



U.S. DEPARTMENT OF  
**ENERGY**

OFFICE OF  
**ENVIRONMENTAL  
MANAGEMENT**

# Annual Environmental Monitoring

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**Betsy Holmes**

*DOE-Idaho*

**April 27, 2015**

# Annual Site Environmental Report

## *DOE Requirements*

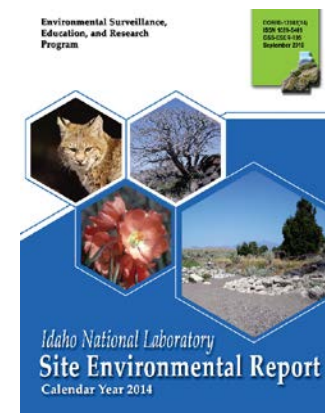
Required Annually for DOE Sites by DOE Order 231.1B, *“Environment, Safety, and Health Reporting”*

- Site Environmental Management Performance
  - Effluent Releases
  - Environmental Monitoring
  - Types and Quantities of Radioactive Materials Emitted or Discharged to the Environment
  - Dose to Public from Exposure to Radiation Sources
- Environmental Occurrences and Responses
- Description of Significant Environmental Programs and Efforts
- Compliance with Environmental Standards and Requirements

# INL Site Environmental Report

## *Calendar Year 2014*

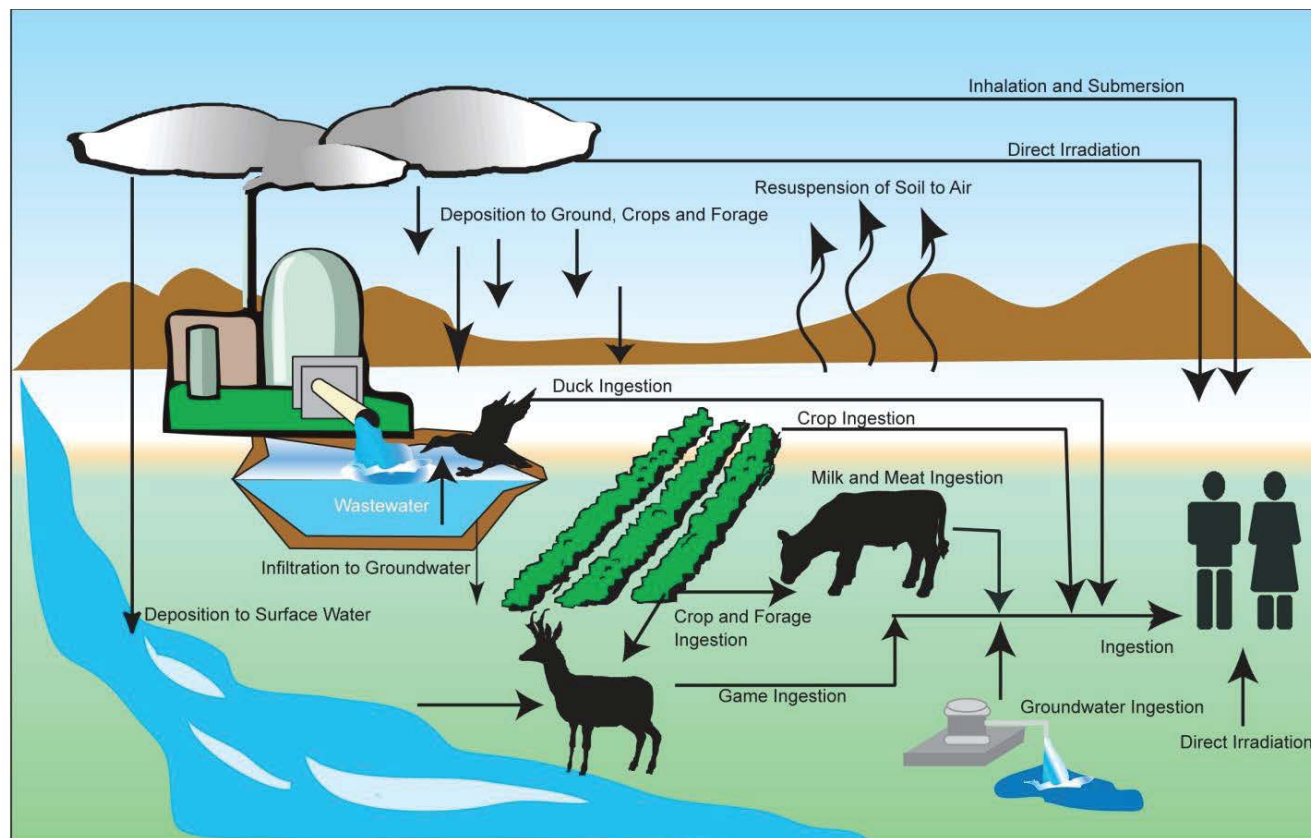
- INL Site contractors, facilities, history, and surrounding populations
  - Air Quality and Radiation Protection
  - Environmental Protection & Remediation
  - Waste Management & Disposition
  - Water Quality & Protection
  - Cultural Resources Protection
  - Environmental Restoration (CERCLA)
  - Environmental Sustainability Programs
  - Decontamination & Decommissioning
  - Spent Nuclear Fuel
  - Environmental Oversight & Monitoring Agreement (state of Idaho)
  - Citizens Advisory Board
- ✓ Dose to the Public and Biota
    - Ecological Research
    - Quality Assurance
  - ✓ Environmental Monitoring Programs
    - ✓ Air
    - ✓ Liquid Effluents
    - ✓ Groundwater
    - ✓ Drinking Water
    - ✓ Surface Water
    - ✓ Agricultural Products
    - ✓ Wildlife
    - ✓ Soil
    - ✓ Direct Radiation



# INL Site Environmental Report

## *Environmental Monitoring Overview*

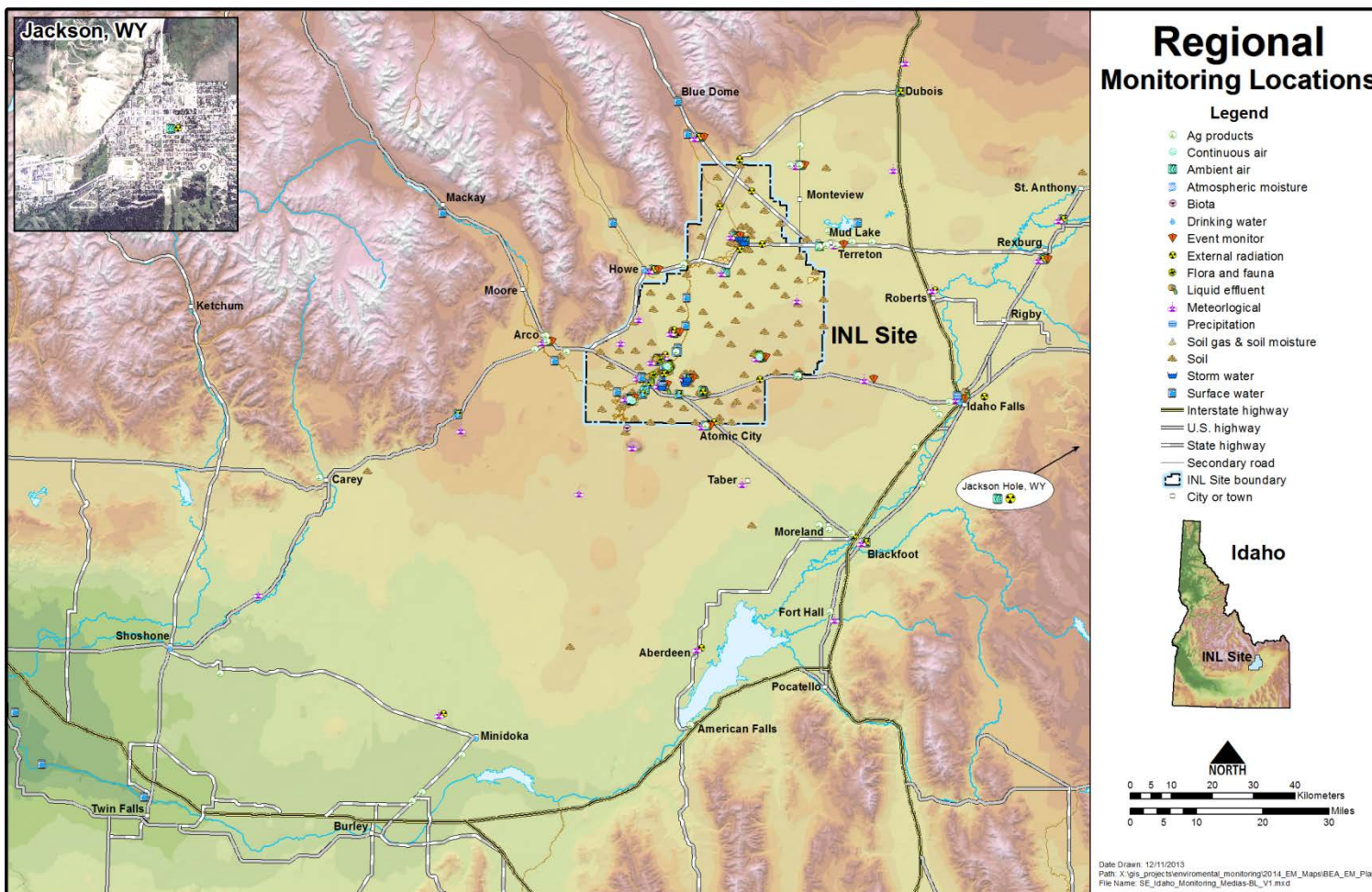
- Comply with applicable local, state, & federal regulations, and DOE requirements.
- Evaluate public health and environmental impacts from DOE operations.





# INL Site Environmental Report

## Environmental Monitoring Overview



INL Site Monitoring Program covers 9,000 square miles in southeast Idaho and Jackson, Wyo.

Thousands of samples are collected and analyzed each year, mainly for radioactive constituents.

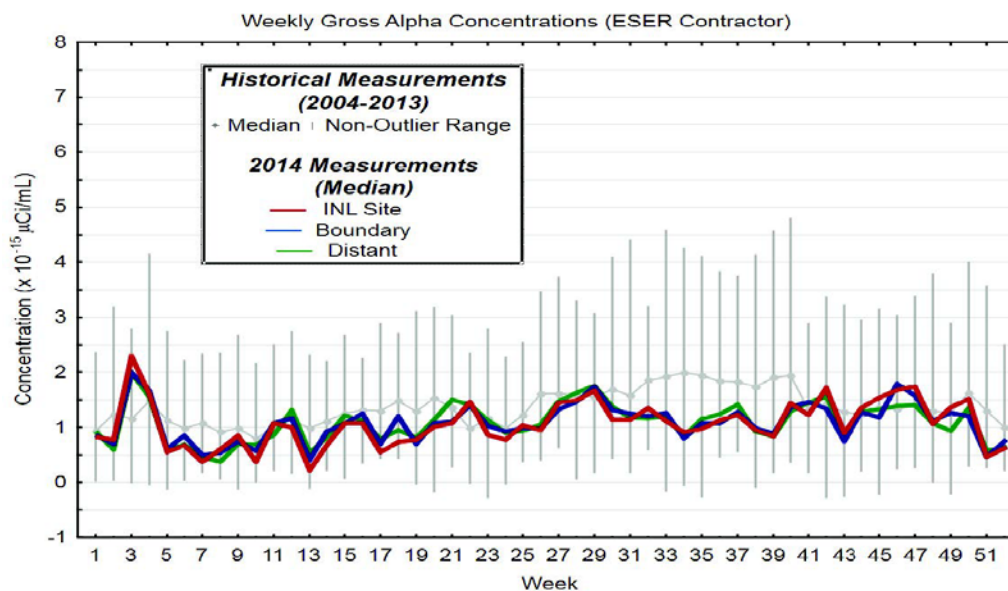
# INL Site Environmental Report

## Ambient Air

- DOE Order 458.1 Compliance
- Air sampling at onsite, boundary, and offsite locations
- Particulates, gaseous iodine, atmospheric moisture & precipitation
- Analyzed for radioactive constituents
- Measured concentrations are below DOE standards



**DOE Order 458.1,  
“Radiation Protection  
of the Public and the  
Environment”**





# INL Site Environmental Report

## *Airborne Effluents*

- Clean Air Act compliance
- Air emissions sources constructed and operated according to state of Idaho and EPA Region 10 permits
- Monitoring is performed according to permit/regulatory requirements
- Continuous emissions monitoring: potential to emit > 0.1 millirem dose/year
- Periodic confirmatory measurements
- 2014: Monitoring performed as required; emissions levels decreased, continuing a downward trend
- Radiological air emissions data are used to calculate annual public dose

# INL Site Environmental Report

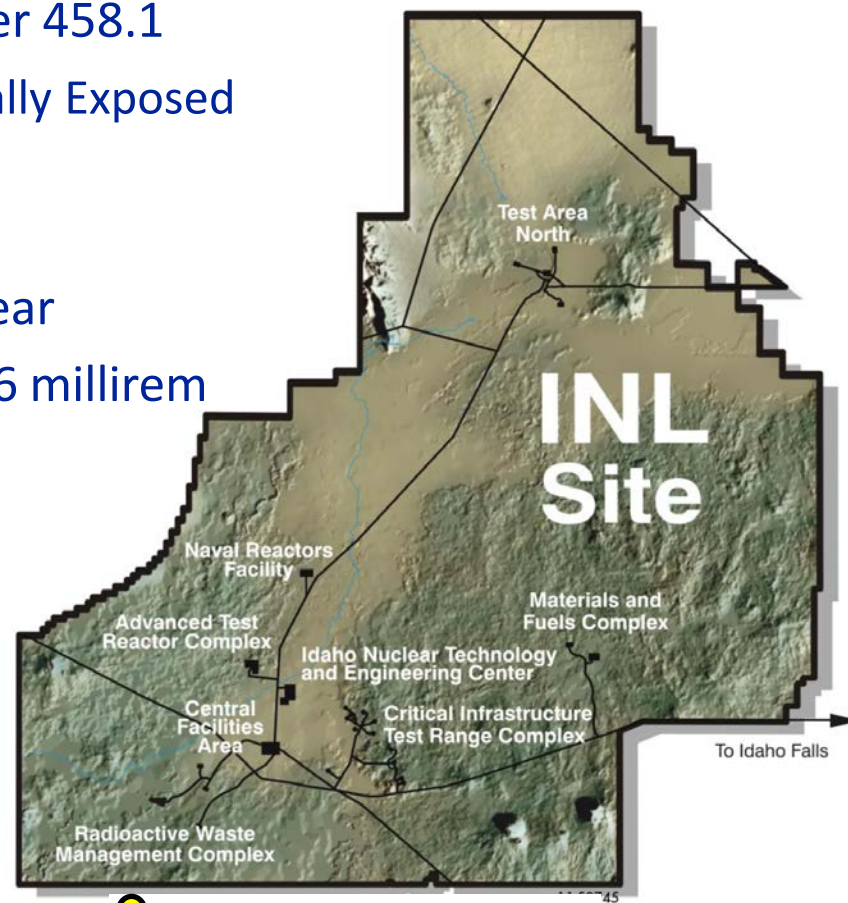
## *Dose to Public*

- Required by Clean Air Act and DOE Order 458.1
- Potential dose to a hypothetical Maximally Exposed Individual or MEI
- Estimated with EPA's CAP-88 model
- EPA MEI dose standard is 10 millirem/year
- 2014 INL Site MEI potential dose = 0.036 millirem

### Comparing Common Exposures to Radiation

Activity	Radiation Dosage in Millirems
Radon in average household (one year)	200
Plutonium-powered pacemaker (one year)	100
Natural radioactivity in your body (one year)	40
Cosmic radiation (one year)	31
Mammogram	30
Smoking one pack of cigarettes per day (one year)	15-20
Chest or dental X-ray	10
Using natural gas in the home (one year)	9
Airline travel (2,000-mile trip)	1
Living near a power plant (one year)	1

Source: U.S. Department of Energy, Oak Ridge Office, "About Radiation," [www.oakridge.doe.gov/external/PublicActivities/EmergencyPublicInformation/AboutRadiation/tabid/319/Default.aspx](http://www.oakridge.doe.gov/external/PublicActivities/EmergencyPublicInformation/AboutRadiation/tabid/319/Default.aspx) (October 29, 2007)



Frenchman's Cabin  
MEI location



# INL Site Environmental Report

## *Dose to Biota*

- Evaluates effects of radiation on terrestrial and aquatic animals
- Required by DOE Order 458.1
- DOE's RESRAD-BIOTA computer code
- INL Site biota dose assessment consistently shows INL Site-related radioactivity is causing no harmful effects



# INL Site Environmental Report

## Water

### *Compliance and Surveillance Monitoring*

#### **Liquid Effluents**

- Permit-regulated discharges to land surface
- Sampled for biological, chemical, physical, and radiological constituents
- MFC Industrial Waste Water Underground Pipe permit limit for total suspended solids exceeded in 2014; other monitoring results were below applicable standards (permit limits or MCL)



#### **Drinking Water**

- Regulated by the State under Safe Drinking Water Act
- 12 drinking water systems & 8 offsite locations (radiological)
- Sampled for biological, chemical, and radiological constituents
- Monitoring results were below applicable standards (MCL or DOE radiological standards)



# INL Site Environmental Report

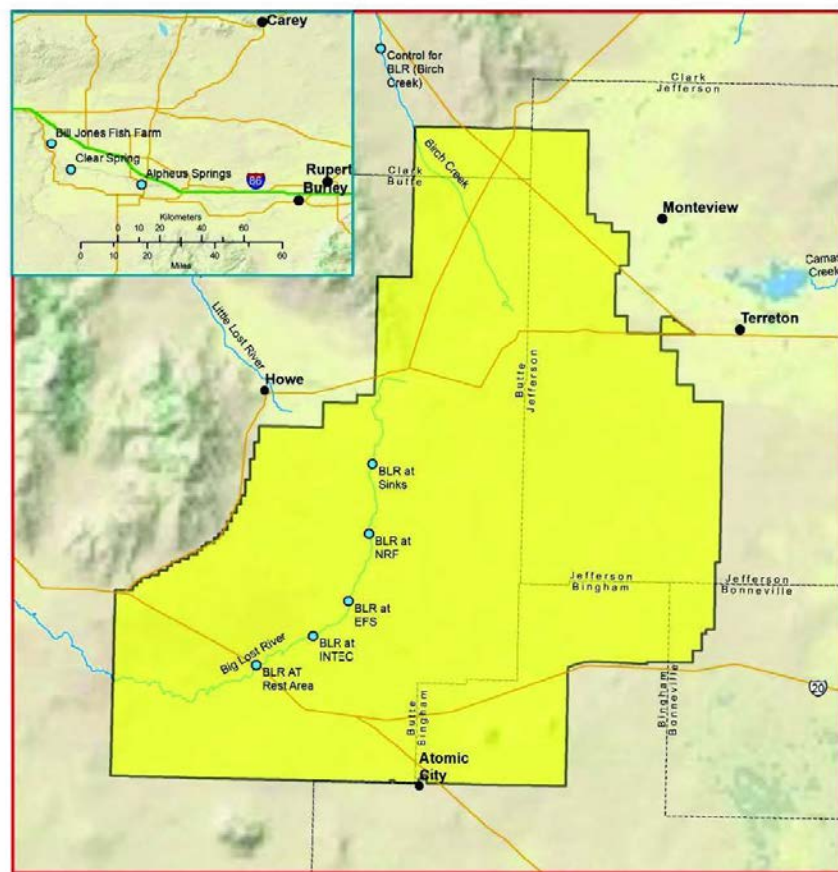
## Water - Continued

### Surface Water Runoff

- Sampled for compliance with DOE Order 435.1, *Radioactive Waste Management*
- Surface water runoff sampled at the Subsurface Disposal Area for radioactive constituents
- Measured concentrations were below DOE standards

### Surface Water

- Big Lost River & 3 downgradient springs sampled for radioactive constituents
- Sampled for compliance with DOE Order 458.1
- Alpheus Springs gross beta activity above EPA MCL for strontium-90, likely due to natural radioactive decay products; other measured concentrations were below MCLs



Surface Water Sampling Locations



# INL Site Environmental Report

## Water - Continued

### CERCLA Groundwater Monitoring

- All Waste Area Groups except WAG 8 (Naval Reactors)
- Sampled for radioactive and chemical constituents – specifics are dependent upon the WAG
- Sample results are compared to limits for drinking water and/or the applicable Record of Decision
- <https://ar.icp.doe.gov/>

### USGS Groundwater Monitoring

- 131 groundwater wells
- Sampled for radioactive and chemical constituents
- <http://id.water.usgs.gov/INL/>

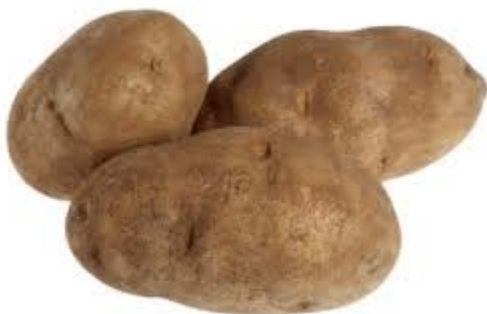


# INL Site Environmental Report

## *Agricultural Products*



-  Alfalfa
-  Wheat
-  Milk
-  Potatoes
-  Lettuce



- Sampled for radioactive constituents
- Specific radionuclides detected in some samples at concentrations below DOE standards and consistent with background levels



# INL Site Environmental Report

## Wildlife



### Road-killed pronghorn, elk, deer

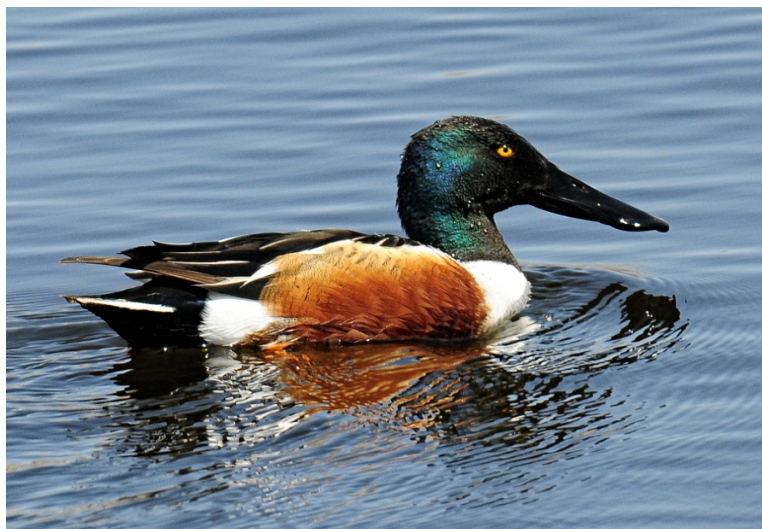
Thyroid and muscle tissue collected & analyzed for radioactive constituents

- *No human-made radionuclides detected in 2014*

### Waterfowl from Wastewater Ponds

Birds are divided into edible tissue, external portion, all remaining tissue & analyzed for radioactive constituents

- *Some human-made radionuclides detected in edible tissue within background concentrations*
- *2014 maximum potential dose 0.032 millirem*



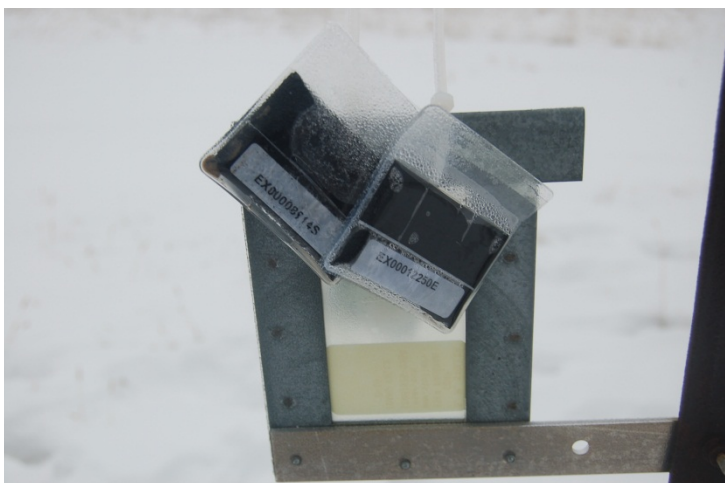
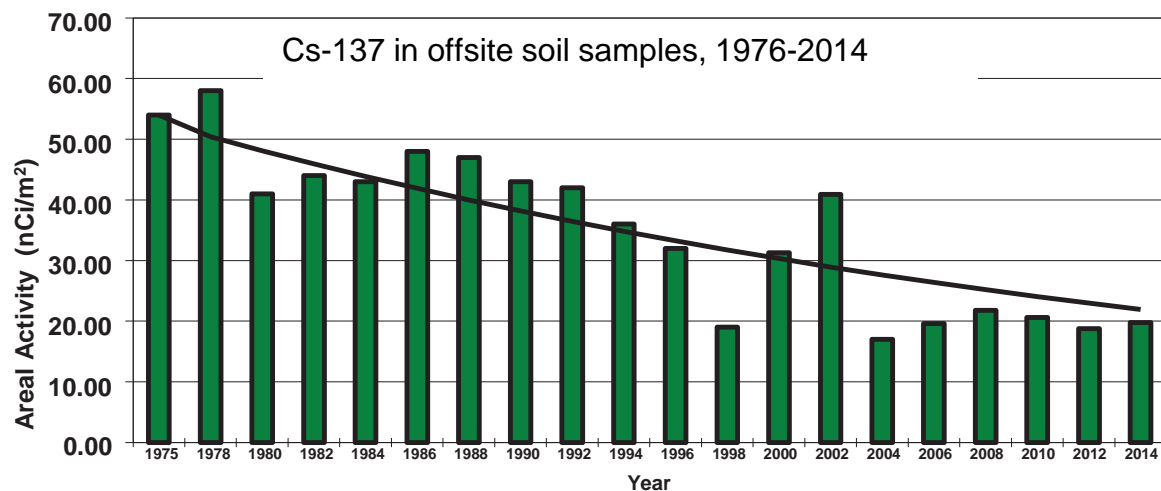


# INL Site Environmental Report

## Soil and Direct Radiation

Soil sampling performed to establish background levels of radionuclides and detect long-term buildup of INL Site-related radionuclides

- *Results are consistent with background concentrations*



Direct radiation measures external exposure with environmental dosimeters

- *Measured exposures are not distinguishable from background levels*

# Accessing Reports

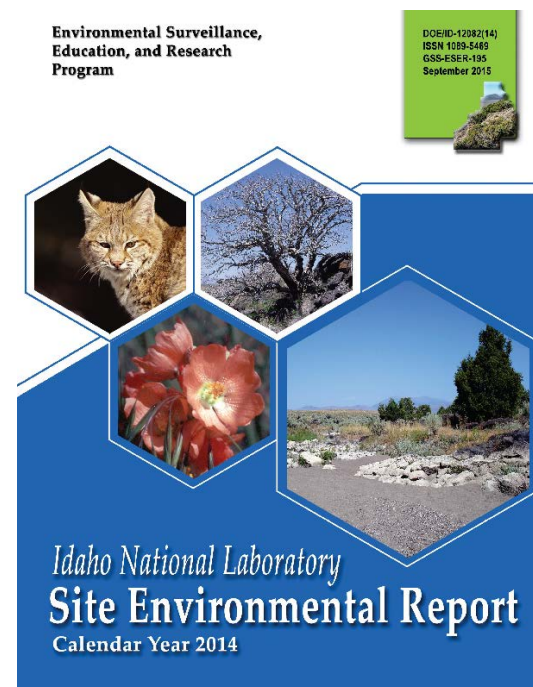
## INL Site Annual Environmental Reports

*1997-Present:* Available on the web at  
<http://www.idahoer.com/publications.htm>

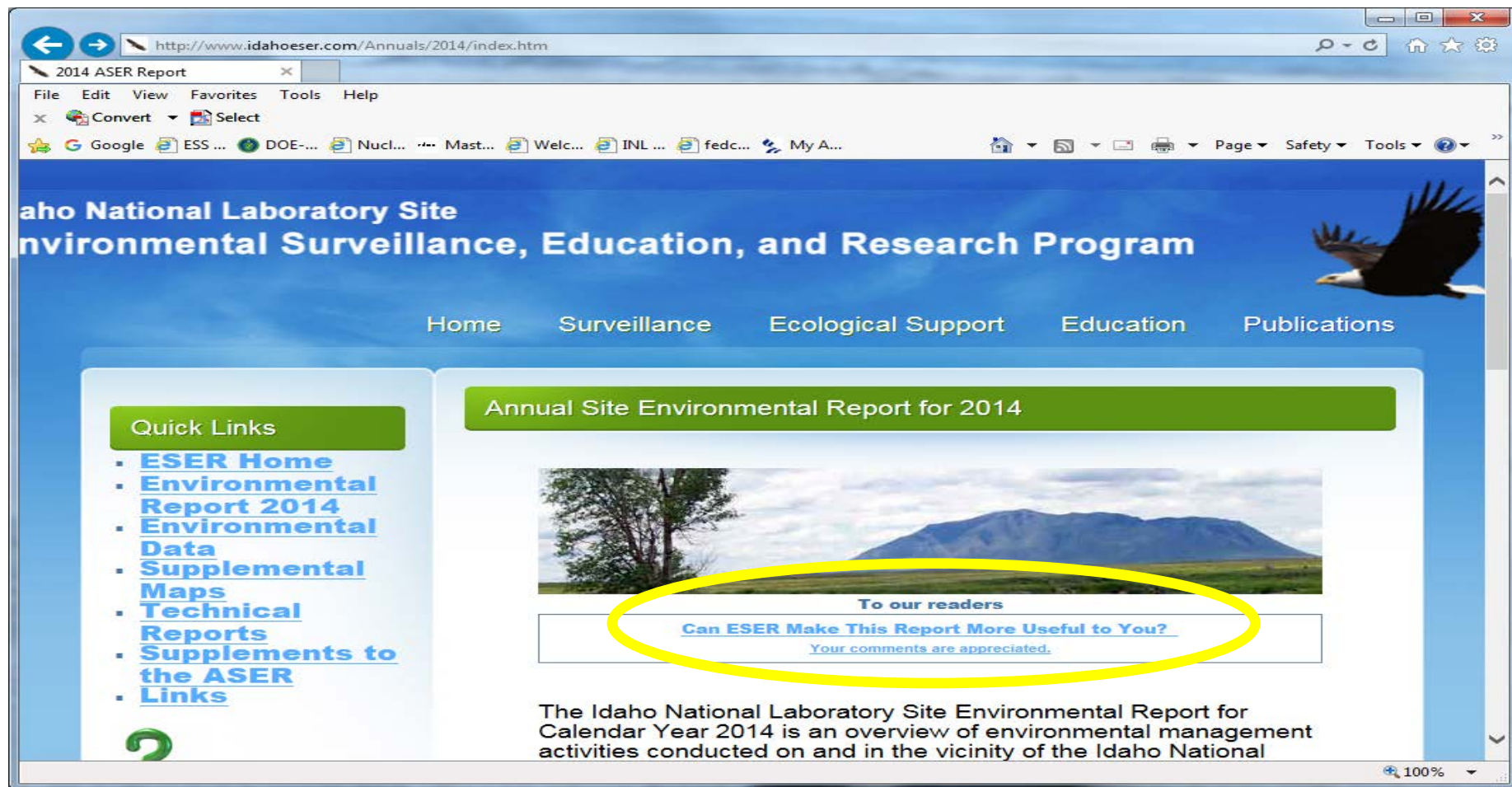
*All Reports:* INL Research Library at  
<https://www.inl.gov/about-inl/general-information/research-library/>

## Other DOE Site Environmental Reports

<http://energy.gov/ehss/policy-guidance-reports/environment-policy-guidance-reports/annual-site-environmental-reports>



# Feedback is Welcomed and Appreciated





# INL Site Annual Monitoring *Summary*

- Monitoring is conducted in compliance with applicable requirements and demonstrates the INL Site is operating within established limits
- Measured concentrations of radiological constituents are typical of historical and background values
- Environmental monitoring is a dynamic program that needs to be responsive to changes in site operations, stakeholder concerns, and unanticipated events

# QUESTIONS?

# Additional Slides



# INL Site Environmental Report

## *2014 Environmental Compliance*

- Environmental compliance monitoring and reporting performed according to permit requirements
  - Permit limit total suspended solids exceeded for the Materials and Fuels Complex Industrial Waste Water Underground Pipe
- DEQ Regulatory Inspections
  - Drinking Water System Sanitary Surveys – no deficiencies identified
  - Annual RCRA Inspection – notice of violation; consent order penalty paid through a Supplemental Environmental Project
  - Underground Storage Tank 3 yr Inspection – informal warnings resolved through corrective actions
  - Air inspections – 3 facilities inspected, all operating in compliance
- Regulatory Milestones
  - Waste treatment and offsite shipments impacted by WIPP and Idaho Waste Treatment Unit progress
- No reportable environmental occurrences
- Migratory Bird Treaty Act Special Use Permit was not activated

# INL Site Environmental Report

## *2014 Other Major Programs*

- Cultural Resources – 25 localities visited and monitored
- Decontamination and Decommissioning – ongoing at Materials and Fuels Complex
- Spent Nuclear Fuel – Seven EBR-II shipments from INTEC to MFC
- Environmental Sustainability – Reduced INL Site water use by 14% compared to 2007; 700 metric tons materials recycled
- Ecological Research – Vegetation recovery and snake monitoring post-fire, five USGS reports published

## **Radiological Environmental Concentrations**

DOE-STD-1196-2011

Derived Concentration Technical Standard

<http://energy.gov/ehss/downloads/doe-std-1196-2011>

## **Biota Dose**

DOE-STD-1153-2002

Graded Approach to Evaluating Radiation Doses to Aquatic and Terrestrial Biota

<http://energy.gov/ehss/downloads/doe-std-1153-2002>

## **Radiological Monitoring and Surveillance**

DOE-HDBK-1216-2015

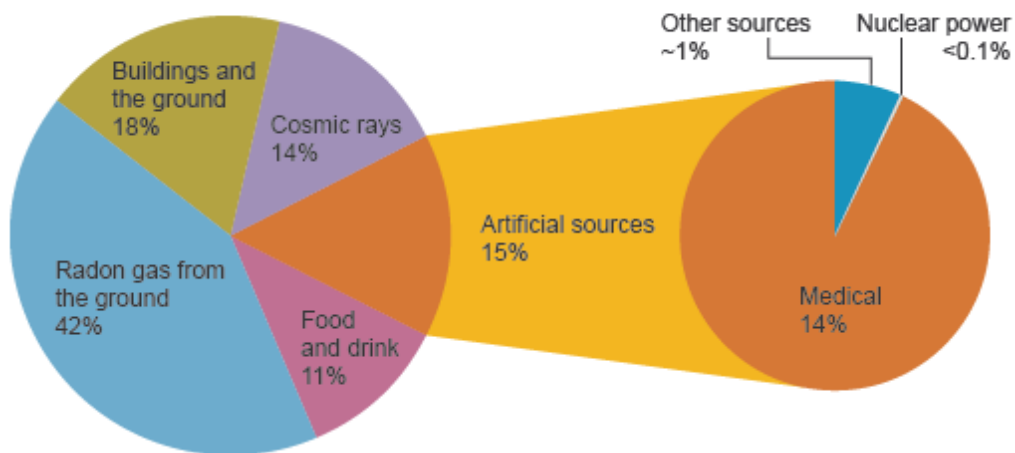
Environmental Radiological Effluent Monitoring and Environmental Surveillance

<http://energy.gov/ehss/downloads/doe-hdbk-1216-2015>



# Terminology

## Background Radiation



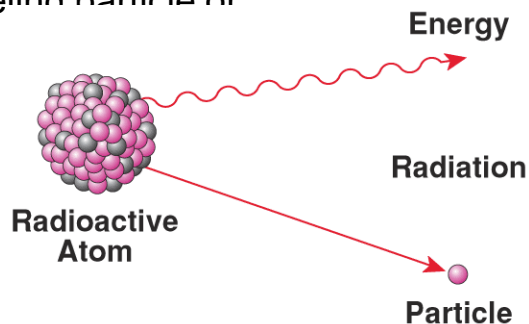
1. Radiation in the natural environment, including cosmic rays from space and radiation from naturally occurring radioactive elements in the air, in the earth, and in human bodies. It also includes radiation from global fallout from historical atmospheric nuclear weapons testing.

2. The level of radiation from sources other than the source of interest.

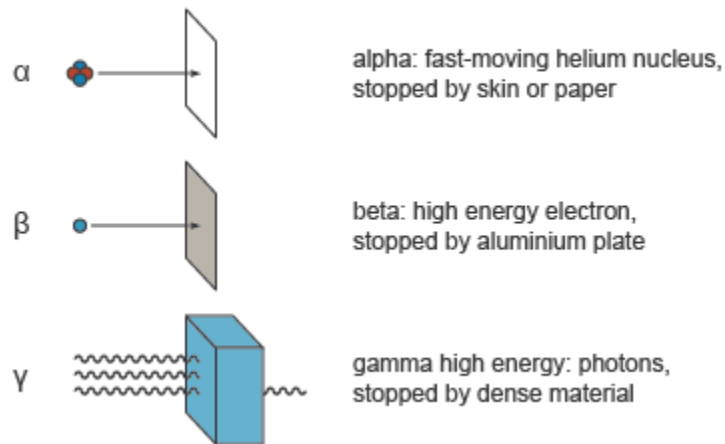
## Radiation vs Radioactivity?

**Radioactivity** – breaking-up (decay) of an atom's nucleus

**Radiation** – a traveling particle or wave

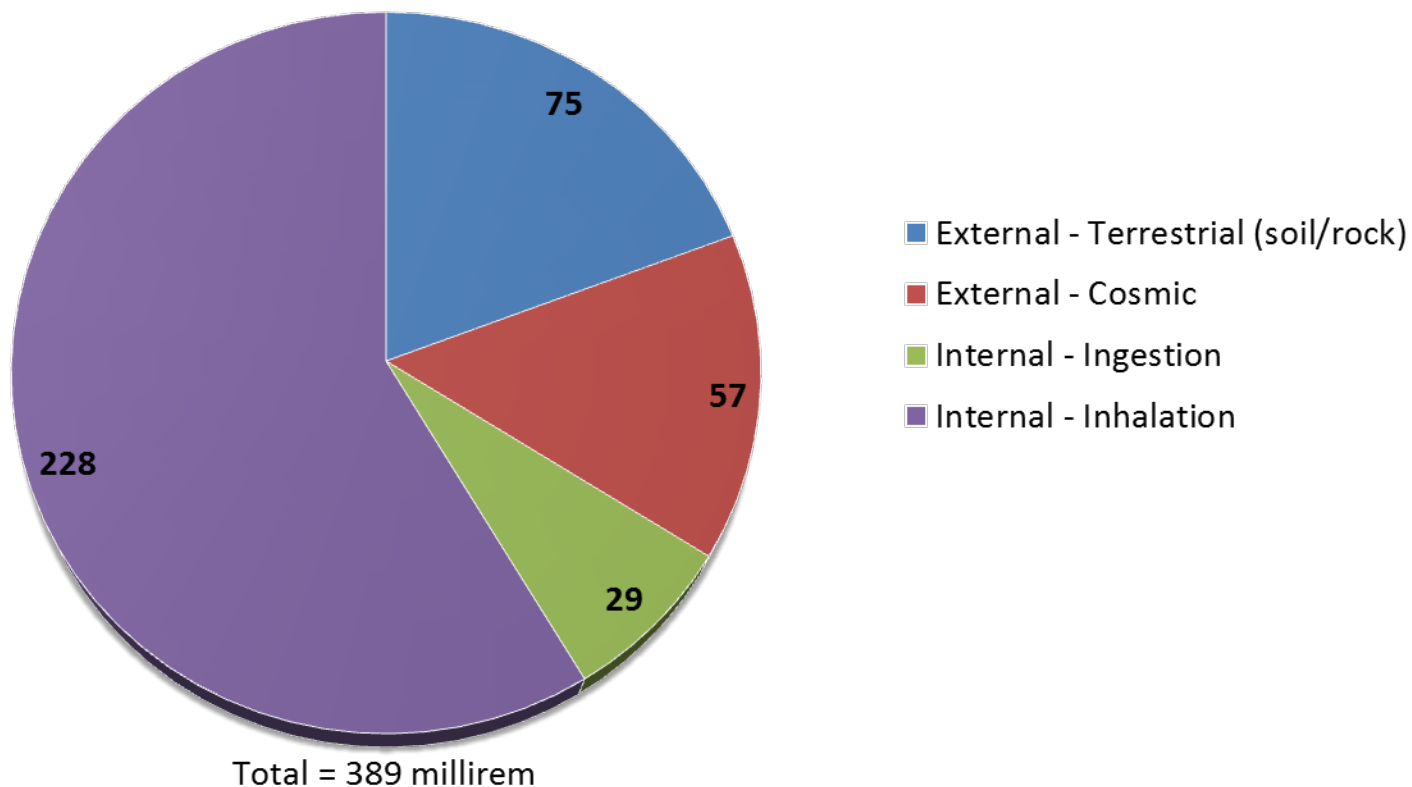


## Ionizing Radiation



# Natural Background Radiation

Calculated Doses from Natural Background Sources for an  
Average Individual Living in Southeast Idaho in 2014 (in millirem)



# INL Site Environmental Report

## Ambient Air Monitoring Locations

