DOE/ID-11441 (2014)

U.S. Department of Energy
Idaho Operations Office

National Emission Standards for Hazardous Air Pollutants—Calendar Year 2013 INL Report for Radionuclides

June 2014

Idaho National Laboratory

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Prepared for the
U.S. Department of Energy
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ABSTRACT

This report documents the calendar year 2013 radionuclide air emissions and resulting effective dose equivalent to the maximally exposed individual member of the public from operations at the Department of Energy's Idaho National Laboratory Site. This report was prepared in accordance with the *Code of Federal Regulations*, Title 40, "Protection of the Environment," Part 61, "National Emission Standards for Hazardous Air Pollutants," Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities." The effective dose equivalent to the maximally exposed individual member of the public was 3.02 E-02 millirem (mrem) per year, 0.30 percent of the 10 mrem per year standard.

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FIGURES

TABLES

ACRONYMS

AMWTF	Advanced Mixed Waste Treatment Facility
AMWTP	Advanced Mixed Waste Treatment Project
ARP	Accelerated Retrieval Project
ATR	Advanced Test Reactor
ATR Complex	Advanced Test Reactor Complex
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
CWI	CH2M-WG Idaho, LLC
CY	calendar year
D&D	deactivation and decommissioning
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
EDE	effective dose equivalent
EFF	Experimental Fuels Facility
EML	Electron Microscopy Laboratory
EPA	Environmental Protection Agency
FAST	Fluorinel and Storage Facility
FCF	Fuel Conditioning Facility
FMF	Fuel Manufacturing Facility
HEPA	high-efficiency particulate air
HFEF	Hot Fuel Examination Facility
ICDF	Idaho CERCLA Disposal Facility
ICE	Inner Contamination Enclosure
ICP	Idaho Cleanup Project
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
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
QC	quality control
RCE	Retrieval Contamination Enclosure
RESL	Radiological and Environmental Sciences Laboratory
RCRA	Resource Conservation and Recovery Act
RDD	radiological dispersion device
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
SMC	Specific Manufacturing Capability
TAN	Test Area North
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 2013 INL Report for Radionuclides

1. INTRODUCTION

This report documents radionuclide air emissions for calendar year (CY) 2013 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's (DOE's) 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 report for INL Site facilities.

Appendix A contains information specific to INL Research and Education Complex (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 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 member of the public from operations at the IRC and RESL.

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

For CY 2013, modeling was performed using Clean Air Act Assessment Package (CAP)88-PC, Version 3 (Release 2-9-2013).

2. 40 CFR PART 61.94(a) FOREWORD

"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 INL Site radionuclide air emissions and the resulting EDE to the MEI for CY 2013. It was prepared in accordance with the 40 CFR 61, 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, 2014.

Table 1 reports the annual radionuclide emissions for INL Site sources that require continuous monitoring for compliance during CY 2013. Table 2 lists the sources used to calculate the EDE to the MEI.

Table 1. Radionuclide emissions, in curies (Ci), from INL Site point sources during CY 2013.

Radionuclide	MFC[a,c,d]-1729-001	MFC-785-018	MFC-764-001	MFC-704-08	ARPs II-VIII[b]	CPP[d]-708-001	CPP-659-033	CPP-767-001[c]	WMF[d]-636-002[c]	WMF-676-002 & 003[c]
Am-241	—	—	—	—	4.9E-05	—	—	—	—	—
Ar-41	—	—	—	—	—	—	—	—	—	—
Co-60	—	—	—	—	—	—	—	—	—	—
Cs-137	—	—	—	—	—	7.79E-06	—	—	—	—
H-3	—	—	—	—	—	—	—	—	—	—
I-129	—	—	—	—	—		—	—	—	—
Kr-85	—	—	—	—	—	—	—	—	—	—
Pu-238	—	—	—	—	—	9.76E-08	—	—	—	—
Pu-239	—	8.55E-08	8.78E-09	1.17E-08	6.16E-05	1.00E-08	—	—	—	—
Pu-240	—	—	—	—	1.17E-05	—	—	—	—	—
Sb-125	—	—	—	—	—	—	—	—	—	—
Sr-90	—	4.61E-07	9.51E-08	8.98E-08	—	1.26E-06	1.20E-08	—	—	—

a. Approval to Construct was issued for the Irradiated Material Characterization Laboratory (IMCL) (MFC-1729) in August of 2011, operations are expected to begin in 2014.

b. Radionuclide emissions from the standby and ongoing excavation operations at Accelerated Retrieval Project (ARP II, III, IV, VII and VIII) enclosures are calculated and presented here to demonstrate INL site-wide compliance using the CAP88-PC model (see discussion of ARP in Section 5.7).

c. No measurable emissions in 2013.

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

Table 2. Sources used to calculate the EDE to the MEI.

Facility	Source
Advanced Mixed Waste Treatment Project (AMWTP):	Waste Management Facility (WMF)-615-001, Drum Vent Facility
	WMF-634-001, Characterization Facility
	WMF-636-001, Transuranic Storage Area-Retrieval Enclosure
	WMF 636-002, Transuranic Storage Area – Retrieval Contamination Enclosure/Inner Contamination Enclosure (RCE/ICE)
	WMF 676-002, Advanced Mixed Waste Treatment Facility (AMWTF) Zone 3 Stack
	WMF 676-003, AMWTF Glove box Stack
	WMF-TR-14-001 Analytical Laboratory
	WMF-TR-14-002 Analytical Laboratory
Advanced Test Reactor (ATR) Complex:	Test Reactor Area (TRA)-670-074, Advanced Test Reactor (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
	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-632, Critical Infrastructure Protection Facility
Idaho Nuclear Technology and Engineering Center (INTEC):	CPP-603-001, Irradiated Fuels Storage Facility
	CPP-653-001, EPA Radiological Dispersion Device (RDD) Decontamination Project
	CPP-659-033, NWCF Stack
	CPP-663-002, Maintenance Building Hot Shop vent
	CPP-684-001, Remote Analytical Laboratory
	CPP-708-001, Main Stack
	CPP-749-001, Spent Fuel Storage Vaults
	CPP-1608-001, Manipulator Repair Cell
	CPP-1774, Three Mile Island (TMI)-2 Independent Spent Storage Installation
	CPP-2707, dry cask storage pad
	CPP88, Disturbed soils
	Idaho Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Disposal Facility Landfill (ICDF) emissions from solid waste
	ICDF pond emissions
	ICDF treatment operations

Facility	Source
Materials and Fuels Complex (MFC):	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-766, D&D -MFC-799 tank treatment
	MFC-768-105, Decontamination shower suspect waste tank vent
	MFC-768-108, Health Physics Area fume hood
	MFC-771, Radioactive Scrap Waste Facility
	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-785-018, Hot Fuel Examination Facility stack
	MFC-787-001, Fuel Assembly and Storage Building
	MFC-792A-001, Space, Security and Power Facility
	MFC-793-001, Sodium Components Maintenance Shop stack
	MFC-794-006, Experimental Fuels Facility exhaust
	MFC-798-017, Radioactive Liquid Waste Treatment Facility
	MFC-1704, Radiochemistry Laboratory
Naval Reactors Facility	See Appendix B
Radioactive Waste Management Complex (RWMC):	WMF-601-001, Health Physics Laboratory Hood
	WMF-1612-001, ARP-II
	WMF-1614-001, ARP-III
	WMF-1615-001, ARP-IV
	WMF-1617, Sludge Repackaging Project
	WMF-1619-001, ARP-VII
	WMF-1621-001, ARP-VIII
	H-3 from groundwater
	Subsurface Disposal Area (SDA) Organic Contamination in the Vadose Zone (OCVZ)-Unit D Waste Area Group 7 (WAG 7)
	OCVZ-Unit E (WAG 7)
	OCVZ-Unit F (WAG 7)
	SDA Buried Beryllium Blocks

Test Area North (TAN) Specific Manufacturing Capability (SMC):	629-013, manufacturing process, Line 2A 679-022, -023, -024 manufacturing process, north process 679-025, -026, -027 manufacturing process, south process 681-018, Process Reclamation Facility 681-020, Process Reclamation Facility
TAN Technical Support Facility (TSF):	Operable Unit (OU) 1-07B, New Pump and Treat Facility

40 CFR 61, Subpart H requires DOE facilities to calculate the resulting dose to the offsite MEI. As in previous years, Frenchman's Cabin was the location of INL Site MEI for CY 2013 (see Figure 1). Historically, the calculated EDE for INL has been less than 0.1 millirem (mrem) per year. The EDE to the MEI was 3.02 E-02 mrem/yr (3.02 E–07 sievert/yr), which is 0.30% of the 10-mrem/yr federal standard and was calculated using all sources that emitted radionuclides to the environment from the INL site. Table 3 provides a summary of INL Site MEI dose by facility and source type.

Table 3. INL facility dose (mrem) contributions and total INL Site dose (mrem) to the MEI located at Frenchman's Cabin for CY 2013 radionuclide air emissions.

Facility ID	Point source dose (mrem/yr)	Fugitive source dose (mrem/yr)	Total dose (mrem/yr)	Notes
CFA Total	**2.65E-08**	**2.21E-05**	**2.21E-05**	Central Facilities Area
CITRC Total	**2.1E-10**		**2.1E-10**	Critical Infrastructure Test Range Complex
INTEC	9.60E-03	2.74E-04	9.87E-03	INTEC including ICDF
INTEC-MS	4.27E-07		4.27E-07	INTEC Main Stack
INTEC Total	**9.60E-03**	**2.74E-04**	**9.88E-03**	Total from INTEC sources
MFC	4.37E-06		4.37E-06	Material Fuels Complex
MFC-MS	2.73E-09		2.73E-09	Material Fuels Complex, Main Stack
MFC Total	**4.37E-06**		**4.37E-06**	Total from MFC sources
NRF Total	**1.47E-04**	**2.44E-06**	**1.50E-04**	Naval Reactor Facility
ATR Complex	4.43E-05	6.90E-03	6.94E-03	Advanced Test Reactor Complex
ATR Complex-ATR	8.65E-03		8.65E-03	Advanced Test Reactor Main Stack at ATR Complex
ATR Complex -MTR	1.04E-04		1.04E-04	Materials Test Reactor at ATR Complex
ATR Complex Total	**8.80E-03**	**6.90E-03**	**1.57E-02**	Total from ATR Complex sources
AMWTP	7.60E-07		7.60E-07	Advanced Mixed Waste Treatment Plant (includes WMF-615, WMF-634, WMF-636, WMF-676, WMF-TR-14)
RWMC	1.95E-04	4.24E-03	4.44E-03	Other Sources at RWMC
RWMC Total	**1.96E-04**	**4.24E-03**	**4.44E-03**	Total from RWMC Sources
TAN-SMC Total	**7.21E-10**		**7.21E-10**	Test Area North –Specific Manufacturing Capability
TAN-TSF Total	**2.93E-07**		**2.93E-07**	Test Area North – Technical Services Facility
INL Site Total	**1.87E-02**	**1.14E-02**	**3.02E-02**	

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 (6 km) south of Howe.

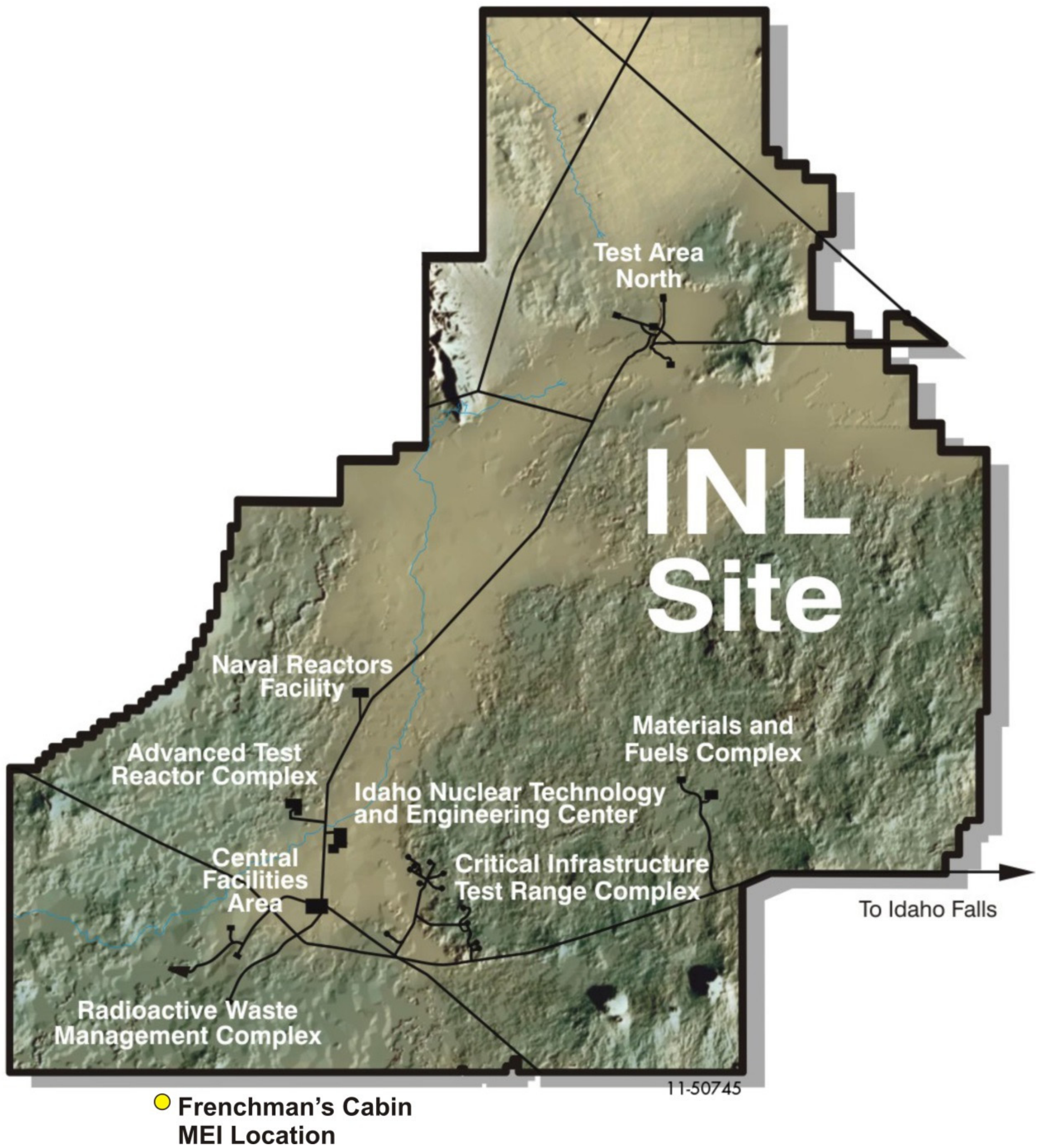

Figure 1. INL Site, including major facility areas and off-site MEI located at Frenchman's Cabin.

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 INL Site during CY 2013 are listed in Table 4. These materials included, but were not limited to, samples, products, process solids, liquids, and wastes that have potential emissions.

Table 4. Radionuclides in use and potentially emitted to the atmosphere from INL Site facilities in CY 2013.

Ac-228	Cs-134	La-142	Pu-241	Tc-99m
Ag-110m	Cs-137	Mn-53	Pu-242	Te-123m
Am-241	Cs-138	Mn-54	Ra-224	Te-125m
Am-242	Eu-152	Mn-56	Ra-226	Te-129
Am-243	Eu-154	Mo-93	Ra-228	Th-228
Ar-39	Eu-155	Mo-99	Rb-88	Th-229
Ar-41	Eu-156	Na-22	Rb-89	Th-230
Ba-133	Fe-55	Na-24	Re-184	Th-232
Ba-137m	Fe-59	Nb-93m	Re-184m	Tl-204
Ba-139	Fe-60	Nb-94	Re-186	Tl-208
Ba-140	Gd-153	Nb-95	Re-186m	U-232
Ba-141	Ge-71	Nb-97	Re-187	U-233
Be-10	H-3	Ni-59	Re-188	U-234
Be-7	Hf-175	Ni-63	Rh-106	U-235
Bi-207	Hf-178m	Np-237	Rn-220	U-236
Bi-210	Hf-179m	Np-239	Ru-103	U-238
Bi-210m	Hf-181	Os-185	Ru-106	V-49
Bi-212	Hf-182	Os-191	Sb-122	W-181
Br-83	Hg-203	P-32	Sb-124	W-185
C-14	Ho-166m	P-33	Sb-125	W-187
Ca-45	I-128	Pa-233	Sc-46	W-188
Cd-109	I-129	Pb-205	Si-32	Xe-133
Ce-139	I-131	Pb-210	Sm-151	Xe-135
Ce-141	I-132	Pb-212	Sn-113	Xe-135m
Ce-144	I-133	Pm-147	Sr-85	Xe-138
Cl-36	I-134	Po-210	Sr-89	Y-88
Cm-242	I-135	Po-212	Sr-90	Y-90
Cm-243	Ir-192	Po-216	Sr-91	Y-92
Cm-244	K-40	Pr-144	Sr-92	Zn-65
Co-57	Kr-85	Pr-144m	Ta-179	Zr-95
Co-58	Kr-85m	Pu-236	Ta-180m	Zr-97
Co-60	Kr-87	Pu-238	Ta-182	
Co-60m	Kr-88	Pu-239	Ta-183	
Cr-51	La-140	Pu-240	Tc-99	

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 Mixed Waste Treatment Project

The AMWTP is located at RWMC and is operated by the Idaho Treatment Group. The AMWTP had nine potential sources of radionuclide emission in operation during CY 2013. Radiological air emissions from the AMWTP may result from the retrieval, characterization, and treatment of transuranic waste, alpha-contaminated low-level mixed waste (alpha LLMW), and LLMW. The mission of the AMWTP is to produce final waste forms that are certified for disposal. These sources were modeled together with RWMC sources (Section 5.6).

5.2 Advanced Test Reactor Complex

The 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 major facility at ATR Complex is the ATR. Other operations at ATR Complex include research and development, site remediation, 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, site remediation, and research and development activities.

5.3 Central Facilities Area

The Central Facilities Area (CFA) is located in the south-central section of 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.

5.4 Critical Infrastructure Test Range Complex

The Critical Infrastructure Test Range Complex (CITRC) is located in the south-central section of INL Site. The CITRC area supports 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 release described in this report 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.

5.5 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 CH2M-WG Idaho, LLC (CWI) for the CY-2013 reporting period.

INTEC radiological air emission sources result from various activities and operations. Emissions exhausted through the Main Stack are associated with ventilation and process and vessel off-gas exhausts from liquid waste operations, including effluent from the Tank Farm Facility tanks, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal. The radioactive emissions exhausted to the Main Stack include both particulate and gaseous radionuclides.

Additional radioactive emissions are associated with decontamination and debris treatment operations, wet-to-dry spent nuclear fuel movements, interim storage of nuclear reactor fuel from Three Mile Island, remote-handled transuranic waste management, radiological and hazardous waste storage facilities, and contaminated equipment maintenance.

Diffuse radiological air emissions from the Sewage Treatment Plant (CPP-1778) and the INTEC Percolation Ponds (CPP-1791) are not being reported for CY-2013 and will not be reported in future reports. These facilities are prohibited from receiving radioactive materials, monitoring has detected only background levels of naturally occurring radioactivity, and they are not managed or controlled as radiological areas.

No diffuse emissions are being reported for INTEC undisturbed soils for CY-2013 because no known surficially contaminated soils are available for resuspension. INTEC undisturbed soils will not be reported in future reports. Soils that were disturbed at INTEC during CY-2013 are not being reported for CY-2013 because they were determined to have less than background radioactivity levels.

There were no abated emissions from the Maintenance Building Hot Shop Vent (CPP-663-002) because no equipment and servicing activities were performed in the CPP-663 hot shop during CY-2013. No abated emissions are being reported for the FAST Stack (CPP-767-001) during CY-2013 because no radionuclides were detected from monitoring activities.

The ICDF is located on the southwest corner of INTEC. Radiological emissions from this facility are estimated from waste disposal in the landfill and evaporation pond operations.

BEA reported minor radioactive emissions from the EPA RDD Decontamination Project located in CPP-653.

5.6 Materials and Fuels Complex

The Materials and Fuels Complex (MFC) is located in the southeastern corner of 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 FCF, waste characterization at the Hot Fuel Examination Facility (HFEF) and fuel research and development at the Fuel Manufacturing Facility (FMF). These facilities are equipped with continuous emission monitoring (CEM) systems. On a regular basis, the effluent streams from FCF, HFEF, FMF 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.

Radiological emissions are estimated from CWI D&D activities that occurred in 2013 in MFC-766, Sodium Boiler Building.

5.7 Radioactive Waste Management Complex

The RWMC, located in the southwestern corner of INL, is a controlled-access area with a primary mission to manage the low-level radioactive site and to temporarily store contact-handled and remote-handled transuranic waste that will be shipped to other designated facilities for disposal. In addition, various activities are being conducted in the Subsurface Disposal Area at the RWMC to complete environmental cleanup of the area under CERCLA. These include waste retrieval activities (Accelerated Retrieval Projects [ARP]), and operation of several units that extract volatile organic compounds from the subsurface.

By agreement with EPA, the ARP used ambient air monitoring as an alternative to air dispersion calculations to verify compliance with the 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.

During CY 2013, sludge from the AMWTP facility was processed at WMF-1617 (previous ARP-V enclosure) , and due to the change in mission during 2013, continuous monitoring was not required. The sludge processing activity is designed to ensure contact-handled stored transuranic waste is compliant with off-site disposal facility waste acceptance criteria by removing prohibited waste items (e.g., free liquids). HEPA filtered radionuclide emissions from the ARP enclosures, including sludge processing at WMF-1617, are calculated for use with emissions measurements from other INL sources to demonstrate INL site-wide compliance using the CAP88-PC Version 3 model.

5.8 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.

5.8.1 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 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.

5.8.2 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 TCE and other volatile organic compounds (VOCs) in the medial zone portion of the OU 1-07B contamination groundwater plume at TAN to below drinking water standards. 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 CWI.

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."

Tables 5 through 13 list the facility stacks, vents, or other points where radioactive materials are released to the atmosphere.

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

Bldg	Vent	Source Description	Effluent Control Description	Efficiency
615	001	Drum Vent Facility	One HEPA filter	99.97%
628	002	Drum Treatment Facility	Two HEPA filters in series	99.97% each
634	001	Characterization Facility		
		Drum Vent	Two HEPA filters in series	99.97% each
		Drum Coring	Three HEPA filters in series	99.97% each
636	001	Transuranic Storage Area-Retrieval Enclosure (TSA-RE)	None	NA
636	002	RCE Stack	Two HEPA filters in series	99.97% each
		ICE Stack	Three HEPA filters in series	99.97% each
676	002	Zone 3 Stack	Three HEPA filters in series	99.97% each
676	003	Glovebox Stack	Three HEPA filters in series	99.97% each
TR-14	001	Laboratory Vent	One HEPA filter	99.97%
TR-14	002	Laboratory Vent	One HEPA filter	99.97%

Table 6. 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	99.97%
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%
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.

Table 7. 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%

a. Bank includes multiple HEPA filters.

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

Bldg	Vent	Source Description	Effluent Control Description[a]	Efficiency
632	NA	Ventilation Exhaust	NA	NA

Table 9. 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	HEPA Filter	99.97%
663	002	Maintenance building hot shop vent	HEPA filter	99.97%
684	001	Remote Analytical Laboratory	Two HEPA filters in series	99.97% each
708	001	INTEC Main Stack	Up to three HEPA filters in series	99.97% total
767	001	FAST Stack	HEPA filter or two 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%

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

Bldg	Vent	Source Description	Effluent Control Description[a]	Efficiency
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	99.97% each
766	001	MFC-799 Tank Treatment	HEPA filter bank	99.97%
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%
771	NA	Radioactive Scrap Waste Facility	None	NA
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	Two HEPA filter banks in series	99.97% each
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, Security and Power Facility	Two HEPA filter banks in series	99.97% each
793	001	Sodium Components Maintenance Shop stack	HEPA filter bank	99.97%
794	006	Experimental Fuels Facility exhaust	HEPA filter bank	99.97%

Bldg	Vent	Source Description	Effluent Control Description[a]	Efficiency
798	017	Radioactive Liquid Waste Treatment Facility	HEPA filter bank	99.97%
1704	NA	Radiochemistry Laboratory	HEPA filter bank	99.97%
1729	001	Irradiated Materials Characterization Laboratory	HEPA filter bank	99.97%

a. Bank includes multiple HEPA filters.

Table 11. 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%
1612	001	ARP-II	HEPA filter	99.97%
1614	001	ARP-III	HEPA filter	99.97%
1615	001	ARP-IV	HEPA filter	99.97%
1617	001	WMF-1617 (ARP-V) Sludge Repackage Project	HEPA filter	99.97%
1619	001	ARP-VII	HEPA filter	99.97%
1621	001	ARP-VIII	HEPA filter	99.97%
SDA	1	Organic Contaminated Vadose Zone (OCVZ)-Unit D (WAG-7)	NA	NA
SDA	1	OCVZ-Unit E (WAG-7)	NA	NA
SDA	1	OCVZ-Unit F (WAG-7)	NA	NA

Table 12. 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 process (RAD Stack #11) manufacturing process (EF-206) and includes releases from the quality control (QC) laboratory	HEPA filter bank	99.97%
679	023	North process (RAD Stack #10) manufacturing process (EF-205) and includes releases from the QC laboratory	HEPA filter bank	99.97%
679	024	North process (RAD Stack #9) 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%

Bldg	Vent	Source Description	Effluent Control Description[a]	Efficiency
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%

a. Bank includes multiple HEPA filters.

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

Bldg.	Vent	Source Description	Effluent Control Description	Efficiency
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 14 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 14. Distances from INL facility points of release to the nearest off-Site receptor location and to Frenchman's Cabin (INL MEI).

Facility	Distance and Direction to Nearest Residence, School, Farm, or Business	Distance and Direction to Frenchman's Cabin
MFC	8,678 m[a] SSE	37,219 m WSW
CFA	12,453 m SE	14,359 m SW
CITRC	10775 m SSE	20,140 m SW
INTEC	15,333 m SSE	18,718 m SSW
NRF	13,714 m NNW	26,675 m SSW
RWMC/AMWTP	7,976 m SSW	7,976 m SSW
TAN-TSF	10,344 m E	54,611 m SSW
TAN-SMC	12,298 m E	54,405 m SSW
ATR Complex	17,421 m NW	19,172 m SSW

a. m = meters.

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."

Tables 15 and 16 show the CAP-88 modeling input parameters for CY 2013.

Table 15. Description of data tables in NESHAP CAP88 database

Table Name	Field Name	Description
UnitDoses	FacilityID	Facility Identification (see Table 15)
	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 15)
	Fugitive	Fugitive or Non-Fugitive release flag
	Radionuclide	Nuclide name
	Q	Release rate (Ci/yr)
MkMEIsBySecName	FacilityID	Facility Identification (see Table 15)
	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 62 receptors surrounding INL. The distance and direction to each receptor varies by facility.

Table 16. INL Site meteorological files and wind measurements heights.

Facility	Facility ID	Wind File	Measurement Height (m)
Central Facilities Area	CFA	690L13.WND	10
Critical Infrastructure Test Range Complex	CITRC	PBFL13.WND	10
Idaho Nuclear Technology and Engineering Center, Idaho CERCLA Disposal Facility	INTEC	GRIL13.WND	10
Idaho Nuclear Technology and Engineering Center – Main Stack	INTEC-MS	GRIU13.WND[b]	30
Materials Fuels Complex	MFC	EBRL13.WND	10
Materials Fuels Complex Main Stack	MFC-MS	EBRU13.WND	30
Naval Reactor Facility	NRF	NRFL13.WND	10
Advanced Test Reactor Complex[a]	ATRC	TRAL13.WND	10
Advanced Test Reactor Complex[a], Advanced Test Reactor Main Stack	ATRC-ATR	GRIU13.WND[b]	30
Advanced Test Reactor Complex[a], Materials Test Reactor Main Stack	ATRC-MTR	GRIU13.WND[b]	30
Radioactive Waste Management Complex	RWMC	RWMCL13.WND	10
Specific Manufacturing Capability	SMC	LOFL13.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.

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"

During calendar year 2013 a confinement tent was installed inside of the Zero Power Physics Reactor (ZPPR) Facility MFC-777. This confinement tent will be used in the dismantlement of approximately 50 kg of highly enriched uranium (HEU) in the form of sodium bearing experimental assemblies. This activity is expected to last approximately 18 months. The calculated unabated dose from this project is expected to be 2.6E-10 mrem/yr.

During calendar year 2013 new equipment was added to the east wing of the Experimental Fuels Facility (EFF), building MFC-794. This modification was performed to support a high density fuel material development activity for Light Water Reactors (LWRs). The calculated unabated dose is expected to be 7.84E-02

Air emissions were evaluated for the Resource Conservation and Recovery Act Drum Repackaging Project being performed at building WMF-1617. The determination includes the addition of an inorganic waste stream, with increased emissions above that of the organic waste stream processing previously reported. The abated dose for processing 9,699 drums of organic and inorganic sludge at 0.0814 mrem/yr is below the 0.1-mrem threshold for requiring an application for approval to construct (40 CFR 61.96).

Building PBF-632 is located within the former Power Burst Facility area, now known as the Critical Infrastructure Protection facility. PBF-632 was an office building. It is now covered with a semi-permanent tent and used to test various cleanup technologies. The release described in this report 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 estimated unabated dose for this activity was 2.0E-07 mrem.

Appendix A

INL Research and Education Complex

Appendix A

INL Research and Education Complex

This report documents radionuclide air emissions for calendar year (CY) 2013 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 Complex (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."

This appendix documents radionuclide air emissions for calendar year (CY) 2013 and the resulting effective dose equivalent (EDE) to the maximally exposed individual (MEI) member of the public from operations at the REC.

For CY 2013, modeling was performed using Clean Air Act Assessment Package (CAP)-88PC, Version 3.

No radionuclide emissions for the IRC or RESL required continuous monitoring for compliance during CY 2013. 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
	IF-638, IRC Physics Laboratory
RESL:	IF-683, Radiological and Environmental Sciences Laboratories

40 CFR 61, Subpart H requires DOE facilities to calculate the resulting dose to the offsite MEI. The location of IRC MEI for CY 2013 is 100 meters south of the IRC. The EDE to the MEI was 1.20E-02 mrem/yr (1.20E–07 sievert/yr), which is 0.120% of the 10-mrem/yr federal standard and was calculated using all sources that emitted radionuclides to the environment from INL. Table 2A provides a summary of INL Site MEI dose by facility and source type.

Table 2A, Dose (mrem) contributions and total IRC dose (mrem) to the MEI located 0.1 km south of the IRC for CY 2013 radionuclide air emissions.

SourceID	Non Fugitive Dose (mrem/yr)	Fugitive Dose (mrem/yr)	Total Dose (mrem/yr)	Notes
RESL Total	1.00E-02	None	1.00E-02	DOE RESL Sources
IRC Complex	1.99E-03		1.99E-03	
IRC-AGC	2.96E-06		2.96E-06	
IRC-EBSD AGR 6-3-2	3.12E-12		3.12E-12	
IRC-EBSD AGR 4-1-1	3.55E-12		3.55E-12	
IRC Total	2.00E-03	None	2.00E-03	BEA IRC Sources
Total	1.20E-02		1.20E-02	

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

The IRC consists of one-story laboratory buildings containing 66 laboratories (Bldg IF-603), the National Security Laboratory (Bldg IF-611) and IRC Physics Lab (Bldg IF-638). RESL (Bldg 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 2013 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. Radionuclides in use and potentially emitted to the atmosphere from REC facilities in CY 2013.

Ac-227	Co-60m	I-129	Pd-103	Sm-145	Th-228
Ag-108m	Cr-51	I-131	Pm-145	Sm-151	Th-230
Ag-110m	Cs-131	In-114m	Pm-147	Sn-113	Th-232
Am-241	Cs-134	Ir-192m	Pm-148m	Sn-117m	Tl-204
Am-243	Cs-135	K-40	Po-210	Sn-119m	Tm-170
Ar-37	Cs-136	Kr-81	Pr-143	Sn-121m	Tm-171
Ar-39	Cs-137	Kr-85	Pr-144	Sn-123	U-232
Ba-131	Er-169	Lu-177m	Pt-193	Sn-125	U-233
Ba-133	Eu-152	Mn-54	Pu-238	Sr-85	U-234
Be-10	Eu-154	Mo-93	Pu-239	Sr-89	U-235
C-14	Eu-155	Nb-92	Pu-240	Sr-90	U-236
Ca-45	Eu-156	Nb-94	Pu-241	Ta-182	U-238
Cd-109	Fe-55	Nb-95	Ra-226	Tb-157	W-181
Cd-115m	Fe-59	Nd-147	Rb-86	Tb-160	Xe-129m
Ce-139	Gd-153	Ni-59	Ru-103	Tb-161	Xe-131m
Ce-141	Ge-71	Ni-63	Ru-106	Tc-97m	Xe-133
Ce-144	H-3	Np-237	S-35	Tc-99	Xe-135
Cf-252	Hf-175	Os-185	Sb-124	Te-121	Y-90
Cl-36	Hf-179m	Os-191	Sb-125	Te-121m	Y-91
Cm-244	Hf-181	Os-194	Sb-126	Te-123m	Zn-65
Co-57	Hg-203	P-32	Sc-46	Te-125m	Zr-95
Co-58	Ho-163	P-33	Se-75	Te-127m	
Co-60	I-125	Pa-231	Se-79	Te-129m	

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 evaluation programs.

The IRC-AGC (Advanced Graphite Capsule) source is calculated from graphite specimens undergoing materials testing at the IRC. The IRC-EBSD AGR-6-3-2 and IRC-EBSD AGR-4-1-1 (Electron Backscatter Diffraction; Advanced Graphite Reactor experiments) sources are calculated from lamella specimens undergoing materials testing at the IRC. The IRC Complex source is calculated from all other remaining radioactive material within the IRC Complex.

The 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.

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 2013.

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.

Radiological emissions from the DOE RESL could be emitted from uncontrolled laboratory fume hoods. These potential emissions are from low-level radiological performance test sample preparation and verification. 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 F-1 stack height is 7.4m (24.3ft) and is located on the east side, center, of the building roof. The F-2 stack height is 7.4 m (24.3 ft) and is located on the north side, center, of the building roof. All heights are from ground level.

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

Bldg	Vent	Source Description	Effluent Control Description	Efficiency
603	HRF[1]-4	Laboratory A-20	NA	NA
603	HRF-4	Laboratory A13	NA	NA
603	HRF-5	Laboratory B-15	NA	NA
603	HRF-6	Laboratory C-4	NA	NA
603	EF[1]-104	Laboratory C-19	HEPA Filter bank	99.97% at 3.0 µm
603	AHU[1]-10	Laboratory 104	NA	NA
611	HV[1]-EF-4	Laboratory 104	NA	NA
611	HV-EF-6	Laboratory 105	NA	NA
611	Blower EF-5	Laboratory 105	NA	NA
611	EF-2	Laboratory 101 and 102	NA	NA
638	AHU-17, AHU-18	Room 115	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.

Bldg	Vent	Source Description	Effluent Control Description	Efficiency
683	F-9	Laboratory 129 fume hood exhaust	NA	NA
683	F-10	Laboratory 129 fume hood exhaust	NA	NA
683	F-11	Laboratory 130 fume hood exhaust	NA	NA
683	F-12	Laboratory 130 fume hood exhaust	NA	NA
683	F-13	Laboratory 131 fume hood exhaust	NA	NA
683	F-14	Laboratory 131 fume hood exhaust	NA	NA
683	F-15	Laboratory 132 fume hood exhaust	NA	NA
683	F-16	Laboratory 132 fume hood exhaust	NA	NA
683	F-17	Laboratory 133 fume hood exhaust	NA	NA
683	F-18	Laboratory 133 fume hood exhaust	NA	NA
683	F-19	Laboratory 134 fume hood exhaust	NA	NA
683	F-20	Laboratory 134 fume hood exhaust	NA	NA
683	F-21	Laboratory 135 fume hood exhaust	NA	NA
683	F-22	Laboratory 135 fume hood exhaust	NA	NA
683	F-23	Laboratory 136 fume hood exhaust	NA	NA
683	F-24	Laboratory 136 fume hood exhaust	NA	NA
683	F-1, F-2	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 of the RESL release points. There is one release point at IRC with effluent control.

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 northeast. 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. The nearest farm producing vegetables, milk and meat is 0.35 km (0.22 mi.) to the north of the IRC.

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 IDAL13.WND from the National Oceanic and Atmospheric Administration station at Fanning Field in Idaho Falls, ID. The measurement height is 15 meters.

The CAP88-PC Version 3 modeling was performed for facilities in Idaho Falls using emission rates for 136 radionuclides. For IRC facility and RESL, releases were calculated from a single ground-level point source for receptors 100 m from the source 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 2013

Calendar Year 2013

Naval Reactors Facility

National Emission Standards for Hazardous Air Pollutants

Report on Radionuclide Air Emissions

Prepared for the U.S. Department of Energy by
Bechtel Marine Propulsion Corporation
Bettis Atomic Power Laboratory

Calendar Year 2013

Naval Reactors Facility

National Emission Standards for Hazardous Air Pollutants

Report on Radionuclide Air Emissions

(As Required under Subpart H of 40 CFR Part 61)

Site Name: Idaho National Laboratory (INL)

Area: Naval Reactors Facility (NRF)

Area Information for NRF

Operator: Bechtel Marine Propulsion Corporation
P. O. Box 2068
Idaho Falls, Idaho 83403-2068

Contact: A. T. Wentzel, Manager, Naval Reactors Facility
Phone: (208) 533-5526

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

Contact: C. B. Haynes, Manager, Naval Reactors Idaho Branch Office
Phone: (208) 533-5317

I. FACILITY INFORMATION

Site Description

Naval Reactors Facility (NRF) is located in the west-central part of Idaho National Laboratory (INL) (see Figure 1). NRF is located approximately 6.7 miles (10.8 kilometers) from the nearest INL border. The nearest residence is 8.5 miles (13.7 kilometers) north-northwest of NRF. The nearest population center is Howe which is located approximately 10.1 miles (16.2 kilometers) north-northwest of NRF. Section III provides specific information concerning the distances to locations used for dose modeling.

The climate of INL is characterized as semi-arid. INL is located on the Snake River Plain with an elevation of approximately 5000 feet (1500 meters). Air masses entering the Snake River Plain from the west lose most of their moisture to 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 by Bechtel Marine Propulsion Corporation. The operations area of NRF within the security fence consists of buildings, streets, and equipment covering about 84 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 October 1989, January 1994, and May 1995, respectively.

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 cores, which results in the creation of less spent fuel requiring disposition. NRF also prepares and packages spent naval fuel for dry storage and eventual transport to a permanent repository.

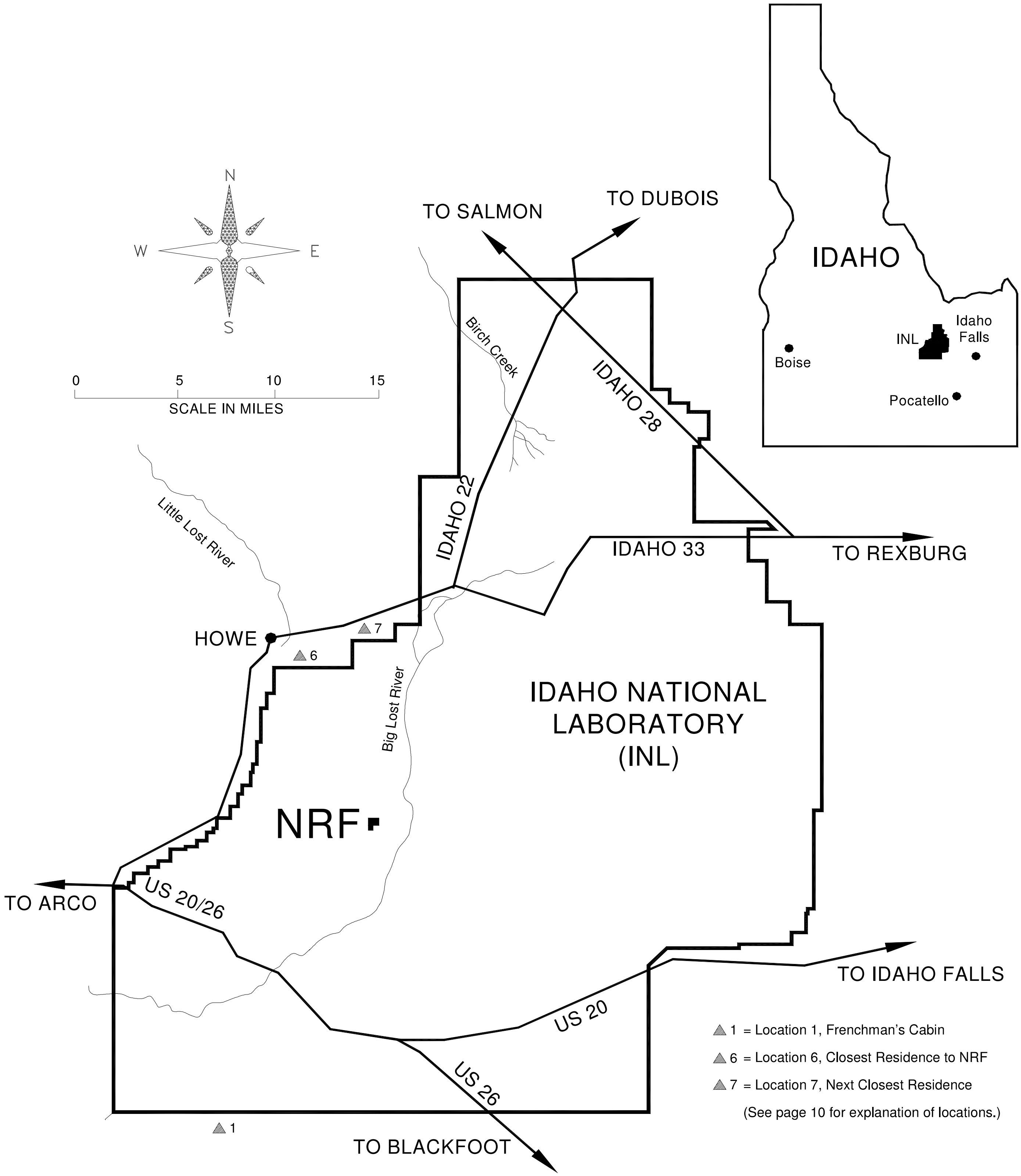

Figure 1. Relation of NRF to INL and the Surrounding Area.

Source Descriptions

NRF receives spent fuel and radioactive components from the U. S. Naval Nuclear Propulsion Program, 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 highbay 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 within the S5G highbay. 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 three main 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. Radioactive water is present in the water pools where the fuel is located. 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, routine inspections of the reactor compartments are conducted and the air exhausted from these facilities is monitored. At the S5G prototype, contaminated materials such as tools, equipment, anti-contamination clothing, and contaminated waste are handled. Analyses are performed on radioactive materials in chemistry laboratories in the A1W prototype building.

(3) Fugitive Soil Emissions from areas surrounding NRF which potentially contain low levels of radioactivity in the soil that are exposed to the wind.

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 61.93(b) of 40 CFR 61, Subpart H, 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 x 10^{-4} sievert) per year standard, which is 0.1 millirem (1 x 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 x 10^{-6} sievert) per year criteria. For emission points whose potential to emit is below this criteria, periodic confirmatory measurements are required to verify the low emissions.

Table II-1 identifies potential point sources of radionuclide air emissions at NRF. The table contains identification codes for area, building, and vent; a general description; a description of the effluent controls and their efficiencies; whether each emission point was monitored; and the distance to the nearest residence, school, business, office, or farm.

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, which contain low levels of radioactivity from past releases to the environment. This source has no effluent control or monitoring. The table presents the distance to the nearest residence, school, business, office, or farm.

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. For determining the EDE, the gross alpha radioactivity is conservatively modeled as plutonium-239 and the gross beta radioactivity is conservatively modeled as strontium-90.

Table II-1. Radiological Air Emission Point Sources at NRF During 2013

Nearest Residence, School, Business, Office, or Farm: 13.7 kilometers north-northwest				
AREA -BLDG -VENT No.	SOURCE DESCRIPTION	EFFLUENT CONTROL DESCRIPTION	EFFICI-ENCY [1]	MONI-TORED [2]
NRF-601-HBRV	S1W High Bay Ventilation (7 individual emission points)	None [3]	NA	Yes
NRF-616-012, 021	A1W Operations Building and Site Chemistry	None [3]	NA	Yes
NRF-617-013	A1W Reactor Compartment 3A	HEPA Filter	99.95%	Yes
NRF-617-020	A1W Reactor Compartment 3B	HEPA Filter	99.95%	Yes
NRF-618-099	ECF Stack Number 1	HEPA Filter Carbon Filter	99.95% 90–99.9%	Yes+
NRF-618-103	ECF Stack Number 2	HEPA Filter	99.95%	Yes+
NRF-618-237	ECF Stack Number 3	HEPA Filter	99.95%	Yes+
NRF-618-HBRV	ECF High Bay Roof Vents (16 individual emission points)	None [3]	NA	Yes+
NRF-633A-057	S5G Radioactive Area Ventilation (RAV) System	HEPA Filter	99.95%	Yes
NRF-633A-HBRV	S5G High Bay Roof Vents (6 individual emission points)	None [3]	NA	Yes
NRF-628-T NRF-710-T NRF-733-T	A1W Radioactive Waste Processing System Remediation Ventilation[4]	HEPA Filter	99.95%	Yes

1. 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. 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 when efficiency drops to 90 percent.
2. "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.)
3. HEPA filtered subsystems that exhaust within the areas ventilated by these sources are sometimes used.
4. These exhaust systems were set up to provide HEPA filtered ventilation during remediation and removal of old radiological structures and equipment. The exhaust systems will be removed after remediation work is complete.

Table II-2. Radiological Air Emission Non-Point Sources at NRF During 2013

Nearest Residence, School, Business, Office, or Farm: 13.7 kilometers north-northwest				
AREA -BLDG -VENT No.	SOURCE DESCRIPTION	EFFLUENT CONTROL DESCRIPTION	EFFI-CIENCY	MONI-TORED
NA	Fugitive Soil	None	NA	No

Table II-3. Point Source Releases from NRF During 2013

Radionuclide	Release (curies)	Release (becquerels)*
Gross alpha (modeled as plutonium-239)	2.9E-06	1.1E+05
Gross beta (modeled as strontium-90)	6.0E-05	2.2E+06
Carbon-14	7.3E-01	2.7E+10
Hydrogen-3 (Tritium)	1.7E-02	6.3E+08
Iodine-129	3.8E-05	1.4E+06
Iodine-131	4.1E-06	1.5E+05
Krypton-85	2.2E-02	8.1E+08
Total	7.7E-01	2.8E+10

* One curie equals 3.7E+10 becquerels.

Table II-4. Non-Point Source Releases from NRF During 2013

Radionuclide	Release (curies)	Release (becquerels)*
Cobalt-60	5.1E-08	1.9E+03
Cesium-137	8.4E-05	3.1E+06
Total	8.4E-05	3.1E+06

* One curie equals 3.7E+10 becquerels.

III. DOSE ASSESSMENTS

Summary

Table III-1 summarizes the EDE results for point sources, non-point sources, and both combined. The total EDE from all NRF sources was determined to be 3.8 x 10^{-4} millirem (3.8 x 10^{-9} sievert) at the location of the maximally exposed individual 9.8 miles (15.8 kilometers) north of NRF. The NRF EDE is for information only; it is the EDE from all INL sources combined that is used to show compliance with the 40 CFR 61.92 standard.

Table III-1. Effective Dose Equivalents from Sources at NRF During 2013

Release Type	EDE [1] (mrem)	EDE [1] (Sv) [2]
1. Point Sources	3.8E-04	3.8E-09
2. Non-Point Sources	3.9E-06	3.9E-11
Total:	3.8E-04	3.8E-09

1. The EDE shown is for the NRF Maximally Exposed Individual (Figure 1, Location 7).
2. One millirem equals 1.0E-05 sievert (Sv).

Description of Dose Model and Summary of Input Parameters

The CAP88 computer code (CAP88-PC Version 3.0, 2013 Update) was used to calculate the EDE from the NRF releases. CAP88 is approved for use by the Environmental Protection Agency (EPA) for demonstrating compliance with 40 CFR 61 Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities." 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 2013 wind data was used, supplied by the National Oceanic and Atmospheric Administration (NOAA). Emissions from all NRF sources were conservatively modeled as ground-level releases with no plume rise. All sources were modeled as originating from the geographic center of NRF. Other user-supplied input parameters are as follows:

Wind Data File: NRFL13.STR per NOAA
Annual Average Temperature: 6 deg C average in 2013 per NOAA
Annual Rainfall: 10 cm in 2013 per NOAA.
Humidity: 4 g/m^3 long term INL average calculated from NOAA data
Lid Height: 800 m per NOAA
Agricultural Class: Rural

The dose from radioactive daughter progeny is included in the dose determined by the CAP88 program.

Compliance Assessment

Maximally Exposed Individual

Subpart H of 40 CFR 61 requires that emissions of radionuclides to the ambient air from DOE facilities shall not exceed those amounts which would cause any member of the public to receive an EDE of 10 millirem (1 x 10^{-4} sievert) per year. "Member of the public" is any offsite point where there is a residence, school, business, or office.

Two locations near the INL boundary were evaluated to determine which received the highest EDE from NRF emissions. The first location is the nearest residence, school, business, or office to NRF. It is a residence 8.5 miles (13.7 kilometers) to the north-northwest of NRF (Figure 1, Location 6). The second location is another residence located 9.8 miles (15.8 kilometers) north of NRF (Figure 1, Location 7). Although Location 7 is a greater distance from NRF, wind direction in some years can cause it to receive a higher EDE from NRF emissions than Location 6. The EDE at both of these locations was evaluated using the CAP88 program, and Location 7 was found to have the higher EDE from NRF's 2013 emissions. The location numbers come from a list of locations near INL where there is a residence, school, business or office. For NRF, receptor Locations 6 and 7 are the only two locations with a reasonable chance of receiving the highest EDE from NRF emissions.

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 highest EDE from all INL facilities combined typically occurs at a location south of INL referred to as Frenchman's Cabin (Figure 1, Location 1).

IV. ADDITIONAL INFORMATION

40 CFR 61 Subpart H requires this report to include 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. NRF did not complete any new construction or modifications of sources of radiological air emissions during 2013.

NRF did not have any unplanned releases of radionuclides to the atmosphere in 2013.

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

The following information is provided at the request of DOE Headquarters. 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 2013 releases.

An estimate of the collective effective dose equivalent (person-rem per year) will be provided in the *Idaho National Laboratory Site Environmental Report for Calendar Year 2013*.

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 x 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 x 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 none of NRF's 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.