Department of Energy
Idaho Operations Office
1955 Fremont Avenue
Idaho Falls, ID 83415

December 10, 2019

SUBJECT: Notification of the Final Environmental Assessment Determination for Expanding Capabilities at the National Security Test Range and the Radiological Response Training Range at Idaho National Laboratory (CLN200243)

Dear Citizen:

The United States Department of Energy (DOE) has completed the Final Environmental Assessment (EA) for Expanding Capabilities at the National Security Test Range and the Radiological Response Training Range at Idaho National Laboratory (DOE/EA-2063) and has determined that a Finding of No Significant Impact (FONSI) is appropriate for the proposed action. The draft EA was made available for a 30-day public review and comment period on September 12, 2019. DOE considered all comments received before finalizing the EA and making the FONSI determination. A Comment Response section is included as Appendix A in the final EA.

The FONSI and final EA can be accessed on the DOE website at https://www.id.energy.gov/. Thank you for your interest in this important endeavor.

Sincerely,

Robert Boston
Manager

U.S. DEPARTMENT OF ENERGY
FINDING OF NO SIGNIFICANT IMPACT FOR THE ENVIRONMENTAL ASSESSMENT FOR EXPANDING CAPABILITIES AT THE NATIONAL SECURITY TEST RANGE AND THE RADIOLOGICAL RESPONSE TRAINING RANGE AT IDAHO NATIONAL LABORATORY

Agency: U.S. Department of Energy (DOE)

Action: Finding of No Significant Impact (FONSI)

Summary: The U. S. Department of Energy (DOE) proposes expanding capabilities at the National Security Test Range and the Radiological Response Training Range at the Idaho National Laboratory (INL) Site. Expansion activities include installation of permanent structures and utilities, an increase in the frequency of range activities, and an increase in testing capabilities. Permanent infrastructure may include offices, classrooms, and conference rooms, restroom and kitchen facilities. In addition, fixed utility infrastructure providing electricity, roadways, testing pads and fencing are also proposed. The proposed activity includes increasing the testing capabilities at each range allowing for the use of unmanned aerial systems and additional radioisotopes for testing and training purposes.

A no action alternative would not expand infrastructure or training and testing capabilities at the Ranges. The no action alternative would continue current and ongoing testing and training activities at the Ranges as analyzed in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID 2007) and the *Final Idaho National Laboratory Radiological Response Training Range Environmental Assessment and FONSI* (DOE-ID 2010). As such, no physical modifications or changes in operations at the Ranges would take place under the no action alternative.

Analysis: Based on the analyses in the Environmental Assessment (EA), the proposed action will not significantly affect the human environment within the meaning of the National Environmental Policy Act (NEPA).

The term "significantly" and the significance criteria are defined by Council on Environmental Quality Regulations for implementing NEPA at 40 CFR 1508.27. The significance criteria relevant to the proposed action are addressed and the applicable corresponding analyses in the EA are referenced below.

1.) Beneficial and adverse impacts [40 CFR 1508.27 (b) (1)]: Potential impacts to air quality, historical and cultural resources, ecological resources, soils, water quality, and public health and safety were fully analyzed. Analysis also addressed potential impacts related to hazardous materials and waste management, noise and ground vibration, environmental justice, and intentionally destructive acts. The analyses demonstrated that there will be no significant impacts from implementing the proposed action. (section 4)

2.) Public health and safety [40 CFR 1508.27 (b) (2)]: Potential impacts to public and worker health and safety from operations at the respective Ranges were analyzed. DOE takes precautions in the planning and execution of activities to prevent injury to people or damage to property. Testing and training conducted at the Ranges presents certain safety and health concerns due to radiological exposure, fragmentation, air blasts, ground shock, and projectiles. Project controls to maintain radiological exposures As Low As Reasonably Achievable (ALARA) and to protect people and property (such as following range guidance criteria and implementing safe stand-off distances) minimize health and safety impacts. The propose action is not anticipated to adversely affect worker or public health and safety. (section 4)

3.) Unique characteristics of the geographical area [40 CFR 1508.27 (b) (3)]: The Eastern Snake River Aquifer underlies the ranges at the INL. The potential for impacts to the aquifer from the proposed action during normal operations is minimal. The INL Site has been a federal reservation with restricted public access since the mid-1940s. As a result of this restricted access, unique characteristics include a well-preserved cultural resources record within the boundary of the INL Site and some of the largest remnants of undeveloped, un-grazed sagebrush steppe ecosystems in the Intermountain West. The proposed action maximizes the use of previously disturbed areas, limits habitat fragmentation, and implements operational controls that help DOE preserve the unique characteristics of the INL Site. (section 3/section 4)

4.) Degree to which effects on the quality of the human environment are likely to become highly controversial [40 CFR 1508.27 (b) (4)]: DOE used state-of-the-art scientific methods, technology, and qualified experts to assure the accuracy and quality of the impacts analyses and to provide confidence in the results of this assessment. There are no substantive technical or scientific issues related to the proposed action that are not understood, quantified, and validated. Since the impacts to the quality of the human environment were determined to be minimal.

5.) Uncertain or unknown risks on the human environment [40 CFR 1508.27 (b) (5)]: The risks associated with the proposed action are well-defined. Testing and training at the Ranges is an extension of what has been occurring for the past decade. All resource areas were screened and carefully analyzed before critical areas were identified for detailed analysis in the EA. All analyses used accepted methodologies and input values and were based on conservative assumptions to ensure the results adequately bounded the potential impacts to human health and the environment.

6.) Precedent for future actions [40 CFR 1508.27 (b) (6)]: The proposed action does not set a precedent for future action that may have significant effects, or represent a decision in principle about a future consideration on the INL Site.

7.) Cumulatively significant impacts [40 CFR 1508.27 (b) (7)]: The calculated impacts to the critical resource areas from implementing the proposed action were individually insignificant. The additive impacts from implementing the proposed action to those manifested from past, ongoing or reasonably foreseeable future projects or programs on and adjacent to the INL were evaluated and also determined to be insignificant. (section 4.1.11)

8.) Effect on cultural or historic resources [40 CFR 1508.27 (b) (8)]: Based on results of pedestrian surveys and subsurface evaluations, the cultural resources identified in the proposed project area are either recommended as ineligible into the National Register of Historic Places or are outside the area potentially affected by proposed project activities. As such, DOE recommended that the proposed action will have no effect on historic properties. DOE completed Section 106 consultation with the Shoshone-Bannock Tribes and the Idaho State Historic Preservation Office (SHPO). SHPO concurred with the recommendation that the proposed action will have no effect on historic properties.

9.) Effect on threatened or endangered species or critical habitat [40 CFR 1508.27 (b)(9)]: The analysis indicates no threatened or endangered species or critical habitat will be adversely impacted by the proposed action. INL is comprised in part by areas of pristine and protected sagebrush steppe ecosystem that provides significant habitat for large numbers of native plant and wildlife species. Implementing the proposed action with identified controls will not result in any significant impacts to these species or resources.

10.) Violation of Federal, State or local law [40 CFR 1508.27 (b) (10)]: The analysis indicates implementing the proposed action will not violate federal, state, or local laws.

Determination: Based upon the analysis presented in the attached EA, I have determined that the proposed action would not significantly affect the quality of the human environment. Therefore preparation of an environmental impact statement is not required.

Issued at Idaho Falls, Idaho on this 10th day of December, 2019

Robert Boston
Manager

Copies of the EA and FONSI are available from: Tim Jackson, Office of Communications, Idaho Operations Office, U.S. Department of Energy, 1955 Fremont Avenue, Idaho Falls, ID 83415, or by calling 208-526-8484.

For further information on the NEPA process contact: Jason Sturm, NEPA Compliance Officer, U.S. Department of Energy, 1955 Fremont Avenue, Idaho Falls, ID 83415, or by calling 208-526-2493.

DOE/EA-2063

U.S. Department of Energy
Idaho Operations Office

Final Environmental Assessment for Expanding Capabilities at the National Security Test Range and the Radiological Response Training Range at Idaho National Laboratory

November 2019

Idaho National Laboratory

DOE/EA-2063

Final Environmental Assessment for Expanding Capabilities at the National Security Test Range and the Radiological Response Training Range at Idaho National Laboratory

November 2019

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

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FIGURES

TABLES

ACRONYMS

ALARA	as low as reasonably achievable
AN	ammonium nitrate
APE	area of potential effect
BCG	Biota Concentration Guide
CCA	Candidate Conservation Agreement
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFA	Central Facilities Area
CFR	Code of Federal Regulations
CITRC	Critical Infrastructure Test Range Complex
DGBE	diethylene glycol monobutyl ether
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
EA	environmental assessment
ED	effective dose
EPA	Environmental Protection Agency
ESER	Environmental Surveillance, Education, and Research
FONSI	finding of no significant impact
GAO	Government Accountability Office
HMX	high-melting explosive
INL	Idaho National Laboratory
MCL	maximum contaminant level
MEI	maximally exposed individual
MFC	Materials and Fuels Complex
NEPA	National Environmental Policy Act
NERP	National Environmental Research Park
NESHAP	National Emission Standards for Hazardous Air Pollutants
NEW	net explosives weight
NHPA	National Historic Preservation Act
NRHP	National Register of Historic Places
NSTR	National Security Test Range
NTR	north training range
PETN	pentaerthritol tetranitrate

PGTB	Power Grid Test Bed
PRGs	preliminary remediation goals
RCRA	Resource Conservation and Recovery Act
RDD	radiological dispersion device
RDX	research department explosive
ROD	Record of Decision
RRTR	Radiological Response Training Range
RWMC	Radioactive Waste Management Complex
SGCA	Sage-Grouse Conservation Area
SHPO	State Historic Preservation Office
SMC	Specific Manufacturing Capability
SRPA	Snake River Plain Aquifer
STP	sewage treatment plant
STR	south training range
TNT	trinitrotoluene
TREAT	Transient Reactor Test Facility
UAV	unmanned aerial vehicle
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound

HELPFUL INFORMATION FOR THE READER

Scientific Notation

Scientific notation expresses numbers that are very small or very large. Negative exponents, such as 1.3×10^{-6}, express very small numbers. To convert the number to decimal notation, move the decimal point to the left by the number of places equal to the exponent, in this case 6. The number thus becomes 0.0000013. For large numbers, those with a positive exponent, move the decimal point to the right by the number of places equal to the exponent (e.g., the number 1.3×10^{6} becomes 1,300,000).

Units

The document uses English units with conversion to metric units given below. Occasionally, metric units are used if metric is the common usage (i.e., when discussing waste volumes or when commonly used in formulas or equations).

ft	foot	Gy	Gray
in.	inch	mrem	millirem
km	kilometer	ppm	parts per million
lb	pound	Rem	Roentgen-equivalent-man
m	meter	yd	yard
		yr	year

Conversions

English to Metric			Metric to English		
To Convert	Multiply By	To Obtain	To Convert	Multiply By	To Obtain
ft	3.048×10^{-1}	m	m	3.28084	ft
gallons	3.785	liters	grams	2.204×10^{3}	lb
lb	4.536×10^{-2}	grams	liters	2.641×10^{-1}	gallons
mi	1.609334	km	km	6.214×10^{-1}	mi
square mi	2.590	square km	square km	3.861×10^{-1}	square mi
yd	9.144×10^{-1}	m	m	1.093613	yd

Glossary

Area of Potential Effects: the geographic area, or areas, within which an undertaking or project may directly or indirectly cause changes in the character or use of historic properties or historical resources, should any such resources be present.

Attainment Area: An area considered to have air quality as good as or better than the National Ambient Air Quality Standards as defined in the Clean Air Act. An area may be an attainment area for one pollutant and a non-attainment area for others.

Basalt: A hard, dense, dark volcanic rock composed chiefly of plagioclase, pyroxene, and olivine, and often having a glassy appearance.

Clean Air Act: The Federal Clean Air Act is the basis for the national air pollution control. Basic elements of the act include national ambient air quality standards for major air pollutants, hazardous air pollutants, state attainment plans, motor vehicle emission standards, stationary source emission standards and permits, acid rain control measures, stratospheric ozone protection, and enforcement provisions.

Clean Water Act: The Clean Water Act is the primary federal law in the United States governing water pollution. The Clean Water Act established the goals of eliminating releases to water of high amounts of toxic substances, eliminating additional water pollution by 1985, and ensuring that surface waters meet standards necessary for human sports and recreation by 1983.

Curie: A unit of radioactivity equal to 3.7×10^{10} disintegrations per second.

Effective Dose: The sum of the products of the dose equivalent received by specified tissues of the body and a tissue-specific weighting factor. This sum is a risk-equivalent value used to estimate the health effects risk of the exposed individual. The tissue-specific weighting factor represents the fraction of the total health risk resulting from uniform whole-body irradiation contributed by that tissue. The effective dose includes the committed effective dose from internal deposition of radionuclides and the effective dose equivalent due to penetrating radiation from sources external to the body. The effective dose is expressed in units of rem or mrem**.**

Historic Properties: Cultural and historic resources that are eligible or potentially eligible for nomination to the National Register of Historic Places.

Maximum Contaminant Level: Standards set by the United States Environmental Protection Agency for drinking water quality. A maximum contaminant level is the legal threshold limit on the amount of a substance allowed in public water systems under the Safe Drinking Water Act.

National Ambient Air Quality Standards: Standards established by the U.S. Environmental Protection Agency under authority of the Clean Air Act that apply for outdoor air throughout the country. Primary standards protect human health, including that of sensitive populations (e.g., children, the elderly, and individuals suffering from respiratory disease), with an adequate margin of safety. Secondary standards protect public welfare from any known or anticipated adverse effects of a pollutant.

National Environmental Research Park: The Idaho National Laboratory Site is a National Environmental Research Park. National Environmental Research Parks are outdoor laboratories that impart opportunities for environmental studies on protected lands that act as buffers around U.S. Department of Energy facilities. U.S. Department of Energy uses these research parks to evaluate the environmental consequences of energy use and development, and strategies to mitigate these effects and demonstrate possible environmental and land-use options. Regional U.S. Department of Energy Operations Offices manage the seven National Environmental Research Parks while the Office of Science coordinates and guides them.

National Emission Standards for Hazardous Air Pollutants for Radionuclides: The Clean Air Act requires the Environmental Protection Agency to regulate airborne emissions of hazardous air pollutants (including radionuclides) from a list of industrial sources called "source categories." Each source category that emits radionuclides in significant quantities must meet technology requirements to control them and is required to meet specific regulatory limits. These standards are the National Emission Standards for Hazardous Air Pollutants for Radionuclides.

Preliminary Remediation Goals: Concentrations that correspond to certain levels of risk in air, soil, water, and biota for a given radionuclide or chemical. Preliminary remediation goals are screening level concentrations that would not likely result in adverse health impacts under reasonable maximum exposure conditions for long-term/chronic exposures.

Radioactive Materials: For the purpose of this document, radioactive materials include (1) sealed sources; (2) special form sealed sources; (3) contained (or unsealed) sources; and (4) dispersible material. Project personnel use these materials to produce radiation fields for detection and training during exercises.

Sagebrush Obligate: Species restricted to sagebrush habitats whether during the breeding season or year-round.

Sealed Radioactive Sources: These sources are small metal containers in which a specific amount of a radioactive material is sealed. Manufacturers of these devices must demonstrate protectiveness of human health and the environment to receive a license to manufacture and sell them.

Tiering: Section 1508.28 of the Council on Environmental Quality regulations defines tiering as "the coverage of general matters in broader environmental impact statements (such as national program or policy statements) with subsequent narrower statements or environmental analyses (such as regional or basin-wide program statements or ultimately site-specific statements) incorporating by reference the general discussions and concentrating solely on the issues specific to the statement subsequently prepared." It also notes that tiering "is appropriate when it helps the lead agency to focus on the issues which are ripe for decision and exclude from consideration issues already decided or not yet ripe."

Vadose Zone: The region of aeration above the water table, which extends from the top of the ground surface to the water table.

Environmental Assessment for Expanding Capabilities at the National Security Test Range and the Radiological Response Training Range at Idaho National Laboratory

1. INTRODUCTION

The National Environmental Policy Act of 1969 (NEPA) (42 USC § 4321 et. seq., 1970) requires federal agencies to consider the environmental consequences of proposed actions before decisions are made. To comply with NEPA, the U.S. Department of Energy (DOE) follows the Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500-1508) and DOE's NEPA implementing procedures (10 CFR Part 1021, 2011). The purpose of an environmental assessment (EA) is to give federal decision makers evidence and analysis for determining whether to prepare an environmental impact statement or issue a finding of no significant impact (FONSI).

DOE manages the National Security Test Range (NSTR) on the Idaho National Laboratory (INL) Site. NSTR was designed and constructed to accommodate testing activities that analyze the effects of explosives and explosive devices, munitions, and similar items on security systems, facilities, vehicles, structures, and other materials. DOE evaluated the environment impacts from establishing and operating NSTR in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID 2007). The selected alternative (Alternative 1) consolidated INL security system testing activities at a central location about 1.5 miles west of Road T-25, 7.1 miles north of the Materials and Fuels Complex (MFC), and 10 miles south of Test Area North. The alternative also included constructing a 900-ft diameter test bed, earthen berm, a concrete test pad, new access road, and laydown and administrative areas. Equipment for monitoring and evaluating testing activities (such as buried data acquisition cables, protective camera boxes, and other such devices) was also installed.

Current activities at NSTR include explosives breaching and testing, non-nuclear weapons testing, vehicle-borne improvised explosive device research, barrier testing, delay analysis for vulnerability assessments, and ballistic testing. Testing includes using explosives and explosive-driven devices and firing explosive and non-explosive projectiles. Typical test assemblies include concrete blocks and walls, electronic sensors, metals, sandbags, and wood. NSTR encompasses about 12 acres at the INL Site. The location was selected because it is separated from any surrounding population or facilities that could be affected by blast or sound and access to the area can be effectively controlled.

DOE established the Radiological Response Test Range (RRTR) to develop and maintain an effective response capability for major radiological incidents. The *Final Idaho National Laboratory Radiological Response Training Range Environmental Assessment and FONSI* (DOE-ID, 2010) evaluated the environmental effects of establishing and operating RRTR. DOE implemented Alternative 1a and uses RRTR to train personnel, test sensors, and develop detection capabilities (both aerial and ground based) under a variety of scenarios in which radioactive materials are used to create a radioactive field for training in activities such as contamination control, site characterization, and field sample collection methods.

Typical training exercises at RRTR currently involve up to 75 people and 15 vehicles. Some exercises involve placing sealed radioactive sources, special form-sealed radioactive sources, and contained (or unsealed) radioactive sources in approved areas. Other exercises disperse radioactive materials (KBr) in a liquid sprayed on the ground, spread dry, or in the air through aerosol or small explosive dispersal. Trainees use specialized equipment to characterize the radiation fields or areas, obtain radiation readings, train with disablement tools, and collect samples in the test area. RRTR includes two training locations at the INL Site: (1) the North Training Range (NTR), including the Technical Support Facility, and (2) the South Training Range (STR). Figure 1 depicts the general location of the proposed action on the INL Site.

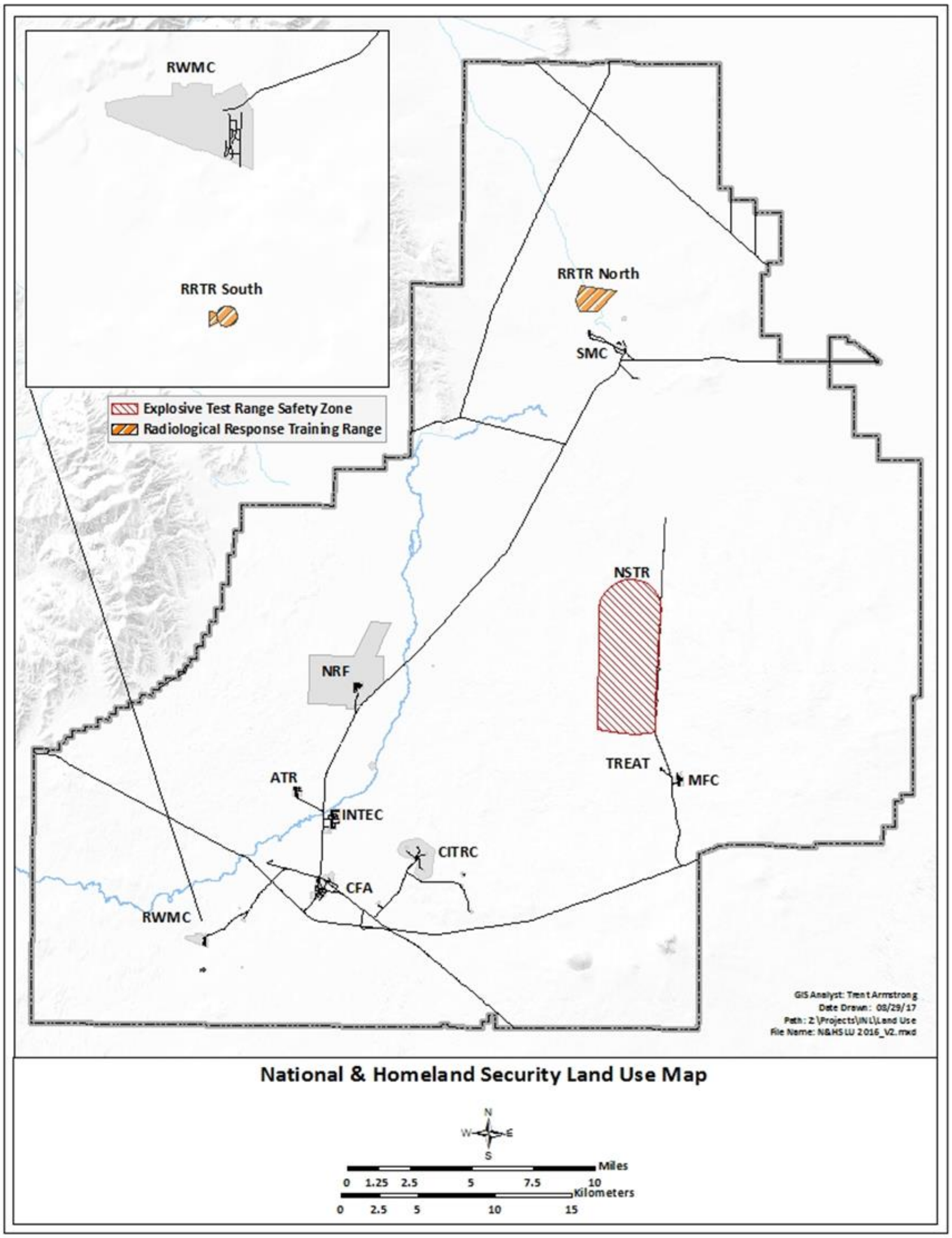

Figure 1. Locations of NSTR and RRTR at the INL Site.

Federal agencies, industry, and academic institutions use NSTR and RRTR (hereafter referred to as the Ranges) to research, develop, demonstrate, and deploy next generation technologies focused on enabling defense, intelligence, and public safety organizations to confront changing threats to military personnel, national and homeland security, and first responders. The Ranges support developing and deploying methods and training to enhance national security by offering capabilities for military, law enforcement, industry, and other partners to develop, test, deploy, and train end users in new technologies and systems.

Testing and training at the Ranges involves defining research questions and test objectives, developing test articles, setting up and calibrating test instruments, performing tests, analyzing results, and using the results to develop future test objectives. Operations require a systematic review of individual test activities. Both Ranges lack support infrastructure. Portable generators supply electricity and a modular classroom serves as a training facility. NSTR erected a tension fabric structure to store materials and offer shelter, but neither range has utility connections. The Ranges use portable sanitary facilities and bottled drinking water.

In this EA, DOE evaluates the following activities aimed at offering new and relevant capabilities to confront changing threats to military personnel, national and homeland security, and first responders:

1. Implementing operational changes such as increasing the frequency of using explosives at NSTR, expanding unmanned aerial vehicle (UAV) operations at both Ranges, using new radiological materials for response training at RRTR, and performing radiological response training at NSTR.
2. Increasing the size of training exercises up to about 200 people and numerous vehicles at the Ranges.
3. Constructing a new explosives test pad and access road, ballistic tunnel, and a downrange target area at NSTR.
4. Constructing an access road to NSTR around the Transient Reactor Test Facility (TREAT) exclusion area and a new power line from MFC to NSTR.
5. Fencing about 184 acres at RRTR's north and south training ranges.
6. Using various methods to spread radioactive materials for training exercises at NSTR and RRTR.
7. Constructing infrastructure (such as permanent buildings, water production and storage facilities, sanitary systems, an electrical substation and distribution system, and data collection and transmission equipment) at NSTR.

The goal of NEPA and this EA is to enable DOE decision-making based on an understanding of environmental consequences. This EA supplies DOE environmental information to (1) evaluate impacts to human health and the environment and (2) develop project controls to minimize or avoid adverse effects to human environmental integrity and natural ecosystems if DOE decides to expand infrastructure and testing and training capabilities at the Ranges (see Figure 2).

Figure 2. NSTR and RRTR.

1.1 Purpose and Need for Action

The isolated nature of the INL Site, its test bed infrastructure, and its applied-science focus make it a major center for national security technology development and demonstration. National and Homeland Security programs at the INL Site protect nuclear material from proliferation, advance the nation's military personnel, address secure communications channels for first responders, and improve the security and resilience of critical infrastructure.

The United States faces a complex array of threats to national security, including political, economic, military, and social systems. These threats continue to evolve as new and resurgent adversaries develop politically and militarily, as weapons and technology advance, and as environmental and demographic changes occur. In a 2018 report to congressional committees, the U.S. Government Accountability Office (GAO) analyzed more than 210 individual threats identified by organizations across the Department of Defense, State Department, Department of Homeland Security, the Office of the Director of National Intelligence; reviewed national security strategies and related documents; and interviewed key agency officials to identify specific threats and develop broad threat categories (GAO, 2018). The following list includes several evolving threats identified in the GAO report:

- Terrorism: Violent ideologies could influence additional individuals to turn to terrorism to achieve their goals across Africa, Asia, and the Middle East. Terrorists could advance their tactics, including building nuclear, biological, or chemical weapons.
- Emerging Technologies: Actors may gain access to emerging technologies (such as additive manufacturing [i.e., three-dimensional printing]) that may be used to manufacture restricted materials, such as weapons.
- Weapons of Mass Destruction: An increasing number of actors may gain access to these weapons. Adversaries could steal nuclear materials from existing facilities to develop weapons.

As new and evolving threats emerge and the nature of warfare changes, the United States and its allies need to develop responses faster than their adversaries; prevent adversaries from acquiring, proliferating, or using weapons of mass destruction; maximize the competitive advantage of the United States and its partners, while constraining the ability of adversaries to achieve their military objectives; and reduce the vulnerability of the United States to terrorism. The Ranges support a wide variety of full-scale and practical research, testing, and training opportunities to address these needs and understand and mitigate emerging challenges with capabilities for emergency or law enforcement response, in-theater conflicts, counterterrorism, and to prevent the proliferation of weapons of mass destruction.

As new and evolving threats are identified, the Ranges need to maintain relevant capabilities for developing solutions to rapidly changing national security and defense threats by (1) enabling research, development, demonstration, and deployment of technologies that provide the United States with a strategic advantage over potential adversaries and (2) supporting defense, intelligence, and public safety organizations in confronting changing threats to military personnel, national and homeland security, and first responders. The purpose of the proposed action is to expand Range capabilities to address new and emerging threats to national security and continue to provide federal agencies, industry, and academia partners with relevant test range assets for conducting national security research, development, demonstration, and deployment.

2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

The CEQ regulations 40 CFR 1508.9(b) (2011) require that an EA include a brief discussion of alternatives to a proposed action. This section describes the proposed action and the no action alternative.

The DOE Idaho Operations Office (DOE-ID) considered action alternatives for meeting the need to offer new and relevant capabilities for confronting changing threats to national security. For the action alternatives to be feasible, they must accomplish the following:

- Enable flexible research and development efforts adaptable to evolving changes
- Enable increased testing and training frequency
- Develop new capabilities to collect and assess the origin of material in response to radiological incidents
- Develop new research and development capabilities for explosives and radiological testing and training
- Limit transporting explosive materials
- Maintain expertise in operations at a single existing, isolated government facility.

2.1 Proposed Action – Expand Capabilities at NSTR and RRTR

The proposed action expands capabilities at the Ranges by offering new infrastructure and implementing operational changes that enable ongoing DOE research and development of new technologies needed by military personnel, national and homeland security, and emergency responders. The proposed action constructs a new explosives test pad and access road, ballistic tunnel, support facilities, and a downrange target area at NSTR; constructs a new access road to NSTR around the TREAT exclusion area; installs a new power line from MFC to NSTR; fences about 184 acres at RRTR's NTR and STR; and authorizes various methods to spread multiple radioactive materials during testing and training exercises at the Ranges. These activities have the potential to impact about 460 acres on the INL Site.

Proposed construction activities and operational changes are summarized in Sections 2.1.1 and 2.1.2, respectively.

2.1.1 Construction Activities

Construction activities require clearing vegetation, grading to level work areas, hauling and placing fill material in cleared areas, establishing a new explosives test pad and a downrange target area, building roads, and installing fences. Equipment and vehicle types include pickup trucks, graders and dozers, bucket trucks, rubber-tired or track-mounted augers, cranes, off highway vehicles, and tractor trailers.

DOE requires vehicles used at the Ranges to be equipped with accessible fire tools (e.g., shovels or fire extinguishers). During operations and maintenance, DOE requires vegetation be mowed and maintained near infrastructure vulnerable to wildland fire. The INL Site's defensible space requirements apply to construction and operations and are as follows:

1. Maintain a 30 to 50-ft defensible area around all buildings, structures, and major support equipment
2. Maintain a 30-ft defensible area around parking lots, storage pads, designated buildings, designated perimeters, designated propane and fuel tanks, substations, and along-the-rail system within the INL Site.

Project controls also require revegetating disturbed areas and controlling weeds and invasive species. In addition, the proposed action curtails range operations involving tracer rounds or other fire hazards from May 1st to the end of the fire season unless authorized by the INL Site Fire Marshal.

2.1.1.1 Construction at NSTR. The proposed action constructs the following new infrastructure at NSTR:

- Access road around the TREAT exclusion area
- Ballistic tunnel
- Downrange target area
- 900-ft diameter explosives test pad with command center and access road
- Power line from MFC to NSTR
- 500-ft radiological testing pad
- Support structures
- Utilities.

Initial TREAT operations established an 833-yard radius exclusion zone during reactor operations; the exclusion zone included part of the T-25 road from MFC to NSTR; this section of the road, and subsequently NSTR, would have been inaccessible during TREAT operations. Current TREAT operations require a smaller exclusion zone that does not include the T-25 road, but future operations could increase the exclusion zone to again include this segment of the T-25 road.

The proposed action upgrades about 1 mile of a two-track road from MFC to the T-25 road outside the original TREAT exclusion zone from a Priority 3 road (maintained as passable, but grading not permitted) to a Priority 2 road (maintained as passable and occasionally graveled and spot graded) to allow uninterrupted access to NSTR in case the TREAT exclusion zone is increased. Assuming a road width of 14 ft, 1 mile of new road disturbs about 2 acres.

There are two laydown areas at NSTR. The proposed action constructs an enclosed ballistic tunnel, about 13 ft × 197 ft in size, at the second laydown area for testing projectiles up to 30 mm (1.18 in.) in size. The specific location of the ballistic tunnel at the second laydown area has not been determined, but it will be within the current disturbed area. The ballistic tunnel includes an earthen berm at the end of the tunnel to collect the fired projectiles.

The proposed action also constructs a down range target area measuring about 3,300 yd × 66 yd with targets located at 100, 200, 300, 400, 500, 750, 1,000, 1,610, 2,260, 2,760, and 3,300 yd from the firing point. The downrange target area includes the following features:

- A 500-ft diameter radiological training pad at the southernmost target
- An 80 ft × 80 ft storage area between the 2,760 and 3,300-yd target areas to support radiological response training activities at the radiological training pad
- A Priority 2 gravel road constructed from the observation point through each target area
- A 150 ft × 150 ft command area at the 2,760-yd target area
- Berms and barriers, concrete pads, rail tracks, Conex containers, and other equipment within the disturbed area at each target area as needed
- Vegetation removed from the first 300 yd downrange.

Constructing the downrange target area and the 500-ft diameter radiological training pad disturbs about 50 acres. Other components of the target area (i.e., storage area, road, and command area) fit within the 66-yd width of the downrange target area. The proposed action also establishes an area around the downrange target area, which covers about 863 acres, known as the downrange area. Projectiles fired at the downrange target area have a 1:10,000 probability of impacting outside the downrange area. Section 4 2.1.2.1 describes the decision process to verify projectiles impact within the down range area.

The proposed 900-ft diameter explosives test pad to the north and east of the current explosives test pad requires a new Priority 2 access road from the observation point to the new test pad (estimated to be about 1 mile long), and the proposed action establishes a graveled 150 ft × 150 ft command area along the new access road about 400 yd south of the new explosives test pad and a temporary static firing point on the new access road to allow firing long-range ammunition at the downrange target area. The new explosives test pad, access road, command area, and firing point have the potential to disturb about 16 acres at NSTR.

To meet explosives safety and range safety criteria for the new explosives test pad, the NSTR administrative boundary needs to be moved north (about 450 yd) and west. Moving the boundary involves surveying the area to avoid cultural resources during sign placement then driving the perimeter and placing warning signs in the ground to mark the border. Routine maintenance of the boundary signs will result in a primitive, unmaintained perimeter road. The administrative boundary perimeter is about 90,660 ft in length and about 28,640 ft of the perimeter parallel to the T-25 road. Assuming a vehicle width of 14 ft and driving the 62,026 ft of perimeter not accessible from the T-25 road, boundary marking potentially disturbs 20 acres.

The proposed action authorizes construction of new support facilities (e.g., trailer units and permanent facilities [less than 15,000 ft^2 total per facility]) to house offices, classrooms, conference rooms, kitchens, restrooms and locker rooms, laboratories, machine shops, and high bays. DOE anticipates construction taking place over several years, as range activity increases, and funding becomes available. The proposed action expands laydown areas by about 12 acres (about 55 yd out from the edge of the current disturbed area) and constructs new support facilities in the laydown areas and collocates utility lines (e.g., power, water, and sanitary systems) along roads and other disturbed areas to the extent practicable. Placing new facilities in expanded laydown areas limits the size and quantity of new facilities. New support facilities include permanent foundation-based buildings and portable and mobile trailer-based units. A water well, storage tanks, and well houses would also be installed at one or both current laydown locations. Wastewater would be discharged to a septic system in one or both laydown areas.

New water wells, well houses, and storage tanks supply a non-transient, non-community potable water system for drinking water, fire suppression systems, and sanitary facilities. Sanitary systems (e.g., septic systems) manage wastewater associated with new infrastructure. New support facilities are limited to the expanded laydown areas. Figure 3 shows the laydown areas and areas surveyed for proposed expansion.

The MFC substation supplies electrical power to new infrastructure at NSTR via a new 13.8-kilovolt (kV) line. The proposed 13.8-kV power line runs about 7 miles parallel to the existing 138-kV line that runs from the MFC substation to NSTR with an off-set between the power lines of about 50 ft. Prior to construction, crews stake and flag the power line corridor (measuring about 100 ft out from each side of center) and mark each structure location. The T-25 road gives access to most new pole locations. Power line construction requires driving from pole to pole to install the new poles and lines. In areas where accessing new pole locations cannot be accomplished by driving a straight line from the previous location, crews access the next location by returning to the T-25 road.

Off-road vehicle access along the 7-mile route disturbs about 170 acres of land (200 ft wide or 100 ft each side of center line) on the INL Site (7 miles = 36,960 ft x 200 ft wide = 7,392,000 ft^2 = 169.7 acres). Because the route follows the established 138-kV power line with about 50-ft offset, an area about 200 ft around each pole will be permanently disturbed for pole installation and future maintenance. The remaining area between poles is considered temporary disturbance and will be revegetated.

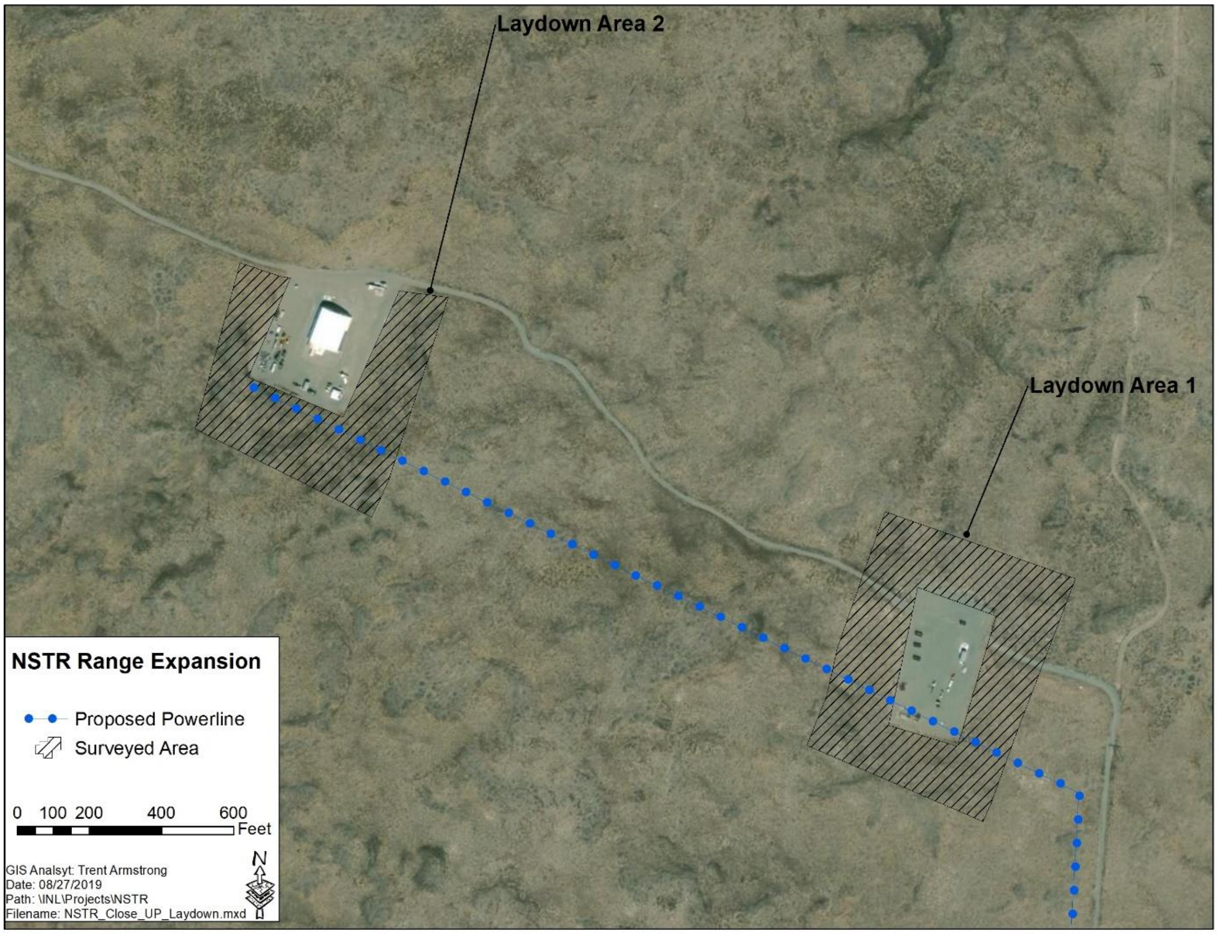

Figure 3. NSTR laydown areas and areas surveyed for proposed expansion.

Installing the power line requires about two to three distinct pull and reel sites to aid stringing the conductor. Power line construction generally requires pull and tension sites every 1 to 4 miles. The size of a pull and tension site varies, but 800 ft by 100 ft is typical. The proposed action locates pull and tension and reel sites within already disturbed areas when possible. However, pulling and reeling stations have the potential to disturb about 6 acres if all are in undisturbed areas.

Figure 4 depicts the combined construction modifications at NSTR included in the proposed action.

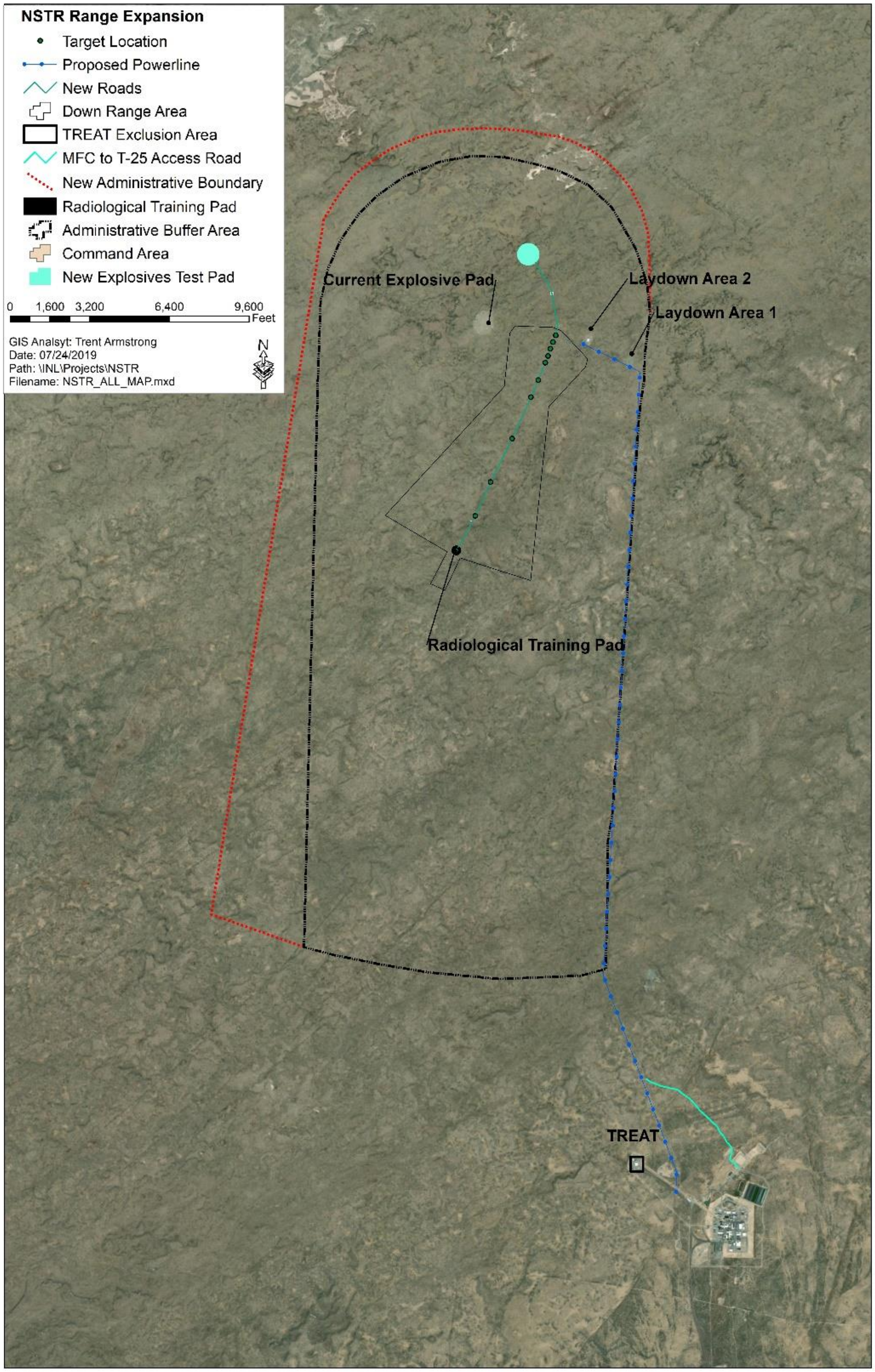

Figure 4. Proposed changes to NSTR in the proposed action.

2.1.1.2 Construction at RRTR. The proposed action modifies the RRTR ranges to support proposed operational changes. RRTR utilizes two locations for radiological response training: (1) NTR, located in the area around the T-28 gravel pit north of the Specific Manufacturing Capability (SMC), and (2) STR south of the Radioactive Waste Management Complex (RWMC). Figure 5 shows the current configuration of the two RRTR locations.

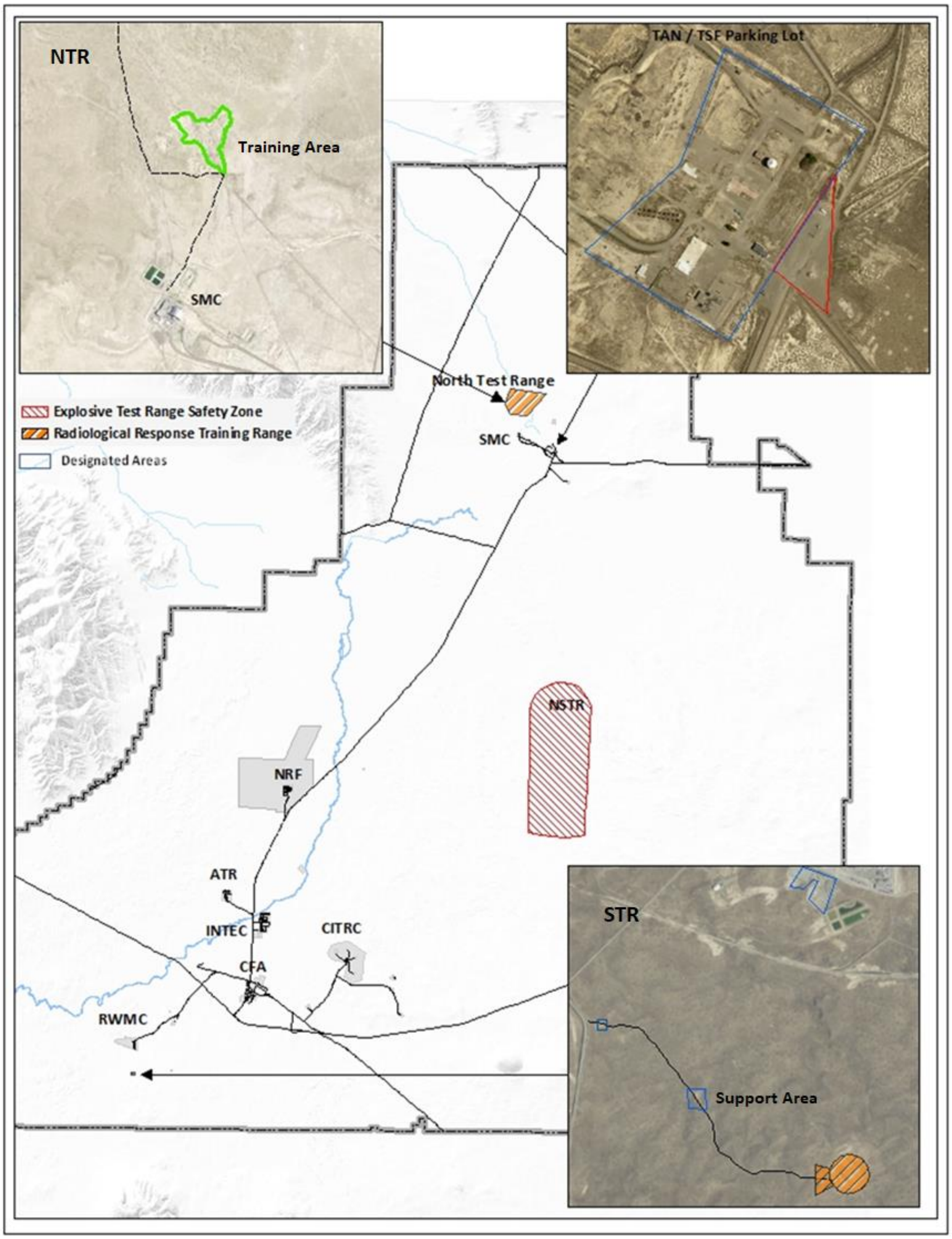

Figure 5. RRTR range configurations.

The proposed action installs a 6 to 8-ft tall chain link fence around the RRTR NTR and STR to control access to training areas. The fence encloses about 184 acres (i.e., about 92 acres at each RRTR range). At NTR, the proposed fence matches the current southern boundary fence and a portion of the new fence road on the west side will connect the T-53 road with the T-28 road to allow access around NTR when access restrictions are necessary. While not all the fenced area will be disturbed, it is counted as such because the area no longer functions as habitat. Figures 6 and 7 show the approximate locations for the proposed fences at NTR and STR.

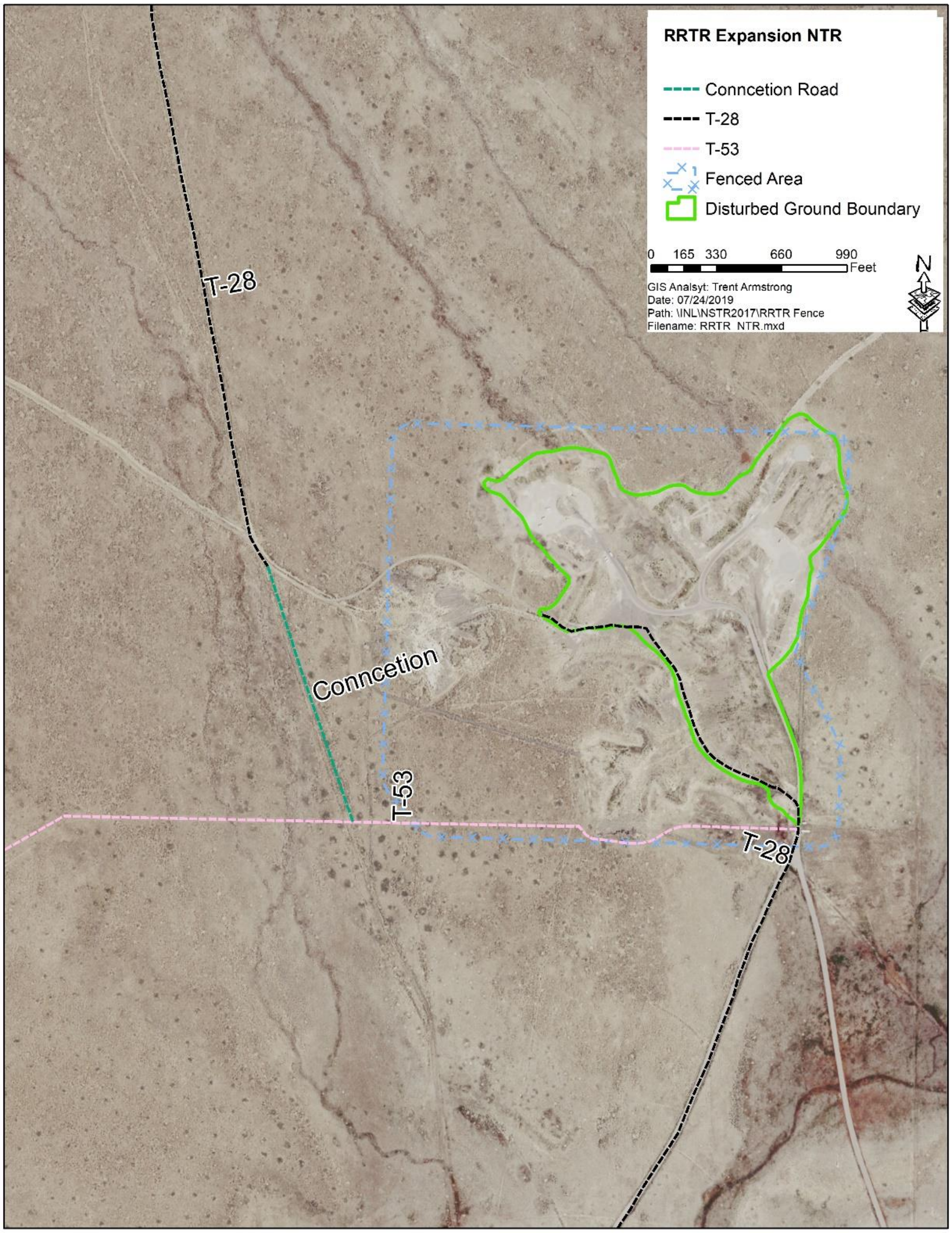

Figure 6. Proposed locations of the NTR fence.

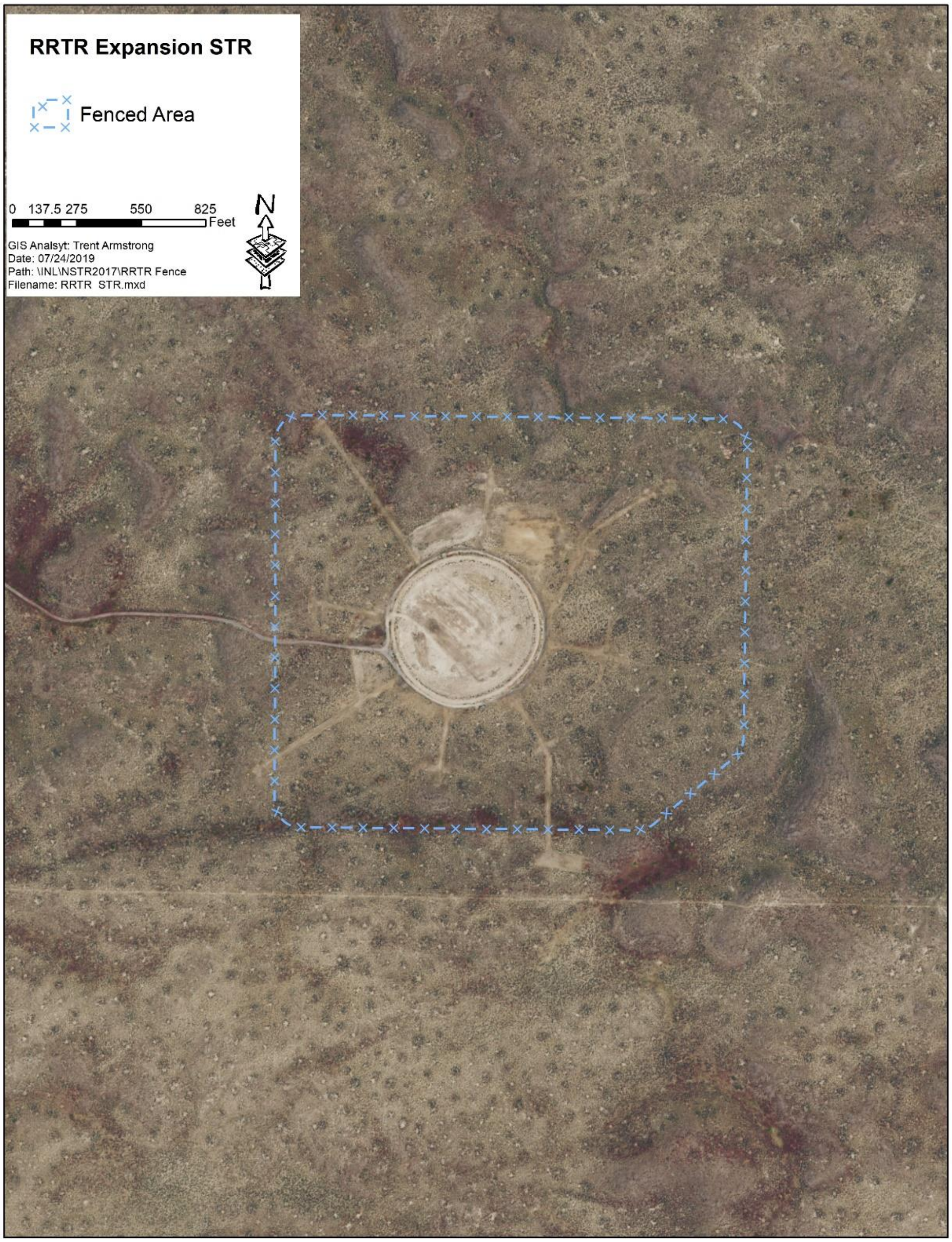

Figure 7. Proposed locations of the STR fence.

2.1.1.3 Construction Cleanup. The proposed action restores temporarily disturbed areas (i.e., not used for proposed operations and infrastructure maintenance) to near preconstruction conditions following construction. Restoration includes grading and restoring sites to original contours and active revegetation using native seed. In addition, the project removes construction materials and debris and recycles or disposes of the materials as appropriate.

2.1.1.4 Permanent Land Use. The proposed action has the potential to disturb about 460 acres at the INL Site. Table 1 summarizes the acres of potential disturbance from completing proposed construction activities.

Table 1. Summary of potential surface disturbance from construction.

Area of Disturbance	Size (acres)
Access road around TREAT	2
Administrative boundary signs installation and maintenance	20
Ballistic tunnel[a]	NA
Downrange target area	45
New 900-ft diameter explosives test pad and access road	16
Power line installation and maintenance	170
500-ft diameter radiological training pad	5
Support facilities and utilities[a]	12
RRTR fences[b]	184
TOTAL	**454**

a. Activity is within previously disturbed areas.
b. Entire area is not disturbed but is no longer considered habitat.

2.1.2 Operational Activities

The proposed action implements radiological and non-radiological operational changes at the Ranges. The proposed action authorizes radiological response training and testing at NSTR and using additional radiological materials not currently authorized for use at RRTR during radiological response training and testing at both NSTR and RRTR. Operational changes also include increasing the frequency of explosives use at NSTR and expanded UAV operations at both Ranges (including using UAVs to detect radiation and chemicals but not for dispersing radionuclides).

Training exercises increase the number of participants from about 75 up to about 200 people and numerous vehicles at the Ranges. Operations include defining research questions and test objectives, developing test articles, setting up and calibrating test instruments, performing tests, analyzing results, and using the results to develop future test objectives. Operations require a systematic review of individual test activities. Testing and training include using explosives and explosive-driven devices, firing explosive and non-explosive projectiles, and using radioactive materials. Typical test assemblies include concrete blocks and walls, electronic sensors, metals, sandbags, wood, silica glass, and foam.

During seasons having high wildland fire potential, DOE requires a fire tender be present during activities having the potential to start wildland fires (e.g., driving vehicles off road or performance of certain test activities). In addition, UAVs carrying explosives or flammable materials are controlled to prevent them from leaving test pad locations (e.g., tethered).

2.1.2.1 Non-Radiological Operations. Non-radiological explosives and ballistic testing only takes place at NSTR and is not proposed at the RRTR ranges (NTR and STR). The proposed action uses a variety of non-radiological explosive materials at NSTR (see Table 2). Typical non-radiological test articles include chain link fencing, concrete barriers, electronic sensors (e.g., high-speed video and photography and pressure sensors), vehicles (drained of all fluids and batteries and mercury switches removed), reinforced concrete walls, armor plates, masonry walls, and customer-provided test articles.

Non-radiological testing involves firing non-explosive projectiles into different test media to understand the penetration resistance or projectile testing.

DOE performs explosive operations per DOE-STD-1212-2012, Explosives Safety (DOE, 2012). This technical standard applies to DOE facilities engaged in developing, manufacturing, handling, storing, transporting, processing, or testing explosives, pyrotechnics, and propellants or assemblies containing these materials and to safely managing such operations. Department of the Army Pamphlet 385-63 (Range Safety, 2014) was referenced for operations not discussed in DOE documents. The proposed action uses other Department of Defense documents and processes if appropriate for testing purposes as identified in TEV-3572 (INL, 2018).

Table 2. List of explosives used at NSTR.

Research Department Explosives (RDX)
- Bulk RDX
- Plastic Explosives, Composition C-4, or PE-4
- Demx
- Shaped Charges
- Linear-Shaped Charges
- Flexible Linear-Shaped Charges
- Explosive Cutting Tape
- SX-2 Primasheet 2000 Sheet Explosives
- Plastic-Bonded Explosives

Pentaerythritol Tetranitrate (PETN) Explosives
- Bulk PETN
- Detonation cord
- Sheet Explosives, DetaSheet, SX-1, Metabel, Primasheet
- Boosters, DetaPrime

Trinitrotoluene (TNT) Explosives
- Bulk TNT
- Cast Boosters

Ammonium Nitrate (AN) Explosives
- AN and Fuel Oil
- AN Slurries
- AN Gels

High-Melting Explosives (HMX)
- Bulk HMX

Smokeless Powder

Black Powder Devices
- Bulk Black Powder
- Time Fuse, Safety Fuse
- Diversionary Devices, Flashbangs

Nitroglycerine Explosives

Dynamite
- Straight
- Ammonia

Detonators
- Electric
- Non-Electric
- Exploding Bridge Wire

Binary Mixtures
- Binex 400
- AN-NM
- NM-Al
- AN-Al
- HMX-GAP
- Al-IPN

Mixed Explosives
- Semtex (50% RDX, 50% PETN)
- Composition B, Shaped Charges, ads (40% TNT, 60 % RDX)
- Octal, Shaped Charges, Warheads (TNT 30 %, HMX 70%)
- Pentolite (TNT 50%, PETN 50%)
- Dexs (PETN 10%, AN 35%)
- Baratol, Warheads (TNT 80%, Barium nitrate 20%)
- Explosive D, Warhead

Tetryol (TNT 30%, Tetryl 70%)

DOE limits explosives testing at NSTR to 20,000 lb net explosives weight (NEW). Table 3 compares proposed uses of explosives to current explosives use.

Table 3. Proposed changes to explosives use at NSTR.

Proposed Explosives Operations Changes	Current Explosives Use
No change	Large explosive events (11,000 to 20,000 lb NEW) once every 5 years
Large projectiles (greater than 30 to 120 mm) about 24 times a year	Large projectiles (greater than 30 to 120 mm) three or four times per year
Mid-test range events (3,000 to 11,000 lb NEW) about 5 times per year	Mid-range explosives test events (3,000 to 11,000 lb NEW) once or twice per year
Explosive dispersal of radionuclides[a]	Not addressed
Rocket-propelled grenades and other live warheads (e.g., 40-mm grenades and mortars up to about 30 lb NEW) may be fired about 24 times per year	Not addressed

Proposed Explosives Operations Changes	Current Explosives Use
Deliver explosives and other materials to ground-based targets using controlled UAVs	Not addressed
Small events (100 to 3,000 lb NEW) about 5 to 8 times per month	Small explosive events (100 to 3,000 lb NEW) about once per month
Small-scale projectiles (30 mm or less) about 10 times per month	Small-scale projectiles (30 mm or less) bi-weekly
Very small events (less than 100 lb NEW) daily	Very small events (less than 100 lb NEW) weekly
a. Explosive radiological dispersals use up to 1 lb NEW TNT equivalent at RRTR and 5 lb at NSTR and are discussed in Section 2.1.2.2.	

The proposed action authorizes shooting incendiary, explosive, and non-explosive projectiles at the NSTR downrange target area. The use of weapons systems to destroy or severely damage a specific target is known, in general, as "fires." "Fires" can be broken down into two subcategories: "direct fire," where the weapon system can physically see and aim directly at the target, and "indirect fire," where the weapon system cannot physically see the target and thus aims instead at a specific target location that has been provided to the weapon system. The "aiming method" is the principal difference between these two types of fires, but usually means the target is closer to the weapon system for direct fire than for indirect fire. Once the weapon has been fired, there is no difference between the two methods at the point of impact. The proposed action uses both firing methods.

The targets used for ground-to-ground fires include both stationary and mobile targets.

For air-to-ground scenarios, proposed non-radiological operations use UAVs capable of delivering explosive or flammable material to ground-based targets on disturbed areas. These activities require using methods that prevent UAVs carrying explosive or flammable materials from escaping operator control. UAVs will be tethered when carrying explosives.

Weapons systems use various munitions that are categorized by size and type. Small arms include .50-caliber munitions and smaller. Large arms include munitions larger than .50 caliber.

To maximize the capabilities at NSTR, the proposed action allows firing weapons having a 1:10,000 probability of impact outside the downrange area boundary (see Figure 4). The proposed action includes shooting incendiary, explosive, and non-explosive projectiles at the NSTR downrange target area (3,300 by 66 yd). A review process is required to determine if projectiles greater than 30 mm and less than or equal to 120 mm will remain within the downrange area under all firing conditions.

The review process for firing large projectiles (greater than 30 to 120 mm) at the downrange target area verifies projectiles remain within the downrange area. TEV-3572 (INL, 2018), "Process to Determine if Projectiles, > 30 mm and ≤120 mm, can be Fired at the NSTR Downrange Target Area," details the methodology for reviewing projectile use under various conditions. Firing activities use administrative and engineering controls, as necessary, to meet this requirement. If modeling and analysis shows the projectile impacts areas outside the downrange area, including with use of administrative and engineering controls, firing the projectile is prohibited. Figure 8 portrays the decision process used to evaluate projectile use at NSTR.

After determining a projectile meets criterion for firing at the downrange target area (including range safety requirements, target requirements, and engineering and administrative controls), the proposed action implements an additional decision process after firing each round as shown in Figure 9.

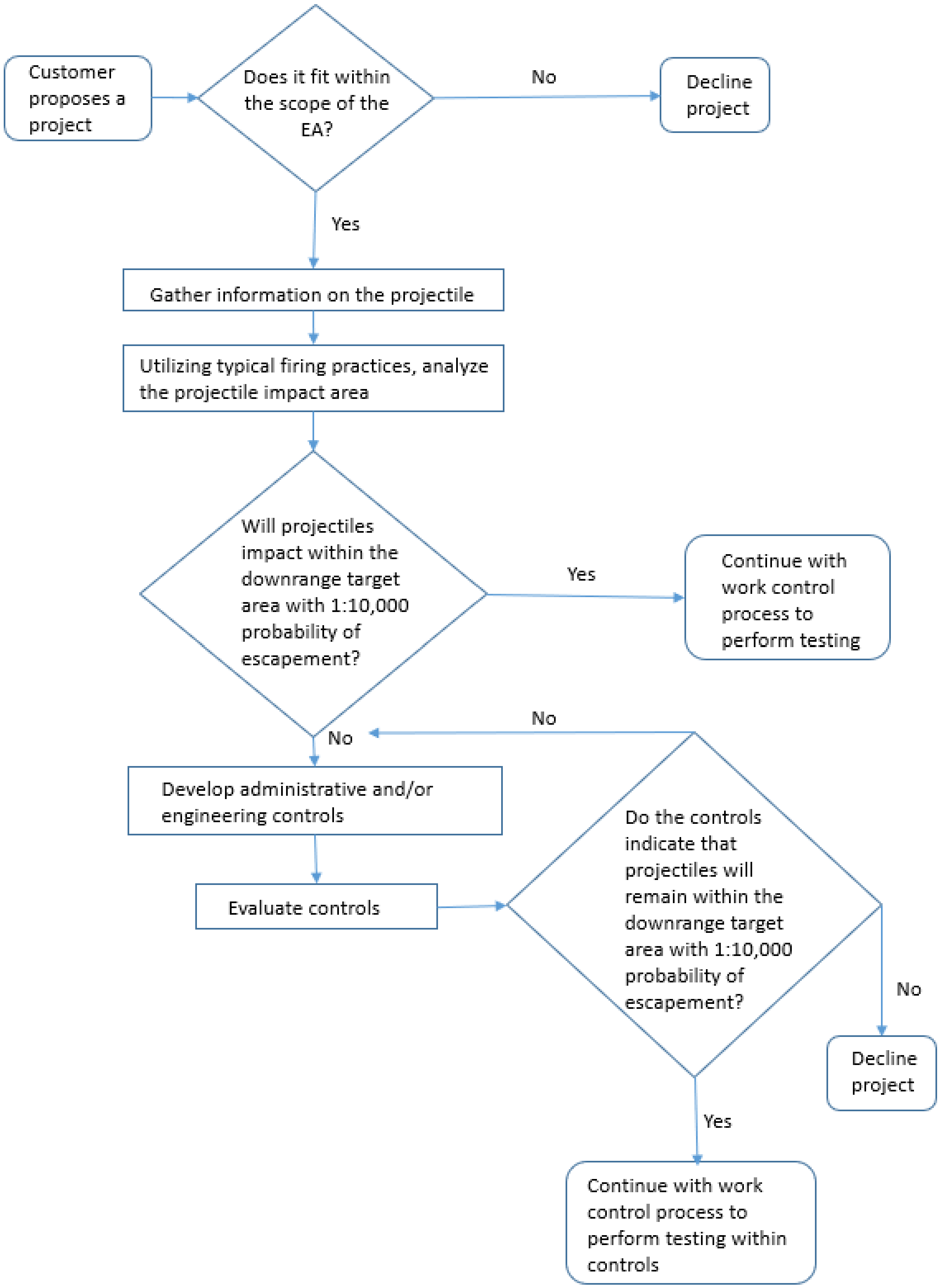

Figure 8. Projectile use decision process.

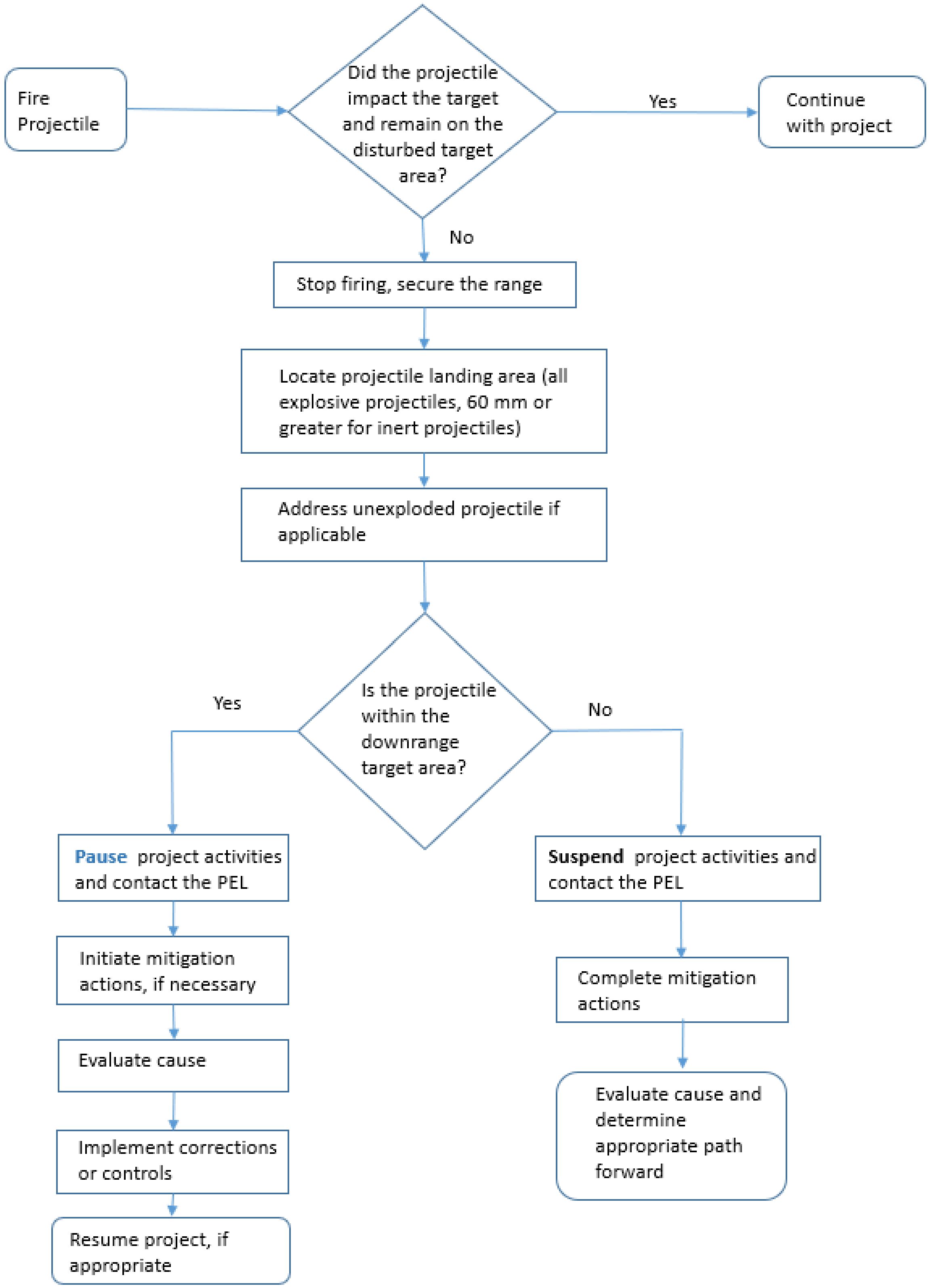

Figure 9. Second process flow for the projectile use decision process.

2.1.2.2 Radiological Training and Testing. Radiological training and testing under various scenarios use (1) dispersed radioactive material, (2) contained (unsealed) radioactive sources, (3) sealed radioactive sources, and (4) special form sealed radioactive sources. Radiological materials are packaged and transported to the training area and placed or dispersed according to approved plans. Testing and training may also include contamination control and decontamination operations, evaluating command and control protocols, collecting samples, and site characterization using vehicles, aerial surveys, and remote radiation measurements. Training equipment includes, but is not limited to, generators, cargo containers, vehicles, and command tents. After each exercise, range personnel remove and store test materials. Training can last several days.

Radiological response training and testing uses the new explosives test pad and the radiological training pad at NSTR (see Figure 4). At both Ranges, proposed radiological response training and testing uses mechanical spreaders or sprayers and limited quantities of explosives to spread radioactive materials on the ground. The proposed action authorizes using multiple radioactive materials (e.g., Cu-64, F-18, K_2O, KBr, $LaBr_3$, and Zr-97) during any single training event. The radioactive KBr, K2O and LaBr3 are produced by irradiating small samples (a few grams) in a low-power, light-water reactor for a period of about 2 hours (Sterbentz, 2019). Explosive radiological dispersals use up to 1 lb NEW TNT equivalent at RRTR and 5 lb at NSTR. The proposed action limits explosive detonations to the disturbed areas of the explosive test pad and radiological training pad at NSTR and to disturbed areas of RRTR. Spreading radioactive materials with mechanical spreaders or sprayers is also limited to these areas. Using explosives to spread radioactive materials releases radionuclide air emissions that can be carried by air currents beyond the boundary of the test pads, the Ranges, and the INL Site. The proposed action does not include mechanical dispersals outside these disturbed areas for testing and training, but foot traffic outside of disturbed areas may occur.

Radiological dispersion device (RDD) training relies on a majority of explosively dispersed radionuclides being dispersed on the ground at or near the detonation site. Small amounts of materials have the potential to disperse outside the detonation site. As the distance from the detonation site increases, the activity of the dispersed material decreases. Boundaries (e.g., ropes, signs, and barricades) are then installed to control access to these areas until the activity returns to normal (i.e., background) levels.

Some training exercises use contained (or unsealed) radioactive sources, sealed radioactive sources, and special form sealed radioactive sources, which are removed from the training location each day. Other exercises spread radioactive material (e.g., Cu-64, F-18, K_2O, KBr, $LaBr_3$, and Zr-97) on the ground. Trainees characterize radiation fields, collect radiation readings and samples, and disable mock devices using specialized equipment. Measuring samples occurs in the field, using hand-held instruments, and in mobile laboratories. Locked and shielded containers store samples. Radiological training uses non-toxic shielding (i.e., tungsten or bismuth) instead of lead when possible.

The term "ground dispersal of radioactive materials" means using mechanical spreaders or sprayers and limited quantities of explosives to spread radioactive materials on the ground for training and testing events. Dispersed radioactive materials contain radionuclides (i.e., unstable atoms of an element that decay and emit energy in the form of radiation). Radionuclides have unique half-lives. A half-life is the length of time it takes for half of the radioactive atoms of a specific radionuclide to decay; radioactive half-lives range from milliseconds to millions of years. Longer half-lives equate to longer persistence in the environment.

Table 4 lists the isotopes produced from irradiating K_2O, KBr, $LaBr_3$, Cu and Zr metals, and F for the proposed source term. The table also includes the half-life for each isotope, the estimated radioactivity released in a single test, and the proposed total annual release. This list includes both short and long lived radionuclides. The long lived radionuclides include naturally occurring isotopes and long lived radionuclides created during irradiating the metals. DOE will evaluate using other radionuclides on an individual basis using the as low as reasonably achievable (ALARA) process and limit the dose to the public at each test location to less than 0.1 mrem/year.

Table 4. Potential source term per test and total annual releases for dispersed radioactive materials.

Radionuclide	Half-Life	Release per Test (Ci)	Total Annual Release[a] (Ci)
Material: Potassium Oxide (K_2O)			
Be-10	1.51E+06 year	2.87E-20	3.44E-19
C-14	5.7E+03 year	2.13E-09	2.56E-08
Cl-36	3.01E+05 year	6.78E-08	8.14E-07
Ar-39	269 year	1.43E-04	1.72E-03
Ar-41	1.83 hour	2.17E-09	2.61E-08
Ar-42	32.9 year	2.15E-15	2.58E-14
K-40	1.25E+09 year	3.43E-06	4.11E-05
K-42	12.4 hour	7.00E+00	8.40E+01
Material: Lanthanum Bromide ($LaBr_3$)			
As-76	1.09 d	1.22E-06	1.46E-05
Se-79	3.26E+05 year	1.45E-11	1.74E-10
Se-81m	57.3 m	1.48E-24	1.77E-23
Br-80	17.68 m	1.71E-03	2.06E-02
Br-80m	4.42 hour	1.60E-03	1.92E-02
Br-82	35.3 hour	4.88E-01	5.86E+00
Kr-79	35.0 hour	1.68E-12	2.02E-11
Kr-81	2.29E+05 year	5.00E-15	6.00E-14
Kr-83m	1.83 hour	7.19E-16	8.63E-15
Cs-135	2.3E+06 year	2.71E-19	3.25E-18
Cs-136	13.04 d	3.59E-09	4.30E-08
Cs-137	30.08 year	1.85E-19	2.22E-18
Ba-136m	0.308 s	5.91E-10	7.09E-09
Ba-139	83.06 m	3.73E-17	4.47E-16
Ba-140	12.75 d	4.19E-17	5.03E-16
La-137	6.00E+04 year	1.15E-14	1.38E-13
La-138	1.02E+11 year	9.48E-11	1.14E-09
La-140	1.679 d	5.08E-01	6.10E+00
La-141	3.92 hour	1.89E-10	2.27E-09
Ce-139	137.6 d	4.44E-26	5.33E-25
Ce-141	32.51 d	4.83E-09	5.80E-08
Material: Potassium Bromide (KBr)			
Cl-36	3.01E+05 year	7.73E-10	9.27E-09
Ar-39	269 year	1.63E-06	1.95E-05
Ar-41	1.83 hour	2.48E-11	2.97E-10
Ar-42	32.9 year	2.44E-17	2.93E-16
K-40	1.25E+09 year	3.90E-08	4.69E-07
K-42	12.4 hour	7.98E-02	9.57E-01
Ni-63	101.2 year	2.06E-14	2.47E-13
Ni-65	2.52 hour	4.16E-16	5.00E-15
Cu-64	12.7 hour	3.97E-09	4.76E-08
Cu-67	61.83 hour	1.57E-11	1.89E-10

Radionuclide	Half-Life	Release per Test (Ci)	Total Annual Release[a] (Ci)
Zn-65	243.9 d	1.22E-08	1.46E-07
Zn-69	56.4 m	1.38E-20	1.66E-19
Ga-72	14.1 hour	1.08E-21	1.30E-20
As-76	1.09 d	1.22E-05	1.46E-04
Se-79	3.26E+05 year	1.45E-10	1.74E-09
Se-81m	57.3 m	1.48E-23	1.78E-22
Br-80	17.68 m	1.71E-02	2.06E-01
Br-80m	4.42 hour	1.60E-02	1.92E-01
Br-82	35.3 hour	4.89E+00	5.86E+01
Kr-79	35.0 hour	1.68E-11	2.02E-10
Kr-81	2.29E+05 year	5.01E-14	6.01E-13
Kr-83m	1.83 hour	7.20E-15	8.64E-14
Kr-85	10.78 year	2.48E-12	2.98E-11
Kr-87	1.27 h	4.95E-21	5.94E-20
Rb-86	18.64 d	3.57E-06	4.28E-05
Rb-87	4.97E+10 year	5.28E-11	6.34E-10
Rh-105	35.36 hour	2.46E-23	2.95E-22
Pd-107	6.5E+06 year	3.26E-21	3.91E-20
Pd-109	13.7 hour	1.10E-13	1.32E-12
Ag-106	24.0 hour	1.83E-12	2.20E-11
Ag-109m	39.6 s	1.13E-13	1.35E-12
Ag-110	24.6 s	2.24E-11	2.69E-10
Ag-110m	249.8 d	1.69E-09	2.02E-08
Ag-111	7.45 d	2.93E-14	3.52E-13
Cd-109	461.4 d	3.67E-17	4.41E-16
Ir-192	73.83 d	9.27E-10	1.11E-08
Ir-194	19.28 hour	3.65E-09	4.39E-08
Material: Copper Metal			
Cu-64	12.7 hour	3	36
Material: Zirconium Metal			
Zr-97	16.744 hour	10	120
Material: Fluorine			
F-18	109.8 m	5	60

a. The assessment assumes using all six material types in each of the 12 tests per year. However, the conclusion remains valid for more or fewer tests if the annual release rates are not exceeded.

Contamination control training involves medical isotopes (e.g., Ga-68 and Tc-99m) used only in contained structures such as Conex containers and tented structures with containment.

Training uses explosives or hand methods to disperse radioactive ballistic particles made from Cu-64 and Zr-97 materials. Radioactive ballistic particles mimic radiological fragmentation for training purposes. Explosives disperse particles about 1 mm × 1mm in size produced from either zirconium or copper (i.e., Zr-97 and Cu-64). Each exercise disperses about 3 curies of Cu-64 pellets and about 10 curies of Zr-97 pellets, respectively.

Radiological response training at the Ranges uses radioactive sources not available on the commercial market but manufactured at INL Site facilities. Silica glass-containing radioactive materials are manufactured using a sol-gel process in a manner that preserves the purity of selected isotopes. These glasses range in size from 20 microns to several millimeters in diameter. The proposed action prohibits using glass particles in the respirable range of 10 microns or less. These particles mimic nuclear fallout and are used to test collection techniques and technologies and analyze forensic detection capabilities.

Each glass material dispersal is limited to 100 grams or less and to 1 Ci or less for indoor and outdoor dispersals that use radioactive materials with half-lives shorter than 20 days (i.e., Au-196, Ba-140, KBr, Sc-44m/44, Te-132, and Y-90). Outdoor glass dispersals containing these short-lived isotopes without containment are limited to releasing no more than 12 Ci/year.

Silica glass dispersals containing isotopes having half-lives longer than 20 days or isotopes with daughter products having half-lives longer than 20 days (e.g., fission and activation products Ce-141, Ce-143, Mo-99, Nd-147, Th-227, and Zr-95) only takes place within enclosed structures having removable spill containment to prevent spreading dispersed material to the environment. The final *Idaho National Laboratory Radiological Response Training Range Environmental Assessment and FONSI* (DOE-ID, 2010) discusses construction and use of temporary containment structures. The proposed action prohibits silica glass dispersals using explosives.

Table 5 lists the half-lives of radionuclides used in silica glass dispersals.

Table 5. Half-life and total annual release limits for radionuclides in silica glass.

Radionuclide	Half-Life	Release per Test (Ci)	Total Annual Release[a] (Ci)
Silica glass with half-lives longer than 20 days requiring containment[b]			
Ce-141	See Table 4	See Table 4	See Table 4
Ce-143	33.04 hours	1	12
Mo-99	65.92 hours	1	12
Nd-147	10.98 days	1	12
Th-227	18.70 days	1	12
Zr-95	64.03 days	1	12
U-238	4.47E9 years	1	12
Silica glass half-lives less than 20 days approved for outdoor dispersal without containment			
Au-196	6.17 days	1	12
Ba-140	12.75 days	1	12
Ce-147	56.40 seconds	1	12
KBr	See Table 4	See Table 4	See Table 4
Sc-44/44m	3.97 hours/58.61 hours	1	12
Te-132	3.20 days	1	12
Y-90	64.00 hours	1	12

a. Total annual release for all glass containing radionuclides will not exceed 12 Ci per year.
b. Dispersed only within enclosed structures having removable spill containment

Some radiological response training exercises investigate RDDs and devise methods for RDD disablement. Disablement training uses gel blocks (100 gel blocks, each about 8 in. × 9 in. × 16 in. in size) or containment foam to cover RDD training materials. Training using foam containment requires that RDD material surveys and evaluations take place after foam dissipation (typically1 to 3 days). Foam containment uses foam-filled, 8-ft fabric cubes or 16-ft and 30-ft diameter fabric domes. Other disablement tools include “Stingrays” (i.e., an explosively formed and focused blade of water) or percussion actuated non-electric disrupters.

Range access control and monitoring continues until background radiation levels return to pre-test levels. Approved security plans prevent unauthorized persons from inadvertent entry to the Ranges during testing and training activities. Table 6 summarizes radiological training material and uses.

Table 6. Summary of radiological training materials and use.

Training Material	Training Use
Radiological materials	Ballistic particle dispersals. Dispersals using multiple radionuclides during single test events. Large area dispersal using up to 5 lb of high explosives at NSTR and 1 lb at RRTR. Multiple dispersals in accordance with releases listed in Table 4. Additional radionuclides evaluated using the environmental ALARA process.
Containment foam and gel blocks	RDD training exercises.
Glass-containing radionuclides	Non-explosive indoor and outdoor glass dispersals containing radionuclides with half-lives less than 20 days (e.g., Au-196, Ba-140, KBr, Sc-44m/44, and Te-132). Non-explosive glass dispersals using materials with a half-life greater than 20 days or progeny with a half-life greater than 20 days (Ce-141, Ce-143, Mo-99, Nd-147, Th-227, and Zr-95) within an enclosed and contained structure.
Sealed radioactive sources and radiation-emitting devices (x-ray and gamma ray radiation-producing equipment such as portable x-ray generators, Betatrons, and sealed radioisotope sources).	Characterizing radiation fields and collecting radiation readings and samples.

2.1.3 Project Controls

Project controls are included in the proposed action for the purpose of reducing anticipated environmental impacts that might otherwise stem from project implementation. The project controls listed in Table 7 are integral to all activities and the proposed action.

Table 7. Project controls.

Component	Control
Air	
	Control fugitive dust by applying water, covering soils, replanting disturbed areas, or other methods
	Remove all portable/mobile generators used during construction and operations within 1 year of installation
	Monitor wind speeds prior to each dispersal
	Limit explosive dispersals to wind speeds less than 25 mph
	Evaluate all new isotopes in irradiated materials for potential offsite dose prior to initial distribution
Historical and Cultural Resources	
	Follow methodology in TEV-3572 when firing large projectiles (greater than 30 and up to 120 mm) at the downrange target area
	Restrict vehicle travel to established roads, laydown areas, and turnarounds
	Stop work and make necessary notifications if unanticipated cultural, historical, or pre-contact resources are discovered during any project activities
	Use Micro-site project elements (e.g., fences, signs, and powerlines) to avoid sensitive resources

Component	Control
Ecological Resources	Restore areas subject to short-term ground disturbance to original contours and revegetate with certified weed-free native seed to at least 70% of pre-disturbed cover
	Control weeds as necessary
	Comply with regulations pertaining to control of noxious weeds on INL Site land
	Comply with regulations and requirements for herbicide use
	Avoid impacts to painted milkvetch along the proposed new power line access route by surveying the proposed route and placing poles in areas not occupied by the species
	Restrict vehicle travel to established roads, laydown areas, and turnarounds
	Construct new support facilities in disturbed areas such as laydown areas, command areas, and safety observation points
	Collocate infrastructure to the extent practicable
	Apply time-of-day restrictions to construction and operations activities within 1 km of greater sage-grouse leks from March 15 to May 15
	Comply with conservation measures described in the Candidate Conservation Agreement (CCA) (DOE-ID & USFWS, 2014) for greater sage-grouse
	Avoid installing power lines within 1 km of an active leks
	Install raptor perch deterrents on power poles and guy wire flight deterrents as necessary
	Control human activity and blasting during the nesting period if ferruginous hawks are confirmed nesting
	Complete pre and post construction surveys to establish the amounts of sagebrush restoration and other native revegetation efforts needed to rehabilitate disturbed areas as determined by DOE's Environmental Surveillance, Education, and Research (ESER) contractor
	Monitoring sagebrush disturbance and plant amounts equal to that disturbed in areas beneficial to sage-grouse
	Minimize impacts to nesting raptors by prohibiting construction and operations within recommended spatial and seasonal buffers identified by the ESER contractor
	Perform migratory bird nesting surveys 72 hours prior to vegetation disturbance during the migratory bird nesting season (April 1 through October 1) and implement measures, such as buffer areas or halting work, to prevent nest abandonment until after the migratory bird nesting season or until young have fledged
	Perform annual surveys for nesting birds, especially ferruginous hawks and burrowing owls.
	Report dead or injured birds immediately
Fire	
	Equip vehicles used at the Ranges with accessible fire tools (e.g., shovels or fire extinguishers)
	Maintain defensible space by mowing or clearing vegetation near infrastructure vulnerable to wildland fire
	Keep a fire tender onsite at the Ranges during activities having the potential to start wildland fires
	Tether UAVs carrying explosives or flammable materials to prevent them from leaving test pad locations
	Remove vegetation from the first 300 yd of the downrange target area
Soils	
	Establish background soil characteristics prior to any testing associated with the proposed action
	Perform contamination control training using medical isotopes (e.g., Ga-68 and Tc-99m) only in contained structures
	Limit individual glass material dispersal to 1 Ci or less for indoor and outdoor dispersals with short-lived radioactive materials
	Limit outdoor glass dispersals containing short-lived isotopes to 12 Ci/year

Component	Control
Soils continued	Disperse glass materials with half-lives greater than 20 days only within enclosed structures having removable spill containment
	Control erosion by placing fill material such as gravel in cleared areas as appropriate
	Restrict vehicle traffic to designated roadways and parking and laydown areas
	Limit regrading of soil to areas maintained as sterile or otherwise free of vegetation
	Limit potential soil contamination so soil does not become contaminated with hazardous waste or exceed soil concentrations of hazardous substances, which would require remediation under federal or state clean-up laws and regulations
	Perform soil monitoring at least every 2 years for at least two rounds of monitoring and, based on the results, increase or decrease monitoring frequency (but to no less than every 5 years) to verify radionuclide, chemical, and explosive constituent concentrations do not approach preliminary remediation goals (PRGs)
	If soil concentrations approach PRGs, remove soils and place in a licensed disposal facility
	If K-40 soil concentrations exceed initial background concentrations, remove soils and place in a licensed disposal facility
	Remove and dispose of range debris in accordance with proper disposal procedures
	Clean up spills as soon as possible and, if necessary, remove contaminated soils and dispose in an approved facility, then sample remaining soils to verify successful removal of contaminants
	Verify all explosive material has been consumed or removed after testing has been performed
Hazardous Materials and Waste Management	
	Prohibit using pure unused Resource Conservation and Recovery Act (RCRA) P or U-listed commercial chemicals that are considered RCRA hazardous waste when released to the environment and chemicals considered RCRA toxic waste when released to the soil
	Evaluate the release of all chemicals to determine if any release exceeds the reportable quantity for that chemical or mixture of chemicals
	Prohibit releases that require an air permit, exceed the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) reportable quantity, exceed groundwater or drinking water standards in the aquifer, or exceed CERCLA screening levels in soil
	Use covered dumpsters to contain refuse and empty dumpsters when full
	Remove unconsumed explosive material, used test articles, and debris from the Ranges and dispose according to applicable regulations
	Use licensed vendors to furnish portable toilets, maintain them on a regular basis, and pump portable toilet waste to approved INL Site facilities (e.g., Central Facilities Area [CFA] sewage treatment plant) after verifying the discharge meets facility acceptance criteria
	Use non-toxic shielding (i.e., tungsten or bismuth) instead of lead when possible for radiological training
Testing and Training	
	Limit explosive radiological dispersals to 1 lb NEW TNT equivalent at RRTR and 5 lb at NSTR
	Explosives operations at NSTR will be monitored to ensure consistency with the evaluated frequency of use as reflected in Table 3.
	Install boundaries (e.g., ropes, signs, and barricades) to control access to radiological training areas until the activity returns to normal (i.e., background) levels.
	Implement approved security plans to prevent unauthorized persons from inadvertent entry to the Ranges during testing and training activities
	Limit the dose to the public at each test location to less than 0.1 mrem/year
	Prohibit silica glass dispersals using explosives
	Limit explosive dispersals to wind speeds less than 25 mph and postpone training and testing as necessary

Component	Control
Testing and Training continued	Verify the curie content and isotopic-distribution of the major, intended, isotopes and any contaminants in radiological materials used in radioactive material distribution testing and training at least once per year
	Evaluate all changes in isotopes or isotope concentrations against Table 4 and include in the annual reporting requirements
	Model newly found isotopes with a half-life greater than 74 days for impact to soil and groundwater prior to initial distribution to demonstrate the impact analysis in this EA remains valid
	Review any changes to the source materials (e.g., composition or manufacturer), which will be irradiated, or the source of irradiation prior to any such use, to verify the releases in Table 4 will not be exceeded

2.2 No Action Alternative

The CEQ regulations (40 CFR 1502.14) direct agencies to evaluate a no action alternative. The purpose of a no action alternative in the NEPA process is to provide a baseline to compare the impacts of the other analyzed alternatives. “No action” does not mean doing nothing. Rather, the no action alternative involves maintaining or continuing the “status quo” of ongoing operations and activities.

The no action alternative does not expand infrastructure or training and testing capabilities at the Ranges. The no action alternative continues current and ongoing testing and training activities at the Ranges as analyzed in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID 2007) and the *Final Idaho National Laboratory Radiological Response Training Range Environmental Assessment and FONSI* (DOE-ID 2010) would continue. As such, no physical modifications or changes in operations at the Ranges take place under the no action alternative.

If the proposed activities were not performed at the INL Site, other entities and locations could potentially support the research, testing, and training capabilities proposed at the Ranges. Performing the proposed activities at another location and the associated environmental impacts is outside the scope of this analysis.

The no action alternative does not include suspension of activities or closure of the Ranges. Furthermore, DOE established the Ranges in DOE/EA-1557 and DOE/EA-1776 and closure of the facilities is not foreseeable.

Table 8 compares activities at the Ranges for the proposed action and no action alternative.

Table 8. Comparison of activities at the Ranges for the proposed action and no action alternative.

Activity	No Action NSTR	Proposed Action NSTR	No Action RRTR	Proposed Action RRTR
Use Containment Foam	Containment foam not used	Use containment foam and gel blocks multiple times per year	Use foam and gel blocks multiple times per year	No change
Disperse Isotopes	Isotopes not dispersed	Ballistic particle dispersals Radionuclide and ballistic particle dispersals Dispersing one or more radionuclides during any individual test event Ground dispersals using up to 5 lb of high explosives within the area of the training pads (air emissions have the potential to travel outside these areas) Use aerial detection capabilities (e.g., helicopters and UAVs) Multiple dispersals in accordance with releases listed in Table 4; additional radionuclides evaluated using the environmental ALARA process	Multiple dispersals per year using KBr (up to 500 grams but less than 1 Ci) at NTR and STR, not exceeding 12 Ci per year	Ballistic particle dispersals Radionuclide dispersals using up to 1 lb of high explosives within the disturbed area of the gravel pit (NTR) and infiltration basin (STR) (air emissions have the potential to travel outside these areas) Radionuclide and ballistic particle dispersals Multiple dispersals in accordance with releases listed in Table 4; additional radionuclides evaluated using the environmental ALARA process
Use Explosives	Deliver explosives to ground-based targets using controlled UAVs not authorized Large explosive events (11,000 to 20,000 lb NEW) once every 5 years Large projectiles (greater than 30 to 120 mm) three or four times per year Mid-test range events (3,000 to 11,000 lb NEW) once or twice a year Firing RPGs and other live warheads not authorized Small events (100 to 3,000 lb NEW) once per month	Deliver explosives to ground-based targets using controlled UAVs Large explosive events (11,000 to 20,000 lb NEW) about once every 5 years Large projectiles (greater than 30 to 120 mm) about 24 times per year Mid-test range events (3,000 to 11,000 lb NEW) about five times per year RPGs and other live warheads fired about 24 times per year Small events (100 to 3,000 lb NEW) about five to eight times per month	Explosive dispersals of radionuclides with about 0.5 lb NEW	Explosive dispersals of radionuclides with up to 1 lb NEW

Activity	No Action NSTR	Proposed Action NSTR	No Action RRTR	Proposed Action RRTR
	Small-scale projectiles (30 mm or less) bi-weekly Very small events (less than 100 lb NEW) weekly	Small scale projectiles (30 mm or less) about ten times per month Very small events (less than 100 lb NEW) daily		
Use Sealed Radioactive Sources and Radiation-Emitting Devices	Radioactive materials not used	X-ray and gamma ray radiation producing equipment such as portable x-ray generators, Betatrons, and sealed radioisotope sources Sealed sources include Ir-192, Co-60, Cs-137, Ra-226, Se-75, and isotopes of Am, Pu, Th, and U Source strengths vary from micro-curies to roughly 200 Ci depending on the isotope	X-ray and gamma ray radiation producing equipment such as portable x-ray generators, Betatrons, and sealed radioisotope sources Sealed sources include Ir-192, Co-60, Cs-137, Ra-226, Se-75, and isotopes of Am, Pu, Th, and U Source strengths vary from micro-curies to roughly 200 Ci depending on the isotope	No change
Use Silica Glass-Containing Radionuclides	Silica glasses not used	Non-explosive dispersals of glass materials containing radionuclides with half-lives greater than 20 days within an enclosed and contained structure Non-explosive dispersals of glass materials with half -lives less than 20 days (Au-196, Ba-140, KBr, Sc-44m/44, Te-132, and Y-90)	Silica glasses not used	Non-explosive dispersals of glass materials containing radionuclides with half-lives greater than 20 days within an enclosed and contained structure Non-explosive dispersals of glass materials with half-lives less than 20 days (Au-196, Ba-140, KBr, Sc-44m/44, Te-132, and Y-90)
Surface Disturbance	No change	About 460 acres of ground disturbance	No change Radiological Response Training continues as defined in DOE/EA-1776	Construct chain-link fence around NTR and STR (enclosing about 184 total acres)

3. AFFECTED ENVIRONMENT

This section describes the area potentially impacted by the proposed action as required by CEQ regulations. The extent of the affected environment may not be the same for potentially affected resource areas. Discussion of the present day setting in this document is limited to environmental information that relates to the scope of the proposed action and alternatives analyzed.

The INL Site contains several facilities, each occupying less than 2 square miles, and covers about 890 square miles of otherwise undeveloped, cool desert terrain. DOE controls INL Site land, which is in portions of five southeastern Idaho counties: Bingham, Bonneville, Butte, Clark, and Jefferson. Population centers in the region include the cities (i.e., more than 10,000 people) of Blackfoot, Idaho Falls, Pocatello, and Rexburg. Several smaller cities and communities (i.e., less than 10,000 people), including Arco, Atomic City, Fort Hall Indian Reservation, Howe, and Mud Lake, are located around the site less than 30 miles away. Craters of the Moon National Monument and Preserve is less than 20 miles to the west of the INL Site; Yellowstone and Grand Teton National Parks and the city of Jackson, Wyoming are located more than 70 miles northeast of the INL Site, and Sun Valley ski resort lies less than 70 miles to the west.

The land adjacent to the INL Site boundary consists of public and private land. The U.S. Bureau of Land Management manages about 75% of land adjacent to the INL Site; their lands support wildlife habitat, mineral and energy production, grazing, and recreation. The State of Idaho owns about 1% of adjacent land that supports uses like those on federal land. The remaining 24% of land adjacent to the INL Site is private land, with grazing and crop production as the most common uses.

Specific recreational and tourism areas near the INL Site include the Birch Creek Camping Area, Black Canyon Wilderness Study Area, Camas National Wildlife Refuge, Craters of the Moon National Monument and Preserve, Hell’s Half-Acre Wilderness Study Area, Market Lake State Wildlife Management Area, and Mud Lake Wildlife Management Area. Two national forests, the Salmon-Challis and Caribou-Targhee, also lie within 50 miles of the INL Site. Populations potentially affected by INL Site activities include INL Site employees, ranchers grazing livestock in areas on or near the INL Site, hunters on or near the INL Site, residential populations in neighboring communities, travelers on public highways, and visitors at the Experimental Breeder Reactor-I National Historic Landmark. No permanent residents are located on the INL Site.

No prime or unique farmland protected by the Farmland Protection Policy Act occurs on the INL Site.

3.1 Air Quality

The five Idaho counties containing portions of the INL Site are in an attainment area or are unclassified for National Ambient Air Quality Standards status under the Clean Air Act. In 2018, the Idaho Department of Environmental Quality issued a facility emission cap permit to construct to INL. For the purposes of air regulations, INL is an area source of air pollution for pollutants and not regulated by the Prevention of Significant Deterioration rules (40 CFR 52.21).

The Craters of the Moon National Monument and Preserve, located west-southwest of the INL Site, is a Prevention of Significant Deterioration Class I area. Class I areas have the highest level of protection from air pollutants and little deterioration of air quality is allowed.

In addition to National Ambient Air Quality Standards requirements, the Clean Air Act includes National Emission Standards for Hazardous Air Pollutants (NESHAP) and New Source Performance Standard requirements. The primary application of NESHAP requirements at INL Site is for controlling and reporting radionuclide emissions (40 CFR 61, Subpart H, 1989). DOE complies with the standards and requirements for radionuclide emissions and associated dose limits to the public (DOE, 2019b). The INL Site is an area source of hazardous air pollutants under the NESHAP regulations. New Source Performance Standard rules apply to any new or reconstructed apparatus to which a standard applies under this program.

Airborne releases of radionuclides from INL Site operations are reported each calendar year with the calendar year 2018 report released in June 2019 (DOE, 2019b). For calendar year 2018, the effective dose (ED) equivalent to the maximally exposed individual (MEI) member of the public was 1.02E-02 millirem (mrem) per year, which is 0.10 percent of the 10 mrem per year standard, for the INL Site.

In 2017, the most current year available, all radionuclide concentrations in ambient air samples were below DOE radiation protection standards for air and were within historical measurements (DOE, 2018). In addition, gross alpha and gross beta concentrations were analyzed statistically; there were few differences between samples collected on the INL Site, at the INL Site boundary, and off the INL Site.

3.2 Historical and Cultural Resources

Cultural resources, including historic and Native American archaeological sites, historic architectural properties, and areas of importance to the Shoshone-Bannock Tribes, are numerous across INL and many are eligible for nomination into the National Register of Historic Places (NRHP or National Register). INL lands are also included within the aboriginal homeland of the Shoshone-Bannock people. The Native American archaeological sites, trails, burial sites, native plants and animals, and features of the natural environment that occur within the protected boundaries of the INL Site continue to fill important roles in tribal heritage and ongoing cultural traditions. Numerous historic archeological sites reflect emigrant use along Goodale's Cutoff (a northern spur of the Oregon Trail) beginning 160 years ago. Soon after, early homesteaders tried harnessing the intermittent flows of the Big Lost River to transform sagebrush flats into irrigated farmland, but few were successful.

During World War II, lands now encompassing the INL Site, were designated a Naval Proving Ground to support the war effort. In 1949, to support development and testing of nuclear reactors, the United States established the National Reactor Testing Station on land that is now the INL Site.

Cultural resource investigations from 2016 to 2018 (Holmer, Cook, Henrikson, Gilbert, & Armstrong, 2019) for NSTR and RRTR identified 19 previously documented archaeological sites through archival searches. Intense archaeological surveys of about 1,725 acres (1,540 acres at NSTR, 106 acres at NTR, and 79 acres at STR) were completed. These surveys recorded 46 Native American archaeological sites, 40 Native American isolate locations, and a historic Euroamerican road at NSTR. Cultural investigations at RRTR (including NTR and STR) documented eight Native American archaeological sites, five Native American isolate locations, and a wooden Euroamerican structure. A variety of natural resources of potential importance to the Shoshone-Bannock Tribes are also contained within the NSTR and RRTR project areas.

A total of 33 potentially eligible properties were documented during the 2016 to 2018 cultural resource investigations of the NSTR and RRTR. Of these properties, 22 potentially eligible properties (21 at NSTR and one at NTR) were evaluated through test excavations and, based on results, all are recommended as ineligible into NRHP. The remaining 11 potentially eligible properties at both the NSTR and RRTR have been avoided through project redesign. Table 9 summarizes these findings.

Table 9. Number of cultural resources identified in the project area.

Number of Cultural Resources Identified at the Ranges				
Location	Native American Sites	Native American Isolates	Euroamerican Artifact	Total
NSTR	46	40	1	87
RRTR	8	5	1	14
Total	**54**	**45**	**2**	**101**

3.3 Ecological Resources

The INL Site covers one of the largest remnants of undeveloped, ungrazed sagebrush steppe ecosystems in the Intermountain West (INL, 2016). The INL Site is also home to the Idaho National Environmental Research Park. The National Environmental Research Park is an outdoor laboratory for evaluating the environmental consequences of energy use and development and strategies to mitigate effects from energy use and development.

A shrub overstory with a grass and forb understory forms most natural vegetation across the INL Site. The most common shrub is Wyoming big sagebrush, though basin big sagebrush dominates or co-dominates in areas with deep or sandy soils.

The INL Site supports a variety of vertebrates, including several sagebrush-obligate species, meaning species that need sagebrush to survive. These species include sage sparrow, Brewer's sparrow, northern sagebrush lizard, greater sage-grouse, and pygmy rabbit.

The United States Fish and Wildlife Service (USFWS) lists, by county, threatened and endangered species and other species of concern for the State of Idaho. The following list includes the species listed as threatened in the five counties of which the INL Site is a part:

- Bull Trout
- Canada Lynx
- North American Wolverine (proposed)
- Ute Ladies'-tresses
- Whitebark Pine
- Yellow-billed Cuckoo.

Of the species listed by the USFWS, the yellow-billed cuckoo has been documented near the INL Site and wolverines may pass through. The remaining species have not been documented on the INL Site.

Several species of concern or candidate species occur on the INL Site, including sage-grouse, three species of bats (i.e., long-eared myotis, small-footed myotis, and Townsend's big-eared), pygmy rabbit, Merriam's shrew, long-billed curlew, ferruginous hawk, northern sagebrush lizard, and loggerhead shrike. Bald and golden eagles also occupy the INL Site and are protected under the Bald and Golden Eagle Protection Act.

The USFWS is evaluating if the little brown myotis and the big brown bat warrant listing under the Endangered Species Act.

The following subsections present site-specific information on the ecological resources of the project area on the INL Site, with much of the information coming from Hafla et al. (2019).

3.3.1 Plant Communities

3.3.1.1 NSTR. Five wildland fires burned plant communities on and around NSTR between 1995 and July 2019. Plant community composition in the area reflects wildland fire activity over the past few decades.

The only sagebrush shrubland in the project area occupies the area of the proposed road around the TREAT exclusion zone. Big sagebrush communities dominated the NSTR site before recent wildland fires. Under normal fire regimes, plant communities will transition back to sagebrush-dominated communities through natural recruitment over the next century or so.

Native, perennial grasses dominate much of NSTR. Localized patches of non-native annuals (such as cheatgrass and Russian thistle) occupy shallow rocky soils on basalt outcroppings.

Twelve plant communities populate the NSTR project area and these communities are in good ecological condition (Hafla, et al., 2019). Table 10 lists the 12 plant communities documented at NSTR.

Table 10. Documented NSTR plant communities.

Scientific Class Name	Colloquial Class Name
***Achnatherum hymenoides* Herbaceous Vegetation**	Indian Ricegrass Herbaceous Vegetation
Agropyron cristatum (Agropyron desertorum) Semi-natural Herbaceous Vegetation	Crested Wheatgrass Semi-Natural Herbaceous Vegetation
Artemisia tridentata Shrubland	Big Sagebrush Shrubland
***Artemisia tridentata* ssp. *wyomingensis* Shrubland**	Wyoming Big Sagebrush Shrubland
***Bromus tectorum* Semi-natural Herbaceous Vegetation**	Cheatgrass Semi-Natural Herbaceous Vegetation
***Chrysothamnus viscidiflorus/Alyssum desertorum* Herbaceous Vegetation**	Green Rabbitbrush/Desert Alyssum Shrub Herbaceous Vegetation
***Chrysothamnus viscidiflorus/Elymus lanceolatus* (*Pascopyrum smithii*) Shrub Herbaceous Vegetation**	Green Rabbitbrush/Streambank Wheatgrass (Western Wheatgrass) Shrub Herbaceous Vegetation
***Chrysothamnus viscidiflorus* Shrubland**	Green Rabbitbrush Shrubland
***Ericameria nana* Dwarf Shrubland**	Dwarf Goldenbush Dwarf Shrubland
***Hesperostipa comata* Herbaceous Vegetation**	Needle and Thread Herbaceous Vegetation
***Leymus cinereus* Herbaceous Vegetation**	Great Basin Wildrye Herbaceous Vegetation
***Poa secunda* Herbaceous Vegetation**	Sandberg Bluegrass Herbaceous Vegetation

Painted milkvetch is the only sensitive plant species positively identified during surveys of the NSTR project area (Hafla, et al., 2019). Surveys located three small populations, each with ten or fewer individuals, along the proposed new power line route. Several additional small populations were observed adjacent to, but not directly within, the area of the new explosives test pad and access road. The downrange target area contains appropriate habitat for painted milkvetch and the species is present in similar adjacent habitats; therefore, it likely occurs on the downrange target area. The proposed downrange target area was moved from the original surveyed location for safety reasons too late in the season to complete new sensitive species surveys. Because painted milkvetch has a short growing season and local population persistence is annually variable, populations may be more detectable in some years than others; therefore, the known distribution of painted milkvetch in 2016 may not reflect population distribution in other years. It is possible for painted milkvetch to occur anywhere in the proposed NSTR project area, with appropriate habitat, during any given year.

3.3.1.2 RRTR. Vegetation at the NTR and STR differ from that found at NSTR. The RRTR locations have not experienced vegetation-changing events, such as fire, since completion of the INL Site vegetation classification in 2008. Native sagebrush with various understory components dominates plant communities at RRTR. Table 11 lists vegetation communities documented at NTR and STR.

The NTR gravel pit is maintained without vegetation to prevent the spread of undesirable species. NTR soils tend to be alkaline and salt-tolerant plant species, such as shadscale saltbush, sickle saltbush, and winterfat, occupy the area. Various grasses also inhabit the area. Although conditions at NTR are favorable to the growth of sensitive plants such as iodinebush, meadow milkvetch, and silvery primrose, surveys of the area did not find any of these sensitive plant species.

Wyoming Big Sagebrush Shrubland surrounds STR and sagebrush and a wide range of other shrub and grass species dominate the area. The infiltration basin at STR and the berm around the basin have less shrub composition than the surrounding areas from past mowing. Soils composing the berm tend to be very dry and vegetative cover is low. Weeds and invasive species compose most of the vegetation on the berm. Surveys of STR did not find sensitive plant species, although conditions are favorable for twinleaf onion and desert dodder.

Table 11. Documented NTR and STR plant communities.

Scientific Class Name	Colloquial Class Name
***Agropyron cristatum (Agropyron desertorum)* Semi-natural Herbaceous Vegetation**	Crested Wheatgrass Semi-Natural Herbaceous Vegetation
***Artemisia tridentata* Shrubland - *Artemisia tripartita* Shrubland**	Big Sagebrush Shrubland - Three-Tip Sagebrush Shrubland
***Artemisia tridentata* Shrubland - *Atriplex falcata* Dwarf Shrubland**	Big Sagebrush Shrubland - Sickle Saltbush Dwarf Shrubland
***Artemisia tridentata* ssp. *wyomingensis* Shrubland**	Wyoming Big Sagebrush Shrubland
***Artemisia tridentata* ssp. *wyomingensis* Shrubland - *Agropyron cristatum* (*Agropyron desertorum*) Semi-natural Herbaceous Vegetation**	Artemisia tridentata ssp. wyomingensis Shrubland - Crested Wheatgrass Semi-Natural Herbaceous Vegetation
***Artemisia tridentata* ssp. *wyomingensis* Shrubland - *Chrysothamnus viscidiflorus – Krascheninnikovia lanata* Shrubland**	Artemisia tridentata ssp. wyomingensis Shrubland - Green Rabbitbrush - Winterfat Shrubland
***Atriplex confertifolia* Dwarf Shrubland - Atriplex falcata Dwarf Shrubland**	Shadscale Dwarf Shrubland - Sickle Saltbush Dwarf Shrubland
***Chrysothamnus viscidiflorus* – Krascheninnikovia lanata Shrubland - Atriplex confertifolia Dwarf Shrubland**	Green Rabbitbrush - Winterfat Shrubland - Shadscale Dwarf Shrubland

3.3.2 Ethnobotany

Species of ethnobotanical importance occur on and around the Ranges. Hafla et al. (2019) lists species thought to be of historical importance taken from *Plant Communities, Ethnoecology, and Flora of the Idaho National Engineering Laboratory* (Anderson, Ruppel, Glennon, Holt, & Rope, 1996). The list includes species used by “indigenous groups of the eastern Snake River Plain.” Plant community and sensitive plant surveys identified 39 species from the list of ethnobotanical importance throughout the project area. Many of these species are abundant and widespread throughout the area and across much of the rest of the INL Site (Hafla, et al., 2019). Table 12 lists species of ethnobotanical importance at the Ranges.

Table 12. Species of ethnobotanical importance at the Ranges.

Scientific Name	Common Name	Uses
Achnatherum hymenoides	Indian ricegrass	Food
Allium textile	Textile onion	Food, medicine, flavoring, and dye
Artemisia tridentate	Big sagebrush	Food, medicine, cordage, clothing, shelter, fuel, and dye
Bromus techorum	Cheatgrass	Food
Chaenactis douglasii	Douglas’ dustymaiden	Food and medicine
Carex douglasii	Douglas’ sedge	Food and medicine
Chenopodium fremontii	Fremont’s goosefoot	Food
Chenopodium leptophyllum	Narrowleaf goosefoot	Food
Chrysothamnus viscidiflorus	Green rabbitbrush	Medicine and gum
Crepis acuminate	Tapertip hawksbeard	Food
Delphinium andersonii	Anderson’s larkspur	Medicine and dye
Descurainia pinnata	Western tansymustart	Food and medicine
Descurainia Sophia	Herb sophia	Food and medicine
Elymus elymoides	Bottlebrush squirreltail	Food
Elymus lanceolatus	Streambank wheatgrass	Food
Ericameria nauseosus	Rubber rabbitbrush	Medicine and gum
Erigeron pumilus	Shaggy fleabane	Medicine and arrow tip poison
Eriogonum ovalifolium	Cushion buckwheat	Medicine

Scientific Name	Common Name	Uses
Gutierrezia sarothrae	Broom snakeweed	Medicine
Hesperostipa comate	Needle-and-threads	Food
Lactuca serriola	Prickly lettuce	Food and medicine
Lappula occidentalis	Flatspine stickseed	Food
Leyms cinerus	Basin wildrye	Food and manufacture
Lomatium dissectum	Fernleaf biscuitroot	Food and medicine
Lomatium foeniculaceum	Desert biscuitroot	Food and medicine
Lygodesmia grandiflora	Largeflower skeletonplant	Food and gum
Mentzelia albicaulis	Whitestern blazingstar	Food
Oenothera caespitosa	Tufted evening-primrose	Food and medicine
Opuntia polyacantha	Pricklypear	Food
Phacelia hastate	Silverleaf phacelia	Food
Pleiacanthus spinosus	Thorn skeletonweed	Food and gum
Poa secunda	Sandberg bluegrass	Food and medicine
Pteryxia terebinthina	Turpentine wavewing	Food
Rumex venosus	Veiny dock	Food and medicine
Salsola kali	Russian thistle	Food
Sisymbrium altissimum	Tall tumblemustard	Food
Sphaeralcea munroana	White-stemmed globe-mallow	Food, medicine, and manufacture
Taraxacum officinale	Common dandelion	Food and medicine
Tragopogon dubius	Yellow salsify	Food and medicine

3.3.3 Wildlife

About 40 years of wildlife research at the INL Site has recorded 219 vertebrate species (Reynolds, Connelly, Halford, & Arthur, 1986). Many recorded species are associated with sagebrush-steppe habitat or are sagebrush obligates. Habitat change from recent fires has altered wildlife communities and wildlife use in burned areas. Areas where sagebrush-associated species such as pygmy rabbit, sage sparrow, and Brewer's sparrow were common before fire now support species that thrive in grasslands such as elk, mountain cottontail, horned larks, and vesper sparrows. Sagebrush-dependent species, such as sage-grouse, flourish in sagebrush habitat outside burned areas and use adjacent grasslands.

Wildlife common to disturbed areas and habitats recovering from fire include small and medium-sized mammals (e.g. bushy-tailed woodrat, Ord's kangaroo rat, black-tail jackrabbit, mountain cottontail, long-tailed weasel, badger, and reptiles such as sagebrush lizard and gopher snake). These species have small home ranges, limited mobility, or a social structure that restricts movement.

Big game species, including elk and pronghorn, utilize most of the INL Site, including areas on and around the Ranges.

3.3.3.1 ***NSTR.*** Many species migrate through the NSTR area between seasonal habitats in search of prey, forage, reproductive areas, and shelter from the elements. Isolated live and burned junipers near lava outcrops contribute nesting sites for ferruginous hawks and other raptors. Bald eagles use the area during the winter and golden eagles use the area throughout the year. Lek surveys conducted since 2008 document the presence of sage-grouse in areas surrounding NSTR, but habitat in these areas is not ideal for sage-grouse.

Surveys documented the western rattlesnake, gopher snake, northern sagebrush lizard, and short-horned lizard near exposed basalt outcrops. Great Basin rattlesnakes are listed as protected non-game wildlife by the State of Idaho. Great Basin rattlesnakes require winter habitats that allow them to go below the frost line. On the INL Site, these habitats are typically associated with volcanic features such as craters, cones, and lava tubes. The presence of rattlesnakes and gopher snakes suggests that a snake hibernaculum (i.e., wintering area) is present in the general area; however, no evidence of a communal hibernation site was identified during surveys. All Idaho reptiles and amphibians (except bullfrog) are classified as protected non-game species. This designation is held at the state level to help protect populations (IDFG 2005).

Surveys documented several small mammal species using the NSTR area, including the black-tailed jackrabbit, mountain cottontail, Townsend's ground squirrel, bushy-tailed woodrat, Ord's kangaroo rat, deer mouse, and montane vole. Although these species are not listed as sensitive, they do provide a food resource for many species such as prairie falcon, ferruginous hawk, bald eagle, golden eagle, coyote, and bobcat.

Many species use the NSTR area in a transitory manner. Bird species observed using the area include horned lark, western meadowlark, vesper sparrow, grasshopper sparrow, loggerhead shrike, rock wren, common nighthawk, red-tailed hawk, ferruginous hawk, prairie falcon, and common raven. Most bird species are protected under the Migratory Bird Treaty Act. Although only one abandoned raptor nest was observed during surveys, isolated live junipers and skeletons of burned junipers near lava outcrops may provide nesting substrate for ferruginous hawks and other raptor species. Bald eagles have been observed using the general area during the winter and golden eagles have been observed using the area throughout the year.

Elk and pronghorn use the NSTR area year-round and benefit from increased grass and herbaceous vegetation associated with recent fires. Elk use the NSTR area for calving, and pronghorn use the area for fawning. The INL Site contributes critical winter range for around 1,000 elk and over 3,000 antelope, and more than 100 elk and about 500 pronghorn summer on the INL Site.

Bat acoustic surveys at NSTR identified western small-footed myotis and big brown bats using the area (Hafla, et al., 2019). The timing and level of observed activity suggests important summer roosts do not occur in the area. Townsend's big eared bat, a Bureau of Land Management sensitive species (BLM, 2004), has been documented roosting in caves and lava tubes across the INL Site but was not detected during NSTR surveys.

3.3.3.2 RRTR. Wildlife species associated with the RRTR include sagebrush obligates and habitat generalists common on the INL Site. Many species identified at NSTR also use areas around RRTR areas, including small and medium-sized mammals, birds, reptiles, and big game. Surveys at RRTR recorded signs of elk, mule deer, and pronghorn use of the area. Pronghorn and elk are common. During winter, golden eagles may be common on the northern side of the INL Site near NTR. Surveys did not find any greater sage-grouse leks in the vicinity.

Surveys at NTR recorded species such as the pygmy rabbit. Pygmy rabbits depend on sagebrush for cover and forage. Populations of pygmy rabbits on the INL Site may be relatively stable because much of the area remains undisturbed. Pygmy rabbit habitat is extensive in sagebrush steppe in the area around NTR and surveys documented both burrow systems and scat.

At STR, pronghorn, mule deer, elk, coyote, and small mammals are present in the vicinity. Surveys have not documented historical greater sage-grouse leks in the vicinity, but recent surveys discovered eggshell fragments.

Wildlife species of concern at RRTR ranges include species protected under the Migratory Bird Treaty Act (including raptors), greater sage-grouse, pygmy rabbits, and big game species.

3.3.4 Invasive and Non-Native Species

Surveys have documented 11 Idaho noxious weeds on the INL Site. Non-native and invasive plants found on or near the project area include cheatgrass, Russian thistle, halogeton, tumble mustard, and crested wheatgrass (Hafla, et al., 2019). Of the 11 noxious weeds found on the INL Site, musk thistle was the only noxious species documented in the NSTR area, although past surveys documented Canada thistle. Musk thistle occupies disturbed areas along T-25 and the alternate access road around the TREAT exclusion zone and one location on the downrange target area.

Surveys of the RRTR facilities did not locate any noxious weeds in the project area, but areas dominated by non-native species such as halogeton, cheat grass, introduced mustards, and desert alyssum occur in the area.

3.4 Soils

Soil sampling at the INL Site is completed on a 5-year rotation to evaluate long-term accumulation trends and to estimate environmental radionuclide inventories. Data from previous years of soil sampling and analysis on the INL Site show no evidence of detectable concentrations depositing onto surface soil from ongoing INL Site releases (DOE, 2018). Soil types and composition at the Ranges are discussed in the following subsections.

3.4.1 NSTR

Sands over basalt generally describes soil in the NSTR area. Figure 10 shows the Grassy Butte-Rock Outcrop Complex found at NSTR. This soil complex has several soil mapping units. Grassy Butte's very stony loamy sand makes up about 30% of this soil complex and Rock Outcrop makes up about 20%. The remaining 50% is about equal parts Grassy Butte 10 to 40 in. deep, Grassy Butte 40 to 60 in. deep, Matheson loamy sand, Bondfarm sandy loam, and Grassy Butte loamy sand. The soil at the new explosive test pad is likely the Grassy Butte series. The downrange target area likely intersects areas of Grassy Butte, Rock Outcrop, and Bondfarm sandy loam.

Both Grassy Butte and Bondfarm sandy loam soil have a very high potential for wind erosion. The very high wind erosion hazard limits use of these soils (Hafla, et al., 2019). These soils are not suited to mechanical rangeland management treatments, including seeding due to erosion potential. These soils also exhibit an impaired ability to support vehicle traffic.

3.4.2 RRTR

Terreton silty clay loam forms in old lakebeds. Terreton silty clay loam comprises the primary soil type at the NTR gravel pit. The soil is very deep and well drained. This soil is typically suitable for crops and native vegetation is usually in excellent condition. Coarse material likely inundates the gravel pit, making it suitable for extraction and use as a borrow source. A large portion contained in the proposed fence is used as a gravel source and is devoid of vegetation.

The soil map (Figure 11) shows Whiteknob gravelly loam in the northwest corner of the proposed fenced area. This soil is deep, well drained, and the underlying mixture is often gravelly or very gravelly sand. This soil type could range farther south, contributing to the suitability for using the area as a gravel source.

The Coffee-Nargon-Atom complex soil (2 to 12% slopes) constitutes the only soil type at STR. This soil is moderate to very deep, well drained, and formed in alluvium from loess deposited on basalt. Areas composed of this soil type are found at elevations between 4,500 and 5,500 ft and receive an average of 10 in. of precipitation per year. The soils are moderately extensive throughout southeast Idaho and dominated by sagebrush (Hafla, et al., 2019).

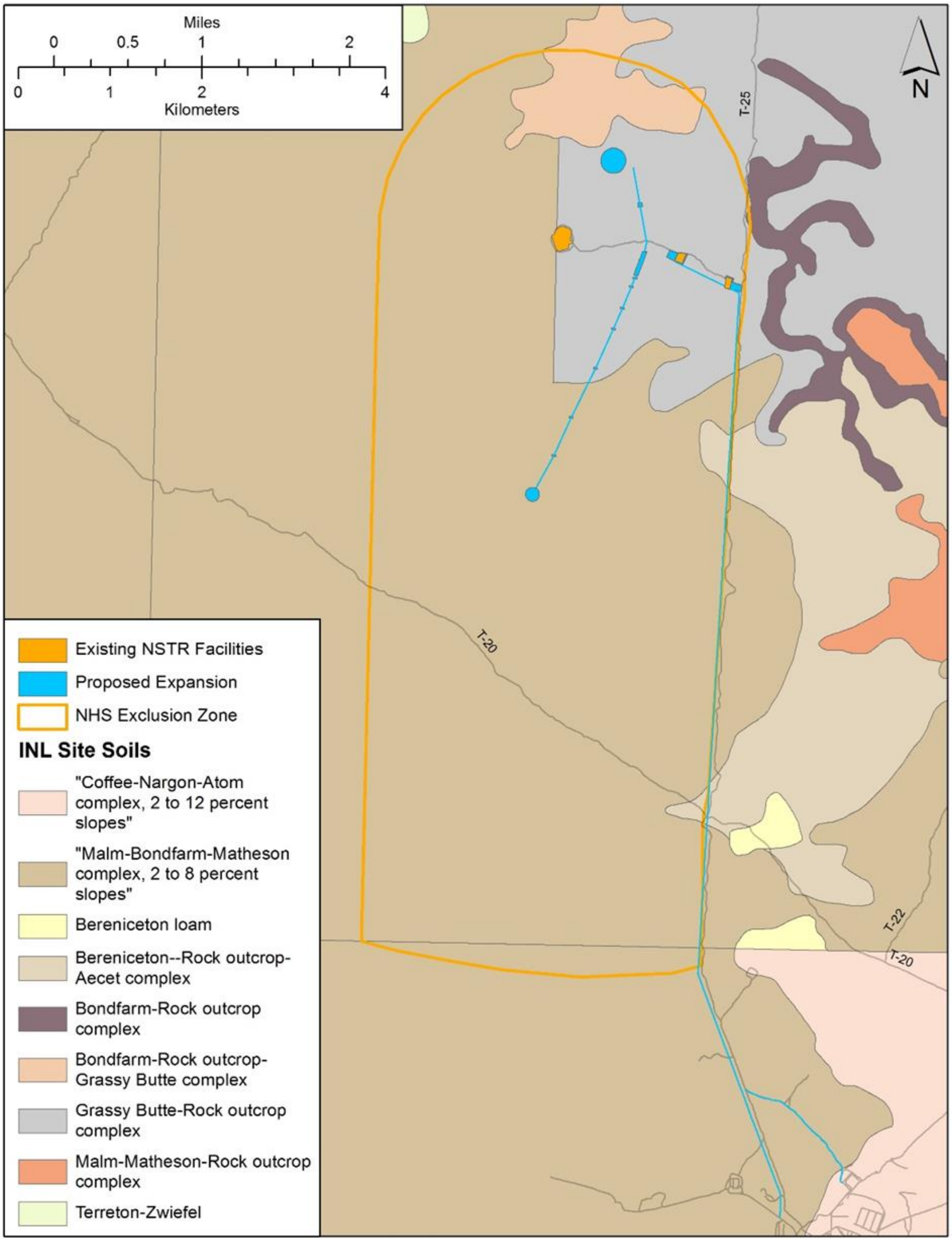

Figure 10. Soils at NSTR.

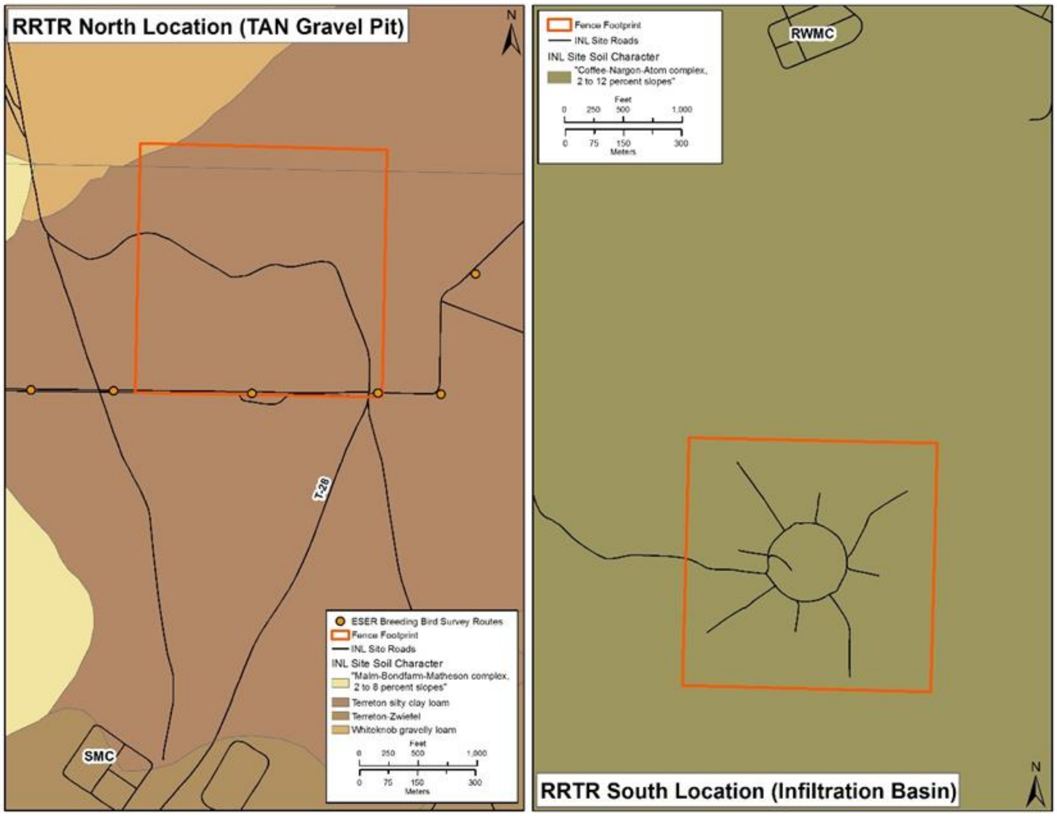

Figure 11. Soils at RRTR locations.

3.5 Water Quality

3.5.1 Groundwater

The Snake River Plain Aquifer (SRPA) under the INL Site lies from 220 ft below land surface at Test Area North to 610 ft below land surface at STR. The geology above the SRPA (i.e., the vadose zone) consists of about 95% basalt flows covered with a layer of soil with thin layers of sediments (1 to 20-ft thick) between basalt flows. The SRPA has geology like the overlying vadose zone and is about 250 to 900-ft thick.

The eastern SRPA is the source for 12 active public water systems at the INL Site and is the primary source for drinking water and crop irrigation in the Upper Snake River Basin. The Environmental Protection Agency (EPA) recognizes the eastern SRPA as a sole source aquifer, because most people living above the aquifer use it as the only source of drinking water. The designation recognizes the importance of water quality in the eastern SRPA. Figure 12 shows predicted average linear flow velocity vectors in the eastern SRPA beneath the INL Site (DOE-ID, 2008).

Historical waste disposal practices have produced localized areas of chemical and radiochemical contamination beneath the INL Site in the eastern SRPA. These areas are regularly monitored, and reports are published showing the extent of contamination plumes.

Groundwater surveillance monitoring is performed for CERCLA waste area groups and the INL Site. At Test Area North, near NTR, groundwater monitoring evaluates the progress of remediation of the plume of trichloroethene. Remedial action consists of three components: (1) in situ bioremediation; (2) pump and treat; and (3) monitored natural attenuation. Sr-90 and Cs-137 were present in wells in the source area at levels higher than those prior to starting in situ bioremediation. The elevated concentrations of these radionuclides are due to in situ bioremediation activities and are predicted to decline below EPA maximum contaminant levels by 2095 (DOE, 2018). No new wells are proposed at NTR.

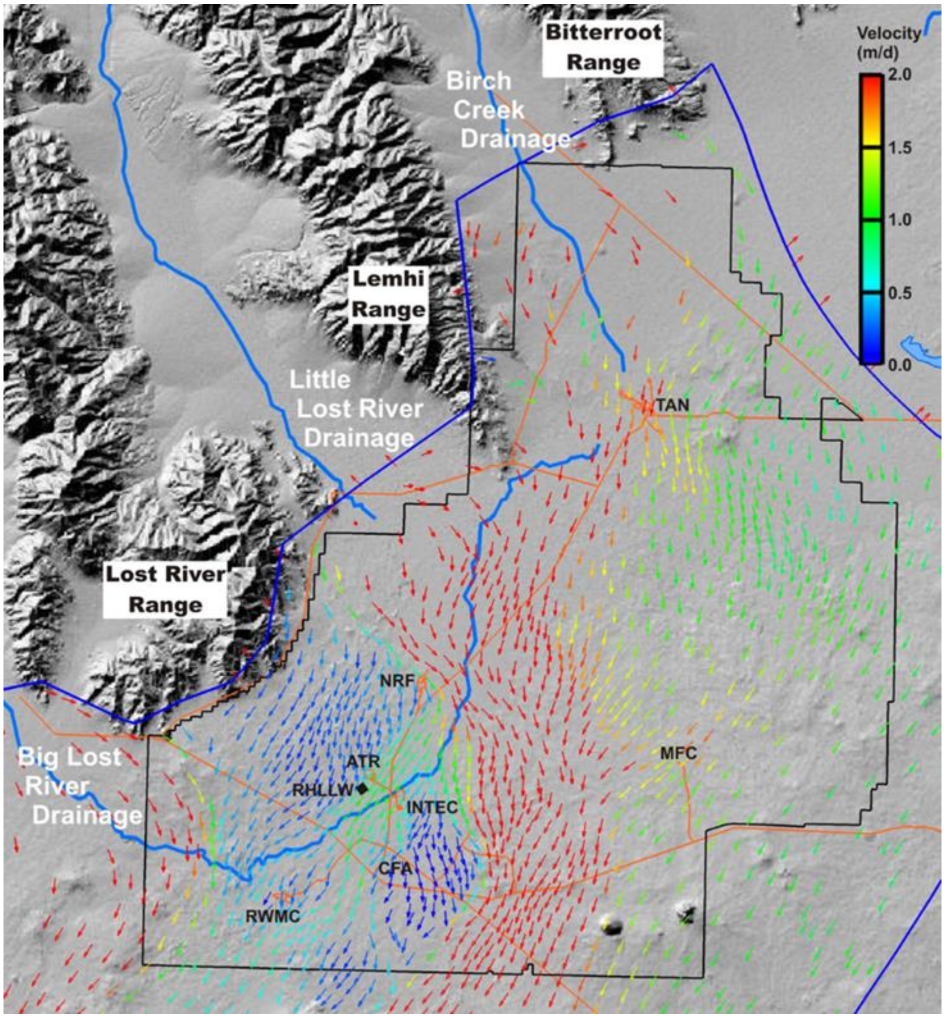

Figure 12. Model-predicted average flow in the SRPA beneath the INL Site.

Historically, volatile organic compound (VOC) concentrations in water samples from several wells at and near RWMC and STR exceeded reporting levels. Concentrations for all VOCs, except tetrachloromethane (also known as carbon tetrachloride), were less than the MCL for drinking water. Concentrations of carbon tetrachloride have routinely exceeded the MCL (5 μg/L) at RWMC since 1998. Trend test results for carbon tetrachloride concentrations in water from the RWMC production well indicate a statistically significant increase in concentrations since 1987, but also indicate a decreasing trend since 2005. The more recent decreasing trend indicates that engineering practices to reduce VOC movement to the aquifer are having a positive effect (DOE, 2018).

Wells at MFC monitored for radionuclides, metals, and other water quality parameters show no evidence of impacts from MFC activities (DOE, 2018). No known past source of potential groundwater contamination of the eastern SRPA occurs at or near NSTR. The nearest drinking water wells at MFC meet groundwater and drinking water standards.

3.5.2 Surface Water

The Big Lost River and Birch Creek are the only surface waters on the INL Site, and both streams carry water on an irregular basis, with most of the flow diverted for irrigation before entering the INL Site boundary. During high water years or during shutdown of the diversion, water has the potential to flow down the historic Birch Creek channel and through parts of the T-28 road and the gravel pit at NTR.

The Big Lost River on the INL Site flows northeast and ends in a playa area called the Big Lost River Sinks on the northwest portion of the INL Site. The river evaporates or infiltrates into the subsurface at the Big Lost River Sinks. No surface water moves off the INL Site.

3.6 Hazardous Materials and Waste Management

3.6.1 Hazardous Materials

Hazardous materials are broadly defined as materials with clearly hazardous properties that pose a substantial threat to human health or the environment. In general, these materials pose hazards from quantities, concentrations, or physical or chemical characteristics. Hazardous materials include common items such as petroleum products, coolants, paints, adhesives, solvents, corrosion inhibitors, cleaning compounds, and chemicals. Hazardous materials also are used in high-technology missiles, munitions, and targets because they are strong, lightweight, reliable, or long-lasting. Both live and inert munitions contain hazardous materials. Hazardous materials at the Ranges include fuel, lubricants, munitions, and cleaning and maintenance materials.

Hazardous constituents are defined as hazardous materials present at low concentrations in a generally non-hazardous matrix; therefore, their hazardous properties do not produce acute effects. Component hazardous materials are considered hazardous constituents. Components that contain hazardous constituents include propellants, batteries, igniters, fuel, diesel fuel, hydraulic fluid, and explosives. Each of these constituents has the potential to affect human health and the environment through direct contact with water, soil, or air.

Equipment used in testing and training does not intentionally release hazardous constituents into the environment. However, tactical equipment may produce waste streams that contain hazardous constituents. Waste streams are handled according to standard DOE procedures and are not released into the environment.

Expended testing and training material such as bombs, targets, and detonation residues can release contaminants to the environment during use or leach small amounts of toxic substances as they explode and decompose. The hazardous constituents that may be released upon use are generally referred to as energetic chemicals. Most are commonly found in the explosive, propellant, and pyrotechnic elements of munitions. These constituents may also leak from munitions that do not detonate upon impact as intended.

DOE conducted a baseline assessment to determine the potential for munitions constituents from NSTR to migrate off-range and cause an unacceptable risk to human or ecological receptors. This baseline assessment was conducted as part of the analysis in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID, 2007). Soil monitoring continues, at a minimum, every 5 years at NSTR. The analysis in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID, 2007) determined these constituents do not pose any significant impact to personnel or facilities on or off the INL Site.

3.6.2 Hazardous Waste Management

A hazardous waste may be a solid, liquid, semi-solid, or contain gaseous material that alone or in combination may: (1) cause, or significantly contribute to, an increase in mortality or an increase in serious irreversible or incapacitating reversible illness; or (2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed, or otherwise managed.

RCRA (42 USC § 6901 st seq.) regulates management of solid waste and hazardous waste. The EPA Military Munitions Rule (40 CFR Parts 260, 261, 262, 263, 264, 265, 266, and 270, 1997) clarifies when conventional and chemical military munitions become a hazardous waste under RCRA. The rule applies to DOE and the Department of Defense. Military munitions are not considered hazardous waste under two conditions stated in the Military Munitions Rule. These conditions cover virtually all uses of munitions and targets at NSTR. Specifically, munitions are not considered hazardous waste when:

- Used for their intended purpose, including training military personnel and explosive emergency response specialists, research and development activities, and when recovered, collected, and destroyed during range clearance events

- Unused and being repaired, reused, recycled, reclaimed, disassembled, reconfigured, or subjected to other material recovery activities.

Hazardous waste is present at INL Site facilities. These materials are accumulated in designated areas and then transported to licensed disposal facilities in accordance with RCRA requirements.

3.7 Noise and Ground Vibration

Testing and training conducted at the Ranges, particularly explosives use at NSTR, present certain safety and health concerns due to fragmentation, air blasts, ground shock, and projectiles. Characteristic noise associated with NSTR explosives testing occurs in pulses rather than as continuous noise. The *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID, 2007) evaluated the noise and ground velocity impacts associated with the maximum test size of 20,000 lb NEW and found that noise and ground motion from 20,000-lb explosives tests have only minor impacts on personnel or facilities on or off the INL Site. Noise levels at the Ranges have not increased above levels analyzed in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID, 2007) and the *Final Idaho National Laboratory Radiological Response Training Range Environmental Assessment and FONSI* (DOE-ID, 2010).

3.8 Public Health and Safety

Public health and safety issues include potential hazards inherent in testing and training operations at the Ranges. It is DOE policy to observe precautions in planning and executing all activities that occur on the Ranges to prevent injury to people or damage to property. Procedures established for the safe use of materials at the Ranges set restrictions on the use of various types of ordnance and certain types of operations. Procedures provide specific safety guidelines for each individual range and testing and training facility.

Public health and safety from current operations at the Ranges are discussed in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID, 2007) and the *Final Idaho National Laboratory Radiological Response Training Range Environmental Assessment and FONSI* (DOE-ID, 2010).

3.9 Environmental Justice

Executive Order 12898, *Federal Action to Address Environmental Justice in Minority Populations and Low-Income Populations* (1994), directs Federal agencies to address disproportionately high and adverse human health or environmental effects of proposed projects on minority populations and low-income populations.

Sixteen counties are within 50 miles of the INL Site. Fifteen of these counties are in the State of Idaho and one is in the State of Montana. This 16-county region has a low population density. In 2010, the population for this region was 390,608 (U.S. Census Bureau, 2011). Nearly 48% of this population resides in the two most populous counties: Bonneville and Bannock. The largest regional cities are Idaho Falls (located in Bonneville County), with a 2010 estimated population of 56,891 residents, and Pocatello (located in Bannock County), with a 2010 estimated population of 54,224 residents. These two cities represent about 28% of the regional population. The Fort Hall Indian Reservation is located south of the INL Site. It has a 2010 estimated population of 3,201 (about 2% of the population in the five counties in which the INL Site is located).

Table 13 (U.S. Census Bureau, 2018b) lists population by race and Hispanic or Latino origin for the five counties in which the INL Site is located.

Table 13. INL five county population by race and Hispanic or Latino origin.

County	Total Population	Race							Hispanic or Latino (of any race)
		One race						Two or More Races	
		White	Black or African American	American Indian and	Asian	Native Hawaiian and Other	Some Other Race		

				Alaska Native		Pacific Islander			
Bingham	45,607	36,752	105	2,970	285	36	4,480	979	7,864
Bonneville	104,234	94,411	585	790	856	86	5,334	2,172	11,912
Butte	2,891	2,761	6	13	5	5	59	42	119
Clark	982	711	7	10	5	0	234	15	398
Jefferson	26,140	23,844	52	203	103	23	1,514	401	2,641
Total	179,854	158,479	755	3,986	1,254	150	11,621	3,609	22,934

For the purpose of this EA, minority populations are those listed in Table 13, except white persons. Minority populations make up about 25% of the five-county population (i.e., 44,174 individuals), and persons of Hispanic or Latino origin comprise 52% of the minority population (i.e., about 12.8% of the total population).

Table 14 shows the percentage of the five-county population living in poverty and median household income in dollars (U.S. Census Bureau, 2018c).

Table 14. Percentage of five county area population in poverty and median household income in dollars by county.

Year	State / County Name	All Ages in Poverty %	Under Age 18 in Poverty %*	Ages 5 to 17 in Families in Poverty %	Median Household Income in Dollars
2017	Bingham County (ID)	12.5	16.1	15.1	$52,697
2017	Bonneville County (ID)	10.5	13.3	11.8	$55,744
2017	Butte County (ID)	16.9	22.1	18.1	$45,226
2017	Clark County (ID)	14.5	21.4	19.2	$42,226
2017	Jefferson County (ID)	9.2	11.3	10.2	$59,869
*Data for ages under age 5 are not available for the counties listed.					

The Fort Hall Indian Reservation has a poverty rate of about 26%, while about 43% of families with children under 18 are below the poverty level (U.S. Census Bureau, 2018a).

4. ENVIRONMENTAL CONSEQUENCES

This section evaluates potential impacts of the proposed action and no action alternative. The CEQ regulations for implementing NEPA require the environmental consequences discussion to address both direct and indirect effects and their significance (40 CFR § 1502.16). Direct effects are caused by the action and occur at the same time and place (40 CFR § 1508.8). Indirect effects are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable (40 CFR § 1508.8). This section discusses potential direct, indirect, and cumulative environmental impacts resulting from implementation of the proposed action.

Assumptions were made to determine impacts of the proposed action within the project area. Construction disturbance was quantified for both temporary and permanent disturbance to estimate the acreage disturbed as presented in Table 1. Using these assumptions, the proposed action permanently disturbs about 460 acres.

4.1 Proposed Action

Preliminary analysis indicates that implementing the proposed action would not result in impacts on the following elements of the human environment: land use and aesthetic resources, socioeconomics, and surface water. Therefore, this EA does not analyze these elements further for the reasons given in the following paragraphs:

Land Use and Aesthetic Resources – Implementing the proposed action would not introduce new land uses at the INL Site. Activities associated with the proposed action are consistent with current land uses for the INL Site. Implementing the proposed action would not degrade the visual character or quality of the INL Site or its surroundings. Therefore, implementing the proposed action would not affect land use or aesthetic resources.

Socioeconomics – Implementing the proposed action could result in hiring of new employees over time at the INL Site. However, because the increase would be gradual over time and because this would be minimal compared to the rest of the INL Site workforce, potential impacts on the local economy, housing demand, and population growth would be negligible. Therefore, implementing the proposed action would not result in impacts on socioeconomics over the no action alternative.

Surface water – Birch Creek is the only surface water feature in the project area. A permanent control structure diverts the entire stream flow for hydropower production at a power plant several miles north and east of NTR and does not return water to the natural channel. Irrigation consumes flow passing through the power plant. Water not used for irrigation during winter infiltrates the surface in trenches above NTR constructed for flood control and aquifer recharge. Ephemeral flow resulting from precipitation events can flow down the historic Birch Creek channel and through parts of the T-28 road and the gravel pit at NTR. The proposed action does not include activities that physically or chemically alter surface water resources and testing activities are not authorized when water is present in the NTR pit. Therefore, the proposed action does not affect surface water resources.

4.1.1 Air Quality

The proposed action has the potential to generate particulate emissions (i.e., dust) from bulldozing, grading, excavating, and dumping during construction and additional grading for road maintenance. To reduce the potential for fugitive dust, construction crews apply water during soil disturbance. In addition, the proposed action covers soils, replants after construction before erosion becomes advanced, and uses engineering controls (e.g., geotextiles) or other methods to prevent fugitive dust and blowing sand.

All portable/mobile generators used during construction and operations activities would be removed within 1 year of installation.

To minimize dispersals and areas of effect, weather conditions are monitored at the Ranges, and testing and training are postponed as necessary. Project activities are subject to air permitting applicability determinations and additional reviews to limit environmental impacts. The proposed action does not allow releases that exceed the limitations of this EA (e.g., require an air permit, exceed the CERCLA reportable quantity, exceed groundwater or drinking water standards in the aquifer, or exceed CERCLA screening levels in soil).

The proposed action does not install any stationary air pollution sources but does produce air contaminants from construction and operations activities. Air quality modeling furnishes a means to estimate downwind air pollution concentrations, given information about the pollutant emissions and nature of the atmosphere. Impacts to air quality from radiological activities at the Ranges considers pollutant transport, dispersion, and transformation in the atmosphere. This analysis evaluates non-radiological and radiological impacts to air quality.

4.1.1.1 *Non-Radiological Impacts NSTR.* Non-radiological explosives and ballistic testing only takes place at NSTR. Proposed activities at NSTR generate air pollutants such as criteria pollutants (e.g., carbon monoxide and sulfur oxides), fugitive dust, soil particles ejected by blasts, and toxic pollutants (e.g., ammonia and formaldehyde). Proposed testing limits explosive amounts and types to keep emissions from exceeding permit to construct facility emission cap limits, indicating very low levels of releases.

Potential airborne emissions from detonating various explosives at NSTR and the effect of those emissions on air quality was modeled for the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID, 2007) and is described in EDF-7147 (INL, 2006). Constituent information used in the 2006 analysis has not changed and the analysis remains valid.

Calculated maximum quantities of explosives that could be detonated without exceeding ambient air concentration limits for toxic air pollutants and criteria pollutant National Ambient Air Quality Standards at points of compliance are documented in EDF-7147 (INL, 2006). Table 15 (INL, 2006, p. 7) lists allowable releases of pollutants as products of explosives and PM_{10} from displaced soil. DOE based these calculations on air modeling (using EPA's toxic screening model), regulatory air quality limits, and background air concentrations. Calculations used the following receptor locations:

1. The nearest public access location, which is a point 7.0 miles from the proposed test range on Idaho State Highway 33 (used for criteria pollutants and toxic air pollutants with short-term limits)
2. A point on the nearest INL Site land boundary, which is 10.9 miles from the proposed test range (used for formaldehyde, which is the carcinogenic toxic air pollutant with an annual limit).

Table 15. Allowable releases of pollutants as products of explosives and PM_{10} from displaced soil.

Contaminant	Receptor Location	Averaging Period	Air Concentration Limit[8] ($\mu g/m^3$)	INL Site Background Concentration	Unit Concentration ($\mu g/m^3$ per lb released)	Allowable Release (lb)
Criteria Pollutants						
Carbon monoxide	Hwy33	8 hours	10,000	2300	4.01E+00	1.92E+03
Carbon monoxide	Hwy33	1 hour	40,000	3600	3.21E+01	1.14E+03
Pb	Hwy33	Quarterly	1.5	0.03	1.46E-02	1.00E+02
PM_{10}	Hwy33	Annual	50	9.6	3.66E-03	1.10E+04
PM_{10}	Hwy33	24 hours	150	43	1.34E+0O	8 .01E+01
NO_2	Hwy33	Annual	100	4.3	3.66E-03	2.61E+04
Sulfur oxides	Hwy33	Annual	80	8	3.66E-03	1.97E+04
Sulfur oxides	Hwy33	24 hours	365	26	1.34E+00	2.54E+02
Sulfur oxides	Hwy33	3 hours	1,300	34	1.07E+01	1.18E+02
Toxic Pollutants						
Al_2O_3	Hwy33	24 hours	500	NA	1.34E+00	3.74E+02
CH_2O_2	Hwy33	24 hours	470	NA	1.34E+00	3.52E+02
CH_3OH	Hwy33	24 hours	13,000	NA	1.34E+00	9.73E+03
HCI	Hwy33	24 hours	375	NA	1.34E+00	2.81E+02
HCN	Hwy33	24 hours	250	NA	1.34E +00	1.87E+02
H_2S	Hwy33	24 hours	700	NA	1.34E+0O	5.24E+02
Ammonia	Hwy33	24 hours	900	NA	1.34E+00	6.74E+02
Carcinogens						
Formaldehyde	INL Site Boundary	Annual	7.7E-02	NA	1.98E-03	3.89E+01

Explosive blasts also eject soil particles. Emissions of soil particles with an aerodynamic diameter less than or equal to 10 micrometers (PM_{10}) were conservatively estimated based on blast crater volumes and the clay fraction measured in soil samples from NSTR. Modeling data show no exceedance of PM_{l0} ambient air limits.

The maximum quantities of explosives that could be detonated without exceeding air quality limits does not change under the proposed action and are listed in Table 16 (also in Table 7 of the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID, 2007, p. 31).The analysis of air effects from fugitive dust, criteria pollutants, and toxic pollutants in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID, 2007) and remains valid.

Table 16. Maximum tons of explosives meeting air quality standards and permit to construct exemption criteria.

Explosive	1 Hour	8 Hours	24 Hours	Annual
	Averaging Time			
AI-IPN	0.2	0.2	0.2	6.1
Ammonium Picrate	6.7	56.7	56.7	2,124.9
AN-AI	0.3	0.3	0.3	12.7
ANFO	16.9	28.7	69.2	298.5
AN-NM	56.7	56.7	56.7	2,124.9
Baratol	0.4	0.4	0.4	15.9
Binex 400	1.0	1.0	1.0	38.2
Black Powder	6.7	11.3	21.8	117.6
Dexs	56.7	56.7	56.7	2,124.9
Detonators	0.1	0.1	0.1	0.4*
Dynamite Ammonia	16.9	16.9	16.9	317.5
Dynamite Gelatin (Nitroglycerine)	10.9	18.5	56.7	150.9
Dynamite Straight	4.0	6.8	56.7	71.2
Explosive Mixtures				
HMX Explosives	0.9	0.9	0.9	34.3
HMX-GAP	0.4	0.4	0.4	13.6
NM-AI	0.3	0.3	0.3	12.6
PETN	3.8	6.5	44.7	67.3
RDX	5.8	9.8	15.3	102.0
Semtex	4.6	7.8	29.3	81.0
Smokeless Powder	14.7	25.0	25	259.7
Tetryol	53.5	53.5	53.5	2,004.6
TNT	1.4	2.4	6.9	25.1

*No more than 0.1 ton per quarter year

Air emissions from proposed construction activities at NSTR are like typical facility and infrastructure construction projects. Light-duty and heavy-duty trucks are used to level sites, deliver materials to the construction areas, and remove any debris within the project area. During construction, short-term adverse effects on air quality may result from dust and exhaust emissions. Construction phases of the proposed action at NSTR do not increase local air pollutant concentrations beyond state and federal standards at any time. Topography and meteorology of the project area does not restrict dispersion of air pollutants. Localized, short-term effects to air quality from construction activities are expected. Once construction activities are completed, air quality returns to near pre-construction levels. Because of the limited nature of construction activities and use of project controls (e.g., applying water to disturbed areas), air quality impacts would be negligible.

Mobile source usage would increase during construction from heavy equipment and during maintenance and operations at the Ranges. The INL Site is in an area classified by EPA as attainment for all criteria pollutants. Therefore, DOE is not required to keep records on, or otherwise track, air emissions generated by the mobile sources operating on and around the Ranges.

4.1.1.2 Non-Radiological Impacts RRTR. Non-radiological air quality impacts from explosives testing are not evaluated for RRTR. The RRTR ranges (NTR and STR) do not allow this type of non-radiological explosives and ballistic testing. Explosives use at the NTR and STR are limited to that needed for radiological response training as described in Section 2.1.

The proposed action installs a 6 to 8-ft tall chain link fence around the RRTR NTR and STR to control access to radiological training areas (see Figures 6 and 7). Light-duty and heavy-duty trucks deliver materials to the areas and remove construction and other debris. During fence construction, short-term adverse effects on air quality may result from dust and exhaust emissions. Topography and meteorology of the project area do not restrict dispersion of air pollutants. Localized, short-term effects to air quality from construction activities are expected. Once construction activities are completed, air quality returns to near pre-construction levels. Fence maintenance involving vehicle use on dirt roads generates fugitive dust and exhaust emissions in small quantities not exceeding regulatory limits. Because of the limited nature of construction activities and use of project controls (e.g., applying water to disturbed areas), air quality impacts would be negligible.

The *Final Idaho National Laboratory Radiological Response Training Range Environmental Assessment and FONSI* (DOE-ID, 2010) analyzed effects to air quality from initial operations of RRTR such as fugitive dust, criteria pollutants, and toxic pollutants and found only minimal impacts to air quality.

4.1.1.3 Radiological Impacts. While the proposed training limits the area of impact from explosive detonations to the disturbed areas of the explosive test pad, radiological training pad at NSTR, to disturbed areas of RRTR and spreading radioactive materials with mechanical spreaders or sprayers to these same areas, these dispersals produce airborne radioactive contaminants. Atmospheric transport of radionuclides to potential receptors and time-integrated air concentrations were calculated with a Gaussian plume model and 3 years of hourly meteorological data from the nearest meteorological tower to compute the dispersion factor for each worker and public receptor location (Sondrup (2019a) and (2019b)). The dispersion factor is the atmospheric concentration of a radioactive material divided by the source strength at a given distance and direction from the source. The dispersion factor illustrates dilution and dispersal effects in the atmosphere.

The analysis assumes performing 12 tests per year at each test area using all six material types (i.e., Cu, F, KBr, K_2O, $LaBr_3$, and Zr) in each test. More or fewer tests may be performed each year with higher or lower release rates, but the total annual release rate remains the same. The analysis is conservative, because using two radioactive materials per test is more realistic than the model assumption. The model also conservatively assumes each test releases the total activity to the atmosphere, and the radionuclides are easily transported through the air. The analysis is especially conservative for the copper and zirconium metal particulates, which are about 1 mm in size. The proposed action uses liquid fluorine, but this analysis assumes fluorine moves in the environment as a respirable particulate.

The U.S. Nuclear Regulatory Commission Regulatory Guide 1.145 (NRC, 1983) recommends using the 95th percentile dispersion factor in consequence analysis of reactor accidents. The 95th percentile dispersion factor translates to a 5% chance of dose exceedance. In calculating the 95th percentile dispersion factor, the model considers the hours between 9:00 am and 4:00 pm.

For dose calculations, multiplying the 95th percentile dispersion factors by the total annual releases gives a time-integrated concentration at each receptor location. The product of the time-integrated concentration and the inhalation rate delivers an intake rate that yields an annual inhalation dose when multiplied by a dose coefficient. For submersion doses, the time-integrated concentration multiplied by the submersion dose coefficient yields the annual dose from submersion. The total dose is the sum of the inhalation and submersion doses.

4.1.1.4 Radiological Impacts NSTR. Explosive radiological dispersals at NSTR use up to a 5-lb NEW TNT equivalent. Radiological air effects at NSTR were analyzed for tests performed at the new explosives test pad and the new radiological training pad (Sondrup, 2019b). A Gaussian plume model used 3 years of hourly meteorological data (2006 through 2008) from the meteorological tower at nearby MFC.

Table 17 shows the annual ED results for each test location by radionuclide for the worker and public receptor locations with the maximum 95th percentile dispersion factor from all analyzed receptors. The table shows total dose by material type and the total dose assuming all six proposed material types during each test.

Table 17 also displays the overall total dose for tests at the new explosives test pad and radiological training pad.

Comparing the 95th percentile dispersion factors for the public shows Location 16 has the highest dispersion factor for the new explosives test pad and Location 13 has the highest for the radiological training pad. Locations 13 and 16 are farmhouses located near Mud Lake, Idaho (see Figure 13).

Figure 14 shows the percent contribution to the total dose by material type for each receptor. The graph is the same for the new explosives test pad and the radiological training pad. The graphs show most dose comes from Zr-97 for both worker and public receptors. The Cu-64 contributes very little to total dose (2.2%).

The overall maximum 95th percentile annual EDs for workers and public receptors are much less than regulatory limits. The maximum 95th percentile dose for a public receptor is 0.0417 mrem/year, which is about 1/239th the regulatory limit of 10 mrem/year. This dose is the maximum dose at Location 16 for tests at the new explosive test pad (12.1 miles north-northeast of the new explosive test pad), plus the maximum dose at Location 13 for tests at the radiological training pad (14.6 miles northeast of the radiological training pad).

Table 17. Maximum 95th percentile annual ED results for NSTR.

Radionuclide	New Explosive Test Pad		Radiological Training Pad	
	Worker Dose (CITRC)[a] (mrem/year)	Public Dose (Location 16)[a] (mrem/year)	Worker Dose (CITRC)[a] (mrem/year)	Public Dose (Location 13)[a] (mrem/year)
Material: Potassium Oxide (K_2O)				
Total Dose K_2O	**3.77E-03**	**2.77E-03**	**4.23E-03**	**2.42E-03**
Material: Lanthanum Bromide ($LaBr_3$)				
Total Dose $LaBr_3$	**1.82E-03**	**1.32E-03**	**2.04E-03**	**1.15E-03**
Material: Potassium Bromide (KBr)				
Total Dose KBr	**7.60E-03**	**5.36E-03**	**8.52E-03**	**4.68E-03**
Material: Copper Metal				
Total Dose Cu-64	**6.02E-04**	**4.32E-04**	**6.75E-04**	**3.78E-04**
Material: Zirconium Metal				
Total Dose Zr-97	**6.02E-04**	**4.32E-04**	**1.68E-02**	**9.88E-03**
Material: Fluorine				
Total Dose F-18	**1.58E-03**	**1.06E-03**	**1.77E-03**	**9.26E-04**
Total Dose All Materials	**3.04E-02**	**2.22E-02**	**3.41E-02**	**1.94E-02**

a. See Figure 13 for locations.

Although the maximum public dose locations are different for the two test locations at NSTR, this analysis conservatively adds the dose values together for comparison to the regulatory limit (see Table 18). The maximum 95th percentile dose for a worker is 0.0644 mrem/year (less than 1/77,000th the federal limit of 5,000 mrem/year). This dose is for a worker located at CITRC, 13.5 miles southwest of the new explosives test pad and 11.4 miles southwest of the radiological training pad. This dose is from 12 tests per year at both the new explosive test pad and the radiological training pad.

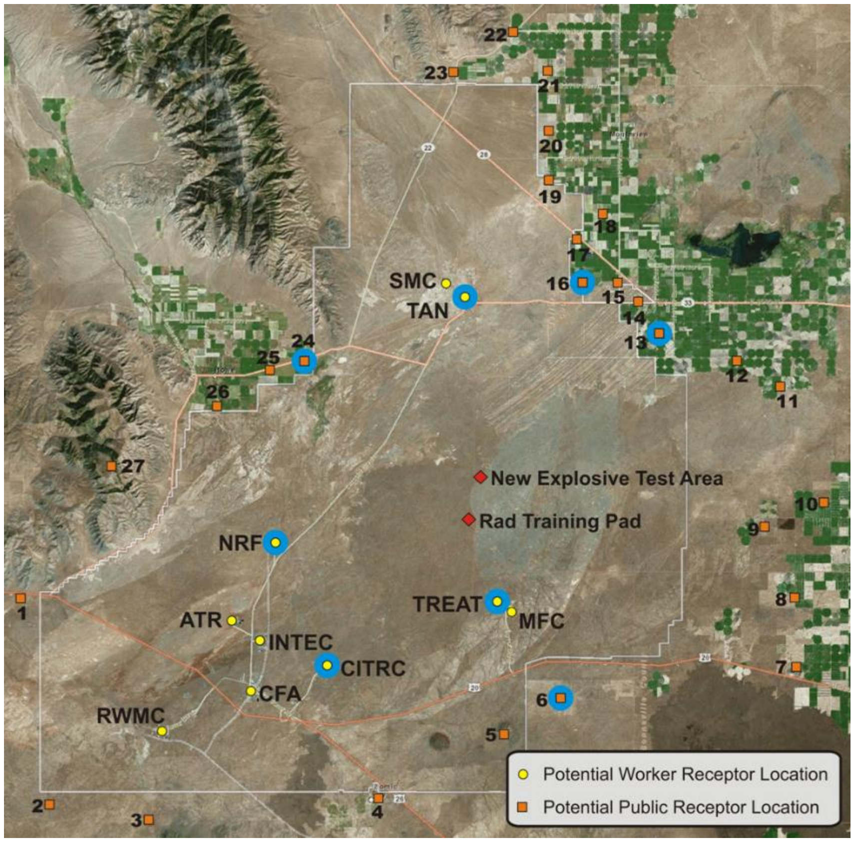

Figure 13. Potential NSTR public and worker receptor locations (analyzed receptors shown in blue).

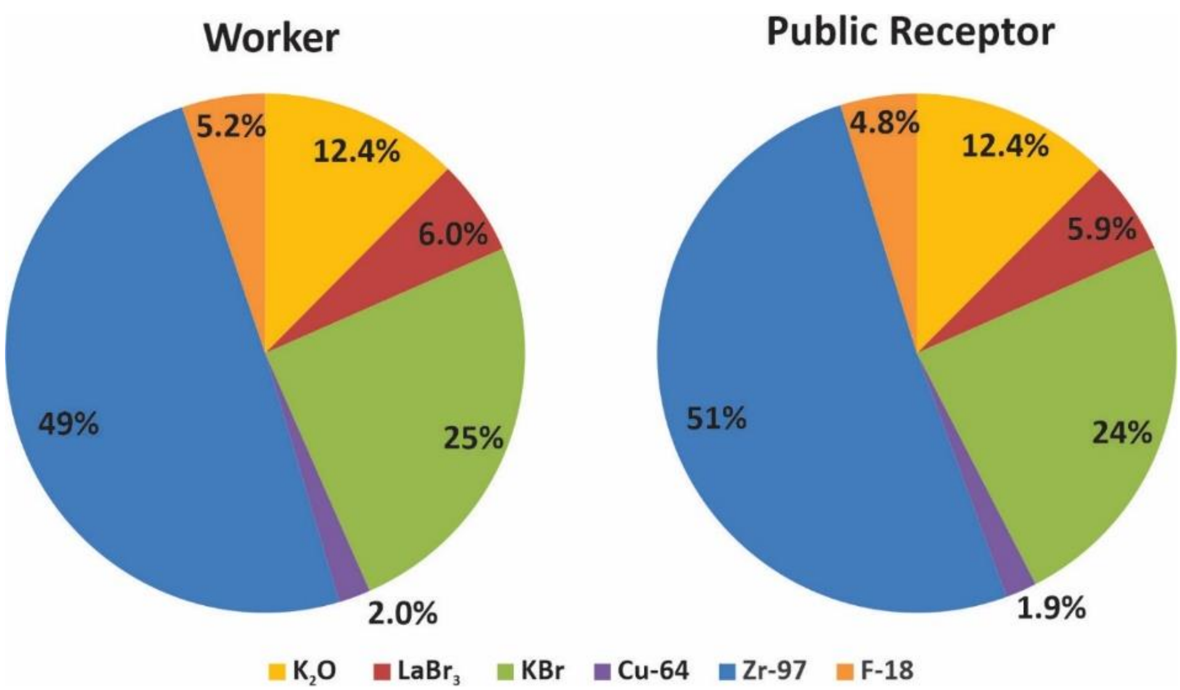

Figure 14. Percent contribution to total dose by material type for NSTR worker and public receptors.

The maximum 95th percentile dose for a public receptor is 0.0417 mrem/year. Although the maximum public dose locations are different for the two test locations at NSTR, this analysis conservatively adds the dose values together for comparison to the regulatory limit (see Table 18). The maximum 95th percentile dose for a worker is 0.0644 mrem/year (less than 1/77,000th the federal limit of 5,000 mrem/year). This dose is for a worker located at CITRC, 13.5 miles southwest of the new explosives test pad and 11.4 miles southwest of the radiological training pad. This dose is from 12 tests per year at both the new explosive test pad and the radiological training pad.

Table 18. Overall combined maximum 95th percentile annual ED for both NSTR locations.

Test Location	Worker Dose (mrem/yr)	Public Dose (mrem/yr)
New Explosives Test Pad	3.04E-02 (CITRC)[a]	2.22E-02 (Location 16)[b]
Radiological Training Pad	3.41E-02 (CITRC)[a]	1.94E-02 (Location 13)[b]
Total	**6.44E-02**	**4.174E-02**[c]

[a] CITRC is the maximum worker dose location for both the new explosives test pad and the radiological training pad.

[b] Location 16 is the maximum public dose location for the new explosive test pad, and Location 13 is the maximum public dose location for radiological training pad. See Figure 13 for locations.

[c] Conservative sum of maximum dose from two different locations.

4.1.1.5 Radiological Impacts RRTR. The analysis evaluates radiological dose from potential atmospheric releases for public receptors off the INL Site and for workers at nearby INL Site facilities. The analysis couples a Gaussian plume model with 3 years of hourly meteorological data (i.e., 2006 through 2008). Meteorological data for the NTR analysis came from the nearest tower at Test Area North and data for STR came from the nearest tower at RWMC (Sondrup, 2019a).

The model calculated dispersion factors at potential public receptor and worker locations (see Figure 15). The analysis calculated dispersion factors for the nearest public receptors to both RRTR sources (i.e., STR and NTR). The public receptor nearest STR is Location 3 (Frenchman’s cabin) and the nearest to NTR is Location 19. Comparison of 95th percentile dispersion factors for Locations 2, 3, and 4, which are nearest to the STR, confirm Location 3 has the highest value. Comparison of 95th percentile dispersion factors for Locations 16 through 20, nearest NTR, indicate the maximum value was not at Location 19, but at Location 20. Location 3 is 3.75 miles south-southwest of STR. Location 20 is 9.18 miles northeast of NTR.

The analysis also calculated dispersion factors for workers at INL Site facilities nearest NTR and STR. The northwest corner of the SMC facility is the worker occupied area nearest NTR (about 1.02 miles south-southwest of NTR) (see Figure 15). The STR worker exposure point is the parking lot at the southeast corner of RWMC, which is located about 0.93 miles north-northeast of STR. The analysis did not consider other facilities because of the proximity to SMC and RWMC.

Figure 16 shows the percent contribution to the total dose by material type for each receptor. The graphs are the same for NTR and STR and show most of the dose comes from Zr-97 with smaller contributions from F-18, K_2O, KBr, and $LaBr_3$ for both receptors. Cu-64 contributes little to the total dose (about 2%).

The calculated maximum 95th percentile annual EDs for workers and public receptors are considerably less than the regulatory limits. The maximum 95th percentile dose for a public receptor is 0.0482 mrem/year, which less than 1/207th the regulatory limit of 10 mrem/year from airborne emissions. This dose is for a receptor 9.2 miles northeast of NTR. The maximum 95th percentile public dose for STR is 3.43E-04 mrem/year, which is also much less than the regulatory limit of 10 mrem/year. The maximum 95th percentile doses for workers are about the same for the NTR (i.e., 0.605 mrem/year) and STR (i.e., 0.594 mrem/year). These doses are less than 1/8200th of the federal worker dose limit of 5,000 mrem/year.

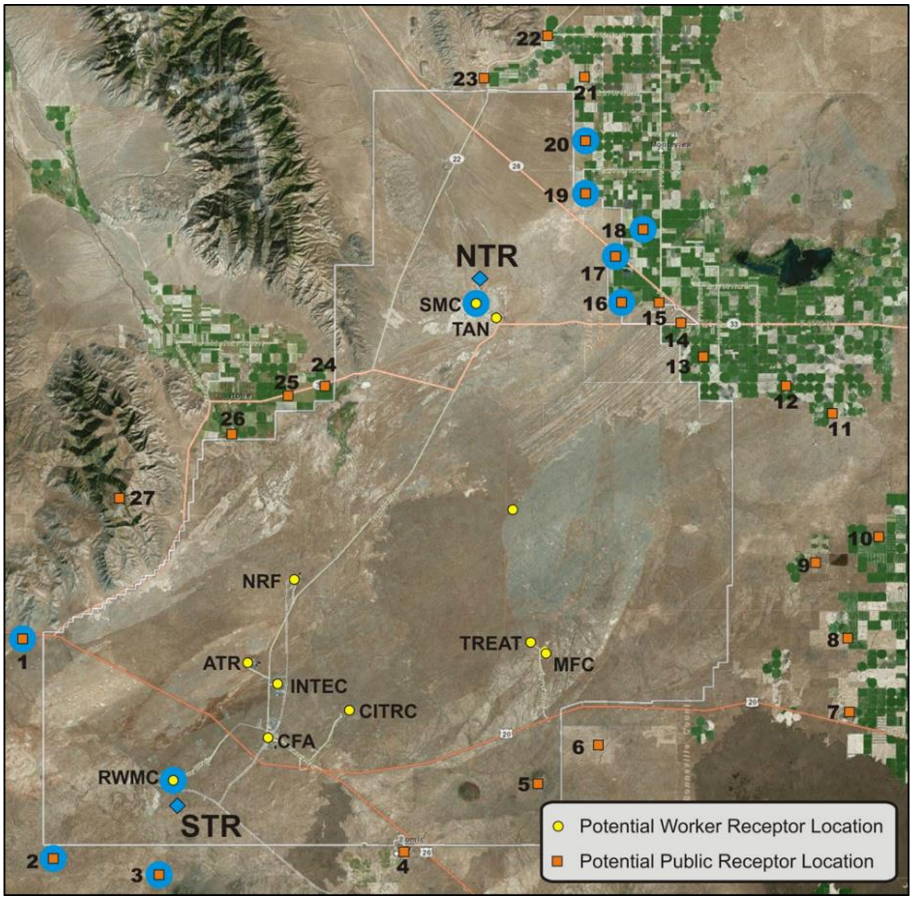

Figure 15. Potential RRTR public and worker receptor locations (analyzed receptors shown in blue).

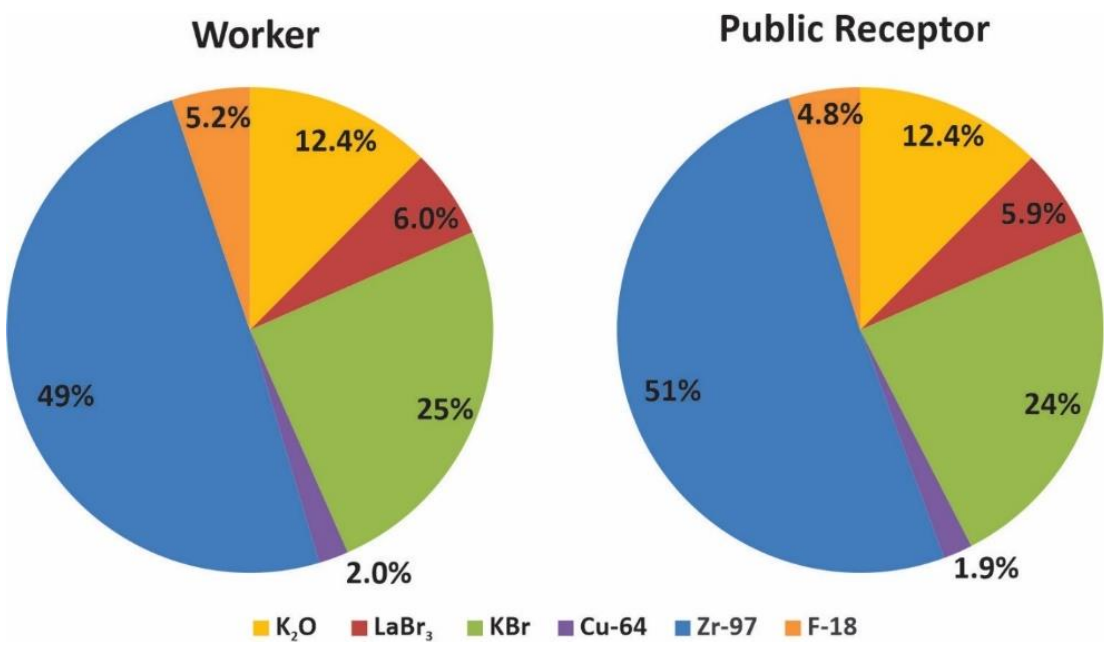

Figure 16. Percent contribution to total dose by material type for the NTR and STR worker and public receptors.

Table 19 shows the annual ED by radionuclide for the NTR and STR worker and public receptor locations. The table shows total dose by material type and the total dose assuming use of all six material types during each test.

Table 19. Maximum 95th percentile annual ED results for NTR and STR.

	------- North Test Range -------		------- South Test Range -------	
Radionuclide	**Worker Dose (SMC)[a] (mrem/year)**	**Public Dose (Location 20)[a] (mrem/year)**	**Worker Dose (SMC)[a] (mrem/year)**	**Public Dose (Location 20)[a] (mrem/year)**
Material: Potassium Oxide (K_2O)				
Total Dose K_2O	7.52E-02	6.00E-03	7.38E-02	4.26E-05
Material: Lanthanum Bromide ($LaBr_3$)				
Total Dose $LaBr_3$	3.62E-02	2.85E-03	3.55E-02	2.03E-05
Material: Potassium Bromide (KBr)				
Total Dose KBr	1.51E-01	1.16E-02	1.49E-01	8.26E-05
Material: Copper Metal				
Total Dose Cu-64	1.20E-02	9.37E-04	1.18E-02	6.66E-06
Material: Zirconium Metal				
Total Dose Zr-97	2.99E-01	2.45E-02	2.93E-01	1.74E-04
Material: Fluorine				
Total Dose F-18	3.14E-02	2.30E-03	3.08E-02	1.63E-05
Total Dose All Materials	**6.05E-01**	**4.82E-02**	**5.94E-01**	**3.43E-04**

a. See Figure 15 for locations.

Figure 16 shows the percent contribution to the total dose by material type for each receptor. The graphs are the same for NTR and STR and show most of the dose comes from Zr-97 with smaller contributions from F-18, K_2O, KBr, and $LaBr_3$ for both receptors. Cu-64 contributes little to the total dose (about 2%).

The calculated maximum 95th percentile annual EDs for workers and public receptors are considerably less than the regulatory limits. The maximum 95th percentile dose for a public receptor is 0.0482 mrem/year, which less than 1/207th the regulatory limit of 10 mrem/year from airborne emissions. This dose is for a receptor 9.2 miles northeast of NTR. The maximum 95th percentile public dose for STR is 3.43E-04 mrem/year, which is also much less than the regulatory limit of 10 mrem/year. The maximum 95th percentile doses for workers are about the same for the NTR (i.e., 0.605 mrem/year) and STR (i.e., 0.594 mrem/year). These doses are less than 1/8200th of the federal worker dose limit of 5,000 mrem/year.

4.1.1.6 Air Quality Modeling Summary and Potential Combined Impacts. Actual air impacts are likely less than those presented due to conservative assumptions and parameters used in the modeling (Sondrup 2019a, Sondrup 2019b). For example, calculations assume release and transport of the entire inventory of each material with no plume deposition, depletion, or radioactive decay during transport. The calculations also assume the same meteorological conditions (e.g., wind velocity, wind direction, and stability class) that produce the 95th percentile dose are the same during all 12 tests each year and the presence of the same receptor during all 12 tests. The analysis also assumes performing 12 tests each year at test locations using all six material types (Cu, F, KBr, K_2O, $LaBr_3$, and Zr) for each test. The assumption is conservative, because using only two materials per test is likely.

Maximum potential dose impacts were calculated and presented separately for the new explosives test pad and radiological training pad at NSTR and for NTR and STR at RRTR. The location of maximum effect for a member of the public was different for each test location. The location of maximum effect for a worker was different for RRTR's NTR (SMC) and STR (RWMC), but it was the same for the new explosives test pad and radiological training pad at NSTR (CITRC).

Modeling did not calculate the effect at a single receptor location (worker or public) from combined testing at locations. However, Table 20 shows the combined effect if the maximum dose results at different receptors are summed for the four test locations. Although the scenario is unrealistic, it highlights the summed results are still below regulatory limits for workers and members of the public. The dose estimates are also below the average background dose from environmental sources (terrestrial and cosmic radiation) for persons living at high altitude (about 0.3 mrem/day) (U.S. EPA, 2017).

The potential annual dose at Frenchman's Cabin has ranged between 0.01 mrem (2018) and 0.07 mrem (2009) over the last 10 years. While the modeled public doses are higher than the annual NESHAP dose, actual doses from testing at NSTR and RRTR are likely to be a smaller fraction of the dose to the INL Site MEI. For example, the estimated dose at the INL Site MEI location from testing at RRTR during 2018 was 7.56E-05 mrem/year (DOE, 2019b), which is less than 1% of the total MEI dose.

Table 20. Overall combined 95th percentile annual ED results for test locations.

Test Location	Worker Dose (mrem/year)	Public Dose (mrem/year)
NSTR New Explosives Test Pad	3.04E-02 (CITRC)	2.228E-02 (Location 16)
NSTR Radiological Training Pad	3.41E-02 (CITRC)	1.94E-02 (Location 13)
NSTR Total	6.44E-02	4.17E-02[a]
RRTR NTR	6.05E-01 (SMC)	4.82E-02 (Location 20)
RRTR STR	5.94E-01 (RWMC)	3.43E-04 (Location 3)
RRTR Total	1.20E+00[a]	4.85E-02[a]
NSTR/RRTR Total	1.26E+00[a]	9.02E-02[a]
Dose Limit (mrem/year)	5.0E+03	1.0E+02

a) These values are mathematical summations and do not represent realistic doses because each dose calculation used a different location. Results summed only for comparison to regulatory limits.

To comply with NESHAP regulations, DOE calculates annual potential doses to public receptors for INL Site releases. The location of the NESHAP MEI is typically Frenchman's cabin south of RWMC (Figure 14, Location 3). The potential annual dose at Frenchman's Cabin has ranged between 0.01 mrem (2018) and 0.07 mrem (2009) over the last 10 years. While the modeled public doses are higher than the annual NESHAP dose, actual doses from testing at NSTR and RRTR are likely to be a smaller fraction of the dose to the INL Site MEI. For example, the estimated dose at the INL Site MEI location from testing at RRTR during 2018 was 7.56E-05 mrem/year (DOE, 2019b), which is less than 1% of the total MEI dose.

Air quality impacts from implementing the proposed action caused by construction, operations, and testing and training activities would be minimal and localized and would not cause changes to regional air quality. In addition, long-term operations would not result in any non-permitted sources of toxic air emissions. Because of the limited nature of construction activities and use of project controls to minimize radiological dispersals and areas of effect, air quality impacts would be negligible.

4.1.2 Historical and Cultural Resources

Under the National Historic Preservation Act (2014) and 36 CFR Part 800 (2004) regulations, the specific legal context of a cultural or historical site's significance as set out in Section 106 of the National Historic Preservation Act (2014), as amended, guides assessing adverse effects on cultural resources. A property may be listed in NRHP if it meets the criteria for evaluation defined in 36 CFR 60.4 (1981):

The quality of significance in American history, architecture, archaeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and

- that are associated with events that have made a significant contribution to the broad patterns of our history
- that are associated with the lives of persons significant in our past
- that embody the distinctive characteristics of a type, period, or method of construction, that represent the work of a master, that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction;
- that have yielded or may be likely to yield information important in prehistory or history.

Most Native American archaeological sites are evaluated according to Criterion d, which refers to site data potential. These sites typically lack historical documentation that might describe important characteristics. Applying archaeological methods and techniques contributes to understanding information recovered from sites. DOE evaluates sites partly to obtain data to contribute to answering scientific research questions, but also to apply those data to further understand traditional cultural values. For example, animal bones from an archaeological deposit can provide information about the nature of precontact peoples' diet, foraging range, exploited environments, environmental conditions, and seasons during which various wildlife species were taken. These data help reconstruct Native American ways of life and further understanding of sites that have traditional or spiritual significance to contemporary Native Americans or other groups.

NRHP eligibility determinations also consider archaeological site integrity. Pre-contact site evaluations analyze location, setting, design, workmanship, feeling, association, and materials to assess site integrity. Cultural and post-depositional factors (e.g., highway construction, erosion, or disturbance) may compromise resources, yet sites may retain their integrity under Criterion d if important information potentially remains. Conversely, the quantities or preservation of archaeological materials may be insufficient for accurate identification, which reduces the potential to obtain information. Assessing these qualities is particularly important when the spatial relationships of artifacts and features are necessary to determine patterns of past human behavior. It is important to note that Native American artifacts remain important to the Shoshone-Bannock Tribes even if they are not associated with an NRHP-eligible archaeological site.

Based on survey results and subsurface evaluations documented in the *Cultural Resource Assessment for the expansion of capabilities at National Security Test Range and Radiological Response Training Range at Idaho National Laboratory* (Holmer, Cook, Henrikson, Gilbert, & Armstrong, 2019), the cultural resources identified at the Ranges are either ineligible for the NRHP or are outside the area potentially effected by project activities. Those resources that remain eligible for inclusion into the NRHP will not be impacted by project activity through project redesign in order to circumvent eligible resources or avoidance and archaeological monitoring during construction activities. As such, the proposed action will have no effect on historic properties.

DOE completed Section 106 consultation with the Shoshone-Bannock Tribes and the Idaho State Historic Preservation Office (SHPO). SHPO concurred with the recommendation that the proposed action will have no effect on historic properties.

While the proposed action will have no effect on cultural or historic properties eligible under NRHP, the cultural practices, beliefs, and identity of indigenous people connects them to the land in intangible ways not captured in the National Register criteria. The National Register criteria do not capture the indigenous cultural feeling, association, and experience derived from an intangible view of the area. Tribal members typically have a high sensitivity to landscape change and changes to the visual quality of the landscape based on these historical and spiritual connections. Infrastructure and other changes across the landscape can erode these connections.

Because proposed infrastructure and land disturbance is mostly associated with existing facilities and previous disturbance, changes to the existing landscape are not expected to be substantial. There are open panoramic views across the INL Site with Big Southern, Middle, and East Buttes and several mountain ranges in the background. However, the exact location of infrastructure such as powerlines and the associated impacts to intangible connections can only be determined and known by the people whose cultural practices, beliefs, or identity connects them to the affected area. As such, DOE is committed to actively engaging representatives of the Shoshone-Bannock Heritage Tribal Office in evaluating new infrastructure, interpreting the associated impacts, and identifying potential mitigation, avoidance, and protection measures.

The proposed action does not have the potential to impact properties eligible for listing on NRHP. However, if during any project activities, project personnel discover unanticipated cultural, historical, pre-contact, or prehistoric resources, they must make proper notifications and cease all work in the immediate area. DOE will follow any and all applicable laws that may apply to the discovery dependent on its nature (e.g., the Native American Graves and Repatriation Act (43 CFR Part 10, 1990) and the Archaeological Resource Protection Act (19 USC Ch. 1B, 2004)); see the Cultural Resource Management Plan (DOE-ID, 2016). Following an analysis of the discovery, work will continue in the area when DOE has given clearance to do so.

4.1.3 Ecological Resources

The following provisions pertain to general wildlife (e.g., jack rabbits, lizards, snakes, and squirrels) and protected species (e.g., those species protected under various state and federal laws or regulations, such as special status species) during construction and operations.

Greater Sage-Grouse — *The Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID 2007) required an annual sage-grouse population survey. These surveys were conducted for nine consecutive years and found no impact on sage-grouse populations in the vicinity of the range (Hafla et al. 2019). The proposed action removes requirements for the annual NSTR survey and supplants the requirement with the annual INL Sitewide sage-grouse population survey as discussed in Hafla et al. (2019).

Time-of-day restrictions apply to construction and operations activities within 1 km of greater sage-grouse (Centrocercus urophasianus) leks from March 15 to May 15. Other design features include reclamation and avoiding habitat disturbance if possible. Activities at the INL Site comply with other conservation measures described in the CCA for greater sage-grouse, including avoiding installing power lines within 1 km of active leks and installing raptor perch deterrents on power poles and guy wire flight deterrents when necessary.

In compliance with the CCA (DOE-ID & USFWS, 2014), the project must complete pre and post construction surveys to establish the amounts of sagebrush restoration and other native revegetation efforts needed to rehabilitate disturbed areas as determined by DOE’s ESER contractor. To mitigate the loss of sagebrush and comply with DOE policy, the proposed action requires monitoring sagebrush disturbance and planting amounts equal to that disturbed in areas beneficial to sage-grouse.

Raptors and Migratory Birds — To minimize impacts to nesting raptors, the proposed action prohibits construction and operations within recommended spatial and seasonal buffers. Spatial and seasonal buffers would be identified by the ESER contractor for species observed in the project area (see Section 3). If topography limits actual line-of-sight between an active nest (i.e., the nest has eggs or young) and construction activities, the spatial and seasonal buffers can be reduced with prior authorization from the ESER contractor.

Work during the migratory bird nesting season (April 1 through October 1) requires a migratory bird nesting survey 72 hours prior to vegetation disturbance in an area. If surveys discover active nests, the project implements measures, such as buffer areas or halting work, to prevent nest abandonment until after the migratory bird nesting season or until young have fledged.

Construction and operations personnel also must report dead or injured birds. Any dead bald eagles or golden eagles that are found must be reported immediately to DOE upon discovery. Other dead or injured migratory birds that appear to have been poisoned, shot, electrocuted, or were otherwise killed or injured as the result of potential criminal activity must also be reported to DOE immediately.

The proposed action would result in the loss of about 1,300 acres of habitat at the Ranges through direct disturbance from activities listed in Table 21. The estimated area of disturbance is conservative because it assumes the proposed action removes all vegetation on the entire downrange area (908 acres). However, direct disturbance in the downrange area to establish the downrange target area amounts to about 45 acres. If projectile testing limits impacts to the disturbed area of the downrange target area, the proposed action disturbs about 270 acres at NSTR.

Table 21. Acres of disturbance in the proposed action.

Location	Acres
Downrange target area and downrange area	908[a]
Laydown areas expansion	12
New explosives test pad and access road	16
NSTR administrative buffer area perimeter	20
NSTR access road around TREAT exclusion zone	2
Power line installation and maintenance	170
NTR fence perimeter and enclosure	92
STR fence perimeter and enclosure	92
Total	1,312

a. It is unlikely the entire downrange area would be disturbed. Construction of the downrange target area disturbs about 45 acres. Disturbance in the remaining downrange area is limited to munitions fired downrange that miss targets.

Section 4.1.3.5 discusses potential impacts on ecological resources from radionuclides used during radiological response training at NSTR and RRTR.

Intensive ecological surveys were completed and are detailed in Hafla et al. (2019). Survey methods and results are summarized in the following subsections. DOE activities at the INL Site release radioactive and non-radioactive constituents. Pathway vectors (such as air, soil, plants, animals, and groundwater) can transport these constituents to nearby populations.

At NSTR, ecological surveys focused on areas of expected disturbance with an additional buffer. Each area was surveyed for signs of wildlife, invasive species, and sensitive plants. The plant community surveys occurred every 100 m in areas in and adjacent to areas of proposed disturbance. A total of 227 points were surveyed for vegetation classification. The point count for each section of the survey follows: powerline adjacent to T-25 – 110, alternate route to T-25 around TREAT– 15, downrange target area – 61, and the new explosives test pad and road – 41. Random surveys of the project area from MFC to NSTR using aerial photos, topographic maps, and previously collected data were conducted to determine areas containing potential habitat for sensitive species and/or wildlife.

At RRTR, ecological surveys focused on areas of expected disturbance based on the project description. Fence placement at NTR and STR will be based on avoiding cultural and other sensitive resources. Therefore, road and fence surveys included a smaller buffer area than surveys at NSTR, but they did consider the general area and focused on areas more likely to have invasive or sensitive species within the fence boundaries and a select number of random areas outside the fence boundaries.

Impacts to ecological resources are considered significant if they result in a loss of protected or sensitive species or loss of local populations from direct mortality or diminished survivorship. Impacts to ecological resources are taken from Hafla, et. al. (2019) and summarized in this section.

4.1.3.1 ***NSTR Plant Communities.*** Soil disturbance, such as blading the explosives test pad, will result in the direct loss of vegetation. Fragmentation of plant communities and reduction to the habitat value of those communities is also a direct environmental consequence of soil disturbance. Indirectly, soil disturbance increases the risk of invasion by non-native weeds and may act as a vector for introducing those weeds into adjacent undisturbed plant communities.

DOE complies with regulations pertaining to control of noxious weeds on INL Site land. The proposed action implements future weed control as needed. Herbicide use complies with regulations and requirements.

The sandy soils and sensitive needle-and-thread dominated communities at the NSTR site are particularly susceptible to weed invasion, which is one of the primary reasons they are considered vulnerable to critically imperiled across their historic range. The proposed action disturbs about 270 acres of vegetation at NSTR. Hafla et al. (2019) note that needle-and-thread dominated and co-dominated communities represent about 10% of the areas surveyed for the new explosives test pad, downrange target area, and new powerline. About 30 acres of needle-and-thread dominated and co-dominated communities would be permanently disturbed.

The soil at the new explosive test pad and the downrange target area have very high potential for wind erosion that makes them unsuitable for revegetation due to erosion. This becomes important when considering restoration or long-term erosion control measures. The proposed action permanently removes vegetation from the new explosives test pad and most of the downrange target area; vegetation restoration is not a goal in these areas. The proposed action controls erosion by placing fill material in cleared areas. Soil impacts are discussed in Section 4.1.4.

Painted milkvetch populations will be removed where soils are disturbed and will be impacted by habitat fragmentation and increased risk of weed invasion across the entire NSTR area. Disturbance to populations of painted milkvetch should be carefully considered, because it is narrowly endemic to the region and occupies specific habitat in semi-stabilized sand dunes. Current population numbers and trends are unknown, so it is difficult to correlate the impact of removing some populations at NSTR to the persistence of the species overall. Removing additional populations on the INL Site (some were removed with the original NSTR project) may eventually affect the regulatory status of the species because it was originally removed from listing consideration due to the stability of several INL Site populations.

Impacts to painted milkvetch populations along the proposed new power line access route can be avoided by surveying the proposed route and placing poles in areas not occupied by the species and restricting vehicle travel. Surveys did not find any populations of this species in the area proposed for the new explosives test pad and access road. While populations of painted milkvetch likely occur on the proposed downrange target area, the downrange target area totals roughly 5.2% of the NSTR downrange area. It is anticipated that with use of administrative and engineering controls, such as conducting operations according to DOE-STD-1212-2012 (DOE, 2012) and Department of the Army Pamphlet 385-63, the likelihood of projectiles impacting painted milkvetch outside of the length and width of the downrange target area is small.

4.1.3.2 RRTR Plant Communities. Vegetation removal and disturbance reduces habitat in the project area, which is more pronounced in good condition sagebrush habitat. In the CCA (DOE-ID & USFWS, 2014), DOE agreed to implement a "no net loss" of sagebrush policy across the INL Site. By fencing areas of sagebrush, the area no longer supplies habitat. The proposed action fences about 184 acres. To mitigate the loss of sagebrush and comply with DOE policy, the proposed action requires monitoring sagebrush disturbance and planting amounts equal to that disturbed in areas beneficial to sage-grouse. Assuming the proposed action disturbs 184 acres of sagebrush, 184 acres of sagebrush would be planted in restoration areas identified in the CCA (DOE-ID & USFWS, 2014). The total amount is likely less than 184 acres, because not all fenced area contains sagebrush.

In addition, all roads and disturbances are vectors for the spread of undesirable species. Weed control around both perimeter roads and other areas at NTR and STR reduces the potential for weed invasion.

Project controls minimize soil and vegetation disturbance and limit vehicle travel to established roadways, laydown areas, and turnarounds. Project controls also require restoring areas subject to short-term ground disturbance to original contours and revegetating with certified weed-free native seed. The loss of protected or sensitive species or loss of local populations from direct mortality or diminished survivorship is not anticipated at the Ranges.

4.1.3.3 NSTR and RRTR Ethnobotany. Most species of ethnobotanical importance documented on the Ranges are common across the INL Site. The impacts of the proposed activities would likely be greater on less common species than they would be on abundant species. Removing several individuals from large populations will not greatly affect the species persistence. However, it will affect the potential use of an area for harvesting seeds or vegetative structures. Because soil disturbance and the risk of non-native species invasion will impact populations of species of ethnobotanical concern, the most effective mitigative measure to protect those populations is to minimize the amount of soil disturbed. Potential impacts to populations of plant species of ethnobotanical concern may also be mitigated through revegetation of areas impacted by soil disturbance.

The proposed action results in loss of individuals but does not affect the persistence of populations of species of ethnobotanical concern.

4.1.3.4 Wildlife. Hafla et al. (2019) identified the following potential direct and indirect impacts to wildlife from implementing the proposed action:

1. Permanent and temporary habitat loss and associated wildlife species from disturbing soils and clearing vegetation
2. Nest abandonment or wildlife displacement from operations (e.g., equipment, materials, and testing)
3. Habitat fragmentation, increased fire frequency, and weed invasion
4. Disturbance and direct wildlife mortality from increased motor vehicle activity
5. Increased wildlife disturbance from increased human and wildlife interactions.

Wildlife impacts occur when habitats or individuals are disturbed or lost. The significance of impacts depends, in part, on population sensitivity. The proposed action has a greater potential to affect sensitive wildlife species than to affect general wildlife, because these species are generally less tolerant of environmental changes. Hafla et al. (2019) detail other potential effects to wildlife summarized as follows:

NSTR—With the incorporation of project controls and other project features, potential impacts to wildlife will be minimized or avoided to the extent practical. These controls include, but are not limited to, seasonal timing of specific testing activities to avoid critical times for wildlife and minimize wildland fire risk, reduced speed limits on access roads, managing potential wildlife attractants such as disturbed soils and trash, weed management planning, keeping work areas neat, warning signs (to alert personnel as to the presence of wildlife), reflectors, ultrasonic warning whistles on vehicles, hazing animals from the road and test bed, and worker awareness programs. For wildlife, impacts are considered significant if they resulted in loss of individuals of protected or sensitive species or loss of local populations of wildlife through high levels of direct mortality or diminished survivorship. No such impacts were identified previously.

Most proposed activities and associated potential impacts are very similar to those from current operations. However, proposed construction activities cause increased ground disturbance and habitat loss within the boundaries of the administrative buffer area. Increased permanent infrastructure (offices and work buildings) would be established in areas previously disturbed or adjacent to disturbed areas. New access roads connecting NSTR facilities (new test circle and downrange target area), new power line, and a new alternate route to T-25 would increase linear features, weed species penetration, and potential fragmentation of wildlife habitat. Consistent implementation of previously identified controls minimizes and avoids potential impacts to wildlife species in the NSTR area.

Proposed activities unique to the NSTR site include installation of a new 13.8-kV distribution line to bring electric power from a substation at MFC to the NSTR facilities area, UAV testing at testing pads, ballistic projectile training outside the current test range, and training using radioactive sources, including the release of radionuclides in specified locations. Among these, only the new distribution line has the potential to affect wildlife. However, the new line would be located within 50 ft of a long established 138-kV transmission line and be sited close to the existing T-25 road; little increased fragmentation would be associated with the new line and limited new access would be required for construction and maintenance. Minimal impacts from the new powerline are expected.

Potential impacts to wildlife from an increase in the frequency of explosive detonations would primarily be noise disturbance. Hafla et al. (2019) note that noise effects on wildlife vary from serious to nonexistent in different species and situations. Impacts include increased stress hormones, fleeing behavior, permanent and temporary hearing threshold shifts, masking the ability to hear predators, and interfering with communication.

Incidental evidence, including continued use of the project area, indicates that wildlife at NSTR are not adversely affected by the existing ambient and impulse noise conditions. Impulse noise events occur only during daytime operational hours (i.e., normally 7:00 a.m. to 5:30 p.m.). Animals active at night (nocturnal) and at twilight (crepuscular) would be unlikely to be active during this time. Therefore, disruption of nocturnal or crepuscular individuals' normal behaviors, including foraging and breeding would be negligible. Impulse noise would be unlikely to result in direct mortality of wildlife because of the short duration (typically less than 1 second) of each event. Diurnal (i.e., active during the daytime) wildlife in the area would likely have a startle reaction to impulse noise events. This reaction could result in the temporary interruption of individuals' normal behaviors, including foraging and breeding. However, because the impulse noise is of short duration and large and mid-range test events are relatively infrequent, it is unlikely to result in adverse impacts on wildlife populations.

The proposed action also involves firing large caliber weapons and small arms at NSTR. However, noise effects from daily explosive detonations using less than 100 lb NEW dominate the overall Range operational noise. Most NSTR activities require short bursts of intense activity and some noise. During these timeframes, wildlife in the immediate vicinity may be disrupted from their normal activities, but there would be no lasting effects. For single detonations, behavioral disturbance is likely to be limited to a short-lived startle reaction. Momentary behavioral reaction of an animal to a brief, time-isolated acoustic event constitutes a minor effect on wildlife. The proposed action would not result in behavioral changes or responses in a biologically important behavior or activity to a point where such behaviors are abandoned or significantly altered.

Wildlife in testing and training areas may temporarily avoid the areas during exercises but will likely return after training has ceased. Therefore, disturbance to wildlife from increased operations and human interactions under the proposed action is expected to be short-term and temporary and will not permanently impact wildlife populations.

Bats—the *Idaho National Laboratory Site Bat Protection Plan* (DOE-ID, 2018) ensures protection of sensitive bat resources through adherence to a number of recommended conservation measures. This document and its conservation measures were developed in collaboration with Idaho Department of Fish and Game and U.S Fish and Wildlife Service bat biologists. Conservation measure number four recommends avoiding blasting within a 0.75-mile (1.2-km) radius of hibernacula and important summer roosts. The 0.75-mile blasting buffer was arrived at through the review of numerous resource agency documents outlining conservation strategies to protect roosting bats from blasting associated with mining, highway construction, and similar massive earth moving activities. The closest bat hibernation cave to the NSTR project area is 6 miles (9.7 km), well outside the recommended blasting buffer distance. Acoustic surveys conducted in closer proximity to the NSTR project area did not indicate the presence of important summer roosts or suitable habitats that would support such roosts within the recommended 0.75-mile buffer.

Greater sage-grouse – In 2014, a spring lek survey route was established around the NSTR area. This route consists of three leks that are monitored annually. Recent burns have resulted in a notable long-term impact on sage-grouse nesting, brood-rearing, and foraging habitat at NSTR and in areas adjacent to NSTR. However, if sage-grouse re-occupy the area in the future, project controls such as seasonal time restrictions for specific testing activities to avoid critical times for sage-grouse, minimizing wildland fire risk, and controlling invasive species will minimize impacts.

NSTR is not within the established sage-grouse conservation area but is subject to DOE's no net-loss of sagebrush habitat policy on the INL Site and the project must complete pre and post construction surveys to establish the amounts of sagebrush restoration and other native revegetation efforts needed to rehabilitate disturbed areas as determined by DOE's ESER contractor. To mitigate the loss of sagebrush and comply with DOE policy, the proposed action requires monitoring sagebrush disturbance and planting amounts equal to that disturbed in areas beneficial to sage-grouse.

Clearing vegetation on the explosives and downrange target area within 2 miles (3.2 km) of nesting habitat may increase use of the area by breeding sage-grouse by inadvertently providing an ideal area for breeding displays during the spring. Continuous use of these areas would likely preclude use by sage-grouse, but if use is observed on new areas cleared under the proposed action, time-of-day and seasonal restrictions will be implemented.

Ferruginous hawk – Ferruginous hawks are highly sensitive to human-induced disturbance. Based on habitat requirements and the presence of nests, this species has the potential to occur in the NSTR area. Increased human activity associated with increased customer use in spring has the potential to displace nesting ferruginous hawks. These impacts can be minimized by temporal avoidance (controlling human activity and blasting during the nesting period if ferruginous hawks are confirmed nesting).

The Migratory Bird Treaty Act protects migratory birds, their nests, and eggs. If any activity having the potential to disturb nests, including mowing, occurs between March 1 and October 1, a nesting bird survey will be conducted before the activity begins. Work control to avoid nest disturbance is implemented when nests are discovered.

RRTR—Direct and indirect impacts to wildlife at the RRTR locations would be like those for NSTR discussed above. Construction activities, additional roads, new fencing, vegetation alteration or removal, and soil disturbance would have common unavoidable impacts to wildlife, including disturbance caused by increased human presence, loss of certain ground-dwelling wildlife species and associated habitat, and displacement of certain wildlife species due to increased habitat fragmentation. The proposed action minimizes these impacts through proper micro-siting of project elements (e.g., fences and signs) to avoid sensitive resources, limiting disturbance footprints, managing weeds, and revegetating temporarily disturbed areas. In addition, installing 8,400 linear feet of 6 to 8-ft fencing at both NTR and STR creates an intermittent barrier for big game species but prevents inadvertent radiological exposure to these species. New fencing encloses about 92 acres around each test area; big game species could potentially enter and be trapped in fenced areas prior to training events; however, the probability is low. Fencing would not prevent movement of birds or small animals.

Although suitable habitat for greater sage-grouse occurs in the vicinity of RRTR test areas, minimal direct impacts to greater sage-grouse are anticipated due to (1) the limited amount of disturbance planned in areas with habitat and (2) the distance from known leks to developed areas. Portions of the proposed STR perimeter fence lie within the Sage-grouse Conservation Area (SGCA). The CCA includes fencing in its definition of infrastructure and construction of fencing within the SGCA constitutes a loss of sagebrush habitat (DOE-ID & USFWS, 2014). Infrastructure (such as fencing) also presents a collision risk to sage-grouse. Fencing 184 acres is well below the habitat adaptive management trigger identified in the CCA (i.e., 20% of existing habitat within the SGCA or 194,922 acres).

In addition, DOE committed in the CCA to avoid constructing new infrastructure in the SGCA unless feasible alternatives could not be identified. This commitment requires that DOE contact the U.S. Fish and Wildlife Service (USFWS) to determine whether an amendment to the CCA or associated conference opinion is necessary. DOE and USFWS have determined the proposed action does not require such amendments.

Consistent implementation of previously identified measures and controls minimize and avoid potential impacts to wildlife species in the project area.

Because of the limited nature of disturbance and use of project controls, ecological impacts would be negligible. Implementing the proposed action will result in the direct loss of vegetation and associated indirect impacts to habitat, soils, and wildlife, but will not cause loss of protected or sensitive species populations or loss of local populations from direct mortality or diminished survivorship (Hafla, et al., 2019).

4.1.3.5 ***Biota Dose Assessment.*** Radiological activities that cause direct radiation of the environment, or that discharge or otherwise release radioactive material into the environment must comply with DOE-STD-1153-2019, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE, 2019a) to show that dose rates to representative biota populations do not exceed the dose rate criteria in DOE

Order 458.1. The DOE dose limits for protecting terrestrial biota (DOE, 2019a) are 1 rad/d (10 mGy/d) for terrestrial plants and 0.1 rad/d (1 milligray [mGy]/d) for terrestrial animals. These dose limits represent expected safe levels of exposure; dose rates below these limits cause no measurable adverse effects to populations of plants and animals (DOE, 2019a).

In addition, the *Operable Unit 10-08 Record of Decision for Site-Wide Groundwater, Miscellaneous Sites, and Future Sites* (DOE-ID, 2009) the ecological screening level for all radionuclides and for all functional groups are based on a chronic dose of 1 mGy/d (10mGy/d for plants), the dose below which there do not appear to be changes in animal populations and is consistent with the DOE dose limits above. The DOE dose limits for protecting terrestrial biota and the ecological screening levels in the *Operable Unit 10-08 Record of Decision for Site-Wide Groundwater, Miscellaneous Sites, and Future Sites* (DOE-ID, 2009) are the same—1 rad/d (10 mGy/d) for terrestrial plants and 0.1 rad/d (1 mGy/d) for terrestrial animals.

The DOE dose limits are measured using rad/d and the discussion of biota dose in the following analysis uses mrem/per unit of time for consistency. The difference between rad and rem is that rad measures the radiation absorbed by the material or tissue. The rem measures the biological effect of that absorbed radiation. Generally, for x-rays and gamma rays, one rad equal one rem (1,000 mrem).

To determine impacts on the environment, the dose from radioactive materials to plant and animal populations in the affected area were evaluated. The maximum predicted soil concentrations in the top 5 cm of soil after 15 years of testing (assuming a density of 1.5 g/cc and a moisture content of 0.3) within a 16-ft diameter circle were used for this assessment (Table 22).

The impact on non-human biota can be assessed using *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE, 2019a) and the associated software, RESRAD-Biota 1.8 (http://resrad.evs.anl.gov/codes/resrad-biota/). Dose limits of 1.0 rad/day (10 mGy/d) for terrestrial plants and 0.1 rad/day (1 mGy/d**)** for terrestrial animals are intended to provide protection from chronic exposure of whole populations of individual species rather than individual members of the population. If the estimated ratio is below 1.0, the dose to the receptor is below the biota dose limit and the general screening evaluation has been passed.

Table 22. Maximum radionuclide concentrations in soil after 15 years of testing.

Nuclide	Maximum Soil Concentration (pCi/g)
Be-10	2.78E-12
C-14	5.00E-03
Cl-36	1.67E-02
K-40	4.64E+01
Ni-63	2.11E-06
Zn-65	6.67E-02
Se-79	6.07E-04
Rb-87	2.37E-03
Pd-107	1.46E-13
Cd-109	1.54E-10
Ag-110m	1.34E-02
Cs-135	3.01E-11
Cs-137	1.76E-11
La-137	1.39E-06
La-138	1.15E-02

The impact on non-human biota can be assessed using *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE, 2019a) and the associated software, RESRAD-Biota 1.8 (http://resrad.evs.anl.gov/codes/resrad-biota/). The RESRAD code calculates both radiological dose and risk. Carbon-14, Cl-36, Cs-135, Cs-137, K-40, and Zn-65 are the only radionuclides shown in Table 22 and in the

RESRAD-Biota 1.8 radionuclide library. The screening results for these radionuclides are presented in Table 23. As shown in the table, terrestrial animals are the limiting organism, and the dose to terrestrial animals from the proposed action is below the biota dose limit for C-14, Cl-36, Cs-135, Cs-137, K-40, and Zn-65.

ERICA 1.2.1 (http://www.erica-tool.com/), a software system like RESRAD-Biota 1.8, was employed to assess the impact of some of the remaining radionuclides on terrestrial biota. The Terrestrial Environmental Media Concentration Limit used for terrestrial environments is analogous to the Biotic Concentration Guide (BCG) used in RESRAD-Biota for terrestrial animals. The limit is based on a dose level of 40 µGy/hour, which is approximately equivalent to 1 mGy/day (the DOE standard for terrestrial animals). ERICA was used to assess the risk quotient (analogous to the BCG/concentration ratio shown in Table 23) for Ni-63, Se-79, Cd-109, and Ag-110m. As shown in Table 24, the final risk quotient sum (2.72E-07) is below 1.0 and four orders of magnitude below the summed BCG/concentration ratios (0.42) calculated using RESRAD-Biota for the radionuclides shown in Table 23.

The sum of the BCG/concentration ratios for C-14, Cl-36, Cs-135, Cs-137, K-40, and Zn-65 (Table 23) and the risk quotients for Ni-63, Se-79, Cd-109, and Ag-110m (Table 24) is 0.39, which is below the DOE dose limit (1 mGy/da or 40 µGy/hour). No detrimental impact to terrestrial biota from these radionuclides is expected.

The remaining radionuclides (Be-10, Rb-87, Pd-107, La-137, and La-138) are not available in either RESRAD-Biota 1.8 or ERICA 1.2.1. They are all long-lived beta emitters and two of them (Rb-87 and La-138) have half-lives long enough (49.2 billion and 102 billion years, respectively) to be considered primordial. The shortest half-life (60 thousand years) belongs to La-137. Palladium-107 (half-life of 6.5 million years) is a pure beta emitter. Be-10 (half-life of 1.39 million years) is also a naturally occurring radionuclide formed in the Earth's atmosphere mainly by cosmic ray spallation of nitrogen and oxygen.

Table 23. Terrestrial BCG report for RESRAD-Biota 1.8 Level 1 analysis.

Terrestrial Animal					
Nuclide	Soil Concentration (pCi/g)	BCG (pCi/g)	Ratio	Limiting Organism	Ratio
C-14	0.005	4.76E+03	1.05E-06	Yes	1.05E-06
Cl-36	0.0167	2.89E+02	5.78E-05	Yes	5.78E-05
Cs-135	3.01E-11	2.62E+02	1.15E-13	Yes	1.15E-13
Cs-137	1.76E-11	2.08E+01	8.48E-13	Yes	8.48E-13
K-40	46.4	1.19E+02	3.90E-01	Yes	3.90E-01
Zn-65	0.0667	4.13E+02	1.62E-04	Yes	1.62E-04
Summed	-	-	**3.90E-01**	-	**3.90E-01**
Terrestrial Plant					
	Soil				TOTAL
Nuclide	**Concentration (pCi/g)**	**BCG (pCi/g)**	**Ratio**	**Limiting Organism**	**Ratio**
C-14	0.005	6.07E+04	8.24E-08	No	8.24E-08
Cl-36	0.0167	3.36E+03	4.98E-06	No	4.98E-06
Cs-135	3.01E-11	2.81E+04	1.07E-15	No	1.07E-15
Cs-137	1.76E-11	2.21E+03	7.98E-15	No	7.98E-15
K-40	46.4	1.38E+03	3.36E-02	No	3.36E-02

Terrestrial Animal					
Nuclide	Soil Concentration (pCi/g)	BCG (pCi/g)	Ratio	Limiting Organism	Ratio
Zn-65	0.0667	2.47E+04	2.70E-06	No	2.70E-06
Summed	-	-	**3.36E-02**	-	**3.36E-02**

Table 24. Risk quotient and limiting reference organisms for ERICA 1.2.1 screening analysis.

Nuclide	Concentration (pCi/g)	Concentration (Bq/kg)	Terrestrial Environmental Media Concentration Limit (Bq/kg)[1]	Risk Quotient	Limiting Reference Organism
Ni-63	2.11E-06	7.81E-11	5.11E+06	4.13E-13	Reptile
Se-79	6.07E-04	2.25E-08	2.20E+05	2.75E-09	Annelid
Cd-109	1.54E-10	5.70E-15	6.38E+04	2.41E-15	Arthropod - detritivorous
Ag-110m	1.34E-02	4.96E-07	2.35E+04	5.69E-11	Mammal - large
			∑ Risk Quotients	**2.72E-07**	
Dose screening rate value is 40 Gy/hour for terrestrial animals, birds, amphibians, and reptiles, and 400 Gy/hour for plants and other aquatic organisms. It previously has been suggested that below these values (of chronic exposure), no measurable population effects would occur. 40 Gy/hour is approximately equivalent to 1 mGy/day, which is the DOE dose rate limit for terrestrial animals.					

These radionuclides are beta emitters and consequently the doses received by terrestrial animals due to external exposure would be negligible. A small burrowing mammal would more likely receive a dose from inhalation of suspended contaminated soil particles or ingestion of soil, but vegetation is prevented from growing on the test pads. Because there are no known published dose conversion factors for biota for Be-10, Rb-87, Pd-107, La-137, and La-138, dose conversion factors for inhalation and ingestion for human receptors (EPA 2002) were used to compare the potential impact of these radionuclides with the those assessed using RESRAD-Biota and ERICA. The comparison of the combination of dose conversion factors and soil concentrations indicates that the doses that would be received by biota from these remaining radionuclides would be bounded by doses previously calculated by RESRAD-Biota and ERICA. For example, the concentration of La-138 in soil (1.15E-2 pCi/g) is similar to that of Cl-36 (1.67E-2 pCi/g). The ingestion dose conversion factor for La-138 (4.05E-03 rem/Ci) is also similar that that for Cl-36 (3.44E03 rem/Ci). The inhalation dose conversion factor for La-138 (5.77E-05 rem/Ci) is slightly higher than for Cl-36 (1.40E-05 rem/Ci). However, given that the BCG ratio estimated for Cl-36 is 5.78E-5 (Table 23), it is logical to assume that the ratio for La-138 would also be orders of magnitude below 1.0 and would not affect the final summed ratios. Using the same approach, the remaining radionuclides were likewise dismissed as minor contributors to the total dose to terrestrial animals.

For populations of flora and fauna not listed as threatened and/or endangered, exposures to contaminated soil that result in a hazard quotient greater than or equal to 10 are inhibited (DOE-ID, 2009). As shown in Table 24, the risk quotient for the proposed action is 2.72E-07 which is 367 times lower than this exposure limit for flora and fauna.

Radiological testing at the Ranges would not exceed DOE standards for protection of biota and do not indicate that populations of plants and animals could be impacted from exposure to ionizing radiation from implementing the proposed action.

4.1.3.6 NSTR Invasive and Non-Native Species. Soil disturbance is a primary contributor to spreading invasive plants. Invasive and non-native plants are present on much of the T-25 road and around the edges of developed areas at NSTR. Most invasive and non-native species produce large numbers of seed. Mowing, blading, and other means used to remove the vegetation could result in the spread of invasive and non-native species. Minimizing ground disturbance minimizes seed dispersal. Failure to limit seed dispersal from these areas increases revegetation and weed management efforts. Given the proposed schedule for construction activity to begin in summer, the probability for seed dispersal onto the project site and roads is high, as is the likelihood of offsite transport of weed seeds.

Project controls restricting unnecessary off-road traffic and repetitive mowing reduces the potential spread of non-native and invasive species. Weed control on and adjacent to areas where soil disturbance and vegetation removal is recurring also minimizes the introduction of weeds. Weed control and prevention requirements at the INL Site are implemented through PLN-611, "Sitewide Noxious Weed Management" (INL, 2013).

4.1.3.7 RRTR Invasive and Non-Native Species. Although surveys of the RRTR ranges did not find noxious weed species, invasions could occur during soil disturbing events. Seed dispersal issues and controls mentioned above for the NSTR location apply to the RRTR locations.

Minimal impacts from invasive and non-native species from the proposed action are expected. Consistent implementation of previously identified measures and controls minimizes and avoids potential impacts from invasive and non-native species in the project area.

4.1.4 Soils

The proposed action minimizes soil and vegetation disturbance to that necessary to install project components and for future safe operation and maintenance. It also limits vehicle travel to established roadways, laydown areas, and turnarounds.

Project controls require restoring areas subject to short-term ground disturbance (e.g., pole areas and spur routes) to original contours. Disturbed areas around poles and on spur routes require revegetation as soon as practicable using certified weed-free seed mix composed of native species found in or endemic to the area. Reclamation aims to restore disturbed areas to at least 70% of pre-disturbed cover.

Under the proposed action, soil monitoring for radionuclides will take place at least every 2 years for at least two rounds of monitoring. Based on the results, monitoring frequency may be either increased to annually or decreased. Soil monitoring and sampling will also be performed no less than every 5 years to verify radionuclide, chemical, and explosive constituent concentrations do not approach ecological screening levels or PRGs. If concentrations approach ecological screening levels or PRGs, soils will be removed and placed in a licensed disposal facility. Using the ecological screening levels and residential PRG verifies human health and the environment will be protected when training at the Ranges is complete.

A vehicle-mounted Global Positioning Radiometric Scanner (GPRS) system (Rapiscan Model GPRS-1111) is used to conduct soil surface monitoring (gross gamma) surveys to assess any buildup of radioactivity due to Range operations. The GPRS system consists of two scintillator gamma detectors, housed in two separate metal cabinets, and a Trimble global positioning system receiver, mounted on a rack above the front bumper of a pickup. The detectors are about 36 inches above-ground. The detectors and the global positioning system receiver are connected to a system controller and to a laptop computer. The GPRS system displays the gamma counts per second from the detectors and the latitude and longitude of the system in real time on the laptop screen. The laptop computer also stores the data files collected for each survey. The GPRS system collects latitude, longitude, and gamma counts per second from both detectors. Data files generated during the radiological surveys are saved for mapping after survey completion, and the maps show where survey counts are at or near background levels and areas above background levels.

Data from the GPTS surveys indicate the need for additional review if data show that soil concentrations exceed background concentrations. Background concentrations are used as comparative data and not as risk-based screening levels or final "action levels" above which a prescribed action must occur. Rather, these data are a starting point by which the significance of a measured concentration and the need for soil sampling can be evaluated.

The DOE Handbook *Environmental Radiological Effluent Monitoring and Environmental Surveillance* (DOE, 2015) states that soil sampling and analysis should be used to evaluate the 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 resuspension of onsite contamination. However, while soil sampling is a useful approach for determining the accumulation of airborne radionuclides that have been deposited on the ground, soil sampling is of questionable value in attempting to estimate small increments of deposition over a period of a few years or less because of 1) the large uncertainties in sampling, 2) the inherent variability in soil, and 3) it is not recommended as a routine method of environmental monitoring except in preoperational surveys (DOE, 1997).

4.1.4.1 Non-Radiological Impacts. Erosion is the natural process by which water or wind removes soil from its natural location. Vegetation removal impacts soils by increasing exposure of susceptible soils to water or wind erosion at the land surface. While bare-ground conditions would not be a typical result of the proposed action (except for at test pads, downrange target area, and roads) in isolated areas, erosion could result in a degradation of the land surface and reduced long-term soil productivity through loss of topsoil material. Soil disturbance also results in a direct loss of native vegetation and supplies opportunities for establishment of invasive and other non-native plants.

NSTR—Vehicle traffic to and on NSTR test areas, including on the downrange target area, also disturbs soil. This is due to the limited ability of the soil at NSTR to support vehicle traffic. All-terrain vehicles can have similar impacts on these sandy soils. Limiting the amount of traffic to the project site and restricting traffic to the project site itself reduces the area of soil disturbance.

Planning and site preparation that minimizes soil disturbance reduces impacts to soil and vegetation, and limits efforts required for revegetation and weed management, efforts which are difficult in the sandy soil types found at NSTR. Implementing the following project controls minimizes or avoids soil disturbance:

- Limit regrading of soil to areas maintained as sterile or otherwise free of vegetation
- Restrict vehicle traffic to designated roadways and parking and laydown areas.

The proposed action limits travel to once a year and on an emergency basis (e.g., wildland fire) on areas that are secondary to the project such as areas where fence and sign maintenance occur. Because of the high wind erosion hazard for these soils, the proposed action requires erosion control measures such as covering soils, replanting after construction before erosion becomes advanced, or using engineering controls (e.g. geotextiles) or other methods to prevent fugitive dust and blowing sand.

The proposed routes for new road segments (downrange target area and new explosives pad) pass through highly erodible soils. Portions of proposed new roads have potential to erode and down-cut during notable precipitation events such as large thunderstorms and rain-on-snow events and will require repair, graveling, or grading.

As part of routine range maintenance activities, range debris (e.g., target debris, military munitions packaging and crating material, and unexploded ordnance) would continue to be periodically removed and disposed of in accordance with proper disposal procedures. Many training events include cleanup after the exercise. Discarded training materials (i.e., expended munitions debris) that accumulate on ranges would also be periodically removed. The actual depth clearing and the frequency for how often this maintenance is required depends on the specific location and ordnance type. Soils would be impacted during the cleanup of discarded training materials but would be regraded and reseeded if necessary.

In addition, the volume of expended material that decomposes within the training areas and the amounts of toxic substances being released to the environment could increase over the period of use. Concentrations of some substances in sediment surrounding the expended material may also increase over time. Transport of these substances via winds and erosion has the potential to disperse these contaminants outside the training areas.

However, background samples for a wide variety of constituents was performed at NSTR in 2007, and additional samples were taken in 2013/2014 and 2017 to assess deposition rates. These soil samples taken over 10 years at NSTR showed positive detections for several products of combustion that may be attributed to detonating explosives and that are also normally found in soil. The concentrations of nearly all detected constituents have remained relatively constant over the 10 years of NSTR operation. Only a few chemical constituents showed an increase in concentration over the lifetime of NSTR. These chemicals, and their respective maximum concentration (in any single sample) can be compared to PRGs using Table 25. Concentrations of chemicals below the PRGs are unlikely to cause adverse health effects over a lifetime of exposure.

Table 25. PRGs and maximum concentrations of products of combustion that increased at NSTR from 2007-2017.

Constituent	PRG (ppm)	Maximum Concentration Detected at NSTR
Ammonia	No PRG	139 ppm
Chloride	No PRG	19.3 ppm
Sulfate	No PRG	37 ppm
Nitrate	1.3E+5 ppm	70 ppm
Toluene	4.9E+3 ppm	24 ppb
m/p-Xylene	5.5E+2 ppm	30 ppm
o-Xylene	6.5E+2 ppm	11 ppm
Methanol	1.2E+5 ppm	0.46 ppm

In addition, the *Comprehensive Remedial Investigation Feasibility Study (RI/FS) for Waste Area Group 6 (WAG-6) and Waste Area Group 10 (WAG 10) Operable Unit (OE) 10-04* (DOE, 2001) identifies the ecological risk for RDX at 2 ppm and TNT at 9 ppm. The minimum concentration in soil samples from NSTR that can be detected with a high degree of confidence is about 0.095 ppm. Soil sampling results from 2007 to 2017 for all nitro-aromatics, including TNT, taken after 10 years of operation at NSTR show "not-detected."

While the proposed action increases the frequency of explosives use at NSTR, the hourly and daily limits listed in Table 16 restrict the amounts of explosives use and remain unchanged from the amounts analyzed in the 2007 NSTR EA (DOE-ID, 2007). Under the proposed action, no individual detonations would exceed 20,000 lb NEW. Table 7 lists a number of required actions to address explosive residues, including verifying that all explosive material has been consumed or removed after testing is performed; removing and disposing of test articles after testing is performed; and performing soil sampling in the area for residue deposition/accumulation at least every five years. Based on these limitations and soil sampling results from 2007 to 2017, the maximum concentrations of chemicals showing an increase in concentration over the lifetime of NSTR are anticipated to remain well below hazardous levels.

As previously stated, soil sampling will be performed no less than every 5 years to verify chemical and explosive constituent concentrations do not approach PRGs. If concentrations approach PRGs, soils will be removed and placed in a licensed disposal facility.

RRTR— The above information also applies to RRTR; however, the proposed action disturbs less ground and does not authorize explosives testing at RRTR. The proposed action disturbs about 5 acres from fence construction and subsequent perimeter road. Although road use increases, the proposed action does not upgrade roads in the RRTR area and prohibits vehicle travel off roads and outside of the gravel pit and infiltration basin.

Impacts to soil from non-radiological operations included in the proposed action are anticipated to be minimal.

4.1.4.2 ***Radiological Impacts.*** This subsection summarizes potential radiological impacts to soil from the proposed action as described in detail for NSTR in Sondrup (2019b) and for RRTR in Sondrup (2019a). One set of calculations was performed as soil and infiltration conditions were assumed to be similar for NSTR and RRTR test sites. Concentrations of radionuclides in soil due to potential buildup from continued testing were calculated and compared to EPA PRGs for workers and potential future residents. PRGs are risk-based concentrations derived from standardized equations combining exposure information assumptions with EPA toxicity data. They are soil concentrations that would not likely result in adverse health impacts under reasonable maximum exposure conditions for long-term/chronic exposures.

The impacts to ecological resources from concentrations of radionuclides in soil are discussed in Section 4.1.3.5. Soil concentrations, BCGs, and the ratio of soil concentrations to BCGs are listed in Tables 22, 23, and 24 and are based on ecological soil screening levels in *Operable Unit 10-08 Record of Decision for Site-Wide Groundwater, Miscellaneous Sites, and Future Sites* (DOE-ID, 2009). DOE Order 458.1, *Radiation Protection of the Public and the Environment*, requires that radiological activities that have the potential to impact the environment be conducted in a manner that protects populations of aquatic animals, terrestrial plants, and terrestrial animals in local ecosystems from adverse effects due to radiation and radioactive material released from DOE operations. Dose limits below which deleterious effects on populations of aquatic and terrestrial organisms have not been observed are considered by DOE to be relevant to protecting all aquatic and terrestrial biota on DOE sites.

As previously stated, the impact on non-human biota was assessed using *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE, 2019a). Using the graded approach demonstrates that resident populations of plants and animals are adequately protected from the effects of ionizing radiation. Typically, PRGs are risk-based, conservative screening values to identify areas and contaminants of potential concern that may warrant further investigation and are represented as a concentration in soil. It is worth noting that the ecological soil screening levels in Table 12 of the *Operable Unit 10-08 Record of Decision for Site-Wide Groundwater, Miscellaneous Sites, and Future Sites* (DOE-ID, 2009) and the dose rate criteria in DOE Order 458.1 (DOE, 2019a) are the same—1 rad/d (10mGy/d) for terrestrial plants and 0.1 rad/d (1 mGy/d) for terrestrial animals. The discussion from Section 4.1.3.5 is not reiterated here.

However, it is important to note that impacts to ecological resources discussed in section 4.1.3.5 are described in terms of absorbed dose. Radiation dose is a well-defined quantity. Absorbed dose is the concentration of energy deposited in tissue as a result of an exposure to ionizing radiation. Absorbed dose describes the intensity of the energy deposited in tissue and is measured in mGy.

PRGs, on the other hand, are risk-based, conservative screening values to identify areas and contaminants of potential concern that may warrant further investigation. PRGs represent acceptable levels, or concentrations, of radionuclides in soil based on a one-in-a-million (1E-06) individual excess cancer risk. This section discusses impacts to soils using risk based PRGs based on concentrations of radionuclides in soil measured in pCi/g.

Silica glass dispersals are not anticipated to impact soils. The longest half-life for short-lived isotopes dispersed outdoors in silica glass is 20 days (Ba-140). After about 200 days, all material would be at background levels. The activity of these materials will decay below background levels before the silica particles break down enough to release radioactive materials for leaching or airborne distribution.

Table 26 provides the release quantities for radionuclides considered for the soil impact analysis. These are radionuclides with half-lives greater than 74 days and the same radionuclides considered for the groundwater pathway modeling (Section 4.1.5.2). Most radionuclides have half-lives less than a few days and will not persist in soil. The analysis assumed 12 tests are performed each year for 15 years at the same test area using all six material types (i.e., Cu, F, KBr, K_2O, $LaBr_3$, and Zr). The analysis is conservative, because using two radioactive materials per test is more realistic than the model assumption.

Table 26. Releases for radionuclides considered for the soil impact analysis.

Radionuclide	Half Life (years)	Release per Test[a] (Ci)	Total Annual Release[b] (Ci)
Be-10	1.51E+06	2.87E-20	3.44E-19
C-14	5.73E+03	2.13E-09	2.56E-08
Cl-36	3.01E+05	6.86E-08	8.23E-07
K-40	1.25E+09	3.46E-06	4.16E-05
Ni-63	1.01E+02	2.06E-14	2.47E-13
Zn-65	6.68E-01	1.22E-08	1.46E-07
Se-79	3.27E+05	1.60E-10	1.92E-09
Rb-87	4.97E+10	5.28E-11	6.34E-10
Pd-107	6.50E+06	3.26E-21	3.91E-20
Cd-109	1.26E+00	3.67E-17	4.41E-16
Ag-110m	6.84E-01	1.69E-09	2.02E-08
Cs-135	2.30E+06	2.71E-19	3.25E-18
Cs-137	3.01E+01	1.85E-19	2.22E-18
La-137	6.00E+04	1.15E-14	1.38E-13
La-138	1.02E+11	9.48E-11	1.14E-09

a. Includes Cl-36 and K-40 from both K_2O and KBr materials and Se-79 from both KBr and $LaBr_3$ materials (see Table **21**).
b. Assumes 12 tests per year.

Calculations assume the entire non-gaseous radionuclide inventory from each test is deposited onto the soil and is subject to leaching and radioactive decay. No atmospheric dispersal or volatilization is assumed. During the 15-year testing period, infiltration is based on a background infiltration rate of 10 cm/year and additional transient water from the use of foam. After testing, the infiltration rate is assumed to be a constant 10 cm/year for 10 years and 1 cm/year thereafter. The 10 cm/year is a typical background infiltration rate for disturbed unvegetated soils at the INL Site, while 1 cm/year is reflective of undisturbed soils. The test area is based on a 16-ft diameter dome. This is more conservative than the 30 ft diameter dome because the amount of water used for testing in a 16-ft diameter dome is less, which results in less leaching and higher soil concentrations. Predicted concentrations are the average concentrations in the top 5 cm of soil.

Table 27 presents PRGs for both an outdoor worker and a potential future resident due to incidental soil ingestion, inhalation of fugitive dust, and external exposure. Worker limits are based on a target risk level of 1E-04, while resident limits are based on a target risk level of 1E-06, even though the *Operable Unit 10-08 Record of Decision for Site-Wide Groundwater, Miscellaneous Sites, and Future Sites* (DOE-ID, 2009) has a target risk for current workers and/or future residents of 1E-04 (DOE-ID, 2009). Table 27 also lists calculated soil concentrations at the end of the 15-year testing period (i.e., time of maximum concentrations) for comparison to worker PRGs and in year 2095 for comparison to resident PRGs. Year 2095 is the end of the 100-year institutional control period assumed for most INL Site CERCLA investigations (DOE-ID, 2009).

Table 27. Predicted soil concentrations compared to PRGs for workers and potential future residents.

Radionuclide	Worker			Future Resident		
	Maximum Soil Concentration at 15 Years (pCi/g)	Worker PRG (pCi/g)	Ratio Maximum Soil Concentration at 15 years to Worker PRG	Maximum Soil Concentration in Year 2095 (pCi/g)	Resident PRG (pCi/g)	Ratio Maximum Soil Concentration in Year 2095 to Resident PRG
Be-10	2.78E-12	1.49E+00	1.87E-12	2.55E-12	3.70E+01	6.89E-14
C-14	5.00E-03	1.95E+04	2.57E-07	6.55E-07	3.17E+02	2.07E-09
Cl-36	1.67E-02	1.23E+05	1.36E-07	0	4.39E+01	0

Radionuclide	Worker			Future Resident		
	Maximum Soil Concentration at 15 Years (pCi/g)	Worker PRG (pCi/g)	Ratio Maximum Soil Concentration at 15 years to Worker PRG	Maximum Soil Concentration in Year 2095 (pCi/g)	Resident PRG (pCi/g)	Ratio Maximum Soil Concentration in Year 2095 to Resident PRG
K-40	4.64E+01	2.15E+03	2.16E-02	1.06E+01	1.44E-01	7.38E+01[a]
Ni-63	2.11E-06	1.00E+04	2.11E-10	1.31E-06	5.23E+02	2.51E-09
Zn-65	6.67E-02	2.62E+04	2.54E-06	5.41E-30	4.13E-02	1.31E-28
Se-79	6.07E-04	7.67E+00	7.91E-05	2.62E-06	6.17E+01	4.25E-08
Rb-87	2.37E-03	2.43E+01	9.73E-05	1.58E-03	6.89E+01	2.29E-05
Pd-107	1.46E-13	2.83E+03	5.16E-17	9.74E-14	1.26E+03	7.73E-17
Cd-109	1.54E-10	3.22E+00	4.79E-11	1.06E-26	1.15E+01	9.26E-28
Ag-110m	1.34E-02	4.98E+05	2.69E-08	1.49E-29	8.85E-03	1.69E-27
Cs-135	3.01E-11	1.69E+06	1.78E-17	2.88E-11	9.20E+01	3.13E-13
Cs-137	1.76E-11	4.05E+04	4.34E-16	4.13E-12	4.55E-02	9.07E-11
La-137	1.39E-06	3.48E+04	4.00E-11	1.36E-06	1.66E+01	8.21E-08
La-138	1.15E-02	6.94E+00	1.65E-03	1.13E-02	1.91E-02	5.90E-01

a. Ratio greater than 1 indicates the predicted concentration exceeds the PRG.

In all cases, calculated maximum soil concentrations are less than PRGs, except for K-40 for the resident. In this case, the maximum K-40 soil concentration in year 2095 (10.6 pCi/g) exceeds the PRG of 0.144 pCi/g. However, it is worth noting that the resident PRG is 167 times less than the average background concentration of K-40 at the INL Site (24 pCi/g; (Rood, Harris, & White, 1996). Because of the conservativeness of the calculations, it is unlikely there would be enough buildup of K-40 in soil to be distinguishable from background. However, because it is remotely possible, soil at the test area will be surveyed prior to testing to establish background levels. If K-40 concentrations exceed the initial background concentrations, soils will be removed and placed in an appropriate disposal facility.

As noted, soil monitoring and sampling will be performed at least every 2 years for at least two rounds of monitoring, and based on the results, frequency will be increased or decreased (but to no less than every 5 years) to verify radionuclide, chemical, and explosive constituent concentrations do not approach the PRGS, BCG, or risk quotients listed in Tables 23, 24, and 27. The most restrictive soil concentrations for each radionuclide analyzed for soil are highlighted in Table 28 and will be used to evaluate soil sampling results for additional actions. The values used are below the human health cleanup levels and ecological screening levels in Table 12 of the *Operable Unit 10-08 Record of Decision for Site-Wide Groundwater, Miscellaneous Sites, and Future Sites* (DOE-ID, 2009). Impacts to soils are anticipated to be minor.

Table 28. Comparison of soil concentrations for PRGs and BCGs for soil sampling evaluations.

Radionuclide	Worker PRG (pCi/g)	Resident PRG (pCi/g)	Terrestrial Animal BCG (pCi/g)	Terrestrial Plant BCG (pCi/g)
Be-10	1.49E+00	3.70E+01	--	--
C-14	1.95E+04	3.17E+02	4.76E+03	6.07E+04
Cl-36	1.23E+05	4.39E+01	2.89E+02	3.36E+03
K-40[b]	2.15E+03	1.44E-01[b]	1.19E+02	1.38E+03
Ni-63	1.00E+04	5.23E+02	5.11E+06[a]	
Zn-65	2.62E+04	4.13E-02	4.13E+02	2.47E+04

Radionuclide	Worker PRG (pCi/g)	Resident PRG (pCi/g)	Terrestrial Animal BCG (pCi/g)	Terrestrial Plant BCG (pCi/g)
Se-79	7.67E+00	6.17E+01	2.20E+05[a]	--
Rb-87	2.43E+01	6.89E+01	--	--
Pd-107	2.83E+03	1.26E+03	--	--
Cd-109	3.22E+00	1.15E+01	6.38E+04[a]	--
Ag-110m	4.98E+05	8.85E-03	2.35E+04[a]	--
Cs-135	1.69E+06	9.20E+01	2.62E+02	2.81E+04
Cs-137	4.05E+04	4.55E-02	2.08E+01	2.21E+03
La-137	3.48E+04	1.66E+01	--	--
La-138	6.94E+00	1.91E-02	--	--

a. Terrestrial Environmental Media Concentration Limit (Bq/kg). Dose screening rate value is 40 Gy/hour for terrestrial animals, birds, amphibians, and reptiles, and 400 Gy/hour for plants and other aquatic organisms. It previously has been suggested that below these values (of chronic exposure), no measurable population effects would occur. 40 Gy/hour is approximately equivalent to 1 mGy/day, which is the DOE dose rate limit for terrestrial animals.

b. The resident PRG for K-40 is 167 times less than the average background concentration of K-40 at the INL Site (24 pCi/g; **(Rood, Harris, & White, 1996)**.

4.1.5 Water Quality

This section summarizes potential groundwater impacts from the proposed action as described in detail for NSTR in Sondrup (2019b) and for RRTR in Sondrup (2019a). Modeling of groundwater impacts conservatively assumes the entire inventory of radionuclides and contaminants in containment foam infiltrates into soil and migrates toward the aquifer. Sondrup (2019a and 2019b) estimates maximum contaminant concentrations from the proposed action in the aquifer below each facility and compares those concentrations to drinking water standards or screening levels for resident tap water.

Figure 17 shows the conceptual model for flow and transport from the source area to a hypothetical receptor well. The model considers (1) transient water influx from the infiltration area, (2) transport through the unsaturated zone, and (3) dilution and mixing in the aquifer. The transport calculations account for advection, dispersion, and sorption in the unsaturated zone along this pathway and advection and dispersion in the underlying aquifer. Modeling also assumes sorption takes place on alluvium and sedimentary interbed materials, but not on basalt. Calculations account for radioactive decay for radionuclides and degradation for non-radionuclides, but not volatilization.

Modeling simulated two source area sizes based on the 16-ft and a 30-ft diameter dome tents the proposed action uses for activities requiring foam containment. Modeling presumes the receptor well (see Figure 17) is located at the immediate downgradient edge of the source area, which is the location of maximum concentration. Because the modeling code uses rectangular source areas, the analysis converted the 16-ft and 30-ft diameter source areas to equivalent size squares. The analysis assumes a receptor ingests the water at the downgradient edge of the source.

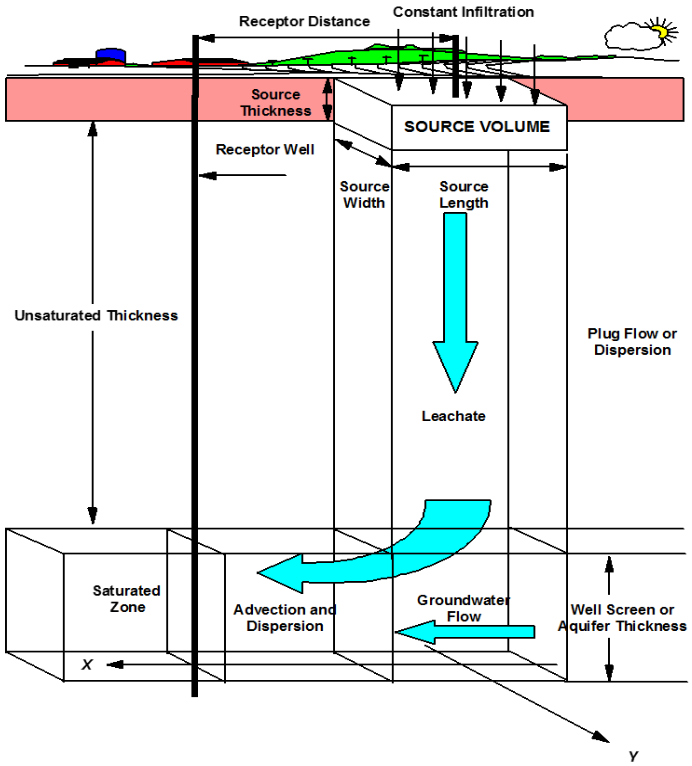

Figure 17. Conceptual flow and transport model for the groundwater pathway.

4.1.5.1 Non-Radiological Impacts to Groundwater. Groundwater pathway modeling analyzed the impacts from performing 12 tests per year for 15 years. The modeling assumes each test has the same location at the Ranges. A single test for a 16-ft diameter dome requires about 150 gallons of water and 10 gallons of BlastGuard AFC-380 foam concentrate for a total liquid volume of 160 gallons. A single test for a 30-ft diameter dome requires about 900 gallons of water and 65 gallons of BlastGuard AFC-380 foam concentrate for a total liquid volume of 965 gallons. According to safety data sheets, BlastGuard AFC-380 includes hazardous constituents diethylene glycol monobutyl ether (DGBE), 1-dodecanol, and isobutanol. Table 29 shows the mass fractions, volumes, and masses of each contaminant for the two dome sizes. After each test, the foam collapses to an aqueous mixture that can infiltrate soil in about 3 days. Modeling assumes the entire volume of liquid and the contaminants from each test soaks into the ground.

There are no enforceable federal or State of Idaho drinking water standards for the non-radionuclide contaminants in Table 29. Therefore, the analysis used EPA regional screening levels for tap water for comparison to the maximum estimated groundwater concentrations (see Table 30). The EPA website https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables supplies these screening levels. The contaminants are not carcinogens; therefore, non-cancer screening levels for children from the Hazard Index (HI) = 1 table were used. Screening levels are not enforceable standards but serve as technical guidance for water quality officials or managers of contaminated sites. Screening levels are contaminant concentrations in tap water that are protective of human exposures (including sensitive subpopulations) over a lifetime. This assessment considers groundwater as tap water.

EPA has not developed MCLs or screening levels for 1-dodecanol, which is a non-toxic food additive and was not included in modeling impacts to groundwater.

Table 29. Contaminant properties and mass released per test for both dome sizes.

Contaminant	CAS #	Volume Fraction	Component Density (kg/L)	16-ft Dome		30-ft Dome	
				Volume in 10 Gallons[a] (L)	Mass Released per Test (kg)	Volume in 10 Gallons[a] (L)	Mass Released per Test (kg)
DGBE	112-34-5	0.1	0.995	3.79	3.77	24.6	24.5
1-dodecanol	112-53-8	0.01	0.833	0.379	0.315	2.46	2.05
Isobutanol	78-83-1	0.5	0.803	1.89	1.52	12.3	9.88

a. Gallons of BlastGuard AFC-380.

Table 30. Regional screening values for non-radionuclide contaminants in tap water.

Contaminant	CAS #	Non-Cancer Screening Level for Child (HI=1) (ug/L)
DGBE	112-34-5	600
1-dodecanol	112-53-8	None available
Isobutanol	78-83-1	5900

Infiltration rate, unsaturated zone hydrostratigraphy, hydraulic conductivity and moisture content relationships, texture of the sedimentary interbeds, contaminant sorptive properties, and the velocity of water in the aquifer comprise the most important groundwater model parameters and characteristics. This analysis obtained parameters from guidance documents, previous studies of flow and transport, and regional studies of groundwater flow and transport.

Table 30 compares the overall maximum concentrations to non-cancer screening levels from Table 31 for NSTR and RRTR. The results show non-radiological contaminants (DGBE and isobutanol) having a low potential to exceed the screening levels. It also appears that continued testing beyond 15 years would not increase maximum concentrations at NSTR or NTR because the concentrations had reached a steady-state condition. Concentrations at STR had not quite peaked at the end of the 15-year testing period, so it is possible they could increase slightly if testing continued, but would not exceed screening levels (Sondrup 2019a, Sondrup 2019b).

Table 31. Comparison of screening levels and predicted maximum groundwater concentrations for non-radionuclides for 15 years.

Contaminant	HI=1 Non-Cancer Screening Level for Child (µg/L)	Maximum Concentration for 16-ft Dome (12 tests/year for 15 years) (µg/L)		Maximum Concentration for 30-ft Dome (12 tests/year for 15 years) (µg /L)	
NSTR					
DGBE	600	7.3		279	
Isobutanol	5,900	3.4		123	
RRTR					
		NTR (µg/L)	STR (µg/L)	NTR (µg/L)	STR (µg/L)
DGBE	600	21.4	0.24	574	36.5
Isobutanol	5,900	9.23	0.11	243	16.1

NOTE: The impact of each range on the concentrations at the other ranges would be insignificant given the distances between them and locations relative the flow paths from each range.

4.1.5.2 Radiological Impacts to Groundwater. Due to radioactive decay, many radionuclides considered in the proposed action decay to inconsequential levels before reaching the aquifer and are not considered in the groundwater pathway modeling. Most of the radionuclides in Table 4 have half-lives less than a few days. This is very short relative to the time it takes for water to travel from land surface to the aquifer (about 2 years based on enhanced infiltration rates from testing). For example, the activity of a radionuclide having a 74-day half-life would be about 1/1000th its original activity after 2 years. Therefore, only radionuclides with half-lives greater than 74 days were included, except for Ar-39 and Ce-139. Ar-39 is a gas and would not impact groundwater. Ce-139 was not included because the activity released each test is only 4.44E-26 Ci (from KBr), which is slightly more than 1 atom. Table 25 lists the release quantities of radionuclides considered for the both the soil and groundwater pathways. The analysis includes K-40 even though it is not regulated (40 CFR Parts 9, 141 and 142) and La-138 even though it is essentially stable.

Table 30 lists the limiting aquifer concentrations for radionuclides. The table includes MCLs from EPA (2000) if there is a published value. The table lists EPA preliminary remediation goal for resident tap water ingestion for radionuclides that do not have a published MCL. These values are based on a risk level of 1E-06 and can be found at https://epa-prgs.ornl.gov/radionuclides/download.html using the "Calculator" option.

Given the rather large sorption coefficients and long half-lives for some radionuclides, simulations cover a period of 100,000 years from the start of testing to verify concentrations in the aquifer have peaked, or nearly peaked. In addition, radionuclide simulations only analyzed the 30-ft dome because it is the limiting case based on the non-radionuclide simulation results.

Table 32 lists the overall maximum concentrations of radionuclides compared to limiting concentrations from Table 33. Peak radionuclide concentrations in the aquifer are less than MCLs (where available) and less than PRGs (if MCL not available). Radionuclides with small sorption coefficients (i.e., C-14 and Cl-36) or relatively short half-lives (i.e., Zn-65, Cd-109, and Ag-110m) result in peak concentrations near the end of the testing period. Peak concentrations of other radionuclides occur hundreds to thousands of years after testing ceases. Concentrations of some radionuclides with high sorption coefficients and long half-lives (i.e., Cs-135, La-137, and La-138) had not peaked by the end of the 100,000-year simulation time, but the concentrations at 100,000 years are very low and unlikely to exceed the limiting values beyond 100,000 years. Potassium-40 (K-40) concentrations were the highest percentage of the respective limiting concentration, but K-40 occurs naturally and is not regulated in food or drinking water.

Table 32. Limiting concentration standards for radionuclides.

Radionuclide	Limiting concentration (pCi/L)	Standard type
Be-10	7.43	EPA PRG[a]
C-14	2,000	MCL
Cl-36	700	MCL
K-40	2.12	EPA PRG[a]
Ni-63	50	MCL
Zn-65	300	MCL
Se-79	7.55	EPA PRG[a]
Rb-87	300	MCL
Pd-107	202	EPA PRG[a]
Cd-109	600	MCL
Ag-110m	90	MCL
Cs-135	900	MCL
Cs-137	200	MCL
La-137	148	EPA PRG[a]
La-138	14.7	EPA PRG[a]

a. For radionuclides with no MCL, the limiting concentration is based on the EPA PRG for tap water ingestion.

Table 33. Comparison of limiting concentrations and predicted maximum groundwater concentrations for radionuclides.

Radionuclide	Limiting Concentration (pCi/L)	Maximum Concentration at NSTR[a] (pCi/L)	Maximum Concentration at RRTR-NTR (pCi/L)	Maximum Concentration at RRTR-STR (pCi/L)
Be-10	7.43	1.52E-17 (93,000)[d]	1.37E-17 (52,000)	2.99E-17 (97,000)
C-14	2,000[b]	3.71E-03 (14)	2.47E-03 (13)	7.22E-03 (16)
Cl-36	700[b]	1.20E-01 (13)	7.96E-02 (13)	2.33E-01 (16)
K-40	2.12	3.18E-02 (5,600)	2.82E-02 (3,100)	6.26E-02 (5,800)
Ni-63	50[b]	<1E-30 (3,200)	9.95E-26 (1,800)	<1E-30 (3,400)
Zn-65	300[b]	1.99E-44 (16)	6.44E-26 (15)	<1E-30 (17)
Se-79	7.55	5.37E-06 (1,500)	4.75E-06 (800)	1.04E-05 (1,600)
Rb-87	300[b]	1.32E-07 (21,000)	1.17E-07 (11,000)	2.61E-07 (21,000)
Pd-107	202	8.13E-18 (21,000)	7.18E-18 (11,000)	1.60E-17 (21,000)
Cd-109	600[b]	<1E-30 (17)	1.17E-25 (15)	<1E-30 (18)
Ag-110m	90[b]	<1E-30 (18)	<1E-30 (17)	<1E-30 (22)
Cs-135	900[b]	~2.50E-17 (>100,000)	~6.24E-17 (>100,000)	~1.17E-18 (>100,000)
Cs-137	200[b]	<1E-30 (990)	<1E-30 (540)	0.00E+00 (NA)
La-137	148	4.62E-21 (>100,000)	~3.84E-15 (>100,000)	1.97E-21 (>100,000)
La-138	14.7	~1.20E-16 (>100,000)	~9.94E-11 (>100,000)	~5.09E-17 (>100,000)
	Sum of Fractions[c]	1.73E-04	1.15E-04	3.36E-04

a) Applies to both new explosive test area and radiological training pad.
b) Limiting concentration is MCL.
c) Sum of fractions represents sum of ratios of model concentration to MCL and does not include ratios of model concentrations to EPA PRGs. The regulation for MCLs (40 CFR 141.66) specifies that for multiple radionuclides the sum of fractions be less than 1. In this case, the peak concentrations are summed even though they occur at different times.
d) Time of maximum concentration (years after testing begins) shown in parentheses. For times greater than 100,000 years, the concentration was increasing only slightly and is not expected to exceed the limiting value.

All results assume 12 test/year for 15 years using a 30-ft dome tent whose location is fixed.

Modeling results show that radionuclide concentrations are not likely to exceed the limiting concentrations. It appears that continued testing after 15 years is not likely to result in an exceedance of limiting concentrations. In addition, dividing the total annual release (see Table 26) into less than 12 tests per year is likely to result in lower concentrations because less tests would mean less additional water from the foam, which would increase the travel time to the aquifer and result in more decay.

4.1.6 Hazardous Materials and Waste Management

The significance of potential impacts associated with hazardous materials and hazardous waste is based on the toxicity of the substances and their management (e.g., transportation, storage, and disposal). Hazardous materials and waste impacts are considered adverse if the use, storage, transportation, or disposal of these substances substantially increases the human exposure risk or environmental contamination.

Fuel trucks transport fuel to construction equipment in the field. Mobile equipment presents sources of potential petroleum or other hazardous material spills. If a fuel, oil, or other hazardous material spill occurs, the spill is cleaned up as soon as possible. If necessary, soil remediation removes contaminated soils and DOE characterizes, manages, and disposes of contaminated soil in an approved facility. Soil sample(s) then verify successful removal in compliance with State of Idaho regulations.

Proposed UAV operations consist of flights with data collection devices (e.g., sensors and cameras), inert materials, chemicals, and explosive or flammable materials at NSTR. Chemical use is subject to classification and the limitations and requirements applicable to the class of chemicals used.

The proposed action prohibits use of pure unused commercial chemicals that are RCRA P or U-listed chemicals considered RCRA hazardous waste when released to the environment. This limitation does not apply to products and mixtures (such as explosives), which include a P or U-listed chemical as a constituent. The proposed action also prohibits using chemicals considered RCRA toxic waste when released to the soil. Project personnel identify substitute chemicals to achieve test objectives when prohibited chemicals are proposed.

CERCLA lists many chemicals as hazardous or extremely hazardous substances that are not considered as RCRA hazardous waste when released. The proposed action evaluates release of these chemicals to the soil and environment to determine if any release exceeds the reportable quantity for that chemical or mixture of chemicals. The goal for limiting use of certain RCRA-identified materials and CERCLA hazardous substances is to limit potential soil contamination so soil does not become contaminated with hazardous waste or exceed soil concentrations of hazardous substances, which would require remediation under federal or state clean-up laws and regulations.

The proposed action does not allow releases that exceed the limitations of this EA (e.g., require an air permit, exceed the CERCLA reportable quantity, exceed groundwater or drinking water standards in the aquifer, or exceed CERCLA screening levels in soil).

DOE considers chemicals not included on the list of CERCLA hazardous or extremely hazardous substances to be relatively benign and subject to minimal review for both environmental and personnel hazards. For example, calcium carbonate (common chalk) is not an environmental hazard, but safety and industrial hygiene professionals evaluate use and dispersal.

To minimize dispersals and areas of effect, weather conditions are monitored at the Ranges, and testing and training are postponed as necessary.

Covered dumpsters contain refuse and are emptied when full. Following construction activities, crews remove refuse, including, but not limited to, broken equipment parts, wrapping material, cords, cables, wire, rope, strapping, twine, buckets, metal or plastic containers, and boxes from the site and dispose of waste as appropriate. Project controls include reusing and recycling items where practicable.

Following testing and training activities, unconsumed explosive material, used test articles, and debris are removed from the Ranges and disposed of according to applicable regulations.

Portable toilets supply sanitary facilities during construction and operations. Licensed vendors furnish portable toilets, maintain them on a regular basis, and pump portable toilet waste to approved INL Site facilities (e.g., CFA sewage treatment plant) after verifying the discharge meets facility acceptance criteria.

The proposed action follows other local, state, and federal regulations relating to using, handling, storing, transporting, and disposing of hazardous materials.

4.1.6.1 Hazardous Materials. Testing and training operations involving hazardous materials would increase in support of the proposed action. Amounts of expended testing and training materials would increase in rough proportion to the overall increases in these training operations.

Test and training at the Ranges would continue to use hazardous materials for operations and maintenance. Increase in hazardous materials transport, storage, and use to support increased training operations under the proposed action would be managed using the same procedures as the no action alternative. No releases of hazardous materials to the environment and no unplanned exposures of personnel to hazardous materials are anticipated.

4.1.6.2 Hazardous Waste Management. Operational changes at NSTR and RRTR have the potential to generate the following types of waste: (1) common trash, (2) low-level radioactive waste, and (3) liquid waste. Routine office trash and non-radioactive personal protective equipment are disposed of at the state-regulated INL Site landfill.

Non-liquid, low-level radioactive waste includes personal protective equipment used during radiological response training and sample material generated during radiological response training (i.e., analytical waste, soil, and wipes). Non-liquid low-level radioactive waste is disposed according to DOE procedures.

Liquid low-level radioactive waste includes water used to decontaminate personnel exiting the radiological response training area, liquid laboratory analytical waste, and sewage. Low-level decontamination water is stored per DOE procedures to allow decay to background levels of the radioactive constituents.

After decay, decontamination wastewater is disposed at the CFA Sewage Treatment Plant (STP), since requirements do not allow disposal of decontamination wastewater off the INL Site. Laboratory analytical waste is solidified, allowed to decay if radioactive, and disposed of at the state-regulated INL Site landfill; none of the waste is expected to be classified as hazardous waste.

A commercial vendor, holding a valid State of Idaho permit, will supply and pump portable toilets at the remote locations (e.g., north and south training ranges at RRTR and NSTR). Wastewater pumped from the portable toilets must be discharged to the CFA STP. The CFA STP must be included on the commercial vendor's State of Idaho approved list of disposal sites prior to discharge. INL Site Facilities and Site Services must approve waste disposal to the CFA STP.

Used targets are collected and retained for examination and future reference and testing, returned to the customer, or disposed per federal and state requirements

Hazardous waste is managed per Idaho regulations and disposed of at a permitted offsite facility.

4.1.7 Noise and Vibration

Under the proposed action, the frequency of explosive detonations at NSTR would increase. However, the limit of 20,000 lb NEW would not increase. Thus, single event noise levels would not be expected to change. Because the proposed action would not increase the size of detonations, vibration conditions around the NSTR perimeter remain unchanged. The noise and vibrations impacts were analyzed in EDF-7235 (INL, 2007).

The proposed action also involves using large caliber weapons and small arms at NSTR. However, noise impacts off the INL Site increase very little from the added weapons firing above the no action levels. Noise effects from explosive detonations dominate the overall Range operational noise off the INL Site and the slight change in noise impacts would not amount to an adverse impact.

Impacts to wildlife from noise are discussed in Section 4.1.3.4.

4.1.8 Health and Safety

DOE conducts radiological operations, including activities at the Ranges, in a manner that protects the health and safety of employees, contractors, and the public and maintains exposures to employees and the public and releases of radioactivity to the environment below regulatory limits. DOE takes deliberate actions to reduce exposures and releases to ALARA. For example, the proposed action limits the use of radioactive materials to quantities and radionuclides that keep exposures and releases ALARA while meeting individual test objectives.

The proposed radiological response training at the Ranges creates potential for multiple types of radiological exposure. Handling activated materials and placing sealed sources at the Ranges can lead to exposure. Dispersing radioactive materials on the ground generates surface contamination and airborne radioactivity that can lead to exposure.

The rules in 10 CFR 835, "DOE Occupational Radiation Protection," (2015) contain radiation protection standards, limits, and program requirements for protecting employees and the public from ionizing radiation resulting from DOE activities. The dose limit from DOE sources to employees is 5,000 mrem/year ED. The dose limit for the public entering an onsite controlled area managed by DOE, such as facilities at the INL Site, is 100 mrem/year ED. The offsite public dose limit in DOE Order 458.1, "Radiation Protection of the Public and the Environment," is 100 mrem/year ED (2013). The public dose limit in DOE Order 458.1 applies to members of the public located off DOE sites and on DOE sites outside of controlled areas and to members of the public exposed to residual radioactive material resulting from any remedial action or property clearance.

In addition, under Federal regulation 40 CFR 61 Subpart H, airborne radionuclide emissions from all INL Site operations must not exceed amounts that would cause any member of the public to receive an annual ED equivalent of 10 mrem/year. Table 34 summarizes public dose limits.

Table 34. Regulatory radiological dose limits for members of the public.

Public Dose Limits		
Regulatory Authority	**Onsite in Controlled Areas**	**Offsite or Onsite Outside of Controlled Areas**
10 CFR 835	100 mrem/year	NA
DOE Order 458.1	NA	100 mrem/year
40 CFR 61 Subpart H	NA	Maximum 10 mrem/year from air emissions[a]
a. Airborne radionuclide emissions are included in the 10 CFR 835 and 40 CFR 61 Subpart H limits but must not exceed 10 mrem/year.		

The proposed action requires verification, no less than once per year, of the curie content and isotopic-distribution of the major, intended isotopes and any contaminants in radiological materials used in radioactive material distribution testing and training. Any changes in isotopes or isotope concentration must be evaluated against Table 4 and included in annual reporting requirements. Newly found isotopes with a half-life greater than 74 days must be modeled for impact to soil and groundwater to demonstrate that the impact analysis in this EA remains valid.

Any changes to the source materials (e.g., composition or manufacturer), which will be irradiated, or the source of irradiation requires additional review, prior to any such use, to verify the releases in Table 4 will not be exceeded. Any new isotopes found in irradiated material, with a half-life greater than 74 days, must be modeled for potential impact to soil and groundwater prior to initial distribution. All new isotopes found in irradiated material must be evaluated for potential offsite air dose prior to initial distribution.

In addition, to minimize radiological material dispersals and areas of effect, weather conditions are monitored at the Ranges, and testing and training are postponed as necessary. Explosive dispersals are limited to wind speeds less than 25 mph; wind speed is monitored prior to each dispersal. Winds speeds less than 10 mph are optimal for training purposes. Range access control and monitoring continues until background radiation levels return to pre-test levels. Approved security plans prevent unauthorized persons from inadvertent entry to the Ranges during testing and training activities.

Public health and safety issues include potential hazards inherent in range training operations. DOE takes precautions in the planning and execution of activities to prevent injury to people or damage to property. Testing conducted at the Ranges presents certain safety and health concerns due to radiological exposure, fragmentation, air blasts, ground shock, and projectiles. Project controls to maintain radiological exposures ALARA and to protect people and property (such as following range guidance criteria and implementing safe stand-off distances) minimize health and safety impacts. No adverse impacts to human health and safety are anticipated from the proposed action.

4.1.9 Environmental Justice

Environmental justice requires fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to developing, implementing, and enforcing environmental laws, regulations, and policies. No predominately minority or low-income populations reside within the five-county area. For this area, about 88% of the population is white and, across the five counties, the percentage of the population living in poverty averages about 13% (tables in Section 3.9).

Most proposed activities occur in Bingham and Butte counties. The population of Bingham county is 81% white, and for Butte County, 95.5% of the population is white. The poverty rate in Bingham county is below the five-county average at 12.5%, which is about equal to the national poverty rate (12.3%), but in Butte County, 16.9% of the total population is in poverty and 22.1% of children under 18 live in poverty. Butte County has the highest county poverty rate for the area; this rate is slightly above the national average. The Fort

Hall Indian Reservation has a poverty rate of about 26% while about 43% of families with children under 18 are below the poverty level (U.S. Census Bureau, 2018a).

The proposed project would not require a large workforce for either construction or operation; therefore, it would not result in impacts to typical socioeconomic parameters (e.g., housing, schools, emergency services, and in-migration of workers).

The proposed action would impact the Shoshone-Bannock Tribes and other people having traditional ties to the INL Site and surrounding areas. Limited access to the INL Site restricts access to culturally significant areas that impart cultural, spiritual, and historical connections to the land and the potential for unauthorized artifact collection. These impacts will be felt most by the Shoshone-Bannock Tribes and constitute a disproportionately high impact to these people.

4.1.10 Intentional Destructive Acts

Explosive materials stored and used on the INL Site have the potential to be stolen and used against facilities and personnel at the INL Site. Security measures are in place at the INL Site to prevent the theft of explosives. Protective force personnel control access to the INL Site and allow access only to persons conducting official business and having proper credentials. Explosives are stored in approved and locked explosive storage magazines. DOE also maintains a highly trained and equipped protective force to prevent attacks against and entry into INL Site facilities.

However, destructive acts to proposed facilities could cause environmental effects. Environmental impacts from attacks to the new infrastructure would most likely cause localized effects resulting from damage and destruction of infrastructure at the Ranges and efforts to mitigate the impact by repairing and reconstructing the damaged infrastructure. Large-scale regional impacts could result, for example, from wildfire if the act resulted in a secondary effect, such as wildfire ignition during particularly dry periods.

The proposed project would present an unlikely target for an act of terrorism and would have an extremely low probability of attack. Fences, gates, and barriers, coupled with using keying systems, access card systems, and security personnel at entry points, restricts access to the INL Site and project area. Using these physical obstructions and warning signs effectively deters and delays intruders. Personnel identification and control measures such as photo IDs, visitor passes, and contractor IDs help quickly identify unauthorized persons within the INL Site.

The proposed action would not constitute an attractive target for vandalism, sabotage, or terrorism, because the facilities would be difficult to damage and the impact from any successful act would be negligible both from a practical and political perspective. Because the proposed action presents an unlikely target for an act of terrorism, the probability of an attack is extremely low.

4.1.11 Cumulative Impacts

Cumulative impacts result "from the incremental impact of an action when added to other past, present and reasonably foreseeable future actions." The impacts of past and present actions from the affected environment are considered in Section 3.

Cumulative impacts can result from individually minor, but collectively significant, onsite or offsite actions occurring over time (40 CFR 1508.7). Those actions within the spatial and temporal boundaries (i.e., project impact zone) of the proposed action are considered in this EA. The spatial and temporal boundaries vary depending on the type of action proposed.

The area potentially affected was determined by the scope of the proposed action, including all potential direct and indirect impacts associated with project. The geographic boundaries for analyses of cumulative impacts in this EA vary for different resources and environmental media. For example, for air quality, the potentially affected air quality region is the appropriate boundary for assessment of cumulative impacts from releases of pollutants into the atmosphere. For wide-ranging or migratory wildlife, impacts from the proposed action might combine with impacts from other sources within the INL Site or elsewhere in the range of a potentially affected population. For soils and plants, on the other hand, the boundary of the project area may provide the appropriate geographical area for assessing cumulative impacts.

There are several proposed projects at the INL Site that DOE considers reasonably foreseeable that would include radiological emissions that could contribute to cumulative impacts. Those that DOE reviewed include the following:

- Remote-Handled LLW Disposal Facility
- Plutonium-238 Production for Radioisotope Power Systems
- Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling
- Resumption of Transient Testing using the TREAT Facility
- Expanding Capabilities at the Power Grid Test Bed.

DOE reviewed the resources at risk; geographic boundaries; past, present, and reasonably foreseeable future actions; and baseline information in determining the significance of cumulative impacts. Conclusions are as follows:

Existing land use would not be affected by the changes in radiological training and increase in explosives use involved in the proposed action, but the area of disturbance increases at NSTR. Land use patterns and designations on the INL Site would remain unchanged. The proposed action would be confined to the Ranges and would not affect land use outside the INL Site. In conjunction with past, present, and reasonably foreseeable future actions, the proposed action would not be expected to result in an adverse cumulative impact to land use.

During normal operations, cumulative radiological and waste generating impacts would be minimal. Radiologic releases during normal operations would not result in adverse health impacts. Additional waste volumes would be small compared to current disposal volumes at INL.

4.1.11.1 Air Quality. Temporary impacts from construction activities and fugitive dust emissions would result in direct, short-term adverse impacts, which would be mitigated through applying project controls and dust control measures during construction. As a result, construction activities present minimal harm to air quality.

Table 35 presents the estimated dose from each reasonably foreseeable project to a MEI. Most are screening-level dose estimates, which means the analysis used conservative assumptions (e.g., no mitigation). In addition, some projects estimate dose at the nearest offsite public receptor location, which may be several miles from Frenchman’s Cabin. For example, the location of the public receptor dose presented for NSTR is near the INL Site northeast boundary, more than 38 miles from the INL MEI location at Frenchman’s Cabin. If the doses for each project are conservatively assumed to occur at Frenchman’s Cabin (which they do not), the total dose from reasonably foreseeable projects, including expanding the Ranges, is 1.77 mrem/year. If combined with the current maximum total annual estimated dose reported for INL Site compliance (0.0102 mrem in 2018), the dose from current and reasonably foreseeable future actions on the INL Site would be 1.78 mrem as indicated in Table 35. Although the actual dose is expected to be much less, this estimated dose is still much lower than the 10 mrem annual dose standard.

Potential additive impacts from implementing the proposed action are determined to be collectively small and would have little impact to reasonably foreseeable future actions or current operations. Future projects at the INL Site would also be regulated by federal and state laws. Table 35 shows the estimated annual air pathway dose (mrem) to the MEI from normal operations and the proposed action.

Table 35. Estimated annual air pathway dose (mrem) from normal operations to the maximally exposed offsite individual from proposed projects, including the estimated dose from expanding capabilities at the Ranges.

Current and Reasonably Foreseeable Future Action	Estimated Annual Air Pathway Dose (mrem)
DOE Idaho Spent Fuel Facility (NRC, 2004)	0.000063[a]
Integrated Waste Treatment Unit (ICP/EXT-05-01116)	0.0746[h]
New DOE Remote-Handled LLW Disposal Facility (DOE/ID 2018)	0.0074[a]
Plutonium-238 Production for Radioisotope Power Systems (DOE/EIS 2013)	0.00000026[b]
Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling (DOE/EIS 2016)	0.0006[c]
TREAT (DOE/EA 2014)	0.0011[a]
Radiological Response Training Range (North Test Range)	0.048[d]
Radiological Response Training Range (South Test Range)	0.00034[a]
National Security Test Range	0.04[e]
HALEU Fuel Production (DOE-ID, 2019)	1.6[a]
Total of Reasonably Foreseeable Future Actions on the INL Site	1.77[g]
Current (2018) Annual Estimated INL Emissions (DOE 2019a)	0.0102[f]
Total of Current and Reasonably Foreseeable Future Actions on the INL Site	1.78[g]

a. Dose calculated at Frenchman's Cabin, typically INL's MEI for annual NESHAP evaluation.
b. Receptor location is not clear. Conservatively assumed at Frenchman's Cabin.
c. Dose calculated at INL boundary northwest of Naval Reactor Facility. Dose at Frenchman' Cabin likely much lower.
d. Dose calculated at INL boundary northeast of Specific Manufacturing Capability. Dose at Frenchman's Cabin likely much lower.
e. Sum of doses from New Explosive Test Area and Radiological Training Pad calculated at separate locations northeast of MFC near Mud Lake. Dose at Frenchman's Cabin likely much lower.
f. Dose at MEI location (Frenchman's Cabin) from 2018 INL emissions (DOE 2019a). The 10-year (2008 through 2017) average dose is 0.05 mrem/year.
g. This total represents air impact from current and reasonably foreseeable future actions at INL. It conservatively assumes the dose from each facility was calculated at the same location (Frenchman's Cabin), which they were not.
h. Dose calculated at the INL southern boundary in the direction of maximum dose, 13,900 m SSW of INTEC.

4.1.11.2 Historical and Cultural Resources. DOE has consulted with SHPO under Section 106 of the National Historic Preservation Act (NHPA) and has received concurrence that there would be no adverse effects to eligible or potentially eligible NRHP sites. Therefore, the proposed action does not contribute to cumulative impacts to eligible cultural and historical resources.

As noted in Section 4.1.3, the cumulative impacts to intangible connections to the land from landscape changes and changes to the visual quality of the landscape can only be interpreted, determined, and known by the people whose cultural practices, beliefs, or identity connects them to the affected area. As such, DOE is committed to actively engaging representatives of the Shoshone-Bannock Heritage Tribal Office in evaluating new infrastructure, interpreting the associated impacts, and identifying potential mitigation/avoidance/protection measures.

4.1.11.3 Ecological Resources. Cumulative effects on ecological resources are generally additive and proportional to the amount of ground disturbance within specific habitat areas. The proposed action has the potential to impact vegetation, wildlife, and sensitive species. Sensitive species at the INL Site are discussed earlier in Sections 3 and 4.

Long-term impacts to plants and animals can be attributed to fragmentation caused by new access roads, downrange target area, and new explosives test pad. New development has the potential to fragment botanical and wildlife habitat at the INL Site. Opening areas to increased vehicular access and testing events causes direct and indirect impacts. Increased human and wildlife interactions, vehicle collisions, and spread of noxious weeds can result. The proposed land disturbance, when combined with road effects from past, present, and reasonably foreseeable actions, reduces the continuity of open and undeveloped land at the INL Site.

The 2019 Sheep Fire burned over 100,000 acres at the INL Site, including the area around NSTR and the INL PGTB. The extent of sagebrush habitat loss from the Sheep Fire is unknown at the present time, but likely far outweighs the loss of such habitat expected from expanding capabilities at the Ranges and PGTB. The area around NSTR also burned in the 2010 Jefferson Fire and was mostly devoid of sagebrush prior to 2019.

A small portion of STR lies within the SGCA. NSTR and NTR are not located within the SGCA. The Sheep Fire burned a relatively small number of acres within the SGCA (INL Wildland Fire Committee Meeting July 29, 2019). The CCA (DOE-ID & USFWS, 2014) established habitat and population triggers to guard against sage-grouse declines. The habitat trigger would be tripped if more than 20% of sagebrush habitat within the SGCA is lost or converted to a non-sagebrush-dominated vegetation class. If a net 38,824 acres of sagebrush habitat were lost, DOE and the USFWS would follow procedures outlined in the CCA to determine the cause and develop new conservation measures.

If the entire fenced area (184 acres) at NTR and STR were comprised of sagebrush, the amount of habitat loss would amount to about 0.5% of the habitat trigger. When combined with potential sagebrush loss from expanding the PGTB (276 acres), the potential loss amounts to about 462 acres (about 1.2% of the habitat trigger). This estimate is conservative because it assumes complete loss of sagebrush across both the PGTB expansion area and NTR and STR. The loss of 462 acres of sagebrush at the INL Site is not expected to affect the Site's ability to maintain enough habitat for sage-grouse or other sagebrush-dependent species.

NSTR is located within a large undisturbed tract of INL that covers about 153,600 acres (about 240 square miles). Establishing NSTR disturbed about 19 acres (DOE-ID 2007). The proposed action disturbs about 270 acres at NSTR, which is about 0.18% of the undisturbed core of the INL Site. While a large portion of the core area burned in the 2019 Sheep Fire, the amount of added disturbance from the proposed action is unlikely to cause a notable amount of habitat fragmentation or to affect wildlife migration though the core area. The stability of INL Site wildlife populations would not be affected.

Increased training operations could have minor impacts on ecological resources. Although there would be no habitat changes, vegetation and wildlife could experience temporary, minor adverse impacts from the proposed increases in disturbance and testing and training activities. The increase in disturbance and in training and testing events is unlikely to cause a notable amount of habitat fragmentation or to result in behavioral changes or responses in a biologically important behavior or activity to a point where such behaviors are abandoned or significantly altered.

Wildlife in testing and training areas may temporarily avoid the areas during exercises but will likely return after training has ceased. Therefore, disturbance to wildlife from increased operations and human interactions under the proposed action is expected to be short-term and temporary. There are no known future actions in the core area that would have additive impacts on wildlife. The stability of INL Site wildlife populations would not be affected.

The proposed action co-locates new infrastructure with current facilities, and the proposed roads and power line follow existing routes. Habitat in these areas has already been lost or modified. Consolidating similar linear features (i.e., power lines and roads) in this manner reduces cumulative effects.

Project activities, such as vegetation removal, soil disturbance, UAV flights, and other disruptive activities have the potential to affect ecological resources. However, from a cumulative impact perspective, the incremental impacts of the proposed action when added to past, present, and reasonably foreseeable actions at the INL Site are minor. Considering the widespread nature of INL Site facilities and pristine conditions on most of the INL Site, the cumulative impacts of the proposed action are small. In addition, by implementing project controls, such as revegetation with native seed, weed control, and minimizing soil disturbance, the effects of the proposed action are anticipated to be minor.

4.1.11.4 Soils. While increased training and testing on the Ranges adds to the potential for soil disturbances and erosion, mitigation through following project controls counters or contains adverse direct impacts.

Review of relevant past and present projects indicates minor impacts during clearing and grading activities; however, potential erosion impacts will be temporary and covering soils with gravel or other surfacing material and revegetating temporarily disturbed areas minimizes soil erosion.

Soils monitoring at the Ranges will take place at least every 2 years for at least two rounds of monitoring. Based on the results, monitoring frequency may be either increased to annually or decreased. Soil monitoring and sampling will also be performed no less than every 5 years to verify radionuclide, chemical, and explosive constituent concentrations do not approach ecological screening levels or PRGs. If concentrations approach ecological screening levels or PRGs, soils will be removed and placed in a licensed disposal facility. Using the ecological screening levels and residential PRG verifies human health and the environment will be protected when training at the Ranges is complete. Monitoring and sampling will continue to be evaluated at a minimum of every 5 years to determine whether a release or substantial threat of a release of testing and training constituents poses an imminent and substantial threat to human health or the environment.

Cumulative impacts to soils are not anticipated.

4.1.11.5 Water Quality. Direct impacts on groundwater from the proposed action are estimated to result in minimal changes in the potential for groundwater contamination. However, even though the increase in testing and training at the Ranges would result in no additional direct negative impacts, the increase in munitions expended at NSTR adds munitions constituents to the soil and could result in an added potential for groundwater contamination, albeit very small.

The analysis of potential groundwater impacts from explosives residues in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID 2007) found that these residues are not expected to have an impact on groundwater due to a low infiltration rate and adsorption onto the soil. Studies at the INL Site undertaken through the CERCLA Program have demonstrated that small amounts of chemical contaminants, located at the ground surface, do not present a risk to groundwater even if there is no adsorption on soil (DOE, 2001).

While there may be additive effects from past, present, and future testing and training events, soil monitoring and removing soil, if necessary, minimizes potential impacts to groundwater quality.

4.1.11.6 Hazardous Materials and Hazardous Waste Management. The proposed action has the potential to deposit hazardous constituents on the Ranges from radiological dispersals and explosive detonations and could increase the amounts of hazardous materials stored at the Ranges. The amounts would be a minor increase compared to existing INL Site operations.

The amount of hazardous waste generated would increase, commensurate with the increase in training operations. The increase in hazardous materials and hazardous waste associated with the proposed action would increase the potential damage a release might cause; however, existing programs and capabilities at the INL Site could easily handle and contain any potential release.

The increase in hazardous materials and normal industrial waste associated with the proposed action is not expected to perceptively add to the existing cumulative hazardous materials and waste impacts. Although weapons constituents are not considered hazardous waste until they leave the range, the increase in hazardous constituents from expended munitions in the soil of the Ranges amounts to a potential contaminant and would be an added minimal cumulative impact.

The Ranges will continue to be evaluated at a minimum of every 5 years to determine whether a release or substantial threat of a release poses an imminent and substantial threat to human health or the environment. If a significant increase in Range operations occurs or new munitions types are used, then the assessment should occur earlier than 5 years to ensure no additional threat resulting from the change in operation.

4.1.12 Conclusion

Implementing the proposed action would result in minor adverse impacts to the environment. These impacts, in conjunction with other past, present, and reasonably foreseeable future actions, would result in negligible cumulative impacts.

4.2 No Action Alternative

The no action alternative means that none of the actions described in the proposed action would occur at the Ranges. Environmental impacts, as described in Section 4, would not occur on the INL Site from actions described in the proposed action. However, current operations at NSTR and RRTR, as evaluated in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID, 2007) and the *Final Idaho National Laboratory Radiological Response Training Range Environmental Assessment and FONSI* (DOE-ID, 2010) would continue.

If the proposed activities were not performed at the INL Site, other entities and locations could potentially support the research, testing, and training capabilities proposed at the Ranges. Performing the proposed activities at another location and the associated environmental impacts is outside the scope of this analysis.

4.3 Summary of Environmental Consequences

Table 36 provides a summary of the environmental consequences that would result from the no action and proposed action alternatives for air, cultural, ecological, and soil resources.

Table 36. Summary of environmental impacts under the proposed action and no action alternatives.

Resource	No Action Alternative	Proposed Action
Air	Under the no action alternative, there would be no change in the current conditions at the INL Site; therefore, there would be no direct, indirect, or cumulative impacts to air quality.	Air quality impacts from implementing the proposed action caused by mobile emissions sources used to conduct project activities (including maintenance and testing) and ground disturbance would be minimal and localized and would not cause changes to regional air quality. In addition, the long-term operation and maintenance of the project would not result in any non-permitted sources of toxic air emissions. Because of the limited nature of construction activities and use of project controls (e.g., applying water to disturbed areas), air quality impacts would be negligible. A conservative assessment of radionuclide releases during anticipated normal operations indicates cumulative doses from all INL sources would be well below the 10 mrem/year dose standard for a member of the public at the INL MEI location.
Historical and Cultural	All archaeological sites within the project area have been recommended as ineligible and the no action alternative would have no effect to historic or cultural properties.	DOE has consulted with SHPO under Section 106 of the NHPA and has received concurrence that there would be no adverse effects to eligible or potentially eligible NRHP sites.
Ecological	The current levels and types of testing and training operations would continue under the no action alternative. No changes would occur to ecological resources. The no action alternative, in conjunction with other past, present, or reasonably foreseeable projects, would not be expected to result in cumulative impacts to ecological resources.	Radiological testing at the Ranges would not exceed DOE standards for protection of biota. The increase in disturbance and in training and testing events is unlikely to cause a notable amount of habitat fragmentation or loss or to affect wildlife migration. The stability of INL Site ecological resources would not be affected.
Soils	Present training operations are contained within well defined, existing training areas and ranges, and no additional impacts would occur by implementing the no action alternative.	The effects of soil disturbance would be localized; there are no other planned projects with which the effects of the proposed action would combine to result in cumulative hazards. Therefore, the impacts to soils from disturbance associated with the proposed action would be minimal. Build-up of munitions constituents and/or radiological materials in soils is unlikely.

Resource	No Action Alternative	Proposed Action
Water Quality	Under the no action alternative there would be no change in the current conditions at the INL Site; therefore, there would be no direct, indirect, or cumulative impacts to water quality.	The proposed action is estimated to result in minimal changes in the potential for groundwater contamination. Therefore, impacts to groundwater are minimal.
Hazardous Materials and Waste Management	The current use levels and types of hazardous materials and waste management activities at the INL Site would continue under the no action alternative. No changes would occur.	The increase in hazardous materials and normal industrial waste associated with the proposed action is not expected to perceptively add to the existing cumulative hazardous materials and waste impacts at the INL Site.
Health and Safety	The current levels and types of testing and training operations would continue under the no action alternative. No changes would occur to human health and safety.	No adverse impacts to human health and safety are anticipated from the proposed action.
Noise and Vibration	The current levels and types of testing and training operations would continue under the no action alternative. No changes would occur.	Vibration conditions around the NSTR remain unchanged from the no action level. Noise impacts increase slightly from added weapons firing above the no action level. Noise effects from explosive detonations dominate the overall Range operational noise and the slight change in noise impacts would not amount to an adverse impact.
Intentional Destructive Acts	Under the no action alternative, there would be no change in current conditions at the INL Site; therefore, there would be no change in the potential for intentional destructive acts.	The proposed action would not constitute an attractive target for vandalism, sabotage, or terrorism, because the facilities would be difficult to damage and the impact from any successful act would be negligible both from a practical and political perspective. Because the proposed action presents an unlikely target for an act of terrorism, the probability of an attack is extremely low.

5. COORDINATION AND CONSULTATION

5.1 Shoshone-Bannock Tribes

DOE provided the NSTR/RRTR cultural resource investigation report (INL/LTD-18-52362) to the Tribes for review and comment on January 29, 2019. DOE briefed Heritage Tribal Office representatives on July 15, 2019, on the EA and project. DOE briefed the Fort Hall Business Council on July 24, 2019.

DOE briefed the Heritage Tribal Office on the cultural resource evaluation for the NSTR/RRTR Project during several regularly scheduled Cultural Resource Working Group meetings held during 2016 through 2019. Members of the Office also participated in field surveys performed within the project area of potential effect as documented in INL/LTD-18-52362.

5.2 Idaho State Historic Preservation Office

DOE performed National Historic Preservation Act Section 106 consultation with SHPO. DOE briefed Idaho SHPO on the cultural resource investigation of NSTR/RRTR on January 31, 2019. DOE provided the NSTR/RRTR cultural resource investigation report (INL/LTD-18-52362) to the Idaho SHPO for review on January 29, 2019. On April 4, 2019, DOE received concurrence from Idaho SHPO on the determination of no adverse effect to historic properties. As a result of the no adverse effect determination, there was no need to consult with the Advisory Council for Historic Preservation.

5.3 Congressional

DOE briefed staff members of Senator Risch, Senator Crapo, and Congressman Simpson on July 16, 2019.

5.4 Idaho Governor's Office

DOE briefed Idaho Governor's Office Energy and Mineral Resources Administrator, John Chatburn, Policy Analyst Marissa Warren, and several Idaho Department of Environmental Quality officials including Regional Administrator Erick Neher on July 15, 2019.

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Appendix A Response to Public Comments

Response to Public Comments

The formal comment period for the Draft EA for *Expanding Capabilities at the National Security Test Range and the Radiological Response Training Range at Idaho National Laboratory* ended on October 11, 2019. DOE received several comments from interested parties and groups. This appendix contains DOE's responses to the comments. This document is being prepared as an appendix to the Final EA. This document will be available online and to other interested parties upon request. Comments are organized by commenter in the order they were received (see Table A-1).

Table A -1. List of commenters, commenters affiliation, and page number of comment response.

Comment #	Commenter	Commenter Affiliation	Page # for Response
1	William C. Phoenix	Self	A-2
2	Alan Gunn	Self	A-3
3	John Chatburn	Idaho Governor's Office of Energy & Mineral Resources	A-4 – A-7
4	Ladd R. Edmo	The Shoshone-Bannock Tribes	A-8 – A-15
5, 7	Tami Thatcher	Self	A-16 – A-46
6	Chuck Broscious	Environmental Defense Institute	A-47 – A-78
8	Dave McCoy	Citizen Action New Mexico	A-79 – A-80

<u>Comment #1-William C. Phoenix</u>

From:	! NSRREA
To:	Jenifer B. Nordstrom; John S. Irving
Subject:	FW: DOE/EA-2063 - comment
Date:	Tuesday, October 15, 2019 7:15:48 AM

1st comment

1

From: William Phoenix <billphoenix101@gmail.com>
Sent: Saturday, September 21, 2019 12:36 PM
To: ! NSRREA <nsrrea@id.doe.gov>
Subject: DOE/EA-2063 - comment

Gentlemen:

I wholeheartedly support expanding the capabilities at the National Security Test Range and the Radiological Response Training Range at the Idaho National Laboratory, per DOE/EA-2063.

Sincerely,

William C. Phoenix, PE
5440 Gleneagles Drive
Idaho Falls, ID 83401
Home telephone: (208) 522-3872
Mobile telephone: (208) 339-3872

Response(s) 1: DOE acknowledges your comment supporting the proposed action. Thank you.

Comment #2-Alan Gunn

From: ! NSRREA
To: Jenifer B. Nordstrom; John S. Irving
Subject: FW: Comments re: Draft Environmental Assessment for Expanding Capabilities at the National Security Test Range and the Radiological Response Training Range at Idaho National Laboratory (DOE/EA-2063)
Date: Tuesday, October 15, 2019 7:16:08 AM

2nd comment

From: Alan Gunn <gunnal@aol.com>
Sent: Monday, October 7, 2019 3:53 PM
To: ! NSRREA <nsrrea@id.doe.gov>
Subject: Comments re: Draft Environmental Assessment for Expanding Capabilities at the National Security Test Range and the Radiological Response Training Range at Idaho National Laboratory (DOE/EA-2063)

I am writing to provide input regarding the *Draft Environmental Assessment for Expanding Capabilities at the National Security Test Range and the Radiological Response Training Range at Idaho National Laboratory (DOE/EA-2063).*

Let the record reflect that I fully support the proposed DOE actions. Furthermore, based on my knowledge of other potential locations for the stated actions, I would consider the Idaho National Laboratory (INL) to be the most suitable site primarily due to the extensive experience and expertise of the INL research, development and operations staff as well as the extensive independent, professional oversight which would be provided by the DOE Idaho Operations Office. Additionally, due to the long history of nuclear reactor operations at the INL site with over 50 reactors having been built and operated over the past 70 years, as well as the extensive history of successful execution of National Security activities at the INL, there should be no need for any further National Environmental Policy Act (NEPA) documentation beyond the final environmental assessment, given the fact that the environmental impacts of any and all INL operations have been scoped, characterized and fully documented for decades. Therefore, the draft environmental assessment should be sufficient given the extensive previous environmental analysis and documentation which has been conducted for completed, ongoing and other proposed nuclear and national security related activities, including reactor operations at the INL, rather than conducting new, redundant environmental analyses. 2 3

Sincerely,

Alan L. Gunn

Response(s) 2-3: Mr. Gunn, thank you for your comments. Please refer to the numbered comments and corresponding numbered responses.

2. DOE acknowledges your comment supporting the proposed action. Thank you.

3. DOE prepared this EA to determine if the proposed action for expanding capabilities at the Ranges as described in the EA had the potential for significant environmental impacts.

Comment #3-John Chatburn, Idaho Governor's Office of Energy & Mineral Resources

IDAHO GOVERNOR'S OFFICE OF ENERGY & MINERAL RESOURCES

BRAD LITTLE
Governor

JOHN CHATBURN
Administrator

304 N. 8th Street, Suite 250, P.O. Box 83720
Boise, Idaho 83720-0199

(208) 332-1660
FAX (208) 332-1661

October 11, 2019

Mr. Vic Pearson
U.S. Department of Energy
Idaho Operations Office
1955 Fremont Avenue,
Idaho Falls, Idaho 83415

Dear Mr. Pearson,

Thank you for the opportunity to provide comments for the *Draft Environmental Assessment for Expanding Capabilities at the National Security Test Range and Radiological Response Training Range at Idaho National Laboratory (DOE/EA-2063)*. The following comments were developed in coordination with the Idaho Governor's Office of Energy and Mineral Resources and the Idaho Department of Environmental Quality (DEQ).

The State of Idaho respectfully requests the following items be fully analyzed and given due consideration in the Final Environmental Assessment (EA) for Expanding Capabilities at the National Security Test Range and Radiological Response Training Range at Idaho National Laboratory (INL):

1. Based on the maps provided in the Draft EA, the proposed actions may involve areas at the INL that are located on Federal Facility Agreement and Consent Order (FFA/CO) Sites that are managed under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Many of these Sites have Institutional Controls (IC's) and other restrictions in place that must be observed whenever these sites are accessed or disturbed. Examples include activities such as construction projects involving soil disturbance, or the requirements associated with Munitions Response Areas. 4

   As such, project staff must coordinate closely with the U.S. Department of Energy (DOE) Office of Environmental Management and external Agencies, such as DEQ and the U.S. Environmental Protection Agency, to ensure compliance with all applicable state and federal laws, controls, and restrictions. Many of these requirements, and other pertinent information, can be found in the "*INL Site-wide Institutional Controls, and Operations and Maintenance Plan for CERCLA Response Actions*" document, DOE/ID-11042, Revision 10, dated December 2017. https://ar.icp.doe.gov/images/pdf/201805/2018050801119SEL.pdf)

2. Regarding the discussion on page 15 of the EA, Section 2.1.2.1 Non-Radiological Operations, please explain if munitions will be composed of uranium, in any form. If uranium is to be used 5
for this purpose, please provide the necessary information to describe the impacts related to the use of this material, consistent with all other material impacts described within the document.

3. On page 18 of the EA, Section 2.1.2.2 Radiological Training and Testing, the description of the radioactive materials found in paragraph two includes KBr, K_2O, and $LaBr_3$. These stable 6
compounds will apparently be irradiated prior to use, but this is not immediately clear to the reader. Please modify the text within this paragraph to clarify if these materials will in fact be irradiated, and also provide a description as to where and how this process is to occur.

4. On pages 18-20 of the EA, Section 2.1.2.2 Radiological Training and Testing, Table 4 includes a listing for elemental (metal) copper and zirconium, along with F-18. The second paragraph found on page 46, Section 4.1.1.3. Radiological Impacts describes how the analysis is conservative for 7
both copper and zirconium metal particulates, and that the analysis has assumed the liquid fluorine being used will move in the environment as a respirable particulate. Please explain if fluorine will be present in elemental form or in a compound, and how that may relate to the F-18 entry in Table 4.

5. The last paragraph on page 20 of the EA, Section 2.1.2.2 Radiological Training and Testing, refers to radioactive materials with half-lives shorter than 20 days, and includes KBr (potassium 8
bromide) as an example. This appears to conflict with the half-lives given in the list of radionuclides found in Table 4 on page 19, Section 2.1.2.2 Radiological Training and Testing. Please clarify as necessary.

6. On page 22 of the EA, Section 2.1.2.2 Radiological Training and Testing, the penultimate row of Table 6, in the second column (entitled training use), appears to have a typo in the last sentence 9
contained within the cell associated with this row and column. The sentence currently states: "…or progeny with a half-life greater than 20 days year…" Please revise this sentence to use either "days" or "year", as appropriate.

The State of Idaho appreciates the opportunity to submit these comments. Pease feel free to contact me should you have any questions or need of clarification.

Sincerely,

John Chatburn

Administrator

Response(s) 4-9: Mr. Chatburn, thank you for your comments. Please refer to the numbered comments and corresponding numbered responses.

4. DOE agrees and intends to closely coordinate proposed activities between the Office of Nuclear Energy, the Office of Environmental Management and other agencies to fully comply with all applicable state and federal laws, controls, and restrictions.

5. Uncontrolled releases of uranium were not authorized or evaluated in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID, 2007), and while limited use of uranium in sol gels within enclosed and contained structures is authorized, uncontrolled release is not part of the action.

6. Stable compounds of KBr, K_2O, and $LaBr_3$ are purchased from commercial suppliers. As part of the procurement process, impurity analyses are required and reviewed to verify material purity. Once a sample of each material is obtained, a portion of known mass is placed in a polymethylpentane "plastic" vial that has been cleaned with high purity water and methanol. The vial containing the compound is then irradiated in a nuclear reactor to attain the desired activity. The material is analyzed by gamma spectrometry to confirm the amount of radioactivity produced and determine if deleterious isotopes are present that would indicate contamination in the initial materials or introduced during capsule loading. If contamination is detected, the material may be separated from the vial to determine if the contamination was introduced during the loading process. The material is not used until the source of the impurity has been identified and removed.

The paragraph has been edited to read as follows:

> "Radiological response training and testing uses the new explosives test pad and the radiological training pad at NSTR (see Figure 4). At both Ranges, proposed radiological response training and testing uses mechanical spreaders or sprayers and limited quantities of explosives to spread radioactive materials on the ground. The proposed action authorizes using multiple radioactive materials (e.g., Cu-64, F-18, K2O, KBr, LaBr3, and Zr-97) during any single training event. The radioactive KBr, K2O and LaBr3 are produced by irradiating small samples (a few grams) in a low-power, light-water reactor for a period of about 2 hours (Sterbentz 2019). Explosive radiological dispersals use up to 1 lb NEW TNT equivalent at RRTR and 5 lb at NSTR. The proposed action limits explosive detonations to the disturbed areas of the explosive test pad and radiological training pad at NSTR and to disturbed areas of RRTR. Spreading radioactive materials with mechanical spreaders or sprayers is also limited to these areas. Using explosives to spread radioactive materials releases radionuclide air emissions that can be carried by air currents beyond the boundary of the test pads, the Ranges, and the INL Site. The proposed action does not include mechanical dispersals outside these disturbed areas for testing and training, but foot traffic outside of disturbed areas may occur."

Sterbentz 2019 has also been added to the list of references in Section 6.

7. Fluorine -18 is procured from a commercial medical isotope supplier. It is made by irradiating ultrapure water with protons. The Oxygen-18 in water is bombarded with high energy protons; the Oxygen -18 isotope captures the proton to form an excited state nucleus that then emits a neutron to form Fluorine-18. The Fluorine-18 is a compound weakly bound to water. Dispersion can be performed by a liquid spray or by using explosives. Either method produces fine water droplets that evaporate. The F-18 isotope decays with a half-life of 109.7 minutes and decays back to stable Oxygen-18.

8. The last paragraph on page 20 refers to silica glass dispersals for which half-life and annual release limits are listed in Table 5. Table 4 lists the half-life and total annual releases for radioactive materials that will be dispersed on the ground using mechanical spreaders or sprayers and limited quantities of explosives. The title of Table 4 has been changed to reflect this difference. The paragraph preceding Table 4 has also been changed to the following:

> "Table 4 lists the isotopes produced from irradiating K_2O, KBr, $LaBr_3$, Cu and Zr metals, and F for the proposed source term. The table also includes the half-life for each isotope, the estimated radioactivity released in a single test, and the proposed total annual release. This list includes both short- and long-lived radionuclides. The long-lived radionuclides include naturally occurring isotopes and long-lived radionuclides created during irradiation of the metals. DOE will evaluate using other radionuclides on an individual basis using the as low as reasonably achievable (ALARA) process and limit the dose to the public at each test location to less than 0.1 mrem/year."

9. "Year" has been deleted.

Comment #4-Ladd R. Edmo, The Shoshone-Bannock Tribes

The SHOSHONE-BANNOCK TRIBES

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October 11, 2019

Vic Pearson
U.S. Department of Energy
Idaho Operations Office
1955 Fremont Avenue, MS 1235
Idaho Falls, Idaho 83415-1222
nsrrea@id.doe.gov

SUBJECT: Comments on the *Draft Environmental Assessment for Expanding Capabilities at the National Security Test Range and the Radiological Response training Range at Idaho National Laboratory* (DOE/EA-2063)

Dear Mr. Pearson,

The Shoshone-Bannock Tribes (SBT) are providing the following comments on the Draft EA for the National Security Test Range (NSTR) Project, as referenced above. The Fort Hall Reservation is roughly 30 miles southeast of Idaho National Laboratory (INL). Historically, the INL lies within the ancestral territory of the Shoshone and Bannock people. This area was an access to the major corridors to the Tribes subsistence and cultural use resources. There are numerous sites on the INL which have not been recorded that have significant historical data of the lifeways of our people before pre-contact times. These resources and sites contain the history, the stories, and the memories of our ancestors. Impacts to the historical data is a significant loss to our cultural history. Accordingly, we have several issues we would like to bring to your attention regarding impacts and mitigation in the Draft EA of the NSTR Project—a project that will involve development and detonations.

A. Ineligible and Isolate Resources Should Be Protected

The Tribes appreciate that DOE has assessed that there will be no adverse impacts on National Register of Historic Places (NRHP) -eligible sites (those eligible sites on the NRHP). But there are potential impacts on ineligible sites and isolate resources. Whether or not cultural resources/sites meet the NRHP criteria is somewhat irrelevant, as we consider all cultural resources significant and worthy of protection. Ineligible resources and isolates comprise a large number—if not the majority—of cultural resources. There are 22 ineligible sites and 45 isolates, or about 70% of cultural resources within the project areas (EA at 29). The problem with considering ineligible and isolate resources as insignificant and unworthy of protection is that DOE could impact the majority of cultural resources. Plus, there is always the possibility that we 10 currently fail to understand their significance, but we might at some future time. Ignoring the possibility of false-negative errors does not bode well for our cultural resources and history. Simply put, if DOE fails to protect these resources now, then our cultural resources and our history are being allowed to be DIMINISHED, isolate by isolate and ineligible site by ineligible site. All cultural resources at INL should be protected, as they are significant aspects of our history. The determination that provides for the eligibility to the National Register Historic Places does not provide for the inherent and spiritual qualities that are exuded by the native people themselves. The Section 106 classification system and determination which follows allows that increased risk of reduction and/or even devalued significance to our ancestral past. Our Past is not measured site by site within a project area, but is seen throughout the landscape. As noted within the affected environment the lands adjacent to the INL site boundary of five southeastern Idaho counties, are all areas of tribal ancestral use. The Tribes ask that DOE work with our Tribes to protect ineligible and isolate resources.

B. Cumulative Effects of Cultural Resources Must Include Ineligible Sites and Isolate Resources

The cumulative effects section on Historical and Cultural Resources is deficient in several ways. First, the foundational part of any cumulative effects section is to show how past, present, and reasonably foreseeable future actions contribute to a cumulative impact. It is a simple process: Past impacts + Present impacts + Reasonably Foreseeable Future impacts = Cumulative impact. This must be included in the Draft EA, but presently is not. 11

Second, DOE concluded no adverse effects on eligible or potentially eligible NHRP sites, and therefore concluded that there are no cumulative effects. This is a false-negative: conclusion of no effect when in fact there is an effect. DOE did not consider impacts on isolate resources and ineligible sites in their conclusion of no cumulative effect. This is a big problem, especially given that for just this NSTR Project alone, 70% of cultural resources are ineligible or isolates. How many other projects has DOE concluded 'no impact' on cultural resources when in fact 70% of cultural resources were impacted? It is surely worth noting again that our Tribes consider impacts on our cultural and historic legacy to be significant, regardless of the NRHP criteria—criteria that automatically disallows many cultural resources and sites from being deemed "eligible." We hope that DOE will reconsider this deficiency in the Draft EA and properly disclose the actual impacts on ***all*** cultural resources—present, past, and reasonable future.

C. No Mitigation Provided for Cultural Resources

There will be impacts on cultural resources—just not "eligible" resources—and no mitigation was offered to offset these adverse impacts. We do acknowledge, however, that DOE stated they are committed to actively engaging with Tribal HeTO staff as to potential mitigation/avoidance/ protection measure (EA at 80.) We look forward to this mitigation commitment. 12

We have several suggestions for mitigation. First, given the possibility that detonations proposed in the Draft EA could expose subsurface cultural resources, it is reasonable that Tribal 13 monitors should be present during NSTR activities. The monitors would be responsible for identifying and assessing blast sites for cultural resources, then working with DOE and Tribal HeTO to catalog and restore/relocate the resources to undisturbed sites. Hiring at least one or two Tribal monitors for this purpose seems reasonable since DOE already anticipates hiring new employees for this NSTR Project (see EA at 42.)

Mitigation should also occur for ***any*** cultural resources potentially impacted by the Project. DOE may be doing this already, although the EA does not say. Where cultural resources could be impacted, the DOE and Tribal HeTO staff might gather the resources prior to ground disturbance and relocate the resources to another location—to a safe zone. 14

Training exercises will be taking place with a number of participants from 75 to 200 people and involve numerous vehicles. A Cultural Protection Plan should be developed for protection of the resources and cultural resources for any training activities. This should also include those other resources for wildlife and botanical plants. Golden Eagles are especially important and must be protected. This would ensure to the Tribes that INL is engaged with the Shoshone-Bannock Tribes in protection and preservation of Historic Resources and ecological resources significant to the Tribes. 15

Mitigation should also be included so as to prevent further impacts of ineligible sites and isolate resources. We suggest a two-tiered approach to achieve this goal. (1) Conduct an historical review of EA/EIS projects at INL to determine the numbers of ineligible sites and isolate resources that have been previously impacted. (2) Draft a report to detail such findings and provide recommended mitigation strategies going forward. DOE should fund the Tribes to conduct this work as part of its mitigation commitment. We are happy to discuss this option further with DOE. 16

The Tribes also suggest that Scholarships for tribal member be made available for Educational endeavors to help in the area of Cultural Resources. This would provide for knowledgeable personnel in the field on the Tribes side and in the INL workforce.

We also recognize DOE's efforts directing project personnel to "cease all work in the immediate area" when they discover unanticipated cultural resources and to "make proper notifications" thereafter (EA at 54 and Table 7 at 22). One issue we have with this—and indeed a justification for why we need Tribal monitors at NSTR sites—is that DOE's NSTR personnel are not trained to recognize cultural resources. So, our Tribes look forward to working with DOE to identify how we can get qualified Tribal monitors to work at NSTR sites. Then, as these inadvertent discoveries arise, we'll have specialists there to properly assess the area. In addition, the Tribes must be contacted when there are inadvertent discoveries. 17

D. Notification Requirements Must Be Included

Because the Tribes have several cultural resources specialists working at INL, we need to make sure that our Tribal staff are given advanced notice of when NSTR/RRTR activities will occur. There must be notification to the Tribes, particularly to LaRae Bill at HeTO. It is unacceptable for our Tribal staff to be exposed to any amount of NSTR/RRTR-related pollutants. 18

Accordingly, a notification requirement must be included in the NSTR EA and in any terms, conditions, or guidance documents for NSTR/RRTR project personnel.

E. Miscellaneous Comments

EA at 22, Table 7. Delete "prehistoric", as this term offers no additional information and incorrectly assumes a time when the Shoshone-Bannock Tribes had no written history. But our Tribes had their own unique history—both written and oral. It is just that it was separate and distinct from European forms. In the EA, it is enough to refer to "pre-contact" which is included in the same sentence as "prehistoric." 19

EA at 29, Section 3.2. We ask the DOE to include our tribal history in discussing "historical trails." That is, the "historical trails" originated as Shoshone-Bannock trails. When Euro-American emigrants began their journeys West through our territory, they used our trails—which were later hardened into high-traffic trails and given European names. 20

Finally, the EA did not address whether detonations could impact bats in caves that are located outside the NSTR/RRTR project boundaries. There was no assessment of how far the vibrations from blasts might affect species like bats, in cave roosts or elsewhere. This is an important consideration especially since large numbers of bats rely on the INL site for roosting and hibernating. Did the EA address the vibration resulting from the explosive activities to the caves surrounding the area? It only mentioned that they were analyzed but did not report an outcome in the EA. With enough vibrations, any cave or structure can fail and be destroyed. 21

If you have any questions, please feel free to contact our Cultural Resources Specialist, LaRae Bill, at lbill@sbtribes.com. We appreciate this opportunity to comment on the NSTR EA and look forward to our continued relationship with DOE.

Respectfully,

Ladd R. Edmo, Chairman

Response(s) 10-21: Mr. Edmo, thank you for your comments. Please refer to the numbered comments and corresponding numbered responses.

10. *The Cultural Resource Assessment for the Expansion of Capabilities at National Security Test Range and Radiological Response Training Range at Idaho National Laboratory* (Holmer, M. P., Cook, R. A., Henrikson, L. S., Gilbert, H. K., & Armstrong, L. T. (2019) details the results of the cultural resource investigations that are summarized in the EA. The Cultural Resource Investigations of the proposed range expansion at the Idaho National Laboratory also lists and identifies isolated finds, and DOE considered the impacts and recommendations from the cultural resource investigation report in the decision-making process. As noted on page 54:

> "While the proposed action will have no effect on cultural or historic properties eligible under NRHP, the cultural practices, beliefs, and identity of indigenous people connects them to the land in intangible ways not captured in the National Register criteria. The National Register criteria do not capture the indigenous cultural feeling, association, and experience derived from an intangible view of the area. Tribal members typically have a high sensitivity to landscape change and changes to the visual quality of the landscape based on these historical and spiritual connections. Infrastructure and other changes across the landscape can erode these connections.
>
> "Because proposed infrastructure and land disturbance is mostly associated with existing facilities and previous disturbance, changes to the existing landscape are not expected to be substantial. However, the exact location of infrastructure such as powerlines and the associated impacts to intangible connections can only be determined and known by the people whose cultural practices, beliefs, or identity connects them to the affected area. As such, DOE is committed to actively engaging representatives of the Shoshone-Bannock Heritage Tribal Office in evaluating new infrastructure, interpreting the associated impacts, and identifying potential mitigation, avoidance, and protection measures."

All sites identified in the area of potential effect, including isolates and ineligible sites, were recorded and documented in Archaeological Survey of Idaho forms as part of the cultural resource assessment INL/LTD-17-43028.

11. DOE relied on the CEQ handbook, *Considering Cumulative Effects Under the National Environmental Policy Act* (CEQ 1997), to develop the cumulative effects analysis. As such, the EA evaluates resources in the impact area based on time, place, and scale. Section 3 in the EA describes the aggregate effects of past actions in the project area, including establishment of the Ranges. It is permissible under NEPA to focus on the current aggregate effects of past actions without delving into the details of past actions. Section 3 presents the current status of resources within the project area, and DOE is unaware of any future proposals in the project area that would incrementally impact the environment. In a broad sense, all impacts associated with the proposed action are cumulative, and the analysis of the proposed action found no significant impacts to the environment would occur by implementing the proposed action.

Also, Section 4.1.11.2 states, "As noted in Section 4.1.3, the cumulative impacts to intangible connections to the land from landscape changes and changes to the visual quality of the landscape can only be interpreted, determined, and known by the people whose cultural practices, beliefs, or identity connects them to the affected area. As such, DOE is committed to actively engaging representatives of the Shoshone-Bannock Heritage Tribal Office in evaluating new infrastructure, interpreting the associated impacts, and identifying potential mitigation/avoidance/protection measures."

12. DOE acknowledges these concerns and recognizes the Tribes as a valuable source of expertise and resource interpretation, particularly in regards to cultural sites, as indicated by including representatives of the Shoshone-Bannock Heritage Tribal Office as active participants in the cultural resource surveys, resource recording, and site interpretation completed for this EA. DOE further sees great value in the collaborative forum stipulated in 36 CFR 800.6 (2004) and Appendix C of the CRMP (DOE-ID, 2016) where decisions for mitigating or minimizing adverse effects to cultural sites and historic properties are made in consultation with the Shoshone-Bannock Tribes. The intent of the EA is to evaluate the environmental impacts of management decisions taken under existing authorities, so that the full impact of those decisions is clearer. DOE will continue to evaluate measures to avoid and/or minimize adverse impacts to resources in accordance with existing requirements. The *Cultural Resource Assessment for the Expansion of Capabilities at National Security Test Range and Radiological Response Training Range at Idaho National Laboratory* (Holmer, M. P., Cook, R. A., Henrikson, L. S., Gilbert, H. K., & Armstrong, L. T., 2019) details the results of the cultural resource investigations that are summarized in the EA.

13. The nature of testing at the Ranges precludes the presence of non-project personnel. Representatives of the Shoshone-Bannock Heritage Tribal Office actively participated in the cultural resource surveys, resource recording, and site interpretation completed for this EA. The *Cultural Resource Assessment for the Expansion of Capabilities at National Security Test Range and Radiological Response Training Range at Idaho National Laboratory* (Holmer, M. P., Cook, R. A., Henrikson, L. S., Gilbert, H. K., & Armstrong, L. T., 2019) details the results of the cultural resource investigations that are summarized in the EA. Section 4.1.2 of the EA sates the following:

> "Based on survey results and subsurface evaluations documented in the *Cultural Resource Assessment for the expansion of capabilities at National Security Test Range and Radiological Response Training Range at Idaho National Laboratory* (Holmer, Cook, Henrikson, Gilbert, & Armstrong, 2019), the cultural resources identified at the Ranges are either ineligible for the NRHP or are outside the area potentially effected by project activities. Those resources that remain eligible for inclusion into the NRHP will not be impacted by project activity through project redesign in order to circumvent eligible resources or avoidance and archaeological monitoring during construction activities."

In addition, TEV-3572 gives an evaluative process for verifying that fired rounds remain in the Area of Potential Effects (APE) for cultural resources. As noted in section 4.1.2, "The proposed action does not have the potential to impact properties eligible for listing on NRHP. However, if during any project activities, project personnel discover unanticipated cultural, historical, or pre contact resources, they must make proper notifications and cease all work in the immediate area. DOE will follow any and all applicable laws that may apply to the discovery dependent on its nature (e.g., the Native American Graves and Repatriation Act (43 CFR Part 10, 1990) and the Archaeological Resource Protection Act (19 USC Ch. 1B, 2004)); see the *Cultural Resource Management Plan* (DOE-ID, 2016). Following an analysis of the discovery, work will continue in the area when DOE has given clearance to do so."

14. Representatives of the Shoshone-Bannock Heritage Tribal Office actively participated in the cultural resource surveys, resource recording, and site interpretation completed for this EA. DOE further sees great value in the collaborative forum stipulated in 36 CFR 800.6 (2004) and Appendix C of the CRMP (DOE-ID, 2016) where decisions for mitigating or minimizing adverse effects to cultural sites and historic properties are made in consultation with the Shoshone-Bannock Tribes. The intent of the EA is to evaluate the environmental impacts of management decisions taken under existing authorities, so that the full impact of those decisions is clearer. DOE will continue to evaluate measures to avoid and/or minimize adverse impacts to resources in accordance with existing requirements.

15. The INL CRMP addresses cultural and historical resource monitoring at the INL Site. The EA found no impact to eligible cultural and historic resources. Monitoring of cultural and historic resources at the INL Site will continue in accordance with the CRMP. DOE acknowledges these concerns and will continue to evaluate measures to avoid and/or minimize adverse impacts to resources in accordance with existing requirements.

Project personnel and others performing activities on the Ranges are given *Cultural Resource Awareness* training (course number 0INL1705) that presents background information on the sensitive cultural resources located within INL Site boundaries. This training also discusses employee responsibilities for protecting these resources during ongoing operations and project work.

Representatives of the Shoshone-Bannock Heritage Tribal Office actively participated in the cultural resource surveys, resource recording, and site interpretation completed for this EA. DOE further sees great value in the collaborative forum stipulated in 36 CFR 800.6 (2004) and Appendix C of the CRMP (DOE-ID, 2016) where decisions for mitigating or minimizing adverse effects to cultural sites and historic properties are made in consultation with the Shoshone-Bannock Tribes.

16. Section 3 in the EA describes the aggregate effects of past actions in the project area, including establishment of the Ranges. It is permissible under NEPA to focus on the current aggregate effects of past actions without delving into the details of past actions. Section 3 presents the current status of resources within the project area, and DOE is unaware of any future proposals in the project area that would incrementally impact the environment. The report *Cultural Resource Assessment for the Expansion of Capabilities at National Security Test Range and Radiological Response Training Range at Idaho National Laboratory* (Holmer, M. P., Cook, R. A., Henrikson, L. S., Gilbert, H. K., & Armstrong, L. T., 2019) details the results of the cultural resource investigations that are summarized in the EA. In addition, the CRMP addresses cultural and historical resource monitoring at the INL Site. The EA found no impact to eligible cultural and historic resources. Monitoring of cultural and historic resources at the INL Site will continue in accordance with the CRMP.

17. The nature of testing at the Ranges precludes the presence of non-project personnel. Project personnel and others performing activities on the Ranges are given *Cultural Resource Awareness* training (course number 0INL1705) that presents background information on the sensitive cultural resources located within INL Site boundaries. This training also discusses employee responsibilities for protecting these resources during ongoing operations and project work.

Also, please refer to page 54 of the EA, which states the following:

> "The proposed action does not have the potential to impact properties eligible for listing on NRHP. However, if during any project activities, project personnel discover unanticipated cultural, historical, or pre contact resources, they must make proper notifications and cease all work in the immediate area. DOE will follow any and all applicable laws that may apply to the discovery dependent on its nature (e.g., the Native American Graves and Repatriation Act (43 CFR Part 10, 1990) and the Archaeological Resource Protection Act (19 USC Ch. 1B, 2004)); see the Cultural Resource Management Plan (DOE-ID, 2016). Following an analysis of the discovery, work will continue in the area when DOE has given clearance to do so."

The INL CRMP requires DOE to notify the Tribes in the case of an inadvertent discovery of cultural resources and to initiate Government-to-Government consultation. DOE takes this responsibility very seriously and will continue to abide by this responsibility at the Ranges and all work at the INL Site.

18. As noted in Sections 3.8 and 4.1.8, it is DOE policy to observe precautions in planning and executing all activities that occur on the Ranges to prevent injury to people or damage to property. Procedures established for the safe use of materials at the Ranges set restrictions on the use of various types of ordnance and operations. Procedures provide safety guidelines for each individual range and testing and training event. Public health and safety from current operations at the Ranges are discussed in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID, 2007) and the *Final Idaho National Laboratory Radiological Response Training Range Environmental Assessment and FONSI* (DOE-ID, 2010).

Contamination areas are posted to protect employees, including field workers. The field worker notification process also protects people from entering dangerous areas during testing and training activities. DOE has received from the Tribes an updated list of their field workers and contact information to notify them of emergencies or the need to take protective actions.

19. The term has been deleted.

20. Section 3, first paragraph has been changed to read, "Cultural resources, including historic and Native American archaeological sites, historic architectural properties, and areas of importance to the Shoshone-Bannock Tribes, are numerous across INL and many are eligible for nomination into the National Register of Historic Places (NRHP or National Register). INL lands are also included within the aboriginal homeland of the Shoshone-Bannock people. The Native American archaeological sites, trails, burial sites, native plants and animals, and features of the natural environment that occur within the protected boundaries of the INL Site continue to fill important roles in tribal heritage and ongoing cultural traditions."

21. Section 3.3.3.1 of the EA and the report *Ecological Support for Environmental Assessment of Idaho National Laboratory's National Security Test Range Revision 1* (Hafla, et.al., 2019) note that bat acoustic surveys at NSTR identified western small-footed myotis and big brown bats using the area. The timing and level of observed activity suggests important summer roosts do not occur in the area. Townsend’s big eared bat, a Bureau of Land Management sensitive species, has been documented roosting in caves and lava tubes across the INL Site but was not detected during NSTR surveys. The noise and vibration impacts at NSTR were analyzed in EDF-7235 (INL, 2007).

Further, the *Idaho National Laboratory Site Bat Protection Plan* (DOE-ID 2018) ensures protection of sensitive bat resources through adherence to several recommended conservation measures. This document and its conservation measures were developed in collaboration with Idaho Department of Fish and Game and U.S Fish and Wildlife Service bat biologists. Conservation measure number four recommends avoiding blasting within a 0.75-mile (1.2-km) radius of hibernacula and important summer roosts. The 0.75-mile blasting buffer was arrived at by reviewing numerous resource agency documents outlining conservation strategies to protect roosting bats from blasting associated with mining, highway construction, and similar massive earth moving activities. The closest bat hibernation cave to the NSTR project area is 6 miles (9.7 km), outside the recommended blasting buffer distance. Acoustic surveys conducted in closer proximity to the NSTR project area did not indicate the presence of important summer roosts or suitable habitats that would support such roosts within the recommended 0.75-mile buffer.

Comment #5-Tammy Thatcher

Public Comment Submittal on the U.S. Department of Energy Draft Environmental Assessment for Expanding Capabilities at the National Security Test Range and the Radiological Response Training Range at Idaho National Laboratory (DOE/EA-2063)

Comment submittal by Tami Thatcher, due October 12, 2019.

Send comments to nsrrea@id.doe.gov

These comments address the draft environmental assessment by the U.S. Department of Energy to allow the DOE to release long-lived radionuclides to air and soil at the Idaho National Laboratory, DOE/EA-2063 at https://www.energy.gov/sites/prod/files/2019/09/f66/draft-ea- 2063-expanding-capabilities-nstr-rrtr-inl-2019-09.pdf

Inadequate time (30 days) was provided for public comment and DOE withheld important reference documents. A complete review of the draft EA was not possible due to the EA's inadequate publicly available documentation. 22

1. Summary of Draft DOE/EA-2063 Inadequacies

The Department of Energy's draft Environmental Assessment is inadequate and deceptive. The Department of Energy must prepare a full Environmental Impact Statement. The communities near the proposed action have already suffered far more harm that the DOE has admitted. 23

Historical and current radiological monitoring programs omit INL releases, and are designed to hide, not reveal, the level and the source of radiological contamination.

The draft EA implies detailed evaluations but then admits that the DOE will release additional radionuclides and in any amount it chooses. The hoax of an EA will result in continued harm to nearby communities. 24

The draft EA implies detailed evaluations which it has not made public and then states that additional radionuclides can be released that are not listed in the EA, "based on ALARA." 25

The INL radiological emissions are currently inadequately monitored and rarely attribute INL's releases to the INL even when there is no other reasonable explanation.

The draft EA fails to address the existing contamination levels in communities and drinking water. The draft EA fails to acknowledge that current INL radiological airborne monitoring is woefully inadequate because (1) emissions from the INL are usually based on estimates and not the reality, (2) the current environmental monitoring programs are designed to be inadequate, (3) the reports are tardy by nearly a year and are increasingly tardy, and (4) the quarterly and annual environmental monitoring reports are not reliable and are prone to "lost samples" or "air monitor not functioning" excuses. 26

The draft EA fails to truthfully discuss the multitude of INL CERCLA cleanup sites that cannot be released in 2095, as it goes about creating more CERCLA sites at the INL. 27

Historical soil monitoring showed that radionuclides unearthed by flooding at the Radioactive Waste Management Complex blew miles away to the farming community of Howe, Idaho, many miles north of the RWMC. The 1998 report, EML-599, study found that transuranic waste from RWMC has blown miles from RWMC.[1 2]

Our air and water cannot remain suitable for human use if radiation levels increase by a factor of 170 that this EA discusses. This draft EA blows off the real issues of radionuclide buildup in our air, soil and water. The draft EA is deceptive, misleading, and is simply a tool for DOE pretending, again, to not be the source of cancer, illness, birth defects in our communities. 28

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[1] T. M. Beasley et. al, Environmental Measurements Laboratory, *Heavy Element Radionuclides (Pu, Np, U) and Cs- 137 in Soils Collected From the Idaho National Engineering and Environmental Laboratory and Other Sites in Idaho, Montana, and Wyoming*, EML-599, October 1998.

[2] See EML-599, page 37 and Figure 14 on page 46 describing the way SDA windblown radionuclides could be distinguished from global weapons testing fallout, Nevada Test Site fallout and stack releases from INTEC. See page 45 describing how elevated Americium-241 to 239+240 Plutonium ratios observed near the SDA differ from weapons testing.

2. **DOE's public outreach has been inadequate and deliberately misleading, the draft Environmental Assessment is not bounding or representative of the proposed expansion, and a full Environmental Impact Statement is needed** 29

In all summaries and brief descriptive material by the DOE, the DOE deliberately omits the most important information about this proposed test range expansion. The DOE deliberately fails to mention in each brief narrative that they will be releasing short and long-lived radionuclides to the environment. The deliberate omissions show that the Department of Energy is more engaged in deception than transparency. No other part of Idaho nor another state would accept such unnecessary intentional release of long-lived radionuclides into our air, soil and water.[3] 30

Here is what the Department of Energy states for public consumption:

"The draft environmental assessment provides DOE's analysis of the proposed expansion which evaluates activities aimed at offering new and relevant capabilities to confront changing threats to military personnel, national and homeland security, and first responders. Capability enhancements include constructing a new explosives test pad and access road, ballistic tunnel, a downrange target area, and supporting infrastructure at the National Security Test Range (NSTR). Also included are expanded capability to support radiological training and technology test and evaluation at both the Radiological Response Training Range (RRTR) and NSTR and fencing the north and south training ranges of the RRTR."

Citizens were not told that the expansion of the Idaho National Laboratory's National Security Test Range and Radiological Response Training Range proposed test range expansion, for at least the next 15 years, will be releasing to the winds various long-lived radionuclides to further the contaminate the INL and to blow to nearby communities. The single Post Register article about it says only that the expanded capabilities would involve radioisotopes for testing and training, but did not say the radioisotopes would be released to blow to nearby communities.[4] 31

DOE has conducted the limited draft Environmental Assessment (EA) because it knows that if the public understood this proposed expansion of activities, it would be opposed.

3. **DOE's use of ALARA, which means "As Low as Reasonably Achievable" is nothing but a pretense to con the public, has no legal or specified meaning, and should not be used to imply some sort of commitment or reasonableness in the draft EA** 32

The draft EA implies meticulous radiation dose estimation, but is coupled with stating that **DOE may decide to release additional radionuclides that are not listed in the draft EA**. The draft EA states that the additional but as of yet unidentified radiological releases will be "based on ALARA." But for the DOE, ALARA, which means "As Low as Reasonably Achievable" can mean anything DOE wants it to mean.

The draft EA's underlying analyses have not been publicly available.[5 6] 33

The draft EA actually says on page 26 (Table 8) that "Multiple dispersals in accordance with releases listed in Table 4; additional radionuclides evaluated using the environmental ALARA process." This means the DOE intends to release any radionuclide, i.e., plutonium-239, they want to release during the training and in any amount. 34

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[3] Military training ranges on the southwest side of the state are extensive, although not shown on many highway maps. The names keep changing, but include Salmon Creek Air Force Range (or Saylor Creek), the Idaho Army National Guard Orchard Training Range, and an extensive training range over the Owyhee desert. Various past National Environmental Policy Act (NEPA) reports have extracted commitments to not release radionuclides in these test ranges.

[4] Nathan Brown, *Idaho Falls Post Register*, "Work could start soon on test range expansions," September 24, 2019.

[5] Sondrup, A.J. (2019a, May 30). Assessment of Potential Dose and Environmental Impacts from Proposed Testing at the INL Radiological Response Training Range, ECAR No. 3533.Idaho Falls: Idaho National Laboratory

[6] Sondrup, A. J. (2019b). Assessment of Potential Dose and Environmental Impacts from Proposed Testing at the INL National Security Test Range ECAR 3565.Idaho Falls: Idaho National Laboratory

4. Weak commitments in the draft EA reveal DOE's objectives – which appear to be "bait and switch" in regard to the amount and specific radionuclides released 35

The DOE claims that predicted radiological doses from the expansion of the radiological training range will be low, lower than the releases expected from current and new operations. But the loose commitments made in the draft EA about how infrequent and weak the efforts will be made to ensure that what is released is within what the EA has assumed, signals to me that the DOE fully intends to release additional radionuclides in whatever amounts DOE chooses. 36

Table 1 lists the radionuclides that the draft EA lists, which are primarily beta particle emitters. This is not typical of radiological releases that the military or emergency responders would encounter. So, I have to think that DOE has deliberately left out of the draft EA the alpha emitters such as plutonium in order to make the whole thing seem more palatable. 37

Table 1. Proposed annual Radiological Test Range radionuclide releases listed in the draft EA.

Radionuclide (Symbol) and Half Life (years)	Main Decay mode, Energy (MeV)	Total Annual Release[b] (Ci)	Federal Drinking Water MCL, pCi/L	Inhalation Limit, pCi/L (NRC effluent concentration limit)
Beryllium-10 (Be-10) 1,510,000 years	Beta, 0.56 MeV	3.44E-19	7.43	0.02 pCi/L (Y class)
Carbon-14 (C-14) 5,730 years	Beta, 0.156 MeV	2.56E-08	2,000	3 pCi/L (compounds)
Chlorine-36 (Cl-36) 300,000 years	Beta, 0.027	8.23E-07	700	0.3 pCi/L (W class)
Potassium-40 (K-40) 1,250,000,000 years	Beta, 1.33 MeV	4.16E-05	2.12	0.6 pCi/L
Nickel-63 (Ni-63) 101 years	Beta, 0.017 MeV	2.47E-13	50	1 pCi/L
Zinc-65 (Zn-65) 0.668 years [Information for beta energy is http://hpschapters.org/northcarolina/NSDS/65ZnPDF.pdf]	Beta, 0.330 MeV (2 % abundance) Gamma, 1.116 MeV (51 % abundance) Annihilation photons, 0.511 MeV (3 % abundance)	1.46E-07	300	0.4 pCi/L
Selenium-79 (Se-79) 327,000 years	Beta, 0.056 MeV	1.92E-09	7.55	0.8 pCi/L
Rubidium-87 (Rb-87) 49,700,000,000 years	Beta, 757 MeV	6.34E-10	300	2 pCi/L

Radionuclide (Symbol) and Half Life (years)	Main Decay mode, Energy (MeV)	Total Annual Release[b] (Ci)	Federal Drinking Water MCL, pCi/L	Inhalation Limit, pCi/L (NRC effluent concentration limit)
Palladium-107 (Pd-107) 6,500,000 years	Beta, 0.033 MeV	3.91E-20	202	0.6 pCi/L
Cadmium-109 (Cd-109) 1.26 years [Information for decay energy from https://ehs.princeton.edu/laboratory-research/radiation-safety/radioactive-materials/radioisotope-fact-sheets/cadmium-109 Very hard to detect.]	X-ray 0.022 MeV	4.41E-16	600	0.07 pCi/L
Silver-110m (Ag-110m) 0.684 years	Beta decay to Cd-110, which is stable but toxic.	2.02E-08	90	0.1 pCi/L
Note: Silver-110m and Zinc-65 known to bioaccumulate in oysters. https://inis.iaea.org/search/search.aspx?orig_q=RN:19082488 Spiders and other fauna concentrating radioactive silver in higher than expected amounts https://www.ncbi.nlm.nih.gov/pubmed/25864469	Beta, 0.53 MeV (30 %), 0.083 MeV (57 %), Photons, various.			
Cesium-135 (Cs-135) 2,300,000 years	Beta, 0.067 MeV	3.25E-18	900	2 pCi/L
Cesium-137 (Cs-137) 30 years	Beta, 0.51 & 1.18 MeV	2.22E-18	200	0.2 pCi/L
Lanthanum-137 (La-137) 60,000 years	Electron capture, Energies not found.	1.38E-13	148	0.1 pCi/L

Radionuclide (Symbol) and Half Life (years)	Main Decay mode, Energy (MeV)	Total Annual Release[b] (Ci)	Federal Drinking Water MCL, pCi/L	Inhalation Limit, pCi/L (NRC effluent concentration limit)
Lanthanum-138 (La-138) 102,000,000,000 years [Information from http://www.nucleide.org/DDEP_WG/Nuclides/La-138_com.pdf]	Electron capture and Beta, 0.205 and 0.370 MeV.	1.14E-09	14.7	0.005 pCi/L

Table notes: MeV is million electron volts. Ci is curie. Annual release is from draft Environmental Assessment DOE/EA-2063 and please note that 15 years of releases, at least, are expected. Federal drinking water maximum contaminant level (MCL) where available; otherwise from Environmental Protection Agency (EPA) Preliminary Remediation Goal (PRG) from DOE/EA-20163. pCi/L is picocurie/liter or 1.0E-12 curie/liter. Beta decay energies, when available, from https://cds.cern.ch/record/1309915/files/978-3-642-02586-0_BookBackMatter.pdf and NRC effluent concentration limits for air (selecting the most conservative limit when varied due to chemical form) at https://www.nrc.gov/reading-rm/doc-collections/cfr/part020/appb/index.html

5. The public needs transparency concerning the ever increasing "normal background" radiation levels at and near the Idaho National Laboratory 38

DOE expects to continue increasing the "normal background" radiation levels both on and off the Idaho National Laboratory site until our communities all receive unhealthy levels of radionuclide ingestion and inhalation.

The draft EA says that hazardous chemicals and radiological materials may disperse outside the detonation site. "Boundaries (e.g., ropes, signs, and barricades) are then installed to control access to these areas until the activity returns to normal (i.e., background) levels.

For long-lived radionuclides, returning to normal levels means blowing around until further dispersed or simply raising the "normal background level" to a new high.

"Normal background levels" are already elevated above what was naturally occurring and continue to rise. By selecting a contaminated area to determine "normal background," it appears to me that this is how some radiological facilities can claim to operate within "normal expected background" no matter what radiological release incident just occurred.

The DOE continues to not disclose what it considers "normal background levels" on and off the INL or to trend how the "normal background levels" have changed over time.

The INL's past practices of inflating "normal background levels" meant that employees worked in contaminated areas that when assessed independently during CERCLA cleanup investigations in 1995, these facilities had to be disposed of as radiological waste. Various INL areas had been highly contaminated for decades, and yet not monitored or controlled as such. See the Administrative Record for CERCLA cleanup at the Idaho National Laboratory at https://ar.icp.doe.gov .

6. DOE's allowable radiation level of 100 mrem/yr would devastate public health 39

The draft EA emphasizes the DOE's allowable radiation level of 100 mrem/yr and implies that reaching such high levels would not be a devastation to the health of people in our communities.

Department of Energy "regulatory radiological dose limits for member of the public" (see draft EA Table 34 on page 76) is 100 mrem/yr for onsite controlled areas and offsite or onsite outsider of controlled areas, no matter the age and gender of the member of the public.

By no means is the DOE's 100 mrem/yr dose limit protective of human health. DOE ignores the epidemiology that shows that a few years of an average 400 mrem/yr to adult radiation workers increases cancer risk. Exposure of pregnant women to DOE's allowed 100 mrem/yr dose would greatly harm fetal health. The DOE ignores all modern epidemiology studies for human health effects that show harm greater than DOE chose to believe decades ago, especially to the unborn, and to females and children.

The public as well as radiation workers need to keep in mind that, despite what they may have been taught:

- The cancer risk is not reduced when radiation doses are received in small increments, as the nuclear industry has long assumed.[7]
- Despite the repeated refrain that the harm from doses below 10 rem cannot be discerned, multiple and diverse studies from human epidemiology continue to find elevated cancer risks below 10 rem and from low-dose-rate exposure.[8]
- The adverse health effects of ionizing radiation are not limited to the increased risk of cancer and leukemia. Ionizing radiation is also a contributor to a wide range of chronic illnesses including heart disease and brain or neurological diseases.

The public and radiation workers take cues from their management that they should not be concerned about the tiny and easily shielded beta and alpha particles. DOE-funded fact sheets often spend more verbiage discussing natural sources of radiation than admitting the vast amounts of radioactive waste created by the DOE. The tone and the meta-message from the DOE, the nuclear industry, is that if you are educated about the risks, then you'll understand that the risks are low. Yet, these agencies continue to deny the continuing accumulation of compelling and diverse human epidemiological evidence that the harm of ingesting radionuclides is greater than they've been claiming.

The biological harm that ionizing radiation may cause to DNA is mentioned sometimes but it is emphasized that usually the DNA simply are repaired by the body. And the training to radiation workers will mention that fruit flies exposed to radiation passed genetic mutations to their offspring but workers are told that this phenomenon has never been seen in humans even though, sadly, the human evidence of genetic effects has continued to accumulate. Birth defects and children more susceptible to cancer are the result.

Gulf War veterans who inhaled depleted uranium have children with birth defects at much higher than normal rate. The same kinds of birth defects also became prevalent in the countries were citizens were exposed to DU. There are accounts to suggest that the actual number of birth defects resulting from the World War II atomic bombs dropped on Japan and by weapons testing over the Marshall Islands have been underreported. The Department of Energy early on made the decision not to track birth defects resulting from its workers or exposed populations. But people living near Hanford and near Oak Ridge know of increased birth defects in those communities.

In radworker training, there may be discussion of the fact that international radiation worker protection recommends only 2 rem per year, not 5 rem per year. There is no mention of recent human epidemiology showing the harm of radiation is higher than previously thought and at low doses, below 400 mrem annually to adult workers, increased cancer risk occurs.

There is no mention of the oxidative stress caused as ionizing radiation strips electrons off atoms or molecules in the body at energies far exceeding normal biological energy levels. And there is no discussion explaining the harm of inhaling or ingesting radioactive particles of fission products such as cesium-137, strontium-90, or iodine-131; of activation products such as cobalt- 60; or transuranics such as plutonium and americium; or of the uranium itself. 40

The volatile or gaseous radionuclides, some of which can't be contained even with air filters — include technetium-99, tritium, carbon-14, iodine-129, argon-39, krypton-85, and radon-222 as the volatile radionuclides dominating the proposed Greater-Than-Class C radioactive waste disposal for the Andrews County, Texas facility. In Idaho, it appears that the DOE fails to adequately address these gaseous emissions from waste and other sources. 41

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[7] Richardson, David B., et al., "Risk of cancer from occupational exposure to ionizing radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS), BMJ, v. 351 (October 15, 2015), at http://www.bmj.com/content/351/bmj.h5359 Richardson et al 2015 This cohort study included 308,297 workers in the nuclear industry.

[8] US EPA 2015 http://www.regulations.gov/#!documentDetail;D=NRC-2015-0057-0436 . For important low-dose radiation epidemiology see also John W. Gofman M.D., Ph.D. book and online summary of low dose human epidemiology in "Radiation-Induced Cancer from Low-Dose Exposure: An Independent Analysis," Committee for Nuclear Responsibility, Inc., 1990, http://www.ratical.org/radiation/CNR/RIC/chp21.txt And see EDI's April 2016 newsletter for Ian Goddard's summary and listing of important human epidemiology concerning low dose radiation exposure.

Often radionuclides with low curie levels dominate the harm to human health from radioactive waste disposal. So, when DOE states an overall curie level without stating which radionuclides and their specific curie levels, neither the radiotoxicity nor the longevity of the radioactive waste has been indicated.

Uranium and thorium and their decay products may be natural but in concentrated form in drinking water, soil or air, they are harmful. Radioactive waste disposal classification has often left out concentration limits for these radionuclides. Massive amounts of depleted uranium are considered Class A radioactive waste but won't be safe at the end of 100 years but will actually be more radioactive through decay progeny. The DOE has typically ignored its extensive releases of uranium and transuranic radionuclides to Idaho communities. 42

Plutonium-238, plutonium-239, and other transuranic radionuclides in radioactive waste in what appear to be low curie amounts also pose health harm. Is DOE planning to say that they stayed below some curie amount, while not disclosing the actual radionuclides released? 43

Cancer rates for uranium are typically based on natural forms for uranium and not chemically altered forms that may be more soluble in the human body. The internal radiation cancer harm is not based on solid epidemiological evidence and there are experts from Karl Z. Morgan to Chris Busby to Jack Valentine that understand that the accepted models may understate the cancer harm by a factor of 10, 100 or more. The nuclear industry continues to ignore the epidemiological evidence that implies tighter restrictions are needed.

Importantly, the chemical forms released at the proposed INL test range may be more harmful than predicted because of particle size, temperatures during processing or releases, or other factors which may affect retention in the human body.

So, when the draft EA states a curie limit without specifying the specific radionuclides **that will actually be released**, the radiotoxicity nor the longevity of the radiological release has been specified. Neither does the draft EA address the harm is radiological contamination already in place or of DNA damage from past airborne releases. Thus, the harm to people in these communities is continued and the deception continues, despite the appearance of disclosure in the draft EA. 44

7. DOE's radiation health model focuses only on cancer and leukemia, ignoring infant mortality, birth defects, and other illnesses and the draft EA underestimates the harm 45

In the U.S., the officialdom radiation protection models are wrong — and they underestimate the health harm of ionizing radiation. Differing vintages of International Commission on Radiological Protection (ICRP) methods are used by the Environmental Protection Agency, Nuclear Regulatory Commission, and Department of Energy to estimate the radiation doses to workers and the public. Internal radiation dose harm is underestimated more than external radiation dose harm. And the health harm from ionizing radiation is not limited to cancer incidence and mortality.

The foundation of U.S. radiation protection standards come from the ICRP. In ICRP 60, it is stated that "The primary aim of radiological protection is to provide an appropriate standard of protection of man without unduly limiting the beneficial practices giving rise to radiation exposure." **Their aim in not the protection of human health; their aim has been and continues to be the protection of the nuclear industry. This cannot be emphasized too strongly.** The ICRP is populated by nuclear industry and radiologists[9] which may explain why evidence that strongly indicates that people are not adequately protected by existing radiation standards is often ignored.

[9] Thomas Dersee and Sebastian Pflugbeil, *A Foodwatch Report*, German Society for Radiation Protection in cooperation with the German Section of the International Physicians for the Prevention of Nuclear War (IPPNW), "Calculated Fatalities from Radiation: Officially Permissible Limits for Radioactively Contaminated Food in the European Union and Japan," September 2011. https://www.foodwatch.org/uploads/tx_abdownloads/files/fw_report_CalculatedFatalitiesfromRadiation11_2011. pdf p. 6.

The EPA's Federal Guidance Series reports, FGR 11, 12, and 13 are based on ICRP 26/30, 38 and ICRP 60. [10 11] OSHA regulations use ICRP Publication 2 and the EPA and NRC still have regulations that require the use of ICRP 2. Along with differing methods, there is tremendous latitude in the selection of assumptions that dramatically alter the estimated radiation dose received, particularly by a worker. The Department of Energy has adopted an ICRP 60 approach for calculating the doses to workers, yet the methods allow tremendous latitude in the selection of assumptions. The U.S. DOE and NRC have never adopted the ICRP radiation dose limit for workers, of 2 rem/yr, preferring the 5 rem/yr limit. This is despite epidemiology that shows an elevated cancer risk from an average 0.4 rem/yr (400 millirem/yr) to radiation workers. [12]

Internal dose methods range from critical organ dose, as determined using ICRP Publication 2 published in 1959 to the most recent method for determining effective dose, based on ICRP Publication 103, published in 2008. [13] ICRP models are always evolving but not necessarily getting more accurate. Tissue weighting factors and the selection of tissues to include have gyrated up and down. The ICRP is always working on a revision that will come out in a few years.[14]

Once the radiation dose has been estimated, cancer risk is only focus for U.S. agencies and this is based on the 1990 ICRP Publication 60. Here, the risk coefficients, average the genders — which leave women less protected than men both leaves both genders inadequately protected. When cancer incidence or mortality dictate the radiation protection standard, the elevated illness and death statistics from the premature aging and the genetic and reproductive effects caused by ionizing radiation are not downplayed or ignored.

The exclusive focus on cancer incidence and mortality from ionizing radiation fails to protect adults and does not adequately protect the unborn or children.

"After the Chernobyl reactor catastrophe, not only were many people afflicted with cancer, but there was also a sharp increase in other somatic illnesses such as a weakening of the immune system, premature aging, cardiovascular disease even in younger patients, chronic diseases of the stomach, the thyroid gland and the pancreas (diabetes mellitus), as well as in neurological- psychiatric disorders and genetic or teratogenic disorders as a result of low-level doses of radiation." [15]

The ICRP models and hence U.S. regulations are based largely on the cancer and leukemia risk obtained from the Life Span Study of World War II Japan's bombing survivors. The problem is that this study has been manipulated by adjusting the estimated radiation dose of external gamma and neutron radiation to the survivors in order to reduce the estimated harm of ionizing radiation. [16 17 18] And the effects of internal radiation from inhalation and ingestion of

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10 EPA powerpoint presentation by Michael Boyd, "The Role of Federal Guidance in Radiation Protection," November 20, 2017. See *llwforum.org*

11 This link describes the EPA's radiation modeling https://www.epa.gov/radiation/tools-calculating-radiation-dose- and-risk

12 Richardson, David B., et al., "Risk of cancer from occupational exposure to ionizing radiation: retrospective cohort study of workers in France, the United Kingdom, and the United States (INWORKS), BMJ, v. 351 (October 15, 2015), at http://www.bmj.com/content/351/bmj.h5359 Richardson et al 2015 . This epidemiology study that included a cohort of over 300,000 nuclear industry workers has found clear evidence of solid cancer risk increases despite the average exposure to workers being about 2 rem and the median exposure was just 410 millirem. Also see December 2015 EDI newsletter.

13 Michael A. Boyd, U.S. EPA, "The Confusing World of Radiation Dosimetry," WM2009 Conference, March 1-5, Phoenix, AZ. http://www.wmsym.org/archives/2009/pdfs/9444.pdf

14 Sora Kim et al., *Journal of Radiation Protection and Research*, "The System of Radiation Dose Assessment and Dose Conversion Coefficients in the ICRP and FGR**,"** 2016; 41(4): 424-435. Published online: December 31, 2016. DOI: https://doi.org/10.14407/jrpr.2016.41.4.424

15 Thomas Dersee and Sebastian Pflugbeil, *A Foodwatch Report*, German Society for Radiation Protection in cooperation with the German Section of the International Physicians for the Prevention of Nuclear War (IPPNW), "Calculated Fatalities from Radiation: Officially Permissible Limits for Radioactively Contaminated Food in the European Union and Japan," September 2011. https://www.foodwatch.org/uploads/tx_abdownloads/files/fw_report_CalculatedFatalitiesfromRadiation11_2011. pdf p. 9.

16 John W. Gofman, M.D., Ph.D., Committee for Nuclear Responsibility, Inc., "Radiation-Induced Cancer from Low-Dose Exposure: An Independent Analysis," 1990.

17 Other books by John W. Gofman, M.D., Ph.D.: *Radiation and Human Health*, Sierra Club Books, 1981; and *Preventing Breast Cancer: The Story of a Major, Proven, Preventable Cause of this Disease*, Committee for Nuclear Responsibility, Inc., 1996.

18 Gayle Greene, "The Woman Who Knew Too Much – Alice Stewart and the Secrets of Radiation," The University of Michigan Press, 2003.

radionuclides are canceled out of the study. [19] Japan's bomb survivors in the city during the bombing and the control group — people outside the city during the bombing but who returned soon after the bombing — were both exposed to the radioactive fallout and internal radioactivity from inhalation and ingestion of radionuclides. So, the Life Span Studies reflect only the gamma and neutron external dose and not the effects of radioactive fallout on internal dose. The dose estimates from the ICRP for external radiation may underestimate the dose by a factor of 2 to 5 or more. But the dose estimates from the ICRP for internal radiation dose from inhalation or ingestion by underestimate the dose by a factor of 100 or more because the simplistic emphasis on the imparted energy from the radionuclide decay does not consider the highly concentrated damage to cellular tissue where the radionuclide is concentrated.

The estimates of radiation dose for the Life Span Studies were made years following the bombing and manipulated after cancer results were available. **An important aspect of the inadequacy of the current radiation model, ICRP 60, [20] is that it underestimates the human health harm, especially to the developing embryo or young child**. The BEIR VII report [21] which **acknowledges higher levels of vulnerability of women and children** to radioactivity, certainly higher than DOE assumes, has not evaluated the growing evidence concerning elevated childhood leukemia from Chernobyl fallout and from other nuclear facilities. [22]

The European Committee on Radiation Risk (ECRR) 2010 report [23] discusses how in 2009, the Scientific Secretary of ICRP, resigned. He stated that the ICRP risk model could not be employed to predict or explain the health effects of exposures to human populations, largely because the underestimation of internal exposures, by a factor of 100.

8. DOE's allowable limits for terrestrial animals and biota are far too high

46

The draft EA on page 60 states that 0.1 rad/day or 100 rad/day is deemed acceptable for animals:

"The DOE dose limits for protecting terrestrial biota (DOE, 2019a) are 1 rad/d(10 mGy/d)for terrestrial plants and 0.1 rad/d (1milligray [mGy]/d) for terrestrial animals. These dose limits represent expected safe levels of exposure; dose rates below these limits cause no measurable adverse effects to populations of plants and animals (DOE, 2019a)."

Note that by using rad instead of rem, it appears that the added harm of alpha emitters and neutrons is not included in estimating these radiological limits. 47

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19 Chris Busby, *The Ecologist*, "The ICRP's radiation risk model is bogus science," October 2014. https://theecologist.org/2014/oct/22/icrps-radiation-risk-model-bogus-science

20 International Commission on Radiological Protection, "Compendium of Dose Coefficients Based on ICRP Publication 60," ICRP Publication 119, Volume 41 Supplement 1 2012.
http://www.icrp.org/docs/P%20119%20JAICRP%2041%28s%29%20Compendium%20of%20Dose%20Coefficients%20based%20on%20ICRP%20Publication%2060.pdf

21 "Health Risks from Exposure to Low Levels of Ionizing Radiation BEIR VII – Phase 2, The National Academies Press, 2006, http://www.nap.edu/catalog.php?record_id=11340 The BEIR VII report reaffirmed the conclusion of the prior report that every exposure to radiation produces a corresponding increase in cancer risk. The BEIR VII report found increased sensitivity to radiation in children and women. Cancer risk incidence figures for solid tumors for women are about double those for men. And the same radiation in the first year of life for boys produces three to four times the cancer risk as exposure between the ages of 20 and 50. Female infants have almost double the risk as male infants.

22 C. C. Busby and A. V. Yablokov, European Committee on Radiation Risk (ECRR), "Chernobyl: 20 Years On. Health Effects of the Chernobyl Accident," 2006. p. 3 http://www.ratical.org/radiation/Chernobyl/chernobylebook.pdf

23 European Committee on Radiation Risk, Edited by Chris Busby with Rosalie Bertell, Inge Schmitz-Feuerhake, Molly Scott Cato and Alexey Yablokov, *2010 Recommendations of the ECRR – Health Effects of Exposure to Low Dose of Ionizing Radiation*, Green Audit Press, 2010. p. 5. http://euradcom.eu/ordering-3/ Free available download of report.

9. The draft EA statements concerning the 100 Year removal of CERCLA institutional controls is misleading and must be corrected

48

The draft EA claims that "most of the INL's CERCLA contamination areas can be released in 2095." [24] But the lion's share of the mess by curie and over 55 of INL's CERCLA contamination areas are "forever" contamination sites already where DOE had to argue that people cannot live there or drink the water, in to perpetuity, in order to claim the lack of cleanup was not harmful to human health. Various INL sites that DOE had previously claimed could be released in 100 years were later discovered to required long-term institutional controls far longer.

The INL cleanup sites that will remain contaminated DOE summarizes in a "Long Term Stewardship Database." This database lists cleanup sites known as "operable units" that require institutional controls to restrict human use. The estimated duration of time that the sites require institutional control is specified either as a specific year such as "2310" or simply as "indefinite." By this rather word, "indefinite," the DOE hopes the public won't understand that what this actually means is "into perpetuity" or forever.

Because these contaminated forever sites are a bummer, the DOE never seems to give a link to or full title of the actual institutional control database. However, I was able to find it on an Environmental Protection Agency website. [25] The database date for as of February 2016, yet the error reported last fall regarding the ATR Complex date for removing institutional controls remained uncorrected. Ah, 2310 or an added 24,000 years or an several 5 million or so years: "Who cares?" they say, "we won't be here."

For many years the public was told by DOE that needed institutional controls could be removed by the Year 2095 and at that time, uncontrolled public access would be allowed to the Idaho National Laboratory. But while this falsehood has been quietly walked back, except in this draft EA, and the INL's "long-term stewardship" list of areas requiring much longer institutional control has continued to grow. The list of INL areas needing thousands of years and more of so- called long-term stewardship may be hidden out of view and not mentioned, and not necessarily accurate or kept up to date, but the INL's long-term stewardship document lists over 55 INL sites requiring institutional control into perpetuity. The draft EA cites in this statement an that is misleadingly optimistic and such incomplete and misleading statements have no place in a document for a National Environmental Policy Act (NEPA) decision, as this draft EA is supposed to provide.

The Department of Energy issued a report in 2016 summarizing a review of the mandated cleanup of the Idaho National Laboratory's chemically and radiologically contaminated areas.[26] In some cases, the DOE earlier had claimed, before 2015, that these sites would be available for human contact in a hundred or so years.[27] The Comprehensive Environmental Response Compensation and Liability Act (CERCLA) cleanup that began in the late 1980s continues today. The Five-year review admits that measures to lower chemical contamination in the aquifer at Test Area North (TAN) are not going well. Aside from that admission, the 2016 report fails to mention the numerous new added sites or the bungling of the date for ending institutional control of an area at the ATR Complex.

New information reported for the ATR Complex, formerly called the Test Reactor Area was reported in 2015.[28] In that new information notice, it was admitted that thousands of years need to be added to the previously date of 2310. While this contamination is under the surface by 10 ft or more, it can migrate to the aquifer.

24 The draft EA states on page 68: "Year 2095 is the end of the 100-year institutional control period assumed for most INL Site CERCLA investigations (DOE-ID, 2009)."

25 INL Waste Area Group Institutional Controls Report. Dated February 16, 2016. https://cleanup.icp.doe.gov/ics/ic_report.pdf from the EPA page: https://cleanup.icp.doe.gov/ics/

26 Department of Energy Idaho Operations Office, Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Site, Fiscal Years 2010-2014, DOE/ID-11513, December 2015.

27 Department of Energy Idaho Operations Office, Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory Site, Fiscal Years 2010-2014, DOE/ID-11513, December 2015.

28 Federal Facility Agreement and Consent Order New Site Identification (NSI), "TRA-04: TRA-712 Warm Waste Retention Basin System (TRA-712 and TRA-612), NSI-26002, signed by the Department of Energy in August of 2015. See Idaho National Laboratory Federal CERCLA Cleanup documents at www.ar.icp.doe.gov

The measured soil contamination included elevated strontium-90, cesium-237, nickel-63, cobalt-60, and europium-152/154/155, all expected to decay to unrestricted use levels within 400 years. But the soil also contained high concentrations of plutonium-238, plutonium-239/240, and Americium-241. While the plutonium concentrations were double the unrestricted concentrations and needed a single half-life to decay to unrestricted levels, the Am-241 concentration of 3210 pCi/g would require about 4 half-lives to decay to the unrestricted concentration of 187 pCi/g, according to the New Site Information (NSI) report.

Am-241 has a 432 year half-year, but because Am-241 decays to Neptunium-237 which has a seriously long half-life of 2.14 million years, but DOE added only an additional 24,000 years.

When the DOE contractor inadvertently discovered the release, they covered up contaminated soil with 1 ft of soil without any transparency or accountability to Idaho citizens what-so-ever.[29] CERCLA cleanup standards promised by the DOE are 11 ft depth, while DOE reneged to a 3 ft depth cleanup at the ATR Complex.

Long-lived radionuclides are present but usually not mentioned by the DOE not only at INL's INTEC facility where naval and research spent nuclear fuel was reprocessed, but also at the ATR Complex where long-lived radionuclides including americium-241 have been present in the environment but absent from U.S. Geological Survey and DOE reports.[30] [31]

Because of the habitual omission of long-lived radionuclides, even the Department of Energy had not properly determined the number of years that institutional controls limiting access to contaminated areas would be required. **When the DOE found that the 2095 date was incorrect, then in 2010, 300 years was added to create the later 2310 date, which was also incorrect. Then NSI-26002 stated an additional 24,100 years needed to be used.** But the number of years that needed to be added was actually far larger because more than one half-life of americium-241 decay was needed and they forgot that americium-241 must decay through several radioactive decay progeny before reaching a stable non-radioactive isotope.[32]

10. Inadequate soil monitoring is built-in to the EA

49

Historical soil monitoring showed that radionuclides unearthed by flooding at the Radioactive Waste Management Complex blew miles away to the farming community of Howe, Idaho, many miles north of the RWMC. The 1998 report, EML-599, study found that radionuclides from transuranic waste from RWMC has blown miles from RWMC.[33] [34]

The draft EA cites a report, Rood et al, 1996 that is not in the list of references. I presume INEL- 94-0250 is meant by the cited report on page 69 of the draft EA. I have not checked for other errors. 50

The EA addresses doses to people in 100 years but does not appear to address radiological doses from soil contamination and ingestion via crops, farm animals, and harvesting wild game during the next 15 years or the following decades. Nor are existing contamination levels in these communities addressed.

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29 See EDI newsletters on ATR Evaporation Pond release in August and September 2017 at www.environmental- defense-institute.org

30 Federal Facility Agreement and Consent Order New Site Identification (NSI), "TRA-04: TRA-712 Warm Waste Retention Basin System (TRA-712 and TRA-612). NSI-26002, signed August 2015. See the CERCLA Administrative Record at ar.icp.doe.gov

31 Federal Facility Agreement and Consent Order New Site Identification (NSI), "TRA Courtyard Area," NSI- 26011, signed April 2014. See the CERCLA Administrative Record at ar.icp.doe.gov. Table 9 includes extensive americium-241 contamination in soil along with europium-152, cesium-137, and cobalt-60.

32 Federal Facility Agreement and Consent Order New Site Identification (NSI), "TRA-04: TRA-712 Warm Waste Retention Basin System (TRA-712 and TRA-612). NSI-26002, signed August 2015. See the CERCLA Administrative Record at ar.icp.doe.gov See page 7 of Rev. 1. showing americium-241 contamination at 3210 pCi/g yet the unrestricted use concentration is 187 pCi/g.

33 T. M. Beasley et. al, Environmental Measurements Laboratory, Heavy Element Radionuclides (Pu, Np, U) and Cs-137 in Soils Collected From the Idaho National Engineering and Environmental Laboratory and Other Sites in Idaho, Montana, and Wyoming, EML-599, October 1998.

34 See EML-599, page 37 and Figure 14 on page 46 describing the way SDA windblown radionuclides could be distinguished from global weapons testing fallout, Nevada Test Site fallout and stack releases from INTEC. See page 45 describing how elevated Americium-241 to 239+240 Plutonium ratios observed near the SDA differ from weapons testing

11. Inadequate air monitoring is built in to the draft EA because of inadequate monitoring by DOE Contractors and by the Idaho Department of Environmental Quality means the various statements in the EA are unreliable and the public cannot be assured of the magnitude of the releases from the expanded test range activities 52

As I study historical and current INL radiological emissions, I find that radiological emissions continue to be inadequately monitored. And reported monitoring rarely attributes INL's releases to the INL even when there is no other reasonable explanation. The environmental monitoring seems to be centered on monitoring in such a way that the results are ambiguous.

I find that current INL radiological airborne monitoring is already inadequate because (1) emissions reporting from various INL facilities are usually based on estimates and not measurements, (2) extensive time-averaging rather than instantaneous monitoring, and (3) increasingly tardy quarterly and annual environmental monitoring reports that are prone to "air monitor malfunctioning" or other excuses to avoid revealing the peak levels of contamination.

The U.S. Environmental Protection Agency has radiological air monitoring in Boise and in Idaho Falls. But strange gaps and lapses in monitoring occur in RadNet. When the explosion in 2018 at the US Ecology Grandview facility occurred, which is a state permitted hazardous waste burial facility that accepts radioactive waste, including Special Nuclear Material, RadNet went down that day and stayed down for weeks.[35] [36]

The Idaho DEQ addresses radionuclide emissions via Permit to Construct licenses which the Idaho DEQ does not make public and does not enforce, based on DEQ's failure to investigate the unplanned disposal of radionuclides at the Advanced Test Reactor Complex radioactive waste pond.

The Idaho Department of Environmental Quality Oversight Monitoring page has removed two decades of citizen-paid-for monitoring.[37] See https://www.deq.idaho.gov/inl- oversight/monitoring/reports/

The INL is required to provide radionuclide air emissions reporting in accordance with federal National Emission Standards for Hazardous Air Pollutants (NESHAPS)[38] means unmonitored guessimated and not-publicly-available rationale for radionuclide estimates are used to make estimated radiological dose estimates all while ignoring the buildup of long-lived radionuclides in the air, soil and water. The NESHAPS report locations frequently change and are difficult to locate. Most of NESHAPs reporting for the INL is not based on monitored emissions; it is based on estimated releases computed in documents that are not identified and are not available for public review. In fact, no one at DOE will discuss whether or not the years of "accidental" resin releases from the Advanced Test Reactor to the open air evaporation pond has been included in NESHAPs reporting. These resins are highly radioactive and a not a permitted release to the evaporation pond. The Idaho Department of Environmental Quality refused to investigate the release and the Idaho National Laboratory refuses to answer any questions about it. 53

The public needs to be aware of the inadequate environmental monitoring as well as deliberately manipulated data to minimize peak contamination levels that appears to me to be prevalent.

According to the air filter analysis conducted by a Department of Energy contractor for environmental monitoring on the IdahoESER.com website, "Alpha-emitting radionuclides 238Pu, 239/240Pu, and 241Am were detected in the Van Buren Gate filter composite at elevated levels compared to historical measurements by the ESER program."39

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[35] Environmental Protection Agency RadNet (that went down in 2018 the day of the US Ecology Grandview, Idaho explosion and stayed down for two weeks after the accident so there are no radiological monitoring data in the Boise area during that time that are publicly available other than radon measurements) at https://www.epa.gov/radnet/near-real-time-and-laboratory-data-state and choose the state, https://www.epa.gov/radnet/radnet-air-data-boise-id or https://iaspub.epa.gov/enviro2/erams_query_v2.simple_query

[36] Environmental Defense Institute March 2019 newsletter article by Tami Thatcher "Serious Flaws in the Radiological Monitoring in the Boise Area and the US Ecology Idaho Disposal and Transfer Facilities," and "Two Explosions at Idaho DEQ RCRA-Permitted Facilities in Idaho in 2018 Suggest Idaho DEQ Doing a Bang- Up Job of RCRA Permitting at http://environmental-defense-institute.org/publications/News.19.March.pdf

[37] See May 2017 Environmental Defense Institute newsletter which discusses the Idaho Department of Environmental Quality Oversight Monitoring page where the monitoring for two decades prior to 2010 has been removed. See the Idaho Department of Environmental Quality website at https://www.deq.idaho.gov/inl- oversight/monitoring/reports/

[38] https://www.epa.gov/compliance/national-emission-standards-hazardous-air-pollutants-compliance-monitoring

39 INL Environmental Surveillance, Education and Research Program, Managed by Veolia Nuclear Solutions – Federal Services, www.idahoeser.com, Second Quarter 2018 INL Quarterly Site Environmental Report, VNS-ID- ESER-SURV-058, http://www.idahoeser.com/Quarterlies/2018Q2/air.html

"This was also one of the infrequent times americium and plutonium isotopes have been detected together in an ESER Program filter composite. Thorough examination of quality assurance and control data, including analytical results from blanks and performance evaluation samples, does not suggest inadvertent contamination of the filter in the field or laboratory. Although the measurements were elevated, they are well below public health standards (i.e., DCSs) and therefore do not represent a public health concern."

The 2018 Second Quarter report, further states: "A possible source of the radionuclides measured in the Van Buren Gate sample is the Radioactive Waste Management Complex (RWMC).

Plutonium isotopes and ^{241}Am are often detected in low-volume air filters collected around the Subsurface Disposal Area, as well as in soil contaminated from past flooding (in 1962 and 1969) of pits and trenches containing transuranic waste originating from the Rocky Flats Plant. The Van Buren Gate is also situated in the predominant downwind direction from the RWMC. This and other possible sources will be investigated further."

Curiously, the four drums exploded at the RWMC in the second quarter of 2018. Also, the Mound Box Project with plutonium-238 and transuranic radionuclide contamination was moving the waste between facilities.

And more curiously, this year the quarterly reports are not timely issued by idahoeser.com.

The environmental reporting by DOE includes trending of airborne contamination that have large lapses in the reporting, of days and weeks.

12. Buildup of radiological contamination in our public drinking water supplies not addressed in the EA because not all basic mechanisms for contamination are addressed 54

The draft Environmental Assessment blow off the issue of the buildup of long-lived radionuclides in Idaho communities from historical and ongoing releases. But long-lived radionuclides are building up and our public water drinking supplies are one indicator of increasing radionuclides, when the levels from historical nuclear weapons testing had been tapering off. Radiological contaminants can arrive in drinking water from groundwater and also from airborne contamination.

Airborne radiological contamination is breathed into water wells and water tanks, where it tends to dissolve and stay in the water, but the DOE and other radiological polluters ignore this.

The INL chose to not monitor radionuclides in its public drinking water and the Idaho Department of Environmental Quality consented to this change, the more lax non-community drinking water sampling requirements were applied to the INL's public drinking water. If Idaho's Department of Environmental Quality had kept requiring radiological monitoring of INL's non-community public drinking water wells, as it had originally, the water sampling for radionuclides would have had been less prone to manipulation because of independent lab analysis and reporting requirements. Sample results for public water systems would also be available on public data bases. Instead, the DOE claims that simply by stating that no DOE limits were violated, there is no need to report actual data results for the INL drinking water supplies.

On the southwest side (Boise) side of Idaho, levels of non-naturally occurring radioactivity are increasing and he Idaho Department of Environmental Quality is aware of it.

The source of increasing radioactive contamination on the Boise side of the state is not being investigated by the Idaho Department of Environmental Quality. The ongoing importation of radioactive waste from around the country to the US Ecology Idaho Grandview site appears to have a role in the increasing airborne radiological contamination. Some of this radioactive waste is from Formerly Utilized Sites Remedial Action Program (FUSRAP) sites around the United States contaminated from the early years of nuclear weapons production and the atomic energy program.

The last 20 plus years the gyrating levels of gross alpha and gross beta (when sampled) in Boise area drinking water, from Kuna to Boise, and Murphy to Marsing, are not from naturally occurring uranium and thorium in the soil.[40]

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[40] Environmental Defense Institute newsletter article for October 2018, "Idaho DEQ Reports Concerning the Elevated Radioactivity in Drinking Water in the Boise Area Don't Identify the Source of the Radioactivity."

The intermittently elevated levels of gross alpha in the southwestern portion of the state have been identified in public drinking water sampling and some studies have been conducted. But from what I see, no analysis has seriously tried to answer what the source of the radioactivity is. I say this because no trending over time of radionuclides has been conducted. No identification of all radionuclides in soil and water has been published. No assessment of the potential sources of the radioactivity have been identified. Basically, the Idaho DEQ actively fails to be curious about and seek the answers. Is it the airborne FUSRAP radionuclides? Is it from historical INL aquifer injection wells and percolation ponds that disposed of large amounts of "low-level" waste?

After contacting the Idaho Department of Environmental Quality to ask why the drinking water on the southwestern side of the state is so radioactive, the Idaho DEQ could not identify anyone at the agency who understood the issue. But the Idaho DEQ did say that there was a report on its website that looked at the issue. It was implied that the report solved the mystery.

The report "Isotopic and Geochemical Investigation into the Source of Elevated Uranium Concentrations in the Treasure Valley Aquifer, Idaho," in 2011[41] does look at the issue — but does not identify the source of the elevated radioactivity. The report confirms the widespread occurrence of sometimes very high uranium concentrations, up to 100 micrograms/liter. The report does conclude that the source is not from agricultural fertilizer. The report suggests that the source is a near-surface source of contamination.

The mystery is not solved by the report and the report does not conclude that the source of the elevated uranium is natural. The report simply concluded that more work was needed — and there is no evidence that any work has continued since 2011.

There is another effort afoot to study the issue by Boise State University but so far it has not provided any answers.[42] It states that "The Treasure Valley Aquifer System (TVAS) in western Idaho contains documented uranium and arsenic concentrations, up to 110 microgram/liter and 120 micrograms/liter, respectively…" And "The contaminants historically show elevated concentrations with high spatial variability throughout the region."

See also our Environmental Defense Institute February newsletter article "What's Up With The Radionuclides in Drinking Water Around Boise, Idaho?"[43]

The DOE has failed to be truthful about past aquifer contamination migration to the south of the Idaho National Laboratory, as I describe in *Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters*.[44]

On the southeast (INL) side of Idaho, the DOE along with the Idaho Department of Environmental Quality are also pretending they don't know the source of radiological contamination — even when they do know. The public drinking water laws require periodically monitoring for gross alpha levels in drinking water. If the levels of gross alpha are high enough, often even, then the evaluation of uranium and radium levels are required. But often, in Idaho's public drinking water, the intermittently elevated levels of gross alpha are not explained by naturally occurring uranium and thorium. The regulations actually make it impossible to answer what radionuclides are in the water because methods to use gamma spec analysis have not been delineated for public drinking water use. Public water drinking municipals lose profits when laboratory sampling requirements are increased.

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41 Brian Hanson, Dr. Shawn Benner, Dr. Mark Schmitz, Dr. Spencer Wood, Department of Geosciences, Boise State University., "Isotopic and Geochemical Investigation into the Source of Elevated Uranium Concentrations in the Treasure Valley Aquifer, Idaho," Submitted to the Idaho Department of Environmental Quality, April 2011. http://www.deq.idaho.gov/media/563327-uranium_treasure_valley_0411.pdf listed at http://www.deq.idaho.gov/regional-offices-issues/boise/water-quality-plans-reports/

42 Gus Womeldorph and Shawn Benner, Boise State University, "A Study of Uranium and Arsenic in the Treasure Valley Aquifer System, Southwestern Idaho, Year 1, 2017-2018," 2018 at https://www.idwr.idaho.gov/files/publications/201807-GWQ-GW-Study-of-Uranium-in-TV-Aquifer-System.pdf

43 Environmental Defense Institute February 2018 newsletter article by Tami Thatcher "What's Up With The Radionuclides in Drinking Water Around Boise, Idaho?"at http://environmental-defense- institute.org/publications/News.18.Feb.pdf

44 Thatcher, T.A., Environmental Defense Special Report, *Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters*, 2017. www.environmental-defense- institute.org/publications/kimamareport.pdf

The DOE and the draft Environmental Assessment blow off the issue of the buildup of long- lived radionuclides from historical and ongoing releases, not just at the specific proposed sites but to surrounding communities, part by ignoring all of the mechanisms for drinking water contamination from radiological airborne releases. Ignoring the science is not the proper way to prepare a draft EA.

Failure to address the buildup of long-lived radionuclides shows the disregard for human health and the environment now and long into the future.

13. Incomplete and inaccurate list of other expected INL radiological releases (Table 35 of draft EA)

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Presumably the facilities that are operating are contributing to the current radiological airborne releases — but because the releases are based on fictional estimates generated in documents the public is not allowed to see and not confirmed by environmental monitoring, that really isn't the case. Systematic understatement of the actual airborne radiological releases is perhaps the normal and expected behavior by the DOE, but it is not sufficient for a NEPA Environmental Assessment.

Because DOE assumes that all of the long-lived radionuclides released each year vanish — disappear — aren't anywhere any more, each year's emissions omits the resuspension of previous many years long-lived airborne radionuclides.

The long-lived radionuclides that the Idaho National Laboratory does not admit it has been releasing for years to the open air evaporation pond at the ATR Complex are not included in the draft EA or NESHAPS reporting. This is likely the tip of the iceberg of unreported radiological releases by the INL.

The draft EA includes a table that shows INL's airborne releases increasing by a factor of more than 170, yet sees no cause for alarm. See my uppercase and bold additions to the table comments regarding the unreliability of the estimated air emissions data.

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Table 2. Estimated annual air pathway dose (mrem) from normal operations to the maximally exposed offsite individual from proposed projects, including the estimated dose from expanding capabilities at the Ranges based on DOE/EA-2063.

Current and Reasonably Foreseeable Future Action	Estimated Annual Air Pathway Dose (mrem)
National Security Test Range	0.04[e]
Radiological Response Training Range (North Test Range)	0.048[d]
Radiological Response Training Range (South Test Range)	0.00034[a]
HALEU Fuel Production (DOE-ID, 2019)	1.6[a]
Integrated Waste Treatment Unit (ICP/EXT-05-01116)	0.0746[h]
New DOE Remote-Handled LLW Disposal Facility (DOE/ID 2018)	0.0074[a]
Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling (DOE/EIS 2016)	0.0006[c]
TREAT (DOE/EA 2014)	0.0011[a]
DOE Idaho Spent Fuel Facility (NRC, 2004)	0.000063[a]
Plutonium-238 Production for Radioisotope Power Systems (DOE/EIS 2013)	0.00000026[b]
Total of Reasonably Foreseeable Future Actions on the INL Site	1.77[g]
Current (2018) Annual Estimated INL Emissions (DOE2019a)	0.0102[f]

Total of Current and Reasonably Foreseeable Future Actions on the INL Site [**DOE WOULD INCREASE INL'S AIRBORNE RELEASES BY OVER 170 TIMES**]	1.78[g]

Table notes:

. Dose calculated at Frenchman's Cabin, typically INL's MEI for annual NESHAP evaluation.

b. Receptor location is not clear. Conservatively assumed at Frenchman's Cabin.

. Dose calculated at INL boundary northwest of Naval Reactor Facility. Dose at Frenchman' Cabin likely much lower.

. Dose calculated at INL boundary northeast of Specific Manufacturing Capability. Dose at Frenchman's Cabin likely much lower.

. Sum of doses from New Explosive Test Area and Radiological Training Pad calculated at separate locations northeast of MFC near Mud Lake. **Dose at Frenchman's Cabin likely much lower. PLEASE NOTE THAT THE PUBLIC AT MUD LAKE IS CLOSER TO THE RELEASE THAN TO FRENCHMAN'S CABIN.**

. Dose at MEI location (Frenchman's Cabin) from 2018 INL emissions (DOE 2019a). The 10-year (2008 through 2017) average dose is 0.05 mrem/year.

PLEASE NOTE THAT MANY RADIOLOGICAL RELEASES ARE IGNORED AND NOT INCLUDED IN THE RELEASE ESTIMATES IN NESHAPS REPORTING. 57

. This total represents air impact from current and reasonably foreseeable future actions at INL. It conservatively assumes the dose from each facility was calculated at the same location (Frenchman's Cabin), which they were not.

h. Receptor location unknown.

14. DOE is hiding, still, the magnitude of radionuclide releases from past decades to Idaho communities 58

The DOE's radiological monitoring of its waste disposal sites, nuclear facility emissions, nuclear fuel melt testing, accidents, and cleanup activities was and continues to be an ongoing coverup of radiological contamination no matter that the DOE claims to be within limits protective of human health and the environment.

DOE has failed to disclose the full extent of past radiological releases and the DOE continues to coverup ongoing intentional and accidental releases. Extensive americium-241 contamination at the ATR Complex was known long ago but the DOE and the U.S. Geological Survey deliberately withheld the information about this and other Snake River Plain Aquifer contamination.

The DOE has long given presentations to the public that deliberately withheld information about long-lived radionuclide contamination. Even now, when filters are evaluated and found to have americium-241, plutonium-238 and plutonium-239, for example, the DOE and State of Idaho usually pretend to not know the source of the radionuclides.

Monitoring of waste burial sites for CERCLA at INL has often been inadequate and biased to hide contamination findings by reduced monitoring and reduced reporting. Spotty monitoring of land and the aquifer means "no discernable trend could be found."

At the Idaho National Laboratory, formerly the Idaho National Engineering and Environmental Laboratory, the Idaho National Engineering Laboratory, and the National Reactor Testing Station, historical releases were monitored yet not actually characterized as to what and how many curies were released. When asked by the governor in 1989 to provide an estimate of the radionuclides released from routine operations and accidents, the Department of Energy issued the "INEL Historical Dose Evaluation."[45] [46]

[45] US Department of Energy Idaho Operations Office, "Idaho National Engineering Laboratory Historical Dose Evaluation," DOE-ID-12119, August 1991. Volumes 1 and 2 can be found at https://www.iaea.org/inis/inis- collection/index.html

[46] Environmental Defense Institute's comment submittal on the Consent-based Approach for Siting Storage for the nation's Nuclear Waste, July 31, 2016. http://www.environmental-defense- institute.org/publications/EDIXConsentFinal.pdf

It has been found to have underestimated serious releases by sometimes 10-fold. Furthermore, the past environmental monitoring used all along to claim no significant releases had occurred were not used in the INEL Historical Dose Evaluation. The environmental records that could have been used against the Department of Energy or its contractors were destroyed.

The Center for Disease Control commenced reviewing the DOE's radiological release estimate that were the basis for denying that any epidemiological study was needed in Idaho communities near the site. The CDC in 2007 issued its review of the 1989 study and found many releases, some of the largest ones, underestimated by a factor of 7.[47]

Errors causing underestimation of the INL releases continue to be found as energy worker compensation studies have continued.

The INL was originally called the National Reactor Testing Station, later called the Idaho Engineering Laboratory, and then the Idaho National Engineering and Environmental Laboratory before being named the Idaho National Laboratory.

Much of the early monitoring was ignored but the Department of Energy, formerly the Atomic Energy Commission, monitored air, water (via the US Geological Survey), rabbit thyroids, agricultural products, milk, and so forth. Milk sampling results were reviewed in the INEL HDE for Idaho Falls or other offsite milk sampling for iodine-131, Elevated levels of I-131 in local milk was found that could not be explained by known INL and weapons fallout.

Sources of iodine-131 other than the INL that were considered were regional weapons fallout (typically from the Nevada Test Site), global weapons fallout from US weapons testing outside the contiguous states, and global weapons tests conducted by foreign countries including the former Soviet Republic, China, France and others.

The past conducting of human research at the Idaho National Laboratory has included workers swallowing incapsulated radioactive materials in order to calibrate whole-body counters (from 1965 to 1972) and the Controlled Environmental Radioiodine Tests (CERTS) where volunteers agreed to stand downwind from intentional iodine-131 airborne releases (from 1963 to 1968), according to the portion of the Human Research Experiments collection for the Department of Energy.[48][49] The role of this radioactive research was tame compared to some of the thousands of other human radiation research experiments, but one of the problems was the lack of follow- up with the volunteers to see if health problems occurred after the brief study ended. Health effects showing up months or years after the study have been be missed, perhaps deliberately, because of lack of follow-up.

The estimates of the 1991 INEL Historical Dose Evaluation [50] continue to be found in error and to significantly underestimate what was released. [51][52][53] Theoretical and idealized modeling of the releases were used for estimating the releases for the 1991 INEL HDE without using environmental monitoring to confirm the estimates — except for the 1961 SL-1 accident in which the environmental monitoring showed that the theoretical modeling had underestimated the release.

47 Center for Disease Control, CDC Task Order 5-2000-Final, Final Report RAC Report No. 3, by Risk Assessment Corporation, October 2002. https://www.cdc.gov/nceh/radiation/ineel/to5finalreport.pdf

48 DOE Human Radiation Experiments, List of Experiments for Idaho Sites athttps://ehss.energy.gov/OHRE/roadmap/experiments/0491doca.html

49 See also the Idaho National Laboratory Human Radiation Experiments Collection of documents for the Idaho site online at the "inl digital library" at https://inldigitallibrary.inl.gov/SitePages/INL%20Research%20Library%20Digital%20Repository.aspx and general library online information at https://www.inl.gov/about-inl/general-information/research-library/

50 US Department of Energy Idaho Operations Office, "Idaho National Engineering Laboratory Historical Dose Evaluation," DOE-ID-12119, August 1991. Volumes 1 and 2 can be found at https://www.iaea.org/inis/inis- collection/index.html p. 40

51 Risk Assessment Corporation, "Identification and Prioritization of Radionuclide Releases from the Idaho National Engineering and Environmental Laboratory," October 8, 2002, https://www.cdc.gov/nceh/radiation/ineel/to5finalreport.pdf See p. 117, 118 for SL-1.

52 SENES Oak Ridge, "A Critical Review of Source Terms for Select Initial Engine Tests Associated with the Aircraft Nuclear Program at INEL," Contract No. 200-2002-00367, Final Report, July 2005. http://www.cdc.gov/nceh/radiation/ineel/anpsourceterms.pdf See p. 4-67 for Table 4-13 for I-131 estimate for IET's 10A and 10B and note the wrong values for I-131 are listed in the summary ES-7 table.

53 CDC NIOSH, "NIOSH Investigation into the Issues Raised in Comment 2 for SCA-TR-TASK1-005," September 3, 2013. https://www.cdc.gov/niosh/ocas/pdfs/dps/dc-inlspcom2-r0.pdf See p. 3 stating various episodic releases underestimated by the INEL HDE: IET 3, IET 4 and IET 10.

In fact, many of the environmental monitoring records were deliberately destroyed before the 1991 report was released. [54] INL airborne releases included a long list of every fission product that exists including iodine-131, long-lived I-129, tritium, strontium-90, cesium-37, plutonium, and uranium.

The source documents for the INEL HDE are in fact part of the Human Radiation Experiments collection of DOE documents. Why? Because there was enough information available for the DOE to know that showering nearby communities and their farms and milk cows with radiation really was likely to be harmful to their health. The INL (formerly the NRTS, INEL and INEEL) takes up dozens of volumes of binders in the DOE's Human Radiation Experiments collection and that isn't including the boxes of documents no one can get access to or the records that were deliberately disposed of.[55]

15. DOE and the CDC still not disclosing the full extent of historical releases, including the magnitude of the 1961 SL-1 release which affected communities including Atomic City and Mud Lake which will be further harmed by the proposed action

59

This matters because communities near the INL, include Atomic City to the south and Mud Lake to the north have been affected already and isn't the harm done to those poor people enough?

The Atomic Energy Commission, predecessor of the Department of Energy, claimed that no other fission products were detected other than 0.1 Curies of strontium-90 and 0.5 curies of cesium-137 within the perimeter fence of the SL-1.[56] The derived release fractions based on trying to fit the AEC claims to a computer derived release fraction show that the AEC claimed low curie amount releases are fiction. Never before or since has a reactor fuel had such low release fractions! The AEC not only left out many radionuclides, they underestimated the amount of the fission product releases from the accident by a factor of over 22 for iodine-131, 588 for

Cs-137 and 277 for Sr-90. And even with the low-balled curie releases, the SL-1 accident was a serious accident.

Despite what Risk Assessment Corporation (RAC) writes about prevailing meteorological conditions at the time of the SL-1 accident being characteristic of the typical conditions at the time of year, the conditions were not typical. During the accident, the prevailing winds were from the north to northeast for 100 hours with an extremely strong inversion. Typical conditions are a prevailing wind in the opposite direction during the daytime, with wind reversals at night typical. The SL-1 radionuclide plume blew south toward American Falls and Rupert, Idaho.

The SL-1 reactor fission product inventory consisted of radionuclides produced during the excursion and also radionuclides the had built up in the fuel during previous reactor operations. The operating history of the reactor consisted of 11,000 hours for a total of 932 MW-days.

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54 Chuck Broscious, Environmental Defense Institute Report, "Destruction and Inadequate Retrieval of INL Documents Worse than Previously Reported," Revised September 1, 2018. http://environmental-defense- institute.org/publications/DocDestruction.pdf

55 February 1995, the Department of Energy's (DOE) Office of Human Radiation Experiments published *Human Radiation Experiments: The Department of Energy Roadmap to the Story and Records* ("The DOE Roadmap"). See also the INL site profile on Occupational Environmental Dose: http://www.cdc.gov/niosh/ocas/pdfs/tbd/inl- anlw4-r2.pdf) Most of the documents in the DOE's Human Radiation Experiments collection remain perversely out of public reach. Documents are said to be stored at the INL site, out of state in boxes, [Good luck with getting these documents via the Freedom of Information Act] and in the National Archives. I found that retrieving documents from the National Archive would require extensive fees for searches and copying. Where is the transparency in creating a document collection that cannot be viewed by the public?

56 Report by Risk Assessment Corporation for Centers for Disease Control and Prevention, Department of Health and Human Services, *Final Report Identification and Prioritization of Radionuclide Releases from the Idaho National Engineering and Environmental Laboratory*, RAC Report No. 3, CDC Task Order S-2000-Final, October 2002, pages 117, 118. https://www.cdc.gov/nceh/radiation/ineel/TO5FinalReport.pdf

The reactor accident resulted in a total energy release of 133 MW-seconds. Roughly 30 percent of the core's fuel inventory was missing from the vessel, when examined after the accident.[57] [58] [59]

Risk Assessment Corporation used the computer code RSAC to calculated a fission product inventory based on operation of the reactor at a power level of 2.03 MW (mega-watts) for 458 days, followed by a shutdown period of 11 days and the excursion power level of 88,700 MW for a period of 0.015 seconds. The Center for Disease Control did not call out what were obvious discrepancies and which meant that the SL-1 radiological consequences have been grossly understated.

Sage brush samples were collected and according to the AEC, the "gamma spectra of representative samples indicated that the activity was due to iodine-131. (IDO-12021, p. 131)

It was customary for the AEC to monitor jack rabbit thyroids and the iodine-131 levels before the SL-1 accident, for jack rabbit thyroids were typically 100 picocuries per gram. After the SL-1 accident, the levels were as high as 750,000 picocuries per gram at the SL-1, 180,000 picocuries/gram at nearby Atomic City, located south of the SL-1, and 50,000 picocuries per gram at Tabor, a farming community southeast of SL-1 and west of Blackfoot, and 11,200 picocuries at Springfield. These rabbit thyroid results reveal much higher rabbit thyroid iodine-131 levels than produced by the other large episodic and routine releases from the Idaho National Laboratory during the 1950s and 1960s. [60] [61] [62] [63]

As the DOE still publishes false information about the SL-1 accident, you can read my report about the consequences of the SL-1 accident on the Environmental Defense Institute website, The SL-1 Accident Consequences, at http://environmental-defense-institute.org/publications/SL- 1Consequences.pdf and the cause of the SL-1 accident on the Environmental Defense Institute website, The Truth about the SL-1 Accident – Understanding the Reactor Excursion and Safety Problems at SL-1 at http://environmental-defense-institute.org/publications/SL-1Accident.pdf

16. Idaho laws being weakened regarding radiological releases

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The State of Idaho weakened laws for radiological releases this year, removing clean air law protections in place since 1995.

I stumbled upon this 2019 law change, effective spring of 2019 after the adjournment of the Idaho Legislature, to IDAPA 58 – Department of Environmental Quality, 58.01.01 – Rules for the Control of Air Pollution in Idaho, Docket No. 58-0101-1801.[64]

57 Department of Energy, Idaho National Engineering Laboratory Historical Dose Evaluation, DOE/ID-12119, August 1991. See https://inldigitallibrary.inl.gov

58 Atomic Energy Commission, "Final Report of the SL-1 Recovery Operation," IDO-19311, June 27, 1962. See p. III-77 regarding fuel damage. https://inldigitallibrary.inl.gov/PRR/163644.pdf

59 Atomic Energy Commission, "Additional Analysis of the SL-1 Excursion Final Report of Progress July through October 1962," IDO-19313, November 21, 1962. See p. 27 Table I-VIII. https://inldigitallibrary.inl.gov/PRR/163644.pdf

60 Atomic Energy Commission, "1958 Health and Safety Division Annual Report, IDO-12012, See p. 72, 73 for iodine-131 in sage brush and rabbit thyroids. https://inldigitallibrary.inl.gov/PRR/112697.pdf

61 Atomic Energy Commission, "Annual Report of Health and Safety Division, 1959," IDO-12014, See p. 88 for iodine-131 in rabbit thyroids. https://inldigitallibrary.inl.gov/PRR/112700.pdf

62 Atomic Energy Commission, "Health and Safety Division Annual Report, 1960," IDO-12019, See p. 91 for iodine-131 in rabbit thyroids. https://inldigitallibrary.inl.gov/PRR/90927.pdf

63 Atomic Energy Commission, "Health and Safety Division Annual Report, 1961," IDO-12021, See p. 128, 133 for iodine-131 in jack rabbit thyroids. https://inldigitallibrary.inl.gov/PRR/163656.pdf

64 Office of the Administrative Rules Coordinator, Department of Administration, Pending Rules, Committee Rules Review Book, Submitted for Review Before House Environment, Energy & Technology Committee, 65th Idaho Legislature, First Regular Session – 2019. January 2019 at https://adminrules.idaho.gov/legislative_books/2019/pending/19H_EnvEnergyTech.pdf

The law had included since 1995 a provision for radionuclides. But this section of the clean air law has now deleted the following text:

xvi. Radionuclides, a quantity of emissions, from source categories regulated by 40 CFR Part 61,Subpart H, that have been determined in accordance with 40 CFR Part 61, Appendix D and by Department approved methods, that would cause any member of the public to receive an annual effective dose equivalent of at least one tenth (0.1) mrem per year, if total facility- wide emissions contribute an effective dose equivalent of less than three (3)mrem per year; or any radionuclide emission rate, if total facility-wide radionuclide emissions contribute an effective dose equivalent of greater than or equal to three (3) mrem per year.(5-1-95)

Given the increasing levels of airborne radiological contamination occurring on the lower west Boise-side and the lower east Idaho National Engineering-side of Idaho, this law change certainly is not about protecting human health and the environment.

17. The Department of Energy is not trustworthy

61

From the DOE's nuclear weapons testing at the Nevada Testing Station, in the Pacific islands, and elsewhere, the DOE told people they were safe and then covered up epidemiology that showed people had increased rates of leukemia and cancer from the fallout. The DOE claimed its releases from the INL were too low to cause harm, but when asked to state what it had released to the Idaho skies, the DOE didn't know. Then when the DOE issued a report of estimated releases through its history to 1989, reviews by the Center for Disease Control found the releases had been significantly underestimated. It is also documented that many environmental monitoring records were subsequently destroyed, which would have indicated more contamination that the DOE wanted others to know about. The DOE has lost or destroyed worker radiation dose records throughout its history when the records would show elevated doses. The DOE uses secrecy, document destruction, omission of key information during public presentations, and adherence to providing false information about its plans, and breaks its commitments. The DOE would not have conducted any cleanup at all if other federal agencies had not been able to say that hazardous chemical laws needed to apply to DOE sites, allowing CERCLA cleanup investigations. The DOE has systematically lied about the pervasive long-lived radionuclides at sites likes the INL, omitting what it well knew, that uranium, plutonium and americium were included in soil and perched water. It omitted this information so well that the DOE and the U.S. Geological Survey have often, without justification, omitted the reporting of extensive radiological contamination at the INL, later found by CERCLA investigations.

DOE lied about its radiological releases decades ago from nuclear weapons testing, reactor testing, and reactor accidents and other operations and it continues to misinform the public about its past and about current contamination.

The Department of Energy has a long history of telling workers they are protected from radiological hazards — but workers got illnesses. Nationwide, billions of dollars of illness compensation have been paid out under the Energy Employee Illness Compensation Program Act (EEICOPA) even with two-thirds of INL claims denied.

The Department of Energy has a long history of saying its radiological releases were too small to affect the public — but studies found that the public had higher infant mortality and certain cancers and leukemia.
The Department of Energy has rightfully earned and continues to earn the public's distrust. The Department of Energy must not be allowed to unilaterally reclassify HLW waste because the DOE cannot be trusted to comply with its own regulations should its regulations or DOE Orders be deemed inconvenient or costly.

18. The DOE has a record of not being transparent

62

The DOE has also conducted numerous public comment opportunities, only to refuse to publish those public comments such as the consent-based interim spent nuclear fuel storage meetings conducted a few years ago.[65 66 67]

People might eventually catch on that Idaho is getting more and more radiologically polluted — but with all the dis-information, probably not before it's too late.

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65 The Department of Energy was planning to use a consent-based approach for siting spent nuclear fuel and high- level waste storage and disposal facilities including: (1) a pilot interim storage facility, (2) consolidated interim storage facilities, and (3) permanent geologic disposal facilities, one for commercial spent nuclear fuel and the other for defense spent nuclear fuel and high-level waste.
A consent-based approach was recommended in the 2012 Blue Ribbon Commission report on the nation's problem of spent nuclear fuel disposal, but no one knows what a consent-based approach entails. What we do know that even with local support, state opposition effectively stymied efforts to obtain authorization to construct the geologic waste disposal at Yucca Mountain at Nevada and prevented a proposed interim storage site at Skull Valley, Utah. The DOE held meetings in 2016 around the country seeking public input on the consent-based process, including one in Boise, Idaho. The Department of Energy successfully disposed of the consent-based approach and the public comments collected following the appointment of Rick Perry as the Secretary of Energy in 2017.
The majority of the spent nuclear fuel is from commercial electricity generation from US nuclear power plants. As of 2013, there was 70,000 metric tons heavy metal, enough for the stymied Yucca Mountain repository. The inventory is expected to roughly double as the existing fleet of US nuclear reactors operates for its expected life. Utilities are winning billions in compensation from the DOE over the continuing costs of storing the spent nuclear fuel because of the DOE's failure to provide a disposal facility.
The rest of the spent nuclear fuel is from DOE research and defense reactors, including nuclear submarines and carriers. The DOE's high-level waste is in various forms ranging from liquid waste at Hanford awaiting vitrification, highly soluble powder-like calcine at Idaho and vitrified waste as other sites.

66 Before ending the consent-based siting effort, information found about the Department of Energy's consent-based siting at www.energy.gov/consentbasedsiting and its Integrated Waste Management and Consent-based Siting booklet at http://energy.gov/ne/downloads/integrated-waste-management-and-consent-based-siting-booklet

67 Environmental Defense Institute's comment submittal on the Consent-based Approach for Siting Storage for the nation's Nuclear Waste, July 31, 2016. http://www.environmental-defense- institute.org/publications/EDIXConsentFinal.pdf

<u>Comment #7-Tammy Thatcher</u>

From: ! NSRREA
To: Jenifer B. Nordstrom; John S. Irving
Subject: FW: DOE invites public comment on Draft Environmental Assessment for Expanding Capabilities at the National Security Test Range and Radiological Response Training Range at Idaho National Laboratory ++ need referenced documents
Date: Tuesday, October 15, 2019 7:24:31 AM

Associated email/comment to Tami Tatcher (Comment 5)

From: Tami Thatcher <tzt@srv.net>
Sent: Thursday, October 10, 2019 12:15 PM
To: ! NSRREA <nsrrea@id.doe.gov>
Subject: FW: DOE invites public comment on Draft Environmental Assessment for Expanding Capabilities at the National Security Test Range and Radiological Response Training Range at Idaho National Laboratory ++ need referenced documents

Dear Department of Energy:

The draft Environmental Assessment (DOE/EA-2063) has several key technical references which do not appear to be publicly available.

These references should have been made available in a convenient web page to support review of the draft EA. 63

Specifically, please provide these (and others):

Sondrup, A.J. (2019a, May 30). Assessment of Potential Dose and Environnmental Impacts from Proposed Testing at the INL Radiological Response Training Range, ECAR No. 3533.Idaho Falls: Idaho National Laboratory.

Sondrup, A. J. (2019b). Assessment of Potential Dose and Environmental Impacts from Proposed Testing at the INL National Security Test Range ECAR 3565.Idaho Falls: Idaho National Lab

Please note that the radiological assessments in the draft EA do not include those additional radionuclides chosen to be released based on ALARA, and so no meaningful review of the proposed activity can actually be conducted. 64

Please extend the public comment period and provide public meetings on this proposed activity that includes releasing long-lived radionuclides to the environment.

Sincerely,
Tami Thatcher

Response(s) 22-64: Ms. Thatcher, thank you for your comments. Please refer to the numbered comments and corresponding numbered responses.

22. DOE's NEPA implementing procedures are found in 10 CFR 1021. Section 1021.301 (d) states, "At DOE's discretion, this review [i.e., the public comment period] shall be from 14 to 30 days." The public comment period for this EA complied with the regulation. The public has been provided a reasonable length of time to comment on the analyses in the EA and point out incorrect or insufficient data. DOE disagrees the EA contained information not available to the public. The commenter requested documents on Thursday October 10th, 2019, and DOE supplied the document the next working day, Tuesday October 15, 2019.

All evaluations are in the administrative record and available for public review upon request.

23. In accordance with the NEPA implementing regulations, a federal agency can prepare an EA at any time for a proposed action. If potential significant environmental impacts are identified, an environmental impact statement (EIS) can always be pursued. Conversely, if no significant environmental impacts are identified, the EA is the appropriate level of documentation and no further evaluation is necessary. DOE verifies the level and quality of analysis and data compiled for the EA is suitable for use in an EIS if it is decided that an EIS should be prepared. This course of action is appropriate for use when an agency has a basis for the belief that the proposal will not manifest significant environmental impacts. DOE also considered the context (setting) and intensity (severity) of any potential environmental impacts before deciding on the appropriate level of NEPA review. DOE prepared the EA and included all information necessary to determine the potential for significant environmental impact. DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. The analyses indicate that the proposed action will not have a significant impact and, therefore, an EIS is not necessary.

24. The EA states DOE will evaluate additional radionuclides on an individual basis using the ALARA process, and will 1) limit the dose to the public at each test location to less than 0.1 mrem/year, 2) verify the curie content and isotopic-distribution of the major, intended, isotopes and any contaminants in radiological materials used in radioactive material distribution testing and training at least once per year, 3) evaluate all changes in isotopes or isotope concentrations against Table 4 and include in the annual reporting requirements, 4) model newly found isotopes with a half-life greater than 74 days for impact to soil and groundwater prior to initial distribution to demonstrate the impact analysis in this EA remains valid, and 5) review any changes to the source materials (e.g., composition or manufacturer), which will be irradiated, or the source of irradiation prior to any such use, to verify the releases in Table 4 will not be exceeded. Please refer to Table 7.

25. DOE disagrees that the evaluations relied on to arrive at conclusions presented in the EA are not available to the public. All evaluations are in the administrative record and available for public review. All requested references were promptly provided.

It is correct that the EA states additional radionuclides not listed in the EA can be released. See previous comment regarding additional releases of radionuclides (comment #24).

26. Section 3.5.1 discusses the current characteristics of groundwater in the project area. The Draft EA evaluated estimated maximum contaminant concentrations from the proposed action in the aquifer below each facility and compares those concentrations to drinking water standards or screening levels for resident tap water. Direct impacts on groundwater from the proposed action are estimated to result in minimal changes in the potential for groundwater contamination. In addition, Section 4.1.11.5 notes, “While there may be additive effects from past, present, and future testing and training events, soil monitoring and removing soil, if necessary, minimizes potential impacts to groundwater quality."

Radiological emissions from all INL facilities are measured or calculated in accordance with 40 CFR 61 Subpart H *National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities* (Subpart H - NESHAP) requirements. Emissions from radionuclide emissions sources are required by Subpart H to be calculated in accordance 40 CFR 61 Appendix D *Methods for Estimating Radionuclide Emissions* or other procedure for which EPA has granted prior approval. Because individual radiological impacts to the public surrounding the INL Site remain too small to be measured by available monitoring techniques, the dose to the public from INL Site operations is calculated using the reported amounts of radionuclides released from INL Site facilities and EPA-approved air dispersion codes. Compliance to Subpart H of 40 CFR 615 is demonstrated primarily using the CAP 88 computer code. EPA requires using the CAP 88 computer code. CAP 88 uses dose and risk tables developed by the EPA. Yearly wind statistics are generated for many of the towers in the INL Site meteorological network; these are used to run the CAP 88 plume dispersion code required for NESHAP compliance.

The INL Site environmental surveillance programs collect and analyze samples or direct measurements of air, water, soil, biota, and agricultural products from the INL Site and off-Site locations in accordance with DOE Order 458.1, *Radiation Protection of the Public and the Environment*. The purpose of DOE

Order 458.1 is to establish requirements to protect the public and the environment against undue risk from radiation associated with radiological activities conducted under the control of DOE pursuant to the Atomic Energy Act of 1954, as amended. The objectives of the order include 1) conducting DOE radiological activities so that exposure to members of the public is maintained within the dose limits established in the order, 2) controlling radiological clearance of DOE real and personal property, 3) ensuring that potential radiation exposures to members of the public are as low as reasonably achievable, 4) ensuring DOE sites have the capabilities, consistent with the types of radiological activities conducted, to monitor routine and non-routine radiological releases and to assess the radiation doses to members of the public, and 5) protecting the environment from the effects of radiation and radioactive material. Monitoring activities are performed to generate measurement based estimates of the amounts or concentrations of contaminants in the environment. Measurements are performed by sampling and laboratory analysis or by “in place” measurement of contaminants in environmental media.

An effective quality assurance (QA) program is essential to collecting quality data. DOE integrates applicable requirements into the INL Site monitoring program plans and procedures. The program plans address the QA elements as stated in ANSI/ASQC E4-1994, *Specifications and Guidelines for Quality Systems for Environmental Data Collection and Technology Programs* (e-standard, U.S. Environmental Protection Agency, current version) to verify that the required standards of data quality are met. In addition, DOE prepared the EA and included all information necessary to determine the potential for significant environmental impact. DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. DOE acknowledges that many different perceptions are represented in the comments received, but no comments were received that indicate any of the impact data presented in the EA should be reconsidered based on technical or scientific reasons.

27. The proposed action will not create additional CERCLA sites at the INL Site. Please refer to Section 4.1.4 of the Draft EA, which states the following:

> "As noted, soil monitoring and sampling will be performed at least every 2 years for at least two rounds of monitoring, and based on the results, frequency will be increased or decreased (but to no less than every 5 years) to verify radionuclide, chemical, and explosive constituent concentrations do not approach the PRGS, BCG, or risk quotients listed in Tables 23, 24, and 27. The most restrictive soil concentrations for each radionuclide analyzed for soil are highlighted in Table 28 and will be used to evaluate soil sampling results for additional actions. The values used are below the human health cleanup levels and ecological screening levels in Table 12 of the *Operable Unit 10-08 Record of Decision for Site-Wide Groundwater, Miscellaneous Sites, and Future Sites* (DOE-ID, 2009). Impacts to soils are anticipated to be minor."

In addition, DOE remains committed to its cleanup obligations, permit requirements for active facilities, and safe and effective management of nuclear materials. Background samples for a wide variety of constituents was performed at NSTR in 2007 and for the RRTR in 2010 to establish background conditions before any activities were performed. Subsequent sampling has not indicated any increase in any radionuclides—short or long-lived. Table 27 on page 67 of the EA shows calculated soil concentrations at the end of the proposed 15-year testing period (i.e., time of maximum concentrations). In addition, soil monitoring and sampling will be performed at least every 2 years for at least two rounds of monitoring, and based on the results, frequency will be increased or decreased (but to no less than every 5 years) to verify radionuclide, chemical, and explosive constituent concentrations do not approach the PRGS, BCG, or risk quotients listed in Tables 23, 24, and 27.

The most restrictive soil concentrations for each radionuclide analyzed for soil are highlighted in Table 28 and will be used to evaluate soil sampling results for additional actions. The values used are below the human health cleanup levels and ecological screening levels in Table 12 of the *Operable Unit 10-08 Record of Decision for Site-Wide Groundwater, Miscellaneous Sites, and Future Sites* (DOE-ID, 2009).

28. Radiation levels are not increasing by a factor of 170. As noted in Table 35, the estimated annual air dose from all current and reasonably foreseeable future actions at the INL Site is 1.78 mrem, which is roughly a third of the dose an individual receives during a trans-oceanic flight. Also, the EA states in Section 4.1.1, at NSTR the maximum 95th percentile dose for a public receptor is 0.0417 mrem/year, which is about 1/239th the regulatory limit of 10 mrem/year and the maximum 95th percentile dose for a worker is 0.0644 mrem/year (less than 1/77,000th the federal limit of 5,000 mrem/year). At RRTR, the NTR maximum 95th percentile dose for a public receptor is 0.0482 mrem/year, which is less than 1/207th the regulatory limit, and the STR is 3.43E-04 mrem/year, which is also much less than the regulatory limit. The maximum 95th percentile doses for workers are about the same for the NTR (i.e., 0.605 mrem/year) and STR (i.e., 0.594 mrem/year). These doses are less than 1/8200th of the federal worker dose limit of 5,000 mrem/year.

29. Please refer to the responses to comments #22 and 23. Section 2 of the Draft EA describes the scope of the proposed expansion, and DOE included all information in the draft EA necessary to determine the potential for significant environmental impact. DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. DOE acknowledges that many different perceptions are represented in the comments received, but no comments were received that indicate any of the impact data presented in the EA should be reconsidered based on technical or scientific reasons.

30. Table 4 lists the isotopes produced from irradiating K_2O, KBr, $LaBr_3$, Cu and Zr metals, and F for the proposed source term. The table also includes the half-life for each isotope, the estimated radioactivity released in a single test, and the proposed total annual release. This list includes both short- and long-lived radionuclides. The long-lived radionuclides include naturally occurring isotopes and long-lived radionuclides created during irradiation of the metals. The long-lived radionuclides were evaluated for impact on the environment (Hafla, et. al. (2019) and Sondrup (2019a) and (2019b)) and determined to pose no adverse impact to the environment or personnel.

31. Please see response to comment 30.

32. ALARA means "As Low As Reasonably Achievable," which is an approach to radiation protection to manage and control releases of radioactive material to the environment, and exposure to the work force and to members of the public so that the levels are as low as reasonable, taking into account societal, environmental, technical, economic, and public policy considerations. DOE Order (O) 458.1, *Radiation Protection of the Public and the Environment*, requires a documented ALARA process be implemented to optimize control and management of radiological activities so that doses to members of the public (both individual and collective) and releases to the environment are kept ALARA. In addition, 10 CFR Part 835, *Occupational Radiation Protection*, prescribes regulations for occupational dose to general employees from exposure to ionizing radiation from DOE activities. 10 CFR Part 835 also includes dose limits for members of the public in a controlled area. ALARA requirements for general employees and definitions of the terms "general employee," "occupational dose," and "controlled area" are addressed in 10 CFR Part 835 and discussed in associated 10 CFR Part 835 guidance. The ALARA process must be applied to DOE activities and the design or modification of facilities that expose the public or the environment, no matter how small the dose. As used in DOE O 458.1, ALARA is not a specific release or dose limit but a process that has the goal of optimizing control and managing releases of radioactive material to the environment and doses so that they are as far below the applicable limits of the Order as reasonably achievable. ALARA optimizes radiation protection. The use of ALARA principles does not excuse DOE from regulatory limits on radiation exposure; rather, it enhances the Department's commitment to protection of workers, the public and the environment.

33. See response to comment #22.

34. Page 18 notes, "DOE will evaluate using other radionuclides on an individual basis using the as low as reasonably achievable (ALARA) process and limit the dose to the public at each test location to less than 0.1 mrem/year." In addition, Table 7 lists specific actions DOE will take to verify this limit is not exceeded.

Uncontrolled releases of U and Pu were not authorized or evaluated in the *Final Environmental Assessment for the National Security Test Range and FONSI* (DOE-ID, 2007) or the *Final Idaho National Laboratory Radiological Response Training Range Environmental Assessment and FONSI* (DOE-ID, 2010), and while limited use of U in sol gels within enclosed and contained structures is authorized, uncontrolled release of U and Pu is not part of the action.

35. Table 7 of the EA lists project controls for the purpose of reducing anticipated environmental impacts that might otherwise stem from project implementation. The project controls listed in Table 7 are integral to all activities and the proposed action and have been reiterated in the response to comment #24. The objectives of expanding capabilities at the Ranges are detailed in Section 1.1 of the EA.

36. Please see responses to comments #24 (project controls), 27 (soil monitoring), and 35. DOE acknowledges that many different perceptions are represented in the comments received, but no comments were received that indicate any of the impact data presented in the EA should be reconsidered based on technical or scientific reasons.

37. Releasing Pu is not part of the action.

38. Background samples for a wide variety of constituents was performed at NSTR in 2007 and for the RRTR in 2010 to establish background conditions before any activities were performed. Subsequent sampling has not indicated any increase in any radionuclides—short or long-lived. Table 27, page 67, lists calculated soil concentrations at the end of the proposed 15-year testing period (i.e., time of maximum concentrations). In addition, soil monitoring and sampling will be performed at least every 2 years for at least two rounds of monitoring, and based on the results, frequency will be increased or decreased (but to no less than every 5 years) to verify radionuclide, chemical, and explosive constituent concentrations do not approach the PRGS, BCG, or risk quotients listed in Tables 23, 24, and 27.

39. The operations proposed would be performed in full compliance with DOE 5400.1, *General Environmental Protection Program*, DOE Order 458.1, *Radiation Protection of the Public and the Environment*, and 10 CFR Part 835, *Occupational Radiation Protection*. Dose based consequences of the proposed action, as detailed in this EA, are derived from the Annals of the ICRP; Publication 103, *The 2007 Recommendations of the International Commission or Radiological Protection*, and in consideration of the latest available scientific information of the biology and physics of radiation exposure. The purpose of this EA is to assess the environmental impacts of the proposed action. Changes to regulatory limits are outside the scope of this analysis.

40. Please refer to page 77 of the EA, which states, "Public health and safety issues include potential hazards inherent in range training operations. DOE takes precautions in the planning and execution of activities to prevent injury to people or damage to property. Testing conducted at the Ranges presents certain safety and health concerns due to radiological exposure, fragmentation, air blasts, ground shock, and projectiles. Project controls to maintain radiological exposures ALARA and to protect people and property (such as following range guidance criteria and implementing safe stand-off distances) minimize health and safety impacts. No adverse impacts to human health and safety are anticipated from the proposed action."

DOE acknowledges that many different perceptions are represented in the comments received, but no comments were received that indicate any of the impact data presented in the EA should be reconsidered based on technical or scientific reasons.

While limited use of U in sol gels within enclosed and contained structures is authorized, uncontrolled releases of U, Pu, and transuranics are not part of the proposed action.

41. DOE prepared this EA to determine whether the proposed action for expanding capabilities at the Ranges as described in the EA had the potential for significant environmental impacts. DOE prepared the EA and included all information necessary to determine the potential for significant environmental impact. DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. DOE acknowledges your comments and notes that they are outside the scope of this EA. The proposed action will not generate any Greater-Than- Class-C type waste.

42. While limited use of U in sol gels within enclosed and contained structures is authorized, uncontrolled releases of U, Pu, and transuranics are not part of the proposed action. DOE prepared this EA to determine whether the proposed action and reasonable alternatives for expanding capabilities at the Ranges as described in the EA had the potential for significant environmental impacts. DOE prepared the EA and included all information necessary to determine the potential for significant environmental impact. DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. DOE acknowledges your comments and notes that they are outside the scope of this EA.

43. As previously noted, while limited use of U in sol gels within enclosed and contained structures is authorized, uncontrolled releases of U, Pu, and transuranics are not part of the proposed action. The EA states DOE will evaluate additional radionuclides on an individual basis using the ALARA process, and will 1) limit the dose to the public at each test location to less than 0.1 mrem/year, 2) verify the curie content and isotopic-distribution of the major, intended, isotopes and any contaminants in radiological materials used in radioactive material distribution testing and training at least once per year, 3) evaluate all changes in isotopes or isotope concentrations against Table 4 and include in the annual reporting requirements, 4) model newly found isotopes with a half-life greater than 74 days for impact to soil and groundwater prior to initial distribution to demonstrate the impact analysis in this EA remains valid, and 5) review any changes to the source materials (e.g., composition or manufacturer), which will be irradiated, or the source of irradiation prior to any such use, to verify the releases in Table 4 will not be exceeded.

44. The operations proposed would be performed in full compliance with DOE 5400.1, *General Environmental Protection Program*, DOE Order 458.1, *Radiation Protection of the Public and the Environment*, and 10 CFR Part 835, *Occupational Radiation Protection*. Dose based consequences of the proposed action, as detailed in this EA, are derived from the Annals of the ICRP; Publication 103, *The 2007 Recommendations of the International Commission or Radiological Protection*, and in consideration of the latest available scientific information of the biology and physics of radiation exposure. The purpose of this EA is to assess the environmental impacts of the proposed action.

The EA states DOE will evaluate additional radionuclides on an individual basis using the ALARA process, and will 1) limit the dose to the public at each test location to less than 0.1 mrem/year, 2) verify the curie content and isotopic-distribution of the major, intended, isotopes and any contaminants in radiological materials used in radioactive material distribution testing and training at least once per year, 3) evaluate all changes in isotopes or isotope concentrations against Table 4 and include in the annual reporting requirements, 4) model newly found isotopes with a half-life greater than 74 days for impact to soil and groundwater prior to initial distribution to demonstrate the impact analysis in this EA remains valid, and 5) review any changes to the source materials (e.g., composition or manufacturer), which will be irradiated, or the source of irradiation prior to any such use, to verify the releases in Table 4 will not be exceeded. Please refer to Table 7.

DOE prepared the EA and included information necessary to determine the potential for significant environmental impact. DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. DOE acknowledges that many different perceptions are represented in the comments received, but no comments were received that indicate any of the impact data presented in the EA should be reconsidered based on technical or scientific reasons.

45. As previously stated, the operations proposed under the proposed action would be performed in full compliance with DOE 5400.1, *General Environmental Protection Program*, DOE Order 458.1, *Radiation Protection of the Public and the Environment*, and 10 CFR Part 835, *Occupational Radiation Protection*. Dose based consequences of the proposed action, as detailed in this EA, are derived from the Annals of the ICRP; Publication 103, The 2007 *Recommendations of the International Commission or Radiological Protection*, and in consideration of the latest available scientific information of the biology and physics of radiation exposure. The purpose of this EA is to assess the environmental impacts of the proposed action. Evaluating regulatory limits, internationally accepted guidance, and standard modeling is outside the scope of this analysis.

46. As noted, DOE considered the latest available scientific information on the biology and physics of radiation exposure. The purpose of this EA is to assess the environmental impacts of the proposed action. Evaluating regulatory limits, internationally accepted guidance, and standard modeling is outside the scope of this analysis.

47. Page 60 of the EA states, "The DOE dose limits are measured using rad/d and the discussion of biota dose in the following analysis uses mrem/per unit of time for consistency. The difference between rad and rem is that rad measures the radiation absorbed by the material or tissue. The rem measures the biological effect of that absorbed radiation. Generally, for x-rays and gamma rays, one rad equal one rem (1,000 mrem). The impact on non-human biota can be assessed using *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE, 2019a) and the associated software, RESRAD-Biota 1.8 (http://resrad.evs.anl.gov/codes/resrad-biota/). Dose limits of 1.0 rad/day (10 mGy/d) for terrestrial plants and 0.1 rad/day (1 mGy/d) for terrestrial animals are intended to provide protection from chronic exposure of whole populations of individual species rather than individual members of the population."

Uncontrolled releases of U, Pu, and transuranics are not part of the proposed action.

48. As noted in the OU 10-08 ROD (DOE-ID 2009), DOE expects to have an active presence at the INL Site until at least 2095 (the institutional control period). DOE will cleanup soils if sampling approaches the values listed in Table 28. Table 27 was used to demonstrate that even with no action, in 2095 all estimates are that the soil concentrations would be less than the limits. To confirm that concentrations in

Table 28 would not be exceeded, soil sampling and monitoring would be performed, and cleanup would occur if current PRGs are approached.

49. The EA notes in Section 4.1.4, "Under the proposed action, soil monitoring for radionuclides will take place at least every 2 years for at least two rounds of monitoring. Based on the results, monitoring frequency may be either increased to annually or decreased. Soil monitoring and sampling will also be performed no less than every 5 years to verify radionuclide, chemical, and explosive constituent concentrations do not approach ecological screening levels or PRGs. If concentrations approach ecological screening levels or PRGs, soils will be removed and placed in a licensed disposal facility. Using the ecological screening levels and residential PRG verifies human health and the environment will be protected when training at the Ranges is complete."

DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. No technical or scientific data has been presented that indicate any of the impact data presented in the EA should be reconsidered.

50. This reference has been added to the EA.

51. As stated in the EA, the highest deposition rates are at the Ranges, and the potential soil contamination is not likely to result in adverse health impacts under reasonable maximum exposure conditions on the INL Site. The impacts would be much less off-Site. Also, deposition rates decrease rapidly with distance from the dispersal point. The soil concentrations outside the INL Site would be a fraction of the soil concentrations presented in the EA, and thus soil impacts are bounded by those presented in the EA and far below any regulatory limit.

The EA also evaluated radiation exposures to terrestrial plants and animals resulting from the proposed Range expansion. Although the dose to humans was not estimated in the RESRAD-BIOTA calculations, the limiting Biota Concentration Guides (BCGs) are so conservative that the dose to humans resulting from eating contaminated biota at the BCG levels is well below the limit established by DOE for the protection of public health (100 mrem/yr). That is, if a person eats 8 oz (227 g) of meat that is contaminated at the BCG level every day for a year, he or she would not exceed the 100 mrem/yr dose limit.

52. The INL Site environmental surveillance programs collect and analyze samples or direct measurements of air, water, soil, biota, and agricultural products from the INL Site and off-Site locations in accordance with DOE Order 458.1, *Radiation Protection of the Public and the Environment*; DOE-HDBK-1216-2015, *Environmental Radiological Effluent Monitoring and Environmental Surveillance*, and DOE-STD-1196-2011, *Derived Concentration Technical Standard*. The programs meet or exceed requirements within these governing documents and have been determined through technical review to effectively characterize levels and extent of radiological constituents in the environment and distinguish INL Site-related contributions from those typically found in the environment at background levels. The air sampling network covers a 9,000 square mile area in southeast Idaho and Jackson, Wyoming, with over 2,0000 samples collected each year and analyzed for key radiological constituents associated with INL Site operations. Results are published annually in the INL Site Environmental Report (http://idahoeser.com/Publications_surveillance.htm).

53. Radiological emissions from all INL facilities are measured or calculated in accordance with 40 CFR 61 Subpart H *National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities* (Subpart H - NESHAP) requirements. Emissions from radionuclide emissions sources are required by Subpart H to be calculated in accordance 40 CFR 61 Appendix D

Methods for Estimating Radionuclide Emissions or other procedure for which EPA has granted prior approval. Because individual radiological impacts to the public surrounding the INL Site remain too small to be measured by available monitoring techniques, the dose to the public from INL Site operations is calculated using the reported amounts of radionuclides released from INL Site facilities and EPA-approved air dispersion codes. Compliance to Subpart H of 40 CFR 615 is demonstrated primarily using the CAP 88 computer code. EPA requires using the CAP 88 computer code. CAP 88 uses dose and risk tables developed by the EPA. Yearly wind statistics are generated for many of the towers in the INL Site meteorological network; these are used to run the CAP 88 plume dispersion code required for NESHAP compliance.

54. Section 3.5.1 discusses the current characteristics of groundwater in the project area. The Draft EA evaluated estimated maximum contaminant concentrations from the proposed action in the aquifer below each facility and compares those concentrations to drinking water standards or screening levels for resident tap water. Impacts to groundwater from the long-lived radionuclides were evaluated in Sondrup 2019a and 2019b and determined to pose no adverse impact to the environment or personnel. Even using the conservative assumptions in the modeling, peak concentrations of radionuclides in the aquifer are very low and unlikely to exceed MCLs or PRGs as listed in Table 32. In addition, Section 4.1.11.5 notes, "While there may be additive effects from past, present, and future testing and training events, soil monitoring and removing soil, if necessary, minimizes potential impacts to groundwater quality."

55. Table 35 lists expected future releases and documents all current INL Site releases as reported in the annual NESHAPS report as required by regulation. DOE is unaware of potential future actions other than those listed in Table 35. DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. No technical or scientific data has been presented that indicate any of the impact data presented in the EA should be reconsidered.

56. Airborne releases are not increasing by a factor of 170. As noted in Table 35, the estimated annual air dose from all current and reasonably foreseeable future actions at the INL Site is 1.78 mrem, which is roughly a third of the dose an individual receives during a trans-oceanic flight. Table 35 shows the 10-year (2008 through 2017) average dose is 0.05 mrem/year. As stated in Section 4.1.1, at NSTR the maximum 95th percentile dose for a public receptor is 0.0417 mrem/year, which is about 1/239th the regulatory limit of 10 mrem/year and the maximum 95th percentile dose for a worker is 0.0644 mrem/year (less than 1/77,000th the federal limit of 5,000 mrem/year). At RRTR, the NTR maximum 95th percentile dose for a public receptor is 0.0482 mrem/year, which less than 1/207th the regulatory and the STR is 3.43E-04 mrem/year, which is also much less than the regulatory limit. The maximum 95th percentile doses for workers are about the same for the NTR (i.e., 0.605 mrem/year) and STR (i.e., 0.594 mrem/year). These doses are less than 1/8200th of the federal worker dose limit of 5,000 mrem/year.

57. Please see response to comment #53.

58. DOE prepared this EA to determine whether the proposed action for expanding capabilities at the Ranges as described in the EA had the potential for significant environmental impacts. DOE prepared the EA and included all information necessary to determine the potential for significant environmental impact. DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. DOE acknowledges your comments and notes that they are outside the scope of this EA.

59. See response to comment #53.

60. Evaluation of State of Idaho regulatory changes is outside the scope of this analysis.

61. DOE prepared the EA and included all information necessary to determine the potential for significant environmental impact. DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. DOE acknowledges that many different perceptions are represented in the comments received, but no comments were received that indicate any of the impact data presented in the EA should be reconsidered based on technical or scientific reasons.

62. The public process for previous DOE proposals is outside the scope of this analysis.

63. DOE disagrees the EA contained information not available to the public. The commenter requested documents on Thursday October 10th, 2019, and DOE supplied the document the next working day, Tuesday October 15, 2019. All evaluations are in the administrative record and available for public review.

64. Page 18 of the EA notes, "DOE will evaluate using other radionuclides on an individual basis using the as low as reasonably achievable (ALARA) process and limit the dose to the public at each test location to less than 0.1 mrem/year." In addition, Table 7 lists specific actions DOE will take to verify this limit is not exceeded.

DOE prepared the EA and included all information necessary to determine the potential for significant environmental impact. DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. The public has been provided a reasonable length of time to comment on the analyses in the EA and point out incorrect or insufficient data. DOE acknowledges that many different perceptions are represented in the comments received, but no comments were received that indicate any of the impact data presented in the EA should be reconsidered based on technical or scientific reasons.

Comment #6-Chuck Broscious, Environmental Defense Institute

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October 12 2019

Vic Pearson
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Comments on Department of Energy's Draft Environmental Assessment for Expanding Capabilities at the National Security Test Range (NSTR) and the Radiological Response Training Range at Idaho National Laboratory (INL) (DOEIEA-2063). [1 2]

DOE must not be allowed under the National Policy Act (NEPA) to get away with the short cut environmental assessment and be required to conduct a complete environmental impact statement due to the cumulative impact of the new NSTR combined with existing soil and water contamination. 65

DOE's NSTR claims: "Due to continued growth and need, DOE proposes to increase the testing capabilities at each range allowing for the use of unmanned aerial systems, additional explosive materials and additional radioisotopes for testing and training purposes. DOE proposes to expand the capabilities of each range allowing for the installation of permanent structures and utilities, an increase in the frequency of range activities, and an increase in testing capabilities."

DOE need not release more radiation ("Total annual release for all glass containing radionuclides will not exceed 12 Ci per year and dispersed only within enclosed structures having removable spill containment") [3] to an already heavily contaminated site – they only need to adequately study what has already been released and conduct adequate study of existing and former workers. CDC and NIOSH did conduct crude and inadequate INL dose-reconstruction that failed to include all the releases and workers. [4] 66

The Environmental Defense Institute (EDI) has been reviewing INL environmental, health and safety issues for over 30 years. Attachment A below shows an excerpt of EDI's Citizens Guide to INL on the sites history of accidents. [5] Of the 52 reactors operated at INL the site has had forty two reactor meltdowns in its history of operations. Sixteen of these meltdowns were accidents. The remaining twenty six were experimental/intentional meltdowns to test reactor design parameters, fuel design, and radiation

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[1] DOE/EA-2063: Draft Environmental Assessment

[2] Final *Idaho National Laboratory Radiological Response Training Range Environmental Assessment and FONSI* (DOE-ID, 2010) discusses construction and use of temporary containment structures.

[3] DOE/EA-2063, Pg. 19.

[4] Chuck Broscious, Comments on Centers for Disease Control and Prevention INEEL Dose Reconstruction Health Study Sanford Cohen and Associates Aerosol Releases from the Idaho Chemical Processing Plant 1957-1959 and A Critical Review of Source Terms for Select Initial Engine Testes Associated with the Aircraft Nuclear Propulsion Program January 5, 2004 submitted on behalf of Environmental Defense Institute. June 23, 2004. http://www.environmental-defense-institute.org/publications/aerosol.releases.com.Final.2.htm

[5] http://www.environmental-defense-institute.org/publications/GUIDE.963.pdf

releases. These nuclear experiments were conducted with little regard to the radiation exposure to workers and surrounding residents. Attachment A below shows a partial listing of the more notable meltdowns and criticality releases and for a listing of acknowledged melt-downs, accidents, and experimental radioactive releases. The term accidental, used by DOE, is perhaps not an appropriate term any more than when the term is applied to a hot-rodder who "accidentally" crashes his car while speeding at 100 miles per hour down a road designed for 30 mph. Hot-rodding a nuclear reactor just to see what it will take is no accident and no less irresponsible.

DOE has the perfect place to conduct studies on the impact of radiation on workers without releasing more radionuclides as planned. There simply is no need to release more. Tami Thatcher has written extensively about the inadequacy of the National Institute for Occupational Health (NIOSH). [6]

DOE states: "Due to continued growth and need, DOE proposes to increase the testing capabilities at each range allowing for the use of unmanned aerial systems, additional explosive materials and additional radioisotopes for testing and training purposes." DOE's new NSTR program promises to use As-Low-As-Possible (ALAR) [7] as the parameter for release of radionuclides. This is an affront to any sensible person given DOE's 60 year history of turning INL into one of the largest and most radioactively contaminated areas in America. 67

Currently, neither DOE nor Idaho Department of Environmental Quality does adequate monitoring of INL emissions to the atmosphere or groundwater. [8] [9] [10] Even the huge INL wild fire of the summer of 2019 got any published results despite press conference commitments.

DOE's complete disregard for workers and downwind populations are clearly shown when they state: "Control fugitive dust by applying water, covering soils, replanting disturbed areas, or other methods; Monitor wind speeds prior to each dispersal; Limit explosive dispersals to wind speeds less than **25 mph**; Evaluate all new isotopes in irradiated materials for potential offsite dose prior to initial distribution." [11] At 25 MPH the radionuclides could be in Mountview in 15 min. or 68

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[6] Tami Thatcher, NIOSH Dose Reconstruction Concerning Radiation Dose Reconstruction for Energy Employee Occupational Illness Compensation, http://environmental-defense-institute.org/publications/EmailNIOSH.pdf

[7] "Multiple dispersals in accordance with releases listed in Table 4. Additional radionuclides evaluated using the environmental ALARA process." Table 6 Pg. 36.

[8] Tami Thatcher, PETITION FOR REVIEWOF HWMA/RCRA HAZARDOUS WASTE TREATMENT AND STORAGE PERMIT RENEWAL FOR THE AMWTP, http://www.environmental-defense-institute.org/publications/IDEQpetition.pdf

[9] Tami Thatcher , Tritium at 800 pCi/L in the Snake River Plain Aquifer in the Magic Valley at Kimama: Why This Matters Environmental Defense Institute Special Report By Tami Thatcher December 31, 2016 (updated January 2017) http://www.environmental-defense-institute.org/publications/kimamareport.pdf

[10] Tami Thatcher, **The Hidden Truth About INL Drinking Water - Environmental**
environmental-defense-institute.org › publications › INLdrinkwater
contaminant levels (MCLs) at some INL *drinking water* wells. ... In one of the few USGS reports to discuss INL *drinking water* contamination, only one INL.
Tami Thatcher, **What's Up With The Radionuclides in Drinking Water Around INL**
www.environmental-defense-institute.org › publications › News.18.Feb.pdf
The public *drinking water* monitoring conducted by the State of Idaho is available on its ... Environmental Working Group at www.ewg.org and see their *tap water*.

[11] DOE/EA-2063, Pg. 22

Idaho Falls in 2 hours. So claims of short-half lived radionuclides are preposterous and ridiculous.

Respectfully submitted on behalf of the Environmental Defense Institute by
Chuck Broscious
EDI Board

Attachment A

EDI Comments Attachment A
INL Radiological Accidents

Citizens Guide to INL Section I.B. INL Accident History [12]

INL has had forty two reactor meltdowns in its history of operations. Sixteen of these meltdowns were accidents. The remaining twenty six were experimental/intentional meltdowns to test reactor design parameters, fuel design, and radiation releases. These nuclear experiments were conducted with little regard to the radiation exposure to workers and surrounding residents. Below is a partial listing of the more notable meltdowns and criticality releases. See IX Appendix (A) for a listing of acknowledged melt-downs, accidents, and experimental radioactive releases. The term accidental, used by DOE, is perhaps not an appropriate term any more than when the term is applied to a hot-rodder who "accidentally" crashes his car while speeding at 100 miles per hour down a road designed for 30 mph. Hot-rodding a nuclear reactor just to see what it will take is no accident and no less irresponsible.

According to Boyd Norton, manager of the SPERT tests in the early 1960s notes, "These reactors are, essentially, stripped-down hot-rodders; they had no radiation shielding and no elaborate safety systems. Sitting as they were, in the middle of more than nine hundred square miles of desert, there wasn't much concern over such things. Not back then." [Norton]

An ICPP criticality accident on October 16, 1959 required evacuation of the facility. "Outside the building and for 130 yards west to the area entrance the radiation field was 5 R/hr or greater." [IDO-10035 @ 4] Thankfully, it was a night shift and less than 10% of the normal work-force was on the site. Twenty-one workers were considered at immediate risk from exposure. Film badge dosimetry and calculations on internal radiation exposure found the highest skin exposure was 50 rem and the highest penetrating exposure was 8 rem. Highest internal dose was 29 mrem. [IDO-10035 @ 5 & 38] This accident followed a Rala run the previous day. Over the course of the accident 337,717 Ci of long-lived fission product was released to the atmosphere. [DOE/ID-12119@A-99]

"The accident at the Stationary Low-Power Reactor Number One (SL-1) occurred on January 3, 1961. Located in the Auxiliary Reactor Area, SL-1 was a small compact Army nuclear power plant designed to generate electricity at remote military locations such as the Arctic or Antarctic. The reactor served both as an experimental prototype and as a training facility for military personnel. On the bitterly cold afternoon of January 3rd, three Army technicians arrived at the facility for the four to midnight shift. The SL-1 reactor had been shut down for routine maintenance, and the task of the three men that evening

[12] http://www.environmental-defense-institute.org/publications/GUIDE.963.pdf

was to complete certain preparations for nuclear startup. Apparently, in the process of attaching control rods to drive motors, one of the men raised the central control rod too far and too fast. Evidence indicates that the rod might have stuck momentarily. In the past, there had been sticking problems with that rod. When it came unstuck, it moved upward much higher than anticipated and triggered a supercritical power excursion in the reactor core. In a fraction of a second the power reached a magnitude of an estimated several billion watts, melting and perhaps even vaporizing a large part of the core. The water in the core region was vaporized, creating a devastating steam explosion. The remaining water in the reactor vessel was hurled upward at high velocity, striking the underside of the reactor's pressure lid and lifting the whole nine-ton vessel upward, shearing cooling pipes in the process. The three men, who had been standing atop the reactor vessel, were crushed against the ceiling of the building before the huge vessel dropped back into place. One of the men remained impaled on the ceiling by a piece of control rod rammed through his groin. It all happened in a second or so." [Norton]

"It [SL-1]was a terrible accident, made even more grisly because the intensely radioactive fission products scattered inside the building by the accident hampered the work of recovering the bodies. Staying in the building for mere seconds resulted in a year's allowable dose of radiation for rescue workers. And it took six days to remove the body that was impaled on the ceiling by use of a remotely operated crane and a closed circuit television. The bodies were so badly contaminated, the heads and hands of the victims had to be severed and buried with other radioactive wastes at the Radioactive Waste Management Complex." [Norton] The Oil Chemical and Atomic Workers Union protested vigorously that the government refused to provide a proper Christian burial for the workers.

The SL-1 reactor explosion not only resulted in three deaths but also serious exposure of 0.1-0.5 roentgens [rem] to nearly 100 personnel. Over 12 workers received exposure greater than 10 roentgens [rem]. [IDO-19301@138] The maximum acknowledged personnel exposure was 1,000 R/hr. (Rad per hour). [ERDA-1536,p.II-243] The exposed reactor was still emitting 22,000 R/hr. five months after the accident. Readings above the reactor one month after the accident were 410 R/hr. [IDO-19301,p.109] 1,128 Ci including 80 Curies of radioactive Iodine were also released during the SL-1 accident. [ERDA-1536,p.II-243] [DOE/ID-12119@A-53] A temperature inversion kept the radiation plume close to the ground and at 25 miles the radioactive iodine levels were 10 times above background. At 100 miles the radiation levels were above background.

The author interviewed the widow of James Dennis who was a member of the SL-1 involuntary Army demolition crew brought in to dismantle the reactor after the accident. Dennis died of a rare blood cancer called Waldenstrom's micro globulin anemia, which his medical documents confirm, was caused by exposure to 50 rem/hr. for nine hours and ten minutes at the SL-1 site. [Dennis ,p.10] Dennis' documents further challenge the government's acknowledged exposure of whole body - 2135 mrem, and skin - 3845 mrem [Dennis citing AEC/SL-1,CAB] as grossly understated. Dr. Charles Miller M.C., hematologist / oncologist, chief of Medical Services at Letterman Army Medical Center and Dennis' internal physician, supports the allegation that Dennis' cancer was caused by exposure to radiation. [Dennis, p.17] The government refused to grant Dennis any compensation for his radiation exposure injuries that caused his early death. John Horan, an INL health physics technician, was an expert witness brought in by the Atomic Energy Commission to refute Dennis' claims to radiation induced injuries. Dennis is only one of thousands of individuals who are victims of the health effects of radiation exposure caused by radioactive releases from DOE facilities.

Another ICPP criticality accident on January 25, 1961 released 5,200 Ci [ERDA-1536 @ C-5] and required full evacuation of the plant. Two hundred fifty one workers were on-site at the time. The highest exposure as determined from film badge readings did not exceed 55 mrem of penetrating radiation. The maximum thermal neutron exposure detected in the 65 badges analyzed was less than 10 mrem. Excessive cesium-138 was detected at the Central Facilities Area three miles south of the ICPP after the accident. [IDO-10036@5&6] "Highest personnel exposure received for the four-week period of January 20 through February 16, 1961 by any Phillips' employee in the ICPP at the time of the incident was 240 mrem gamma, 310 mrem beta." [Ibid.@37] Considerable uncertainty exists in relying on the badge reading due to variability in isotope exposure, and the distance the badge is from the worker's hands. More often than not, the badges are considerable understatements of exposure.

For more detailed information see Tami Thatcher's SL-1 report at: http://environmental-defense-institute.org/publications/SL-1Article%20Rev5.pdf

INL Managers Deny Any Responsibility for ZPPR Accident (By Tami Thatcher)

"A recent article in the Boise Weekly about the 2011 Zero Power Physics Reactor (ZPPR) accident at the Idaho National Laboratory's Materials and Fuels Complex (MFC) included interviews of INL managers.[13]

"The ZPPR accident contaminated workers with plutonium when damaged fuel plates were exposed. The DOE accident investigation report[14] concluded that the accident was preventable and that the safety chairman for MFC had twice given written information about his concerns about the continued use of the hood and the higher likelihood of finding damaged ZPPR plates.

"The Department of Energy accident investigation report stated that "Battelle Energy Alliance (BEA) continued operation of the ZPPR Facility with known safety basis deficiencies and without adequately analyzing the hazard to the worker."

"Interviewed for the Boise Weekly, Phil Breidenbach recalls the meeting with the safety oversight chair as cordial and soft-spoken. "This letter, when it's looked at outside the context of what goes on here every day, creates the image that someone ran in here and said, 'No, stop, danger, danger, danger.'" John Grossenbacher said. "That's not the case."

"DOE and its contractors should take note: all safety issues of *actual* importance require the person describing it to say "Stop" and then say "danger, danger, danger" at least three times.

"Breidenbach said one simple action could have prevented the exposure: Ralph Stanton and others could have stopped the work once they found the plastic-wrapped plate. "I'm not a rocket scientist or a Ph.D.," Grossenbacher added, "but if I'm a rad-con tech and I think, 'Well, what happens to this stuff after 30 years of being wrapped in plastic, anybody know?' And if the answer is no, I would say, 'You know what, let's stop.'"

"These two INL managers have forgotten the DOE accident investigation report that describes Stanton and others who questioned several times whether to proceed and it describes the operations personnel including the facility manager – who confidently directed that the work proceed. They have also forgotten the finding that BEA management failed to report the Safety Chair's findings as an Unreviewed Safety Question." [15] [16]

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[13] Article by Jessica Murri, "Half-Life: How an Accident at the Idaho National Laboratory Changed a Family," *Boise Weekly*, April 2014. http://www.boiseweekly.com/boise/half-life-how-an-accident-at-the-idaho-national-laboratory-changed-a-family/Content?oid=3094301&showFullText=true

[14] Department of Energy, Office of Health, Safety and Security (HSS), Accident Investigation Report, "Plutonium Contamination in Zero Power Physics Reactor Facility (ZPPR) at the Idaho National Laboratory" accident 11/8/11 at the Materials and Fuels Complex (MFC). http://energy.gov/hss/downloads/investigation-november-8-2011-plutonium-contamination-zero-power-physics-reactor.

[15] DOE Occurrence Report NE-ID-BEA-ZPPR-2011-0001 https://orpspublic.hss.doe.gov/orps/reports/displayReport2.asp?crypt=%87%C3%95%9Ba%8Etjz%5D%91

"Breidenbach said, "the stars aligned in such a way that too much equipment was out of service." But, BEA had problems far beyond the work room's ventilation and inadequate alpha alarm placement.

"For INL managers who had been briefed on the safety problem but never acted on it, never bothered to find out if operations people understood the increased risk, never questioned whether the controls were adequate – for them to state that it was the fault of the rad-con techs reflects an uncorrectable mentality.

"Grossenbacher also said that when it comes to the health effects of plutonium inhalation: "We know what kind of radiation exposures will result in physical impacts on a person's health, and none of these exposures came anywhere near that."

"The problem is that estimated doses have are large uncertainties and questionable cancer risk prediction adequacy.[17]

"I would also like to remind Grossenbacher that the Energy worker compensation act (EEOICPA) points out that "studies indicate than 98 percent of radiation-induced cancers within the nuclear weapons complex have occurred at dose levels below existing maximum safe thresholds." [18]

Experimental Reactors and Atmospheric Releases

The original name for INL was the National Reactor Testing Station (NRTS). The name more accurately characterizes the activities undertaken at the site. Idaho was the proving ground for military and commercial reactor designs. Reactors were deliberately run to high power levels (excursioned [sic] or melted down) to establish operating limit parameters and component durability under accident scenarios. The power stability of different types of fuel and their configuration inside the core were also the subject of many tests. During INL's six decade history, experimental nuclear projects contributed significantly to the site's radioactive emissions to the environment. Detailed information about these projects is still largely classified as secret and unavailable to the public. Therefore, the complete history of INL may await an executive order from the President. To his credit, President Clinton is releasing more information than the previous two Presidents; however, the Defense Department (DOD) remains intransigent. Because most of the reactor and fuel reprocessing programs at INL were military related, DOD has claimed jurisdiction over DOE in the declassification decisions. The Air Force has claimed jurisdiction over some of the intentional radioactive releases from the ICPP during operation Bluenose.

Aircraft Nuclear Propulsion Program

The US Air Force's Aircraft Nuclear Propulsion (ANP) program in the 1950's designed built, and flight tested a nuclear jet powered bomber which employed more than 10,000 workers. The plane was a modified B-36 (called NB-36) built by Convair and flight tested at Carswell Air Force Base in Fort Worth, Texas. Between 1955 and 1957, the NB-36 made 47 test flights. In 21 of these flights, the nuclear jets were operating. This particular prototype was powered by six conventional propeller engines and two nuclear jets powered by a reactor in the fuselage of the bomber. Considerable radiation was

[16] See the October 2013 EDI newsletter article about ZPPR: http://www.environmental-defense-institute.org/publications/News.13.Oct.-Final.2.pdf

[17] December 2013 EDI Newsletter article, "How Believable are Estimated Radiological Doses Following Plutonium Inhalation?" by Tami Thatcher. http://www.environmental-defense-institute.org/publications/News.13.Dec.Final..pdf

[18] 42 USC 7384, The Act--Energy Employees Occupational Illness Compensation Program Act of 2000 (EEOICPA), as Amended.

released by the unshielded reactor and by the exhaust resulting from the reactor driven jet engine nozzles, which meant the plane was radioactive after each flight. To protect the flight crew from radiation from the reactor, up to 2.5 inches of lead and 17 inches of special rubber were used to line the crew compartment. WFAA-TV's American Portrait program on the "History of the Nuclear Jet Engine" offers original Air Force footage of the NB-36 and related ANP programs.

The Air Force was intent on building a bigger long-range nuclear powered bomber that could stay aloft indefinitely over the North Pole and deliver a nuclear attack on the Soviet Union. Pratt and Whitney, General Electric, and Lockheed were competing for contracts on reactor designs on this next generation of nuclear powered bombers. GE won the contract and proceeded to build and ground test the 44,000 horsepower nuclear jet engines at INL where a 20,000 foot runway was also slated to be built for the plane. The 8-foot concrete shielded hanger for the plane was built at INL's Test Area North where the runway was also to be built. This test program was called the Initial Engine Tests (IET), and it lasted from 1955 through 1961 when it was canceled by President Kennedy. By 1961, the ANP program consumed $4.6 billion. [American Portrait, 1993] Another analysis in 1995 included all related ANP activities and found the price tag to be over $6 billion. [Wald(b)] Other space related reactor testing programs at INL, however, continued with the SPERT, SNAPTRAN, and NASA's Light-bulb reactor tests.

"The power plant design concept selected for development by the General Electric Company was the direct air cycle turbojet. Air is the only working fluid in this type of system. The reactor receives air from the jet engine compressor, heats it directly, and delivers it to the turbine. The high-temperature air then generates the forward thrust as it exhausts through the engine nozzle." [Wilks]

One Initial Engine Test (IET) series at INL released from April to June of 1956 over 1.9 million curies of activity including significant amounts (453,350 Ci) of Iodides. [DOE-ID-12119@A-114] Between 1956 and 1970, fifty-nine ANP tests released an estimated 4,635,724 curies of radiation. [DOE/ID-12119 @A55] By comparison, the Three Mile Island reactor accident, generally considered this nation's worst nuclear incident, released 15 curies (Ci) of radioactive iodine to the environment.

"The ANP Reactors were direct, open cycled air cooled. This means that air was driven into the jet engine, compressed, passed through the reactor fuel element where heat energy was extracted, and then discharged through the turbine and jet engine nozzle." ... "Any radioactivity leaking from the fuel elements was also discharged to the air stream." [ERDA-1536@II-239]

Many deliberate fuel element failure tests by blocking reactor coolant were conducted to test a full scale aircraft reactor accident. One of these tests went awry resulting in significant portions of reactor core to melt and considerable additional radiation to be released to the environment. [Ibid.] DOE publicly denies that any ANP reactors were buried at INL yet the literature specifically acknowledges that jet engines are buried at the Radioactive Waste Management Complex (RWMC) Subsurface Disposal Area (SDA). [PR-W-79-001 @ 4-1] The SDA does not meet the Environmental Protection Agency's Subtitle D garbage landfill standards let alone Nuclear Regulatory Commission greater than class C radioactive waste disposal standards. The IET series involved three reactor assemblies that were constructed at INL for the ANP program. "These three assemblies were designated HTRE No. 1, HTRE No. 2, and HTRE No. 3." [DOE/ID-12119@A-87] Though two ANP nuclear jet engine shells are on display at the Experimental Breeder Reactor-I, the disposition of the other engines and reactor cores for these engines was to the RWMC. The HTRE experiments included the following:

> "HTRE-1. The HTRE-1 reactor operated a modified J47 turbojet engine exclusively on nuclear power in January 1956. It accumulated a total of 150.8 hours of operation at high nuclear power

levels."
"HTRE-2. The HTRE-2 reactor was a modification of HTRE-1. Testing began in July 1957. The reactor accumulated 1,299 hours of high-power nuclear operation."
"HTRE-3. The HTRE-3 reactor was built in a full-scale aircraft reactor configuration. Two modified J47 turbo jets engines were operated by this reactor. Full nuclear power was achieved in 1959 and the system operated for a total of 126 hours." [RE-P-82-053 p.2]

Knowing full well how hazardous the emissions from these reactors would be, the IET managers built a remote test site called the IET Core Test Facility some distance north of TAN's Technical Support Facility. The two sites were connected by a 4-rail track on which the reactors were moved on rail dollies between test series. The Technical Support Facility Hot Shop assembled and disassembled the reactors. The Core Test Facility (CTF) is where the reactors actually operated. CTF consisted of an underground bunker control building where personnel ran the reactors, and a 214 foot-exhaust duct connected to a 150-foot exhaust stack. The reactors were rolled up to the exhaust duct using a shielded locomotive. When the reactors were operating, a plume rose from the exhaust stack to a height of over 1,200 feet. Jackrabbit thyroids sampled downwind from the IET in March 1958 showed radioactivity at 293,700 disintegrations per minute per gram (d/m/g). [IDO-12082(58)@74]

The HTRE-2 and 3 were disassembled in the IET Hot Shop where the highly radioactive plug shield and core assembly were removed and shipped intact to the RWMC. Radiation levels (300 R/h) were too high to allow further disassembly of the reactor vessel and its shielding. Then the reactor vessels were moved back out to the IET test pad where the 200 ton HTRE-2 (with dollies) and the 90 ton HTRE-3 (w/o dollies) were jacked up off the rail tracks and a special 350-ton transporter was moved under for shipment to the RWMC burial grounds at INL. Bridges between TAN and the RWMC had to be blocked up to take the heavy transporter, and special ramps made into the trench where they were buried. [PR-W-79-001 @4-3] The 106,000 pounds of radioactive mercury used in a tank for shielding around the HTRE-3 and considerable volumes of related radioactive parts were dumped at the RWMC. [See Section IV(C)] These dumping practices are another reason why the RWMC is a Superfund cleanup site today.

The Strategic Defense Initiative Organization (SDIO) revived the nuclear jet engine project for use in the space program. This new Black Budget program's (code name Timberwind) purpose is to develop the technology and demonstrate the feasibility of a high-temperature particle bed reactor propulsion system to be used to power an advanced nuclear rocket engine. The Strategic Defense Initiative involves orbiting space platforms that theoretically will have the capacity to shoot down missiles launched at the USA. To build these platforms, heavy payloads would have to be launched - requiring powerful rockets. SDIO believes that the nuclear rocket offers a greater thrust to weight ratio than conventional rocket designs. SDIO generated a secret Environmental Impact Statement (EIS) on Timberwind in 1990. When the existence of this EIS was discovered by the Federation of American Scientists, they demanded that it be released. A declassified Environmental Impact Statement (EIS) was released in 1991, however most substantive (classified) sections have been blacked out. This violates the intent of the National Environmental Policy Act which requires full disclosure of the environmental impacts of proposed federal activities. The Timberwind program was later officially transferred to the Air Force and a new EIS was released in 1992. The 103rd Congress, however, eliminated funding for nuclear rocket program in the FY-1994 budget after spending $464 million. Black Budget projects rarely survive the light of day. The 104th Congress revived the SDI program so Timberwind may also be revived. Since INL was originally selected as the Timberwind ground test site, it is possible that Idahoans will again be subjected to massive radioactive emissions if the nuclear propulsion part of SDIO's program is built and tested. For a more detailed assessment of Timberwind, the Environmental Defense Institute's written comments upon the EIS are available on request.

In other nuclear aircraft related tests, General Electric conducted two open air burning tests on March 20, 1957 of reactor fuel rods to see how much radiation would be released in a nuclear powered plane crash. These tests, called Operation Wiener Roast because of the live animals used to test radiation exposure, also released over 78.3 curies of radiation to the air. [DOE/ID-12119 p. A-55]

The US Air Force conducted the Fission Products Field Release Tests (FPFRT) between July and September 1958. "The tests were performed to obtain information for evaluating the release of radioactivity from potential accidents involving nuclear powered aircraft using metallic reactor fuel." [DOE-ID-12119 @A-176] These open air, furnace induced hot burns of reactor fuel rods released 502.7 curies of radiation to the atmosphere.[Ibid. p. A-54] "The experiments at Idaho using 'fresh' fuel elements were cooled from 21 days before meltdown, thus losing essentially all of the short lived isotopes of iodine." [Dunning(b)] The Atomic Energy Commission put a limit on the ANP individual releases of iodine at 1500 rads. [Dunning (b)] See ANP Test Table.

The Special Power Excursion Reactor Test (SPERT) reactor test series were "planned integral core destructive tests to investigate the consequences of reactor accidents." [DOE/ID-12119@79] "The accident scenarios tested included reactors suddenly being made greatly supercritical and undergoing a severe power excursion or transient. In just hundredths of a second the power, or fission rate, could leap from zero to billions of watts, with the potential for severe core damage." [Norton] Each of the four SPERT reactors was different. "SPERT-I, built in 1954 was the simplest of the four, with a large open tank containing the core and moderator. Before it [SPERT-I] was shut down in 1967, seven different cores had been used in it and more than two thousand power excursions conducted."... "In 1962, it was decided to conduct the ultimate test on SPERT-I. Blow it up, deliberately. It would be an answer to ... how far could you push a highly enriched core in a power excursion?" [Norton] The November 15, 1962 SPERT-I experimental reactor "destruct" test resulted in a release of 240,000 Curies including Iodine. [DOE/ID-12119@79] The reactor was placed in an open tank 16 feet deep and 5 feet in diameter. Coolant water was spewed 100 feet in the air in less than one hundredth of a second after the 2 and a half billion watt power surge. Gross reactor damage occurred. Wind direction and the arrival of a monitoring airplane were factors in the timing of the meltdown. [Norton] SPERT-I site would later be used for the Power Burst Facility. SPERT-II was a scale prototype of a modern nuclear power plant except that it used low pressure and heavy water as a moderator. SPERT-II first went critical in 1959, performed tests for five years, and was retired in 1964. The reactor was remotely controlled from a control center one half mile away. The SPERT-II reactor "destruct test" experiment on November 10, 1963 produced 24,000,000 curies; 530 curies were released including iodine. This was a pressurized heavy water reactor.

SPERT-III was a high temperature, pressurized (2,500 psi) light water reactor built in the late 1950's, went critical in 1958, and was placed on standby in 1968. The April 14, 1964, SPERT-III test released 1900 Ci. to the atmosphere producing a radioactive cloud that was tracked for 2.5 miles. The reactor surged in one hundredth of a second from zero to thirty billion watts. [Norton] Using different cores the reactor continued to run until an accidental melt-down in 1968. [Norton] The SPERT-III site was later to be used for the WERF incinerator. SPERT-IV, constructed in 1960, and was called a swimming pool reactor; was immersed in a 30 foot diameter tank and was placed on standby in 1970. These tests demonstrated reactor instability and power oscillations. SPERT project manager Boyd Norton acknowledges "...that it got pretty scary in the control room when the power began oscillating out of control and threatened to blow the thing apart. Being at the reactor console was ... a total exercise in sphincter control. SPERT-IV was later converted to the Capsule Drive Core, forerunner of the Power Burst Facility, which was built a few years later." [Norton] What was left of the SPERT reactors and components were buried at the RWMC. [ERDA-1536,p.II-244-246]

The Space Nuclear Auxiliary Power Transient (SNAPTRAN) destructive reactor tests were part of the space nuclear power program. The tests were conducted at Test Area North's IET site. These reactors lacked shielding because of the added weight limitations. The tests were "designed to provide information on the radiological consequences of accidental immersion of a SNAP 2/10A reactor in water or wet earth such as could occur during assembly, transport, or a launch abort." [ERDA-1536,@II-247] The SNAPTRAN involved the following tests:

- "A series of tests aimed at providing information about beryllium-replicated reactor performance under atmospheric conditions and assessing hazards during reactor assembly and launch."
- "Nuclear excursions resulting from immersion of the reactor in water or wet earth."
- "Non-destructive tests including static tests and those kinetic tests in which minor damage to the reactor occurred, and"
- "Destructive tests in which the reactor was destroyed". [RE-P-82-053,p.3]

The first April 1, 1964 SNAPTRAN destructive reactor test released 24,000 curies plus 9,500 gallons of highly contaminated water that blew out of the test tank when the operators intentionally allowed the reactor to blowup. The radioactive cloud was followed by an airplane for 21 miles before it dissipated. Estimated dose at INL boundary was 10 mRem. Reactor debris was buried at RWMC. [ERDA-1536,.@II-248] The SNAPTRAN second open air destructive tests in January 1966 exploded spreading reactor fuel 700 feet around the site and released 600,000 curies (Ci) including 0.1 Ci I-131 and created widespread heavy contamination of beryllium on the surrounding ground. The radioactive cloud was followed by aircraft for 19 miles before it was no longer visible. Estimated radiation dose at INL boundary was 10 mRem. Again, reactor debris and 300 cubic yards of contaminated soil were buried at RWMC. [Ibid@II-249]

Aircraft Nuclear Propulsion Program INL Tests 1956 to 1970

IET Test Number	Test Date	Release Quantity (Curies)	Source
IET # 3 HTRE-1	2/11 – 2/24/56	132,000.00	D @ ES-11
IET # 4			
# 4-A-1	5/1 – 5/23/56	7,264.00	D @ ES-13
# 4-B-2	5-24 – 6/29/56	205,772.00	D @ ES-13
# 4-C-3	6/29/56	689,886.00	D @ ES-13
IET # 6	12/18/56	9,000.00	B @ A-202
IET # 8 HTRE-2	7/31 – 8/28/57	1,700.00	B @ A-121
IET # 10-A			
# 10-B	12/20/57 – 2/25/58	2,220,000.00	D @ ES-16
# 10-C	3/1 - 3/6/58	2,740,000.00	D @ ES-16
IET # 11	3/20/58 to 4/14/58	4,635.00	B @ A-128
IET # 12 "Boot"	4/21/58 to 5/7/58	29,070.00	B @ A-132
FPFRT-1	7/25/58	9.80	B @ A-201

FPFRT-2	8/4/58	9.30	B @ A-201
FPFRT-3	8/6/58	9.90	B @ A-200
FPFRT-4	8/14/58	9.60	B @ A-200
FPFRT-5	8/27/58	140.00	B @ A-200
FPFRT-6	9/4/58	115.28	B @ A-200
FPFRT-7	9/17/58	90.79	B @ A-200
FPFRT-8	9/18/58	102.48	B @ A-200
FPFRT-9	9/26/58	10.08	B @ A-200
IET # 13	10/8/58 to 11/18/58	9,730.00	B @ A-137
IET # 14	4/24/59 to 5/19/59	13,456.00	B @ A-139
IET # 15	5/27/59 to 6/24/59	3,178.34	B @ A-199
IET # 16	7/28/59 to 10/28/59	294.42	B @ A-199
IET # 17	11/2/59 to 12/12/59	6,202.00	B @ A-147
IET # 18 "HTRE-3"	12/23/59 to 2/8/60	14,157.30	B @ A-153
IET # 19	2/9/60 to 4/30/60	11,381.00	B @ A-153
IET # 20	5/1/60 to 6/13/60	10,249.00	B @ A-155
IET # 21 "Feet # 1"	6/20/60 to 8/8/60	3,752.00	B @ A-158
IET # 22	8/12/60 to 8/25/60	10,526.80	B @ A-160
IET # 23 "Feet #2"	9/1/60 to 10/14/60	2,890.00	B @ A-163
IET # 24 "Lime"	10/17/60 to 10/26/60	7,725.90	B @ A-165
IET # 25	11/15/60 to 12/16/60	10,171.26	B @ A-197
IET # 26	12/22/61 to 3/31/61	12,110.00	B @A-173
SPERT-1	11/5/62	240,000.00	B @ A-79

SPERT-2	11/10/63	530.00	A @ II-246
SNAPTRAN-3	4/1/64	24,000.00	A @ II-248
SPERT-3	4/14/64	1,900.00	A @ II-244
SNAPTRAN-2	1/11/66	600,000.00	A @ II-249
7 Module # 1168 to # 1183	1967 to 1968	?	C @ 29 to 116
3 Module # 1185 to # 1192	1969	?	C @ 165 to 179
Total # Tests > 59		Total Curies* 7,021,878.25	
Total Uranium Released		1,635.82 grams	

Acronyms: IET = Initial Engine Test; FPFRT = Fission Product Field Release Test; SPERT- Special Power Excursion Reactor Test; SNAPTRAN = Special Nuclear Auxiliary Power Transient; Modular - NASA's Modular Cavity or "Light Bulb" Reactor.

* Only hot run tests are listed in the table above, therefore, missing test numbers indicate cold runs. Curie content of uranium released is not included in the total curies released. Releases for the 7 &3 Module are not yet fully analyzed. Between 1956 and 1966 the ANP reactors operated in excess of 3,064.24 hours. During this time the reactors were operated at high power for 1,575.8 hours.[DOE/ID-12119] [PG-WM-85-008 @2-3] Table sources: [A - ERDA-1536]; [B - DOE/ID-12219]; [C - IN-1376]; [D - Critical Review of Source Terms for Select Initial Engine Tests Associated with the Aircraft Nuclear Propulsion Program at INEL, CDC, 7/03.

Other nuclear jet engine projects that impacted INL were ground tested in Nevada. [Times News10/15/90] The nation's first nuclear-powered rocket engine, Kiwi-A, first fired for five minutes in July 1959 at the Nuclear Rocket Development Station about 100 miles northwest of Los Vegas. Several Kiwi-A's were test fired throwing smoke and dust hundreds of feet into the air. "The remains of the reactors from the development project collectively called the ROVER project are among the highly radioactive wastes stored at the INL's ICPP." [Ibid.] ICPP also has a ROVER fuel reprocessing building that has been identified in DOE's Highly Enriched Uranium vulnerability report as having criticality problems.

In 1972, after the ROVER program had shut down, 26,000 fuel elements were shipped from Jackass Flats, Nevada to INL. About 18,000 rods of ROVER program fuel were eventually processed at the ICPP between April 1983 and June 1984 removing about 3,200 kilograms of highly enriched uranium.[Times News10/15/90] The reprocessing of ROVER fuel was discontinued because burning the graphite off the fuel plugged up the off-gas systems and dissolved fuel raffinate plugged up process lines. These plugged lines remain as they were left at the end of the program. "For the contractor slated to deactivate the ROVER Facility...criticality risks are of paramount concern. The ROVER Facility which was shut down in 1984, houses a substantial amount of uranium in its processing lines, vessels, and related equipment."[EM Progress, Winter 1996] Workers attempting to decontaminate the fuel burn cells in 1984 received significant exposures because the graphite plugged face masks and seeped into protective suits.

Management refused to provide workers with pressurized air lines and suits so the workers refused to reenter the ROVER cells. After a dozen years and a belated commitment of over $23 million, DOE is finally willing to address this lingering criticality hazard.

The NERVA (Nuclear Engine for Rocket Vehicle Application) - engine, later developed by Aerojet-General and Westinghouse Electric, was designed to propel a rocket or space vehicle once it escapes the earth's atmosphere. The heart of the engine is a little reactor that uses small ceramic-coated fuel pellets imbedded in graphite. The reactor heated liquid hydrogen, causing it to expand and turn to gas. The rapid expansion provided the propelling force of the engine. [Times News10/15/90]

Budget disputes in 1991 over the Strategic Defense Initiative revealed a secret program called Centaurus at INL. Bill Thielbahr, director of DOE Idaho's energy technology division, acknowledged the difficulties of gaining continued Congressional funding for the $3 million annual requirements of the project. Thielbahr described the Centaurus as a "nuclear-pumped laser" testing program. The work could include studying methods to recover safely some space debris and new systems to produce electrical power. This INL research team consisted of about 20 workers. The $4 million total proposed for INL research is uncertain, since both chambers of Congress have voted to cut the 1991 SDI budget by at least $1 billion. [AP(k)] The basic SDI concept is a space-based network of nuclear powered lasers that could shoot down missiles launched at the United States. This secret program has never had any publicly available environmental monitoring data, which is a repetition of decades of non-accountability fostered by classified Black Budget projects.

Atmospheric Release Experiments

OMRE Solvent Burning Experiment on November 16, 1960 was conducted to "determine the feasibility of open-air burning of contaminated solvents accumulated at the Organic Moderated Reactor Experiment (OMRE) facility. 400 gallons of radioactive solvents were placed in an open vessel and ignited." [DOE/ID-12119 @A-173]

Other "human guinea pig" experiments were carried out just to see how Iodine-131 is absorbed in humans and disperses in the surrounding ground. Twenty-nine Controlled Environmental Radio iodine Test (CERT) between May 1963 and December 1977 released over 32.72 Ci including 26 Curies of Iodine-131 to the environment. [ERDA-1536@II-250]&[DOE/ID-12119] "On three of these CERT releases, human subjects were deliberately exposed. The general design was that radioactive iodine was released in gaseous form, and prevailing winds took the iodine over an area designated the 'hot pasture.' Monitoring devices in the pasture determined the radioactivity deposited. A herd of cows was than led to the pasture to graze for several days. The cows were milked and the milk monitored for Radio iodine. Humans were exposed either by drinking the milk or by direct exposure to the released iodine gas. During CERT-1, conducted in May 1963, one curie of radioactive iodine was released into the hot pasture. Six cows were placed in the contaminated pasture. Cows were milked twice a day and the milk from one cow saved for human ingestion. Seven human subjects each drank 0.5 liter of radioactive milk over a period of 18 days. Radioactive iodine uptake was determined by counting the radioactivity absorbed in the thyroid of each subject." [IDO-12053]

CERT-2 was conducted in September 1964. Approximately one curie of radioactive iodine was again released over the hot pasture. Milk samples were again tested, but were not consumed by humans. Instead, three human subjects were placed on the pasture during iodine release, and the radiation accumulated in their thyroids was counted after exposure. This was not a food chain experiment, but was designed to measure the direct iodine dose from inhalation. During CERT-6 conducted in the summer of 1965, several vials of Radio iodine were broken and the contents (2-6 curies) released to the environment. [IDO-12053, 8/66 @2] "Several individuals were inadvertently exposed to airborne Radio iodine from the leaking and broken containers, and efforts were made to obtain data on the retention of this form of iodine in humans." [Ibid. @2] These exposures occurred over a four-day period, and a few people received multiple exposures; radiation accumulation in the thyroids of these individuals was counted. CERT-7 was conducted in November 1965; 1 curie of I-131 in the gaseous molecular form was released over the pasture at the INL Experimental Dairy Farm. Six cows grazed, and milk samples were counted. In addition, seven human 'volunteers' were placed seated on the pasture area. Uptake of radioactive material was determined by counting the subject's thyroids. "DOE reported to the Subcommittee that no medical follow up of the experimental subjects in the CERT tests was performed." Through the course of the CERT tests, twenty one individuals were exposed. [Congressional Research Service, 5-156 @ 22- 24]

"From 1963 to 1965, at the Atomic Energy Commission National Reactor Testing Station in Idaho, [now called Idaho National Laboratory] radioactive iodine was purposely released on seven separate occasions. In one of these experiments, seven human subjects drank milk from cows which had grazed on iodine-contaminated land. This experiment was designed to measure
the passage of iodine through the food chain into the thyroids of human subjects. In a second experiment, three human subjects were placed on the pasture during iodine release, and seven subjects were placed on the pasture in a third experiment. In addition, "several" individuals were contaminated during yet another experiment when vials of radioactive iodine accidentally broke.
Cows grazed on contaminated land and their milk was counted in four of the experiments; in the remaining three, radiation measurements were made only in the pasture."

http://www2.gwu.edu/~nsarchiv/radiation/dir/mstreet/commeet/meet1/brief1/br1n.txt

"Between 1965 and 1972, 8 individuals were involved in 13 different human experiments. All eight were employees of the Idaho Division of the Atomic Energy Commission. In four experiments, subjects inhaled Argon-41; in nine experiments, subjects swallowed capsules containing micro curie amounts of radioactivity. These experiments were funded and carried out by the Atomic Energy Commission. The objective of this experiment was to calibrate instruments that measure radioactive substances inside the human body; such instruments are usually used to examine workers accidentally exposed or hospital patients receiving radioactive material for diagnostic purposes. A second objective of the experiments was to examine the metabolism of radionuclides ingested or inhaled by humans. In the first set of experiments, one subject was fed one micro curie of Manganese-54; another subject was fed an unspecified amount of Iodine-131. In a second set of experiments, individual subjects were fed 3.5 micro curie of Cesium-132, 1.9 micro curie of Potassium-42, or 1.1 micro curie of Manganese-54. In addition, 4 subjects inhaled Argon-41 in amounts of 1.3 to 2.2 micro curie. In a third experiment, one subject was fed 1.5 micro curie of Cobalt-60 and Cesium-137. The Department of Energy reported there was no medical follow up of any of these experimental subjects." [Congressional Research Service, 5-156 @ 35-36]

Intentional releases of Iodine-129 into the environment referred to as the Iodine-129 Technology Studies took place in August 1964. The studies were a collaborative effort of the US Weather Bureau Research Station at the INL and the Nuclear Science and Engineering Corporation of Pittsburgh, PA. The Iodine-129 Technology Studies were conducted to examine the atmospheric mixing and dilution of gases and particles containing small amounts of Iodine-129. There were a total of five tests: two with particles, one with gases, and two more with particles and gases combined. The first three tests were sampled to distances of about 10 miles over a densely instrumented grid located in the center of the INL site. The last two tests were sampled at distances of 25 to 35 miles in off-site areas to the north-east of the point of release. One mill curie of iodine-129 was released during the experiment. [DOE News, 7/31/95] The 17-million year half-life of Iodine-129 plus its ability to enter the food chain and subsequently concentrate in the thyroid makes this isotope especially toxic.

The Atomic Energy Commission (AEC) also collected human body parts that were used in radiation experiments from hospitals in the Idaho Falls area. Between 1954 and 1955, five samples of human bone obtained at surgery or autopsy from local hospitals were analytically compared with measurements of radioactivity in animals located at the INL. According to the US General Accounting Office report titled "Information on DOE's Human Tissue Analysis Work", the human bone samples appear to have been analyzed for two radioactive elements, strontium and yttrium. In other studies between 1968 and 1970 skin from amputated limbs or other surgical procedures was obtained from various hospitals in the Idaho Falls area. The study's ultimate objectives were to apply radioactive iodine to the human skin to evaluate the hazards caused by iodine permeation. The principal goals of the program were to establish procedures for making accurate predictions of the thyroid dose that would result from an accidental iodine exposure. Other goals were to help in selecting iodine impermeable materials for protective clothing and to develop improved decontamination procedures. In both of these studies informed consent was **not** obtained from the patients and/or family by the researchers. [GAO/RCED-95-109FS@39]

Three Long Distance Diffusion Tests (LDDT) between March 1971 and August 1972 were conducted by the National Oceanic and Atmospheric Administration and the Health Services Lab at INL. These tests released 1000 Ci of Krypton-85 and 12.3 Ci of Iodine-131 into the atmosphere. The stated purpose of these tests was to see how these radionuclides disperse in the atmosphere. [DOE/ID-12119@A-59] The Three Mile Island nuclear accident released more than 15 curies of Iodine-131.

Nine Experimental Cloud Exposure Study tests, appropriately named EXCES, released between May 1968 and April 1970, 987 Ci of Xenon-133 and Sodium-24.[DOE/ID-12119.@A-61] Another air dispersion testing series called Relative Diffusion Tests (RDT) released 10.4 Ci of Iodine-131 between November 1967 to October 1969. [Ibid]

The U.S. Army built support structures and reactors at the Auxiliary Reactor Area (ARA) between 1957 and 1965 when the program was phased out. ARA was divided into four areas (I through IV). ARA-I acted as support facility for the other ARA sites. ARA-III originally housed the Army Gas Cooled Reactor Experiment (AGCRE), water moderated, nitrogen-cooled reactor that generated heat but no electricity and was finally placed on standby on April 6, 1961. After the Army vacated ARA, the buildings were used for various INL projects such as sensor fabrication, experimental instrumentation, and a metallurgical laboratory for nuclear reactor experiments. In 1965, the U.S. Army built the ARVF in the center of INL. "The facility consisted of a test pit, an underground bunker, and a system of pulleys and cables. The steel-lined, open-top test pit was filled with water into which nuclear fuel elements were placed." [DOE/EH/OEV-22-P @2-39] Presumably, the tests were done to create an accident scenario of a nuclear plane or satellite crash and the resulting radioactive releases to the crash site. In 1974, "four drums of radioactively contaminated NaK from ERB-1 were placed in the bunker, where they remain today. In 1980, a protective shed and crane were built above the pit, and in 1980-81 a series of explosive tests were conducted in the pit." [DOE/EH/OEV-22-P @2-39]

INL has a long history of intentional reactor melt-downs that were conducted to test the operating parameters of military and civilian reactor designs. The Loss-of Fluid Tests (LOFT) were conducted at INL's Test Area North (TAN) beginning in late 1977 and ending in 1985 costing over $350 million.[Norton]

As the name suggests, the purpose of LOFT was to test the effects of loss of coolant to a reactor, damage to fuel, and related reactor systems. DOE acknowledges eight LOFT test series over this period. [DOE-ID-12119@A-57] The main components of the LOFT facility were the Mobile Test Assembly that was a large four rail dolly capable of moving the reactor between the Technical Support Facility (TSF) Hot Cell and the test pad containment vessel. The Hot Cell assembled the reactor on the rail dolly, which then transported it to the test pad.

The LOFT test pad containment structure is 70 feet wide and 129 feet high with huge doors to allow the reactor and rail dolly to move in and out. As with the ANP, the tests were conducted at a site removed from the main TAN support area because of the known hazards. After the test run, the rail dolly was moved by a shielded locomotive back to the TSF Hot Cell for disassembly and inspection. After the reactor components were inspected, they were transported to INL's RWMC burial ground for shallow disposal. [ERDA-1536 @II-123]

A "blow-down emission suppression system" in the LOFT containment structure was intended to catch steam and water ejected during the intentional melt-downs resulting from loss of coolant. A 150-foot stack was used to exhaust the effluent into the atmosphere. ERDA's "conservatively estimated airborne radioactivity releases from LOFT experiments" were 941,912 Ci per year which includes stack emissions and containment structure leakage. [ERDA-1536 @II-118] Annual solid radioactive waste generated by LOFT contained 27,000 Ci. [Ibid @ II-124] The last LOFT experiment (LP-FP-2) on July 9, 1985 released 8,800 Ci plus 0.09 Ci of Iodine. [DOE/ID-12119 @A-52]

These releases were done with full knowledge of the implicit hazards of radioactive emissions. "In 1950 the 'destructive force of the atom' and the 'harmful effects of radiation' were basically understood." [DOE-ID-12119@A-50] Yet, no public announcements or warnings were ever given to the public so that they could take some measure of precaution.

Indeed, INL operations were shrouded in absolute secrecy. Only recently have public interest groups had some limited success in gaining access to historical records through the Freedom of Information Act. Today, the vast majority of the most revealing documentation is still classified, technically unavailable in contractor files, or intentionally destroyed. DOE and Department of Defense's (DOD) claims of national security concerning the declassification of fifty-year old radiation release documents is not justified. DOE and DOD have yet to offer guarantees to agencies of the US Health and Human Services conducting health studies at INL that all operating history documents will be declassified. Moreover, DOE delayed for two years granting security clearances to public health agency researchers.

Bluenose Releases

In the late 1940s and 1950s a U. S. Atomic Energy Commission (AEC) and U.S. Air Force secret program code named Operation Bluenose attempted to determine Soviet plutonium production levels by analysis of fission product gases released during the reprocessing of reactor fuel. To test the instruments in their U-2 spy planes, the Air Force requested that large amounts of radiation be released from the Hanford, Washington and Oak Ridge, Tennessee process facilities. The Hanford Education Action League (HEAL) received a DOE document through the Freedom of Information Act (FOIA) describing the releases. "The April 1949 report obtained by HEAL recommends that another test be conducted at Hanford that would release more radiation and also suggests that the plant filters be disconnected. This was done for the Green Run experiment." [HEAL(d)] The Hanford Environmental Dose Reconstruction

Health Study determined that the Green Runs released 740,000 curies of Iodine-131. The Richland Washington Tri-City Herald offered the following interpretation:

"In the 1940s Walt Singlevich headed a classified program known as Operation Bluenose whose object was to determine soviet plutonium production by analysis of fission product gases given off during the reprocessing of reactor fuel."... "The 340,000 curies intentionally released [from Hanford] in 1949 were part of this test program. This release was achieved by hauling 'green' irradiated fuel from the 100 area over to the 200-B Plant were it was dissolved in nitric acid and 'some purple iodine was vented up the stack'. It was later found that I-131 was not an accurate indicator of plutonium processing throughput ..." The noble gas Krypton-85 was found to be the only isotope which could not be removed from the off-gases and that is what Francis Gary Powers was sampling in 1960 when he was downed by the Soviets. His U-2 spy plane had a Cold Finger sampler in-take on its wingtip to sample air at 100,000 feet over the USSR for its Kr-85 content." [Tri-City Herald]

Michael D' Antonio's book *Atomic Harvest* notes a series of articles in the Portland Oregonian newspaper that interviewed Carl Gamertsfelder, a retired Hanford radiation control manager who was at the site during the infamous "Green Runs." Gamertsfelder seems to corroborate the above *Tri-City Harold* article. According to D' Antonio, Gamertsfelder's characterization of the "Green Runs" in the following way.

"It had related to the intrigue and espionage of the Cold War. The United States had been trying to spy on Soviet weapons factories from the stratospheric perspective of exotic surveillance aircraft. The aircraft, and monitoring stations at sites bordering the Soviet Union, could be equipped with devices that would measure the pollution coming out of Russian plutonium plants. But in order to know how the emissions related to the volume of uranium being processed, the Americans needed to simulate Soviet manufacturing methods. To do this, they ran the [Hanford] T-Plant Soviet style, shortening the cooling period and allowing higher levels of pollution. They then measured off-site radiation and worked out a formula that would turn readings from monitoring devices into estimates of the enemy's bomb-production rate. Since the Soviets processed green uranium, in order to stay competitive in the arms race, Hanford had to conduct a Green Run too. Of course, without documentation, no one could be sure that this explanation was accurate. Years later, HEAL would continue to suggest that there was more to the story. Jim Thomas theorized that the US scientists have to perform the Green Run in the way they did because their instruments were not sensitive enough to detect the small emissions." [D' Antonio@125]

Secret document titles obtained during the Hanford Environmental Dose Reconstruction suggest that the INL's ICPP was involved in this Bluenose program in the 1950s. The focus on Kr-85 is confirmed in a United States Government Office Memorandum titled Bluenose and Other Matters that was the transmittal document conveying the attached "Critique of Possible Methods of Computing the Amount of American Kr-85 in the Atmosphere." [HAN-40477] The INL Research Bureau (IRB) submitted a Freedom of Information Act (FOIA) request to both Hanford and INL for release of these documents. Though Hanford did send copies of some of the formerly secret documents, INL refuses to declassify these forty year old documents because of "national security." In a formerly secret memorandum from Paul G. Holsted, Chief of Planning and Reports Branch, Hanford Operations Division, titled "Review of Bluenose Program" dated May 26, 1955, Holsted notes the following:

"General Electric Company has been requested by the [AEC] Division of Research to make release calculations to cover operations of the ICPP at Arco. This work has not yet started although many Kgs of U-235 have been recovered. GE had indicated that it would be willing to do the calculations but that further information would be necessary before it could start. This program was discussed briefly and GE is now ready to start the work." [HAN-59174@4]

The Bluenose program precisely irradiated U-235 slugs under highly controlled reactor conditions by AEC prime contractor General Electric Hanford Atomic Products Operation. [HAN-58767] The slugs were shipped from Hanford to other sites where the slugs were dissolved in nitric acid and the gases allowed to escape. These other sites identified are Savannah River, Oak Ridge, Argonne National Laboratory, Knolls Atomic Power Laboratory, Brookhaven National Laboratory, and National Reactor Testing Station (now INL). [HAN-59174@][HAN-401931 Hanford has the INL release data related to the Bluenose program but refuses to release the documents, referring the Environmental Defense Institute (EDI) to INL who also refuses to release the documents. Dr. Charles Miller, Centers for Disease Control, Environmental Health Physicist, has a Q-security clearance and was shown a secret Bluenose document at INL. Dr. Miller's security cleared characterization of the document is that it had nothing to do with releases but was related to shipping of nuclear materials between sites. Verbatim transcript of the CDC May 25, 1994 meeting note:

"Mr. Miller: Let me tell you what I can tell you legally, I'm reading my notes very carefully because they have been approved. Bluenose was a measurement program, measurement of analytical samples. It did involve the shipment of what are called limited quantities. Now that is not a judgment [sic] on the part of anybody, that's a legal definition as defined by the U.S. Department of Transportation, a limited quantity of radioactive material. And it did involve the shipment of these limited quantities between DOE sites. There were no releases associated with the project. It was not a release project. INEL has been involved since 1970 and everything else was classified.

"Mr. Broscious: Was it the Air Force that was involved in it?

"Mr. Miller: I can't answer that."

"Mr. Broscious: so are they going to declassify that information?

"Mr. Miller: I would say absolutely no way.

"Mr. Broscious: No way?

"Mr. Miller: No way." [CDC(d)@175]

Dr. Miller concluded that the Bluenose program was not a relevant issue to the INL Dose Reconstruction Study because he was convinced no releases occurred. It is entirely possible that the Bluenose document Dr. Miller was shown only dealt with transporting the Hanford irradiated U-235 slugs to INL. However other declassified documents released under FOIA to EDI clearly show the Bluenose program objectives for releases at numerous chemical processing sites around the country including INL. For instance a document titled "Reporting Bluenose Releases" from S. G. English, Chief, Chemistry Branch, Division of Research, and Washington to G. Victor Board, Director, Health and Safety Division, Idaho Operations Office, Idaho Falls states: "Enclosed for your information are the November reports on the dissolving at the ICPP." [HAN-64357] Another declassified March 18, 1955 memo between AEC Washington, D.C. and Hanford titled Preparation of ICPP Release Data states: "Your wire of January 27, 1955, requested a review of the feasibility of having General Electric perform calculations on krypton releases from the ICPP plant at Arco." [HA-58488]

Jim Thomas, now with a law firm involved in a Hanford Downwinder class action suit against DOE still believes that the U.S. efforts to determine Soviet plutonium production rates first tried iodine releases and switched to Krypton-85 because it was more reliable. They used atmospheric inventories of Kr-85 through known U.S. and Allied releases and subtracted that sum from the global total to determine the Soviet production levels.

It appears that through ineptitude or conspiracy, CDC has allowed DOE to hide relevant information needed to establish radioactive releases from INL. These Bluenose revelations strike at the very core of public confidence in CDC's political will to conduct good science. Before a scientific finding can have any credibility in the real world the methodology and supporting data must be reviewed and the method replicated by other independent scientists. As long as information remains classified, independent researchers cannot review the source information that CDC relied on to do the INL Dose Reconstruction health study, and therefore cannot replicate the science. The public will remain justifiably skeptical as long as fundamental scientific method is not followed.

The INL Research Bureau (IRB), a coalition sponsored by the Environmental Defense Institute, filed a Freedom of Information Act (FOIA) request to DOE Richland Operations Office in September for copies of documents identified during the Hanford Dose Reconstruction. The Department's October 24th response was: "We have conducted a thorough search of the Department of Energy's Richland Operations Office (RL) and contractor offices and the following documents were not located." "Therefore, this portion of your request must be denied." Twenty seven documents were listed as lost.

The IRB's appeal to DOE's Office of Hearings and Appeals in Washington, DC notes that "if indeed the requested documents are no longer in existence, the more serious implications of document destruction raises issues of Department non-compliance with United States Code, Title 44 Chapter 31 "Records Management by Federal Agencies"; Chapter 33, "Disposal of Records"; Code of Federal Regulations, 36 CFR, Chapter XII, Subchapter B, "Records Management"; 41 CFR Chapter 201, "Agency Programs"; DOE Order 200.1; and Secretary of Energy memorandums dated March 26, 1990, and January 13, 1994 mandating the retention of epidemiological and other related health study records. The IRB requested that DOE stipulate the fate of these 'not located' records."

The reason these INL documents were at Hanford is both sites were involved in Operation Bluenose. In the 1950's, the Air Force 's U-2 spy plane would fly over the Soviet nuclear production sites, take pictures and take air monitoring samples. In order for the air samples to be useful, the instruments had to be calibrated. As previously noted, intentionally large amounts of fission products including Iodine-131 and later Krypton-85 were released from Hanford, INL and other US production sites and over flown by the U-2 planes. Since The US throughput (production rate) was known, the air sample instruments could be calibrated.

Hanford, being the older AEC sibling, was also involved in INL's start up. INL's original name was the National Reactor Testing Station which more accurately characterizes its five decade mission. No other site has had a more diverse range of operations. Because of this diversity, documents needed for a dose reconstruction study are spread out over the country at different sites and archives. Preservation of these records is essential until after the dose reconstruction studies are completed and all challenges resolved.

Missing documents are not the only problem researchers face. DOE's response to a June INL Research Bureau Freedom of Information Act request was to black out the important parts of the report.

These documents quantified the amount of krypton-85 that was released from INL in support of the 1956 Bluenose project. DOE justified deleting the amount of krypton that was released by stating that:

"The Atomic Energy Act of 1954 prohibits the disclosure of information concerning atomic energy defense programs that is classified as Restricted Data pursuant to the Atomic Energy Act. The portions deleted from the subject documents pursuant to exemption 3 contain information about nuclear weapons design that has been classified as Restricted Data. Disclosure of the exempt data could jeopardize the common defense and the security of the nation." [DOE-9/23/97]

The only credible aspect of national security in jeopardy is the American public's confidence in its government to tell the truth. It is ludicrous to suggest that a person could figure out how to make a bomb from knowing how much iodine and krypton INL released over forty years ago. People living downwind or downstream have a right to know the truth about how these government activities affected their lives.

Summary of INL Radioactive Releases to Atmosphere

Facility	Date	Curies Released	Source
Naval Reactor			
Facility*	6/18/55	305	A @ A-203
ERB-1	11/29/55	single excursion	LA-13638
ICPP*	10/58	1,200	B @ C-3
ICPP*	10/16/59	367,717	A @ A-99
ICPP*	1/25/61	5,200	B @ C-5
SL-1*	1/3/61	1,128	A @ A-196
BORAX-1*	7/22/54	714	A @ A-203
Aircraft Nuclear			
Propulsion*	1956-66	4,635,724	see ANP table

Other INL			
Operational Release	1952-89	13,552,880	A @ A-189
Total Air Release	1952-98	18,564,868	

Sources: (A) DOE/ID-12119; (B) ERDA-1536; LA-13638 Los Alamos

* Significant episodic releases not included in general INL operational releases to the atmosphere. Curie releases less than 0.1 were not added in this summary and are considered understated due to lack of information.

A Review of Criticality Accidents 2000 Revision
Resource: Los Alamos National Laboratory Report, LA-13638

Idaho Chemical Processing Plant, 16 October 195913 pg. 18
Uranyl nitrate solution, U(91), in a waste receiving tank; multiple excursions; two significant exposures.
During evacuation of the building, airborne fission products (within the building) resulted in combined beta and gamma doses of 50 rem (one person), 32 rem (one person), and smaller amounts to 17 persons. While the evacuation proceeded relatively rapidly, the general evacuation alarm was never activated; it was a manually activated system.

Idaho Chemical Processing Plant, 25 January 196114,15,16,17 pg. 18
Uranyl nitrate solution, U(90), in a vapor disengagement vessel; multiple excursions; insignificant exposures.
Radiation alarms sounded throughout the process areas, apparently from the prompt gamma–rays associated with the fission spike. All employees evacuated promptly, and there were only minimal doses (<60 mrem) caused by airborne fission products after personnel left the building. A team of operating and health physics personnel reentered the building 20 minutes after the excursion and shut down all process equipment. As radiation levels had quickly returned to normal and there was no indication of any contamination within the manned areas, management authorized the workers to return to the plant at 14:45.

Idaho Chemical Processing Plant, 17 October 197828,29,101 pg. 45
Uranyl nitrate solution, U(82), in a lower disengagement section of a scrubbing column; excursion history
unknown; insignificant exposures.
The shift supervisor and the health physicist went outside the building and detected radiation levels up to 100 mrem/h. At 21:03, the shift supervisor ordered the building evacuated, and by 21:06 an orderly evacuation had been completed. Road blocks were established and management was notified.

SPERT

National Reactor Testing Station, 22 July 195469,70,71,72
BORAX reactor, aluminum-uranium alloy, water moderated; single excursion; insignificant exposures.

National Reactor Testing Station, 3 January 196174,75
SL–1 reactor; aluminum-uranium alloy; water moderated; single excursion; three fatalities
National Reactor Testing Station, 5 November 196276 pg.98

Assembly of Spert fuel elements; single non-nuclear excursion; insignificant exposures.

National Reactor Testing Station, 29 November 195582,83
EBR-1; enriched uranium fast breeder reactor; single excursion; insignificant exposures.

National Reactor Testing Station, 18 November 195884 pg. 105
HTRE Reactor; instrumentation failure; single excursion; insignificant exposures.

Idaho Chemical Processing Plant, 16 October 195913 pg.18
Uranyl nitrate solution, U(91), in a waste receiving tank; multiple excursions; two significant exposures.

This accident occurred in a chemical processing plant that accepted, among other items, spent fuel elements from various reactors. The fissile material involved in the accident (34 kg of enriched uranium, U(91), in the form of uranyl nitrate concentrated to about 170 g U/ l) was stored in a bank of cylindrical vessels with favorable geometry. The initiation of a siphoning action, inadvertently caused by an air sparging operation, resulted in the transfer of about 200 l of the solution to a 15,400 l tank containing about 600 l of water. Before the accident, a campaign was underway to process stainless steel clad fuels by sulfuric acid dissolution followed by impurity extraction in three pulse columns. Intermediate between the first and second cycle extraction, the solution was stored in two banks of 125 mm diameter by 3050 mm long pipe sections, often referred to as pencil tanks. There was a line leading from the interconnected banks of pencil tanks to the 5000 gallon (18900 l) waste receiving tank, but it was purposefully looped 600 mm above the top of the tanks to avoid any possibility of gravity drain from the pencil tanks to the waste tank. Only deliberate operator actions were thought capable of effecting transfers to the waste tank. On the day of the accident the operators, following routine written procedures, initiated sparging operations to obtain uniform samples for analysis. While the pressure gauge that indicated the sparge air flow was showing expected pressures from one of the banks, the gauge associated with the other bank was not functioning. There was not another gauge on this bank and the operator proceeded to open the air (sparge) valve until circumstantial evidence indicated that the sparge was operating. However, the air sparge was apparently turned on so forcefully that it caused the liquid to rise about 1,200 mm, from the initial liquid height in the pencil tanks to the top of the loop leading to the waste tank, which initiated a siphoning action. Although the siphoning rate was 13 liters per minute, it is difficult to relate this directly to the reactivity insertion rate since it also depended on the degree of mixing. The reactivity insertion rate could have been as high as 25 ¢/s. Because the 2.73 m diameter by 2.63 m long waste receiving tank was lying on its side, the solution configuration approximated a near infinite slab. Waves in the solution could have caused large fluctuations in the system reactivity. After the accident, much of the uranyl nitrate was found crystallized on the inner walls of the tank, and most of the water had evaporated. The resulting excursions generated 4 _ ⌋1019 fissions, sufficient to boil away nearly half of the 800 l solution volume that eventually terminated the excursions.

The excursion history is a matter of conjecture. There were only strip chart recordings from continuous air monitors at various distances from the tank. Some of these apparently stopped recording upon being driven to a very high level while those in lower radiation fields (generally farther away) may have been influenced by fission product gases. It is not unreasonable to assume that an initial spike of at least 1017 fissions was followed by multiple excursions and, finally, by boiling for 15 to 20 minutes. The very large yield is a result of the large volume of the system and the relatively long duration, rather than of the violence of the excursion tank. Because of thick shielding, none of the personnel received significant prompt gamma or neutron doses. **During evacuation of the building, airborne fission products (within the building) resulted in combined beta and gamma doses of 50 rem (one person), 32 rem (one person), and smaller amounts to 17 persons. While the evacuation proceeded relatively rapidly, the general evacuation alarm was never activated; it was a manually activated system**. The reason offered was that the accident occurred during the graveyard shift, and the small workforce left their work areas promptly and were all accounted for at the guard station. Afterwards it was acknowledged that local radiation alarms sounded relatively frequently and had somewhat conditioned operators to not evacuate until the second or third separate alarm had sounded. It was also noted that the normal building egress was used by all personnel; none used the prescribed and clearly marked evacuation route. This led to a bottleneck at the exit point, which could have been severe during the day shift with ten times as many workers present. Thus exposures could probably have been reduced somewhat if immediate evacuation by the proper route had occurred. Equipment involved in the excursion was not damaged. Several factors were identified by investigating committees as contributing to the accident:

• the operators were not familiar with seldom used equipment, the banks of pencil tanks, and their controlling valves.
• there was no anti-siphon device on the line through which the siphoning occurred. It was noted that such devices were installed on routinely used tanks.
• operating procedures were not current nor did they adequately describe required operator actions such as the need for careful adjustment of the air sparge

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8. Idaho Chemical Processing Plant, 25 January 196114,15,16,17
Uranyl nitrate solution, U(90), in a vapor disengagement vessel; multiple excursions; insignificant exposures.

This accident occurred in the main process building, CPP 601, in H–cell, where fission products were chemically separated from dissolved spent fuel. The uranium was then concentrated via evaporation. Operations were conducted 24 hours per day on three 8–hour shifts. The accident happened at 09:50 after a routine shift change at 08:00. This was only the fifth day of operation following a shutdown that had lasted nearly a year. The accident took place in the upper disengagement head of the H–110 product evaporator. This was a vertical cylindrical vessel of about 600 mm diameter and more than a meter tall, which was above a 130 mm diameter favorable geometry section. In spite of an overflow line located just below the disengagement
head to preclude significant amounts of solution from reaching it, concentrated uranyl nitrate solution, about 200 g U(90)/ l , was apparently rapidly ejected up into this unfavorable geometry section. There were several conjectured causes of the solution entering the disengagement head, which were discussed in the accident investigating committee's reports.14,15 The most probable cause was thought to have been a bubble of high pressure air (residuum from an earlier line unplugging operation) inadvertently forcing a large fraction of the available 40 l of uranyl
nitrate solution in the 130 mm pipe section up into the vapor disengagement cylinder. Neither the exact fissile volume (and thus uranium mass) nor the geometry at the time of the spike is known; they can only be conjectured and bounded. It was certain that the excursion occurred in the head and was reported to be of short duration, a few minutes or less. The total number of fissions was estimated to be 6 x10⌐1017 with an uncertainty of 25%. There was no instrument readout to give a direct indication of the excursion history. Recordings from remote detectors such as continuous air monitors were all that were available from which to infer the time evolution of the excursion. Inspection of these strip chart recordings along with knowledge of their locations led to inconclusive, and, in the case of one strip chart, unexplainable findings. A subsequent
American Nuclear Society (ANS) paper15 on a method for estimating the energy yield of criticality excursions shows an initial spike of 6 ∟_1016 and a total yield of 6 ⊔∟1017. The source of these values could not be determined. Experimental data from the CRAC5 series
of prompt critical excursions coupled with the knowledge of the bounds on the volume of liquid involved in this accident support the values in the ANS paper. One final source of guidance as to the likely first spike yield is a private communication from Dr. D. L. Hetrick in which he concludes that a value of 6 ∟∟1016 seems the most reasonable. 17

Radiation alarms sounded throughout the process areas, apparently from the prompt gamma–rays associated with the fission spike. **All employees evacuated promptly, and there were only minimal doses (<60 mrem) caused by airborne fission products after personnel left the building. A team of operating and health physics personnel reentered the building 20 minutes after the excursion and shut down all process equipment. As radiation levels had quickly returned to normal and there was no indication of any contamination within the manned areas, management authorized the workers to return to the plant at 14:45.**

No equipment was damaged. Several items were noted in the reports of the accident investigation committees as contributing causes. These included (1) poor communications, particularly oral messages between operators as to the positions of valves; (2) unfamiliarity of personnel with the equipment after such a long shutdown; and (3) relatively poor operating condition of the equipment.

19. Idaho Chemical Processing Plant, 17 October 197828,29,101

Uranyl nitrate solution, U(82), in a lower disengagement section of a scrubbing column; excursion history unknown; insignificant exposures.

The accident occurred in a shielded operation of a fuel reprocessing plant in which solutions from the dissolution of irradiated reactor fuel were processed by solvent extraction to remove fission products and recover the enriched uranium.

In the solvent extraction process, immiscible aqueous and organic streams counter–flow through columns while in intimate contact and, through control of chemistry, material is transferred from one stream to the other. A string of perforated plates along the axes of the columns was driven up and down forming a "pulsed column" that increased the effectiveness of contact between the two streams. The large diameter regions at the top and bottom of the columns were disengagement sections where the aqueous and organic streams separated.

In this particular system (Figure 27), less dense organic (a mixture of tributyl phosphate and kerosene) was fed into the bottom of the G–111 column while an aqueous stream containing the uranium and fission products was fed into the top. As the streams passed through the pulsed column, uranium was extracted from the aqueous stream by the organic with fission products remaining in the aqueous stream. The aqueous stream containing fission products was sampled from the bottom of the G–111 column to verify compliance with uranium discard limits before being sent to waste storage tanks. The organic product stream (containing about 1 g U/ l) from the top of the G–111 was fed into a second column, H–100; at the bottom of its lower is engagement section.

In H–100, the organic product was contacted by a clean aqueous stream (fed into the top) to scrub out residual fission products. The aqueous stream was buffered with aluminum nitrate to a concentration of 0.75 molar to prevent significant transfer of uranium from the organic stream to the aqueous stream. In normal operation, a small amount of uranium (about 0.15 g/ l) would be taken up by the aqueous stream, which was, therefore, fed back and blended with the aqueous recovery feed going into G–111. The organic stream from H–100, normally about 0.9 g U/ l , went on to a third column, where the uranium was stripped from the organic by 0.005 molar nitric acid. The output of the stripping column then went to mixer settlers where additional purification took place. Still further downstream, the uranium solution went to an evaporator where it was concentrated to permit efficient recovery of the uranium.

Several factors contributed to this accident. The water valve on the aluminum nitrate make–up tank (PM–106) used for the preparation of the aqueous feed for the scrubbing column, H–100, had been leaking for about a month prior to the accident. Over time, this leak caused a dilution of the feed solution from 0.75 M to 0.08 M. The 13,400 l make–up tank was equipped with a density alarm that would have indicated the discrepancy, but the alarm was inoperable. A density alarm was scheduled to be installed on the 3,000 l process feed tank (PM–107) that was filled, as necessary, from the make–up tank, but this had not been done. The make–up tank was instrumented with

a strip–chart recorder showing the solution level in the tank. However, the leak into the tank was so slow that the change in level would have not have been discernible
unless several days' worth of the chart was analyzed.

To complicate matters, the chart recorder had run out of paper on 29 September and it was not replaced until after the accident. Furthermore, procedures that required the taking of samples from the feed tank, PM–107, to confirm the density, were not being followed.

Figure 27. First cycle extraction line equipment. The accident occurred in the lower is engagement section of the H-100 column. Scrubbing column caused it to operate as a stripper
rather than as a scrubber. Some of the enriched uranium was removed from the H–100 column organic and recycled into the input of G–111. This partially closed loop resulted in a steady increase in the uranium inventory in the two columns. Each time diluted solution was added to the feed tank from the make–up tank, the aluminum nitrate concentration in the feed was further reduced and stripping became more effective until the excursion occurred.

Analyses of the aqueous feed for column H–100 (feed tank PM–107) showed the proper concentration of 0.7 M aluminum nitrate on 15 September 1978.

Samples taken on 27 September and 18 October (the day after the accident) had on concentrations of 0.47 M and 0.084 M, respectively. Concentrations of aluminum nitrate less than 0.5 M would allow some stripping of uranium from the organic, and the final aluminum nitrate concentration would result in almost all of the uranium being stripped from the organic.

The feed tank (PM–107) was filled with aluminum nitrate solution from the make–up tank (PM–106) at about 18:30, on 17 October. At approximately 20:00, the process operator was having difficulty in controlling the H–100 column. During his efforts to maintain proper operation, he reduced the system pressure causing an increased aqueous flow from H–100 back to G–111. At approximately 20:40, a plant stack radiation monitor alarmed, probably because of fission products in the plant stack gases. Shortly after this alarm, several other alarms activated and the plant stack monitor gave a full–scale reading. **The shift supervisor and the health physicist went outside the building and detected radiation levels up to 100 mrem/h. At 21:03, the shift supervisor ordered the building evacuated, and by 21:06 an orderly evacuation had been completed. Road blocks were established and management was notified.**

It is probable that as the uranium inventory in the bottom of H–100 increased the system achieved the delayed critical state, then became slightly supercritical. As the power increased, the temperature rose compensating for the reactivity introduced by the additional uranium. This process would continue as long as the uranium addition was slow and until the reduced pressure on the column permitted more rapid addition of uranium and a sharp increase in reactivity.

The system is thought to have approached prompt criticality, at which time the rate of power increase would have been determined by the neutron lifetime (on the order of milliseconds).
Prior to evacuating, the process operator shut off all feed to the first cycle extraction process, but did not stop the pulsation of the columns. The continuation of the pulse action after the feed was turned off probably led to better mixing of the solution in the bottom section of H–100 and terminated the excursion. Later analysis showed that the excursion had occurred in the lower disengagement section of the H–100 column.

Records indicate the reaction rate increased very slowly until late in the sequence, when a sharp rise in power occurred. The uranium inventory in Column H–100 was estimated to have been about 10 kg, compared with slightly less than 1 kg during normal operation.

The total number of fissions during the excursion was estimated to be 2.7 ⊥L 1018. Several factors contributed to this accident.

• The water valve on the aluminum nitrate make-up tank (PM-106) used for preparation of the aqueous had been leaking for about a month prior to the accident.
• Significantly more solution had been transferred from the make–tank to the feed tank than should have been available (because of the leak). This was not noticed by any of the plant staff.

• The chart recorder for the make–up tank that would have shown the solution level had run out of paper weeks earlier. The paper was not replaced until after the accident.
• The density recorder and alarm on the aluminum nitrate feed tank, PM–107, had not been installed even though it appeared on the controlled drawings of the plant.
• The operating procedure that required sampling before transfer between the aluminum nitrate make–up and feed tanks was not followed. Furthermore the procedure actually used on the process floor was an older out–of–date version that did not contain this requirement.
• In the two years preceding the accident, the experience level of the operators had decreased dramatically.
• The safety analysis prepared in 1974 identified the criticality risk if the aluminum nitrate scrub feed were to become dilute, but in correctly assumed that stoppage of the scrub feed was also necessary. The evaluation process had been excessively focused on the physics of sub criticality and not on risk assessment. There were no significant personnel exposures and no damage to process equipment. As a direct result of this event, the plant suffered an extended and expensive shutdown. Operating procedures were reviewed in detail and revised as appropriate. Increased emphasis was given to plant maintenance and operator training.

An extensive and highly instrumented plant protection system involving redundant sensors and redundant automatic safety controls was installed. The importance of maintenance of safety related equipment and the need for adherence to well-developed operating procedures were reemphasized by this accident.

SPERT

SPERT-1 reactor cores (heterogeneous, moderated, and reflected by water)99 were of two general types. The first had fuel in the form of MTR type aluminum– uranium plates and cores designed to include the range from under moderation to the more hazardous region of over moderation. The second was composed of canned UO2 rods about 10 mm in diameter. The uranium enrichment in these rods was 4%.

Transients of the plate type reactors have been extensively studied since 1957 in an effort to solve core design problems and to find the limitations of such reactors. In particular, the period and energy release that can cause damage have been carefully determined. The shutdown of a power transient in the SPERT systems is more complicated than in simpler reactors. The model developed includes heating and density change of the water; heating of the core structure, including its own geometry changes and moderator expulsion from such changes; and finally, the boiling of water next to the plates and loss of moderator when water is expelled from the core. When the plate type core was destroyed, the reactivity, period, peak power, and fission energy release were essentially as predicted. The destructive steam pressure pulse starting some 15 milliseconds after completion of the nuclear phase was not foreseen and is thought to have been caused by very rapid transfer of energy from the near molten aluminum plates to the thin layer of water between the plates. The transfer, occurring before any significant volume change took place, and the resulting high pressure destroyed the core. This effect seems to have been involved in the destruction of BORAX, SPERT, and SL-1.

The second type of SPERT-1 core89 (4% enriched UO2 rods in water) was tested during 1963 and 1964. Transient experiments with this core demonstrated the effectiveness of the Doppler mode of self-shutdown and provide a basis for analysis of accidents in similar power reactor systems. Two attempts to destroy the core by placing the reactor on very short periods (2.2 and 1.55 milliseconds) failed. In each case, the Doppler effect was operative and additional quenching developed because one or two fuel pins (out of several hundred) cracked and caused local boiling. The pins were thought to have been saturated with water before the test.

5. National Reactor Testing Station (now called INL), 22 July 1954 69,70,71,72
BORAX reactor, aluminum-uranium alloy, water moderated; single excursion; insignificant exposures.

The National Reactor Testing Station was located near Idaho Falls, Idaho in the United States. This excursion was an accident only in the sense that it was larger than expected. The BORAX-I reactor had been built as a temporary affair; steady state and transient studies were regarded as complete; and it was decided that the reactor should be forced onto a short period transient to obtain the maximum amount of experimental information before it was dismantled. The excess reactivity was chosen to produce a fission yield such that about 4% of the fuel plates would melt.

The BORAX-I reactor consisted of 28 MTR-type fuel elements moderated by light water. Each element contained 18 fuel plates 2.845 inches ¯ 0.060 inches ΓΓ24.6 inches consisting of aluminum–uranium alloy clad with about 0.020 in. of aluminum.

The total uranium inventory was 4.16 kg, and the whole core was in a semi–buried tank 4 feet in diameter and 13 feet high.

It had been estimated from earlier controlled prompt excursions that about 4% excess *k* would put the reactor on a period between 2.0 and 2.5 milliseconds and that the resulting excursion would release about 80 mega joules of fission energy. To perform this experiment a larger than usual fuel loading and a more effective central control rod were required.

The excursion and associated steam explosion following rapid ejection of the control rod completely disassembled the reactor core and ruptured the reactor tank (Figure 59). Very extensive melting of the fuel plates occurred; some elements remained in the tank and small pieces were found up to 200 feet away.

An example of the force of the explosion was the carrying away of the control rod mechanism. This mechanism, which weighed 2,200 pounds, sat on a base plate, about 8 feet above the top of the reactor tank. Except for the base plate, about 4 feet square, the top of the 10 foot shield tank was essentially unobstructed.

The force of the explosion plus the impingement of water and debris on the base plate tore the plate loose from its coverage and, as revealed by high speed movies, tossed the mechanism about 30 feet into the air. 71

The total energy release was 135 mega joules instead of the predicted 80 mega joules or, assuming 180 MeV deposited per fission, 4.68 Γ¯1018 fissions. This energy is equivalent to that contained in about 70 pounds of high explosive, but it has been estimated that between 6 and 17 pounds of high explosives would produce comparable damage. The minimum period was 2.6 milliseconds, and the maximum power was about 1.9 ׀1010 watts. It is apparent that the nuclear excursion was completed before the steam explosion destroyed the system.

In this excursion, the reactor was destroyed but, because of the remote site, physical damage was limited to the reactor. No personnel were exposed to radiation.

8. National Reactor Testing Station, 3 January 196174,75

SL–1 reactor; aluminum-uranium alloy; water moderated; single excursion; three fatalities

The SL-1 reactor (originally known as the Argonne Low Power reactor) was a direct–cycle, boiling water reactor of 3 megawatts gross thermal power using enriched uranium fuel plates clad in aluminum, moderated, and cooled by water. Because the reactor was designed to operate for 3 years with little attention, the core was loaded with excess 235U. To counterbalance the excess of 235U, a burnable poison (10B) was added to some core elements as aluminum–10B – nickel alloy. Because the boron plates had a tendency to bow (and, apparently, to corrode, increasing reactivity), some of them were replaced in November 1960 with cadmium strips welded between thin aluminum plates. At that time the shutdown margin was estimated to be 3% (about 4 $) compared to the initial value of 3.5% to 4%. The cruciform control rods, which tended to stick, were large cadmium sheets sandwiched between aluminum plates.

The nuclear accident was probably independent of the poor condition of the core. After having been in operation for about 2 years, the SL-1 was shut down 23 December 1960 for routine maintenance; on 4 January 1961, it was again to be brought to power. The three man crew on duty the night of 3 January was assigned the task of reassembling the control rod drives and preparing the reactor for startup.

Apparently, they were engaged in this task when the excursion occurred. The best available evidence (circumstantial, but convincing) suggests that the central rod was manually pulled out as rapidly as the operator was able to do so.

This rapid increase of reactivity placed the reactor on about a 4 millisecond period; the power continued to rise until thermal expansion and steam void formation.

9. National Reactor Testing Station, 5 November 196276

Assembly of Spert fuel elements; single non-nuclear excursion; insignificant exposures.

The accident occurred with a small test assembly designed to investigate the transient behavior of water moderated and cooled plate type reactors. The Spert fuel consisted of plates of highly enriched uranium alloyed with aluminum and clad with the same material. Previous test programs had produced data for transients whose initial period exceeded 8 millisecond.

These experiments were nondestructive, having resulted in only minor fuel plate distortion. However, some data of a destructive nature was obtained for a 2.6 millisecond period in the 1954 BORAX-I test that resulted in an explosion that destroyed the reactor.

These experiments were therefore designed to investigate the transition from essentially non–damaging to destructive excursions.

After completion of a long experimental program, two tests were conducted resulting in periods of 5.0 and 4.6 milliseconds. These resulted in some plate distortion and some limited fuel melting. The transient behavior was regarded as a reasonable extrapolation of data from earlier experiments having longer periods.

There was no indication that further extrapolation was not valid. In the final test with a 3.2 milliseconds period (energy release 30.7 MJ) all 270 plates showed melting to some degree, with the average molten fraction about.

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In the final test with a 3.2 milliseconds period (energy release 30.7 MJ) all 270 plates showed melting to some degree, with the average molten fraction about 35%. The performance of this test, from the nuclear point of view, was very close to predicted. Evidently the nuclear characteristics of the shutdown were essentially identical to the earlier transients and involved fuel and moderator thermal expansion and boiling of water. However, about 15 milliseconds after the nuclear transient was terminated, a violent pressure surge resulted in total destruction of the core. This is attributed to a steam explosion caused by rapid energy transfer from the molten fuel to the water moderator.

Fuel, water, and core structure were violently ejected from the vessel in which the experiment took place.

This experiment was instrumented to measure the activity of any fission products that might be released, even though no violent excursion was expected. The measurements showed that about 7% of the noble gases produced during the transient escaped to the atmosphere. The roof and some of the siding of the reactor building had been removed prior to the test, so the building provided only limited confinement.

Neither solid fission products nor any radioiodines were found in the atmosphere. Based on the detection sensitivity of the instrumentation and the lack of any indicated presence of iodine, it was established that less than 0.01% of the radioiodines produced had escaped to the atmosphere.

2. National Reactor Testing Station, 29 November 195582,83
EBR-1; enriched uranium fast breeder reactor; single excursion; insignificant exposures.

Design of the EBR-1 fast neutron reactor was started in 1948 with the objectives of establishing possible breeding values and demonstrating the feasibility of cooling a metal fueled reactor with liquid metals. These objectives were met, and in early 1952, the plant furnished more than enough electrical power for the reactor and the reactor building; excess steam was blown to the condenser.

The reactor core consisted of cylindrical, highly enriched uranium rods slightly less than 1/2 inch in diameter canned in stainless steel with a bonding of NaK between the rod and can. The total core mass of about 52 kg of uranium was bathed in a stream of NaK, which served as a coolant.

The final experiment was designed to investigate coefficients of reactivity and, in particular, to study a prompt positive power coefficient without coolant flow.

To do this, the system was placed on a period of 60 seconds at a power of 50 watts. About 3 seconds later the power was 1 megawatt, the period had decreased to 0.9 seconds, and core temperatures were rising significantly.

The signal to scram the system was given, but by error the slow moving motor driven control rods were actuated instead of the fast acting scram—dropping part of the natural uranium blanket under gravity—as had been done to conclude similar experiments. This change in reactivity caused a momentary drop in power, but was inadequate to overcome the natural processes (very slight bowing inward of the fuel elements) adding reactivity to the system. After a delay of not more than 2 seconds, the fast scram was actuated, both manually and by instruments, and the experiment completed.

It was not immediately evident that the core had been damaged. Later examination disclosed that nearly one-half the core had melted and vaporized NaK had forced some of the molten alloy into the reflector.

Theoretical analysis showed that the excursion was stopped by the falling reflector, after the power reached a maximum of 9 to 10 megawatt. The total energy release was close to 4.6 ¯¯1017 fissions. The theoretical analysis was carried further in an attempt to determine if the core would have shut itself off in a non–catastrophic manner. The conclusion was that the energy release could have been nearly 2.5 times the observed yield but would not have resulted in violent disassembly of the core.

During this accident no one received more than trivial radiation from airborne fission products, and direct exposure was essentially zero.

*R. Feynman pointed out the similarity of the procedures used in these experiments to tickling the tail of a dragon.

4. National Reactor Testing Station, 18 November 195884
HTRE Reactor; instrumentation failure; single excursion; insignificant exposures.

The High Temperature Reactor Experiment (HTRE No. 3) power plant assembly was a large reactor (core diameter 51 in., length 43.5 in.) with nickel–chromium-UO2 fuel elements, hydrided zirconium moderator, and beryllium reflector. The experimental objective was to raise the power to about 120 kilowatts, about twice that attained earlier in the day. This was done by manual control until about 10% of desired power was reached. At that point, control shifted to a servomechanism programmed to take the reactor power to 120 kilowatts on a 20 second period. When about 80% of full power was attained, the flux, as shown on the power level recorder, began to fall off
rapidly and the servosystem further withdrew the control rods. The power indication, however, did not increase but continued to drop. This situation existed for about 20 seconds when the reactor scrammed automatically; within 3 seconds the operator took The critical assembly consisted of a large cylindrical enriched uranium–graphite core on a lift device and a stationary platform holding a reflector of graphite and beryllium into which the core was raised.

Most of the 235U was placed in the graphite in the form of thin foils, therefore the excursion characteristics should be similar to those of the honeycomb assembly. The experiment was concerned with measurements of the axial fission distribution, which was perturbed from its normal value by an end reflector of layers of graphite and polyethylene. For this reason, some fresh 235U foils had been placed in the assembly to obtain a reasonably precise value of the fission energy release.

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rapidly and the servosystem further withdrew the control rods. The power indication, however, did not increase but continued to drop. This situation existed for about 20 seconds when the reactor scrammed automatically; within 3 seconds the operator took action that also activated the scram circuit. It is thought that the automatic scram was triggered by melting thermocouple wires. The primary cause of the accident was a drop in the ion collecting voltage across the detection chamber of the servosystem with increasing neutron flux. This behavior was, in turn, caused by the addition to the wiring of a filter circuit designed to reduce electronic noise from the high voltage supply or
its connecting cable. Thus, this accident appears to be unique, as it was due solely to instrumentation.

In the nonviolent power excursion of about 2.5 x∟1019 fissions, all core fuel elements experienced some melting; only a few of the zirconium hydride moderator pieces were ruined. The melting of fuel elements allowed a minor redistribution of fuel, decreasing the reactivity by about 2%. Some fission product activity was released downwind, but personnel radiation doses apparently were negligible.

Reference: Los Alamos A Review of Criticality Accidents 2000 Revision LA-13638

Response(s) 65-68: Mr. Broscious, thank you for your comments. Please refer to the numbered comments and corresponding numbered responses.

65. DOE evaluated the cumulative impacts to soil and water from the proposed Range expansion with results summarized in Section 4.1.11 of the EA. In accordance with the NEPA implementing regulations, a federal agency can prepare an EA at any time for a proposed action. If potential significant environmental impacts are identified, an environmental impact statement (EIS) can always be pursued. Conversely, if no significant environmental impacts are identified, the EA is the appropriate level of documentation and no further evaluation is necessary. DOE ensures the level and quality of analysis and data compiled for the EA is suitable for use in an EIS if it is decided that an EIS should be prepared. This course of action is appropriate for use when an agency has a basis for the belief that the proposal will not manifest significant environmental impacts. DOE also considered the context (setting) and intensity (severity) of any potential environmental impacts before deciding on the appropriate level of NEPA review. DOE prepared the EA and included all information necessary to determine the potential for significant environmental impact. DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. The analyses indicate that the proposed action will not have a significant impact and, therefore, an EIS is not necessary.

66. The need for the proposed action is presented in Section 1.1 of the EA. The purpose of the proposed action is to expand Range capabilities to address new and emerging threats to national security and continue to provide federal agencies, industry, and academia partners with relevant test range assets for conducting national security research, development, demonstration, and deployment. Background samples for a wide variety of constituents was performed at NSTR in 2007 and for the RRTR in 2010 and show the Ranges are not "heavily contaminated."

67. The EA states DOE will evaluate additional radionuclides on an individual basis using the ALARA process, and will 1) limit the dose to the public at each test location to less than 0.1 mrem/year, 2) verify the curie content and isotopic-distribution of the major, intended, isotopes and any contaminants in radiological materials used in radioactive material distribution testing and training at least once per year, 3) evaluate all changes in isotopes or isotope concentrations against Table 4 and include in the annual reporting requirements, 4) model newly found isotopes with a half-life greater than 74 days for impact to soil and groundwater prior to initial distribution to demonstrate the impact analysis in this EA remains valid, and 5) review any changes to the source materials (e.g., composition or manufacturer), which will be irradiated, or the source of irradiation prior to any such use, to verify the releases in Table 4 will not be exceeded. Please refer to Table 7.

68. DOE takes its responsibility for the safety and health of the workers and the public seriously. DOE prepared the EA and included all information necessary to determine the potential for significant environmental impact. DOE used state-of-the-art science, technology, and expertise to assure quality in the impact analyses. DOE acknowledges that many different perceptions are represented in the comments received, but no comments were received that indicate any of the impact data presented in the EA should be reconsidered based on technical or scientific reasons.

Comment #8-Dave McCoy, Citizen Action New Mexico

From:	! NSRREA
To:	Jenifer B. Nordstrom; John S. Irving
Subject:	FW: NSTR Comment
Date:	Tuesday, October 15, 2019 7:26:06 AM

Comment 7 - will check with Jason on disposition – not responsive to the comment period.

From: dave mccoy <dave@radfreenm.org>
Sent: Monday, October 14, 2019 1:51 PM
To: ! NSRREA <nsrrea@id.doe.gov>
Subject: NSTR Comment

Dear Sir,
Re: The draft environmental assessment by the U.S. Department of Energy to allow the DOE to release long-lived radionuclides to air and soil at the Idaho National Laboratory, DOE/EA-2063 at https://www.energy.gov/sites/prod/files/2019/09/f66/draft-ea2063-expanding-capabilities-nstr-rrtr-inl-2019-09.pdf

The draft EA is typical of the shoddy lack of analysis for contamination of the public and environment that one has come to expect from the DOE. Do you folks ever consider that your actions result in human cancer and death and untold misery? You are in reality no better than common murderers in your planned release of mpre radioactive poison to a public that has already suffered enormously in Idaho.

I agree with the comments submitted on October 12, 2019 by the Environmental Defense Institute regarding the fact that there is no need for the planned testing. The problem is that the DOE is completely deaf to the public when it comes to the public asking for protection from more of the insanity of more exposure to radiation. Please address past DOE caused deaths and accidents for workers and the public. 69

Dave McCoy, Executive Director
Citizen Action New Mexico
dave@radfreenm.org

Response(s) 69: Mr. McCoy, thank you for your comments. Please refer to the numbered comments and corresponding numbered responses.

69. The need for the proposed action is presented in Section 1.1 of the EA. The purpose of the proposed action is to expand Range capabilities to address new and emerging threats to national security and continue to provide federal agencies, industry, and academia partners with relevant test range assets for conducting national security research, development, demonstration, and deployment.