



U.S. Department of Energy
Idaho Operations Office

National Emission Standards for Hazardous Air Pollutants—Calendar Year 2011 INL Report for Radionuclides

June 2012



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**National Emission Standards for Hazardous Air
Pollutants—Calendar Year 2011 INL Report for
Radionuclides**

June 2012

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

ABSTRACT

This report documents the calendar year 2011 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 4.58E-02 mrem per year, 0.46 percent of the 10 mrem standard.

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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
CPP	Chemical Processing Plant
CWI	CH2M-WG Idaho, LLC
CY	calendar year
D&D	decontamination and decommissioning
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
EBR-II	Experimental Breeder Reactor-II
EDE	effective dose equivalent
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
ICE	Inner Contamination Enclosure
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IRC	INL Research Center
ITG	Idaho Treatment Group
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
MWSF	Mixed Waste Storage Facility

NESHAP	National Emission Standards for Hazardous Air Pollutants
NOAA	National Oceanic and Atmospheric Administration
NPTF	New Pump and Treat Facility
NRF	Naval Reactors Facility
OCVZ	organic contamination in the vadose zone
OU	operable unit
PBF	Power Burst Facility
QC	quality control
RACL	Radioanalytical Chemistry Laboratory
RCE	Retrieval Contamination Enclosure
RCL	Radiochemistry Laboratory
RESL	Radiological and Environmental Sciences Laboratory
RCRA	Resource Conservation and Recovery Act
RDD	radiological dispersion device
RH	remote handled
RH-TRU	remote handled transuranic
RRTR	Radiological Response Test Range
RWMC	Radioactive Waste Management Complex
SDA	Subsurface Disposal Area
SMC	Specific Manufacturing Capability
TAN	Test Area North
TRA	Test Reactor Area
TRU	transuranic
TSF	Technical Support Facility
VCO	Voluntary Consent Order
WAG	waste area group
WMF	Waste Management Facility

National Emission Standards for Hazardous Air Pollutants—Calendar Year 2011 INL Report for Radionuclides

1. INTRODUCTION

This report documents radionuclide air emissions for calendar year (CY) 2011 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 the Environmental Sciences Laboratory (RESL) emissions located in Idaho Falls, Idaho. RESL moved from the INL Site to a new location in Idaho Falls during CY 2011 and the dose for RESL was divided between the INL Site and the REC. Radionuclide emissions from the REC are not included in INL Site EDE calculation since the facilities are not contiguous. Compliance to the 10-mrem 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 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 2011, modeling was performed using Clean Air Act Assessment Package (CAP)-88PC, Version 3.

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 2011. It was prepared in accordance with the 40 CFR 61, Subpart H. As required, this report is submitted to both the Environmental Protection Agency (EPA) Headquarters and the appropriate regional office (EPA Region 10) no later than June 30, 2012.

Table 1 reports the annual radionuclide emissions for INL Site sources that require continuous monitoring for compliance during CY 2011. 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 2011.

Radionuclide	MFC-785-018 ^a	MFC-764-001	MFC-704-08	ARPs 1-6 ^b	CPP-708-001	CPP-659-033 ^c	CPP-767-001	WMF-676-002 ^c	WMF-676-003 ^c
Am-241	—	—	—	2.60E-03	—	—	—	—	—
Ar-41	—	—	—	—	—	—	—	—	—
Co-60	—	—	—	—	—	—	—	—	—
Cs-137	—	—	—	—	3.95E-04	—	4.32E-07	—	—
H-3	—	—	—	—	—	—	—	—	—
I-129	—	—	—	—	—	—	—	—	—
Kr-85	—	1.12E-01	—	—	—	—	—	—	—
Pu-238	—	—	—	—	2.09E-06	—	—	—	—
Pu-239	4.85E-07	1.14E-07	1.91E-07	4.60E-04	1.67E-07	—	—	—	—
Pu-240	—	—	—	—	—	—	—	—	—
Sb-125	—	—	—	—	—	—	—	—	—
Sr-90	4.50E-07	1.66E-07	7.94E-08	—	4.46E-04	—	—	—	—

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- a. Particulate stack monitoring results have been increased for January through March to account for probe misalignment.
 - b. Radionuclide emissions from the ARP enclosures are calculated and presented here to demonstrate INL site-wide compliance using the CAP88 model (see discussion of ARP in section 5.6).
 - c. No measurable emissions in 2011.
-

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-628-002, Drum Treatment 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 Glovebox Stack
	WMF-TR-14-001 Analytical Laboratory
	WMF-TR-14-002 Analytical Laboratory
Advanced Test Reactor (ATR) Complex:	Test Reactor Area (TRA)-603 MTR Decontamination & Decommissioning (D&D)
	TRA-670-074, Advanced Test Reactor (ATR) Chemistry Laboratory fume hoods exhaust
	TRA-670-086, laboratory
	TRA-670-098, laboratory
	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 (RACL)
	TRA-610 MTR Fan House D&D
	TRA-712, TRA-612, TRA-760 Retention Basin D&D
	TRA-632 Hot Cell Building D&D
Central Facilities Area (CFA):	CFA-690-001, -002, -003, -005, -006, -007, -008, -009, -045, -046, -047, -Vent-195, Radiological and Environmental Sciences Laboratory (RESL)
	CFA-625, CFA Laboratory Complex
	Tritium emissions from pumped aquifer water
	CFA-54 Soil Remediation
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-767-001, FAST Stack
	CPP-1608-001, Manipulator Repair Cell

Facility	Source
	CPP-1774, TMI-2 Independent Spent Storage Installation
	CPP-1778, Sewage Treatment Plant
	CPP-1791, INTEC percolation ponds
	CPP-2707, dry cask storage pad
	CPP – undisturbed soil (windblown CPP-88)
	CPP- 88 disturbed soils
	INL Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Disposal Facility Landfill (ICDF) emissions from solid waste disposal
	ICDF pond emissions
	OU 3-13 soils removal
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 (Experimental Breeder Reactor [EBR]-II/Fuel Conditioning Facility (FCF) exhaust)
	MFC-766, -767, D&D - sodium removal
	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, Contaminated Equipment Storage Building exhaust
	MFC-798-017, Radioactive Liquid Waste Treatment Facility
	MFC-1704, Radiochemistry Laboratory (RCL)
Naval Reactors Facility	See Appendix B
Radioactive Waste Management Complex (RWMC):	ICP Analytical Services
	WMF-601-001, Health Physics Laboratory Hood
	WMF-697-001, Accelerated Retrieval Project (ARP)-1
	WMF-1612-001, ARP-2
	WMF-1614-001, ARP-3
	WMF-1615-001, ARP-4
	WMF-1615-001, ARP-5

Facility	Source
	WMF-1615-001, ARP-6
	H-3 from groundwater
	Subsurface Disposal Area (SDA) Organic Contamination in the Vadose Zone (OCVZ)-Unit D (WAG 7)
	OCVZ-Unit E (WAG 7)
	OCVZ-Unit F (WAG 7)
	SDA Buried Beryllium Blocks
Test Area North (TAN)	629-013, manufacturing process, Line 2A
Specific Manufacturing Capability (SMC):	679-022, -023, -024 manufacturing process, north process
	679-025, -026, -027 manufacturing process, south process
	681-016, Process Reclamation Facility
	681-018, Process Reclamation Facility
	681-020, Process Reclamation Facility
Test Area North (TAN) Technical Support Facility (TSF):	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 2011 (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 4.58E-02 mrem/yr (4.58 E-07 sievert/yr), which is 0.46% 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 2011 radionuclide air emissions.

Facility ID	Point source dose (mrem/yr)	Fugitive source dose (mrem/yr)	Total dose (mrem/yr)	Notes
CFA Total	8.50E-08	1.28E-05	1.29E-05	Central Facilities Area
INTEC	6.83E-05	7.80E-03	7.87E-03	Idaho CERCLA Disposal Facility and other INTEC soils
INTEC-MS	2.42E-05		2.42E-05	INTEC Main Stack
INTEC Total	9.25E-05	7.80E-03	7.89E-03	Total from INTEC sources
MFC	2.36E-04		2.36E-04	Materials and Fuels Complex
MFC-MS	2.14E-08		2.14E-08	Materials and Fuels Complex, Main Stack
MFC Total	2.36E-04		2.36E-04	Total from MFC sources
NRF Total	1.25E-04	3.02E-06	1.28E-04	Naval Reactor Facility
ATR Complex	7.71E-05	4.48E-03	4.55E-03	ATR Complex
ATR Complex-ATR	5.26E-03		5.26E-03	Advanced Test Reactor Main Stack at ATR Complex
ATR Complex -MTR	1.17E-05		1.17E-05	Materials Test Reactor at ATR Complex
ATR Complex Total	5.35E-03	4.48E-03	9.82E-03	Total from ATR Complex sources
AMWTP	1.39E-02		1.39E-02	Advanced Mixed Waste Treatment Plant (includes WMF-636, WMF-634, WMF-628-002, WMF-615)
RWMC		1.38E-02	1.38E-02	Others sources at Radioactive Waste Management Complex
RWMC Total	1.39E-02	1.38E-02	2.77E-02	Total from RWMC sources
TAN-SMC Total	2.38E-09		2.38E-09	Test Area North –Specific Manufacturing Capability
TAN-TSF Total	5.23E-07	7.83E-06	8.35E-06	Test Area North – Technical Services Facility
TOTAL	1.97E-02	2.61E-02	4.58E-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 2011 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 2011.

Ac-227	Co-57	Kr-79	Pr-144	Ta-180m
Ag-108m	Co-58	Kr-83m	Pu-236	Ta-182
Ag-110	Co-60	Kr-85	Pu-238	Ta-183
Ag-110m	Co-60m	Kr-85m	Pu-239	Tc-99
Am-241	Cr-51	Kr-87	Pu-240	Tc-99m
Am-242	Cs-134	Kr-88	Pu-241	Te-123m
Am-243	Cs-135	La-140	Pu-242	Te-125m
Ar-39	Cs-137	La-142	Ra-224	Th-228
Ar-41	Cs-138	Mn-53	Ra-226	Th-229
Ba-133	Eu-152	Mn-54	Ra-228	Th-230
Ba-137m	Eu-154	Mn-56	Rb-88	Th-231
Ba-139	Eu-155	Mo-93	Rb-89	Th-232
Ba-140	Eu-156	Mo-99	Re-184	Th-234
Ba-141	Fe-55	Na-22	Re-184m	Tl-204
Be-10	Fe-59	Na-24	Re-186	Tl-208
Be-7	Fe-60	Nb-93m	Re-186m	U-232
Bi-207	Ge-71	Nb-94	Re-187	U-233
Bi-210	H-3	Nb-95	Re-188	U-234
Bi-210m	Hf-175	Ni-59	Rh-106	U-235
Bi-212	Hf-178m	Ni-63	Ru-103	U-236
Bi-214	Hf-179m	Np-237	Ru-106	U-238
Br-80	Hf-181	Np-239	Sb-122	V-49
Br-80m	Hf-182	Os-185	Sb-124	W-185
Br-82	Hg-203	Os-191	Sb-125	W-187
Br-83	I-125	P-32	Sc-46	W-188
C-14	I-128	P-33	Se-81	Xe-133
Ca-45	I-129	Pa-233	Se-81m	Xe-135
Cd-109	I-131	Pa-234m	Si-32	Xe-135m
Ce-139	I-132	Pb-205	Sm-151	Xe-138
Ce-141	I-133	Pb-210	Sn-113	Y-88
Ce-144	I-134	Pb-212	Sr-85	Y-90
Cl-36	I-135	Pb-214	Sr-89	Y-92
Cl-38	Ir-192	Pm-147	Sr-90	Zn-65
Cm-242	K-40	Po-210	Sr-91	Zr-95
Cm-243	K-42	Po-212	Sr-92	Zr-97
Cm-244	K-43	Po-216	Ta-179	

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. It had nine potential sources of radionuclide emission in operation during CY 2011. 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.

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, analytical laboratory services, and facility decommissioning and demolition activities.

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, research and development activities, and decommissioning and demolition activities.

For CY 2011, CH2M-WG Idaho, LLC (CWI) radiological emissions were the result of decontamination and demolition activities at the TRA-603 (MTR Reactor and Building), TRA-610 (MTR Fan House), TRA-632 (three hot cells and building), and the Retention Basin System, which included TRA-712, TRA-612, and TRA-760. Radiological emissions from these activities were associated with contaminated equipment and waste removal, demolition of contaminated structures, closure of mixed waste tank systems, and removal of contaminated soils.

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:

- DOE Radiological and Environmental Sciences Laboratory (RESL; CFA-690)
- Maintenance shops
- Vehicle maintenance facilities
- Instrument calibration laboratories
- Communications and security systems
- Fire protection
- Medical services
- Warehouses
- Laboratory Facilities
- Other support services facilities

Decontamination, decommission, and remediation activities.

With the exception of RESL, operations at CFA are conducted by BEA. The RESL is operated directly by the Department of Energy Idaho Operations Office (DOE-ID).

Minor emissions occur from CFA facilities where work with small quantities of radioactive materials is routinely conducted. This includes low-level radiological performance testing samples preparation and verification at RESL (CFA-690) and radiochemical research and development (CFA-625). Other minor emissions result from research and development laboratory operations and groundwater usage.

In June of 2011 RESL moved from the INL Site at CFA-690 to a new laboratory at the Research and Education Complex in Idaho Falls. Dose calculations for the in town facility are included in Appendix A.

In 2011, CWI completed soil remediation at site CFA-54, a contaminated soil site. Minor emissions are reported from that activity.

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. As its primary mission, it began operations in 1953 to recover and reprocess spent nuclear fuel. It was operated for DOE-ID by CWI for the CY-2011 reporting period.

Radiological air emissions from INTEC sources are primarily associated with liquid waste operations, including effluents from the Tank Farm Facility, Process Equipment Waste Evaporator, and Liquid Effluent Treatment and Disposal, which are exhausted through the Main Stack. These radioactive emissions include particulates and gaseous radionuclides. Additional radioactive emissions are associated with deactivation and decommissioning activities, decontamination and debris treatment operations, wet-to-dry spent nuclear fuel movements, CERCLA site remediation, RH-TRU waste management, radiological and hazardous waste storage facilities, and contaminated equipment maintenance.

BEA had radioactive emissions from the EPA radiological dispersion device (RDD) Decontamination Project. Minor emissions are reported from this activity.

5.5 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 Fuel Conditioning Facility (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 NESHAP reporting on an annual basis.

In 2011, CWI decontamination and demolition activities involved several MFC facilities, including MFC-766, Sodium Boiler Building, and MFC-767, EBR-II Reactor Plant Building. These activities also included treatment of elemental sodium and sodium/potassium alloy in the EBR-II Primary Tank by reaction with a citric acid solution. Radiological emissions are reported from these activities.

5.6 Radioactive Waste Management Complex

The Radioactive Waste Management Complex (RWMC), located in the southwestern corner of INL, is a controlled-access area with a primary mission to safely dispose of INL-generated low-level radioactive waste 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.

Potential unabated emissions from the ARP exceed 0.1 mrem/yr. By agreement with EPA, ARP uses ambient air monitoring as an alternative to air dispersion calculations to verify compliance with the standard. Therefore, record sampling is not performed, although CAMs are used for real-time monitoring for detection of off-normal emissions. 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.

To fulfill these missions, the RWMC maintains facilities and processes in separate areas for administrative and operations support, and waste storage and disposal. Administrative and Operations Area buildings are used for security and access control, personnel offices, lunchrooms, change and shower rooms, equipment and materials storage, craft and maintenance shops, and radiological control. This section covers the Operations at the RWMC conducted by CWI, under the administration of DOE Idaho and does not include those operations performed by other contractors under the administration of DOE.

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.

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 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 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 Operable Unit (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 12 list the facility stacks, vents, or other points where radioactive materials were released to the atmosphere during CY 2011.

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	99.97% each
634	001	Characterization Facility		
		Drum Vent	Two HEPA filters	99.97% each
		Drum Coring	Three HEPA filters	99.97% each
636	001	Transuranic Storage Area- Retrieval Enclosure (TSA-RE)	None	Not applicable
636	002	RCE Stack	Two HEPA filters	99.97% each
		ICE Stack	Three HEPA filters	99.97% each
676	002	Zone 3 Stack	Three HEPA filters	99.97% each
676	003	Glovebox Stack	Three HEPA filters	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%
715	001	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)

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

Bldg	Vent	Source Description	Effluent Control Description	Efficiency
625	010	Laboratory fume hoods	HEPA Filter bank ^a	99.97%
690	001	RESL	NA	NA
690	002	RESL	NA	NA
690	003	RESL	NA	NA
690	005	RESL	NA	NA
690	006	RESL	NA	NA
690	007	RESL	NA	NA
690	008	RESL	NA	NA
690	009	RESL	NA	NA
690	045	RESL	NA	NA
690	046	RESL	NA	NA
690	047	RESL	NA	NA
690	195	RESL	NA	NA

a. Bank includes multiple HEPA filters.

Table 8. 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	HEPA filter or up to three HEPA filters in series	99.97% each
767	001	Flourinel and Storage Facility (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	-	TMI-2 Independent Spent Fuel Storage Installation	HEPA filter	99%

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

Bldg	Vent	Source Description	Effluent Control Description	Efficiency
704	008	Fuel Manufacturing Facility stack	Two HEPA filter banks ^a 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	Laboratory and Office (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	Main Stack	EBR-II—HEPA filter bank FCF—Two HEPA filter banks	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%
771	NA	Radioactive Scrap Waste Facility	NA	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%
793	001	Sodium Components Maintenance Shop stack	HEPA filter bank	99.97%
794	006	Contaminated Equipment Storage Building exhaust	HEPA filter bank	99.97%
798	017	Radioactive Liquid Waste Treatment Facility	HEPA filter bank	99.97%
1704	NA	Radiochemistry Laboratory	HEPA filter bank	99.97%

a. Bank includes multiple HEPA filters.

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

Bldg	Vent	Source Description	Effluent Control Description	Efficiency
601	1	Health Physics Laboratory Hood	HEPA filter	99.97%
697	1	ARP-1	HEPA filter	99.97%
1612	1	ARP-2	HEPA filter	99.97%
1614	1	ARP-3	HEPA filter	99.97%
1615	1	ARP-4	HEPA filter	99.97%
1617	1	ARP-5	HEPA filter	99.97%
1618	1	ARP-6	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 11. Stacks, vents, or other points of radioactive materials release to the atmosphere at TAN-SMC.

Bldg	Vent	Source Description	Effluent Control Description	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	One HEPA filter bank	99.97%
679	023	North process (RAD Stack #10) manufacturing process (EF-205) and includes releases from the QC laboratory	One HEPA filter bank	99.97%
679	024	North process (RAD Stack #9) manufacturing process (EF-204) and includes releases from the QC laboratory	One HEPA filter bank	99.97%
679	025	South process (RAD Stack #8) manufacturing process (EF-203)	One HEPA filter bank	99.97%
679	026	South process (RAD Stack #7) manufacturing process (EF-202)	One HEPA filter bank	99.97%
679	027	South process (RAD Stack #6) manufacturing process (EF-201)	One HEPA filter bank	99.97%
681	016	Process Reclamation Facility	NA	NA
681	018	Process Reclamation Facility	One HEPA filter bank	99.97%
681	020	Process Reclamation Facility	One HEPA filter bank	99.97%

Table 12. 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-107B 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 13 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 13. 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
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 14 and 15 show the CAP-88 modeling input parameters for CY 2011.

Table 14. Description of data tables in NESHAPS CAP88 database

Table Name	Field Name	Description
UnitDoses	FacilityID	Facility Identification (see Table 15)
	Nuclide	Nuclide 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
MkMEIsBySecName	Q	Release rate (Ci/yr)
	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 15. INL Site meteorological files and wind measurements heights.

Facility	Facility ID	Wind File	Measurement Height (m)
Central Facilities Area	CFA	690L11.WND	10
Idaho Nuclear Technology and Engineering Center, Idaho CERCLA Disposal Facility	INTEC	GRIL11.WND	10
Idaho Nuclear Technology and Engineering Center – Main Stack	INTEC-MS	GRIU11.WND	30
Materials and Fuels Complex	MFC	EBRL11.WND	10
Materials and Fuels Complex Main Stack	MFC-MS	EBRU11.WND	30
Naval Reactors Facility	NRF	NRFL11.WND	10
Advanced Test Reactor Complex	ATR Complex	TRAL11.WND	10
Advanced Test Reactor Complex-Advanced Test Reactor	ATR Complex - ATR	GRIU11.WND	30
Advanced Test Reactor Complex- Materials Test Reactor	ATR Complex -MTR	GRIU11.WND	30
Radioactive Waste Management Complex	RWMC	RWMCL11.WND	10
Test Area North - Specific Manufacturing Capability	SMC	LOFL11.WND	10
Test Area North - Technical Support Facility	TAN	LOFL11.WND	10

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”

The AMWTP constructed the Transuranic Storage Area – Retrieval Contamination Enclosure/Inner Contamination Enclosure (RCE/ICE) (WMF 636-002) in calendar 2011. The RCE is an enclosure over the existing waste that still needs to be retrieved within the Transuranic Storage Area. The ICE is a soft sided enclosure within the RCE that is used to process containers as they are retrieved. The calculated unabated dose for the RCE/ICE is $7.65E-01$ mrem/yr.

INL Radioanalytical Chemistry Laboratory at the ATR Complex began operation in the first quarter of 2011. Activities at the lab include wet chemical analysis to determine trace radionuclides, higher level radionuclides, inorganic and general purpose analytical chemistry. HEPA filtered hoods are located in the laboratory including the radiological control room used for analysis of contaminated samples. The calculated unabated dose for the RACL is $6.49E-5$ mrem/yr.

The Radiological Response Test Range (RRTR) – North Test Range (located at TAN-TSF) and South Test Range (located at RWMC) began operation in July, 2011 to support federal agencies responsible for the nuclear forensics mission. The maximum calculated unabated dose for the RRTR North Test Range is $5.37E-02$ mrem/yr and for the South Test Range is $6.45E-02$ mrem/hr.

Appendix A

INL Research and Education Complex

Appendix A

INL Research and Education Complex

This report documents radionuclide air emissions for calendar year (CY) 2011 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 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) 2011 and the resulting effective dose equivalent (EDE) to the maximally exposed individual (MEI) member of the public from operations at the REC.

For CY 2011, 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 2011. 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 2011 is 100 meters south of the IRC. The EDE to the MEI was 9.51E-03 mrem/yr (9.51E-08 sievert/yr), which is 0.095% 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 2011 radionuclide air emissions.

Facility ID	Point source dose (mrem/yr)	Fugitive source dose (mrem/yr)	Total dose (mrem/yr)	Notes
IRC Total	2.12E-03		2.12E-03	BEA IRC sources
RESL Total	7.39E-03		7.39E-03	DOE RESL sources
TOTAL	9.51E-03		9.51E-03	

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 consist of a one-story laboratory building 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 2011 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 2011.

Ag-108m	Co-57	I-129	Pd-103	Sc-48	Te-127m
Ag-110m	Co-58	I-131	Pm-145	Se-75	Te-129m
Am-241	Co-60	In-114m	Pm-147	Se-79	Te-131m
Ar-37	Co-60m	Ir-192m	Pm-148	Sm-145	Th-228
Ar-39	Cr-51	Ir-194	Pm-148m	Sm-151	Th-230
As-76	Cs-131	K-40	Pm-149	Sm-153	Th-232
As-77	Cs-134	Kr-81	Pm-151	Sn-113	Tl-204
Au-199	Cs-135	Kr-85	Po-210	Sn-117m	Tm-170
Ba-131	Cs-136	La-140	Pr-143	Sn-119m	Tm-171
Ba-133	Cs-137	Lu-177m	Pt-191	Sn-121	U-232
Ba-133m	Cu-67	Mn-54	Pt-193	Sn-121m	U-233
Ba-135m	Er-169	Mo-93	Pt-195m	Sn-123	U-234
Be-10	Er-172	Mo-99	Pu-238	Sn-125	U-235
Bi-210	Eu-152	Nb-94	Pu-239	Sr-85	U-236
Br-82	Eu-152m	Nb-95	Ra-226	Sr-89	U-238
C-14	Eu-154	Nb-95m	Rb-86	Sr-90	W-181
Ca-45	Eu-155	Nd-147	Re-186	Ta-182	Xe-129m
Ca-47	Eu-156	Ni-59	Rh-105	Ta-183	Xe-131m
Cd-109	Fe-55	Ni-63	Ru-103	Tb-157	Xe-133
Cd-115	Fe-59	Ni-66	Ru-106	Tb-160	Xe-133m
Cd-115m	Gd-153	Np-237	Ru-97	Tb-161	Xe-135
Ce-137m	Ge-71	Os-185	S-35	Tc-97m	Y-90
Ce-139	H-3	Os-191	Sb-122	Tc-99	Y-91
Ce-141	Hf-175	Os-193	Sb-124	Tc-99m	Yb-175
Ce-143	Hf-179m	Os-194	Sb-125	Te-121	Zn-65
Ce-144	Hf-181	P-32	Sb-126	Te-121m	Zr-89
Cl-36	Hg-203	P-33	Sc-46	Te-123m	Zr-95
Cm-244	I-125	Pa-231	Sc-47	Te-125m	

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.

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 2011.

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. Stack 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 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.

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-3	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-102 & 103	Laboratory 104	NA	NA
611	HV-EF-4	Laboratory 104	NA	NA
611	HV-EF-6 & HClO ₄ fume hood Fan/Stack	Laboratory 105	NA	NA
638	EF-104	Room 115	NA	NA

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	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 IRC or RESL release points.

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 IDAL11.WND from the NOAA station at Fanning Field in Idaho Falls, ID. The measurement height is 15 meters.

The CAP88-PC modeling was performed for facilities in Idaho Falls using annual doses for unit emission rates for 169 radionuclides were calculated. 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.”

The new RESL IF-683 laboratory began operation during the third quarter of CY-2011. The potential unabated dose was calculated at 6.65E-02 mrem/yr.

Appendix B

Naval Reactors Facility National Emission Standards for Hazardous Air Pollutants—Radionuclides Annual Report for 2011

Naval Reactors Facility
Calendar Year 2011

Naval Reactors Facility
National Emission Standards for Hazardous Air Pollutants
Report on 2011 Radionuclide Emissions



Prepared for the U.S. Department of Energy by

Bechtel Marine Propulsion Corporation
Bettis Atomic Power Laboratory

Under Contract No. DE-NR0000031

U. S. Department of Energy
Radionuclide Air Emissions Annual Report
(under Subpart H of 40 CFR Part 61)
Calendar Year 2011

Site Name: Idaho National Laboratory (INL)

Area: Naval Reactors Facility (NRF)

Area Information for NRF

Operator: Bechtel Marine Propulsion Corporation

Address: P. O. Box 2068
Idaho Falls, Idaho 83403-2068

Contact: M. A. DiBattista, Manager, Naval Reactors Facility

Phone: (208) 533-5526

Owner: Naval Reactors Idaho Branch Office

Address: 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

The developed area of the Naval Reactors Facility (NRF) covers 84 acres and is located in the west-central part of the Idaho National Laboratory (INL) site (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 the INL is characterized as semi-arid. The 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 the INL; therefore, annual precipitation at the INL is light. Winds are channeled over the Snake River Plain by bordering mountain ranges so that wind from the southwest predominates over the INL. The second most frequent winds are from the northeast. 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, Bettis Atomic Power Laboratory. 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 transportation to a permanent repository.

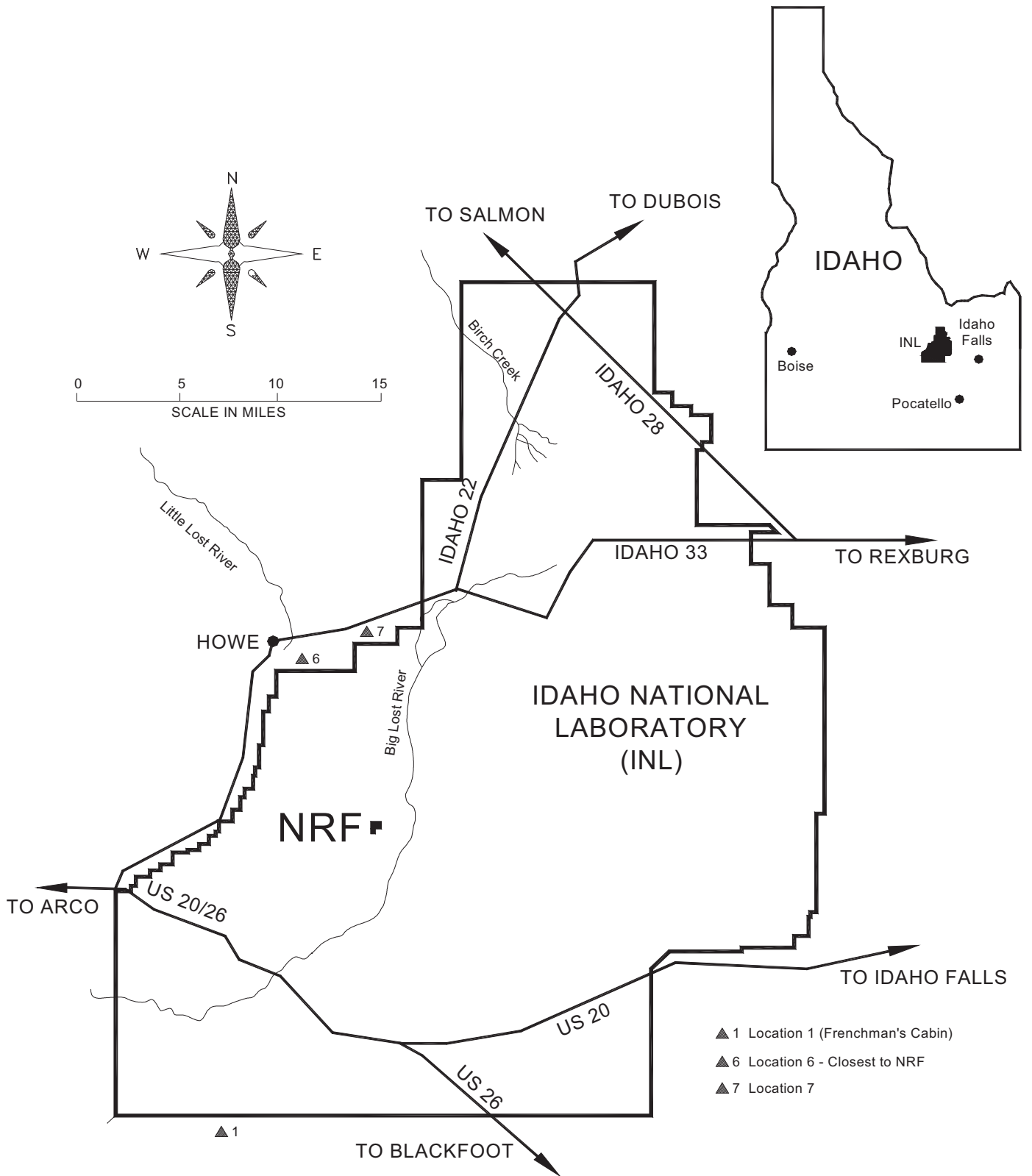


Figure 1. Relation of NRF to the INL.

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, verifying shielding, and performing radiography. 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 radioactive specimens from shipping containers, fuel examinations, removal of non-fuel structural pieces, and storage of fuel. Segregation and repackaging of radioactive waste are performed within the S5G highbay, and decontamination of inactive radiological systems proceeds 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.

All radioactive material is controlled by a radioactive material accountability system and maintained in designated storage areas. All movements of radioactive material within the facility are performed under escort of qualified radiological controls personnel and tracked in the accountability system.

Radioactive liquids are used to support operations. Radioactive liquids may be processed through a series of filters and demineralizers for reuse.

Disposable materials and waste products associated with the handling of radioactive materials are controlled and tracked as radioactive waste. The waste is temporarily stored on-site in designated storage areas until sufficient quantities accumulate to comprise a shipment to a DOE low-level disposal site.

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

- (1) ECF, where spent fuel from naval cores and contaminated materials such as anti-contamination clothing, tools, and other 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 monitored and calculated by NRF. The data are included in the calculation of the INL's annual effective dose equivalent (EDE) to members of the public.

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 EDE to a member of the public in excess of 1 percent of the 10 millirem (1×10^{-4} sievert) per year standard, which is 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 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. The table contains identification codes for area, building, and vent; a general description; a description of the effluent controls and their efficiencies, if applicable; and those emission sources that were monitored.

Table II-2 identifies potential fugitive sources of radionuclide air emissions. The only fugitive source is windblown soil from areas on NRF property surrounding the developed facility, which contain low levels of radioactivity from past releases. Fugitive sources have no effluent control or monitoring.

Tables II-3 and II-4 list the combined radionuclide emissions from the point sources and fugitive 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. Potential Radiological Air Emission Point Sources at NRF During 2011

Nearest Residence, School, Business or Farm: 13.7 kilometers NNW				
AREA -BLDG -VENT No.	SOURCE DESCRIPTION	EFFLUENT CONTROL DESCRIPTION	EFFICI- ENCY ¹	MONI- TORED ²
NRF-601-023	S1W Reactor Compartment	None ³	NA	No
NRF-601-HBRV	S1W High Bay Ventilation	None ³	NA	Yes
NRF-616-012, 021	A1W Operations Building and Site Chemistry	None ³	NA	Yes
NRF-616-PCMA	A1W Primary Components Maintenance Area and Extension	None ³	NA	No
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	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	None ³	NA	Yes
NRF-733-T	RWPS Tunnel Temporary Ventilation ⁴	HEPA Filter	99.95%	Yes
NRF-628A-T	Bldg 628A Temporary 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. “No” indicates that the source was not monitored during 2011 because it did not operate during 2011. “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 the amount of process production.)
3. Subsystems that exhaust within the areas ventilated by these sources may have HEPA filters.
4. These temporary exhaust systems were set up to provide ventilation during remediation of old radiological work areas. The exhaust systems will be removed after remediation work is complete.

Table II-2. Potential Radiological Air Emission Fugitive Sources at NRF During 2011

Nearest Residence, School, Business or Farm: 13.7 kilometers NNW				
AREA-LOCATN-I.D. CODE	SOURCE DESCRIPTION	EFFLUENT CONTROL DESCRIPTION	EFFICIENCY	MONITORED
NA	Fugitive Soil	None	NA	No

Table II-3. Point Source Releases From NRF During 2011

Radionuclide	Symbol	Release (curies)	Release (becquerels)*
Carbon-14	C-14	1.0E+00	3.7E+10
Gross alpha (modeled as plutonium-239)	Pu-239	1.9E-06	7.0E+04
Gross beta (modeled as strontium-90)	Sr-90	6.0E-05	2.2E+06
Cobalt-60	Co-60	5.9E-08	2.2E+03
Tritium	H-3	2.3E-02	8.5E+08
Iodine-131	I-131	6.5E-06	2.4E+05
Iodine-129	I-129	4.3E-05	1.6E+06
Krypton-85	Kr-85	1.3E-01	4.8E+09
Total		1.2E+00	4.4E+10

* One curie equals 3.7E+10 becquerels.

Table II-4. Fugitive Source Releases From NRF During 2011

Radionuclide	Symbol	Release (curies)	Release (becquerels)*
Cobalt-60	Co-60	3.6E-06	1.3E+05
Cesium-137	Cs-137	1.5E-04	5.6E+06
Total		1.6E-04	5.9E+06

* One curie equals 3.7E+10 becquerels.

III. DOSE ASSESSMENTS

Summary

Table III-1 summarizes the EDE results for point sources, fugitive sources, and both combined. The total EDE from all NRF sources was determined to be 3.2×10^{-4} millirem (3.2×10^{-9} sievert) and occurred at a location 8.5 miles (13.7 kilometers) north-northwest 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 2011

Release Point	EDE ¹ (mrem)	EDE ¹ (Sv) ²
1. Point Sources	3.2E-04	3.2E-09
2. Fugitive Sources	5.3E-06	5.3E-11
Total:	3.2E-04	3.2E-09

1. The EDE shown is for the NRF maximally exposed individual (Figure 1, Location 6).
2. One millirem equals $1.0\text{E-}05$ sievert (Sv).

Description of Dose Model and Summary of Input Parameters

General

The CAP-88 computer code (PC Version 3) was used to calculate the EDE from the NRF releases. CAP-88 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 CAP-88 is the EDE, which includes the 50-year committed EDE (CEDE) from internal exposure through the ingestion and inhalation pathways and the external EDE from ground deposition and air immersion.

Site-specific 2011 wind data was used, supplied by the National Oceanic and Atmospheric Administration (NOAA). Emissions from all NRF sources were modeled as ground-level releases with no plume rise, as the most conservative approach. All sources were modeled as originating from the center of the facility. Other user-supplied input parameters are as follows:

Wind Data File: NRFL11.WND per NOAA

Annual Average Temperature: 5 deg C average in 2011 per NOAA

Annual Rainfall: 18 cm in 2011 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 daughter progeny is included by the CAP-88 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 (1×10^{-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 dose from NRF emissions. The first is the nearest "residence, school, business, or office" to NRF. It is a residence 8.5 miles (13.7 kilometers) to the north-northwest (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 dose from NRF emissions than Location 6. The dose at both of these locations was evaluated using the CAP-88 program, and Location 6 was found to have the higher dose from 2011 emissions.

The EDE at Location 6 from NRF emissions is given 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 the INL. The highest dose from all INL facilities combined typically occurs at a location referred to as Frenchman's Cabin south of the INL (Figure 1, Location 1).

IV. ADDITIONAL INFORMATION

The EPA requires in 40 CFR 61 Subpart H that 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" be included.

In 2011, NRF installed equipment in preparation for the remediation of Alpha Containers. These are small containers of nuclear material. The existing NRF inventory of these containers will be vented and repackaged. Although no new construction was needed, the installation of unique equipment could be considered a modification. The process was evaluated for radionuclide emissions in accordance with Appendix D of 40 CFR 61 Subpart H and found to qualify for exemption from EPA construction approval. The potential EDE was determined to be $9.07\text{E}-04$ mrem per year.

V. SUPPLEMENTAL INFORMATION

The following information is provided at the request of DOE Headquarters and is not required as part of the annual National Emission Standards for Hazardous Air Pollutants reporting requirements (under 40 CFR Section 61.94).

REQUEST: Provide an estimate of the collective effective dose equivalent (person-rem per year) for 2011 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 2011*.

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 the Naval Reactors Facility. Subpart T of 40 CFR Part 61, "National Emission Standards for Radon Emissions From the Disposal of Uranium Mill Tailings," is not applicable to the Naval Reactors Facility.

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.

The Naval Reactors Facility 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.

The Naval Reactors Facility 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.

The Naval Reactors Facility does not have any emission points that require continuous monitoring under Section 61.93(b). 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 production. 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 much 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.