2014	21.06	Wet
Mean +30 percentile	18.91	2015	19.77	Wet
		2016	11.54	Dry
		2017	11.33	Dry

Comparative AERMOD runs were made using previously processed INL GRID3 AERMET data from 2000–2004 and this AERMET data set to confirm consistency in results. Results were similar. Sets were created without and with the “USTAR” option used; the data incorporating the ustar* option are denoted as version “D.”

The average wind speed of the data for the period from 2013–2017 is 4.3 m/s, and the percent calm distribution is 2%. Missing data account for less than 1% of the data period.

Included in Figure 25 are wind rose and data frequency distribution graphs.



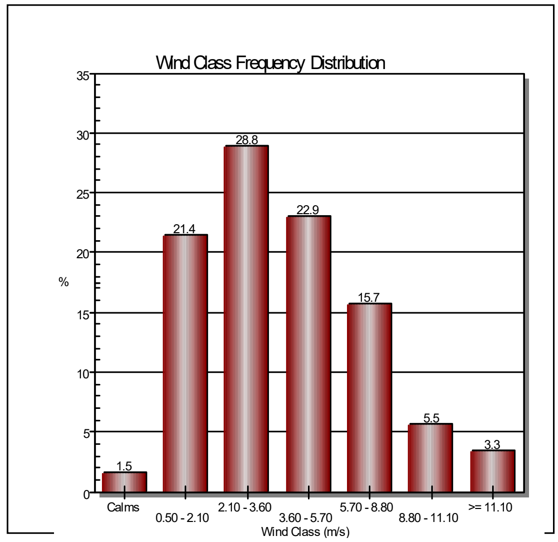


Figure A-1. Wind rose and data-frequency distribution graphs.

Appendix B

Explanation and Impact of New Receptors Added to the Modeling Following the Review by Idaho Department of Environmental Quality

After Idaho DEQ's initial review of the permit-revision application, DEQ declared the application incomplete and requested additional items be provided in order for the review to proceed [letter/email from Chris Duerschner (DEQ) to Nicole Hernandez (DOE-ID), July 21, 2020]. One request was that INL add more receptors around the location of maximum 1-hr SO_2 impact. DEQ requested the additional receptors "to demonstrate that the pollutant-specific receptor grid is adequately able to resolve the maximum modeled concentration and confidently demonstrate compliance with the 1-hour SO_2 NAAQS." DEQ also requested a graphic showing concentrations at receptors in the vicinity of the maximum modeled impact to provide evidence that receptor spacing was adequate.

Upon receipt of the incomplete application determination, INL requested further clarification on the new receptor locations and DEQ provided the coordinates for eight new receptors [email from Pao Baylon (DEQ) to Kristopher Murray (BEA), July 24, 2020]. The email also stated that INL could submit an addendum to the modeling report that demonstrates compliance with the 1-hour SO_2 NAAQS once the eight additional receptors were modeled for the case where the full operational variability and growth components are released at CFA. This is the scenario that results in the maximum 1-hr SO_2 impact. The information in this appendix was created to address DEQ's demands.

B-1. Model Results Before Adding New Receptors

Figure B-1 shows the receptor locations along Highway 20/26 south of CFA used in the model for the original permit-revision application. Receptors on Highway 20/26 are spaced approximately 450 m apart, except for an 11 km stretch south of CFA where 115 receptors (labeled from 1004 to 1118) are spaced approximately 95 m apart. The receptor locations and elevations were provided by Thomas Swain of DEQ in 2015 and used in the modeling for the original application. The location of maximum impact for 1-hr SO_2 was Receptor 1078, as indicated in the figure.

Figure B-2 shows the modeled 1-hr SO_2 concentrations at Receptors 1004–1118 shown in Figure B-1. The concentrations are the result of releasing the total operational variability and growth component at CFA from the CFA-608 boiler stack. The concentrations are the 5-year average of the fourth highest maximum daily 1-hr SO_2 concentrations, which is the acceptable model-design value for 1-hr SO_2 (see Table 3 in main report). The concentrations include the average INL background concentration of 12.3 $\mu g/m^3$ (see Section 5.8 in main report), so the maximum impact is the model predicted concentration (181.3 $\mu g/m^3$), plus background (12.3 $\mu g/m^3$) for a total impact of 193.6 $\mu g/m^3$. The NAAQS for 1-hr SO_2 is 196 $\mu g/m^3$.

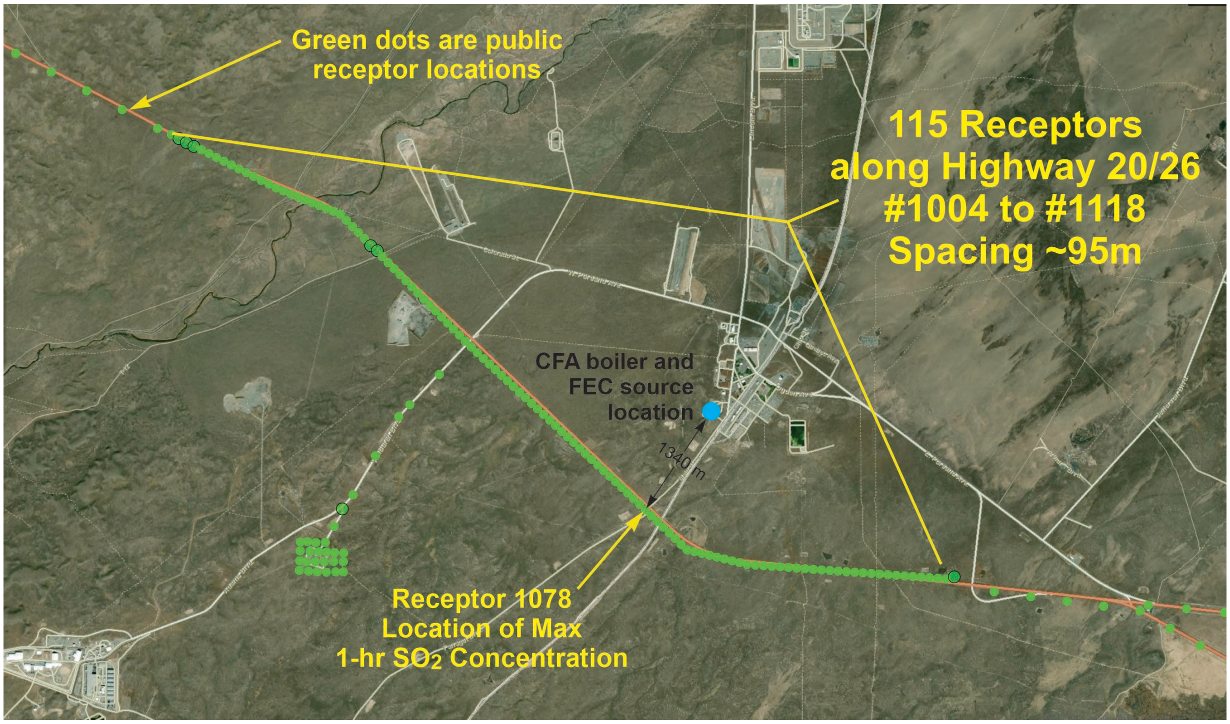


Figure B-1. Public receptor locations (green dots) near CFA used in the model for the original permit revision application.

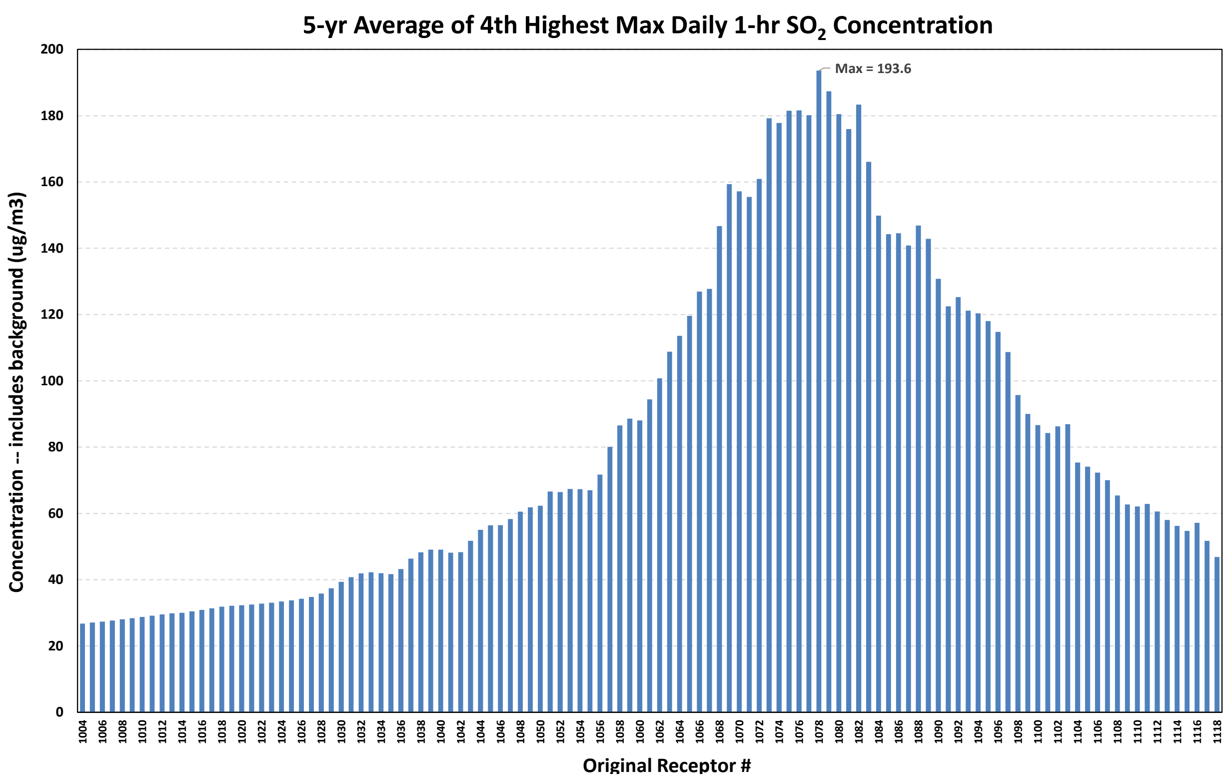


Figure B-2. One-hour SO_2 concentration for Receptors 1004–1118 along Highway 20/26 south of CFA (see Figure B-1 for locations). These are the original receptor locations.

B-2. Model Results After Adding 8 New Receptors

Eight new receptor locations provided by DEQ were added to the modeling simulation for 1-hr SO_2. The coordinates and elevations for the eight new locations are shown in Table B-1. Although AERMOD does not assign receptor numbers, the receptors were renumbered for tracking and plotting purposes only. The elevations in Table B-1 were determined by running AERMAP.

Table B-1. UTM coordinates for 8 new receptor locations.

Receptor #	UTM Northing (m)	UTM Easting (m)	Elevation (m)
1078	341629.1	4820028	1513.44
1079	341643.1	4820014	1513.06
1080	341656.6	4820001	1513.06
1081	341670.3	4819987	1513.06
1082[a]	341683.7	4819974	1513.06
1083	341697.2	4819960	1513.06
1084	341711.1	4819947	1513.06
1085	341724.4	4819933	1513.06
1086	341738.6	4819919	1513.06

Figure B-3 shows the locations of the original receptors and the eight new receptors along Highway 20/26. Figure B-4 shows a close-up view of the area where the maximum impact occurs and where the eight new receptors were placed. The green dots in both figures are the original receptor locations; the orange dots are the eight new receptor locations. The receptors were renumbered after inserting the eight new receptors.

Figure B-5 shows the modeled 1-hr SO_2 concentrations at Receptors 1004–1126, shown in Figure B-3. The graph shows the maximum concentration is the same and occurs at the same receptor location. The concentrations at the eight new receptor locations are all less than the original maximum. Thus, the addition of new receptors did not result in an increase to the maximum predicted impact.

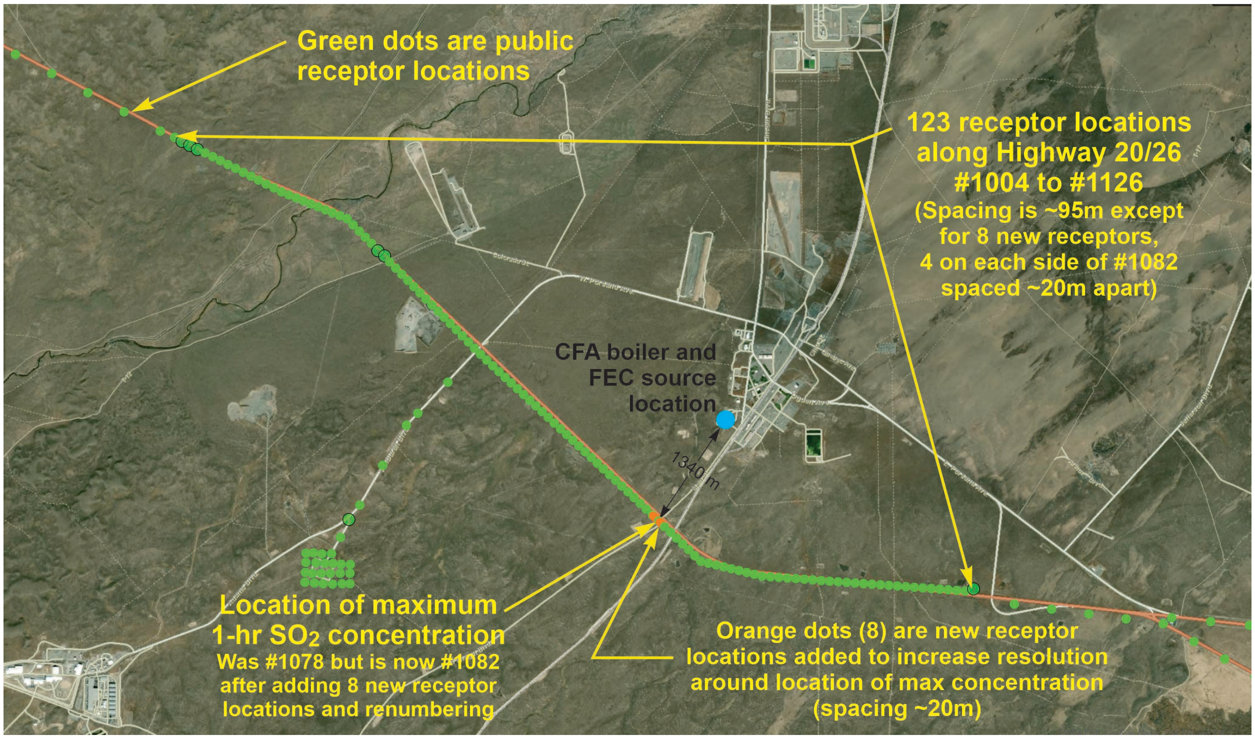


Figure B-3. Public receptor locations near CFA showing the eight new receptor locations.

Figure B-4. Close up of public receptor locations near CFA showing the eight new receptor locations.

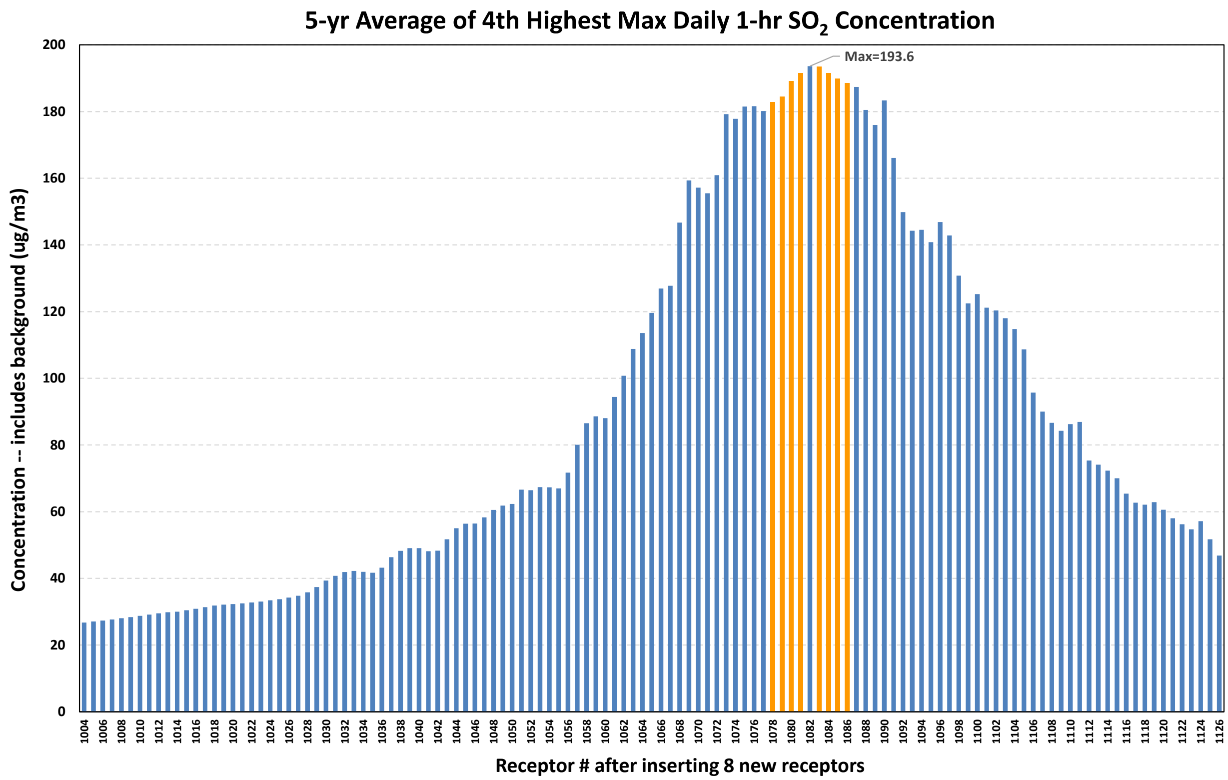


Figure B-5. One-hour SO_2 concentration for Receptors 1004–1126 along Highway 20/26 south of CFA (see Figure B-3 and Figure B-4 for locations). These are the original receptors (blue) plus the eight new receptors (orange).