Chapter 7: Environmental Surveillance Monitoring Programs – Agricultural Products, Wildlife, Soil, and Direct Radiation

CHAPTER 7

Radionuclides released by operations and activities at the Idaho National Laboratory (INL) Site have the potential to be assimilated by agricultural products and game animals, which then can be consumed by humans. These media are thus sampled and analyzed for human-made radionuclides because of the potential transfer of radionuclides to people through food chains. Iodine-131 and cesium-137 were not detected in any milk samples collected in 2024; however, strontium-90 (^{90}Sr) was detected in a milk sample collected in Terreton, Idaho. The result was within the acceptable range of historical values and well below the derived concentration standard (DCS) of ^{90}Sr in milk, which is 5,800 pCi/L. Based on this result, the milk is safe for consumption. Additionally, no human-made radionuclides were detected in any of the other agricultural products (e.g., lettuce, grain, potatoes, alfalfa) collected in 2024.

No human-made radionuclides were detected in road-killed animal samples collected in 2024. But two human-made cobalt-60 (^{60}Co) and ^{90}Sr radionuclides were detected in some exterior subsamples of waterfowl collected at Central Facilities Area (CFA) and from the Sewage Lagoons at the INL Site. Although the concentration of ^{60}Co in the subsample from the Sewage Lagoons was above the three sigma (3σ) uncertainty, it did not exceed the minimum detectable concentration. A concentration of ^{90}Sr was detected in the exterior subsample of a control duck collected from the South Fork of the Snake River. All results were within the historical measurements.

Direct radiation measurements made at the boundary and offsite locations were consistent with background levels. The average annual dose equivalent from external exposure was estimated from the dosimeter measurements to be 123 mrem off the INL Site. The total background dose from natural sources to an average individual living in southeast Idaho was estimated to be approximately 388 mrem per year.

Radiation measurements taken in the vicinity of waste storage and soil contamination areas near INL Site facilities were consistent with previous measurements. Direct radiation measurements using a radiometric scanner system at the Radioactive Waste Management Complex (RWMC) and the Idaho Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Disposal Facility (ICDF) were historically near background levels.

7. ENVIRONMENTAL SURVEILLANCE MONITORING PROGRAMS – AGRICULTURAL PRODUCTS, WILDLIFE, SOIL, AND DIRECT RADIATION

This chapter summarizes the results of the INL Site contractors' environmental surveillance monitoring of agricultural products, wildlife, soil, and direct radiation on and around the INL Site during 2024. Details of these programs may be found in the "Idaho National Laboratory Site Environmental Monitoring Plan" (DOE-ID 2023). INL Site contractors monitor soil, vegetation, biota, and direct radiation both on and off the INL Site to comply with applicable United States (U.S.) Department of Energy (DOE) orders and other requirements. The INL Site has the potential to release contaminants to the environment, which may be present in agricultural products, biota, soil, and direct radiation. To improve the readability of this chapter, detection result data tables are included when surveillance monitoring results exceed three sigma (3σ) and/or the background upper threshold limits.

7.1 Agricultural Products and Biota Sampling

Agricultural products and game animals are sampled by the INL contractor because of the potential transfer of radionuclides to people through food chains. Sampling of agricultural foodstuffs is performed on and around the INL Site to meet the following requirements and criteria for environmental surveillance of DOE facilities:

- DOE O 458.1, "Radiation Protection of the Public and the Environment"

- DOE-HDBK-1216-2015, "Environmental Radiological Effluent Monitoring and Environmental Surveillance" (DOE 2015)
- Stakeholder inputs and values.

The INL contractor agricultural sample results for 2024 are provided in the quarterly surveillance reports (INL 2025a, INL 2025b, INL 2025c, and INL 2025d).

7.1.1 Sampling Design

Agricultural products could become contaminated by radionuclides released from INL Site facilities, which are transported offsite by wind and deposited in soil and on plant surfaces. This is important, since approximately 45% of the land surrounding the INL Site is used for agriculture (DOE-ID 1995). Additionally, many residents maintain home gardens that could be impacted by INL Site releases. In addition, animals could eat contaminated crops and transfer radionuclides to humans in turn through the consumption of meat and milk.

Agricultural product sampling began in the vicinity of the INL Site in the 1960s with milk and wheat as part of the routine environmental surveillance monitoring program. Currently, the program focuses on milk, leafy green vegetables, alfalfa, potatoes, and grains.

As specified in DOE-HDBK-1216-2015 (DOE 2015), representative samples of the pathway-significant agricultural products grown within 16 km (10 miles) of the INL Site should be collected and analyzed for radionuclides that potentially could be present from INL Site operations. These samples should be collected in at least two locations: (1) the place of expected maximum radionuclide concentrations, and (2) a "background" location unlikely to be affected by radionuclides released from the INL Site.

Sample design was primarily guided by wind direction and frequencies, as well as from farming practices. Using CALPUFF and INL Site meteorological data measured from 2006 through 2008, air-dispersion modeling was performed to develop data quality objectives for radiological air surveillance monitoring for the INL Site using the methodology documented in Rood and Sondrup (2014). Then, this same methodology was used to discern the dispersion and deposition patterns resulting from these sources, which reflect wind patterns typical of the INL Site. Prevailing winds at most INL Site locations are from the southwest during daytime hours. During evening hours, the winds will sometimes shift direction and blow from the north or northeast but at a lower velocity. Model results show the maximum offsite deposition location is between the southwest INL Site boundary and the Big Southern Butte. Because there are no agricultural activities in this region, sampling is focused on other agricultural areas west and northeast of the INL Site. In addition, the sampling design considers locations of interest to the public, as well as those of historical interest, which is why some samples are collected at extended distances from the INL Site.

7.1.2 Sampling Methods

Fresh produce and milk are purchased from local farmers when available. In addition, lettuce is grown by the INL contractor in areas that have no commercial or private producers.

7.1.3 Sampling Results

Milk

Milk is sampled to monitor the pathway from potentially contaminated, regionally grown feed to cows, and then to milk, which is afterward ingested by humans. During 2024, the INL contractor collected 175 milk samples—including duplicates and controls—at various locations off the INL Site and purchased milk commercially produced outside the state of Idaho, which served as the control sample. The number and location of the dairies can vary from year to year as farmers enter and leave their businesses. Milk samples were collected weekly from dairies in Rigby and Terreton, Idaho, as well as monthly at other locations around the INL Site.

All milk samples were analyzed for gamma-emitting radionuclides, including iodine-131 (^{131}I) and cesium-137 (^{137}Cs). During the second and fourth quarters, samples were analyzed for strontium-90 (^{90}Sr) and tritium as well. Iodine is an essential nutrient and is readily assimilated by cows or goats eating plants containing the element. Iodine-131 is of particular interest because it is produced by reactor operations or nuclear weapons testing, is readily detectable, and, along with ^{134}Cs and ^{137}Cs, can dominate the ingestion dose regionally after a severe nuclear event, such as what occurred after the Chernobyl accident (Kirchner 1994) in Ukraine and the 2011 accident in Fukushima, Japan. The ingestion pathway of milk is the main route of internal ^{131}I exposure for people. Iodine-131 has a short half-life of just 8 days; therefore, it does not persist in the environment. Past releases from experimental reactors at the INL Site and fallout from atmospheric nuclear weapons tests and the Chernobyl accident are no longer present. Iodine-131 was not detected in any of the air samples collected at or beyond the INL Site boundary (see Chapter 4), nor was it detected in any milk sample collected during 2024.

Cesium-137 is chemically analogous to potassium in the environment and behaves similarly by accumulating in many types of tissue, most notably in muscle tissue. With a half-life of about 30 years, ^{137}Cs tends to persist in soil. If in a soluble form, it can readily enter the food chain through plants. It is widely distributed throughout the world from historic nuclear weapons detonations, which occurred between 1945 and 1980, and has been detected in all environmental media at the INL Site. Potential sources of ^{137}Cs include releases from INL Site facilities and the resuspension of previously contaminated soil particles. Cesium-137 was not detected in any milk sample collected in 2024.

Strontium-90 is an important radionuclide because it behaves like calcium and can deposit in bones. Like ^{137}Cs, ^{90}Sr is produced in high yields either from nuclear reactors or from the detonation of nuclear weapons. It has a half-life of about 29 years and can persist in the environment. Strontium tends to form compounds that are more soluble than ^{137}Cs and are therefore comparatively mobile in ecosystems. A concentration of ^{90}Sr was detected in one milk sample (0.66 ± 0.13 pCi/L) collected in Terreton, Idaho, on May 20, 2024. Based on this result, the milk is safe for consumption. This level was similar to the levels reported by the U.S. Environmental Protection Agency (EPA) as resulting from worldwide fallout deposited on soil and taken up by cows through the ingestion of grass. The results for a limited dataset of seven samples collected from 2007 through 2016 in EPA Region 10, which includes the state of Idaho, ranged from 0 to 0.54 pCi/L (EPA 2017). The maximum concentration of ^{90}Sr detected in the past 10 years was 1.53 ± 0.0.1 pCi/L, which was measured at Blackfoot, Idaho, in May 2021.

DOE has established a DCS for radionuclides in air, water, and milk (DOE 2022). A DCS is the concentration of a radionuclide in air, water, or milk that would result in a dose of 100 mrem from ingestion, inhalation, or immersion in a gaseous cloud for one year. The DCS for ^{90}Sr in milk is 5,800 pCi/L. Therefore, the observed value of ^{90}Sr in a milk sample (0.66 ± 0.13 pCi/L) is approximately 0.01% of the DCS for milk.

Tritium, with a half-life of about 12 years, is an important radionuclide because it is a radioactive form of hydrogen, which combines with oxygen to form tritiated water. The environmental behavior of tritiated water is like that of water and can be present in surface water, precipitation, and atmospheric moisture. Tritium is formed by natural processes, as well as by reactor operations and nuclear weapons testing. Tritium enters the food chain through surface water, which people and animals drink, and from plants that contain water. Tritium was not detected in any of the milk samples collected in 2024. The DCS for tritium in milk is 12,000,000 pCi/L.

Lettuce

Lettuce was sampled because radionuclides in air can be deposited on soil and plants, which then can be ingested by people. The uptake of radionuclides by plants may occur through root uptake from the soil, as well as from deposited material absorbed into leaves. For most radionuclides, uptake by foliage is the dominant process for plant contamination (Amaral et al. 1994). For this reason, green, leafy vegetables, such as lettuce, have higher-concentration ratios of radionuclides to soil than any other kind of plant. The INL contractor collects lettuce samples every year from areas on and adjacent to the INL Site. The number and locations of gardens have changed from year to year, depending on whether vegetables were available. Home gardens have been replaced with portable lettuce planters because the availability of lettuce from home gardens was unreliable at some key locations.

In addition, planters can be placed, and lettuce samples collected in areas previously unavailable to the public, such as on the INL Site and near air samplers, can provide reliable results. The planters can allow the radionuclides deposited from the air to accumulate on the soil and plant surfaces throughout the growth cycle. The planters are placed in the spring, filled with soil and potting mix, sown with lettuce seed, and self-watered through a reservoir.

Ten lettuce samples were collected from southeast Idaho locations, as well as one duplicate from Pocatello, which were analyzed for the gamma-emitting ^{137}Cs radionuclide and for ^{90}Sr. A control sample purchased from a local grocery store was analyzed as well. Four of the ten lettuce samples were collected from portable planters at Atomic City, the Experimental Field Station (EFS), Howe, and Monteview, in the state of Idaho. Soil from the vicinity of the sampling locations was used in the planters. This soil was amended with potting soil as a gardener in the region would typically use when growing lettuce. In addition to obtaining samples from the portable locations, duplicate samples were obtained from a home garden in Idaho Falls, Idaho, in addition to two more farms located in Blackfoot and Pocatello, Idaho. A control sample was purchased from a grocery store in the state of Washington.

These samples were analyzed for ^{90}Sr and gamma-emitting radionuclides. Strontium-90 was not detected in the lettuce samples collected during 2024. Strontium-90 is present in the environment as a residual of fallout from above-ground nuclear weapons testing, which occurred between 1945 and 1980. No other human-made radionuclides were detected in any of the lettuce samples. Although ^{137}Cs fallout from nuclear weapons testing is measurable in soils, the ability of vegetation, such as lettuce, to incorporate cesium from soil in plant tissue is much lower than for strontium (Fuhrmann et al. 2003; Ng, Colsher, and Thompson 1982; Schulz 1965). In addition, the availability of ^{137}Cs in plants depends highly on the properties of the soil, such as the clay content or alkalinity, which can act to bind the radionuclide (Schulz 1965). Soil in southeast Idaho tends to be moderately to highly alkaline.

Grain

Grain, including wheat and barley, is sampled because it is a staple crop in the region. In 2024, the INL contractor collected grain samples at 11 locations from areas surrounding the INL Site; a duplicate sample was not collected in 2024 but a control sample was purchased from outside the state of Idaho. These locations were selected because they typically are farmed for grain and are encompassed by the air surveillance monitoring network. Exact locations may change as growers rotate their crops. No human-made radionuclides were found in any of the samples. Agricultural products, such as fruits and grains, are naturally lower in radionuclides than those found in green, leafy vegetables (Pinder et al. 1990).

Potato

Potatoes are collected because they are one of the main crops grown in the region and are of special interest to the public. Because potatoes are not exposed to airborne contaminants, they typically are not considered a key part of the ingestion pathway. Potatoes were collected by the INL contractor at nine locations in the INL Site vicinity, while a duplicate sample was collected from Raft River, Idaho. A control sample was purchased from outside the state of Idaho. None of the potato samples collected during 2024—including the duplicate—contained a detectable concentration of any human-made radionuclides. Potatoes, like grain, are generally less-efficient at removing radioactive elements from the soil than leafy vegetables, such as lettuce, can effectively remove.

Alfalfa

In addition to analyzing milk, the INL contractor began collecting data in 2010 on alfalfa consumed by milk cows. Samples of alfalfa were collected from four locations in areas surrounding the INL Site vicinity. Mud Lake, Idaho, is an agricultural area with a high potential for offsite contamination via the air pathway. (Note: The offsite location with the highest air concentration used for estimating human doses was detected southeast of the INL Site's east entrance; however, there is limited agriculture near that location.) No ^{90}Sr or gamma-emitting radionuclides were detected in the alfalfa samples collected during 2024.

Big Game Animals

Since big game historically have been documented to uptake some level of radioactive contaminants, the opportunistic sampling of road-killed game animals is important to ascertain the potential impacts of these contaminants on the animals, as well as the humans potentially consuming them (INL 2022a).

Various tissue samples were collected from seven elk under a scientific collection permit. Muscle, liver, and thyroid samples were collected from three of the elk. Only muscle and thyroid samples were collected from the remaining four elk because their livers were damaged due to vehicular strikes. The muscle and liver samples were analyzed for ^{137}Cs because it is an analog of potassium and is readily incorporated into muscle and organ tissues. Thyroids are analyzed for ^{131}I because the isotope accumulates selectively in the thyroid gland of many animals when ingested, making them an ideal bio-indicator of atmospheric releases. Iodine-131 was not detected in the thyroid samples. No ^{137}Cs or other human-made, gamma-emitting radionuclides were found in any of the muscle or liver samples.

Waterfowl

Waterfowl are collected each year at ponds on the INL Site and at a location offsite under scientific collection permits with the Idaho Department of Fish and Game and the U.S. Fish and Wildlife Service. Three waterfowl samples were collected from wastewater ponds located at the Sewage Lagoons, two control waterfowl samples were collected from the South Fork of the Snake River, and two additional waterfowl samples were collected from CFA due to unforeseen natural causes that allowed for collection. These waterfowl samples were analyzed for gamma-emitting radionuclides (^{90}Sr) and actinides (^{241}Am, ^{238}Pu, $^{239/240}Pu$). These radionuclides were selected because they have been measured historically in liquid effluents from some INL Site facilities. Each sample was divided into the following three subsamples: (1) edible tissue (e.g., muscle, gizzard, heart, liver); (2) the external portion (e.g., feathers, feet, head); and (3) all remaining tissue.

A total of two human-made radionuclides (^{60}Co and ^{90}Sr) were detected in the exterior subsamples from the waterfowl samples collected at CFA and the South Fork of the Snake River, as indicated in Table 7-1. The ^{60}Co result for an exterior subsample of a waterfowl collected from the Sewage Lagoons was above the 3σ uncertainty but did not exceed the minimum detectable concentration. All results were within the historical measurements that were observed from 2014 to 2023. No other human-made, gamma-emitting radionuclides were found in the collected edible or remainder subsamples.

Table 7-1. Radionuclide concentrations detected in waterfowl collected in 2024.

RADIONUCLIDES DETECTED IN WATERFOWL TISSUE (pCi/kg)				
LOCATION	SPECIES	PORTION	RADIONUCLIDE	CONCENTRATION
CFA	Canada goose	Exterior	Cobalt-60	315.00 ± 34.00
South Fork of the Snake River	Canada goose	Exterior	Strontium-90	12.80 ± 4.04

7.2 Soil Sampling

DOE-HDBK-1216-2015 (DOE 2015) states that soil sampling and analysis should be used to evaluate long-term accumulation trends and to estimate environmental radionuclide inventories. It notes that soil provides an integrating medium that can account for contaminants released to the atmosphere either directly in gaseous effluents, or indirectly from the resuspension of onsite contamination or through liquid effluents released to a stream that is subsequently used for irrigation. However, while soil sampling is a useful approach for determining the accumulation of initially airborne radionuclides deposited on the ground, such sampling generally serves a supplementary role in environmental surveillance monitoring programs (Gallegos 1995; Hardy and Krey 1971; EML 1997). In addition, soil sampling is of questionable value in attempting to estimate small increments of deposition over a period of a few years or less due to the large uncertainties in sampling and the inherent variability in soil, and because it is not recommended as a routine method of environmental surveillance monitoring except in pre-operational surveys (EML 1997).

The INL contractor currently completes soil sampling on a 5-year rotation at the INL Site to evaluate long-term accumulation trends and to estimate environmental radionuclide inventories. The next soil sampling and analysis event is scheduled for 2027. Data from previous years of soil sampling and analysis on the INL Site show slowly declining concentrations of short-lived radionuclides of human origin (e.g., ^{137}Cs), with no evidence of detectable concentrations depositing onto surface soil from ongoing INL Site releases (INL 2017).

7.3 Direct Radiation

Environmental, direct radiation measures the exposure of the public and non-involved workers within INL Site boundaries and surrounding areas. Dosimeters are placed around INL facilities, along the INL Site perimeter, and in areas within a 50-mile radius of the INL Site boundaries. Direct radiation sample results for 2024 are provided in the quarterly surveillance reports (INL 2025b; INL 2025d).

7.3.1 Sampling Design

An array of optically stimulated luminescent dosimeters (OSLDs) is distributed throughout the Eastern Snake River Plain and on the INL Site to measure environmental radiation. In addition, neutron dose surveillance monitoring is conducted around INL facilities and buildings where neutron radiation may be present. The two sampling periods were from November 2023 to April 2024 and from May 2024 to October 2024. Dosimeters on the INL Site are placed at facility perimeters, concentrated in areas likely to detect the highest gamma radiation readings. Other dosimeters on the INL Site are located near radioactive materials storage areas and along roads.

7.3.2 Sampling Methods

Environmental OSLDs are placed in the field for 6 months. After the 6-month period, the OSLDs are collected and returned to the supplier for analysis. Transit control dosimeters are shipped with the field dosimeters to measure any dose received during shipment. Background radiation levels are highly variable; therefore, historical information establishes localized regional trends to identify variances. It is anticipated that 5% of the measurements will exceed the background dose. If a single measurement is greater than the background dose, it does not necessarily mean that an unusually high amount of radiation exists in that area. When a measurement exceeds the background dose, the measurement is compared to other values in the area and to historical data to determine whether the results may require further action as described in the report, “Data Quality Objectives Supporting the Environmental Direct Radiation Monitoring Program for the Idaho National Laboratory” (INL 2022b). The method for computing the background value as the upper tolerance limit

(UTL) is described in EPA (2009) and EPA (2016). ProUCL Version 5.1 software (EPA 2016) has been used to compute the UTL for these locations, given all available data in the area since 2012.

7.3.3 Direct Radiation Results

The 2024 direct radiation results collected by the INL contractor at the boundary, offsite, and onsite locations are provided in the INL contractor quarterly surveillance reports (INL 2025b; INL 2025d). The 2024 reported values for these field locations were primarily below the historic six-month background UTL. Table 7-2 contains the locations that exceeded their specific 6-month background UTL. As anticipated, 3% exceeded the UTL for 2024 (see Subsection 7.3.2). The results listed in Table 7-2 showed similarity to the historical data suggesting that no further action was required.

Table 7-2. Dosimetry locations above the six-month background UTL (2024).

LOCATION (BUILDING)	NOV. 2023 – APRIL 2024 SAMPLE RESULT (mrem)	MAY 2024 – OCT. 2024 SAMPLE RESULT (mrem)	BACKGROUND LEVEL UTL[a] (mrem)
EBR-I (EBR-I O-2)	—[b]	93.0 ± 4.7	91.0
Idaho Falls (IF-638W O-4)	69.7 ± 3.5	—	66.4
Idaho Falls (IF-665 O-5)	—	67.7 ± 3.4	66.2
Idaho Falls (IF-675S O-34)	65.2 ± 3.3	—	63.0
INTEC (ICPP O-15)	—	169.7 ± 8.5	146.9
INTEC (ICPP O-27)	—	269.6 ± 13.5	230.2
INTEC (ICPP O-28)	—	248.8 ± 12.4	230.2
NRF (NRF O-16)	—	84.6 ± 4.2	79.2
NRF (NRF O-19)	—	80.8 ± 4.0	79.2
Roberts (RobNOAA)	—	80.9 ± 4.0	79.2
TAN (TAN LOFT O-10)	81.7 ± 4.1	—	79.8

a. The UTL is the value such that 95% of all the doses in the area are less than that value with 95% confidence. It is anticipated that 5% of the doses should exceed the UTL.
b. — = The sample did not exceed the UTL for the collection period.

Neutron dose surveillance monitoring is conducted around buildings in Idaho Falls where sources may emit or generate neutron radiation. All of the neutron dosimeters collected in 2024 were reported as "M," which denotes that the dose equivalents are below the minimum measurable quantity of 10 mrem. The background level for the neutron dose is zero, and the current dosimeters have a detection limit of 10 mrem. Any measured neutron dose is considered present due to sources inside the building. The INL contractor follows the recommendations of the manufacturer to prevent environmental damage to the neutron dosimetry by wrapping each in aluminum foil. Then, to keep the foil intact, the dosimeter is inserted into an ultraviolet protective cloth pouch when deployed.

Table 7-3 summarizes the calculated effective dose a hypothetical individual would receive on the Snake River Plain from various sources of natural background radiation (e.g., cosmic, terrestrial). This table includes the latest recommendations of the National Council of Radiation Protection and Measurements (NCRP) in "Exposure of the Population in the United States and Canada from Natural Background Radiation" (NCRP 2009).

The terrestrial natural background radiation exposure estimate is based on the concentrations of naturally occurring radionuclides found in soil samples collected from 1976 to 1993, as summarized by Jessmore, Lopez, and Haney (1994). Concentrations of naturally occurring radionuclides in the soil do not change significantly over this relatively short period. Data indicates the average concentrations of ^{238}U, ^{232}Th, and ^{40}K were 1.5, 1.3, and 19 pCi/g, respectively. The calculated external dose equivalents received by a member of the public from ^{238}U plus decay products, ^{232}Th plus decay products, and ^{40}K based on the above-average area soil concentrations were 21, 28, and 27 mrem/yr, respectively, for a total of 76 mrem/yr (Mitchell et al. 1997). Because snow cover can reduce the effective dose that Idaho residents receive from the soil, a correction factor must be made each year to the estimated 76 mrem/yr. In 2024, this resulted in a reduction in the effective dose from the soil to a value of 74 mrem/yr.

Table 7-3. Calculated effective dose from natural background sources (2024).

SOURCE OF RADIATION DOSE	TOTAL AVERAGE ANNUAL DOSE	
	CALCULATED (mrem)	MEASURED[a] (mrem)
EXTERNAL IRRADIATION		
Terrestrial	74[b]	NA[c]
Cosmic	57[d]	NA
Subtotal	**131**	**123**
INTERNAL IRRADIATION (PRIMARILY INGESTION)[e]		
Potassium-40	15	NM[f]
Thorium-232 and uranium-238	13	NM
Others (carbon-14 and rubidium-87)	1	NM
INTERNAL IRRADIATION (PRIMARILY INHALATION)[d]		
Radon-222 (radon) and its short-lived decay products	212	NM
Radon-220 (thoron) and its short-lived decay products	16	NM
TOTAL	**388**	

a. Calculated from the average annual external exposure at all offsite locations measured using OSLDs.
b. Estimated using concentrations of naturally occurring radionuclide concentrations in soils in the Snake River Plain.
c. NA indicates terrestrial and cosmic radiation parameters were not measured individually but were measured collectively using dosimeters located offsite and at the boundary of the INL Site.
d. Estimated from Figure 3.4 of NCRP Report No. 160 (2009).
e. Values reported for the average American adult in Table 3.14 of NCRP Report No. 160 (2009).
f. NM = not measured.

The cosmic component varies primarily with increasing altitude. Using Figure 3.4 in NCRP Report No. 160 (NCRP 2009), it was estimated that the annual cosmic radiation dose near the INL Site is approximately 57 mrem. Cosmic radiation may vary slightly because of solar cycle fluctuations and other factors.

Based on this information, the sum of the terrestrial and cosmic components of external radiation dose to a person residing on the Snake River Plain in 2024 was estimated to be 131 mrem/yr. This is similar to the 123 mrem/yr measured at offsite locations using OSLD data. Measured values are typically within normal variability of the calculated background doses. Therefore, it is unlikely that INL Site operations contributed to background radiation levels at offsite locations in 2024.

The component of background dose that varies the most is inhaled radionuclides. According to the NCRP, the major contributor of effective dose received by a member of the public from ^{238}U plus decay products are short-lived decay products of radon (NCRP 2009). The amount of radon in buildings and groundwater depends, in part, upon the natural radionuclide content of soil and rock in the area. The amount of radon also varies among buildings of a given geographic area depending on the materials each contains, the amount of ventilation and air movement, and other factors. The U.S. average of 212 mrem/yr was used in Table 7-3 for this component of the total background dose. The NCRP also reports that the average dose received from thoron, a decay product of ^{232}Th, is 16 mrem.

Individuals also receive an internal dose from ingestion of ^{40}K and other naturally occurring radionuclides in environmental media. The average ingestion dose to an adult living in the U.S. was 29 mrem/yr (NCRP 2009).

With all these contributions, the total background dose to an average person living in southeast Idaho was estimated to be approximately 388 mrem/yr, as identified in Table 7-3. This value was used to calculate the background radiation dose to the population living within 50 miles of INL Site facilities (see Table 8-2).

7.4 Waste Management Surveillance Sampling

In compliance with DOE O 435.1, "Radioactive Waste Management," vegetation and soil sampling were conducted at RWMC, while direct surface radiation was measured at RWMC and the ICDF. Soil sampling was conducted at the Subsurface Disposal Area (SDA) at the RWMC from 1994 to 2017. Soil surveillance monitoring was discontinued based on several factors, including the limited availability of undisturbed soils and sufficient historical data being collected previously to satisfy the characterization objectives.

7.4.1 Vegetation Sampling at the Radioactive Waste Management Complex

Vegetation samples were collected historically from four major areas at RWMC and a control location approximately seven miles south of the SDA at the base of the Big Southern Butte. Samples of Russian thistle, crested wheatgrass, and rabbitbrush were collected historically. Using guidance from the DOE Handbook (DOE 2015) in 2018, the Idaho Cleanup Project contractor decided to discontinue further biota sampling activities. This decision was based on an evaluation of biota sample data trends, which concluded that vegetation is not considered a major mode of radionuclide transport through the environment surrounding the SDA at RWMC.

7.4.2 Surface Radiation Survey at the Radioactive Waste Management Complex and the Idaho CERCLA Disposal Facility

Surface radiation surveys are performed to characterize gamma radiation levels near the ground surface at waste management facilities. Comparing the data from these surveys year to year helps to determine whether radiological trends exist in specific areas. This type of survey is conducted at the SDA at RWMC and at ICDF to complement air sampling. The SDA contains legacy waste, some of which is in the process of being removed for repackaging and shipment to an offsite disposal facility. The ICDF consists of a landfill and evaporation ponds, which serve as the consolidation points for CERCLA-generated waste within the INL Site boundaries.

Surface radiation mapped at RWMC occurred on October 31, 2024. Background readings were 2,534 counts per second and the SDA had a mean of 3,302 counts per second. The maximum reading was 4,464 counts per second. Historically, the average background values were around 4,000 counts per second at RWMC with most readings being at or near the background levels.

Surface radiation mapping occurred at ICDF on September 25, 2024. The background values were measured at roughly 3,700 counts per second with most readings matching near the background values. Historically, most readings at ICDF also were at or near the background.

7.5 References

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Swallowtail caterpillar eating turpintine wavewing plant.