Chapter 2: Environmental Monitoring Programs – Air

Although all Idaho National Laboratory (INL) Site facilities are carefully managed and controlled, the potential exists to release radioactive and nonradioactive hazardous constituents in amounts above the regulatory limits during an operational upset or emergency incident situation.

In such an event, pathway vectors, such as air (see Chapter 2); groundwater (see Chapters 3 and 4); soil, plants, and animals (see Chapter 5); may transport these constituents to nearby populations. A conceptual model showing routes of exposure/pathways for these potential environmental releases can be found here.

Reviews of historical environmental data and environmental transport modeling indicate that air is a key pathway from INL Site releases to members of the general public. The ambient air monitoring network operates constantly and is a critical component of the INL Site's environmental monitoring programs. It monitors routine and unforeseen releases, provides verification the INL Site complies with regulatory standards and limits, and can be used to assess impact to the environment over time. This chapter presents the INL Site contractors' results of radiological analyses of airborne effluents and ambient air samples collected both on and off the INL Site. Click here for an overview of the radiological air monitoring activities relative to INL's major radiological sources, as well as the minor onsite and offsite radiological sources. Details may be found in the INL Site Environmental Monitoring Plan (DOE-ID 2023).

2.1 Organization of Air Monitoring Programs

The INL Site contractors document airborne radiological effluents at all INL Site facilities in an annual report prepared in accordance with 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities." Subsection 2.2 summarizes the emissions reported in "National Emission Standards for Hazardous Air Pollutants—Calendar Year 2025 INL Report for Radionuclides" (DOE-ID 2026), referred to hereafter as the National Emission Standards for Hazardous Air Pollutants (NESHAP) Report. The report also documents the estimated potential dose received by the general public due to INL Site activities.

Ambient air monitoring is conducted by the INL contractor to ensure the INL Site remains in compliance with the requirements in NE O 458.1A, "Radiation Protection of the Public and the Environment." The INL contractor collects air samples primarily around the INL Site, encompassing a region of 23,390 km^2 (9,000 mi^2), extending as far as Jackson, Wyoming. Air moisture and precipitation samples are also collected for tritium analysis. Subsection 2.3 summarizes the results for ambient air monitoring conducted in 2025.

The Idaho Cleanup Project (ICP) contractor monitors air around waste management facilities to comply with DOE O 435.1, "Radioactive Waste Management" and DOE O 458.1, "Radiation Protection of the Public and the Environment." These facilities are the Subsurface Disposal Area (SDA) at Radioactive Waste Management Complex (RWMC) and the Idaho Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Disposal Facility (ICDF) near the Idaho Nuclear Technology and Engineering Center (INTEC). Subsection 2.4 discusses the air sampling process the ICP contractor performs in support of waste management activities.

The National Oceanic and Atmospheric Administration (NOAA) has collected meteorological data at the INL Site since 1950. The data historically have been tabulated, summarized, and reported in several climatography reports and used by scientists to evaluate atmospheric transport and dispersion. The latest report, "Climatography of the Idaho National Laboratory," Fourth Edition (Clawson et al. 2018), was prepared by the Special Operations and Research Division of the Air Resources Laboratory and presents over 20 years (1994–2015) of quality-controlled data from the NOAA INL mesonet meteorological monitoring network. More recent data are provided by the Special Operations and Research Division to scientists modeling the dispersion of INL Site releases (see Chapter 6 and the supplemental "Meteorological Monitoring" report).

2.2 Airborne Effluent Monitoring

Each regulated INL Site facility determines the airborne effluent concentrations from its regulated emission sources as required under state and federal regulations. Radiological air emissions from INL Site facilities also are used to estimate the potential dose to a hypothetical maximally exposed individual (MEI), who is a member of the public (Subsection 6.2.1). Radiological effluents and the resulting potential dose for 2025 are reported in "Idaho National Laboratory CY 2025

National Emission Standards for Hazardous Air Pollutants Analysis, Methodology and Results for Radionuclides" (INL 2026) and the NESHAP report (DOE-ID 2026). Potential radiation doses to the public are discussed in more detail in Chapter 6 of this report.

The NESHAP report includes three categories of airborne emissions:

- Sources that require continuous monitoring under the NESHAP regulation are primarily the stacks at the Materials and Fuels Complex (MFC), the Advanced Mixed Waste Treatment Project, and INTEC
- Releases from all other point sources (e.g., stacks and exhaust vents)
- Nonpoint—or diffuse—sources, otherwise referred to as fugitive sources, which include radioactive waste ponds, buried waste, contaminated soil areas, radiological test ranges, and decontamination and decommissioning operations.

INL Site emissions include all three airborne emission categories and are summarized in Table 2-1. During 2025, an estimated 1,792 Ci (6.62×10^{13} Bq) of radioactivity was potentially released to the atmosphere from all INL Site sources. The 2025 release is 13% higher than the estimated total of 1,588 Ci (5.88×10^{13} Bq) released in 2024 due to normal variations in facility operations (DOE-ID 2026). Figure 2-1 shows the facilities that were major contributors to the total emissions.

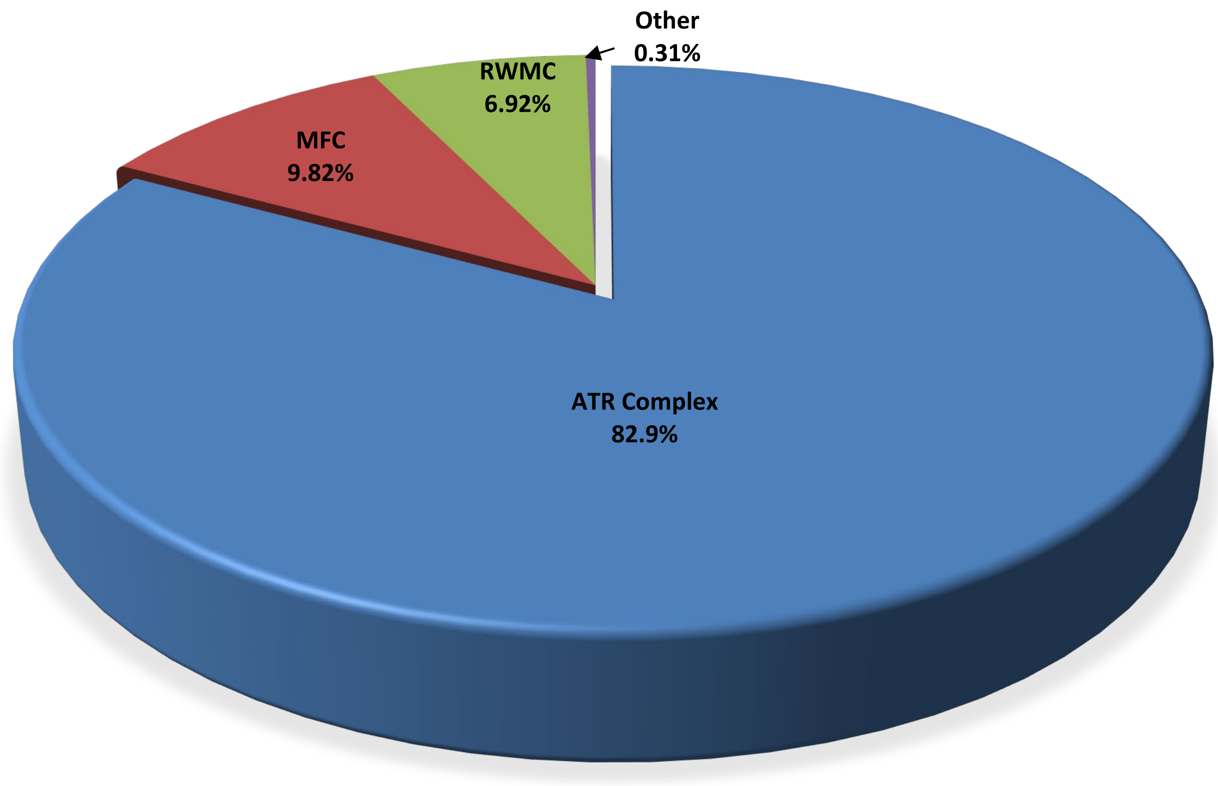

Figure 2-1. Percent contributions in Ci, by facility, to total INL Site airborne radiological releases (2025).

Table 2-1. Summary of potential radionuclide composition of INL Site airborne effluents (2025).

	TOTAL CURIES[a] RELEASED										
FACILITY[b]	TRITIUM	NOBLE GASES[c] ($T_{1/2}$ > 40 DAYS)	NOBLE GASES[d] ($T_{1/2}$ < 40 DAYS)	FISSION AND ACTIVATION PRODUCTS[e] ($T_{1/2}$ < 3 HOURS)	FISSION AND ACTIVATION PRODUCTS[f] ($T_{1/2}$ > 3 HOURS)	TOTAL RADIOIODINE[g]	TOTAL RADIOSTRONTIUM[h]	TOTAL URANIUM[i]	PLUTONIUM[j]	OTHER ACTINIDES[k]	OTHER[l]
ATR Complex	9.24E+01	–	1.39E+03	5.14E+00	1.75E-02	1.88E-06	2.98E-02	–	8.44E-06	3.23E-07	–
CFA	3.30E-01	1.07E-03	9.58E-02	8.00E-05	2.48E-01	9.55E-02	4.40E-10	7.09E-09	1.34E-10	5.50E-11	1.55E-02
CITRC	2.09E-04	–	–	2.86E-05	–	–	–	–	–	–	–
INTEC	2.27E-01	1.08E+00	–	–	2.61E+00	9.56E-05	1.37E-04	5.38E-07	8.38E-06	2.80E-06	–
MFC	2.45E+00	2.99E-01	1.62E+02	1.12E+01	1.63E-02	4.73E-06	1.37E-02	2.06E-01	2.78E-07	4.73E-12	–
NRF	4.40E-02	3.21E-01	–	–	5.01E-01	1.57E-05	3.73E-05	4.35E-10	1.82E-06	1.83E-07	–
RRTR	–	–	–	–	1.50E-05	–	–	–	–	–	–
RWMC	1.24E+02	–	–	–	3.66E-02	–	8.04E-11	3.46E-11	5.68E-06	1.89E-06	–
SMC	–	–	–	–	–	–	–	4.12E-08	–	–	–
TAN	1.45E-02	–	–	–	–	–	3.01E-05	–	–	–	–
Total	2.19E+02	1.70E+00	1.55E+03	1.63E+01	3.43E+00	9.56E-02	4.37E-02	2.06E-01	2.46E-05	5.19E-06	1.55E-02

a. One curie (Ci) = 3.7×10^{10} becquerels (Bq).

b. ATR Complex = Advanced Test Reactor Complex; CFA = Central Facilities Area; CITRC = Critical Infrastructure Test Range Complex; INTEC = Idaho Nuclear Technology and Engineering Center; MFC = Materials and Fuels Complex; NRF = Naval Reactors Facility; RRTR = Radiological Response Training Range; RWMC = Radioactive Waste Management Complex (including the Advanced Mixed Waste Treatment Project [AMWTP]); SMC = Specific Manufacturing Capability; and TAN = Test Area North.

c. Noble gases ($T_{1/2}$ > 40 days) released in 2025 = ^{39}Ar, ^{42}Ar, ^{81}Kr, and ^{85}Kr.

d. Noble gases ($T_{1/2}$ < 40 days) released in 2025 = ^{37}Ar, ^{41}Ar, ^{79}Kr, ^{83m}Kr, ^{85m}Kr, ^{87}Kr, ^{88}Kr, ^{89}Kr, ^{219}Rn, ^{220}Rn,^{127}Xe, ^{131m}Xe, ^{133}Xe, ^{133m}Xe, ^{135}Xe, ^{135m}Xe, ^{137}Xe, and ^{138}Xe.

e. Fission products and activation products ($T_{1/2}$ < 3 hours) released in 2025 = ^{106}Ag, ^{109m}Ag, ^{110}Ag, ^{111m}Ag, ^{137m}Ba, ^{139}Ba, ^{83}Br, ^{84}Br, ^{117}Cd, ^{118}Cd, ^{134m}Cs, ^{138}Cs, ^{139}Cs, ^{140}Cs, ^{66}Cu, ^{165}Dy, ^{167m}Er, ^{68}Ga, ^{75}Ge, ^{78}Ge, ^{117}In, ^{117m}In, ^{118}In, ^{142}La, ^{27}Mg, ^{56}Mn, ^{101}Mo, ^{16}N, ^{97}Nb, ^{149}Nd, ^{65}Ni, ^{211}Pb, ^{111}Pd, ^{211}Po, ^{215}Po, ^{144}Pr, ^{144m}Pr, ^{88}Rb, ^{89}Rb, ^{90}Rb, ^{103m}Rh, ^{104}Rh, ^{106}Rh, ^{128m}Sb, ^{77m}Se, ^{81}Se, ^{81m}Se, ^{127}Sn, ^{128}Sn, ^{101}Tc, ^{129}Te, ^{131}Te, ^{133}Te, ^{133m}Te, ^{134}Te, ^{207}Tl, ^{89m}Y, ^{91m}Y, and ^{69}Zn.

f. Fission products and activation products ($T_{1/2}$ > 3 hours) released in 2025 = ^{108m}Ag, ^{110m}Ag, ^{111}Ag, ^{112}Ag, ^{113}Ag, ^{76}As, ^{77}As, ^{78}As, ^{140}Ba, ^{82}Br, ^{14}C, ^{41}Ca, ^{47}Ca, ^{109}Cd, ^{113m}Cd, ^{115}Cd, ^{115m}Cd, ^{117m}Cd, ^{141}Ce, ^{143}Ce, ^{144}Ce, ^{36}Cl, ^{38}Cl, ^{57}Co, ^{58}Co, ^{60}Co, ^{51}Cr, ^{134}Cs, ^{135}Cs, ^{136}Cs, ^{137}Cs, ^{64}Cu, ^{67}Cu, ^{166}Dy, ^{169}Er, ^{171}Er, ^{172}Er, ^{152}Eu, ^{154}Eu, ^{155}Eu, ^{156}Eu, ^{157}Eu, ^{55}Fe, ^{59}Fe, ^{72}Ga, ^{73}Ga, ^{159}Gd, ^{77}Ge, ^{175}Hf, ^{181}Hf, ^{203}Hg, ^{166}Ho, ^{167}Ho, ^{115m}In, ^{192}Ir, ^{194}Ir, ^{40}K, ^{42}K, ^{140}La, ^{141}La, ^{54}Mn, ^{99}Mo, ^{22}Na, ^{24}Na, ^{93m}Nb, ^{95}Nb, ^{95m}Nb, ^{96}Nb, ^{147}Nd, ^{59}Ni, ^{63}Ni, ^{66}Ni, ^{191}Os, ^{32}P, ^{107}Pd, ^{109}Pd, ^{112}Pd, ^{147}Pm, ^{149}Pm, ^{151}Pm, ^{143}Pr, ^{145}Pr, ^{86}Rb, ^{87}Rb, ^{186}Re, ^{188}Re, ^{189}Re, ^{105}Rh, ^{103}Ru, ^{105}Ru, ^{106}Ru, ^{122}Sb, ^{124}Sb, ^{125}Sb, ^{126}Sb, ^{127}Sb, ^{128}Sb, ^{129}Sb, ^{46}Sc, ^{47}Sc, ^{48}Sc, ^{79}Se, ^{151}Sm, ^{153}Sm, ^{156}Sm, ^{117m}Sn, ^{119m}Sn, ^{121}Sn, ^{121m}Sn, ^{123}Sn, ^{125}Sn, ^{126}Sn, ^{182}Ta, ^{183}Ta, ^{184}Ta, ^{161}Tb, ^{99}Tc, ^{99m}Tc, ^{127}Te, ^{127m}Te, ^{129m}Te, ^{131m}Te, ^{132}Te, ^{171}Tm, ^{181}W, ^{185}W, ^{187}W, ^{90}Y, ^{91}Y, ^{92}Y, ^{93}Y, ^{65}Zn, ^{71m}Zn, ^{72}Zn, ^{93}Zr, ^{95}Zr, and ^{97}Zr.

g. Radioiodine released in 2025 = ^{129}I, ^{130}I, ^{131}I, ^{132}I, ^{132m}I, ^{133}I, ^{134}I, and ^{135}I.

h. Radiostrontium released in 2025 = ^{89}Sr, ^{90}Sr, ^{91}Sr, and ^{92}Sr.

i. Uranium isotopes released in 2025 = ^{232}U, ^{233}U, ^{234}U, ^{235}U, ^{236}U, ^{237}U, and ^{238}U.

j. Plutonium isotopes released in 2025 = ^{238}Pu, ^{239}Pu, ^{240}Pu, ^{241}Pu, and ^{242}Pu.

k. Other actinides released in 2025 = ^{227}Ac, ^{241}Am, ^{243}Am, ^{242}Cm, ^{243}Cm, ^{244}Cm, ^{237}Np, ^{230}Th, and ^{231}Th.

l. Other = radioisotopes of elements that are not noble gases, activation or fission products, radioiodine, radiostrontium, or actinides released in 2025. These are typically heavy elements that are decay chain members of actinides. They include ^{211}Bi, ^{223}Ra, and ^{35}S.

2.3 Ambient Air Surveillance Monitoring

Ambient air surveillance monitoring is conducted both onsite and offsite to identify regional and historical trends, detect accidental and unplanned releases, and verify that air concentrations are below the Derived Concentration Standards (DCSs) established by U.S. Department of Energy (DOE) for inhaled air (DOE 2022). Each radionuclide-specific DCS corresponds to a dose of 100 mrem for continuous exposure during the year. The Clean Air Act NESHAP regulatory standard is 10 mrem/yr (0.1 mSv/yr) (40 CFR 61, Subpart H).

2.3.1 INL Contractor Air Surveillance Monitoring

The INL contractor operates an extensive air monitoring network to detect potential radioactive releases and ensure protection of the public and environment. Samplers are strategically placed near INL facilities, in downwind directions, in predominant downwind directions, within nearby communities, and at background locations.

Air Monitoring Network

In 2025, the INL contractor maintained:

- 36 low-volume air samplers (including quality assurance units)
- 11 atmospheric moisture samplers
- 9 precipitation samplers

For emergency response, the contractor also maintains 16 high-volume event air samplers at NOAA weather towers, which are activated only during events such as wildfires or unplanned releases.

Air Particulates – Sampling and Analysis

Filters and charcoal cartridges are collected weekly. Initial screening for gross alpha and gross beta activity provides an overall indication of airborne radioactivity. Because gross alpha and beta measurements do not identify specific radionuclides, elevated results trigger targeted analyses. Gross beta is almost always detected, while gross alpha appears less often and can increase during wildfires or temperature inversions.

Quarterly, filters from each location are composited and analyzed for gamma-emitting radionuclides, including cesium-137 (from past INL activities and global fallout) and naturally occurring radionuclides (e.g., beryllium-7, potassium-40). Additional analyses target alpha- and beta-emitting radionuclides historically associated with INL operations or global fallout (e.g., americium-241, chlorine-36, plutonium and uranium isotopes, and strontium-90).

Air Particulates Monitoring Results

Weekly gross alpha and beta results primarily reflect naturally occurring radionuclides, but elevated readings can signal potential issues. Weekly results are reviewed for unusual patterns, and anomalies are investigated promptly. Overall, monitoring data provides valuable information for tracking trends and ensuring environmental safety.

Weekly results are reviewed for changes in patterns between locations and groups (i.e., onsite, boundary, and offsite locations) and for unusually elevated results. Anomalies are further investigated by reviewing sample or laboratory issues, meteorological events (e.g., inversions), and INL Site activities that are possibly related. If indicated, analyses for specific radionuclides may be performed. These data provide useful information for trending the total activity over time.

Results that detected gross alpha and gross beta through ambient air surveillance monitoring conducted by the INL contractor are summarized in Table 2-2.

Table 2-2. Gross alpha and gross beta detected in ambient air samples collected by the INL contractor (2025).

RADIONUCLIDE	NUMBER OF DETECTED RESULTS[a]	LOCATION OF MINIMUM DETECTED CONCENTRATION	MINIMUM CONCENTRATION (10^{-15} μCi/mL)[b]	LOCATION OF MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION (10^{-15} μCi/mL)
Gross Alpha	1,257 of 1,614	Jackson, WY	0.48 ± 0.15	Howe	7.56 ± 1.72
Gross Beta	1,613 of 1,614	Craters of the Moon	7.58 ± 0.79	INTEC (west side)	92.5 ± 4.36

a. Excludes blanks and duplicates.
b. Results ± 1σ. Results shown are ≥ 3σ and below the DCS values for these radionuclides in air.

The highest detected gross alpha result for the air filter was collected at Howe (7.56 ± 1.72) × 10^{-15} µCi/mL on September 10, 2025. This maximum result is less than the DCS (DOE 2022) of 1.1 × 10^{-13} µCi/mL for $^{239/240}$Pu, which is the most conservative specific radionuclide DCS that could be applied to gross alpha activity. Gross alpha results are within the historical range, as shown in Figure 2-2.

The highest detected gross beta result for the air filter was collected at INTEC (west side) (92.5 ± 4.36) × 10^{-15} µCi/mL on July 2, 2025. The maximum weekly gross beta concentration is significantly below the DCS (DOE 2022) of 9.6 × 10^{-12} µCi/mL for the most restrictive beta-emitting radionuclide in the air, ^{90}Sr. Gross beta results are within the historical range, as shown in Figure 2-2.

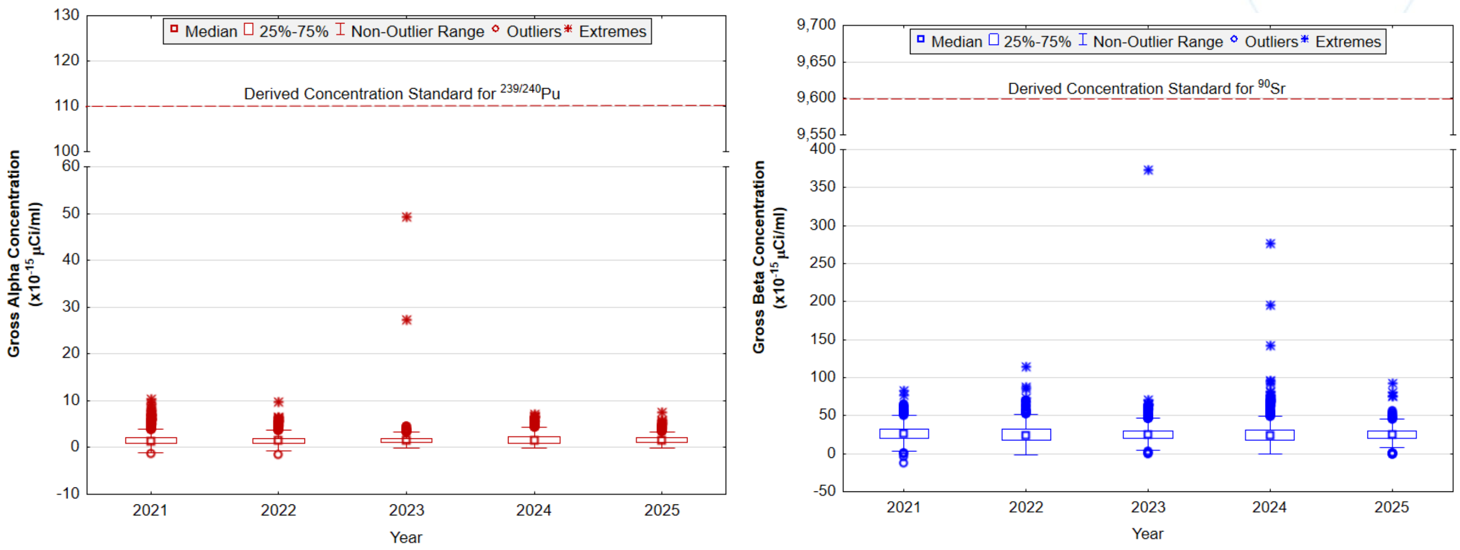

Figure 2-2. Gross alpha (left) and gross beta (right) 5-year trend.

Quarterly Composite of Air Filters Monitoring Results

The INL contractor observed no detectable concentrations of radionuclides of interest (^{137}Cs, ^{90}Sr, ^{65}Zn, ^{241}Am, ^{238}Pu, ^{239}Pu, and ^{36}Cl) in 2025 air filter composites at any location. In addition to the radionuclides discussed earlier, the INL contractor began surveillance monitoring for uranium during 2023. The detections of uranium radionuclides, as observed in Table 2-3, occur routinely at concentrations that suggest natural origin. Natural ^{7}Be was detected in numerous INL contractor composite samples at concentrations consistent with past concentrations. Levels of atmospheric ^{7}Be result from reactions of galactic cosmic rays and solar energetic particles with nitrogen and oxygen nuclei in Earth's atmosphere.

Table 2-3. Human-made radionuclides detected in ambient air samples collected by the INL contractor (2025).

RADIONUCLIDE	NUMBER OF DETECTED RESULTS[a,b]	LOCATION OF MINIMUM DETECTED CONCENTRATION	MINIMUM CONCENTRATION (µCi/mL)[a]	LOCATION OF MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION (µCi/mL)
Uranium-233/234	8 of 132	Idaho Falls	(2.18 ± 0.66) E-17	INTEC	(28.5 ± 3.09) E-17
Uranium-238	14 of 132	Sugar City	(1.82 ± 0.56) E-17	INTEC	(27.5 ± 2.99) E-17

a. Results ± 1σ. Results are ≥ 3σ and below the DCS values.
b. Excludes blanks and duplicates

Charcoal Cartridges

Charcoal cartridges are analyzed weekly for iodine-131, (^{131}I), an isotope produced by nuclear fission that concentrates in the thyroid and has a short half-life of 8 days. Detecting ^{131}I would indicate a recent release of fission products.

Charcoal Cartridges Monitoring Results

The INL contractor collected and analyzed approximately 1,866 charcoal cartridges, including blanks and duplicates, in 2025. There were no statistically positive measurements of ^{131}I.

Precipitation and Atmospheric Moisture

The INL contractor monitors tritium, a radioactive form of hydrogen, because it combines with oxygen to form tritiated water, which behaves like normal water and can occur in air moisture and precipitation. Air moisture is collected using molecular sieve material and analyzed for tritium, while precipitation samples are routinely collected and tested using liquid scintillation counting. These two sampling methods provide a comprehensive picture of tritium in the environment.

Tritium occurs naturally in the atmosphere and has decreased globally since the 1963 Nuclear Test Ban Treaty. At INL, tritium detected in precipitation is primarily from natural sources, while tritium in air moisture may result from natural atmospheric production, past global fallout, and releases from INL facilities.

Precipitation Surveillance Monitoring Results

The INL contractor collects precipitation samples weekly, when available, from Atomic City, CPP, Experimental Field Station (EFS), Howe, IRC, Remote-Handled Low-Level Waste (RHLLW) Facility, SMC, and Van Buren Blvd. Precipitation is also collected monthly at Idaho Falls for Environmental Protection Agency (EPA) RadNet monitoring and a subsample is taken by the INL contractor for analysis. A total of 228 precipitation samples, including blanks and duplicates, were collected during 2025. Tritium was detected in three of the samples. The concentrations ranged from 96.7 ± 29.6 pCi/L from a sample collected at EFS on 8/27/2025 to 592 ± 67.2 pCi/L for a sample collected at RHLLW facility. For comparison, the DCS value is 2.6×10^6 pCi/L for tritium in water. The results were compared with tritium concentrations reported by the EPA for precipitation during the 10-year period from 2002–2011 (measurements discontinued after 2011) based on the query of available data. Concentrations reported by EPA for Idaho Falls during that period ranged from -84 to 1,718 pCi/L and averaged 35.1 pCi/L.

Annual tritium concentrations in atmospheric moisture and precipitation have no discernible statistical distribution, so non-parametric statistical methods were used to assess both datasets (see "Statistical Methods Used in the Idaho National Laboratory Annual Site Environmental Report," a supplement to this annual report). To summarize these results, box plots were constructed illustrating the annual tritium concentrations measured in atmospheric moisture (as water) and precipitation samples collected by the INL contractor for the past 10 years, as observed in Figure 2-3. The results appear

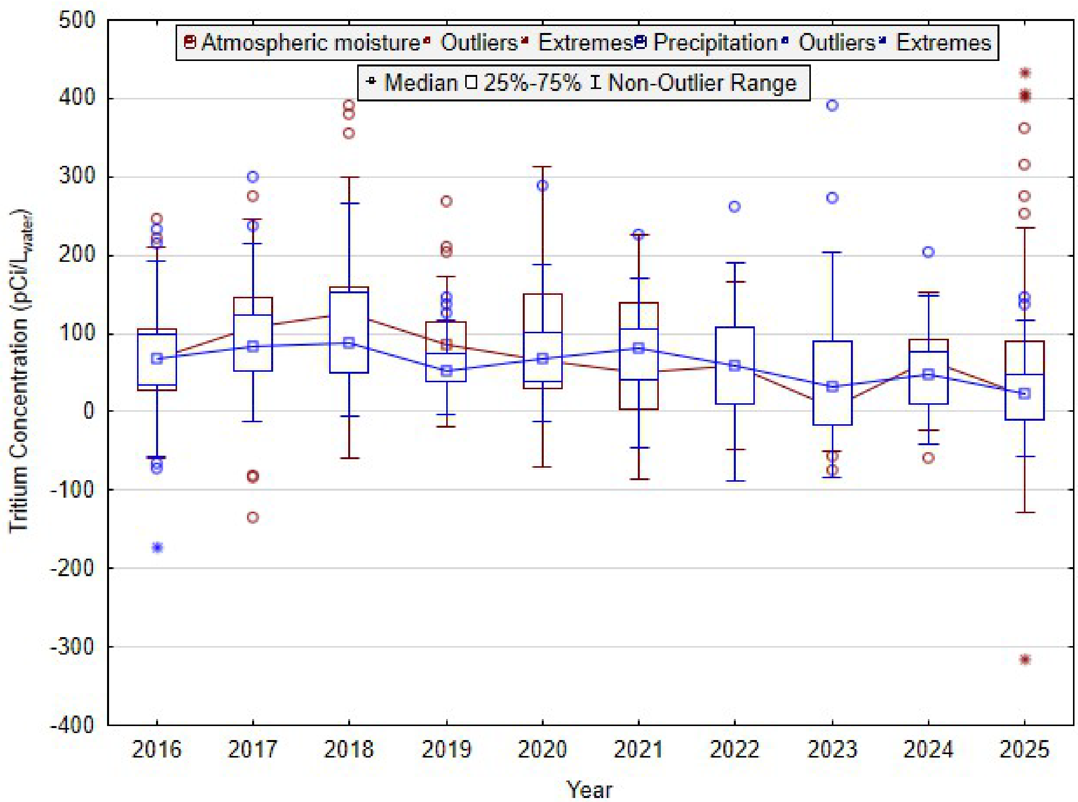

Figure 2-3. Box plots of tritium concentrations measured in atmospheric moisture and in precipitation from 2015–2025.

to be similar for each year. A statistical comparison of both datasets shows there are no differences between the median annual tritium concentrations measured in atmospheric moisture and in the precipitation samples. Because low levels of tritium exist in the environment at all times as a result of cosmic ray reactions with atmospheric gases in the upper atmosphere and the decreasing influence of fallout from nuclear weapons testing in the atmosphere and because tritium concentrations do not appear to differ between precipitation and atmospheric moisture samples, the source of tritium measured in precipitation and atmospheric moisture is most likely of natural origin and past nuclear tests and not from INL Site releases.

Atmospheric Moisture Surveillance Monitoring Results

During 2025, the INL contractor collected 87 atmospheric moisture samples at Atomic City, Craters of the Moon, EFS, Howe, Idaho Falls, RHLLW, and Van Buren. Table 2-4 shows a total of 12 tritium detections in 2025. The observed tritium concentrations are far below the DCS of 1.3×10^{-7} μCi/mL$_{air}$ for tritium in air (as water vapor).

Table 2-4. Tritium detected in atmospheric moisture samples collected by the INL contractor (2025).

RADIONUCLIDE	NUMBER OF DETECTED RESULTS	LOCATION OF MINIMUM DETECTED CONCENTRATION	MINIMUM CONCENTRATION (pCi/mL$_{air}$)[a]	LOCATION OF MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION (pCi/mL$_{air}$)
Tritium	12 of 87	Craters of the Moon	(5.03 ± 1.54) E-13	RHLLW	(115 ± 21.2) E-13

a. Results ± 1σ. Results are below the DCS value of 1.3×10^{-7} uCi/mL$_{air}$ for tritium in air (as water vapor).

The source of tritium measured in atmospheric moisture samples collected on and around the INL Site is probably of cosmogenic origin and, to some extent, global fallout. Tritium releases from non-fugitive sources are highly localized and, although they may be detected immediately adjacent to the facility, they are unlikely to be detected at current air surveillance monitoring stations because of atmospheric dispersion.

2.3.2 ICP Contractor Air Surveillance Monitoring

Air Monitoring Network

ICP waste management monitoring operations are performed in the SDA at RWMC and ICDF at INTEC. These operations have the potential to emit radioactive airborne particulates. In 2025, the ICP contractor maintained:

- 9 low-volume air samplers (including quality assurance units).

Air Particulates Monitoring Results

The ICP contractor collected samples of airborne particulate material from the perimeters of these waste management areas in 2025. Also, samples were collected at a control location in Howe to compare with the results of the SDA and ICDF.

Samples were obtained using suspended particulate monitors similar to those used by the INL contractor. The 4-in.-diameter air filters are collected on the closest working day to the first and the fifteenth of each month. Gross alpha and gross beta activity were determined on all suspended particulate samples. Table 2-5 shows the range of detected gross alpha and beta concentrations for 2025.

Table 2-5. Gross alpha and gross beta detected in ambient air samples collected by the ICP contractor (2025).

RADIONUCLIDE	NUMBER OF DETECTED RESULTS	LOCATION OF MINIMUM DETECTED CONCENTRATION	MINIMUM CONCENTRATION (μCi/mL)[a]	LOCATION OF MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION (μCi/mL)
Gross Alpha	145 of 182	SDA 6.3B	(16.1 ± 5.29) E-17	SDA 2.3	(8.78 ± 1.25) E-16
Gross Beta	145 of 182	SDA 9.3A	(19.5 ± 1.37) E-16	SDA 4.2C	(124 ± 3.40) E-16

a. Results ± 1σ. Results are ≥ 3σ and below the DCSs for $^{239/240}Pu$ in air and ^{90}Sr in air for gross alpha and gross beta, respectively.

The 2025 gross alpha results for the SDA and ICDF are well below the DCS (DOE 2022) of 1.1 × 10-13 µCi/mL for $^{239/240}$Pu, which is the most conservative specific radionuclide DCS that could be applied to gross alpha activity. The 2025 gross beta results for the SDA and ICDF are well below the DCS of 9.6 × 10-12 µCi/mL for the most restrictive beta-emitting radionuclide in the air (^{90}Sr). Results from the SDA and ICDF were compared with the results collected from the background monitoring location in Howe. The ranges of concentrations measured at the SDA and ICDF were aligned with the range measured at the background monitoring location in Howe.

Quarterly Composite of Air Filters Monitoring Results

Air filters are collected by the ICP contractor, composited in a laboratory, and analyzed for human-made, gamma-emitting radionuclides and specific alpha-emitting and beta-emitting radionuclides. Gamma spectroscopy analyses are performed monthly, and radiochemical analyses are performed quarterly.

In 2025, no human-made, beta-emitting, gamma-emitting, or alpha-emitting radionuclides were detected in air samples at ICDF at INTEC or at the SDA at RWMC.

Table 2-6 shows specific radionuclides detected in the SDA in 2025. These detections are consistent with levels measured in the air at the SDA in the last 5 years. All detections for radionuclides were three to four orders of magnitude below the DCS, as stipulated in DOE 2022. Statistically, false positives at the 95% confidence error are possible. The detections of uranium radionuclides occur routinely at concentrations that suggest a natural origin.

Table 2-6. Specific radionuclides detected in ambient air samples collected by the ICP contractor (2025).

RADIONUCLIDE	NUMBER OF DETECTED RESULTS	LOCATION OF MINIMUM DETECTED CONCENTRATION	MINIMUM CONCENTRATION (µCi/mL)[a]	LOCATION OF MAXIMUM DETECTED CONCENTRATION	MAXIMUM CONCENTRATION (µCi/mL)
Uranium 233/234	10 of 32	SDA 6.3B	(22.5 ± 6.16) E-18	INT 100.3	(4.75 ± 1.04) E-17
Uranium 238	9 of 32	SDA 6.3B	(19.4 ± 5.28) E-18	SDA 2.3	(5.50 ± 1.21) E-17

a. Results ± 1σ. Results are ≥ 3σ and below the DCS values for these radionuclides in air.

2.4 Unplanned Releases

Unplanned releases are unexpected discharges of hazardous or radioactive materials into the environment that occur outside normal operations. These events can result from equipment failures, accidents, natural events such as wildfires, or other unforeseen circumstances. While rare, they require immediate attention to protect workers, the public, and the environment. The INL Site contractors maintain monitoring systems and emergency response capabilities to quickly detect, assess, and mitigate any potential impacts.

2.4.1 Wildland Fires

There were no wildland fires on the INL Site in 2025, and therefore wildland fire did not result in a detected release of radionuclides.

2.4.2 Hazardous Substances and Regulatory Emissions

INL Site contractors had no unplanned releases of hazardous substances or any events resulting in emissions exceeding reporting thresholds that would require notification to be made to regulatory agencies in 2025.

2.4.3 Radiological Emissions

All radiological emissions were accounted for in the dose received by the MEI (Chapter 6).

2.5 Public Notification of Clearance of Property

The INL contractor complies with NE O 458.1A, while the ICP contractor follows DOE O 458.1. Both directives establish a public radiation dose limit of 100 mrem per year (1 mSv per year) above background. For 2025 INL Site releases, the potential MEI dose was evaluated using the CAP-88 PC model (Chapter 6, Subsection 6.2).

The "Derived Concentration Technical Standard" (DOE 2022) defines the quantities (DCSs) used in the design and conduct of radiological environmental protection programs. The DCSs are concentrations of radionuclides in water, milk, or air that would result in a 100-mrem (1-mSv) annual effective dose via ingestion, air submersion, or inhalation. All environmental measurements around the INL Site were below applicable DCSs.

Program requirements establish limits for the unrestricted release of property to the public. INL Site contractors apply a graded approach to property clearance, allowing administrative release of certain categories of controlled-area items (e.g., personal items, office materials, recyclables, non-radiological housekeeping waste, medical and bioassay samples, and items with approved release plans) without a radiological survey. Items originating from radiological areas that do not fall within these categories are subject to radiological surveys, process knowledge evaluation, or both prior to release.

Items advertised for public auction are surveyed before shipment to the INL property/excess warehouse, where additional random surveys are performed to ensure items are not released with inadvertent contamination.

All INL Site contractors survey materials prior to release and disposal at the state-permitted landfill located onsite. Items with potential internal contamination are instead sent to Waste Generator Services for disposal through approved offsite treatment, storage, and disposal facilities capable of accepting low-level contamination. DOE – Idaho Operations Office provides oversight of these clearance processes using a graded approach.

On May 15, 2025, DOE rescinded the Moratorium on Free Release of Volumetrically Contaminated Metals, allowing sites to pursue metal recycling consistent with applicable requirements.

2.5.1 INL Contractor Clearance of Property

For 2025, the INL contractor performed approximately 952 release surveys of personal property items with approximately 95% of these releases being for reuse at INL (i.e., instruments being sent for calibration, miscellaneous tools, shielding, heavy equipment, and scientific equipment). Those that were not released for reuse were released for appropriate disposal. All releases were performed using pre-authorized limits and were below the "Surface Contamination Values" (10 CFR 835, Appendix D). The INL contractor did not release any items using the pre-authorized volumetric radioactivity screening levels for clearance of personal property in 2025. As of the end of 2025, the INL contractor has not yet updated program requirements to allow metals to be released.

There were no releases of real property in 2025.

2.5.2 ICP Contractor Clearance of Property

The ICP contractor had 355 release surveys of personal property items. Those that were not released for reuse were released for appropriate disposal. The ICP contractor diverted 3,526,753 lbs. of mixed-metal scrap from onsite landfills in 2025 by sending it to an offsite recycling facility. The scrap metal was accumulated during the deactivation and decommissioning of the Submarine First Generation Westinghouse, Aircraft Carrier First Generation Westinghouse prototypes, and Submarine Fifth Generation GE Prototypes at Naval Reactors Facility. Before their release, these materials were characterized to ensure they were not hazardous waste and were deemed free of radioactive contamination based on surveys performed by radiological protection personnel.

There were no releases of real property in 2025.

2.6 Quality Assurance

2.6.1 INL Contractor Quality Assurance

In 2025, the INL contractor implemented its quality control program to ensure environmental monitoring results were accurate and trustworthy. Quality assurance activities included the use of blanks, duplicates, and performance evaluation samples to verify the performance of the contracted analytical laboratory. When discrepancies were identified, the contractor collaborated with the laboratory to refine processes, procedures, and methods. Field sampling, laboratory measurements, and performance evaluation samples were thoroughly reviewed. These measures ensure that monitoring data used to protect public health and the environment are valid, reliable, and defensible. All laboratory data presented by the INL contractor meet these standards.

2.6.2 ICP Contractor Quality Assurance

The ICP contractor followed a similar approach in 2025 to maintain data integrity and reliability. Its quality assurance activities also included blanks, duplicates, and performance evaluation samples to assess laboratory performance and identify discrepancies. Corrective actions were implemented as needed to strengthen processes and ensure accuracy. By adhering to these rigorous quality control measures, the ICP contractor ensures that all reported data are accurate, defensible, and compliant with regulatory requirements for protecting public health and the environment. All laboratory data presented by the ICP contractor meet these standards.

2.7 References

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