Department of Energy
Idaho Operations Office
1955 Fremont Avenue
Idaho Falls, ID 83415

June 28, 2023

Mr. Jim McAuley
Environmental Protection Agency, Region 10
Office of Air and Waste
1200 Sixth Avenue, Suite 900
M/S AWT-155, OAW-150 Seattle, WA 98101

SUBJECT: National Emission Standards for Hazardous Air Pollutants - Calendar Year 2022 Idaho National Laboratory Report for Radionuclides, June 2023 (CLN231285)

Dear Mr. McAuley:

In accordance with 40 CFR 61.94, the Department of Energy, Idaho Operations Office (DOE-ID) is submitting the National Emission Standards for Hazardous Air Pollutants - Calendar Year 2022 Idaho National Laboratory (INL) Report for Radionuclides. The effective dose equivalent (EDE) from site facilities to the maximally exposed individual (MEI) member of the public was calculated at 1.78E-02 millirem per year. The EDE for the INL Research and Education Complex (REC) to the MEI member of the public was calculated at 4.03E-03 millirem per year. Radionuclide emissions from REC are not included in the INL Site EDE. The Naval Reactors Facility (NRF), located on the INL Site, report is included in Appendix B for information only and the NRF emissions are included in the INL Site EDE. The report and DOE-ID certification statement are included in this electronic submittal.

If you have any questions concerning the report, please contact me, at (208) 526-5004 or (208) 541-2821.

Sincerely,

JAMES LANER

Digitally signed by JAMES LANER
Date: 2023.06.28 08:33:17 -06'00'

James Laner
Environment and Sustainability Division

Enclosures (2)

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DOE/ID-11441 (2023)

U.S. Department of Energy
Idaho Operations Office

National Emission Standards for Hazardous Air Pollutants - Calendar Year 2022 INL Report for Radionuclides

June 2023

Idaho National Laboratory

DOE/ID-11441 (2023)

National Emission Standards for Hazardous Air Pollutants - Calendar Year 2022 INL Report for Radionuclides

June 2023

Prepared for the
U.S. Department of Energy
Idaho Operations Office

ABSTRACT

The U.S. Department of Energy (DOE) Idaho National Laboratory (INL) Site operates facilities with potential emissions of radioactive materials. This report has been prepared to comply with the *Code of Federal Regulations*, Title 40, Protection of the Environment, Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities" (Subpart H). Subpart H requires the measurement and reporting of radionuclides emitted from DOE facilities that result in an offsite dose from those emissions.

This report documents the calendar year 2022 radionuclide air emissions and resulting effective dose equivalent to the maximally exposed individual (MEI) member of the public from operations at the INL. The MEI is defined in Subpart H as any member of the public at any off-site location where there is a residence, school, business, or office.

For calendar year 2022 the effective dose equivalent to the maximally exposed individual member of the public was 1.78E-02 millirem (mrem) per year, which is 0.18 percent of the 10 mrem per year standard, for the INL Site. The effective dose equivalent to the maximally exposed individual for the Research and Education Campus was 4.03E-03mrem per year or 0.04 percent of the standard.

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FIGURES

TABLES

ACRONYMS

AFF	Advanced Fuel Facility
AMWTP	Advanced Mixed Waste Treatment Project
ARP	Accelerated Retrieval Project
ATR	Advanced Test Reactor
BEA	Battelle Energy Alliance, LLC
CAP	Clean Air Act Assessment Package
CEM	Continuous Emission Monitoring
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
Ci	curies
CITRC	Critical Infrastructure Test Range Complex
CPP	Chemical Processing Plant
CY	calendar year
D&D	deactivation and decommissioning
DOE	Department of Energy
EDE	effective dose equivalent
EML	Electron Microscopy Laboratory
EPA	Environmental Protection Agency
FASB	Fuels and Applied Science Building
FAST	Fluorinel and Storage Facility
FCF	Fuel Conditioning Facility
FMF	Fuel Manufacturing Facility
HEPA	high-efficiency particulate air
HFEF	Hot Fuel Examination Facility
HPIL	Health Physics Instrument Laboratory
ICDF	Idaho CERCLA Disposal Facility
ICE	Inner Contamination Enclosure
IEC	Idaho Environmental Coalition, LLC
IMCL	Irradiated Materials Characterization Laboratory
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IRC	INL Research Center
LLMW	low-level mixed waste
L&O	Laboratory and Office Building
MEDE	melt-drain-evaporate
MEI	maximally exposed individual
MFC	Materials and Fuels Complex
mrem	millirem
MTR	Material Test Reactor
NESHAP	National Emission Standards for Hazardous Air Pollutants

NPTF	New Pump and Treat Facility
NRF	Naval Reactors Facility
NWCF	New Waste Calcining Facility
OCVZ	Organic Contamination in the Vadose Zone
OU	operable unit
PIC	Potential Impact Category
QC	quality control
REC	Research and Education Campus
RCE	Retrieval Contamination Enclosure
RCRA	Resource, Conservation, and Recovery Act
RESL	Radiological and Environmental Sciences Laboratory
RDD	radiological dispersion device
RRTR	Radiological Response Training Range
RSWF	Radioactive Scrap Waste Facility
RWMC	Radioactive Waste Management Complex
SCMS	Sodium Components Maintenance Shop
SDA	Subsurface Disposal Area
SMC	Specific Manufacturing Capability
STAR	Safety and Tritium Applied Research
TAN	Test Area North
TDS	Thermal Desorption Spectroscopy
TMI	Three Mile Island
TRA	Test Reactor Area
TSF	Technical Support Facility
WAG	Waste Area Group
WMF	Waste Management Facility

National Emission Standards for Hazardous Air Pollutants - Calendar Year 2022 INL Report for Radionuclides

1. INTRODUCTION

This report documents radionuclide air emissions for calendar year (CY) 2022 and the resulting effective dose equivalent (EDE) to the maximally exposed individual (MEI) member of the public from operations at the U.S. Department of Energy (DOE) Idaho National Laboratory (INL) Site.

The title of each section in this report corresponds to reporting requirements found in 40 *Code of Federal Regulations* (CFR) Part 61.94. A description of the applicable reporting requirements is cited under the titles in italicized text followed by the compliance status for the INL Site facilities.

Appendix A contains information specific to INL Research and Education Campus (REC) which includes the INL Research Center (IRC) and the Radiological and Environmental Sciences Laboratory (RESL) emissions located in Idaho Falls, Idaho. Radionuclide emissions from the REC are not included in the INL Site EDE calculation since the facilities are not contiguous. Compliance to the 10 millirem (mrem) per year dose standard is demonstrated by documenting REC radionuclide air emissions and the resulting EDE to its MEI from operations at the IRC and RESL.

Appendix B of this report contains information specific to the Naval Reactors Facility (NRF) located within the INL Site boundary. The EDE for NRF radionuclide emissions is included in the INL Site EDE to demonstrate overall compliance to the 10-mrem/year dose standard set by 40 CFR Part 61, Subpart H (Subpart H), "National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities."

For CY 2022, modeling was performed using Clean Air Act Assessment Package - 1988 PC (CAP88), Version 4.1.

2. 40 CFR PART 61.94(a) Effective Dose Equivalent

"Compliance with this standard shall be determined by calculating the highest effective dose equivalent to any member of the public at any offsite point where there is a residence, school, business or office. The owners or operators of each facility shall submit an annual report to both Environmental Protection Agency (EPA) headquarters and the appropriate regional office by June 30, which includes the results of the monitoring as recorded in DOE's Effluent Information System and the dose calculations required by §61.93(a) for the previous calendar year."

This report documents the INL Site radionuclide air emissions and the resulting EDE to the MEI for CY 2022. It was prepared in accordance with the Subpart H. As required, this report is submitted to both the EPA Headquarters and the appropriate regional office (EPA Region 10) no later than June 30, 2023.

2.1 Reporting Period Discussion

INL re-evaluated receptors and locations for the 2022 reporting year data. This effort both evaluated the possibilities of new receptors previously unaccounted for, as well as minimizing the total quantity. All receptors within a specified offset from the INL boundary were identified. Of those identified, one from each of the 16 sectors, if available, for each source were selected based on their proximity and orientation. The closest receptor in each sector relative to each source was selected. Of those receptors, many overlapped from one source to the next, and many of the other potential receptors were located within the same relative sector but further from the source. Those receptors were removed as they would not have the potential to receive the highest EDE from any of the sources. This effort reduced the total number of receptors from 62 to 31 surrounding the INL Site. This effort also changed the numbering of the receptors. Most notably, the receptor previously receiving the highest EDE, receptor 54, is now receptor 26.

INL has also recently participated in an inspection at the Advance Test Reactor, report dated April 13, 2022. In that inspection, EPA identified an area of concern in the methods that INL uses to calculate estimated emissions from minor sources that incorporate reductions from HEPA filtration. As of the writing of this report, this matter has not been resolved. INL is reporting emissions consistent with historical practice as well as including the comparison of total emissions using EPA's preferred Appendix D methodology for reference.

2.2 Emissions and EDE

Table 1 below tabulates the emissions and resulting EDE to both receptors previously reported as the MEI. Included are those estimated emissions utilizing EPA's preferred Appendix D methodology. It should be noted that the estimated emissions effected by the difference in methods are those that are estimated due to their low potential to emit, and those emissions that would have otherwise been reduced due to filtration through HEPA filters. Noble gases or other material heated to the gaseous state would not result in differing emissions based on the difference in these methods.

Table 1. CY 2022 Emissions and Resulting Dose from Existing Method Compared to Appendix D Methodology.

Receptor	Historical Method (DOE-HDBK)		Appendix D Method	
	Emissions (Ci/yr)	EDE (mRem/yr)	Emissions (Ci/yr)	EDE (mRem/yr)
1	315.92	0.0097	315.93	0.0182
26	315.92	0.0178	315.93	0.0203

Receptor 26 received the highest EDE resulting in the MEI again for reporting year 2022. Receptor 26 is the same receptor as previous years Receptor 54. This change was due to the receptor re-evaluation effort conducted earlier in the year, as mentioned above. Receptor 26 is a farm and cattle operation located approximately 2.3 km south of the INL border, and northeast of the East Butte (see Figure 1). The dose to the MEI, 0.0179 mRem/year, is consistent with recent years, down slightly from 2021 of 0.067 mRem/year. 0.0179 mRem/year is 0.179% of the 10 mRem/year Submpart H Standard. The cause for the reduced emissions are primarily from the lack of operation of the Advanced Test Reactor in CY22 and removal of inventory from the MFC Radiochemistry Laboratory.

2.2.1 Emissions Determination & Methodology

Emissions from the INL are determined via three primary methods consisting of: continuously monitored Potential Impact Category (PIC) 1 or PIC 2 sources, measured PIC 3 or PIC 4 sources, and estimated PIC 3 or PIC 4 sources. These sources are estimated or measured based on a graded approach to emission estimates.

The majority of emissions are derived from the measured PIC 3 or PIC 4 sources and consist of a variety of sampling and or measuring methods, such as periodic destructive/ non-destructive filter analysis, engineering analysis based on operating energies and activation coefficients, continuous sampling, etc. Table 2 below tabulates the highest emitted radionuclides for each monitoring or estimating category as well as the total emissions and percent emissions from that category for CY 2022.

The second largest contribution of emissions, but the largest contribution to EDE is from the estimating of PIC 3 or PIC 4 sources. The primary form of estimating emissions in this category is calculating emissions from inventories or materials used over the reporting period. Inventories are assumed emitted to the atmosphere based on resuspension factors derived from their physical states and any downstream abatement reductions.

The method contributing the least emissions, but also the most accurate are the continuously monitored or sampled PIC 1 or PIC 2 sources. Emissions from those sources are tabulated in Table 4 below.

Table 2. Emissions and EDE by Measurement or Estimation Method.

Method	Emissions (Ci/yr)		Dose (mRem/yr)	
	Total	%	Total	%
PIC 1 & 2	1.37E-06	0.00000%	2.83E-07	0.00159%
Measured	201.77	63.87%	0.0005	2.82%
Estimated	114.15	36.13%	0.0173	97.18%
Total	315.92		0.01780	

Table 3. List of Emission Sources Used to Determine the MEI.

Facility	Source
Advanced Test Reactor (ATR) Complex:	Test Reactor Area (TRA)-670-074, ATR Chemistry Laboratory fume hoods exhaust
	TRA-670-086, laboratory fume hood exhaust
	TRA-670-098, laboratory fume hood exhaust (2 hoods)
	TRA-670, ATR canal
	TRA-678-001, Radiation Measurements Laboratory fume hoods vent
	TRA-710-001, Materials Test Reactor (MTR) stack
	TRA-715-001, Warm Waste Evaporation Pond
	TRA-770-001, ATR main stack

Facility	Source
	TRA-1626, Test Train Assembly Facility TRA-1627-001, Radioanalytical Chemistry Laboratory
Central Facilities Area (CFA):	CFA-625, CFA Laboratory Complex Tritium emissions from pumped aquifer water
Critical Infrastructure Test Range Complex (CITRC):	Power Burst Facility-(PBF)-612, CITRC Control System Research Facility PBF-623, CITRC Wireless Communication Support PBF-622, Explosives Detection Research Center Stack
Idaho Nuclear Technology and Engineering Center (INTEC):	Chemical Processing Plant (CPP)-603-001, Irradiated Fuels Storage Facility CPP-659-033, New Waste Calcining Facility (NWCF) Stack CPP-684-001, Remote Analytical Laboratory CPP-708-001, Main Stack CPP-749-001, Underground Fuel Storage/Vault Area CPP-767-001, FAST Stack CPP-1608-001, Manipulator Repair Cell CPP-1774, Three Mile Island (TMI)-2 Independent Spent Storage Installation CPP-2707, Dry Cask Storage Pad Idaho Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) Disposal Facility Landfill (ICDF) emissions from solid waste disposal ICDF pond emissions Operable Unit 3-14 Evaporation Pond
Materials and Fuels Complex (MFC):	CPP-653-001, Decontamination Testbed Facility MFC-704-008, Fuel Manufacturing Facility stack MFC-720-007, Transient Reactor Test Facility reactor cooling air exhaust MFC-752-004, Laboratory and Office Building (L&O) main stack MFC-752-005, L&O nondestructive assay stack MFC-764-001, Main Stack (Fuel Conditioning Facility [FCF] exhaust) MFC-768-105, Decontamination shower suspect waste tank vent MFC-768-108, Health Physics Area fume hood MFC-774-026, Electron Microscopy Laboratory (EML) exhaust MFC-774-027, EML exhaust MFC-774-028, EML exhaust MFC-774-029, EML exhaust MFC-777-002, Zero Power Physics Reactor MFC-784-001, Advanced Fuels Facility MFC-785-018, Hot Fuel Examination Facility stack MFC-787-001, Fuel Assembly and Storage Building MFC-792A-001, Space and Security Power Systems Facility MFC-793-001, Sodium Components Maintenance Shop (SCMS) stack MFC-794-002, Experimental Fuels Facility-West exhaust MFC-794-006, Experimental Fuels Facility-East exhaust MFC-1702-001, Radiochemistry Laboratory MFC-1729-001, Irradiated Materials Characterization Laboratory
Naval Reactors Facility	See Appendix B

Facility	Source
Radioactive Waste Management Complex (RWMC):	Waste Management Facility (WMF)-601-001, Health Physics Laboratory Hood WMF-615-001, Drum Vent Facility WMF-634-001, AMWTP Characterization Facility WMF-636-001, Transuranic Storage Area – Retrieval Enclosure WMF-636-002, RCE Stack, ICE Stack, and Contamination Control Enclosure WMF-676-002, AMWTP WMF-676-003, Glovebox Stack WMF-1612-001, Accelerated Retrieval Project (ARP)-II WMF-1614-001, ARP-III WMF-1615-001, ARP-IV WMF-1617-001, Sludge Repackaging Project, ARP V WMF-1619-001, ARP-VII WMF-1621-001, ARP-VIII WMF-1622-001, ARP IX RWMC H-3 from groundwater SDA Buried Beryllium Blocks
Test Area North (TAN) Specific Manufacturing Capability (SMC):	TAN-629-013, manufacturing process, Line 2A TAN-679-022, -023, -024 manufacturing process, north process TAN-679-025, -026, -027 manufacturing process, south process TAN-681-018, Process Reclamation Facility TAN-681-020, Process Reclamation Facility TAN-681-016, Process Reclamation Facility North Radiological Response Test Range (RRTR)
TAN Technical Support Facility (TSF):	Operable Unit (OU) 1-07B, New Pump and Treat Facility

2.2.2 EDE

Table 4 reports the annual radionuclide emissions for the INL Site sources that require continuous monitoring for compliance during CY 2022.

Table 4. Radionuclide emissions, in curies (Ci), from the INL Site continuously monitored point sources during CY 2022.

Radionuclide	MFC[a]-1729-001	MFC-785-018	MFC-764-001	MFC-704-008	CPP[a]-767-001	WMF[a]-636-002	WMF-676-002	WMF-676-003
Pu-239	2.16E-08	8.88E-08	2.31E-08	1.84E-08	ND	5.63E-09	ND	ND
Pu-240	---	---	---	---	---	5.63E-09	ND	ND
Sr-90	2.22E-07	4.54E-07	4.83E-07	5.07E-08	ND	ND	ND	ND

a. Materials and Fuels Complex (MFC), Chemical Processing Plant (CPP), Waste Management Facility (WMF).

Table 5. INL facility dose (mrem) contributions and total INL Site dose (mrem) to the MEI located at Receptor 26 for CY 2022 radionuclide air emissions.

Facility	Point source dose (mrem/yr)	Fugitive source dose (mrem/yr)	Total dose[a] (mrem/yr)	Notes
CFA Total	**5.43E-07**	**2.59E-06**	**3.13E-06**	Total from 3 CFA sources
CITRC Total	**2.56E-11**	**7.92E-15**	**2.56E-11**	Total from 3 CITRC sources
INTEC	1.21E-06	2.75E-04	2.76E-04	10 INTEC sources including ICDF, FAST Stack emissions were non-detect in 2022.
INTEC-MS	2.18E-07		2.18E-07	INTEC Main Stack (CPP-708)
INTEC Total	**1.43E-06**	**2.75E-04**	**2.77E-04**	Total from all INTEC sources
MFC	1.56E-02		1.56E-02	20 MFC sources
MFC-MS	4.92E-08		4.92E-08	MFC Main Stack (MFC-764)
MFC-TREAT	4.96E-04		4.96E-04	TREAT Exhaust Stack
MFC Total	**1.61E-02**		**1.61E-02**	Total from all MFC sources
NRF Total	**4.57E-05**	**1.20E-07**	**4.58E-05**	Total from all NRF sources
ATR Complex	3.37E-06	6.02E-04	6.05E-04	8 ATR Complex sources
ATR Complex-ATR	2.91E-06		2.91E-06	ATR Stack (TRA-770)
ATR Complex-MTR	0.00E+00		0.00E+00	No emissions from MTR stack in CY-22[a]
ATR Complex Total	**6.27E-06**	**6.02E-04**	**6.08E-04**	**Total from ATR Complex sources**
RRTR Total		**2.14E-04**	**2.14E-04**	Total from all RRTR sources
RWMC Total	**7.73E-05**	**5.34E-04**	**6.12E-04**	14 RWMC sources including ARPs. AMWTP and the Glovebox Stack emissions were non-detect in 2022.
TAN-SMC Total	**4.08E-09**		**4.08E-09**	Total from SMC emissions
TAN-TSF Total	**1.23E-06**		**1.23E-06**	OU 1-07B emissions
INL Site Total	**1.62E-02**	**1.63E-03**	**1.78E-02**	Total MEI dose from all INL Site sources

a. Emissions from Safety and Tritium Applied Research (STAR) facility (TRA-666) at the ATR Complex are typically routed to and out the MTR stack. During CY 2021, TRA-666 began a building ventilation system modification project and emissions were routed to a temporary stack. All TRA-666 emissions for CY-2022 were conservatively reported as a ground-level release and no emissions were reported from the MTR stack.

3. 40 CFR PART 61.94(b) (1)

"Name and location of the facility."

Site Name: Idaho National Laboratory Site.

Site Location: The INL Site encompasses approximately 890 square miles on the upper Snake River Plain in southeastern Idaho (see Figure 1). The nearest INL boundaries to population centers are approximately 22 mi (35.3 km) west of Idaho Falls, 23 mi (37 km) northwest of Blackfoot, 44 mi (70.8 km) northwest of Pocatello, 7 mi (11.3 km) east of Arco, 1 mi (1.6 km) north of Atomic City, 3 mi (5 km) west of Mud Lake and 2 mi (3 km) south of Howe. Figure 1 below displays the INL site along with the major facilities and the off-site MEI location (Receptor 26).

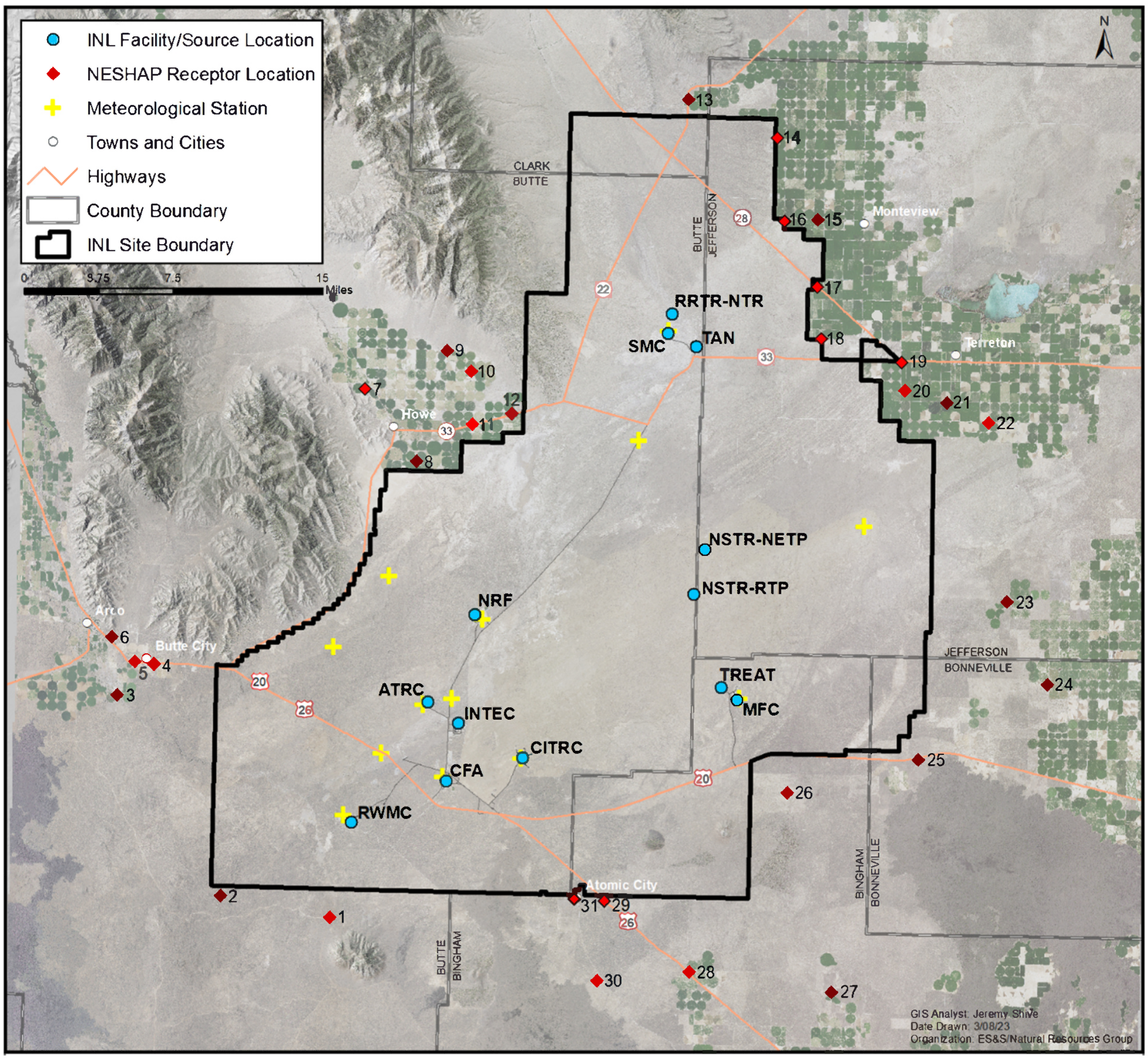

Figure 1. INL Site - Source and Receptor Locations

4. 40 CFR PART 61.94(b) (2)

"A list of the radioactive materials used at the facility."

The individual radionuclides found in materials used at the INL Site during CY 2022 are listed in Table 6. These materials included, but were not limited to, samples, products, process solids, liquids and wastes that have potential emissions.

Table 6. Radionuclides in use and potentially emitted to the atmosphere from the INL Site facilities in CY 2022.

Ac-227	Cm-243	Ho-166m	Ni-57	Pu-241	Sn-113	Tm-170
Ag-106	Cm-244	I-125	Ni-59	Pu-242	Sn-117m	Tm-171
Ag-108m	Co-57	I-126	Ni-63	Pu-244	Sn-119m	U-232
Ag-109m	Co-58	I-128	Ni-65	Ra-223	Sn-121	U-233
Ag-110	Co-58m	I-129	Ni-66	Ra-224	Sn-121m	U-234
Ag-110m	Co-60	I-130	Np-237	Ra-226	Sn-123	U-235
Ag-111	Co-60m	I-131	Np-239	Rb-83	Sn-125	U-236
Ag-112	Cr-51	I-132	Os-185	Rb-84	Sn-126	U-237
Am-241	Cs-134	I-133	Os-189m	Rb-86	Sn-127	U-238
Am-243	Cs-135	I-134	Os-191	Rb-87	Sn-128	V-48
Ar-39	Cs-136	I-135	Os-191m	Rb-88	Sr-80	V-49
Ar-41	Cs-137	In-114	Os-193	Rb-89	Sr-85	W-181
Ar-42	Cs-138	In-114m	P-32	Rb-90	Sr-89	W-185
As-73	Cs-139	In-115m	P-33	Re-184	Sr-90	W-187
As-76	Cs-140	In-117	Pa-231	Re-184m	Sr-91	W-188
As-77	Cu-64	Ir-190	Pa-233	Re-186	Sr-92	Xe-127
As-78	Cu-67	Ir-192	Pa-234	Re-186m	Ta-179	Xe-131m
Au-196	Dy-159	Ir-194	Pa-234m	Re-187	Ta-180	Xe-133
Au-198	Dy-165	K-40	Pb-205	Re-188	Ta-182	Xe-133m
Au-198m	Dy-166	K-42	Pb-210	Rh-102	Ta-183	Xe-135
Ba-133	Er-169	Kr-79	Pb-211	Rh-102m	Ta-184	Xe-135m
Ba-137m	Eu-152	Kr-81	Pb-212	Rh-103m	Tb-157	Xe-137
Ba-139	Eu-154	Kr-83m	Pb-214	Rh-105	Tb-158	Xe-138
Ba-140	Eu-155	Kr-85	Pd-107	Rh-106	Tb-160	Y-88
Ba-141	Eu-156	Kr-85m	Pd-109	Rh-106m	Tb-161	Y-89m
Be-10	Eu-157	Kr-87	Pm-146	Rn-219	Tc-97m	Y-90
Bi-207	Eu-158	Kr-88	Pm-147	Rn-220	Tc-99	Y-91
Bi-210	Fe-55	Kr-89	Pm-148	Ru-103	Tc-99m	Y-91m
Bi-210m	Fe-59	La-140	Pm-148m	Ru-106	Te-123m	Y-92
Bi-211	Fe-60	La-141	Pm-149	S-35	Te-125m	Y-93
Bi-212	Ga-68	La-142	Pm-150	Sb-122	Te-127	Zn-65
Bi-214	Ga-70	Lu-177	Pm-151	Sb-124	Te-127m	Zn-69
Br-80	Ga-72	Lu-177m	Po-210	Sb-125	Te-129	Zn-69m
Br-82	Ga-73	Mn-52	Po-212	Sb-126	Te-129m	Zn-71m
Br-83	Gd-153	Mn-53	Po-215	Sb-126m	Te-131	Zn-72
Br-84	Gd-159	Mn-54	Po-216	Sb-127	Te-131m	Zr-93
C-14	Ge-68	Mn-56	Pr-143	Sb-128	Te-132	Zr-95
Ca-45	Ge-71	Mo-93	Pr-144	Sb-128m	Te-133	Zr-97
Cd-109	Ge-75	Mo-99	Pr-144m	Sb-129	Te-134	Co-59*
Cd-113m	Ge-77	Na-22	Pr-145	Sb-130	Th-227	Kr-90 (Rb-90)**
Cd-115	Ge-78	Na-24	Pt-189	Sc-46	Th-228	Kr-91 (Sr-91)**
Cd-115m	H-3	Nb-92m	Pt-191	Sc-47	Th-229	Kr-92 (Sr-92)**
Cd-117	Hf-175	Nb-93m	Pt-193	Sc-48	Th-230	Rb-92 (Sr-92)**
Ce-139	Hf-178m	Nb-94	Pt-193m	Se-79	Th-231	Xe-139 (Cs-139)**
Ce-141	Hf-179m	Nb-95	Pt-195m	Se-81	Th-232	Xe-140 (Cs-140)**
Ce-143	Hf-180m	Nb-95m	Pt-197	Se-81m	Th-234	Ba-136*
Ce-144	Hf-181	Nb-96	Pu-236	Si-32	Tl-204	
Cf-252	Hf-182	Nb-97	Pu-238	Sm-151	Tl-207	
Cl-36	Hg-203	Nd-147	Pu-239	Sm-153	Tl-208	
Cm-242	Ho-166	Nd-149	Pu-240	Sm-156	Tm-168	

* Radionuclide not included in CAP88 as it is stable.

** Radionuclide not included in CAP88 database due to short half-life. Parent converted into first progeny (shown in parentheses) included in CAP88 database.

5. 40 CFR PART 61.94(b) (3)

"A description of the handling and processing that the radioactive materials undergo at the facility."

5.1 Advanced Test Reactor Complex

The Advanced Test Reactor (ATR) Complex is operated by Battelle Energy Alliance, LLC (BEA) and is located in the south-central section of INL. The ATR Complex has facilities for studying the performance of reactor materials and equipment components under high neutron flux conditions. The primary facility at ATR Complex is the ATR. Other operations at ATR Complex include research and development, and analytical laboratory services.

Radiological air emissions from ATR Complex are primarily associated with operation of the ATR. These emissions include noble gases, iodines and other mixed fission and activation products. Other radiological air emissions are associated with sample analysis, and research and development activities.

5.2 Central Facilities Area

The Central Facilities Area (CFA) is located in the south-central section of the INL Site. The CFA provides services that support the following INL Site facilities:

Maintenance shops

Vehicle maintenance facilities

Instrument calibration laboratories

Communications and security systems

Fire protection

Medical services

Warehouses

Laboratory Facilities

Other support services facilities

Minor emissions occur from CFA facilities where work with small quantities of radioactive materials is routinely conducted. This includes sample preparation and verification and radiochemical research and development. Other minor emissions result from groundwater usage via evapotranspiration from irrigation or evaporation from sewage lagoons and carbon-14 tracer release.

5.3 Critical Infrastructure Test Range Complex

The Critical Infrastructure Test Range Complex (CITRC) is located in the south-central section of the INL Site. The CITRC area supports the National and Homeland Security missions of the laboratory, including program and project testing (i.e., critical infrastructure resilience and nonproliferation testing and demonstration). Wireless test-bed operations, power line and grid testing, unmanned aerial vehicle testing, accelerator testing, explosives detection and training radiological counter-terrorism emergency-response take place at the CITRC area.

The radiological releases this reporting period took place as part of a training exercise for first responders to a release of radioactive material. Small amounts of a short-lived radionuclide were placed on various surfaces within the building as part of the training exercise. Building ventilation is not filtered.

The Plutonium, Uranium, Reduction, Extraction (PUREX) process is used for the extraction and recovery of uranium and plutonium from dissolved used nuclear fuel. A pilot plant is operated at PBF-622 that mimics several aspects of nuclear fuel reprocessing in the PUREX process using non-radioactive surrogates and some radioactive material.

5.4 Idaho Nuclear Technology and Engineering Center

The Idaho Nuclear Technology and Engineering Center (INTEC) is located in the southern portion of the INL Site and began operations in 1953 to recover and reprocess spent nuclear fuel. It was operated for the Department of Energy Idaho Operations Office by Idaho Environmental Coalition, LLC (IEC) for the CY 2022 reporting period.

INTEC radiological air emission sources result from various activities and operations. It has two continuously monitored point sources (one regulated, and one voluntary) and various other diffuse and non-diffuse sources.

Emissions exhausted through the Main Stack are associated with ventilation and process and vessel off-gas exhausts from liquid waste operations, including effluent primarily from periodic operation of the Process Equipment Waste Evaporator and Liquid Effluent Treatment and Disposal, as well as relief valve emissions from the Tank Farm Facility.

Additional radioactive emissions are associated with spent nuclear fuel storage, including interim storage of nuclear reactor fuel from Three Mile Island (managed by Spectra Tech, Inc.), remote-handled transuranic and mixed waste storage and treatment, radiological and hazardous waste storage facilities, contaminated equipment servicing and repair and the Remote Analytical Laboratory (CPP-684) which is in cold standby.

Soils that were disturbed at INTEC during CY 2022 as the result of maintenance and other project activities are not being reported for CY 2022 because they were determined to have activities at background or lower radioactivity levels.

The Idaho CERCLA Disposal Facility (ICDF) is located on the southwest corner of INTEC. Diffuse radiological emissions from this facility are estimated from waste disposal in the landfill and evaporation pond operations.

5.5 Materials and Fuels Complex

The Materials and Fuels Complex (MFC) is located in the southeastern corner of the INL Site. MFC, a research facility operated by BEA, is involved in advanced nuclear power research and development, spent fuel and waste treatment technologies, national security programs and projects to support space exploration.

Radiological air emissions are primarily associated with spent fuel treatment at the Fuel Conditioning Facility (FCF), waste characterization and fuel research and development at the Hot Fuel Examination Facility (HFEF), fuel research and development at the Fuel Manufacturing Facility (FMF) and post irradiation examination at the Irradiated Materials Characterization Laboratory (IMCL). These facilities are equipped with continuous monitoring or continuous sampling systems. On a regular basis, the effluent streams from FCF, HFEF, FMF, IMCL and other non-CEM radiological facilities are sampled and analyzed for particulate radionuclides. Gaseous and particulate radionuclides may also be released from other MFC facilities during laboratory research activities, sample analysis, waste handling and storage and maintenance operations. Both measured and estimated emissions from MFC sources are consolidated for National Emission Standards for Hazardous Air Pollutants (NESHAP) reporting on an annual basis.

5.6 Radioactive Waste Management Complex

The RWMC, located in the southwestern corner of INL, is a controlled-access area consisting of two primary project areas: The Advanced Mixed Waste Treatment Project (AMWTP) and the Subsurface Disposal Area (SDA) and associated Accelerated Retrieval Project (ARP). The primary mission of AMWTP is to sort, characterize, and treat transuranic and mixed low-level waste, and package the treated waste for shipment offsite for disposal. Various activities are being conducted in the SDA to complete environmental cleanup of the area under CERCLA and to conduct waste storage and treatment under the

Resource, Conservation, and Recovery Act (RCRA). These include waste retrieval activities at APR IX and operation of RCRA-permitted waste storage and treatment facility at WMF-1619. All projects at RWMC during 2022 were operated by IEC.

With approval from EPA, exhumation at the CERCLA ARP IX as well as RCRA waste storage and treatment operations at ARP VII (WMF-1619) use ambient air monitoring as an alternative to air dispersion calculations to verify compliance with the emissions standard during ARP operation. Therefore, record sampling is not performed, although continuous air monitors are used for real-time monitoring for detection of off-normal emissions.

The RCRA permitted Sludge Repackage Project (SRP) at WMF-1619 facility (ARP VII) processed and treated transuranic waste (originating at AMWTP). Waste treatment included segregating/sorting waste, adding absorbents, waste and container sizing, decontaminating debris items, and waste repackaging. High efficiency particulate air (HEPA) filtered radionuclide emissions from the ARP enclosures are calculated for use with emissions measurements from other INL sources to demonstrate INL site-wide compliance using the CAP-88 model.

The AMWTP had six potential sources of radionuclide emission in operation during CY 2022, of which three are continuously monitored point sources. Radiological air emissions from the AMWTP may result from the characterization and treatment of transuranic waste, alpha-contaminated low-level mixed waste (alpha LLMW) and LLMW.

5.7 Test Area North

Test Area North (TAN) is the northernmost developed area within INL. It was originally established to support the Aircraft Nuclear Propulsion Program, which operated from 1951 to 1961. Since 1961, TAN buildings have been adapted for use by various other programs, including current BEA operations at the Specific Manufacturing Capability (SMC) facility, the North Radiological Response Training Range (RRTR), and the New Pump and Treat Facility (NPTF).

5.7.1 Specific Manufacturing Capability

The TAN-SMC Project, managed by BEA, is a manufacturing operation that produces an armor package for the U.S. Department of the Army. The TAN-SMC Project was assigned to the INL Site in mid-1983. Operations at TAN-SMC include material development, fabrication and assembly work to produce armor packages. The operation uses standard metal-working equipment in fabrication and assembly. Other activities include developing tools and fixtures and preparing and testing metallurgical specimens. Radiological air emissions from TAN-SMC are associated with processing of depleted uranium. Potential emissions are uranium isotopes and associated radioactive progeny.

5.7.2 The North Radiological Response Training Range

The North Radiological Response Training Range (RRTR) began operation in July 2011 to support federal agencies responsible for the nuclear forensics mission.

5.7.3 New Pump and Treat Facility

The main purpose of the New Pump and Treat Facility (NPTF) located at TAN-TSF is to reduce concentrations of trichloroethylene and other volatile organic compounds in the medial zone portion of the OU 1-07B contamination groundwater plume at TAN to below drinking water standards (before reinjection into the aquifer). Low levels of Sr-90 and H-3 are also present in the treated water and are released to the atmosphere by the treatment process. The NPTF is operated by IEC.

6. 40 CFR PART 61.94(b) (4) and (5)

"A list of the stacks or vents or other points where radioactive materials are released to the atmosphere. A description of the effluent controls that are used on each stack, vent, or other release point and an estimate of the efficiency of each control device."

Table 7 through Table 14 list the facility stacks, vents, or other points where radioactive materials are released to the atmosphere. NRF emission points are listed in Appendix B.

Table 7. Stacks, vents, or other points of radioactive materials release to the atmosphere at ATR Complex.

Bldg	Vent	Source Description	Effluent Control Description	Efficiency
670	074	Laboratory 124 fume hoods exhaust	HEPA filter	99.97%
670	086	Laboratory 131 fume hoods exhaust	HEPA filter[b]	99.97%[b]
670	098	Laboratory 103 fume hoods exhaust (two hoods)	HEPA filter	99.97%
670	NA	ATR Canal	NA	NA
678	001	Radiation Measurements Laboratory fume hoods vent	HEPA Filter	99.97%
710	001	MTR Stack	Partial HEPA filtered[a]	99.97%
715	001	Warm Waste Evaporation Pond	NA	NA
770	001	ATR Main Stack	NA	NA
1627	001	Radioanalytical Chemistry Laboratory fume hoods stack	HEPA Filter	99.97%

a. HEPA filters are on the effluent from the Safety and Tritium Applied Research Facility (TRA-666) prior to being emitted from the MTR stack.
b. Emission reduction credit was not taken for this HEPA filter during 2022 due to HEPA filter test results.

Table 8. Stacks, vents, or other points of radioactive materials release to the atmosphere at CFA.

Bldg	Vent	Source Description	Effluent Control Description[a]	Efficiency
625	010	Laboratory fume hoods	HEPA Filter bank	99.97%
1618		HPIL	NA	NA
NA	NA	CFA-Tritium, Pumped groundwater	NA	NA

a. Bank includes multiple HEPA filters.

Table 9. Stacks, vents, or other points of radioactive materials release to the atmosphere at CITRC.

Bldg	Vent	Source Description	Effluent Control Description	Efficiency
612	NA	PBR 12, CITRC Control System Research	NA	NA
623	NA	CITRC Wireless Communication Support	NA	NA

Table 10. Stacks, vents, or other points of radioactive materials release to the atmosphere at INTEC.

Bldg	Vent	Source Description	Effluent Control Description	Efficiency
603	001	Irradiated Fuel Storage Facility	Two HEPA filters in series	99.97% each
659	033	NWCF Stack	Two HEPA filters in series	99.97%
684	001	Remote Analytical Laboratory	Two HEPA filters in series	99.97% each

Bldg	Vent	Source Description	Effluent Control Description	Efficiency
708	001	INTEC Main Stack	Up to three HEPA filters in series	99.97% total
749	001	Underground Fuel Storage/Vault Area	HEPA filter	99.97%
767	001	FAST Stack	Up to three HEPA filters in series	99.97% each
1608	001	Manipulator Repair Cell	Two HEPA filters in series	99.97% each
1774	NA	TMI-2 Independent Spent Fuel Storage Installation	HEPA filter	99.97%
CPP-2707	NA	Dry Cask Storage Pad	NA	NA
ICDF	NA	ICDF Landfill	NA	NA
OU-3-14	NA	Evaporation Pond	NA	NA

Table 11. Stacks, vents, or other points of radioactive materials released to the atmosphere at MFC.

Bldg	Vent	Source Description	Effluent Control Description[a]	Efficiency
CPP-653	001	Decontamination Testbed Facility	Two HEPA filter banks in series	99.97% each
704	008	Fuel Manufacturing Facility Stack	Two HEPA filter banks in series	99.97% each
720	007	Transient Reactor Test Facility reactor cooling air exhaust	Two HEPA filter banks in series	99.97% each
752	004	L&O Building main stack	Two HEPA filter banks in series	99.97% each
752	005	L&O Building nondestructive assay building stack	One to four HEPA filters in series	99.97% each
764	001	FCF Main Stack	Two HEPA filter banks in series	99.97% each
768	105	Decontamination shower suspect waste tank vent	HEPA filter bank	99.97%
768	108	Health Physics area fume hoods	HEPA filter bank	99.97%
774	026	EML exhaust	Two HEPA filter banks in series	99.97% each
	027	EML exhaust	Two HEPA filter banks in series	99.97% each
	028	EML exhaust	Two HEPA filter banks in series	99.97% each
	029	EML exhaust	Two HEPA filter banks in series	99.97% each
777	002	Zero Power Physics Reactor exhaust	HEPA filter bank	99.97%
784	001	Advanced Fuels Facility	One HEPA filter	99.97%
785	018	Hot Fuel Examination Facility stack	Two HEPA filter banks in series	99.97% each
787	001	Fuel Assembly and Storage Building	HEPA filter bank	99.97%
792A	001	Space and Security Power System Facility	Two HEPA filter banks in series	99.97% each
793	001	SCMS stack	HEPA filter bank	99.97%
794	002	Experimental Fuels Facility-West exhaust	HEPA filter bank	99.97%
794	006	Experimental Fuels Facility-East exhaust	HEPA filter bank	99.97%
1702	001	Radiochemistry Laboratory	HEPA filter bank	99.97%
1729	001	Irradiated Materials Characterization Laboratory	One to two HEPA filters in series	99.97%

Bldg	Vent	Source Description	Effluent Control Description[a]	Efficiency

a. Bank includes multiple HEPA filters.

Table 12. Stacks, vents, or other points of radioactive materials release to the atmosphere at RWMC.

Bldg	Vent	Source Description	Effluent Control Description	Efficiency
601	001	Health Physics Laboratory Hood	HEPA filter	99.97%
615	001	Drum Vent Facility	HEPA filter	99.97%
636	001	Transuranic Storage Area-Retrieval Enclosure (TSA-RE)	None	NA
767	002	Zone 3 Stack AMWTP	Three HEPA filters in series	99.97% each
676	003	Glovebox Stack	Three HEPA filters in series	99.97% each
1612	001	ARP-II	HEPA filter	99.97%
1614	001	ARP-III	HEPA filter	99.97%
1615	001	ARP-IV	HEPA filter	99.97%
1615	NA	ARP-IV Demolition	NA	NA
1617	001	WMF-1617 (ARP-V) Sludge Repackage Project	HEPA filter	99.97%
1619	001	ARP-VII Debris Repackage Project	HEPA filter or two HEPA filters in series	99.97%
1621	001	ARP-VIII	HEPA filter	99.97%
1622	001	ARP-IX	HEPA filter	99.97%
SDA	1	Buried Beryllium Blocks	NA	NA
		H-3 from groundwater	NA	NA

Table 13. Stacks, vents, or other points of radioactive materials release to the atmosphere at TAN-SMC.

Bldg	Vent	Source Description	Effluent Control Description[a]	Efficiency
629	013	Line 2, manufacturing process	Two HEPA filter banks	99.97%
679	022	North manufacturing process (EF-206) and includes releases from the quality control (QC) laboratory	HEPA filter bank	99.97%
679	023	North manufacturing process (EF-205) includes releases from the QC laboratory	HEPA filter bank	99.97%
679	024	North manufacturing process (EF-204) and includes releases from the QC laboratory	HEPA filter bank	99.97%
679	025	South process (RAD Stack #8) manufacturing process (EF-203)	HEPA filter bank	99.97%
679	026	South process (RAD Stack #7) manufacturing process (EF-202)	HEPA filter bank	99.97%
679	027	South process (RAD Stack #6) manufacturing process (EF-201)	HEPA filter bank	99.97%
681	018	Process Reclamation Facility	HEPA filter bank	99.97%
681	020	Process Reclamation Facility	HEPA filter bank	99.97%
681	016	Process Reclamation Facility	NA	NA

a. Bank includes multiple HEPA filters.

Table 14. Stacks, vents, or other points of radioactive materials release to the atmosphere at TAN-TSF.

Bldg.	Vent	Source Description	Effluent Control Description	Efficiency
1611	NA	OU 1-07B Treatment Process	NA	NA

7. 40 CFR PART 61.94(b) (6)

"List distances from the points of release to the nearest residence, school, business or office and the nearest farms producing vegetables, milk and meat."

Table 15 shows distances from the points of release to the nearest residence, school, business or office and the nearest farms producing vegetables, milk and meat.

Table 15. Distances from INL facility points of release to the nearest off-Site receptor location, farm, dairy, feedlot and to Receptor 26 (INL MEI).

Facility	Distance and Direction to Nearest Residence, School, Business	Distance and Direction to Nearest Vegetable Farm	Distance and Direction to Nearest Dairy	Distance and Direction to Nearest Feedlot	Distance and Direction to MEI (Receptor 26)
MFC	8.7 km[a] SSE	13.6 km ESE	30 km ENE	8.7 km SSE	8.7 km SSE
CFA	12.5 km SE	12.5 km SE	35 km SE	27.8 km E	27.8 km E
CITRC	10.8 km SSE	10.7 km S	33.5 km SE	21.5 km E	21.5 km E
INTEC	15.3 km SSE	14.5 km SSE	38 km SE	27.2 km ESE	27.2 km ESE
NRF	13.7 km NNW	11.7 km NNW	20.9 km NNW	15.6 NNW	28.8 km ESE
RWMC/AMWTP	8.0 km SSW	14.8 km ESE	38.5 km ESE	35.3 km E	35.3 km E
TAN-TSF	10.3 km E	9.1 km E	18.2 km E	16.7 km E	36.7 km SSE
TAN-SMC	12.3 km E	11.1 km E	20.4 km E	18.9 km E	38.1 km SSE
ATR Complex	17.4 km NW	17 km SSE	41 km SE	30.2 km ESE	30.2 km ESE

a. km = kilometers.

8. 40 CFR PART 61.94(b) (7)

"The values used for all other user-supplied input parameters for the computer models (e.g. meteorological data) and the source of these data."

Table 16 and Table 17 show the CAP-88 modeling input parameters for CY 2022.

Table 16. Description of data tables in NESHAP CAP-88 database

Table Name	Field Name	Description
UnitDoses	FacilityID	Facility Identification (see Table 16)
	Nuclide	Radionuclide name
	Direction	Direction to MEI
	Distance	Distance to MEI
	UDose	Unit dose (mrem/Ci)
Releases	SourceID	Source Identification
	FacilityID	Facility Identification (see Table 16)
	Fugitive	Fugitive or Non-Fugitive release flag
	Radionuclide	Nuclide name
	Q	Release rate (Ci/yr)
MkMEIsBySecName	FacilityID	Facility Identification (see Table 16)
	SectorName	Text name of the 16, 22.5-degree sectors
	Distance	Distance from the facility to the receptor
	ReceptorNum[a]	Receptor number index

a. The receptor number is the identification assigned to the 31 receptors surrounding INL. The distance and direction to each receptor varies by facility.

Table 17. INL Site meteorological files and wind measurements heights.

Facility	Facility ID	Wind File	Measurement Height (m)
Central Facilities Area	CFA	690L22.WND	10
Critical Infrastructure Test Range Complex	CITRC	PBFL22.WND	10
Idaho Nuclear Technology and Engineering Center, Idaho CERCLA Disposal Facility	INTEC	GRIL22.WND	10
Idaho Nuclear Technology and Engineering Center – Main Stack	INTEC-MS	GRIU22.WND[b]	30
Materials and Fuels Complex	MFC	EBRL22.WND	10
Materials and Fuels Complex Main Stack	MFC-MS	EBRU22.WND	30
Materials and Fuels Complex – TREAT Stack	MFC-TREAT	EBRU22.WND	30
Naval Reactors Facility	NRF	NRFL22.WND	10
Advanced Test Reactor Complex[a]	ATRC	TRAL22.WND	10
Advanced Test Reactor Complex[a], Advanced Test Reactor Main Stack	ATRC-ATR	GRIU22.WND[b]	30
Advanced Test Reactor Complex[a], Materials Test Reactor Main Stack[c]	ATRC-MTR	GRIU22.WND[b]	30
Radioactive Waste Management Complex	RWMC	RWMCL22.WND	10
Specific Manufacturing Capability	SMC	LOFL22.WND	10

Facility	Facility ID	Wind File	Measurement Height (m)
Test Area North, Technical Support Facility	TAN-TSF	LOFL22.WND	10

a. The Advanced Test Reactor Complex (ATRC) was formerly known as the Test Reactor Area (TRA) and Reactor Technology Complex (RTC). The acronyms based on former names may still be used to describe facility buildings, meteorological stations, etc.

b. The nearest tower with an upper (30 m) measurement height (GRID III) was used for stacks at INTEC and the ATR Complex. The GRID III tower is approximately 1.6 km north of INTEC and 1.7 km east of the ATR Complex.

c. Advanced Test Reactor Complex, Materials Test Reactor Main Stack reported no releases during calendar year 2022.

9. 40 CFR PART 61.94(b) (8)

"A brief description of all construction and modifications which were completed in the calendar year for which the report is prepared, but for which the requirement to apply for approval to construct or modify was waived under §61.96 and associated documentation developed by DOE to support the waiver. EPA reserves the right to require that DOE send to EPA all the information that normally would be required in an application to construct or modify, following receipt of the description and supporting documentation."

IEC performed three different permitting applicability determinations over the course of 2022. These included applicabilites for the particulate matter and radionuclide emissions from the decommissioning and demolition of S1W Complex at the NRF (EDF-11377), the treating and repackaging of wastes at CPP-659 (EDF-11378), and the treating and repackaging of wastes at CPP-666 (EDF-11380).

Please see Appendix B for any construction or modifications performed by NRF.

Appendix A

INL Research and Education Campus

INL Research and Education Campus

This report documents radionuclide air emissions for calendar year (CY) 2022 and the resulting effective dose equivalent (EDE) to the maximally exposed individual (MEI) member of the public from operations at Idaho National Laboratories (INL) at the INL Research Center (IRC) and the Department of Energy - Idaho Operations Office (DOE-ID) Radiological and Environmental Sciences Laboratory (RESL) on the INL Research and Education Campus (REC).

The heading of each section in this report corresponds to the citation found in 40 *Code of Federal Regulations* (CFR) Part 61.94. The applicable reporting requirement is cited under the heading in italicized text followed by the compliance report for REC.

40 CFR 61.94(a)

"Compliance with this standard shall be determined by calculating the highest effective dose equivalent to any member of the public at any offsite point where there is a residence, school, business or office. The owners or operators of each facility shall submit an annual report to both Environmental Protection Agency (EPA) headquarters and the appropriate regional office by June 30, which includes the results of the monitoring as recorded in DOE's Effluent Information System and the dose calculations required by §61.93(a) for the previous calendar year."

No radionuclide emissions for the IRC or RESL required continuous monitoring for compliance during CY 2022. Table 1A lists the sources used to calculate the EDE to the MEI.

Table 1A. Sources used to calculate the EDE to the MEI.

Facility	Source
IRC:	IF-603, IRC Laboratory (IRC-L) Building
	IF-611, National Security Laboratory (NSL)
RESL:	IF-683, Radiological and Environmental Sciences Laboratories

Subpart H requires DOE facilities to calculate the resulting dose to the offsite MEI. The location of IRC/RESL MEI for CY 2022 is an office building 115 meters south southeast of RESL. The EDE to the MEI was 4.03E-3 mrem/yr, which is 0.040% of the 10-mrem/yr federal standard and was calculated using all sources that emitted radionuclides to the environment from IRC/RESL. Table 2A provides a summary of IRC/RESL Site MEI dose by facility and source type.

Table 2A, Dose (mrem) contributions and total IRC/RESL dose (mrem) to the MEI located 0.1 km south of the IRC/RESL for CY 2022 radionuclide air emissions.

Source ID	Non Fugitive Dose (mrem/yr)	Percent of Total MEI Dose	Notes
RESL IF-683	3.79E-03	93.89%	DOE RESL Sources
IRC IF-603/611	2.46E-04	6.11%	IRC Laboratories
REC Total	**4.03E-03**	**100%**	**REC Total**

40 CFR 61.94(b)

"In addition to paragraph (a), the annual report will include the following information:"

40 CFR 61.94(b)(1)

"The name and location of the facility."

IRC and RESL facilities are located contiguously on a partially developed 14.3-ha (35.5-acre) plot of the REC on the north side of the City of Idaho Falls. Though programs and operations at the IRC/RESL are affiliated with INL, the IRC/RESL is located within the city limits of Idaho Falls and is not contiguous with the INL Site, the nearest boundary of which is approximately 22 mi west of Idaho Falls.

BEA facilities include three, one-story laboratory buildings containing 66 laboratories in IRC-L (Building IF-603) and NSL (IF-611). RESL (IF-683) consists of 8 radiochemistry laboratories, stable chemistry laboratories, offices and conference areas.

40 CFR 61.94(b)(2)

"A list of the radioactive materials used at the facility."

The individual radionuclides found in materials used at the IRC and RESL during CY 2022 are listed in Table 3A. These materials included, but were not limited to, samples, products, process solids, liquids and wastes that have potential emissions. Table 3A does not contain radionuclides with an activity <1E-25.

Table 3A. Radionuclides in use and potentially emitted to the atmosphere from REC facilities in CY 2022

Ac-227	Kr-85	Th-232
Am-241	Mn-54	U-232
Am-243	Na-22	U-233
Ba-133	Ni-63	U-234
Ba-140	Np-237	U-235
C-14	Pa-231	U-238
Cd-109	Pb-210	Xe-131m
Ce-139	Pu-236	Xe-133
Cm-244	Pu-238	Xe-135
Co-57	Pu-239	Y-88
Co-58	Ra-226	Zn-65
Co-60	Ru-103	Zr-95
Cs-134	Ru-106	
Cs-137	Sb-125	
Eu-152	Sm-151	
Eu-154	Sn-113	
Eu-155	Sr-85	
Fe-55	Sr-89	
H-3	Sr-90	
Hg-203	Tc-99	
I-125	Tc-99m	
I-129	Th-228	
I-131	Th-229	
Ir-192	Th-230	

40 CFR 61.94(b)(3)

"A description of the handling and processing that the radioactive materials undergo at the facility."

The IRC is principally an experimental research facility dedicated to a wide range of research areas including microbiology, geochemistry, materials characterization, welding, ceramics, thermal fluids behavior, materials testing, nondestructive evaluation of materials using standard industrial x-ray processes, x-ray diffraction and x-ray fluorescence, analytical and environmental chemistry and biotechnology. Non-research activities include analytical chemistry and preparation of reference radioactive and nonradioactive standards for performance evaluation programs.

Radiological emissions from the IRC could arise from uncontrolled laboratory fume hoods within the facility. Exhaust from most of the fume hoods is released directly to the outside atmosphere via the heat recovery fan system of the IRC heating, ventilating, and air conditioning system. The heat recovery fan system exhausts to the outside via vents on the north side of the mechanical penthouse on top of the IRC laboratory building. The height of these vents is 7.6 m (25 ft). The exhausts from other fume hoods (not exhausted to the heat recovery fan) are released to the atmosphere via a 2.1-m (7.0-ft) stack above the roof or two 8.5-m (28-ft) stacks above the roof.

Emissions can occur from other areas as well. Not all radiological emissions will occur from work in a fume hood. Some work is done on work benches or in bay areas.

The Radiological and Environmental Sciences Laboratory (RESL) is a federally owned and operated laboratory by the Department of Energy (DOE). The laboratory's focus is primarily in analytical chemistry, radiation protection and as a reference laboratory for numerous performance evaluation programs. RESL emissions are from low-level radiological performance testing sample preparation and verification.

Radiological emissions from the DOE-ID RESL (Bldg IF-683) could be emitted from uncontrolled laboratory fume hoods. The fume hoods are identified by vent numbers and the emissions exhaust directly to the outside atmosphere via individual stacks on the south side of the building roof. These stacks all have a height of 9.6m (31.6ft). Radiological emissions from RESL could also be emitted from the centralized building exhaust system (F-1 and F-2) located in all the south labs plus the following rooms: Alpha and Gamma spectrometry, Beta Counting, Radiological Standards Vault and the Sample and Radiological Storage. The stack height for the centralized exhaust system is 7.4m (24.3ft) and is located on the east side, center, of the building roof. All heights are from ground level.

40 CFR 61.94(b)(4)

"A list of the stacks or vents or other points where radioactive materials are released to the atmosphere."

Tables 4A and 5A list the facility stacks, vents, or other points where radioactive materials were released to the atmosphere during CY 2022.

Table 4A. Stacks, vents, or points of radioactive materials release to the atmosphere at IRC.[1]

Building	Vent	Source Description	Effluent Control Description	Efficiency
IF-603	HRF-4	Laboratories A13, A15, A20 and B4-B6	NA	NA
IF-603	HRF-5	Laboratory B12	NA	NA
IF-603	HRF-6	Laboratories C6 and C10	NA	NA
IF-611	HV[1]-EF-4	Laboratory 104	NA	NA
IF-611	HV-EF-6	Laboratory 105	NA	NA
IF-611	Blower EF-5	Laboratory 105	NA	NA
IF-638		IRC Physic Laboratory	NA	NA

1. Key- EF: exhaust fan, AHU: air handler unit, HRF: heat recovery fan, HV: heating ventilation.

Table 5A. Stacks, vents, or points of radioactive materials release to the atmosphere at RESL.

Building	Vent	Source Description	Effluent Control Description	Efficiency
IF-683	F-9	Laboratory 129 fume hood exhaust	NA	NA
IF-683	F-10	Laboratory 129 fume hood exhaust	NA	NA
IF-683	F-11	Laboratory 130 fume hood exhaust	NA	NA
IF-683	F-12	Laboratory 130 fume hood exhaust	NA	NA
IF-683	F-13	Laboratory 131 fume hood exhaust	NA	NA
IF-683	F-14	Laboratory 131 fume hood exhaust	NA	NA
IF-683	F-15	Laboratory 132 fume hood exhaust	NA	NA
IF-683	F-16	Laboratory 132 fume hood exhaust	NA	NA
IF-683	F-17	Laboratory 133 fume hood exhaust	NA	NA
IF-683	F-18	Laboratory 133 fume hood exhaust	NA	NA
IF-683	F-19	Laboratory 134 fume hood exhaust	NA	NA
IF-683	F-20	Laboratory 134 fume hood exhaust	NA	NA
IF-683	F-21	Laboratory 135 fume hood exhaust	NA	NA
IF-683	F-22	Laboratory 135 fume hood exhaust	NA	NA
IF-683	F-23	Laboratory 136 fume hood exhaust	NA	NA
IF-683	F-24	Laboratory 136 fume hood exhaust	NA	NA
IF-683	F-1, F2	Building exhaust	NA	NA

40 CFR 61.94(b)(5)

"A description of the effluent controls that are used on each stack, vent, or other release point and an estimate of the efficiency of each control device."

No effluent control equipment is associated with any release points of radioactive material at IRC facilities.

40 CFR 61.94(b)(6)

"Distances from the points of release to the nearest residence, school, business or office and the nearest farms producing vegetables, milk and meat."

The nearest residence is approximately 0.4 km (0.25 mi.) to the west. The nearest school is approximately 0.4 km (0.25 mi.) to the south. The nearest business or office is approximately 0.1 km (0.0620 mi.) east, north and south of the IRC/RESL. The nearest farm producing vegetables, milk and meat is 0.35 km (0.22 mi.) to the north of the IRC/RESL.

40 CFR 61.94(b)(7)

"The values used for all other user supplied input parameters for the computer models (e.g., meteorological data) and the source of these data."

The meteorological input file used to calculate the MEI was IDAL18.WND from the NOAA station at Fanning Field in Idaho Falls, ID. The measurement height is 15 meters.

The CAP88-PC Version 4.1 modeling was performed for facilities in Idaho Falls using emission rates for radionuclides listed in Table 3A. For IRC facility and RESL, releases were calculated from a single ground-level point source for receptors in each of the 16, 22.5-degree sectors.

40 CFR 61.94(b)(8)

"A brief description of all construction and modifications that were completed in the calendar year for which the report is prepared, but for which the requirement to apply for approval to construct or modify was waived under § 61.96 and associated documentation developed by DOE to support the waiver."

None.

Appendix B

Naval Reactors Facility National Emission Standards for Hazardous Air Pollutants - Radionuclides Annual Report for 2022

DEPARTMENT OF ENERGY
NAVAL REACTORS LABORATORY FIELD OFFICE
POST OFFICE BOX 2469
IDAHO FALLS, IDAHO 83403-2469

NRLFO:IBO-23/063
May 15, 2023

Lance Lacroix, Manager
U.S. Department of Energy, Idaho Operations Office
1955 Fremont Avenue
Idaho Falls, ID 83415-1216

2022 NAVAL REACTORS FACILITY NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS REPORT ON RADIONUCLIDE AIR EMISSIONS

Dear Mr. Lacroix,

I have enclosed the Calendar Year 2022 Naval Reactors Facility (NRF) National Emission Standards for Hazardous Air Pollutants (NESHAP) Report on Radionuclide Air Emissions. The report presents the amount of radionuclide air emissions from sources at NRF and the dose to the public that was determined to result from those emissions. The report is being transmitted independently to Battelle Energy Alliance for inclusion in the overall Idaho National Laboratory (INL) NESHAP report.

NRF inadvertently underreported emissions of carbon-14 in 2021 by a small amount. The INL 2021 effective dose equivalent (EDE) to the maximally exposed individual was re-calculated using the increased carbon-14 emissions. The increase did not change the reported EDE to the maximally exposed individual from INL facilities. Therefore, there is no need to correct the reported dose value in the 2021 NESHAP report.

If you have any questions regarding this matter, please contact me at (208) 533-5205.

Statement of Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. See, 18 U.S.C. 1001.

J. D. Redman
Acting Manager, Idaho Branch Office

Enclosure: as stated

Copy to:
K. J. Murray, BEA
T. D. Butler, DOE-ID
N. K. Hernandez, DOE-ID
J. Laner, DOE-ID

Naval Reactors Facility National Emission Standards for Hazardous Air Pollutants Report on Radionuclide Air Emissions for Calendar Year 2022

Enclosure (1)
to
NRLFO:IBO-23/063

Pages (12)

Naval Reactors Facility

National Emission Standards for Hazardous Air Pollutants

Report on Radionuclide Air Emissions

For Calendar Year 2022

FLUOR®

Prepared for the U.S. Department of Energy by
Fluor Marine Propulsion, LLC

Calendar Year 2022

Naval Reactors Facility

National Emission Standards for Hazardous Air Pollutants

Report on Radionuclide Air Emissions

As required under 40 CFR Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities"

Site Name: Idaho National Laboratory (INL)

Area: Naval Reactors Facility (NRF)

Area Information for NRF

Operator: Fluor Marine Propulsion, LLC
P. O. Box 2068
Idaho Falls, Idaho 83403-2068

Contact: C. R. Blakely, Director, Naval Reactors Facility
Phone: (208) 533-5526

Owner: Naval Reactors Laboratory Field Office
Idaho Branch Office
P. O. Box 2469
Idaho Falls, Idaho 83403-2469

Contact: R.G. Pratt, Manager, Naval Reactors Idaho Branch Office
Phone: (208) 533-5317

I. FACILITY INFORMATION

Site Description

The Naval Reactors Facility (NRF) is located in the west-central part of Idaho National Laboratory (INL), as shown in Figure 1. The nearest population center is Howe, which is located approximately 16.3 kilometers (10.1 miles) north-northwest of NRF.

The climate of INL is characterized as semi-arid. INL is located on the Snake River Plain with an elevation of approximately 1500 meters (5000 feet). Air masses entering the Snake River Plain from the west lose most of their moisture as precipitation prior to reaching INL; therefore, annual precipitation at INL is light. Winds are channeled over the Snake River Plain by bordering mountain ranges so that winds from the southwest and northeast predominate over INL. The meteorological data for the area is used in the dose modeling, as described in Section III.

Established in 1949, NRF is operated for the U. S. Naval Nuclear Propulsion Program (NNPP) by Fluor Marine Propulsion, LLC. The operations area of NRF within the security fence consists of buildings, streets, and equipment covering about 89 acres. The principal facilities at NRF are three former naval reactor prototypes (S1W, A1W, and S5G) and the Expended Core Facility (ECF). The S1W, A1W, and S5G prototypes were shut down in 1989, 1994, and 1995, respectively.

In 2019, NNPP and the Department of Energy Office of Environmental Management (DOE-EM) signed an agreement that included deactivation and decommissioning (D&D) of the three prototypes. Over the next several years, the D&D work will be performed by the DOE-EM Idaho Cleanup Project contractor. As each prototype enters into D&D, operational, radiological, and environmental responsibilities are transferred to DOE-EM. The S1W prototype, along with its surrounding and support areas, was formally transferred over to DOE-EM on January 27, 2022. Emissions up to the formal transfer are included in this NESHAP report.

Developmental nuclear fuel material samples, naval spent fuel, and irradiated reactor plant components/materials are examined at ECF. The knowledge gained from these examinations is used to improve current designs and to monitor the performance of existing reactors. The naval spent fuel examined at ECF is critical to the design of longer-lived reactor cores, which results in the generation of less spent fuel requiring disposition. NRF also prepares and packages spent naval fuel for dry storage and eventual transport to a permanent repository.

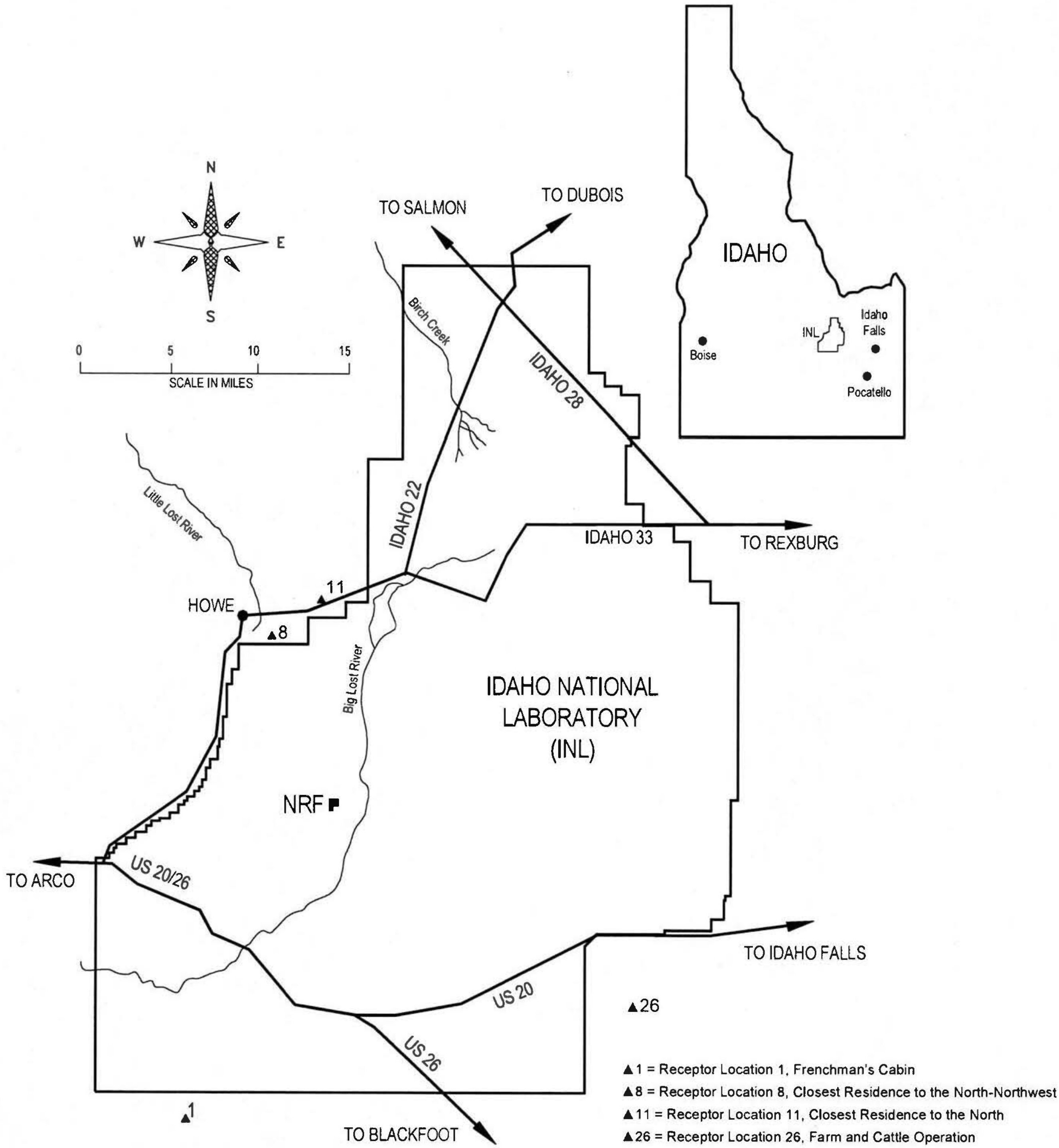

Figure 1. Relation of NRF to INL and the Surrounding Area

Note: Receptor locations were evaluated by INL and some of the location numbers were changed in 2022.

Source Descriptions

NRF receives spent fuel and radioactive components from the NNPP, shipped in Department of Energy (DOE)/Nuclear Regulatory Commission approved shipping containers in accordance with Department of Transportation requirements. The shipments are processed and examined at ECF.

Radioactive materials at NRF include enriched uranium fuel with associated fission products, activation products, and activated corrosion and wear products. Various radiation sources are used for calibrating and checking equipment, and for verifying shielding. Soil with low levels of radioactivity from past releases is also present at NRF.

Radioactive materials are handled and processed in several areas at NRF, including shielded hot cells, chemical and metallurgical laboratories, water pools, and radioactive material storage areas. Physical, chemical, and metallurgical testing of small quantities of highly radioactive material specimens is performed in the ECF shielded hot cells. Radioactive work conducted within the ECF high bay water pools consists of unloading spent naval fuel and radioactive specimens from shipping containers, fuel examinations, removal of non-fuel structural pieces, and storage of fuel. In another part of ECF called the Spent Fuel Packaging Facility, the spent naval fuel is removed from the water pools and packaged for long-term dry storage. Segregation and repackaging of radioactive waste are performed at the S5G prototype building. Decontamination of inactive radiological systems is conducted throughout NRF controlled areas. Radioactive work is performed in appropriate containment. Storage and movement of radioactive materials are under strict control. Special laboratory facilities are available for the chemical analysis of low-level radioactive samples.

Radionuclide emissions to the atmosphere can come from the following sources at NRF:

(1) ECF, where spent fuel from naval reactor cores and contaminated materials such as anti-contamination clothing, tools, and equipment are handled. Spent fuel is handled, stored, and prepared for disposal in the water pools. Radioactive specimens are handled in the shielded hot cells. Spent fuel is unloaded from shipping containers and is packaged for long-term storage at a permanent repository.

(2) S1W, A1W, and S5G Prototype Reactors. Although the reactors have been shut down and defueled, other activities such as routine inspections of the reactor compartments have a small potential to emit radionuclides. At the S5G prototype building, contaminated materials such as anti-contamination clothing, tools, equipment, and contaminated waste are handled. Analyses are performed on radioactive materials in chemistry laboratories in the A1W prototype building. The S1W prototype, along with its surrounding and support areas, was formally transferred over to DOE-EM for D&D on January 27, 2022. D&D was started shortly after the formal transfer.

(3) Fugitive soil emissions from areas surrounding NRF that potentially contain low levels of radioactivity.

(4) Remediation and demolition activities at various buildings and structures with historical radioactive contamination.

II. AIR EMISSIONS DATA

NRF has a number of stacks and vents with the potential to emit low quantities of radionuclides. These emissions are quantified by monitoring and/or by calculations based on production.

Continuous monitoring is required by 40 CFR § 61.93(b), for emission points that have a potential to emit radionuclides in quantities that could result in an Effective Dose Equivalent (EDE) to a member of the public in excess of 1 percent of the 10 millirem (1×10^{-4} sievert) per year standard, which equates to 0.1 millirem (1×10^{-6} sievert) per year. None of the emission points at NRF qualify for the continuous monitoring requirement; all emission points are below the 0.1 millirem (1×10^{-6} sievert) per year criterion. For emission points whose potential to emit is below this criterion, periodic confirmatory measurements are required to verify the low emissions.

Table II-1 identifies point sources of potential radionuclide air emissions at NRF. Table II-2 identifies potential non-point sources (also called diffuse, or fugitive sources) of radionuclide air emissions. The only non-point source at NRF is windblown soil from areas on NRF property outside of the operations area that contain low levels of radioactivity from past releases to the environment. Table II-3 lists the amount of each radionuclide emitted from point sources and Table II-4 lists the amount from non-point sources. The tables include measured values for those radionuclides that are routinely monitored and calculated values for those radionuclides that are not monitored.

The nearest residence, school, business, or office to NRF is a residence 13.3 kilometers (8.3 miles) to the north-northwest. The nearest cultivated land is 11.6 kilometers (7.2 miles) to the north. This area is typically planted in wheat, barley, or alfalfa. The nearest farm producing milk is 20.9 kilometers (13.0 miles) to the north-northwest. The nearest feedlot producing meat is 15.6 kilometers (9.7 miles) to the north-northwest. However, cattle are grazed on private and public land throughout the area. Cattle are allowed to graze as close as 3.4 kilometers (2.1 miles) to the north of NRF. These distances are from the northern-most emission point at NRF. The distances are greater from other NRF emission points. These distance values may differ from those stated in the overall INL report since that report may use a different origination point at NRF for calculating distances.

Table II-1. Radiological Air Emission Point Sources at NRF During 2022

AREA-BLDG-VENT	SOURCE DESCRIPTION	EFFLUENT CONTROL	EFFICIENCY	MONI-TORED [1]
NRF-601-HBRV[2]	S1W High Bay Roof Vents (6 individual emission points)	None	NA	Yes
NRF-601-132[2]	S1W Deep Pit Area Ventilation	HEPA Filter	99.95% [3]	Yes
NRF-616-012, 021	A1W Operations Building and Site Chemistry	None	NA	Yes
NRF-617-013	A1W Reactor Compartment 3A	HEPA Filter	99.95% [3]	Yes
NRF-617-020	A1W Reactor Compartment 3B	HEPA Filter	99.95% [3]	Yes
NRF-618-099	ECF Stack Number 1	HEPA Filter Carbon Filter	99.95% [3] 90–99.9% [4]	Yes+
NRF-618-103	ECF Stack Number 2	HEPA Filter	99.95% [3]	Yes+
NRF-618-237	ECF Stack Number 3	HEPA Filter	99.95% [3]	Yes+
NRF-618-HBRV	ECF High Bay Roof Vents (16 individual emission points)	None	NA	Yes+
NRF-633A-057[5]	S5G Radioactive Area Ventilation (RAV) System	HEPA Filter	99.95% [3]	Yes
NRF-633A-HBRV	S5G High Bay Roof Vents (7 individual emission points)	None	NA	Yes

Table II-1 Notes:

1. "Yes" indicates that the source was monitored, and the measured emissions are included in this report. "Yes+" indicates that the source was monitored, and both measured and calculated emissions are included in this report. Because some gaseous radionuclides could not be measured, the amounts of these radionuclides were calculated based on process production rate.
2. Responsibility for the S1W prototype was transferred to DOE-EM on January 27, 2022. Emissions up to the formal transfer of S1W are included in this report.
3. High Efficiency Particulate Air (HEPA) filters are tested by the manufacturer prior to delivery to NRF and by NRF during the life of the filter. The manufacturer tests the efficiency for 0.3-micron monodispersed dioctylphthalate (DOP) particles to a minimum of 99.97 percent. NRF tests the efficiency for 0.7-micron polydispersed DOP particles to a minimum of 99.95 percent.
4. The carbon filters have an efficiency of 99.9 percent for the removal of radioactive iodine when new. Their efficiency lessens with use, as the carbon adsorbent depletes. The carbon filters are replaced every 3 years.
5. The stack for the S5G Radioactive Area Ventilation (RAV) System was capped and the monitoring system for the stack was removed in 2022. Emissions up to removal of the monitoring system on July 27, 2022 are included in this report.

Table II-2. Radiological Air Emission Non-Point Sources at NRF During 2022

AREA-BLDG-VENT	SOURCE DESCRIPTION	EFFLUENT CONTROL	EFFICIENCY	MONI-TORED
NA	Fugitive Soil	None	NA	No

Table II-3. Point Source Releases from NRF During 2022

Radionuclide	Release (curies)	Release (becquerels)[1]
Gross alpha activity (modeled as plutonium-239)	2.7E-06	9.8E+04
Gross beta activity (modeled as strontium-90)	5.5E-05	2.1E+06
Carbon-14	3.2E-01	1.2E+10
Hydrogen-3 (Tritium)	1.1E-02	4.0E+08
Iodine-129	9.6E-06	3.5E+05
Iodine-131	4.8E-06	1.8E+05
Krypton-85	4.2E-03	1.6E+08
Total	3.3E-01	1.2E+10

Table II-3 Note:

1. One curie equals 3.7E+10 becquerels.

Table II-4. Non-Point Source Releases from NRF During 2022

Radionuclide	Release (curies)	Release (becquerels)[1]
Cesium-137	1.0E-05	3.8E+05
Total	1.0E-05	3.8E+05

Table II-4 Notes:

1. One curie equals 3.7E+10 becquerels.
2. In 2022, there was no measurable or calculated release of cobalt-60.

III. DOSE ASSESSMENT

Description of Dose Model and Summary of Input Parameters

The CAP88 computer code (CAP88-PC Version 4.1.1) was used to calculate the EDE from NRF releases. CAP88 is approved for use by the Environmental Protection Agency (EPA) for demonstrating compliance with 40 CFR Part 61, Subpart H. The output from CAP88 is the EDE, which includes the 50-year committed EDE from internal exposure through the ingestion and inhalation pathways, and the external EDE from ground deposition and air immersion.

Site-specific 2022 wind data was used, supplied by the National Oceanic and Atmospheric Administration (NOAA). The emissions from all NRF sources were totaled and modeled as a single emission point; individual emission points were not modeled separately. The emissions were modeled as ground level releases with no plume rise. Other user-supplied input parameters are as follows:

Wind Data File: NRFL22.STR provided by NOAA
Annual Average Temperature: 5.7 degrees Celsius average in 2022 per NOAA
Annual Rainfall: 16.4 centimeters in 2022 per NOAA
Humidity: 4 grams/cubic meter long-term INL average calculated from NOAA data
Lid Height: 800 meter standard value for INL, provided by NOAA
Agricultural Class: Rural

For determining the EDE, the gross alpha radioactivity was conservatively modeled as plutonium-239 and the gross beta radioactivity was conservatively modeled as strontium-90. The dose from radioactive daughter progeny is included in the dose determined by the CAP88 program.

Table III-1 summarizes the EDE results for point sources, non-point sources, and both combined.

Table III-1. Effective Dose Equivalents from Sources at NRF During 2022

Release Type	EDE [1] (millirem)	EDE [1] (Sv) [2]
Point Sources	1.4E-04	1.4E-09
Non-Point Sources	8.0E-07	8.0E-12
Total:	1.4E-04	1.4E-09

Table III-1 Notes:

1. The EDE shown is for the NRF maximally exposed individual (Figure 1, Location 11).
2. One millirem equals 1.0E-05 sievert (Sv).

Compliance Assessment

40 CFR Part 61, Subpart H requires that emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts that would cause any member of the public to receive an EDE of 10 millirem (1×10^{-4} sievert) per year. "Member of the public" is any offsite point where there is a residence, school, business, or office. The CAP88 program determined the dose from NRF emissions at various locations around the INL where there is a residence, school, business, or

office. The highest dose occurred at a residence 15.4 kilometers (9.6 miles) to the north of NRF (Figure 1, Location 11). This location is not the closest residence to NRF. The closest residence, school, business, or office is a residence 13.3 kilometers (8.3 miles) to the north-northwest (Figure 1, Location 8). However, the direction of winds throughout the year caused Location 11 to be more affected by NRF emissions than Location 8. The location numbers come from a list of residences around the INL boundary created by INL for dose modeling. The receptor locations were evaluated by INL in 2022 and some of the location numbers in Figure 1 were changed (Table III-2).

Table III-2. Receptor Numbers

Old Receptor Number	New Receptor Number
1	1
6	8
7	11
54	26

The EDE from NRF emissions is provided for information only. For compliance purposes, the EDE from all INL emissions combined must comply with the 40 CFR § 61.92 standard of 10 millirem per year. NRF emissions are combined with emissions from other INL facilities to determine the overall EDE for INL. The location of the maximally exposed individual differs between NRF and INL facilities due to proximity to public locations. In recent years, the maximally exposed individual for INL shifted from receptor location 1 to receptor location 26.

IV. ADDITIONAL INFORMATION

40 CFR Part 61, Subpart H requires this report to include a brief description of all construction and modifications that were completed in the calendar year for which the report is prepared, but for which the requirement to apply for approval to construct or modify was waived.

During 2022, non-destructive examinations were expanded in the ECF shielded hot cells. Using conservative methods, the potential EDE to the maximally exposed individual was estimated to be 4.9×10^{-6} millirem per year, which is less than 0.1 millirem per year so an application for approval to construct was not required per 40 CFR § 61.96(b).

NRF did not have any unplanned releases of radionuclides to the atmosphere in 2022.

A dose assessment of the diffuse (non-point) emissions from NRF is presented in Section III. As shown in Table III-1, the EDE from diffuse sources does not significantly add to the overall EDE from NRF emissions. The only diffuse source of air emissions from NRF is soil with low levels of radioactivity from historical releases that is exposed to the wind. The amount of this diffuse emission is determined based on the measured activity in the soil and a conservative calculation of the amount of soil that leaves the NRF site as windblown dust.

V. SUPPLEMENTAL INFORMATION

A March 25, 1993, memorandum from the DOE Office of Environmental Guidance requested that the following supplemental information be included in the annual report. This information is not required by the reporting requirements of 40 CFR § 61.94.

REQUEST: Provide an estimate of the collective effective dose equivalent (person-rem per year) for 2022 releases.
An estimate of the collective effective dose equivalent for the population within 50 miles (80 kilometers) of NRF for 2022 is 7.2×10^{-3} person-rem per year (7.2×10^{-5} person-sievert per year).

REQUEST: Provide information on the status of compliance with Subparts Q and T of 40 CFR Part 61 if pertinent.
Subpart Q of 40 CFR Part 61, "National Emission Standards for Radon Emissions from Department of Energy Facilities," is applicable to the design and operation of storage and disposal facilities for radium-containing material that emit radon-222 into the air. Subpart Q is not applicable to NRF. Subpart T of 40 CFR Part 61, "National Emission Standards for Radon Emissions from the Disposal of Uranium Mill Tailings," is not applicable to NRF.

REQUEST: Provide information on radon-220 emissions from sources containing uranium-232 and thorium-232 where emissions potentially can exceed 0.1 millirem (1×10^{-6} sievert) per year to the public or 10 percent of the non-radon dose to the public.
NRF does not have any sources of uranium-232 or thorium-232 emissions that potentially can exceed 0.1 millirem (1×10^{-6} sievert) per year to the public or 10 percent of the non-radon dose to the public.

REQUEST: Provide information on non-disposal and non-storage sources of radon-222 emissions where emissions potentially can exceed 0.1 millirem (1×10^{-6} sievert) per year to the public or 10 percent of the non-radon dose to the public.
NRF does not have any non-disposal or non-storage sources of radon-222 emissions that potentially can exceed 0.1 millirem (1×10^{-6} sievert) per year to the public or 10 percent of the non-radon dose to the public.

REQUEST: For the purpose of assessing facility compliance with the National Emission Standards for Hazardous Air Pollutants effluent monitoring requirements of Subpart H under Section 61.93(b), give the number of emission points subject to the continuous monitoring requirements, the number of these emission points that do not comply with the Section 61.93(b) requirements, and if possible, the cost for upgrades. Describe site periodic confirmatory measurement plans. Indicate the status of the quality assurance program described by Appendix B, Method 114.
NRF does not have any emission points that require continuous monitoring under Section 61.93(b), and therefore does not have any emission points that do not comply, and no upgrades are necessary. Periodic confirmatory measurements were made using a combination of sampling and calculation. Particulate radionuclides were sampled on a continuous basis. Iodine-131 was sampled on a continuous basis from two stacks. Other gaseous radionuclide emissions were calculated based on process knowledge and production rate. The Appendix B Method 114 quality assurance program is not required since no NRF emission points require continuous monitoring. However, a quality assurance program is followed which incorporates many of the same features, such as equipment calibration, the use of blanks and known standards, and the annual review and validation of data by peer reviewers.

DOCUMENT CERTIFICATION

Department of Energy, Idaho Operations Office

National Emission Standards for Hazardous Air Pollutants – Calendar Year 2022
INL Report for Radionuclides
40 CFR 61.94(b)(9)

DOE/ID-11441 (2023)
June 2023

I certify under penalty of law that I have personally examined and am familiar with the information submitted herein and based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment. See, 18 U.S.C. 1001.

Manager, Idaho
Operations Office: ______________________ Date: 6/28/2023
Lance L. Lacroix