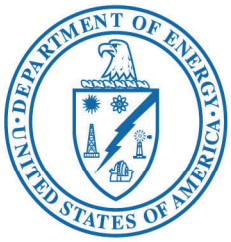
DOE/EA-2209
Revision 0



U.S. Department of Energy
Idaho Operations Office

Final Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project

August 2023

DOE/ID-2209
Revision 0

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INL/RPT-22-68976

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

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FIGURES

TABLES

ACRONYMS

AL	Analytical Laboratory
ALARA	As Low As Reasonably Achievable
APE	Area of Potential Effects
ARDP	Advanced Reactor Demonstration Program
ASER	Annual Site Environmental Report
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CGS	Cover Gas System
CH-LLW	Contact Handled Low-Level Waste
CPP	Chemical Processing Plant
CRMP	Cultural Resource Management Plan
DAF	Device Assembly Facility
dBA	A-weighted decibel
DID	Defense-in-Depth
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EA	Environmental Assessment
EBR	Experimental Breeder Reactor
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ESRP	Eastern Snake River Plain
FMF	Fuel Manufacturing Facility
FHS	Fuel Handling System
FMG	Fuel Manufacturing Glovebox
FONSI	Finding of No Significant Impact
FSC	Fuel Salt Container
FSSL	Fuel Salt Synthesis Line
HEPA	High-Efficiency Particulate Air
HEU	Highly Enriched Uranium
HVAC	Heating, Ventilation, and Air Conditioning
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
ISC	Irradiated Salt Container

kW	Kilowatt
kWth	Kilowatt thermal
LCF	Latent Cancer Fatality
LLW	Low-Level Waste
LOTUS	Laboratory for Operation and Testing in the United States
MCFR	Molten Chloride Fast Reactor
MCRE	Molten Chloride Reactor Experiment
MEI	Maximally Exposed Individual
MFC	Materials and Fuels Complex
MFG	Multi-Function Glovebox
MLLW	Mixed Low-Level Waste
MSR	Molten Salt Reactor
MT	Metric tons
MWe	Megawatt electric
MWth	Megawatt thermal
NE	DOE Office of Nuclear Energy
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NIS	Nuclear Instrumentation System
NRC	Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NRIC	National Reactor Innovation Center
OSHA	Occupational Safety and Health Administration
PBF	Power Burst Facility
PIE	Post-irradiation Examination
PM	Particulate matter
R&D	Research and development
rem	Roentgen Equivalent Man
RH-LLW	Remote Handled Low-Level Waste
ROI	Region of Influence
RPP	Radiation Protection Program
SSC	Structures, Systems, and Components
TED	Total Effective Dose
USC	United States Code
WMP	Waste Management Program

ZPPR	Zero-Power Physics Reactor

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 six places. Thus, the number 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 formula or equations).

Ft	foot	Gy	Gray
In	inch	mrem	millirem
Km	kilometer	ppm	Parts per million
Lb	pound	yd	yard
M	meter	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
lb	4.536×10^{2}	grams	grams	2.204×10^{-3}	lb
gallons	3.785	liters	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

Understanding Small and Large Numbers

Number	Power	Name
1,000,000,000,000,000	10^{15}	quadrillion
1,000,000,000,000	10^{12}	trillion
1,000,000,000	10^{9}	billion
1,000,000	10^{6}	million
1,000	10^{3}	thousand
10	10^{1}	ten
0.1	10^{-1}	tenth
0.01	10^{-2}	hundredth
0.001	10^{-3}	thousandth

Number	Power	Name
0.000001	10^{-6}	millionth
0.000000001	10^{-9}	billionth
0.000000000001	10^{-12}	trillionth
0.000000000000001	10^{-15}	quadrillionth

UNDERSTANDING DOSE (MILLIREM DOSES) AND LATENT CANCER FATALITY

Relative Dose

A dose[a] is the amount of radiation energy absorbed by the body. The United States (U.S.) unit of measurement for radiation dose is the Roentgen Equivalent Man (rem). In the U.S., doses are most commonly reported in millirem (mrem). A millirem is one thousandth of a rem (1000 mrem = 1 rem). The inset diagram describes radiation doses from common radiation sources, both from natural and human sources, for comparison (Figure 1). According to the National Council on Radiation Protection and Measurements, the average annual radiation dose per person in the U.S. is 620 mrem. This information is to help the reader understand and compare dose information described in this document.

a https://www.epa.gov/radiation/rad3.3333iation-sources-and-doses.

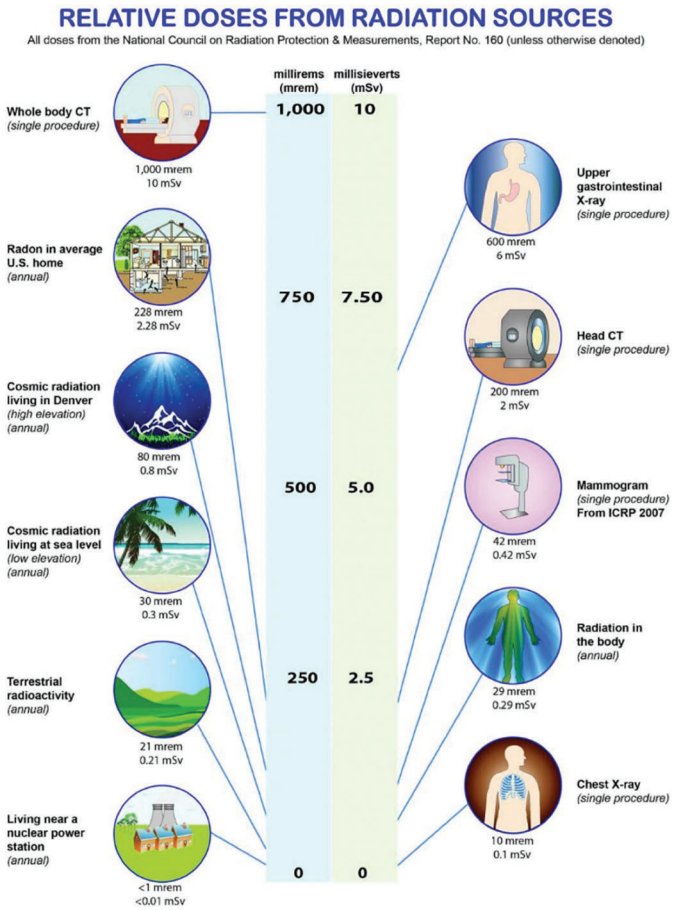

Figure 1. Diagram describes radiation doses from natural and human sources.

Latent Cancer Fatality

A latent cancer fatality is a death caused from a cancer that results from and occurs an appreciable time after exposure to ionizing radiation. Death from radiation-induced cancers can occur any time after the exposure. Based on a dose-to-risk conversion factor of 0.0006 latent cancer fatality (LCF) per person-rem[b] and assuming the linear no-threshold model, an exposed worker receiving a dose of 1 rem would have an estimated lifetime probability of radiation-induced fatal cancer of 0.0006, or a 1 in 1,700 chance.

There are questions in the scientific community regarding overestimation of LCFs by using the linear no-threshold theory.

THE BASICS OF NUCLEAR POWER REACTORS

In some elements, the nucleus of an atom can split as a result of the nucleus absorbing an additional neutron through a process called nuclear fission. Such elements capable of nuclear fission are called fissile materials. When a nucleus fissions, it causes three important events, which result in the release of energy: (1) release of radiation, (2) release of neutrons (usually two or three), and (3) formation of two new nuclei (fission products). Some of the released neutrons collide with other atoms in the fissile materials, causing them to fission and release more neutrons. Fission also releases a large amount of heat.

b Estimating Radiation Risk from Total Effective Dose Equivalent (TEDE) ISCORS Technical Report No. 1 (DOE 2003).

Nuclear reactors contain fissile material in the nuclear fuel. A nuclear reactor achieves criticality (and is said to be critical) when each fission event releases enough neutrons to sustain a steady state or an ongoing series of reactions. This is called a chain reaction. Generally, the heat produced from fission is removed from the reactor by various methods, such as by a circulating fluid, and can be used to produce electricity.

Not every arrangement of fuel can be brought to criticality. A critical concentration of fissile material must be present to bring the reactor to a critical state; otherwise, neutrons can be absorbed by other reactor components, which can inhibit a sustained chain fission reaction. Similarly, even where there is a high enough concentration of fissile material for criticality, a nuclear reactor must have an appropriate volume and a prescribed geometric form otherwise interactions between neutrons and fissile material will not be sufficient to sustain a chain reaction. This requirement imposes a limit on the minimum critical volume and critical mass within a reactor.

While there are several different types of nuclear reactors, they have many shared characteristics, including a supply of fissionable fuel in the reactor core. Some nuclear reactors also have neutron moderators. These moderators are materials that slow down neutrons to increase their probability for causing fissions or neutron absorbers, which are materials that absorb neutrons and shut down the nuclear reactions and the heat it creates. Reactor control is normally achieved using components made from neutron-absorbing material such as cadmium, hafnium, or boron. Some nuclear designs also contain a coolant, which absorbs and transports heat from the reactor for electric power production and cools the reactor core to ensure the fuel and core structures maintain their integrity. Finally, a nuclear reactor must have specifically designed shielding around it to absorb and reflect radiation to protect plant personnel from exposure.

An advanced nuclear reactor is defined in legislation enacted in 2018 as “a nuclear fission reactor with significant improvements over the most recent generation of nuclear fission reactors.” (P.L. 115–248, 2018). Many advanced nuclear reactors including molten salt reactor (MSR) designs use different moderators, coolants, and types of fuel. Some of these advanced designs are small, transportable, and often self-adjusting reactors capable of producing less than 20 megawatts of thermal energy, which can be used as heat to produce electricity or to scale larger commercial nuclear reactors. In contrast, existing commercial nuclear reactors generate an average of 3,000 megawatts of thermal energy.

Advanced reactor concepts include safety, efficiency, and other improvements over existing commercial reactors. These concepts include gas-cooled reactors, liquid-metal cooled reactors, and MSRs.

Final Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project

1. INTRODUCTION

1.1 Introduction

Through the Advanced Reactor Demonstration Program (ARDP) Risk Reduction Pathway, the Department of Energy (DOE) announced an award, in 2020, to Southern Company Services (Southern Company), which would fund the advancement of the TerraPower, LLC (TerraPower) Molten Chloride Fast Reactor (MCFR) technology through the design, construction, and testing of the Molten Chloride Reactor Experiment (MCRE). Southern Company and TerraPower endeavor to design, construct, and test a liquid-fueled, fast-spectrum, chloride salt-fueled experimental system. MCRE is anticipated to operate for six months after which it will be decommissioned.

The National Reactor Innovation Center (NRIC) mission is to enable and accelerate the development and demonstration of advanced reactors. Led by INL, the NRIC program provides private sector nuclear energy technology developers with needed infrastructure and resources to accelerate the demonstration and deployment of advanced nuclear energy.

In accordance with the Council on Environmental Quality (CEQ) regulations at 40 Code of Federal Regulations (CFR) § 1500–1508 and with the DOE National Environmental Policy Act (NEPA) procedures at 10 CFR § 1021 (2011), DOE has prepared this environmental assessment (EA) to analyze the potential environmental impacts associated with the development, construction operation, and decommissioning of the MCRE project at the Materials and Fuels Complex (MFC) located on the INL Site (Figure 2). Depending on the results of this EA, DOE could determine either two options:

Environmental Assessment
A primary purpose of an EA is to determine if a Proposed Action would have significant environmental impacts. If there would be none, no further NEPA documentation is required. If there would be significant environmental impacts, an EIS is required.

1. The potential environmental impacts of the proposed action would be significant to human health and to the environment, in which case DOE would prepare an environmental impact statement (EIS).
2. A finding of no significant impact (FONSI) is appropriate, in which case DOE could proceed with the proposed action without additional NEPA documentation.

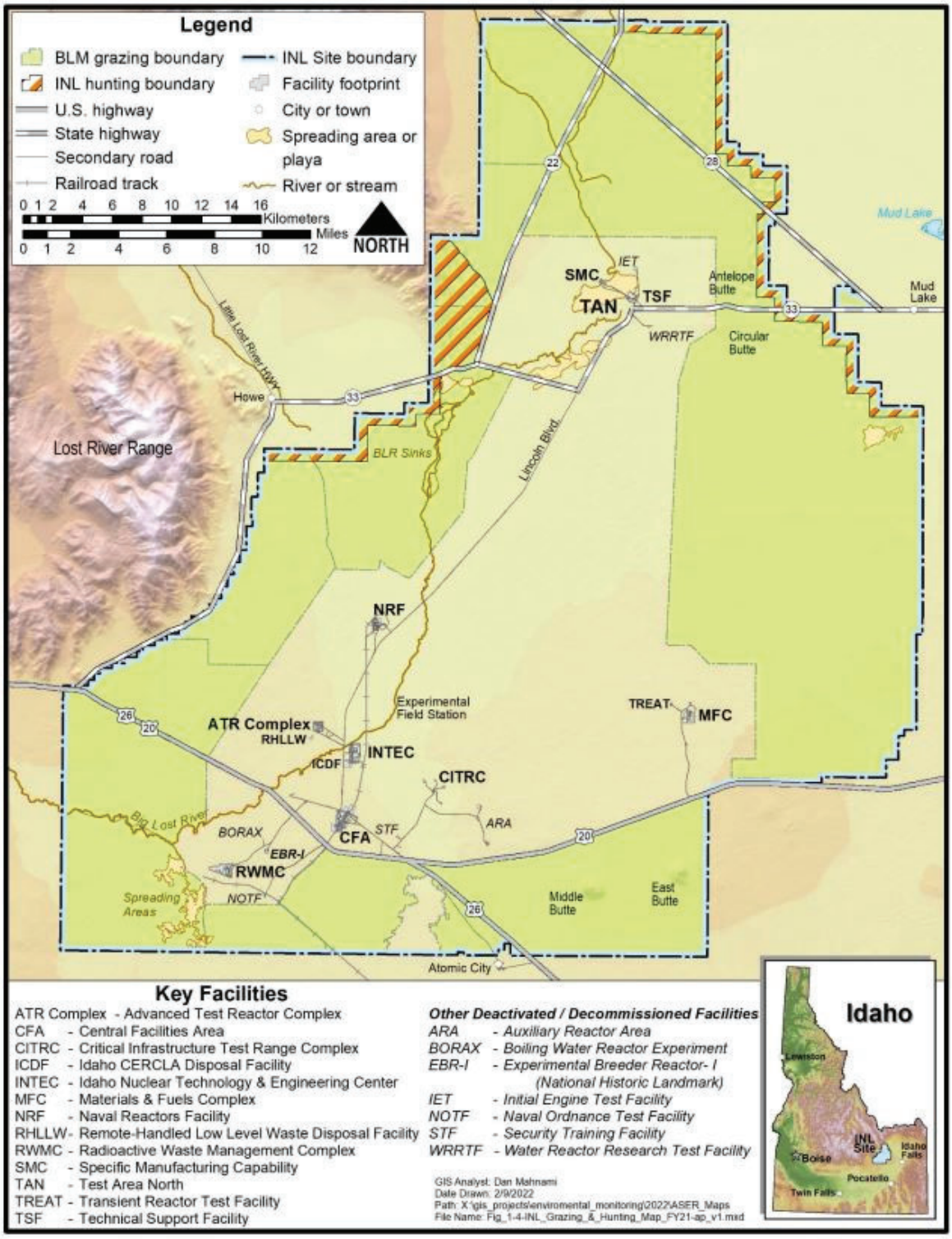

Figure 2. Site map of INL.

1.2 Background

As the Nation's premier nuclear science and technology laboratory, INL supports efforts for research, development, and demonstration projects to maintain and expand nuclear energy use. The laboratory offers a unique research environment with capabilities and facilities for advancing nuclear energy. INL has dedicated facilities focused on nuclear research and development (R&D), including nuclear fuel fabrication, examination, and handling facilities.

As described by TerraPower, MCFR is an advanced nuclear reactor technology intentionally designed to combine the best aspects of homogeneous (liquid fueled) reactors, fast reactors, and molten salt reactors (MSR) to create superior performance, safety, and economic benefit when compared to conventional light-water reactors and other advanced reactor concepts. The molten chloride salt fuel of the MCFR serves as both the fuel and the coolant. MCFR technology operates at higher temperatures than conventional reactors, thus generating electricity more efficiently and without emissions. The commercial MCFR design would use high-assay low-enriched uranium fuel.

The primary foundations of the MCFR technology date back to R&D programs that were initiated shortly after the discovery of uranium fission and to the later commercial civilian MSR programs that were originally launched in the 1950s. TerraPower has improved MSR technology to eliminate run-away reactions and meltdown scenarios, reduce refueling requirements and reactor size, and operate a reliable source of electricity.

Southern Company is an electric operating and power generation company headquartered in Birmingham, Alabama. Southern Company's mission is to provide clean, safe, reliable, and affordable energy to customers and communities they serve. To accomplish that mission, Southern Company has created an R&D organization to develop low- and no-carbon generation technologies, advance renewables, store energy, distribute generation solutions, and modernize the grid.

TerraPower is an R&D company, headquartered in Bellevue, Washington, that is focused on creating technologies that can provide safe, affordable, and abundant carbon-free energy.

Southern Company and TerraPower have partnered with CORE POWER, Orano Federal Services, and 3M to provide technical cost share support for the project.

1.3 Purpose and Need for Agency Action

The primary mission of DOE-NE is to advance nuclear power as a resource capable of meeting the nation's energy, environmental, and national security needs by resolving technical, cost, safety, security, and proliferation resistance through research, development, and demonstration. Advanced nuclear energy concepts under development in the U.S. anticipate commercial deployment as soon as this decade. To prepare, DOE must resolve technical challenges, develop experimental infrastructure to enable testing and demonstration, and enable advanced nuclear energy concepts integration into end-user applications for broad commercial deployment and use and for public safety.

The purpose of the MCRE project is to address technical and regulatory topics associated with the MCFR technology by designing, constructing, and operating a fueled experiment in preparation for commercial deployment. The MCRE project will be used to increase the knowledge of key phenomena that are essential to successfully licensing reactors based on MCFR technology through the Nuclear Regulatory Commission (NRC).

1.4 Scope of the Environmental Assessment

This EA documents the proposed action and its alternatives, describes the existing condition or environment where the project will take place (i.e., affected environment), projected future conditions of the environment if the project is implemented (i.e., environmental consequences), and references DOE's statutory obligations and authorities[c] as required by current DOE NEPA implementing procedures described in 10 CFR Part 1021. This EA focuses on analyzing the material effects of the proposed action and describes the environmental impacts with enough detail to support the decision to either prepare an EIS or FONSI.

Considering the development and operation of MCRE is experimental, it is anticipated that project activities described in the proposed action section may not necessarily reflect what is implemented. A bounding approach is used to ensure the EA thoroughly documents the affected environment and the environmental consequences of the MCRE project. When details about the proposed action are incomplete, a bounding approach is used to assess potential effects. When this approach is used, reasonable maximum assumptions are made regarding potential emissions, waste streams, and project activities; therefore, the analysis usually provides an overestimation of potential effects. Any proposed future action(s) exceeding the assumptions (the bounds of this effects analysis) would not be allowed until an additional NEPA review is performed. A decision to proceed or not with the action(s) would then be made.

Project segmentation can occur when a proposed activity or project is broken into smaller parts to avoid the appearance of a significant total action. The proposed project, as described and analyzed in this document, has not been segmented into smaller parts and is not connected or related to other actions with potentially significant impacts.

1.5 Public Participation

On March 16, 2023 in accordance with 10 CFR 1021.301, DOE published a draft of this EA on the DOE NEPA webpage (https://www.energy.gov/nepa/articles/doeea-2209-draft-environmental-assessment) for public review and comment. DOE provided an email address and postal address where comments could be submitted. DOE has provided an approximately 14-day comment period that was later extended an additional 14 days to April 14, 2023.

DOE NEPA implementing procedures include integration of compliance with Section 106 of the National Historic Preservation Act (NHPA) (36 CFR 800). Pursuant to 36 CFR 800.29(d), the DOE-ID sought input from the public on the proposed action's potential to affect historic properties.

DOE considered comments received during the comment period on the draft EA. A comment response document was prepared and is presented in this final EA in Appendix A.

2. DESCRIPTION OF THE PROPOSED ACTION

The following section describes the specifics of the proposed action, no-action alternative, and alternatives not considered for further analysis. The information in the Proposed Action section is organized as follows: project overview, MCRE overview, project siting and safety measures, operational lifecycle, fuel salt synthesis, and decommissioning.

c NEPA requires that the environmental analysis (in this case an EA) be performed at the earliest reasonable time to ensure that agencies consider environmental impacts in their planning and decisions. For the MCRE project, the NEPA process has been initiated prior to the final design selection.

2.1 Proposed Action

2.1.1 MCRE Project Overview

The MCRE project is a 200-kilowatt thermal (kWth) nuclear experiment. The preferred location for MCRE is in the NRIC Laboratory for Operation and Testing in the United States (LOTUS) testbed, which will be located in the former Zero-Power Physics Reactor (ZPPR) cell at MFC. Once operating, MCRE will be the first critical fast-spectrum circulating fuel system. The primary objective of the MCRE project is to reduce the technical, regulatory, and operational/human factors risks of the MCFR technology, and ultimately support the MCFR Commercial design. INL will support the MCRE project by performing the following activities: (1) supporting design and fabrication, (2) installing MCRE in the LOTUS testbed[d] at MFC, (3) developing and synthesizing fuel salt, (4) operating MCRE[e] and (5) decommissioning MCRE. The entirety of the proposed activities would occur at INL; however, some MCRE project components will be developed and manufactured at Southern Company, TerraPower-sponsored offsite facilities, and Orano Federal Services-sponsored offsite facilities[f]. It is assumed that these facilities would operate in accordance with all applicable federal, state, and local laws, regulations, and ordinances. INL personnel would support the development of project components by providing expertise in design; inspecting components before, during, and after fabrication; and validating project plans and procedures. Southern Company, TerraPower, and Orano Federal Services will perform the transportation of equipment to the INL Site. The transportation of equipment to the INL Site would be similar to other types of equipment transports that occur at INL on a daily basis.

2.1.2 MCRE Overview

The experimental system will not have power conversion equipment and will not rely on traditional solid fissile material for fuel. The intention of the project is to demonstrate the operation of molten fuel salts at temperatures sufficient to drive traditional subcritical and super-critical Rankine cycles, CO_2 power cycles, or other less conventional power cycles. Figure 3 is an illustration of the preconceptual design of MCRE. Table 1 summarizes the individual systems that comprise the overarching system. Design parameters for MCRE are shown in Table 2.

d For this analysis, the LOTUS testbed is assumed to be located at the former ZPPR cell at MFC. Furthermore, it is assumed that no new facilities will be constructed as a result of this project.

e The operation of MCRE at INL will require the development of project specific plans, procedures, and requirements. The development of these articles will be the responsibility of INL in conjunction with the project proponents.

f For this analysis, it is assumed that some components will be manufactured by subcontractors who are not directly affiliated with the proposed project and that those facilitates would be operated in accordance with all applicable federal, state, and local laws, regulations, and ordinances.

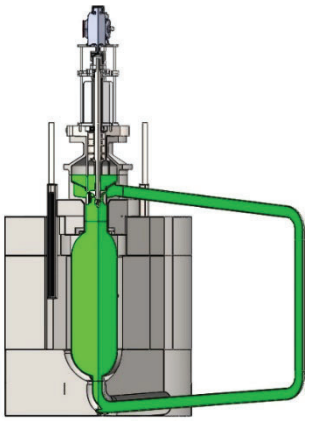

Figure 3. MCRE core cross section.

Table 1. MCRE system summary description.

System	Function
Reactor Core System	Maintains fuel salt in a critical configuration, allows fuel salt to circulate, and generates fission heat
Reactor Enclosure System	Encloses the reactor core system via the reactor vessel and head
Fuel Salt Pump	Pumps fuel salt through the reactor core system
Reactivity Control System	Controls reactivity during operation
Core Heating System	Heats up the reactor to fuel filling temperature and maintains temperature of reactor while fission power is less than heat losses
Environmental Cooling System	Cools the reactor cavity (inside the shielding)
Radiation Shielding System	Reduces the amount of radiation dose to workers and equipment during operations and reduces the neutron activation of the testbed
Fuel Salt Handling System	Provides means to transfer flush and fuel salt into and out of the reactor core system, provides offload and decay heat removal method, and enables additional fuel insertion, if needed
Cover Gas System (CGS)	Provides an inert cover gas within the Reactor Core System and Fuel Handling System, provides the motive force for pneumatic transfer of flush salt, and processes fission gases
Reactor Protection System	Ensures the safe operation and shutdown of the reactor in the event of an offset condition
Nuclear Instrumentation System	Monitors neutron flux to provide signals to control the reactor
Instrumentation and Controls System	Monitors, controls, and collects data
Electrical System	Provides electrical power to systems and components

Table 2. MCRE conceptual design parameters.

Parameter	Value	Units
Thermal Power	200	kW
Minimal Fuel Salt Temperature	595	°C
Nominal Fuel Salt Temperature	597.5	°C
Maximum Fuel Salt Temperature	600–700	°C
Fuel Salt Mass Flow Rate	25–100	kg/s
Design Pressure	750	kPa
Time at Temperature	6000	hours
Time at Power	1000 (out of 6000)	hours
Nominal Temperature Rise	5	°C
Max Temperature Rise	20	°C
Heat Removal	Inert Gas-cooled Vessel	–
Structural Material	SS316H	–
Cladding Materials	Inconel 600 or Inconel 625	–

2.1.3 Fuel

The fuel salt is a eutectic mixture of sodium chloride (NaCl) and uranium trichloride (UCl_3). The fuel salt will be made from highly enriched uranium (HEU) feedstock currently in storage at ZPPR. This composition has a calculated melting temperature of approximately 456°C. As part of the proposed action, the fuel salt will be synthesized at INL in a Fuel Salt Synthesis Line (FSSL) established at MFC. Once synthesized, solid fuel will be stored in canisters at the Fuel Manufacturing Facility (FMF) or at another appropriate location until it is added to the reactor fuel cycle. It is anticipated that approximately 2.6 metric tons (MT) of fuels salt will be required for the entirety of the project.

2.1.4 MCRE Project Siting at INL

Proposed project operational activities supported by INL are planned to be located at MFC. The assumed location for the LOTUS testbed where the MCRE operational activities will take place is in the ZPPR cell. The document "Evaluation of Site for Advanced Reactor Demonstrations at Idaho National Laboratory" (INL/EXT-20-57821) supports the assumption that the ZPPR cell structure is a suitable location for the MCRE project (INL 2020a). Per the selection criteria described in INL/EXT-20-57821, the ZPPR cell meets (1) the necessary confinement to prevent a radioactive material release, (2) the requirements to control nuclear materials, and (3) the safe operation of a nuclear reactor. Use of the ZPPR cell would not drastically interfere with existing DOE mission capabilities (INL 2020a).

The structure was originally designed to study the physics of low-power nuclear reactor designs similar to the proposed MCRE project. The ZPPR cell acts as a confinement structure capable of siting small experimental reactors and critical experiments that use high security materials for operation.

The structure is a 50-foot inner-diameter reinforced-concrete cylinder with 16-inch thick walls (Figure 4). The cell will be reconfigured to support the demonstration of various advanced nuclear energy systems (i.e., reactors). The reconfigurations include installation of an access door on the side of the cell; electrical power upgrades; installation of a new heat removal system; new life safety systems (i.e., fire protection and oxygen monitoring); new electrical, instrument, and control systems; and security upgrades (Balsmeier 2020).

Figure 4. INL ZPPR cell outside view (left) and inside view (right).

The fuel salt will be synthesized in the FSSL at FMF within MFC. FMF is a Hazard Category 2 nuclear facility, as defined by 10 CFR § 830,[g] and consists of multiple workrooms and a material storage vault. The workrooms house equipment that supports multiscale fuel development, including gloveboxes. The vault contains and supplies feedstock materials used for numerous programs in multiple facilities within MFC. The FSSL would be designed and operated within the Multi-Function Glovebox (MFG) within FMF. Synthesized fuel salt will be stored in the appropriate locations (i.e., FMF) until it is needed for fueling the system. Upon completion of the fuel salt synthesis, the FSSL will remain in operation for future INL R&D projects as needed.

Analytical chemistry analysis will take place within the Analytical Laboratory (AL) (MFC-752) to characterize the isotopic distribution, identify primary elemental constituents, moisture content, and fuel salt impurity. The mission of the AL is to (a) perform chemical, radiochemical, and physical measurements; (b) provide nondestructive analysis measurements; and (c) conduct applied research and engineering development activities in support of advanced nuclear fuel design, waste management, environmental, and other programs at MFC.

g Per Table 1 in Appendix A to Subpart B of 10 CFR § 830, an HC-2 nuclear facility is defined as one that shows the potential for significant onsite consequences based on a hazard analysis. As such the facility is subject to minimum thresholds for many radionuclides and hazardous chemicals on the basis for consequences from these hazards in the immediate vicinity of the facility.

2.1.5 MCRE-LOTUS Integration

The LOTUS testbed is designed to support reactor demonstration projects aligned with the DOE mission to accelerate the demonstration and deployment of advanced nuclear energy.

The MCRE project will be designed to interface with the testbed capabilities (Figure 5). Specific interfaces include the (1) transfer of fuel salt into and out of the system, (2) radiation shielding for worker and structure protection, (3) cell ventilation to the facility's ventilation system, (4) existing control room, and (5) facility electrical power system.

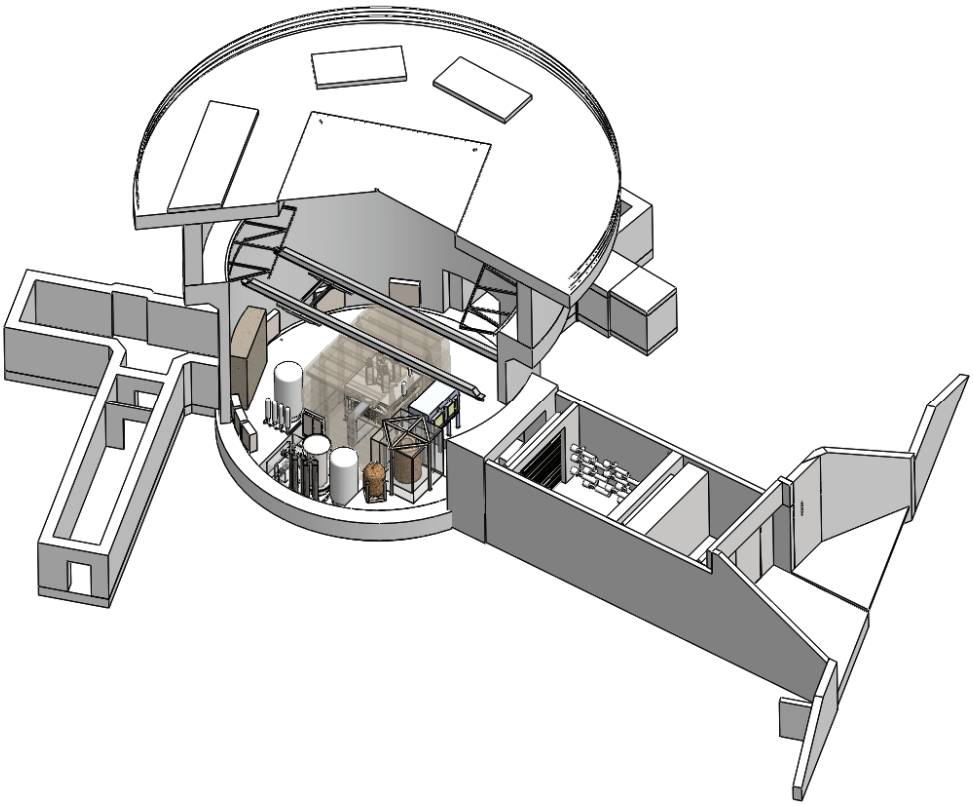

Figure 5. 3D rendering of the MCRE within a containment cell.

The LOTUS testbed ventilation system exhaust stack would have an effluent monitoring system compliant with ANSI/HPS N13.1-2011. This standard states that sources with an unmitigated dose greater than 0.5 mrem/yr shall require continuous sampling for a record of emissions and in-line, real-time monitoring with alarm capability and consideration of separate accident monitoring system.

The MCRE project will be designed in modules, which will be shipped to MFC and assembled onsite. Offsite manufacturing of the modules is considered under this EA. Modules will be staged in designated laydown areas (no greater than 6 acres each) prior to installation in the testbed (Figure 6). Laydown areas are located in previously disturbed areas. Module assembly will include the interface with the LOTUS testbed and will be performed according to project design requirements that incorporate INL operating plans and procedures.

The MCRE project integration into the LOTUS testbed is expected to take approximately 6 months.

Figure 6. Proposed temporary laydown areas at MFC for MCRE project modules.

2.1.6 Safety

MCRE relies on passive means to ensure safety from nuclear accident events, and it incorporates active prevention and recovery controls. The most significant passive safety features of molten fuel systems are the strong, inherent temperature feedback mechanisms. The fuel density is temperature dependent, and as such, it expands upon increased temperature. The expansion is strong enough to bring the systems that are subcritical through negative reactivity feedback as fuel temperature increases.

Hazard evaluations, as part of the Documented Safety Analysis (DSA),[h] are performed to support each phase of the MCRE project design efforts, ensure safe operating standards, and safeguard nuclear material (DOE 2002b). MCRE hazard evaluations are compliant with the requirements in DOE-STD-1189-2016, "Integration of Safety into the Design Process," and will follow the Licensing Modernization Project as outlined in Nuclear Energy Institute (NEI)-18-04, "Risk-Informed Performance-Based Technology Inclusive Guidance for Non-Light-Water Reactor Licensing Basis Development" (2019). The Licensing Modernization Project process is adapted to fit DOE reactor regulatory requirements, as applicable and appropriate, using a graded approach. The MCRE project DSA will comply with 10 CFR § 830, "Nuclear Safety Management," and DOE-STD-1189-2016. This approach provides reasonable assurance of meeting DOE-STD-1189-2016 requirements for protection of the public, worker, and environment for the MCRE project.

MCRE hazard evaluations are performed for the identification and selection of the safety classification of structures, systems, and components (SSCs),[i] SSC safety functions, and design basis accidents applicable to the MCRE project. With these SSCs identified, the reactor can be built and operated safely in the LOTUS testbed. The MCRE project safety-in-design approach implements a defense-in-depth (DID) strategy by adopting the three layers of DID: (1) control of heat generation, (2) control of heat removal, and (3) retention of radionuclides. The DID layers are an integral part of the SSC classification and performance requirement determination.

MCRE is also designed to maintain reliability during a seismic event and other environmental hazards. Systems are designed to have a high confidence of low probability for failure for a seismic event of 1.66 times the safe shutdown earthquake.[j] It is also expected that the LOTUS testbed will provide adequate protection from all other natural external hazards, including high winds, flooding, and fire.

2.1.7 MCRE Operational Lifecycle

The lifecycle of the MCRE project is broken into five phases: (1) manufacturing/assembly, (2) commissioning, (3) operations, (4) deactivation, and (5) disposal. The manufacturing portion of the first phase is undertaken by Southern Company and TerraPower at offsite facilities. The assembly portion includes MCRE modules arriving at INL and MFC from Southern Company, TerraPower, and affiliated manufacturing facilities of Orano Federal Services. Once components are received and the testbed is ready, the modules will be installed into the facility according to project requirements.

The commissioning phase will bridge the project status from assembly to operation. Commissioning includes checking the systems for readiness by heating systems, inspecting them for leaks, pressure testing, and testing instruments and control systems to ensure they are properly functioning. It is anticipated that the commissioning phase will occur all at once. Reactor and fuel systems will be filled with a nonfuel flush salt and energized to perform commissioning tests to ensure that systems are functioning properly. In preparation for full operations, the nonfuel flush salt is removed from the systems and stored (see Sections 2.1.8.3 and 2.1.8.5). The system is then prepared for filling with fuel salt and subsequent operations.

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h As defined by 10 CFR § 830.3, a DSA means a documented analysis of the extent to which a nuclear facility can be operated safely with respect to workers, the public, and the environment, including a description of the conditions, safe boundaries, and hazard controls that provide the basis for ensuring safety.

i As required by 10 CFR § 830.3, safety SSCs are systems that perform important defense-in-depth functions; and equipment relied on for the safe operation and safe shutdown of a nuclear facility, and to maintain the facility in a safe shutdown condition as documented in the safety basis. Support systems to SSCs that are required for the safety functions are also included.

j Per 10 CFR § 100.23 and 110 CFR § 50 Appendix S SSE is defined as the vibratory ground motion for which certain structures, systems, and components must be designed to remain functional. SSE are developed using guidance that satisfies 10 CFR § 100.23.

The operations phase is divided into subphases that include fuel salt loading, subcritical testing, approach to critical, hot zero-power, reactor start-up, and full power operations. The fuel salt loading subphase includes melting and transferring fuel salt into the Reactor Control System using the Fuel Handling System. Subcritical testing is a host of operational testing where the instruments, control components, and reactor are checked for functionality. The approach to critical involves positioning the control elements to achieve criticality at a desired design temperature. The hot zero-power subphase withdraws the control elements to achieve criticality at temperature. The start-up subphase occurs when the control elements are withdrawn to criticality and reaches the point of adding heat to the Reactor Control System. Full power operations are considered normal operations and are the conditions under which the reactor is available for testing.

Following the operational phase, the reactor is deactivated with the termination of critical operations, cooldown, and decontamination; the systems are dismantled. Following deactivation, the reactor, components, and fuel are dispositioned to the appropriate disposal pathways (see Section 2.1.9).

No activities beyond what has been described here have been proposed. While additional activities may occur, they have not been fully developed and are not analyzed in this EA. As such, activities are not fully scoped, and reporting on them would be speculative. If additional activities are eventually determined to be useful and the MCRE were to be used for research into the irradiated fuel salt or energy production, those efforts would need to be analyzed in separate NEPA documentation.

2.1.8 Fuel Salt Synthesis

2.1.8.1 Overview

In accordance with the terms and conditions of the ARDP Risk Reduction Award Number DE-NE0009045, DOE has agreed to provide sufficient nuclear fuel for the MCRE project with existing DOE supplies from material at INL. In support of the MCRE project, INL will synthesize approximately 2.6 MT of fuel salt. A metal chloride reaction will be used to generate the $NaCl\text{-}UCl_3$ fuel salt from a combination of NaCl, iron chloride ($FeCl_2$), and HEU feedstock from the decommissioned ZPPR.

In addition to the fuel salt, INL will receive approximately 1 MT of nonfuel flush salt from TerraPower for commissioning and decommissioning processes. The nonfuel flush salt is a non-radiological sodium chloride-magnesium chloride eutectic salt that will be used to ‘flush’ the reactor systems during commissioning testing to ensure that all systems are working appropriately. The nonfuel flush salt will then be reused during the decommissioning phase to ‘flush’ the reactor systems again to remove any remaining irradiated material. After being used for the decommissioning phase, the nonfuel flush salt will be considered radiologically contaminated and be disposed of as radiological waste.

In addition to the primary synthesis furnace, the FSSL will also have the capability to perform removal of surface oxides or other surface contaminants from the HEU feedstock, transfer fuel salt to fuel salt containers (FSCs), and test for impurities using an X-ray fluorescence spectrometer.

The FSSL will be installed in FMF. The MFG will be comprised of interconnected gloveboxes, including multiple Fuel Manufacturing Gloveboxes (FMGs), a Fuel Characterization Glovebox, and a Transuranic Breakout Glovebox.[k] The FSSL will be integrated into the MFG ventilation, off-gas, power, and safety systems and procedures.

Equipment for the FSSL is relatively small in nature and will be delivered to the INL/MFC receipt warehouses. No laydown areas will be required.

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k The FSSL will be connected to the Transuranic Breakout Glovebox but will not utilize the space within the glovebox to avoid any potential contamination.

2.1.8.2 Synthesis Process

Fuel salt synthesis begins with removing the stainless steel cladding from the existing ZPPR plates and is followed by removing any corrosion from the HEU metal feedstock. Decontamination of the feedstock occurs in the Fuel Characterization Glovebox. Resizing the feedstock HEU may be performed either by a mechanical or chemical process to reduce the particle size and increase the surface area. Following decontamination, the NaCl and $FeCl_2$ are prepared for mixing by placing them in a synthesis crucible along with the decontaminated HEU. The crucible is then placed in a secondary container that will act as a secondary containment in the event of a spill or crucible failure. The material is then placed into a furnace within the FMG, where it will be held for a designated time and temperature, until a mixture of molten NaCl-UCl_3, eutectic salt, and solid iron metal is formed.

After the initial synthesis, the separation of the molten salt from the solid iron metal will be accomplished by mechanical filtration by passing the salt through a stainless steel mesh filter at 600–700°C.

Following filtration, the salt will be cooled to room temperature, manually broken out of the crucible, and transferred into an FSC. Once filled, the solid fuel salt in the FSC will be stored in the FMF until transferred to the testbed to fuel the system.

During the transfer of the fuel salt to the FSC, salt samples will be obtained to verify that the product meets project specifications. Samples will be tested at the AL within the MFC. Samples used for analysis will be disposed of in accordance with AL disposal methods.

To maintain purity and provide a level of safety, the fuel salt will be maintained in an inert gas atmosphere during synthesis, storage, when in use in the reactor, and when removed from the reactor.

Based on the criticality safety restrictions of FMF, only 18 kg of HEU can be present in each glovebox section at any given time. Additionally, each furnace is limited to 9 kg of HEU per batch. With these restrictions, it is anticipated that a minimum of 72 batches (runs) of the synthesis process will be needed to produce the estimated 2.6 MT of fuel salt. The fuel salt synthesis portion of the project is expected to take approximately 24 months.

2.1.8.3 Fuel Salt Containers

The INL will assist Orano Federal Services and other project proponents with the design and manufacture of approximately 150 FSCs to receive fuel salt from FSSL, store salt under an inert cover gas, transport salt to and from FMF vault and the testbed, and empty the fuel salt into the MCRE. The FSCs are anticipated to be cylindrical with an outside diameter of 7.5 inches and a height of 15 inches. They will be manufactured at an Orano Federal Services-sponsored offsite facility. The FSCs will be designed to secure fuel salt for temporary storage while also protecting workers and the environment from radiological contamination.

2.1.8.4 Irradiated Fuel Salt

The irradiated fuel salt, which will remain under DOE's ownership following reactor experimentation, will have significant value for future advanced reactor fuel, advanced fuel cycle R&D material, or to be a candidate for uranium recovery. As such, it is proposed that these materials be managed and stored for future programmatic use at an appropriate INL storage facility. If the material should be determined to no longer have programmatic value (either as fuel salt, advanced fuel cycle R&D material, or uranium recovery processes), then the DOE waste determination process would be invoked, and the material would be managed accordingly and stored in a compliant manner while awaiting final disposition.

It is anticipated that the MCRE project will generate no more than 13,000 kWh of energy through fission while completing all planned critical operations. During the entirety of operations, it is anticipated that less than 570 milligrams of fission product will be generated. A portion of the fission product, such as xenon and krypton, will be volatile and will be managed by the CGS. It is expected that any remaining fission products will be mixed well with fuel salt.

The material will be stored in a configuration that facilitates easy retrieval for programmatic reuse at an appropriate INL facility, for future uranium recovery activities or eventual disposition in an appropriate facility. The long-term management of irradiated fuel salt will depend on the future application of this material and will be comparably managed to similar materials that currently reside at INL.

The appropriate storage location for this material will be determined upon finalization of the project design and test plan. This information will better inform the expected characteristics of the material, enabling identification of viable storage locations based on those characteristics and other programmatic considerations.

The INL Site has existing facilities for handling irradiated fuel salt material, such as the Irradiated Fuels Storage Facility (facility number CPP-603), the Fluorinel Dissolution Process and Fuel Storage facility (CPP-666), the Fuel Processing Restoration Facility (CPP-691), the Remote Analytical Laboratory (CPP-684), the Material Security and Consolidation Facility (CPP-651), Transient Reactor Test (TREAT) Facility (MFC-720), the Fuel Conditioning Facility (MFC-765), and HFEF (MFC-785). Additionally, the NRIC-DOME testbed or a temporary hot cell facility near MFC could be used. The specific facility for this activity has not been identified, and neither procedures nor plans have been developed for such an activity; however, any facility identified for future irradiated fuel salt storage will meet all the operational requirements in accordance with DOE Order 470.4B “Safeguards and Security Programs”.

2.1.8.5 Irradiated Salt Containers

INL will assist Orano Federal Services and other project proponents with the design and manufacture of approximately 60 safe irradiated salt containers (ISCs) to receive irradiated fuel salt from MCRE. As part of the proposed operations, INL personnel will defuel the system once operations cease and then will place the salt into these ISCs. ISCs are designed to secure irradiated fuel salt for long-term storage while also protecting workers and the environment from radiological contamination. The ISCs are anticipated to be cylindrical with an outside diameter of 9 inches and a height of 40 inches. They will have the ability to maintain an inert cover gas over the irradiated fuel salt and will be designed for compatibility with a standard DOE hazardous waste container. The ISCs will be manufactured at an Orano Federal Services-sponsored offsite facility.

2.1.9 Decommissioning

MCRE will be designed and operated to prevent contamination of the LOTUS testbed. MCRE systems, within which are radiological constituents, will be present and will be designed so that radioactive material remains contained and does not contaminate the testbed. During the decommissioning of the reactor phase, which will of necessity require breaching these systems to facilitate removal and disposal of MCRE equipment, the INL Radiation Protection Program (RPP) will be followed, including requirements for contamination control.

During decommissioning, containment devices and processes will be used to ensure that the testbed is not contaminated. In the event that off-normal situations occur in which contamination is released from primary systems/containments, a defense-in-depth (DID) approach will be used to ensure that the testbed does not become irretrievably contaminated:

- Secondary containments (e.g., tents, strippable coatings, Herculite surface coverings) will be used to ensure that even in off-normal situations, contamination is controlled and is not able to reach testbed structures.
- The concrete floor and walls of the testbed are painted, which facilitates effective decontamination in the unlikely event that contamination breaches primary and secondary containments.
- Any testbed decontamination will be conducted to meet the RPP criteria for NOT classifying the area as a contamination area. In the event that decontamination of testbed structures is required, INL will employ decontamination techniques with proven success from many years of use at INL. Such techniques could include the use of mild decontamination solutions, physical abrasive techniques, or advanced chemical decontamination techniques.

The decommissioning of the MCRE project will include the following steps:

- Reactor cooldown. MCRE will be placed into a safe standby mode for a period of 30–90 days so that short-lived radionuclides can decay to minimize radiation dose to workers.
- Defueling. MCRE will be defueled after cooldown. The fuel salt will be heated until molten and then transferred to ISCs. After transfer, the ISCs will be cooled and transferred to a docked transfer cask. The ISCs will then be transferred to an appropriate storage facility.
- Reactor flush. The surfaces of the reactor vessel and ancillary equipment that were in contact with fuel will be flushed with nonfuel salt (flush salt) to sweep the remaining fissile material from the reactor components. The flush salt will be transferred from the reactor vessel and ancillary equipment into flush salt containers. The flush salt containers will then be transferred to an appropriate storage facility using an appropriate transfer cask.
- Removal of ancillary equipment. Following defueling and the reactor flush, project equipment will be removed from the testbed. Equipment located outside of the shielded area is expected to be un-irradiated and have little-to-no radiological contamination. Equipment located inside the shielded area is expected to be contaminated. All equipment, both inside and outside the shielded area, will be placed within appropriate waste packaging and be transferred to the appropriate waste storage location pending disposition. Equipment that is declared as waste may be stored temporarily to allow time for sufficient decay to occur in preparation for offsite shipment and final disposal.
- Removal of reactor vessel. Depending on the final project design the reactor will be disassembled in situ or removed intact. Regardless the reactor vessel will be declared as waste, removed, and then placed into an appropriate waste container for transfer to an appropriate disposal facility. It may be necessary to provide interim storage for the vessel package until sufficient decay has occurred to allow for offsite transport and disposition.
- Removal of the shield and remaining equipment. Following the removal of the reactor vessel, all remaining equipment and shielding will be removed from the testbed, declared as waste, placed in appropriate waste packaging, and transported to an appropriate disposal facility. Following the removal of all remaining equipment, the LOTUS testbed will be decontaminated and returned to pre-project condition.

2.1.10 Waste Management

All waste generated at INL during or following operation of MCRE will be permanently disposed of in accordance with applicable environmental compliance regulations and DOE O 435.1. Waste management for MCRE project-generated waste at INL involves the ultimate disposal of post-irradiation examination (PIE) wastes, reactor components, fuel synthesis wastes, and flush salt and associated equipment as well as the storage of the irradiated fuel salt after the MCRE project is complete. The MCRE project will use existing INL Waste Management Program (WMP) processes and procedures.

Wastes generated at TerraPower, Southern Company, and Orano Federal Services-affiliated facilities will be managed in accordance with all applicable federal, state, and local laws, regulations, and ordinances.

Transuranic (TRU) waste is not anticipated to be generated during MCRE activities.[1]

The ultimate disposition of all waste generated at INL during the MCRE project will be the responsibility of DOE.

2.2 No-Action Alternative

The no-action alternative is not to develop the MCRE project for operation at INL, integrate into the LOTUS testbed, or develop and synthesize fuel salt at MFC. The consequences of the no-action alternative serves as a baseline, enabling decision makers to compare the magnitude of environmental effects of the proposed action alternative (CEQ 1981).

2.3 Alternatives Considered but Eliminated from Detailed Analysis

As required by 40 CFR § 1502.14 (a), alternatives that an agency considered but eliminated from further detailed analysis should be briefly discussed, and the reasoning for their elimination should be given. To meet that requirement, this section describes alternative actions considered but eliminated from further analysis.

DOE considered alternative site locations for the proposed MCRE project from a larger pool of potential sites across the DOE laboratory complex (INL 2020a). Selection criteria mandated that a site (1) meets requirements for DOE O 421.1C, "Facility Safety," (2) provides the necessary confinement that will prevent a radioactive material release, (3) has the infrastructure to appropriately control nuclear materials, and (4) does not drastically interfere with existing DOE mission capabilities. This selection process considered the following sites:

- Nevada Nuclear Security Site Device Assembly Facility (DAF). The Nevada Nuclear Security Site DAF is an existing Hazard Category 2 nuclear facility that currently houses the Kilowatt Reactor using Stirling technology. The DAF is integral to the National Nuclear Security Administration Stockpile Stewardship program. Based on the facility size, configuration, and ongoing mission, DAF would not meet the needs of the MCRE project without significant facility modifications and a significant change to the existing mission requirements.
- Experimental Breeder Reactor (EBR)-II Dome. The EBR-II Dome is an existing facility at MFC that formally held the EBR-II Reactor and is scheduled for future mission use. This facility would require significant facility modifications and would interrupt future mission capabilities.
- Idaho Nuclear Technology and Engineering Center (INTEC) Chemical Processing Plant (CPP)-691. CPP-691 is a Hazard Category 2 nuclear facility at INTEC, which is located on the INL Site. The facility was not designed to house a reactor and would require significant modifications to provide the appropriate containment for a reactor.
- INTEC CPP-1634. CPP-1634 was originally designed as a fluorine dissolution development and support facility and designated a Hazard Category 2 nuclear facility. Currently, the facility is classified as a less than Hazard Category 3 facility. This facility would require significant modifications to provide the appropriate containment for a reactor.

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1 Transuranic waste consists of waste containing transuranic radionuclides with a half-life >20 years in concentrations above 100 nCi/g. Final waste packaging configuration will determine the radionuclide concentrations. Because any waste from MCRE will be newly generated, it will not be subject to the Idaho Settlement Agreement.

- Power Burst Facility (PBF)-612 and PBF-613. These facilities are located on the INL Site near the Critical Infrastructure Test Range Complex and were originally designed as Hazard Category 2 facilities. These facilities would require major upgrades and modifications to qualify for the proposed activities. Additionally, any new activity at these facilities would interfere with the mission capabilities at Critical Infrastructure Test Range Complex.
- New Facility. Design and construct new Hazard Category 2 nuclear facility on the INL Site or on another DOE laboratory site that can house the MCRE project. A proposed new facility would meet the selection criteria; however, the anticipated cost and time for design and construction and the potential disturbance to environmental resources would not meet the needs of the MCRE project nor the purpose and need for agency action.

Alternative sites considered for the siting of the MCRE project would require significant upgrades or modifications to existing facilities, interfere with existing DOE mission capabilities, or not meet the necessary confinement requirements to prevent a radioactive material release. To meet MCRE project requirements and the selection criteria for siting any advanced reactor demonstration project, the ZPPR cell at MFC is the preferred location for the siting of the MCRE project and is the assumed location for the purpose of this EA. Other siting alternatives were not considered further for detailed analysis. As a result, only the alternative remaining is the no-action alternative.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section presents the affected environment and the environmental consequences of the proposed action and the no-action alternative to that environment. The affected environment is addressed in the Proposed Action section, the Regional Setting section, and briefly described in specific resource area sections. Extensive information regarding the INL environment and resources are available in recent EAs and EISs such as the EIS for the Construction and Operation of a Prototype Mobile Microreactor (DoD 2022), the EA for the Microreactor Applications Research, Validation and Evaluation (MARVEL) Project (DOE 2021a), and the EA for the Resumption of Transient Testing of Nuclear Fuels and Materials (DOE 2014*)*.

The environmental consequences analysis builds upon the information provided in Sections 1 and 2. Compliant with DOE's NEPA guidance, this EA applies a sliding-scale approach to the impacts analysis consistent with DOE's "Recommendations for the Preparation of Environmental Assessments and Environmental Impacts Statements" (DOE 2004). Specifically, more information is provided regarding the resources that have a greater potential to be impacted by the proposed action and the no-action alternative while less depth and breadth of analysis is applied to resource areas having no or minor environmental impacts. This approach focuses on significant environmental issues and alternatives and discusses impacts in proportion to their significance.

Under the no-action alternative, activities at the INL Site would continue under the current operations, and the MCRE project would not be implemented. The no-action alternative would not result in impacts to resources at the INL Site beyond those captured in the discussion of the affected environment. The environmental impacts of future activities at the INL Site would be evaluated in project or program specific analyses in compliance with NEPA. Therefore, impacts from the no-action alternative are not discussed further in this EA.

Consideration of direct, indirect, or cumulative effects or impacts of the proposed action to the affected environment is the basis of this document. The purpose of describing direct, indirect, and cumulative effects is to ensure that the full range of reasonably foreseeable effects are considered in any decision to proceed or not with the action. The degree of potential impact includes short- and long-term effects, beneficial and adverse effects, effects on public health and safety, and effects that would violate federal, state, tribal, or local law protecting the environment. To facilitate this evaluation, the degree of potential impact is discussed in terms of *context* and *intensity*. Context is described in terms of duration, timing, and geospatial area of an impact. Intensity refers to the severity of the impact and is often referred to as the magnitude of the effects of the proposed action. When both context and intensity are used to describe an impact, the following definitions apply:

- NEGLIGIBLE. Any anticipated impact or effect is not detectable in the affected environment or differs from existing INL Site operations.
- LOW. Any anticipated impact or effect is sufficiently minor that it will neither destabilize nor noticeably alter any important attribute of the resource.
- MODERATE. Any anticipated impact or effect is sufficient to noticeably alter, but not destabilize, important attributes of the resource.
- HIGH. Any anticipated impact or effect is noticeable and can sufficiently destabilize important attributes of the resource. These impacts would be considered significant.

For this document, a cumulative effect is defined as an impact on the environment that results from the incremental impact of actions when added to past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions. The analysis of cumulative effects includes reasonably foreseeable actions that have a reasonably close causal relationship to the proposed action. Cumulative effects are discussed in the environmental consequence section for each resource area.

The discussions and analyses provided in this document are based on the most available and relevant information, current scientific evidence, and research methods generally accepted in the scientific community.

This section concludes with a description of the unavoidable adverse effects, the relationship between short-term use of resources and long-term productivity, and the irreversible or irretrievable resource commitments associated with the proposed action and no-action alternative.

3.1 Regional Setting

INL is an 890-square-mile DOE facility located on the Eastern Snake River Plain (ESRP). It is primarily located within Butte County, Idaho, but portions of INL are also in Bingham, Jefferson, Bonneville, and Clark counties. All the land within the INL Site is controlled by DOE, and public access is restricted to highways, DOE-sponsored tours, special-use permits (i.e., hunting and grazing), and the Experimental Breeder Reactor-I National Historic Landmark (INL 2020b).

Public highways U.S. 20 and 26 and Idaho 22, 28, and 33 pass through the INL Site, but off-highway travel within the INL Site and access to INL Site facilities are controlled. Currently, INL employs approximately 9,750 people (5,750 employees at BEA, 2,000 employees at Idaho Environmental Coalition, and 2,000 employees at the Naval Reactors Facility). No permanent Idaho residents reside within the INL Site boundary. Population centers in the region include large cities (more than 10,000 residents), such as Idaho Falls, Pocatello, and Blackfoot, which are located to the east and south of the INL Site, and several smaller cities (less than 10,000 residents), such as Arco, Howe, and Atomic City, which are located near the boundaries of the INL Site (Figure 7).

Vegetation is dominated by low shrubs, such as sagebrush and rabbitbrush, and a wide variety of grass species (INL 2020b). The area is populated with animals that inhabit sagebrush grasslands. Animals include pronghorn, deer, elk, coyotes, badgers, rabbits, many bird species (e.g., raptors, game birds, and waterfowl), a variety of small rodents, and several reptile species. Some plants and animals that live within the boundaries of INL are culturally significant to the Shoshone-Bannock Tribes.

Cultural resources are numerous on the INL Site (DOE-ID 2016). Identified resources include the following:

- Pre-contact archaeological sites representing Native American use over a span of approximately 13,000 years
- Historic archaeological sites representing settlement and agricultural development during the period from 1805 to the late 1920s
- Historic architectural properties associated with World War II and with the development of nuclear science and technology
- Other areas of cultural importance to the Shoshone-Bannock Tribes.

Many of these resources are eligible for nomination to the National Register of Historic Places (NRHP). Archaeological sites and Native American resources are generally located in undeveloped areas; however, historic architectural properties are found within facility perimeters at the INL Site. A tailored approach to manage these resources and comply with relevant federal and state law is included in DOE-ID's INL Cultural Resource Management Plan (DOE-ID 2016), which is based on a programmatic agreement among DOE-ID, the Idaho State Historic Preservation Office, and the Advisory Council on Historic Preservation as well as an Agreement in Principle between DOE-ID and the Shoshone-Bannock Tribes.

The area surrounding the INL Site is classified as a Prevention of Significant Deterioration Class II area, designated in United States Code (USC) under the Clean Air Act (42 USC 7401 et seq) as an area with reasonable or moderately good air quality while still allowing moderate industrial growth. Craters of the Moon National Monument and Preserve, located approximately 30 miles from MFC, is classified as a Prevention of Significant Deterioration Class I area and is the nearest area to the INL Site where additional degradation of local air quality is severely restricted.

The Snake River Plain Aquifer underlies about 10,800 square miles, including the INL Site. The Snake River Plain Aquifer is the major source of drinking water and crop irrigation for southeastern Idaho and has been designated a sole source aquifer by EPA (IDEQ, 2023). In the Snake River Plain Aquifer ranges, transmissivity averages about 93,000 square feet per day. Groundwater flow rates in the aquifer move horizontally, mainly through fractures in the basalts and basalt interflow zones. Interflow zones are composed of highly permeable rubble zones between basalt flows. Groundwater flow primarily toward the southwest.

The INL Site has an extensive groundwater quality monitoring network maintained by the U.S. Geological Survey and INL contractors. This network includes monitoring or production wells in the Snake River Plain Aquifer from which samples are collected and analyzed for selected organic, inorganic, and radioactive constituents. Localized areas of radiochemical and chemical contamination are present in the Snake River Plain Aquifer beneath the INL Site. These areas, or plumes, are considered to be the result of past disposal practices. Groundwater monitoring has shown long-term trends of decreasing concentrations of radionuclides and current concentrations are near or below EPA MCLs for drinking water (DOE-ID, 2022b). The decreases in concentrations are attributed to discontinued disposal to the aquifer, radioactive decay, and dilution within the aquifer.

Release of radionuclides into the environment from current INL operations can expose individuals near the INL Site to radiation. Types and quantities of radionuclides released from INL operations,

including dose estimates from these releases, are listed in the National Emission Standards for Hazardous Air Pollutants annual reports (DOE-ID 2021). Historically, the dose to the maximally exposed individual (MEI) is less than 1% of the 10-mrem/yr federal standard.

INL Site workers receive the same dose as the general public from background radiation, but they may also receive an additional dose from working in facilities with nuclear materials. The average dose to the individual worker (involved worker) and the cumulative dose to all INL Site workers (total workers) fall within the radiological regulatory limits of 10 CFR § 835 (2011). According to the accepted risk estimator of 6.0×10^{-4} LCF per person-rem among workers, 0.05 LCF is the projected radiological risk for INL Site workers from normal operations[m] in 2020 (DOE-ID 2021a). Since the radiological risk is less than 0.5, no latent cancer fatalities are expected as a result of this exposure.

MFC is the most eastern INL facility complex (Figure 7). It is located about 38 miles west of Idaho Falls in Bingham County in the southeastern corner of INL. MFC is located on approximately 100 acres (inside the MFC fence) and is approximately 2.7 miles from the southern INL Site boundary (Figure 8). MFC includes a wide variety of facilities and capabilities that support INL's nuclear research missions. Activities performed at MFC include R&D for new reactor fuels and related materials and demonstration of various nuclear energy technologies. In addition, MFC supports DOE programs for space and defense radioisotope power systems. FMF is located within the MFC boundary. For the purpose of this document, it is assumed that the LOTUS testbed will be located within the MFC boundary.

m Normal operation is defined as the day-to-day work at INL, not including the MCRE project.

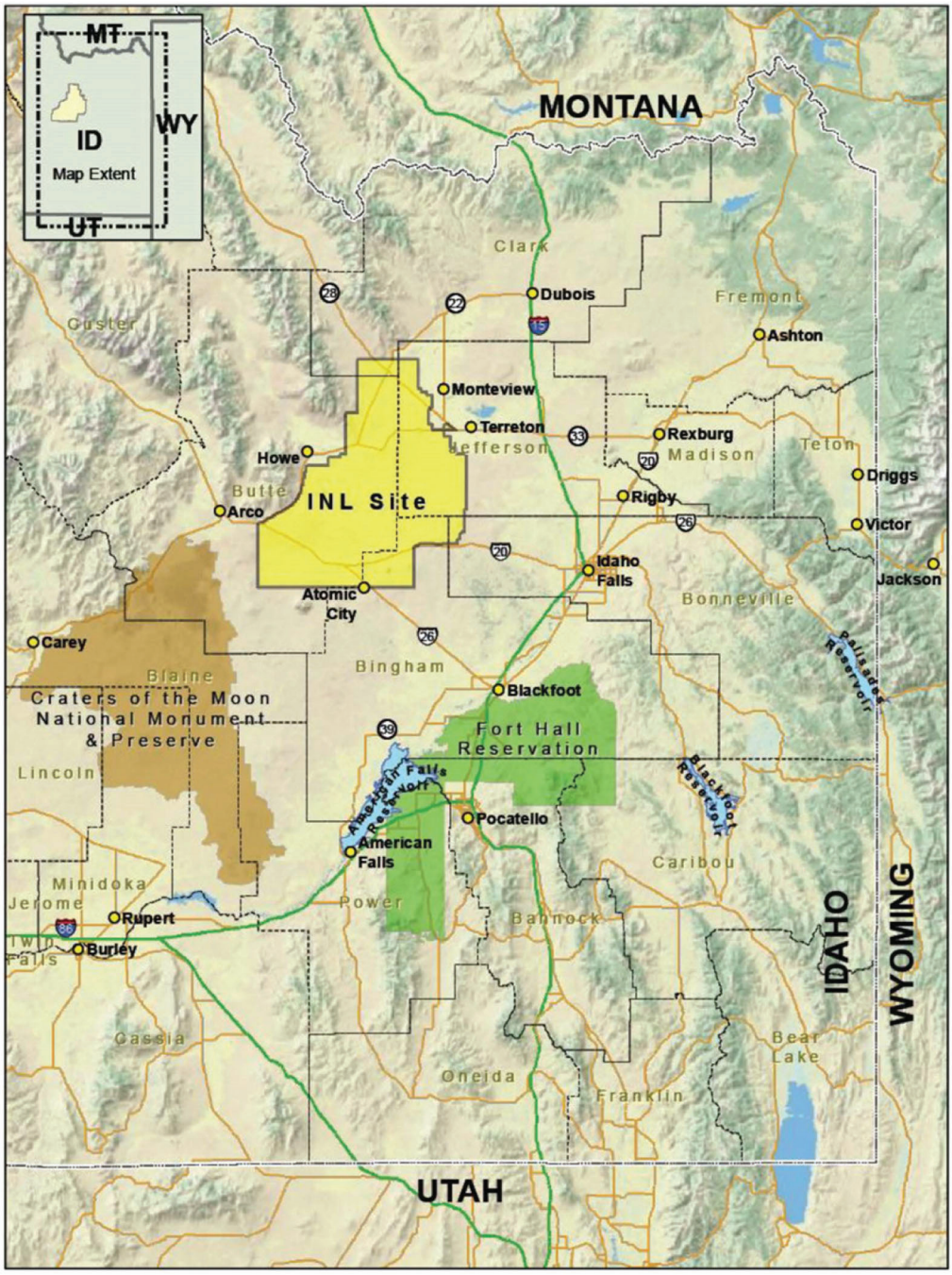

Figure 7. Location of the INL Site.

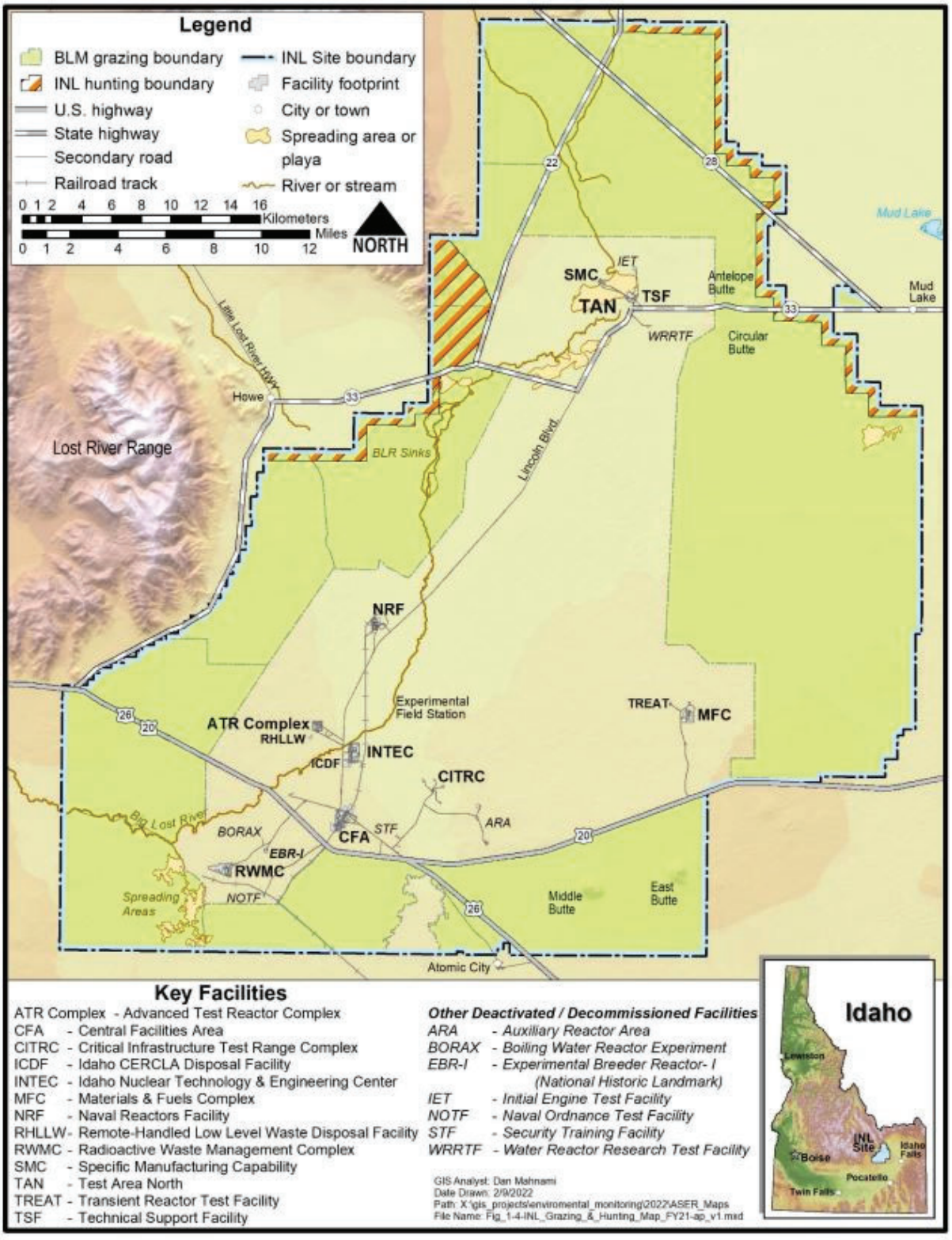

Figure 8. INL Site and facilities.

3.2 Resource Areas Eliminated from Further Analysis

Scoping and preliminary analyses indicate the MCRE project would not likely impact the following resource areas; therefore, this EA does not analyze these areas further:

- Ground and Surface Water. Neither perennial nor permanent surface water bodies are near MFC. All facilities within the fenced MFC area are in a single local topographically closed watershed. The MFC watershed contains natural drainage channels, which can concentrate overland flow during periods of high precipitation or heavy spring runoff. The approximate elevation of MFC is 5,130 feet above sea level and more than 7 feet above the water level predicted to occur under the probable maximum flood event corresponding to repeated rainfall events over frozen ground; therefore, the facilities described in the proposed action are not subject to flooding (Koslow 1986). The MCRE project does not include activities that physically or chemically alter ground or surface water resources. Therefore, the MCRE project does not affect ground or surface water resources.
- Land Use and Visual Resources. It is assumed that the MCRE project will not require the construction of new facilities, additional land use, or ground disturbance and will occur in existing facilities designed or modified for this purpose. The MCRE project would not impact land use or visual resources.
- Noise. MFC is approximately 2.7 miles from the INL Site boundary. The closest noise-sensitive receptor is an agricultural homestead that is approximately 5.3 miles from MFC and 2 miles from U.S. Highway 20, which is the primary noise at this location. Discernable noise from the MCRE project is generated from the electrical equipment associated with operations. It is expected that discernable sound would range from approximately 80 to 85 decibels (dBA). To give context, a whisper registers at approximately 30 dBA, normal conversation approximately 50 to 60 dBA, a ringing phone 80 dBA, and a power mower 90 dBA (OSHA 2011). Activities associated with the MCRE project will be located in existing buildings at MFC. These buildings include a number of noise-generating sources typical of industrial activities such as industrial heating, ventilation, and air conditioning (HVAC) equipment, blowers, moving equipment, and vehicles. The noise generated from the MCRE project would be consistent with other existing industrial equipment at MFC, and the potential concurrent noise would be similar to existing levels. It is anticipated that the MCRE project would not cause a change in the noise environment at MFC or the INL Site.
- Socioeconomics.[n] It is assumed that INL would hire no more than 10 full-time employees to support the MCRE project. In 2020, the total population of Bannock, Bingham, Bonneville, Butte, Clark, Jefferson, and Madison Counties was 354,598 (U.S. Census Bureau 2023). Any potential impacts to population, housing, employment, income, community services, public transportation, and public finance from an additional 10 employees would be negligible. Potential impacts to the local socioeconomic regional landscape from the MCRE project would not likely be distinguishable from current INL Site operations, and the anticipated change would not noticeably alter socioeconomic conditions in the seven-county region around the INL Site.

n Economic or social impacts are not considered significant by themselves unless they are interrelated with natural or physical environmental impacts. To this end, any potential impact to the regional socioeconomic landscape would be directly related to potential impacts to other resources such as, but not limited to, land use, greenhouse gases, waste management, and environmental justice.

- Greenhouse Gases. A natural greenhouse effect is the warming of the earth's atmosphere due to terrestrial radiation absorbed or trapped by gases in the atmosphere. These gases primarily consist of carbon dioxide and include trace amounts of nitrous oxide, methane, sulfur hexafluoride, and chlorofluorocarbons. Emissions of greenhouse gases (carbon dioxide equivalents [CO_2e]) in 2020 at INL were estimated to be 0.1 million MT per year, which is significantly less than the total 6.457 billion MT of CO_2e produced in the U.S. in 2019 (EPA 2029). The proposed MCRE project is not projected to increase INL's greenhouse gas emissions and will adhere to INL's net-zero carbon emission initiative and goals.

3.3 Air Quality

3.3.1 Affected Environment

Sources of non-radiological air emissions at the INL Site include oil-fired boilers; diesel engines; emergency diesel generators; small gasoline, diesel, and propane combustion sources; and emissions from using chemicals and solvents. Boilers generate steam for heating facilities and are the main source of non-radiological air emissions at the INL Site. Diesel engines are mainly used to generate electricity for facility operations. Miscellaneous nonvehicle sources include small portable generators, air compressors, and welders.

Sources of non-radiological air emissions at offsite facilities include those related to the machining and manufacture of project components. These include the generation of PM and emissions from using chemicals and solvents.

Radionuclide emissions at INL occur from (1) point sources, such as process stacks and vents, and (2) fugitive sources, such as waste ponds, buried waste, contaminated soil areas, and decontamination and decommissioning operations. In 2021, the calculated effective dose equivalent[o] to the MEI member of the public[p] from INL Site operations was 6.7×10^{-2} millirem (mrem) per year, which is 0.67% of the 10 mrem per year regulatory standard for the INL Site (DOE-ID 2022).

Radiological air emissions from MFC occur from spent fuel treatment at the Fuel Conditioning Facility, waste characterization, fuel R&D at the Hot Fuel Examination Facility, fuel R&D at the FMF, and PIE at the Irradiated Materials Characterization Laboratory. Exhaust streams from these facilities pass through High-Efficiency Particulate Air (HEPA) filtration systems prior to being monitored via continuous emissions monitoring systems or emission sampling systems. The effective dose equivalent to the MEI member of the public from MFC operations in 2021 was calculated at 6.5×10^{-2} mrem per year, which is 97% of the effective dose equivalent to the MEI member of the public for the INL Site (DOE-ID 2022). No radiological air emissions would be produced from project activities at offsite facilities because no radiological material would be used.

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o Dose equivalent is a measure of the biological damage to living tissue as a result of radiation exposure. The dose equivalent is calculated as the product of absorbed dose in tissue multiplied by a quality factor. Effective dose equivalent is the sum of the products of the dose equivalent and the weighting factors applicable to each of the body organs or tissues that are irradiated. Refer to the Helpful Information for the Reader section at the beginning of this document or Nuclear Regulatory Commission publication Dose in Our Daily Lives and Measuring Radiation for more information (NRC 2021).

p A maximally exposed individual member of the public is a hypothetical individual who, because of proximity, activities, or living habits, could potentially receive the maximum possible dose of radiation or of a hazardous chemical from a given event or process.

3.3.2 Environmental Consequences

The MCRE project activities have the potential to generate minor amounts of toxic air pollutants and radionuclide air emissions.

Offsite activities would occur in facilities that are designed to operate the machining and manufacturing of project components and include all pollution prevention measures as required by all applicable federal, state, and local laws, regulations, and ordinances. It is anticipated that any non-radiological emissions from these facilities would be similar to existing emissions as the manufacturing processes would be similar to what these facilities currently produce.

The integration of MCRE systems and components into the testbed is minimal and are typical activities performed at INL. It is expected that integration activities would have no radiological impact on the general public.

Combustion equipment, such as generators, portable heaters, ventilation equipment, and heavy equipment fueled with diesel fuel, may be used during project activities. In general, emissions during construction type activities are exempt from Prevention of Significant Deterioration[q] review because these requirements are primarily for major stationary sources and specifically exempt temporary increases in emissions. Emissions from mobile generators are exempt from regulation since the generators are temporary and will be in place for less than one year.

Combustion of fossil fuel in construction type equipment, trucks, and worker commuter vehicles would emit non-radiological criteria air pollutants and hazardous air pollutants. Temporary emissions include reactive organic gases, nitrogen oxides, and respirable PM with an aerodynamic diameter of 10 micrometers or less (referred to as PM_{10}). PM_{10} consists of PM emitted directly into the air (e.g., fugitive dust, soot, and smoke) from mobile and stationary sources and construction operations.

The mobile and intermittent operation of equipment emission sources combined with the integration of the MCRE project into the ZPPR cell occurring indoors would result in dispersed concentrations of these pollutants adjacent to proposed activities. The substantial transport distance of emissions from MFC to the nearest locations of the INL Site boundary (approximately 3 miles south) would produce greater dispersion and negligible concentrations of hazardous air pollutants beyond the INL Site boundary. The use of worker commuter vehicles on public roads would result in low concentrations of pollutants. Concentrations generated by integrating the MCRE project into the ZPPR cell and by worker transportation activities would not result in adverse conditions beyond the existing baseline. Any potential impact would be considered low.

The synthesis of fuel salt in the FSSL could potentially emit a minimal amount of radiological emissions. Any radiological emissions would be managed by the FMF cell ventilation system. The cell ventilation system exhaust stack has an effluent monitoring system compliant with ANSI/HPS N13.1-2011.

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q Prevention of Significant Deterioration applies to new major sources or major modifications at existing sources for pollutants where the source is located in attainment or unclassifiable with National Ambient Air Quality Standards as defined by the Clean Air Act.

The MCRE project is designed to operate with minimal risk to the health and safety of the public. The fuel salt is contained under an inert cover gas to limit the possibility of fuel salt and any emissions from migrating from the system. By nature of the proposed activities, the expected fuel burn-up will be low, thereby further reducing the risk of a release of fission products into the environment. The integration of MCRE project components inside the ZPPR cell provides the needed confinement necessary (e.g., walls, floor, and ceiling) to prevent unintended toxic air pollutants and radiological emissions from entering the environment. The integration includes incorporating project components with the LOTUS testbed ventilation system that includes HEPA filtration and negative air pressure to prevent contaminated exhaust air.

The inert cover gas, as part of the CGS, acts as a barrier by retaining fission products and limiting the release of toxic air pollutants and radiological emissions to the environment. When integrated with the ZPPR cell, any off gases from the CGS will be emitted through the ventilation system and exhaust stack.

Under the MCRE project, there are no direct emissions from the fission process during normal operations because of the inert cover gas. Any indirect emission would be abated through the ventilation system. The ventilation system would vent to a stack that would operate with a continuous emission monitoring system and HEPA filters or series of HEPA filters that would each have a control efficiency of at least 99.97%.

The impact of unabated radioactive air emissions from fuel salt synthesis to an offsite member of the public and co-located worker was assessed and determined to be extremely low when compared to the regulatory limits (INL 2022). Doses were calculated with CAP88-PC, a set of computer programs, databases, and associated utility programs to estimate the dose and risk from radionuclide emissions to the air. CAP88-PC is both a mature and EPA-recommended model for demonstration of compliance with the applicable performance objective (40 CFR 61, Subpart H). The potential dose to an offsite member of the public (INL Site MEI[r]) is 2.4×10^{-3} mrem/year, and the dose to a co-located worker is estimated to be 7.62×10^{-2} mrem/year. The estimated 2.4×10^{-3} mrem/year dose to a member of the public is significantly less than both the 10 mrem/year regulatory standard and the minor source threshold of 0.1 mrem/yr. The estimated potential dose to a co-located worker of 7.62×10^{-2} mrem/year is significantly less than the 5,000 mrem/year regulatory dose standard.

The dose estimates are calculated without accounting for abatement via HEPA filtration system. Assuming that radiological emissions are abated, it is anticipated that the actual dose to a member of the public and a co-located worker would be significantly less than estimated. Because the estimated dose is significantly less than the regulatory limits, the normal operation of the MCRE project would not result in adverse conditions beyond the existing baseline, and any potential impact would be considered low.

During decommissioning, hazardous and radioactive materials will be removed to ensure the protection of workers, public health and safety, and the environment. Activities associated with decommissioning the MCRE project, FSSL, and associated equipment will be performed in existing INL facilities. The actual emissions would be determined when more definite operational conditions have been defined. Decommissioning operations will comply with all regulatory requirements of the Clean Air Act; therefore, the operations are bound by the regulatory limits.

r The INL Site MEI for CY 2020 is a farmhouse and cattle operation located 3.1 km south of Highway 20, 3 km from INL's east entrance. It is also the location of the highest potential dose for a residence, school, business, or office for MCRE project emissions.

INL will develop an air permitting and applicability determination for each applicable source of radiological air emissions associated with the project to ensure compliance with the National Emission Standards for Hazardous Air Pollutants, Subpart H (40 CFR § 61). The air permitting and applicability determination will also demonstrate compliance with the facility emissions cap site-wide permit (P-2020.0045) for any non-radiological emissions. In the event a Permit to Construct is required, an application for the Permit to Construct will be submitted to the Idaho Department of Environmental Quality, pursuant to IDAPA 58.01.01, "Rules for the Control of Air Pollution in Idaho," and an Approval to Construct application will be submitted to EPA, pursuant to 40 CFR § 61.96.

As described above, the MCRE project (including the manufacturing of components, operation, fuel salt synthesis, and decommissioning) would produce minor amounts of air emissions. Transport of these emissions would produce negligible ambient air pollutant concentrations at offsite locations. Therefore, any minor increase in offsite air pollutant concentrations produced from the MCRE project, in combination with emissions from other past, present, and reasonably foreseeable future actions, including future demonstration reactor projects (e.g., Versatile Test Reactor [VTR], Project Pele, and MARVEL), would result in air pollutants concentrations that would not exceed the state and National Ambient Air Quality Standards and would not substantially contribute to cumulative air quality impacts. Similarly, any radioactive air emissions would result in negligible dose impacts to co-located workers and offsite members of the public. Any potential direct, indirect, or cumulative impacts to air quality from the MCRE project would be considered low.

3.4 Ecological Resources

3.4.1 Affected Environment

Ecological resources include the plant and animal species, habitats, and ecological relationships between the land and water within the area of interest, as described in the 2021 Annual Site Environmental Report (ASER), which is the area directly or indirectly affected by the proposed MCRE project (DOE-ID 2022b). Consideration is given to sensitive species, which are those species protected under the Endangered Species Act, Idaho Rules Governing Classification and Protection of Wildlife (IDAPA 13.01.06.000), Migratory Bird Treaty Act of 1918, and Bald and Golden Eagle Protection Act (INL 2020b). For this document, sensitive and protected ecological resources include plant and animal species that are federally or state-listed for protection.

3.4.2 Environmental Consequences

An impact to ecological resources is considered significant if they result in a loss of protected or sensitive species or a loss of local populations from direct mortality or diminished survivorship.

As stated in the proposed action section, activities associated with the MCRE project are anticipated to occur within or near existing facilities. Ground disturbing activities, additional land use, or additional exterior night-time lighting are not anticipated. The expected noise from project activities is not likely to exceed existing industrial noise levels. As such, it is not expected that activities associated with the manufacturing of project components at offsite facilities or the integration of the MCRE project into the testbed, operation, or decommissioning would impact ecological resources.

Trucks transporting project equipment to and from INL and increased motor activity from additional commuting employees have the potential to impact wildlife from inadvertent vehicle strikes. Vehicle noise also disturbs wildlife, causing some animals to relocate. While large ungulates, such as elk and deer, adapt to busy highways, roads with continuous, slow-moving traffic can cause displacement and change in range use. Smaller animals are less noticeable and slower moving; direct strikes from motorized vehicles may occur.

It is expected that the MCRE project would not result in major disruptions to wildlife or increases in wildlife mortality because MFC is located where vehicle use regularly occurs. Any increase in traffic from transport or commuter vehicles would not be discernable from current INL operations. The loss of protected or sensitive species or loss of local populations or their respective habitats from direct mortality or diminished survivorship is not anticipated. Therefore, impacts to ecological resources from project traffic would be negligible.

Radiological activities that cause direct radiation to 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," to show that dose rates to representative biota populations do not exceed the dose rate criteria in DOE Order 458.1 (DOE 2019). The impact of potential radioactive air emissions on terrestrial biota was assessed using an approach that compares the potential maximum concentration of each radionuclide in the soil to an INL Site-specific ecologically based screening level. Based on this analysis, it is expected that potential radiological air emissions from fuel salt synthesis and from the operation of MCRE would not exceed the dose rate criteria for the protection of populations of aquatic and terrestrial biotic. Therefore, any potential impact to ecological resources from radiological air emissions would be low to negligible (INL 2022).

As described above, the potential impacts to ecological resources from air emissions and traffic associated with the MCRE project is considered low to negligible and may not be discernable from existing INL activities. Therefore, these potential direct and indirect impacts in combination with other impacts to ecological resources from other past, present, and reasonably foreseeable future actions would not result in a long-term loss of protected or sensitive species or loss of local populations from direct mortality, diminished survivorship, or habitat loss.

3.5 Cultural Resources

3.5.1 Affected Environment

The portion of the MCRE project occurring at INL was reviewed under Section 106 of the National Historic Preservation Act (NHPA) per 36 CFR § 800 through processes identified in the INL Cultural Resource Management Plan (CRMP) and supporting documents by the INL Cultural Resource Management Office (CRMO) (DOE-ID 2016). CRMO personnel meet the appropriate Secretary of the Interior's Professional Qualifications Standards for cultural resource management under 36 CFR Appendix A § 61.

Installation of MCRE into the LOTUS testbed is consistent with the purpose and mission for which LOTUS was designed. Assuming that the LOTUS testbed is installed into the interior of the ZPPR cell (MFC-776), which is a historic property eligible for inclusion in the NRHP, the LOTUS testbed will become a permanent component of ZPPR and allows the facility to continue to function as it was initially designed.

Synthesizing the fuel salt in the FSSL is consistent with the standard operating activities conducted at FMF, MFC-704, as is the fuel salt's analytical chemistry analysis that would be conducted in the AL, MFC-752. Standard operating activities and procedures that take place inside buildings that use existing infrastructure do not meet the threshold of federal undertakings with the potential to affect historic properties and do not require Section 106 review and are not considered when defining the area of potential effects (APE).

Several activities within the proposed action were excluded from further Section 106 review due to the nature of the activities aligning with excluded actions, as defined in the INL CRMP (DOE-ID 2016). These activities have no potential to affect historic properties and are excluded from further cultural review or consideration when defining the APE. Therefore, the APE[s] was determined to include the secondary construction laydown area located outside the MFC fence, which encompasses approximately 5.4 acres, and the interior of ZPPR.

The installation of MCRE is consistent with the standard operation procedures for which the LOTUS testbed was designed and will use the LOTUS testbed infrastructure. Modifications to ZPPR will not be required to install MCRE into the LOTUS testbed. As the LOTUS testbed continues the original function of ZPPR, there will not be any effect to the characteristics that qualify ZPPR as a historic property. In the event of an off-normal situation, containment measures have been developed to ensure that contamination is controlled and is not allowed to reach testbed infrastructure. Thus, there would be no impacts to ZPPR.

Previous Class III surveys were conducted within the 5.4 acres of the secondary construction laydown area and no historic properties were identified. Use of the construction laydown area would have no effect on any historic properties.

Offsite project activities would occur in existing facilities where proposed activities regularly occur and any disturbance to cultural resources are not expected.

3.5.2 Environmental Consequences

The integration of the MCRE project into the LOTUS testbed would require a few modifications that have been identified to have little-to-no potential to affect historic properties within the interior of the facility. Furthermore, these modifications would be temporary in nature (less than two years) and would be required during the integration into the testbed, operational lifecycle, and decommissioning process. At decommissioning, MCRE project components would be removed, and the testbed would be returned to preproject conditions. No modifications to the exterior of the LOTUS testbed would be necessary to accommodate the MCRE project. The use of the secondary construction laydown area was evaluated under Section 106 of the NHPA per 36 CFR § 800. The result of the Section 106 review recommends the MCRE project would not affect historic properties. On February 14, 2023, DOE concurred with the recommendation and determined the undertaking would not affect historic properties. As such, it is expected that the MCRE project would have no impact on historic properties within the APE. In addition, the project would not contribute to cumulative impacts to any historic properties.

3.6 Geological and Soil Resource

3.6.1 Affected Environment

MFC is located on the ESRP, part of the Snake River Plain, a large physiographic region (~90 km [56 mi] wide and 560 km [348 mi] long) within low-relief and is covered by basaltic lava flows and sediment. The Snake River Plain extends in a broad arc across southern Idaho from the Yellowstone Plateau to Wyoming on the east and into eastern Oregon on the west (Figure 9). Surface elevations on the Snake River Plain decrease continually and gradually from approximately 2,000 m (6,562 ft) near Yellowstone to approximately 650 m (2,132 ft) near the Idaho-Oregon border.

s APE is the geographic area (or areas) within which a federal undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist.

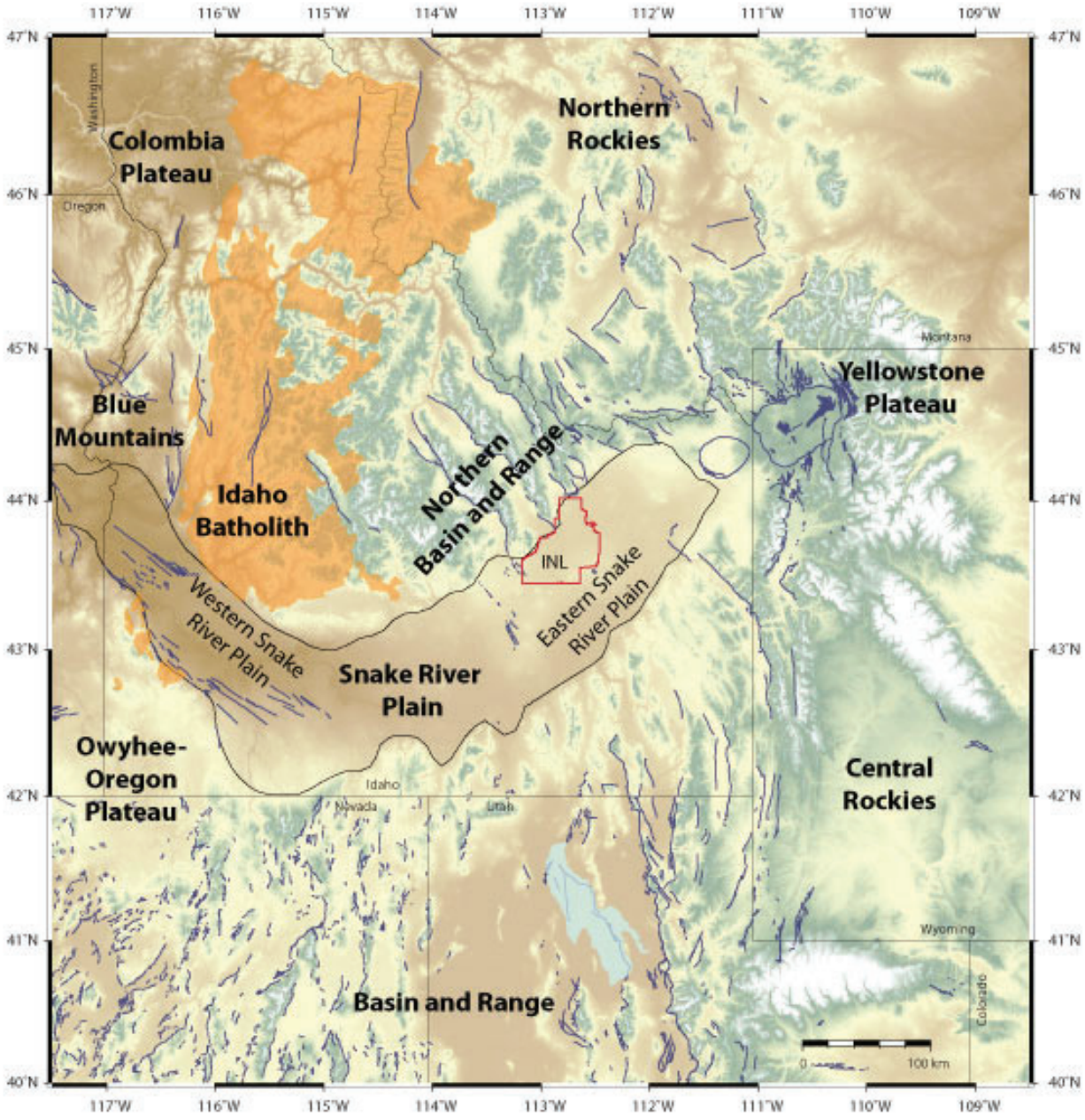

Figure 9. Snake River Plain in relation to regional geographic features.

The ESRP represents the track of buried and extinct volcanic centers associated with passage of the North American plate over the relatively stationary "Yellowstone" hotspot (Pierce and Morgan 1992; 2009; Smith et al. 2009). Between approximately 6.3 and 8.4 million years ago, the crust beneath the ESRP at and near INL's location was impacted by volcanism associated with the Yellowstone hotspot (McCurry et al. 2016; Anders et al. 2014; Schusler et al. 2020). Volcanism within the last 2.1 million years associated with the Yellowstone hotspot is now centered beneath the Yellowstone Plateau (Christensen et al. 2007) at approximately 160 to 230 km (99 to 143 mi) northeast of INL. Since about 4 million to 2,100 years ago, in the ESRP at and around INL basaltic magma has continued to periodically erupt, producing volcanic vents and lava flows (Kuntz et al. 1994; Kuntz et al. 2002; Kuntz et al. 2007). Surface basalt flows at INL range in age from 13,000 years to 1.2 million years ago (Kuntz et al. 1994). Along the southern INL Site border, basaltic magma stagnated in the crust and eventually evolved in composition to erupt between 300,000 years and 1.4 million years ago, producing rhyolitic domes, which formed five buttes with heights between 120 and 750 m (394 to 2,460 ft) (McCurry et al. 2008).

MFC is located in the eastern part of the INL Site and on thin surficial sediments of primarily eolian origin overlying basaltic lava flows. MFC is within a closed basin and outside of the Big Lost River drainage basin, thus sediments are deposited primarily by the wind and localized drainage during precipitation events. The surface sediment thicknesses near the ZPPR cell range from approximately 2 m (6.5 ft) to 8 m (26.5 ft). The surface sediment thickness of two nearby locations of the ZPPR cell are as deep as 9.6 m (31.5 ft) and 14 m (46 ft) and are composed of silty, sandy layers containing varying amounts of basalt rock fragments. Basaltic lava flows at MFC erupted as pahoehoe flow types and generally have rubbly zones from the top of the flow to more massive interiors at the center (Northern Testing Laboratories 1978). The ZPPR cell is underlain by basalt lava flows that erupted from nearby vents south and east of MFC, which have been dated to be less than 358,000 years to over 1.4 million years old (Champion et al. 2011). The closest basaltic vents are more than 7 km (4.3 mi) east and south of the ZPPR cell. There are not any mapped faults at or near MCRE nor any volcanically induced features such as ground cracks or fractures (Kuntz et al. 1994).

The Snake River Plain transects and sharply contrasts with the surrounding mountainous country of the Northern Basin and Range Province. Summits of mountains surrounding the Snake River reach elevations of up to 3,660 m (12,000 ft), producing a maximum elevation contrast of 2,150 m (7,050 ft). North and northwest trending mountain ranges, up to 200 km (124 mi) long and 30 km (19 mi) wide, are separated by intervening basins filled with terrestrial sediments and volcanic rocks. Extension of the Earth's crust over the last 16 million years formed normal faults, including the three closest range-bounding faults northwest of INL (northern Basin and Range) and those east and south of the ESRP in the Basin and Range (Figure 9).

From 1850–2020, 22,870 earthquakes with magnitudes of >2.0 compiled from nearby seismic networks and INL's networks show a parabolic distribution of epicenters located predominantly in the Basin and Range regions outside of the ESRP (Payne and Falero 2022) (Figure 10). The two largest earthquakes, the 1959 earthquake with a momentous magnitude (M) 7.3 in Hebgen Lake, Montana, and the 1983 earthquake with a M 6.9 Borah Peak, Idaho, produced normal faulting surface ruptures with maximum lengths of 36 km (22 mi) (Crone et al. 1987) and 37 km (23 mi) (Myers and Hamilton 1964), respectively. Three earthquakes have caused ground shaking at INL, but no damage occurred due to the large distances of their epicenters from INL. Infrequent small magnitude earthquakes occur within the ESRP. From 1972–2020, INL's seismic network has located 103 microearthquakes with magnitudes of <2.4 in the ESRP (Bockholt et al. 2022). Of these, 15 occurred within INL Site boundaries, and none were located near MFC.

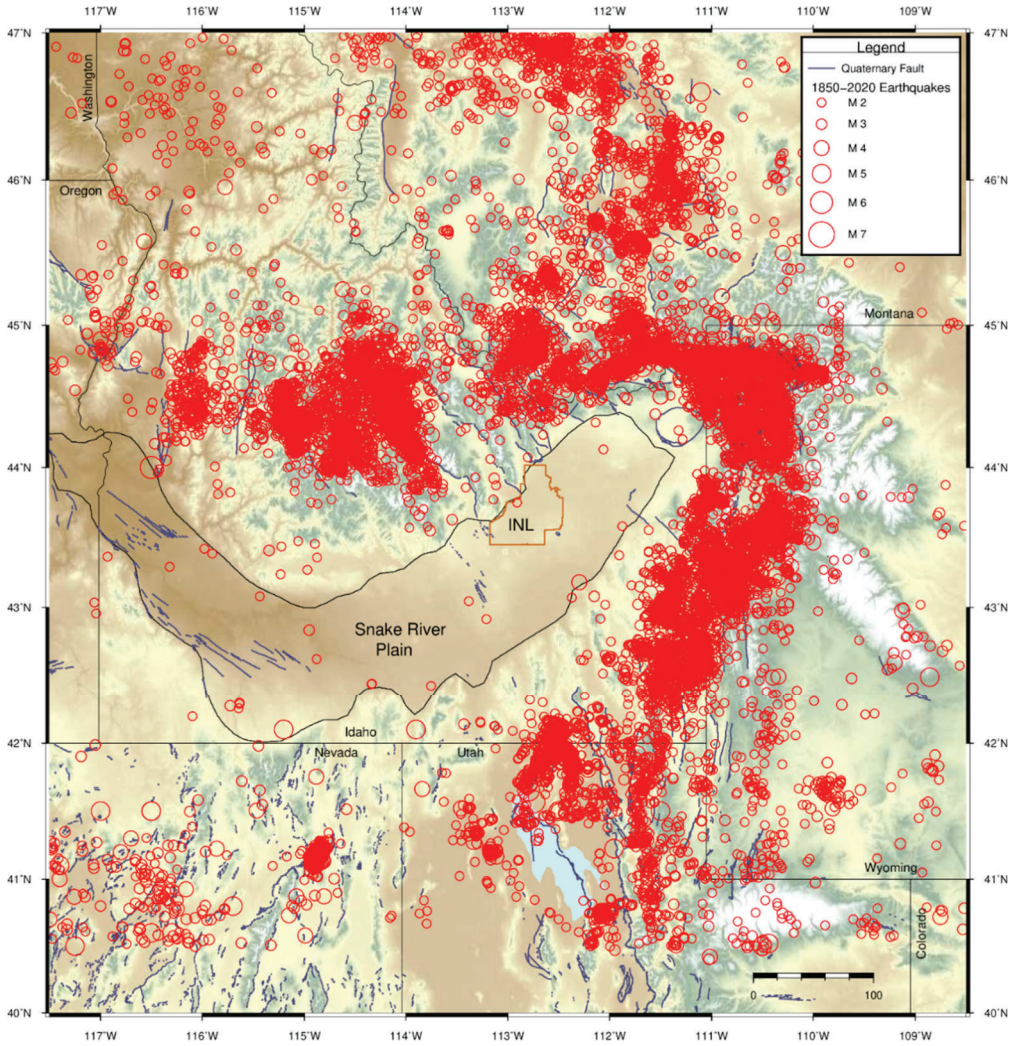

Figure 10. Earthquakes occurring from 1850 to 2020 with magnitudes greater than 2.0.

Soils beneath MFC generally consist of light brown-gray, well-drained, silty loams to brown, extremely stony loams. Soils are highly disturbed within the developed areas of MFC (DOE 2002). The thickness of surficial soils and sediment range from 0.5 to 26 ft, with deposits at two locations that are 31.5 and 46 ft thick (Payne 2006). Two primary types of soils at MFC are classified as Bondfarm-Rock outcrop-Grassy Butte complex and Maim-Bondfarm-Matheson complex (DOE 1998). The permeability of these soils is moderately rapid to rapid, and their erosion hazard is slight or moderate.

Offsite project activities would occur in existing facilities where proposed activities regularly occur and any disturbance to geological or soil resources are not expected.

3.6.2 Environmental Consequences

The MCRE project will be located in existing facilities. No ground disturbance or change to existing land use at MFC is expected; therefore, there are not any anticipated impacts to geological or soil resources.

No environmental impacts are assessed from the MCRE project as a result of potential future earthquakes. The ZPPR cell is classified as Seismic Design Category (SDC)-3 facility per DOE Order 420.1C, "Facility Safety" (DOE 2012), which is implemented through DOE Standard, DOE-STD-1020, "Natural Phenomena Hazards Design and Evaluation Criteria" (DOE 2016). Seismic design criteria were developed from site-specific, seismic hazard analyses of soil and rock conditions at the ZPPR cell (Payne 2006; INL, 2022b). The evaluation of the ZPPR cell under seismic loads is currently being performed. MCRE and its installation in the ZPPR cell will be designed to withstand vibratory ground motions (or ground shaking) as specified by American Society of Civil Engineers (ASCE 2017) Standard 4-16, "Seismic Design of Safety-Related Nuclear Structures." Ground shaking levels are obtained from the U.S. National Seismic Hazard Maps available online from the U.S. Geological Survey (https://earthquake.usgs.gov/hazards/interactive/) for peak ground acceleration data.

As described above, potential impacts due to seismic activity are not expected. Therefore, no cumulative impacts to geologic or soil resources from other past, present, and reasonably foreseeable future actions are expected.

3.7 Infrastructure

3.7.1 Affected Environment

INL Site infrastructure includes basic resources and services required to support planned construction, operation activities, and continued operations of existing facilities. For the purpose of this document, infrastructure is defined as electricity, fuel (for equipment), water, and municipal wastewater. Table 3 summarizes INL's 2020 infrastructure usage and capacity.

Table 3. INL 2020 infrastructure usage and capacity.

Resource	Site Usage	Site Capacity
Electricity from INL Power Infrastructure		
Energy Consumption (megawatt-hours per year)	186,255	481,800[a]
Peak Load (megawatts)	36	55[a]
Fuel		
Natural Gas (cubic feet per year)	3,149,227	Not limited[b]
Fuel Oil for Heating (gallons per year)	902,001	Not limited[b]
Diesel Fuel (gallons per year)	571,028	Not limited[b]
Gasoline (gallons per year)	262,909	Not limited[b]
Propane (gallons per year)	627,007	Not limited[b]

Resource	Site Usage	Site Capacity
Water		
Water (gallons per year)	754,699,070	11,400,000,000[c]
Municipal Wastewater		
MFC Sewage Effluent (gallons per day)	10,512	14,950[d]

Source (DOE 2021)
a. Limited by contract with the Idaho Power Company
b. Capacity is limited only by the ability to ship resources to the INL Site
c. Water right allocation
d. MFC wastewater lagoons design capacity.

Offsite project activities would occur in existing facilities where proposed activities regularly occur. Because the exact location is not known, projections for infrastructure use cannot be ascertained. However, it is anticipated that infrastructure and utility use would not be greater than what the existing facilities would be capable of accommodating.

3.7.2 Environmental Consequences

Project activities at INL would use approximately 350 kWh of electricity per year, which would be supplied by the INL Site power infrastructure. This is an anticipated increase of 0.2% from the annual site usage. Any potential impacts to electrical energy consumption at the INL Site would be low and nearly indiscernible from current consumption rates.

MCRE is a MSR and does not require water for its operation. Water usage for operation is not required. It is anticipated that 10 employees would be added to the existing workforce at INL, resulting in an increase of 34,470 gallons per year of water consumption. This is an anticipated increase of 0.0046% of total gallons of water used at INL per year. The small increase in water consumption would not affect the ability of the system to provide an adequate supply to meet the requirements for personnel, process, and fire protection purposes. Any potential impacts to water consumption at the INL Site would be negligible.

The MFC sanitary sewer system collects and treats domestic wastewater from its facilities. The 10 new employees would result in the addition of approximately 100 to 250 gallons of wastewater per day to the MFC sanitary sewer system. The small increase in effluent to the sanitary sewer system would not affect the ability of the system to perform as currently designed. Any potential impacts to the sanitary sewer system at MFC would be low.

INL employs approximately 9,750 people (5,750 employees at BEA, 2,000 employees at Idaho Environmental Coalition, and 2,000 employees at the Naval Reactor Facility). During a typical workweek, the majority of employees take buses to various work areas at the INL Site, covering about 70 bus routes. About 1,200 private vehicles also travel to and from the INL Site daily. Adding 10 new commuter trips per day under the MCRE project would not result in discernable impacts to traffic at the INL Site or on public roads.

It is anticipated that the MCRE project would have low-to-negligible impact on the current INL Site infrastructure. Direct and indirect impacts would be nearly indiscernible from current operations when combined with past, present, and reasonably foreseeable future actions. Cumulative impacts would be low.

3.8 Waste Management

3.8.1 Affected Environment

The INL WMP provides the processes and procedures for compliant management of radioactive waste, hazardous waste, mixed waste, universal waste, and hazardous recyclables at INL. The INL WMP facilitates management of containerized radioactive waste, hazardous waste, mixed waste, universal waste, and hazardous recyclables. This process includes the characterization of waste through disposal and disposition is minimized, exposures are below allowable levels and as low as reasonably achievable (ALARA), and comply with DOE Order 435.1, "Radioactive Waste Management," (2021) and the accompanying DOE Manual 435.1-1, "Radioactive Waste Management Manual" (2021).

Construction and demolition debris that are not hazardous may be recycled or disposed of at onsite facilities or sent offsite, but the debris would be recycled to the greatest extent possible regardless of the facility. From Fiscal Year (FY) 2018 through FY 2021, MFC generated and disposed of an average of 17.3 m^3 of recyclable[t] and industrial[u] waste per year. During the same period, the volume of non-radiological hazardous wastes generated at MFC and disposed of at an offsite facility averaged 88.9 m^3 of hazardous[v] and universal[w] wastes per year (Table 4) (INL 2022).

Project activities at offsite facilities would likely produce construction type debris from machining and fabrication operations. It is anticipated that this waste would be managed in accordance with all applicable federal, state, and local laws, regulations, and ordinances. Furthermore, any waste generation would be acceptable to all disposal facilities.

Radioactive wastes generated at INL are generally divided into the following categories: low-level waste (LLW),[x] mixed low-level waste (MLLW),[y] and TRU. Waste quantities vary with different operations, construction activities, and implementation of waste minimization activities. Radioactive wastes are typically disposed of at offsite or onsite waste disposal facilities. From FY 2018 through FY 2021, MFC generated and disposed of an average of 1136.9 m^3 of LLW and MLLW per year (Table 4) (INL 2022).

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t Recyclable means material or objects that may be reclaimed or processed and used in the production of raw materials or products.

u Industrial waste means the solid waste generated by manufacturing and industrial and research and development processes and operations, including contaminated soil, nonhazardous oil spill cleanup waste and dry nonhazardous pesticides and chemical waste, but it does not include hazardous waste regulated under Subtitle C of the Solid Waste Disposal Act (42 U.S.C. 6921 et seq.), mining, or oil and gas waste.

v Hazardous waste is waste with properties that make it dangerous or capable of having a harmful effect on human health or the environment as defined by the Resource Conservation and Recovery Act (40 CFR § 239–282).

w Universal wastes are considered hazardous wastes that are subject to the universal waste requirements of 40 CFR § 273. These wastes include, but are not limited to, batteries, pesticides, mercury-containing equipment, light bulbs or lamps, and aerosol cans.

x Low-level radioactive waste is radioactive waste that is not high-level radioactive waste, spent nuclear fuel, transuranic waste, byproduct (as defined in Section 11e. (2) of the Atomic Energy Act, as amended), or naturally occurring radioactive material.

y Mixed low-level radioactive waste contains source, special nuclear, or byproduct material subject to the Atomic Energy Act, as amended, and a hazardous component subject to the Resource Conservation and Recovery Act.

Table 4. Summary of generated waste from MFC from FY 2018 through FY 2021.

Waste Type	Four Year Annual Average	
	Gross Volume (m^3)	Gross Mass (kg)
LLW		
CH-LLW	9.88E+02	1.09E+06
RH-LLW	1.08E+01	1.05E+04
CH-MLLW	1.35E+02	6.01E+04
CH-MLLW	3.13E+00	3.74E+03
Totals	1.14E+03	1.16E+06
Non-Radioactive Waste		
Recyclable	1.24E+01	8.04E+03
Universal	1.08E+00	3.56E+02
Hazardous	8.78E+01	2.65E+04
Industrial	4.91E+00	5.14E+03
TSCA[a]	3.72E-01	2.53E+02
Totals	1.07E+02	4.03E+04

a TSCA wastes include mercury, PCBs, lead, and other chemicals described in the Toxic Substances Control Act. These wastes are considered hazardous wastes.

3.8.2 Environmental Consequences

Potential impacts associated with the implementation of the MCRE project include the generation of waste from the integration of the MCRE project into the testbed, fuel salt synthesis, operations, PIE, and decommissioning.

During the integration phase the MCRE project is expected to generate a minimum quantity of installation waste ranging from small tools and packaging material used to transport and assemble the project components. This waste will consist of industrial, recyclable, and hazardous wastes (e.g., lead, brass, and circuit boards). Much of the construction waste will be recycled to the greatest extent possible. LLW and MLLW are not expected to be generated during construction activities.

Waste from the fuel salt synthesis process that is contaminated with process chemicals are expected to be designated as CH-LLW.[z] Waste will include stainless steel crucibles, stainless steel mesh, iron metal particles contaminated with process and residual chemical waste, uranium-containing concentrated process scrap material and metal slag, and containers. CH-LLW will be disposed of as routine glovebox waste according to the direction of INL Waste Generator Services. Based on the estimated 2.6 MT of fuel salt, it is projected that 8.16 m^3 of CH-LLW will be produced during the synthesis process (Table 5).

Most of the radioactive waste generated associated with the routine operations of the project are anticipated to be to CH-LLW. Routine operations are expected to include sampling activities, PPE, scrap metal, filters, wipes, rags, and radiological control supplies. It is expected that these wastes would be designated as CH-LLW. The projected radioactive waste generated during the MCRE project operations is approximately 0.91 m^3 of CH-LLW (Table 5).

z CH-LLW is low-level radioactive waste that can be handled directly by workers using appropriate PPE.

PIE waste includes, but is not limited to, laboratory samples of fuel salt, activated foils, filters, scrap metal, cellulosics, plastics, and rubber. Waste generated during PIE activities is expected to be CH-LLW or Remote Handled (RH)-LLW.[aa] The projected PIE waste generated during the MCRE project is approximately 5.33 m^3 of CH-LLW 0.57 m^3 of RH-LLW (Table 5).

Wastes generated during MCRE project decommissioning will include the reactor, flush salt, and all ancillary equipment. Based on an evaluation of the equipment inside and outside of the radiation shield, it is anticipated that CH-LLW and RH-LLW will be generated (INL 2022). Approximately 59 m^3 will be disposed of as RH-LLW, and 258 m^3 will be disposed of as CH-LLW (Table 5).

Table 5. Summary of projected radioactive waste generated from the MCRE project.

Project Phase	Waste Type	Total Waste Volume (m^3)	Percentage of MFC Generated Annual Waste
Fuel Synthesis	CH-LLW	8.16	0.64
Operations	CH-LLW	0.91	0.07
PIE	CH-LLW	5.33	0.41
	RH-LLW	0.57	0.044
Decommissioning	CH-LLW	257.54	19.97
	RH-LLW	59.41	4.61

Based on the projected radioactive waste quantities from the MCRE project, the majority of the MCRE project radioactive waste will occur during the decommissioning phase of the project (24.6%). It is anticipated that the waste generated during the decommissioning phase will cause a temporary increase in the overall waste generated at MFC. Radioactive waste generated during other project phases would be indiscernible from the annual radioactive waste generated at MFC.

Based on the projected amount of waste generated, is not expected that storage capacities of either onsite or offsite waste storage facilities will be permanently impacted (see Section 3.9, Transportation). LLW has a clear and accepted disposition pathway with little uncertainty, and the additional amounts contributed from the MCRE project would have a negligible direct or indirect impact on the aggregate LLW inventory. Any potential impacts would be temporary and minor in nature when compared to current operations when combined with past, present, and reasonably foreseeable future actions.

3.9 Transportation

3.9.1 Affected Environment

Truck shipments and commuters from Bonneville, Bingham, Bannock, Madison, Butte, Jefferson, and Clark counties access the INL Site from U.S. Highway 20, U.S. Highway 26, or Idaho State Highway 33 (Figure 7). Highway 20 is the closest public road and the only access to MFC. The closest interstate highway to the INL Site is Interstate 15 (I-15), which is east of the INL Site and is the major transportation route from the local area to places beyond eastern Idaho. Truck shipments to and from the INL Site primarily enter the region on the I-15 and reach the Site along either U.S. Highway 26 from Blackfoot, Idaho, or U.S. Highway 20 from Idaho Falls, Idaho.

aa RH-LLW is low-level radioactive waste that emits radiation, which can penetrate container walls and human skin, making it unsafe for workers to handle directly and requires remote-handling equipment to protect workers.

3.9.2 Environmental Consequences

The MCRE project at INL would involve non-radiological shipments from offsite manufacturing facilities. These shipments will consist of MCRE project equipment, including the reactor and other material necessary for successful integration of the project into the testbed. No radiological shipments to INL are expected because the radiological material is already located at MFC. It is anticipated that the normal transport of this material would not adversely impact the public as all shipments would adhere to Department of Transportation requirements and would be similar to other nonhazardous material shipments received on the INL Site.

It is anticipated that the MCRE project will add an additional 41 INL Industrial Waste Landfill radiological shipments of LLW. The transportation of other types of hazardous waste from INL is also expected to be minimal. Shipments of LLW and other hazardous waste from INL are a regular occurrence and are described in DOE/EIS-0200, "Waste Management Programmatic Environmental Impact Statement for Managing Treatment, Storage, and Disposal of Radioactive and Hazardous Waste" (1997). The packaging and transportation of hazardous waste is strictly regulated and is conducted in accordance with the U.S. Department of Transportation regulation, 49 CFR § 100–185, and DOE Order 460.1D, "Hazardous Materials Packaging and Transportation Safety" (2016). It is anticipated that the normal transport of LLW and other hazardous waste from INL would not adversely impact the public. Any potential impact would be low.[bb]

Onsite shipments containing radiological materials undergo an extensive safety analysis and review process to ensure proper safety plans are developed and implemented. Accidents are not likely to occur more than once in every 100,000 miles on public roadways (NRC 2012). Minor accidents are even less likely to occur on the INL Site because of the low transport speeds and because access along the INL transportation route will be restricted. The total number of miles traveled on the INL Site per year is expected to be less than 1,000. Based on mileage alone, the likelihood of a minor accident would be small.

A small increase in worker commuter traffic is not anticipated to adversely impact the existing level of roadway service that services the INL Site. The addition of approximately 10 new staff members to support the MCRE project would not cause a major increase in traffic, and it is anticipated that traffic will generally flow at the posted speed limits to and from the INL Site.

It is anticipated that the MCRE project would have low-to-negligible impact on the transportation network that serves the INL Site. These impacts would be nearly indiscernible from current operations when combined with past, present, and reasonably foreseeable future actions. Cumulative impacts would be low.

bb Annually, about three million radioactive materials packages are shipped in the United States by highway, rail, air, and water. DOE successfully completes thousands of shipments each year. The shipments have included a variety of waste types, such as low-level radioactive waste, primarily by highway and rail (DOE 2020).

3.10 Worker and Public Health and Safety

3.10.1 Radiation Exposure and Risk

3.10.1.1 Affected Environment

DOE monitors radiation in the environment and the exposure of workers and calculates the radiation doses of members of the offsite general public and workers on the INL Site. Historically, the dose to the MEI has been in the range of hundredths of an mrem/year and less than 1% of the 10 mrem/yr, which is the federal standard (40 CFR § 61 Subpart H) for radionuclide emissions from DOE facilities. For calendar year 2022, the dose to the public MEI from INL Site operations was 6.7×10^{-2} mrem/yr. The risk of developing an LCF from this dose is less than one in one million.[cc]

The annual dose to an individual from INL Site operations is several orders of magnitude less than the average dose of 381 mrem/year from exposure to natural background radiation for someone living on the Snake River Plain (DOE-ID 2022b). Potential impacts from radiological air emissions are discussed in Section 3.3.1.

To protect workers from impacts from radiological exposure, 10 CFR § 835 imposes an individual dose limit of 5,000 mrem (5 rem) per year. Additionally, worker doses must be monitored and controlled below the regulatory limit to ensure that individual doses are less than a DOE administrative limit of 2,000 mrem (2 rem) per year, as detailed in DOE-STD-1098-2017, "Radiological Control," and maintained ALARA (2017). INL imposes further ALARA considerations through a 700 mrem/yr administrative limit for worker dose.

To protect the public against undue risk from radiation associated with radiological activities conducted under the control of DOE, DOE O 458.1, "Radiation Protection of the Public and the Environment," establishes the public dose limit at a total effective dose not to exceed 100 mrem/yr above background radiation levels.

3.10.1.2 Environmental Consequences

As described in Section 3.3, the potential dose to an offsite member of the public from unabated emissions associated with the MCRE project is estimated to be approximately 2.4×10^{-3} mrem/yr. This is less than 4% of the 2020 dose to the public MEI from all INL Site operations and is significantly less than the 10 mrem/year regulatory standard for all sources. Therefore, the MCRE project dose contribution to the cumulative offsite dose from other INL Site operations would be low.

Fuel salt synthesis at the FMF will use existing processes in compliance with the limitations set in 10 CFR § 835 and DOE-STD-1098-2017. Gloveboxes used during fuel salt synthesis will use shielding and radiological designs that adequately limit operator radiological exposure. Regulations require that all activities are conducted following the ALARA dose principle.

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cc For comparison, the American Cancer Society estimated in 2021, that from the U.S. population of about 330 million, about 1.9 million new cancer cases would be diagnosed and about 608,570 cancer deaths would occur. About 30% of U.S. cancer deaths are estimated to be caused by tobacco use. The average U.S. resident has about 4 in 10 chances of developing an invasive cancer over his or her lifetime (41% probability for males, 39% for females) (American Cancer Society 2021).

INL Site workers receive the same dose as the general public from background radiation. Some workers may receive an additional dose from working in facilities with nuclear materials. The MCRE project would require an estimated total 40 operation workers that could receive a measurable dose over the project life. Each MCRE project operation worker would be expected to receive a total effective dose of approximately 62.27 mrem per year (INL 2022). During fuel fabrication, the MCRE project would require about 20 workers who could receive a total effective dose of approximately 174.0 mrem per year (INL 2022). During operations and defueling, the MCRE project would require about eight workers who could receive a total effective dose of approximately 69.4 mrem per year each (INL 2022). During decommissioning, the MCRE project would require approximately 22 workers who could receive a total effective dose of approximately 30.4 mrem per year each (INL 2022). All potential doses are well within the administrative control level for INL workers (700 mrem per year). During all operations, DOE would implement measures to minimize worker exposures and maintain doses ALARA, including the use of shielding, personal protective equipment, and training mock-ups to improve the efficiency of operations and reduce exposure times.

For comparison, the average collective total effective dose (TED)[dd] for INL employees from 2014 to 2019 was 84.7 person-rem, as shown in Table 6 (DOE 2021b). Operating the MCRE project is anticipated to add approximately 2.1 person-rem to the INL Site's average worker occupational exposure (collective TED).

Table 6. Annual radiation dose to INL workers during operations 2014 to 2019.

Year	Collective TED (person-rem)	Number with Measurable Dose	Avg Measured TED (rem)	Radiological Risk[a]
2014	61.292	1257	0.049	0 (0.04)
2015	71.814	1437	0.05	0 (0.04)
2016	92.67	1273	0.073	0 (0.06)
2017	123.232	1331	0.093	0 (0.07)
2018	82.66	1368	0.060	0 (0.05)
2019	76.511	1203	0.064	0 (0.04)
AVERAGE	84.70	1311.5	0.065	0 (0.05)

a Represents the probability of the occurrence of an LCF for an individual or a population group from exposure to ionizing radiation or other carcinogens when the number of latent cancer fatalities is less than one. Calculated using a dose conversion factor of 6×10^{-4} LCF per rem (6×10^{-7} per mrem). Values in parentheses are calculated values. A value of less than 0.5 is considered to result in no LCFs. There are questions in the scientific community regarding over estimation of LCFs by using the linear no-threshold theory.

Activities associated with the MCRE project decommissioning will be performed in existing INL facilities. INL would monitor worker dose and take appropriate action to limit the individual worker dose to be below the INL 700 mrem annual administrative control level. DOE-STD-1098-2017 identifies an effective ALARA process as including implementation of both engineered and administrative controls to manage worker dose. All equipment and operations would be designed and implemented following this principle. Further worker protection would be incorporated into the final decommissioning process to ensure worker doses are ALARA. The dose received by workers would be monitored and limited for decommissioning activities at any facility in accordance with regulatory limits.

dd TED is the sum of the effective dose (for external exposures). An effective dose is the summation of the products of the equivalent dose received by specified tissues or organs of the body and the appropriate tissue weighting factor. It includes the dose from radiation sources internal or external to the body.

The average dose to the individual worker (involved worker) and the cumulative dose to all INL Site workers (total workers) are significantly below the radiological regulatory limits of 10 CFR § 835. The MCRE project potential impact to worker and public health and safety from direct radiation and radiological emissions are expected to be low and will provide a low contribution to the existing baseline doses.

3.10.2 Non-Radiological Health and Safety

3.10.2.1 Affected Environment

Non-radiological exposures are controlled through programs intended to protect workers from normal industrial hazards. Activities at INL are controlled by the safety and health regulations for DOE contractor workers governed by 10 CFR § 851, which established requirements for worker safety and health programs to ensure DOE-contracted workers have a safe work environment. Provisions are included to protect against occupational injuries and illnesses, accidents, and hazardous chemicals.

Project activities occurring at offsite facilities would be subject to Occupational Safety and Health Administration standards for those specific industries. Considering that these activities would occur in facilities that operated under these industry-specific standards, workers are expected to have a safe work environment and be protected against occupational injuries and illnesses, accidents, and hazardous chemicals. Furthermore, considering these facilities are established in their respective areas, it is also anticipated that there would be controls in place to prevent accidents or injuries to the general public.

3.10.2.2 Environmental Consequences

Potential impacts from noise, chemical exposure, and occupational injuries are and would continue to be regulated to protect human health. Per 10 CFR § 851, employee exposures to hazardous agents are maintained below the American Conference of Governmental Industrial Hygienists threshold limit values, the Occupational Safety and Health Administration permissible exposure limits, and other applicable standards as defined by DOE. When exposure limits defined by the various agencies conflict, INL policy is to comply with the most stringent limit.

Hazardous materials (radiological and chemical) at the INL Site are minimized to those necessary to accomplish the mission. The MCRE project will follow site-wide and facility/project-specific plans and procedures for handling and storing hazardous materials.

Standard industrial hazards are hazards that are routinely encountered in general industry and construction. For these hazards, national consensus codes and standards (e.g., OSHA standards and DOE-prescribed occupational safety and health standards) guide safe design and operation of the MCRE project. In accordance with the guidelines in DOE-STD-1027-2018, "Hazard Categorization of DOE Nuclear Facilities" (2019), and DOE-STD-3009-2014, "Preparation of Nonreactor Nuclear Facility Documented Safety Analysis" (2014), a special analysis is not required for these occupational hazards unless they are possible initiators for an uncontrolled release of radioactive or hazardous material.

The level of exposure to non-radiological hazards, the regulatory requirements for managing those hazards, and the existing exposures are not anticipated to change. Therefore, the potential impacts from exposure to normal industrial hazards at INL would be low.

3.10.3 Facility Accidents

A safety basis describes the nuclear facility hazards and the risks to the workers, the public, and the environment and defines the safety-related equipment, procedures, and practices used to adequately control those hazards. To support the development of a DSA[ee] for the MCRE project, hypothetical events are identified that are evaluated to determine the potential accident consequences and identify appropriate safety SSCs necessary to ensure the prevention and mitigation of functions. Furthermore, per the recommendations from "Recommendations for Analyzing Accidents under the National Environmental Policy Act" (DOE 2002), the collective impact to a population is determined. The DSA development for the MCRE project is ongoing and will include a set of safety SSCs and their associated, required safety functions to avoid unacceptable consequences. The safety SSCs for the MCRE project are assigned a safety classification based on whether they perform a required safety function, provide environmental conditions for the performance of safety functions, or provide significant DID protection.

MCRE is a relatively small, low-power density, low burn-up reactor that is fueled with a molten uranium chloride salt. The reactor is designed to survive a wide variety of off-normal, upset, or accident conditions. The typical safety response for the reactor is to shut down, and after an in-vessel shutdown period, the reactor response is to offload the reactor fuel to the drain tank. Following the fuel offload, the system is passively safe with no further actions necessary.

The primary hazard for a facility release is the irradiated fuel. In the event of a release of irradiated fuel, the LOTUS testbed will perform the confinement function for non-gaseous fission products, and the MCRE CGS will contain a portion of the gaseous fission products.

A theoretical possibility is that a severe accident could occur that challenges the plant design basis. Thus, a maximum, reasonably foreseeable accident assumed to be initiated by operator error, equipment failure, or a severe natural phenomena hazard is evaluated for this project (INL 2022). The hypothetical accident scenario includes a reactor boundary breach that results in a portion of fuel leaks into the reactor cell.

If this type of event were to occur, it is assumed that a plume of fission products would disperse from the testbed. Under this scenario, it is assumed that some hypothetical receptors would be unaware of the accident, so emergency actions would not be taken for protection. Therefore, the receptors would be susceptible to the entire potential dose. By way of the calculated TED, the evaluation estimates the collective impact to the population of co-located workers and a member of the public at the nearest INL Site boundary, the nearest population zone, and the city of Idaho Falls (INL 2022) (Table 7).

Table 7. Summary of dose impacts for the highest postulated accident consequences for the MCRE project (INL 2022).

Receptor (distance)	Dose (TED) person-rem	LCF Risk[a]
Co-located worker (100 meters)	9.04	0 (5.42×10^{-2})
Nearest Site Boundary (4700 meters)	1.36×10^{-2}	0 (8.16×10^{-6})
Nearest Low-Population Zone (~32,000 meters)	1.78×10^{-2}	0 (1.07×10^{-5})
Idaho Falls (~48,000 meters)	7.51×10^{-3}	0 (4.51×10^{-6})

a Calculated using a dose conversion factor of 6×10^{-4} LCF per rem. Values in parenthesis are calculated values. A value of less than 0.5 is considered to result in no LCFs.

ee A DSA is the formal document that is required by 10 CFR 830.294. A DSA includes a systematic identification of the hazards, analyses of potential accidents, and analyses of measures to eliminate, reduce, control, and mitigate the hazards. A DSA is a living document that must change as the facility configuration or operations are modified or change.

Adverse consequences from significant releases of radioactive or hazardous materials are limited by MCRE size, fuel type, and fission product inventory. However, DOE requirements for emergency planning, as described in DOE Order 151.D, "Comprehensive Emergency Management System" (2016), state that distances to site boundaries on DOE facilities and additional safety management programs, including the MCRE project DID strategy, are used to mitigate consequences from extremely low probability events. In all cases, the release of fission products during normal operations, as described here, is within the guidelines for public exposure under severe accident conditions (see Section 3.3, Air Quality). Existing low-population exposures to humans from radiation resulting from a hypothetical accident with the MCRE project would remain low. When combined with past, present, and reasonably foreseeable actions at INL, the cumulative effects of the evaluated hypothetical accident (i.e., any accidental release of radioactive material) is anticipated to be low.

3.10.4 Emergency Preparedness

DOE Order 151.D, "Comprehensive Emergency Management System," describes detailed requirements for emergency management DOE must implement (2016). Each DOE site, facility, and activity, including the INL Site, establishes and maintains a documented emergency management program that implements the requirements of applicable federal, state, and local laws, regulations, and ordinances for fundamental worker safety programs (e.g., fire, safety, and security). In addition, each DOE site, facility, and activity containing hazardous materials (e.g., radioactive materials or certain chemicals that do not fall under the purview of fundamental worker safety programs) establishes and maintains an Emergency Management Hazardous Materials program. Finally, each site that receives or initiates shipments managed by the Office of Secure Transportation must be prepared to manage an emergency involving such a shipment, should that emergency occur onsite.

The emergency management system at INL includes emergency response facilities and equipment, trained staff, and effective interface and integration with offsite emergency response authorities and organizations. INL maintains the necessary apparatus, equipment, and a state-of-the-art Emergency Operations Center in Idaho Falls to respond to emergencies not only at INL but throughout the local communities.

A readiness assessment will be completed prior to the integration of the MCRE project into LOTUS, fuel synthesis at FMF, and MCRE operation to demonstrate that there is a reasonable assurance that operations are performed safely and provide adequate protection for workers, the public, and the environment. The readiness assessment includes, but is not limited to, an evaluation of safety management programs; operational interfaces, selection, training, and qualification of operations and support personnel; implementation of facility safety documentation; programs to conform and periodically reconfirm the condition and operability of all safety and support systems; procedures; emergency management; and conduct of operation processes.

3.11 Environmental Justice

3.11.1 Affected Environment

Consideration of environmental justice in NEPA analysis is driven by Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," and is further supported by Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad," and Executive Order 14096, "Revitalizing Our Nation's Commitment to Environmental Justice for All" and accompanying guidance (CEQ 1997; IWG 2017). The executive orders effectively direct federal agencies to identify disproportionately high and adverse human health or environmental effects of federal programs, policies, and activities on minority, low-income, and minority and low-income populations and to take action to address such impacts. The definitions used for minority,

low-income, and minority and low-income populations in this document are consistent with the definitions within the executive orders and guidance.

In evaluating potential impacts on populations in closer proximity to MFC, radial distances of 15, 25, and 50 miles were analyzed at the Census block-group level (which is the smallest geographic area within which the U.S. Census Bureau provides data). Minority and low-income populations are evaluated using an absolute 50% and a relative meaningfully greater[ff] percentage criteria for potentially affected block groups in the identified radial distances. If a block group's percentage of minority or low-income individuals exceeds 50% of the potentially affected populations or is more than 1.2 times the percentage of the total minority population, then the block group is identified as having a minority or low-income population. Table 8 describes the minority and low-income composition of the potentially affected area surrounding MFC at each of the radial distances.

The radial distance of 50 miles of INL's MFC is considered the Region of Influence (ROI). A 50-mile ROI was selected for environmental justice because it focuses on the resource areas where an impact could potentially occur (e.g., radiological air emissions, transportation issues, and socioeconomic influences). The potentially affected area for environmental justice includes parts of 14 counties throughout Idaho.

The total population residing within the 50-mile ROI is approximately 253,454, of which 44,780 people (17.7% of the population) are in a minority population (U.S. Census Bureau 2022) (Table 8). The meaningfully greater criterion for minority populations is 21.2%. The overall composition of the projected populations within every radial distance is predominantly nonminority. Minority populations within the 50-mile ROI are predominantly White Hispanic or other minority. The concentration of minority populations is greatest within the 25-mile radial distance. American Indian and Alaska Native populations comprise approximately 2% of the population within the 50-mile radial distance because the Fort Hall Reservation of the Shoshone-Bannock Tribes lies largely within the ROI (Table 8). In total, minority populations represent less than 50% of the total population of the ROI at radial distances.

Table 8. Minority and low-income populations within the 50-mile radius of MFC.

Population Group	Within 15 Miles		Within 25 Miles		Within 50 Miles	
	Population	Percent of Total	Population	Percent of Total	Population	Percent of Total
Total Population	1,496	100	4,154	100	259,367	100
Nonminority	908	60.8	2,911	70.1	214,095	82.5
Total Minority	588	39.2	1,243	29.9	45,272	17.5
White – Hispanic/Latino	541	36.1	1,147	27.6	31,932	12.3
Black/African American	0	0	0	0	956	0.4
American Indian or Alaska Native	5	0.3	18	0.4	4,192	1.6

[ff] Meaningfully greater is defined as a minority or low-income population percentage in a block group within the ROI that is 1.2 times the percentage of the total minority or low-income population within the comparison population.

Population Group	Within 15 Miles		Within 25 Miles		Within 50 Miles	
	Population	Percent of Total	Population	Percent of Total	Population	Percent of Total
Other Minority[1,2]	42	2.8	78	1.9	8,192	3.2
Low Income[3]	133	8.9	332	8.0	20,497	7.9

Source (U.S. Census Bureau 2022)

Includes persons who also indicated Hispanic or Latino origin.

Other Minority includes all combined individuals of Asian, Native Hawaiian and Other Pacific Islanders, Some Other Race, or Two Races.

Low-income is defined as a household income between $25,000–50,000 annually (U.S. Census Bureau 2022). The U.S poverty rate for a family of five individuals for 2022 is less than or equal to an annual income of $32,470 (HHS 2022).

Of the total population living within the ROI, approximately 7.9% are identified as living below the U.S. poverty rate. Therefore, the meaningfully greater criterion of low-income populations is 9.5%. Of the total population identified, no block groups have a low-income population that exceeds the 50% criterion (Figure 11).

3.11.2 Environmental Consequences

When determining whether environmental effects from the MCRE project on minority or low-income populations are disproportionately high and adverse, DOE considered the following three factors:

1. Whether there is, or may be, an impact on the natural or physical environment that significantly and adversely affects minority or low-income populations.
2. Whether environmental effects are significant (as defined by 40 CFR § 1500–1508) and are, or may, adversely impact minority or low-income populations that appreciably exceeds, or is likely to exceed, the general population or another appropriate comparison group.
3. Whether the environmental effects occur, or may occur, in a minority or low-income population affected by cumulative or multiple adverse exposures from environmental hazards.

Under the proposed activities and the analysis provided in their respective sections, the potential impacts attributed to the MCRE project are anticipated to be low to negligible for factors of socioeconomics, worker and public health and safety, transportation, waste management, and air quality. Any potential impact to these resources from proposed activities are not anticipated to significantly and adversely affect minority or low-income populations more than the population at large within the ROI.

The potential radiological dose to the MEI (i.e., a member of the public located approximately 2 miles south of MFC outside of the INL Site boundary), regardless of minority or low-income status, was estimated to be 2.4×10^{-3} mrem/year. This number represents no appreciable change in dose exposure over natural background levels at the INL Site (i.e., 381 mrem/year) and is significantly less than both the 10 mrem/year regulatory standard and the minor source threshold of 0.1 mrem/year. Therefore, all other average individual doses at each radial distance from the project location would be smaller than this estimated amount and similarly would not represent an appreciable change in dose exposure over baseline levels.

Regarding potential impacts to communities who rely on subsistence consumption, ongoing monitoring from the entirety of INL operations does not indicate any health risks from radiation exposure directly or through subsistence consumption (DOE-ID 2022b). The total annual dose (via air and ingestion) estimated to be received by an MEI during 2021 was 0.07 mrem, which is below the regulatory limit of 100 mrem per year for a public dose (DOE-ID 2022b). When considering the estimated dose from the proposed activities, the overall levels of exposure would remain low and well below DOE and regulatory limits. Furthermore, as described in Sections 3.3 and 3.4 there would be low-to-negligible impacts to these resource areas that may affect offsite populations (including Native American populations) or subsistence resources. Land disturbance at the INL Site from the proposed activities would be negligible as the project would occur within an existing facility. Therefore, any potential impact to communities that rely on subsistence consumption (including Native American populations) would be negligible.

Considering the low levels of risk exposure from project activities and the location of minority and low-income populations in relation to the project site (Figure 11 and Figure 12), the overall levels of exposure from the MCRE project is not expected to (1) significantly impact or adversely affect the natural or physical environment, (2) adversely impact a minority or low-income population in a manner that would exceed any impact on the general population, or (3) expose a minority or low-income population group to an environmental hazard more than the general population when considering cumulative impacts. In total, when considering any direct or indirect impacts in conjunction with past, present, and reasonably foreseeable future actions, any impact as a result of the proposed action would be considered low to negligible as it relates to any potential disproportionately high, adverse impacts on minority or low-income populations.

In accordance with DOE Order 458.1 and DOE-HDBK-1216-2015, environmental sampling would continue to be performed at several locations on the INL Site, at the INL Site boundary, and at various distances from the INL Site, including locations at the Fort Hall Reservation of the Shoshone-Bannock Tribes. These efforts would ensure that any potential adverse effects on the populations surrounding the INL Site would be limited. The status of environmental sampling can be reviewed in the latest “Idaho National Laboratory Site Environmental Report” (DOE-ID 2022b).

Any potential impact to the Fort Hall Reservation of the Shoshone-Bannock Tribes, members, or their use of sacred and traditional-use areas, natural landscapes, water, and ecological resources on or near the INL Site that are significant to them would be limited. The MCRE project would not limit access to these resources as all proposed activities would occur in existing facilities. It is not expected that radiological activities would significantly affect terrestrial or aquatic biota populations, thus subsistence resources available to those on the Fort Hall Reservation would not be impacted.

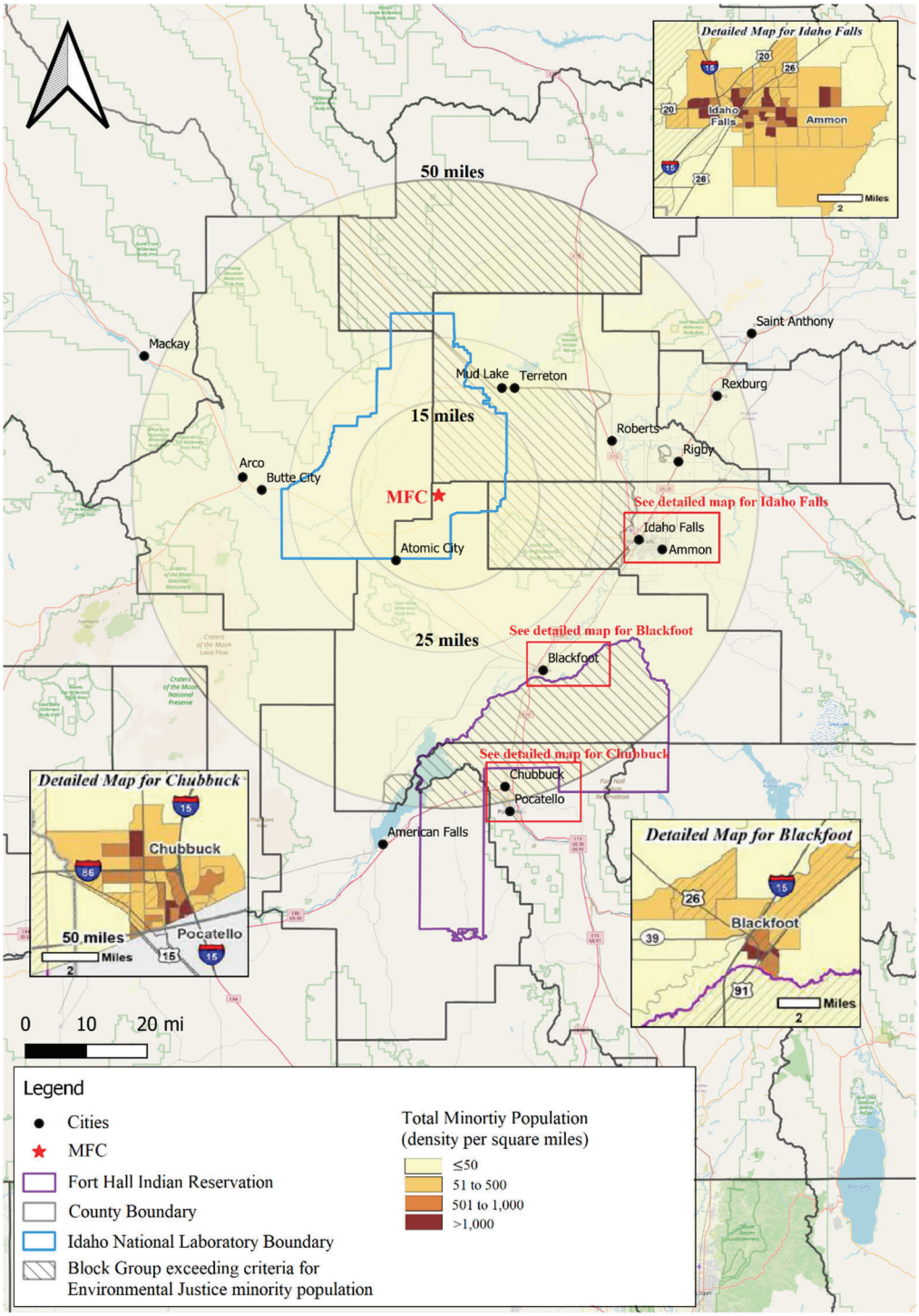

Figure 11. Locations of Census block groups meeting the criteria for environmental justice minority populations. Note: There are no minority populations residing within the INL boundary although the Census block groups identify minority populations. The Census block group does cross into the INL boundary.

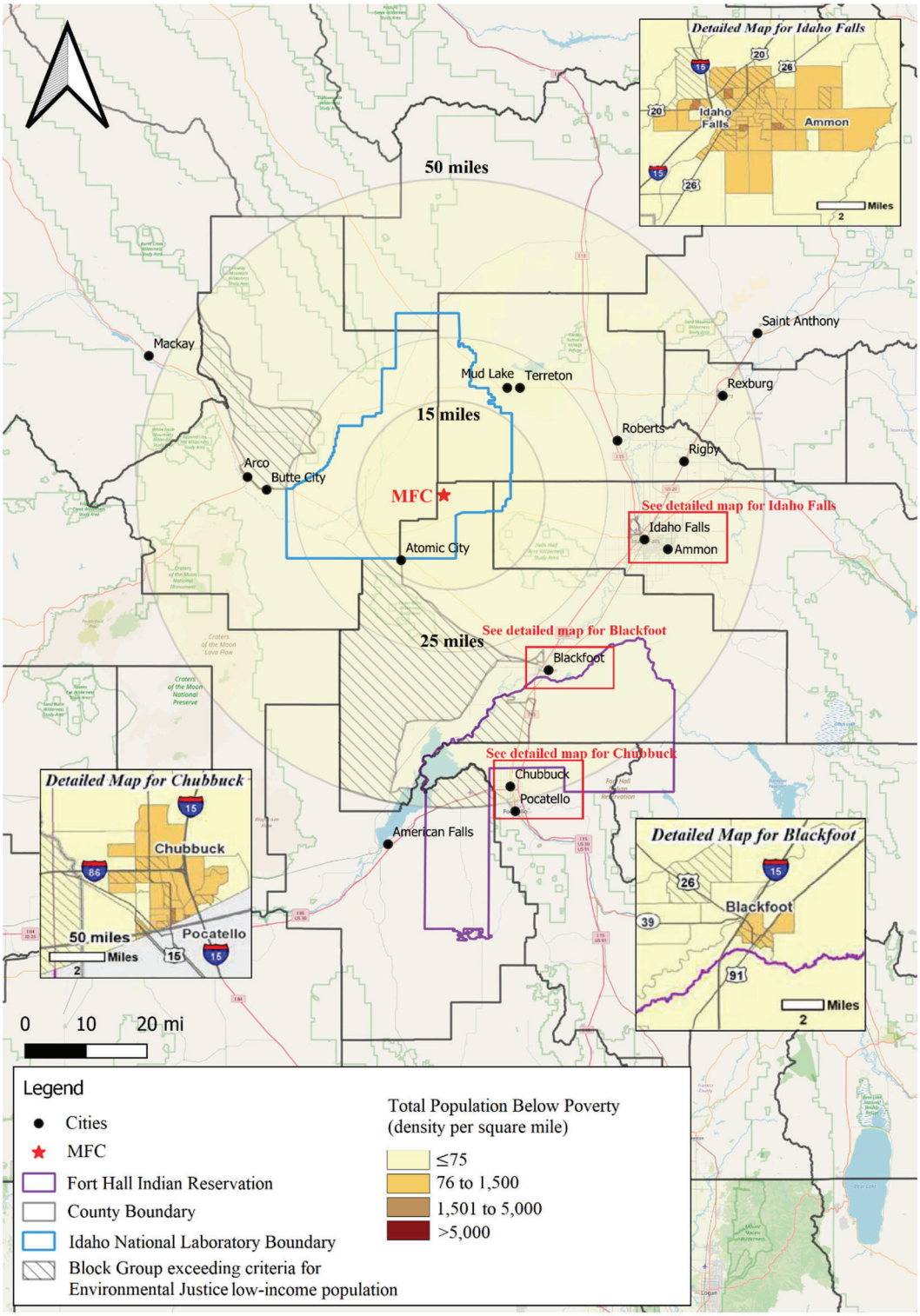

Figure 12. Locations of Census block groups meeting the criteria for environmental justice low-income populations.

3.12 Intentional Destructive Acts

INL routinely uses a variety of measures to mitigate the likelihood and consequences of intentional destructive acts. DOE maintains a highly trained and equipped Protective Force intended to prevent attacks against and entry into facilities and to mitigate the potential for an act of sabotage to occur onsite.

Whether an intentional destructive act were to occur—including its exact nature, location, and consequential magnitude—is inherently uncertain. However, MCRE project activities would be performed within the highly secure ZPPR cell and FMF protected area, under a high level of security at MFC. If an intentional destructive act involving the ZPPR cell or FMF occurred, then the potential consequences would be dependent on the amount of fissile material in those facilities at the time of the event. This hypothetical scenario could potentially be similar to the maximum reasonably foreseeable accident as described Section 3.10.3.

3.13 Irreversible and Irretrievable Commitment of Resources

Irreversible commitment of resources refers to the loss of future options for resource development or management, especially of nonrenewable resources such as cultural resources. The implementation of the MCRE project would not require the disturbance of soil, conversion of current land uses, or disturbance of habitat. All activities would occur in existing facilities designed to support the proposed activities. The MCRE project would require the irretrievable commitment of nonrecyclable materials for the fabrication of project equipment, fuel consumed by equipment and vehicles, and the energy consumed by the project.

3.14 Relationship Between Short-Term Use of Resources and Long-Term Productivity

The proposed action or no-action alternatives would not result in a substantial change to the existing condition. Therefore, there would be no impact from the short-term use versus long-term productivity due to the MCRE project. The results of the MCRE project will contribute to the commercialization of the MCFR technology and be beneficial in the long-term productivity of non-carbon sources of energy production.

3.15 Conclusion

The selection of any alternative would not exceed a regulatory limit or standard (e.g., air emissions), capacity of a specific resource (e.g., ecological resources), or infrastructure and utilities capability to provide services (e.g., waste treatment) for the MCRE project. Based on the impact analysis associated with the proposed action implementation, potential adverse impacts were not identified that would require additional mitigation measures beyond those required by regulations, permits, and agreements or achieved through design features and best management practices. Any adverse impact is considered to be minor and will neither destabilize any important attribute of the resource or the environment as described in the ASER (DOE-ID 2022b). Many potential impacts will be indistinguishable from the existing environment of INL Site operations. However, these potential impacts, in conjunction with other past, present, and reasonably foreseeable future actions, would not result in long-term cumulative impacts. Finally, based on the analysis provided in this document, it is anticipated that any potential impact would not significantly affect the quality of the human environment.

4. COORDINATION AND CONSULTATION

4.1 State of Idaho

DOE briefed staff from the Idaho Office of Energy and Mineral Resources on the MCRE project on March 8, 2023.

4.2 Shone-Bannock Tribes

DOE briefed the Shoshone-Bannock Tribal staff and Fort Hall Business Council on the MCRE EA and project on April 3, 2023.

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APPENDIX A

Agency and Public Comments Received on the Draft Environmental Assessment and DOE-NE Response

This appendix consists of responses to comments received on the Draft Environmental Assessment (EA) for the Molten Chloride Reactor Experiment (MCRE) project. DOE values the state, tribal, and public comments received and has made revisions to the final EA based upon comments received or to clarify this EA as needed.

The initial comment period for the Draft EA for the MCRE Project ended on March 31, 2023. DOE extended the comment period to April 14, 2023, in response to extension requests. DOE received and considered numerous comments from interested parties and groups. The following pages provide DOE's responses to the comments. This document is being prepared as an appendix to the final EA, and DOE will send copies to those individuals and groups who gave DOE comments. This document will also be available online and to other interested parties upon request. Comments are organized by commenter in the order that they were received (Table A-1).

Forty-seven comments were received during the public comment period. Most of the comments focused on the following: (1) the experimental value of a molten salt reactor, (2) the public comment period, (3) the aquifer, (4) safety, (5) use of tax dollars, and (6) legacy waste. Many commentors expressed their general opposition or support for DOE's action. Comments focusing on activities, such as past business practices; perceived mismanagement, fraud, waste, and abuse; and ethical responsibility, were noted but no further responses were prepared as they are outside the scope of the EA. Table A-1 provides DOE's responses to comments on a comment-by-comment basis. Comments that were captured in a letter or other separate document submitted to DOE are presented in this appendix and included in Table A-1.

Table A- 1. Comment response matrix.

Comment ID Number	Date	Name and Affiliation (if provided)	Comment	DOE Response
1	3-16-2023	David Wilfert	Question/Comment on the Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE). How much of real value will be learned from this test reactor that wasn't already learned with the Molten Salt Reactor Experiment (MSRE) in OakRidge?	As stated in Section 2.1.1, the primary objective of the proposed action is to reduce the technical, regulatory, and operational/human factors risks to support a future commercial reactor design. DOE prepared the EA to assess the environmental impacts of the proposed action. MSRE was a graphite moderated, thermal spectrum, fluoride salt reactor. As stated in Section 2.1.1, the MCRE project is a fast-spectrum circulating fuel reactor. DOE is leveraging the experience with MSRE where appropriate; however, additional research is still needed to generate data on key phenomena relevant to the design and safe operation of the molten chloride fast reactor (MCFR) to aid in future licensing and commercial deployment of this technology.
2	3-17-2023	Nic Thompson	I support the MCRE for many reasons. Mainly, we need inexpensive, safe, and abundant nuclear energy and we need it soon. We are gambling with our future if we do not speed up deployment of advanced reactor designs around the country. Thank you for your time.	DOE acknowledges your comment.
3	3-20-2023	James Sprinkle	In my opinion, the MCRE project should proceed. The proposed activity is consistent with previous work done at INL under a safe and secure process and does not introduce new risks.	DOE acknowledges your comment.
4	3-22-2023	Jill ZamEk	I am requesting an extension for the public comment deadline on the draft EA for Bill Gates/Southern Co. Molten Chloride Reactor Experiment planned for Idaho. 14 days to comment is inadequate.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall “make the finding of no significant impact available for public review 30 days before the agency makes its final determination” because the proposed action is closely similar to one that normally requires the preparation of an EIS.

Comment ID Number	Date	Name and Affiliation (if provided)	Comment	DOE Response
5	3-22-2023	Tom Clements, Savannah River Site Watch	I hereby request a 30-day extension of the comment period for the draft Environmental Assessment on the Molten Chloride Reactor Experiment (MCRE) Project at the Idaho National Laboratory. The notice about the comment period said "The 14-day public comment period on the draft environmental assessment begins on March 17, 2023, and concludes on March 31, 2023." 14 days is entirely too short in which to comment. I find it interesting that DOE places high importance on the MCRE - "The Department is committed to reviving and expanding domestic nuclear energy research and development infrastructure and supporting the development of transformational advanced reactor nuclear technologies so that innovative reactor concepts can be licensed and deployed by commercial entities to meet specific user requirements. This will play a crucial role in helping the United States reach net-zero emissions by 2050." - yet the briefest of time periods is allotted for public comments, with no reason given for such a short period of time (which is far shorter than other DOE comment periods with which I'm familiar). As the brief comment period is totally incongruent with the high level of importance that DOE places on the project, I thus request a 30-day comment period extension. If the MCRE project does, in fact, play a "crucial role" in our energy future it would be best, in my opinion, if you take the time to make sure that the public is afforded a longer period of time in which to comment. Thank you for including this request as part of the EA record on the MCRE. And, thank you in advance for extending the comment period.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.
6	3-22-2023	Marilyn Elie	Extend the deadline for public comment period! We need more time to think about this and respond.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.
7	3-23-2023	Deb Katz, Citizens Awareness Network	DOE has given us 14 days to comment on the draft EA for Bill Gates/Southern Co. Molten Chloride Reactor Experiment planned for Idaho. This is to further the (stalled) Terrapower project planned for WY. Citizens Awareness Network is asking for an extension of the comment project. Fourteen day seems arbitrary and capricious.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.

Comment ID Number	Date	Name and Affiliation (if provided)	Comment	DOE Response
8	3-23-2023	Leigh Ford, Snake River Alliance	*See letter titled [DOE/EA-2209: Draft Environmental Assessment]* Request for Extension of Comment Period on The United States Department of Energy (DOE *Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE)* Project at the Idaho National Laboratory. The Snake River Alliance respectfully requests that the United States Department of Energy extend the public comment period on the above-referenced Draft Environmental Assessment by a minimum of sixty (60) days beyond the currently scheduled public comment deadline. The Snake River Alliance represents over 1000 members, supporters, and volunteers and has served as Idaho's Nuclear Watchdog and Clean Energy Champion for over forty years. We envision an Idaho where our people and our environment are free from the threat of nuclear waste and contamination, and our communities are healthy, strong, and prosperous because of our reliance on clean and renewable energy. The Idaho National Laboratory (INL) was built in 1949 on 890 square miles of public land in southern Idaho's high desert plain. Beneath that plain lies the Snake River Aquifer, the second-largest unified aquifer on the North American continent. This EPA-designated sole-source aquifer flows beneath INL, providing water for the Magic Valley, drinking water for more than 300,000 Idahoans, and supporting one of the state's richest agricultural regions with a growing population and diverse economy. The Shoshone-Bannock peoples have lived on and used the land for time immemorial. The 14-day public comment period for the MCRE draft environmental assessment began on March 17, 2023, and concludes on March 31, 2023. The U.S. Department of Energy (DOE) has given longer public comment periods and extended comment periods in the past. In early 2021 DOE extended the public comment period for the *Draft Versatile Test Reactor Environmental Impact Statement* (Draft VTR EIS) from 57 days to 71 days. The Department of Energy is asking for public comment on the MCRE Draft EA, which contains a variety of complex technological and scientific matters, and is an experiment that puts our EPA-designated sole-source aquifer at risk. Much of Idaho is rural, and lacks stable internet access. A 14-day comment period poses a significant barrier for many people to access the EA and submit comments. The development of thoughtful comments in the 14-day comment period provided is unachievable and is thus inconsistent with adequate, lawful public participation. The Snake River Alliance respectfully requests that DOE extend the public comment period for at least an additional 60 days, similar to the Draft VTR EIS. Thank you for considering this request.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.

Comment ID Number	Date	Name and Affiliation (if provided)	Comment	DOE Response
9	3-23-2023	David Kraft, Nuclear Energy Information Service	*See letter titled Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project – request to extend comment period* Nuclear Energy Information Service requests an extension of time to review the above named DEA. We request an extension from the listed 14 days out to 60 days. It is more than unreasonable to expect the lay public to gather resources and experts to competently review a highly technical subject in the 14 day span prescribed in the DOE's announcement and even pretend that truly critical analysis and informed consent could be obtained. The only thing achieved by the 14-day comment window is a check-box exercise, not meaningful public comment. Therefore we request that the new date be extended to May 15, 2023, 60 days after the March 15 announcement and posting. Thank you for your consideration of this request.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.
10	3-25-2023	Bryant Kusy	I agree with many of your initiatives and you've brought many good things into our world (maybe not Windows 95) but if you need radioactive materials for your reactors and storage for their blistering waste, would you please do this in your state of WA - perhaps near your super cool home? If it's such a good idea permits should be readily proffered. Idaho's aquifer supports MUCH of our state's agriculture and drinking water 💧 so could you set up shop near your house please?	As stated in Section 2.1.4, proposed activities would be contained entirely within the LOTUS testbed, FMF, and other analytical facilities at INL, as appropriate; and no liquid discharges would occur under normal operations. Section 3.2 states that the MCRE project would not include activities that physically or chemically alter ground or surface waters. The proposed project activities would not affect the Snake River Aquifer. DOE adheres to all applicable waste management statutes. Generated waste would be managed and dispositioned as addressed in Sections 2.1.10 and 3.8 of the EA, and all waste from the MCRE project has a path for disposition.
11	3-25-2023	Monte Wilson	Please send a paper copy of the draft environmental assessment	A paper copy of the draft environmental assessment was sent as requested.
12	3-25-2023	Larry Hyatt	Extend public comments time by at least a month	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.
13	3-25-2023	Barbara McClain	Please extend the comment period to be longer than 14 days	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final

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				determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.
14/15	3-25-2023	John Sinsky	Please extend the comment time for the Molten Chloride Reactor draft environmental impact statement. 14 days are totally unreasonable. Thank you! Please choose the No Action Alternative for the Molten Chloride Reactor plan. There hasn't been enough notice nor time for public comment.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS. DOE acknowledges your support of the no action alternative.
16	3-25-2023	Alida Bockino	As several renowned physicists have so aptly said, Molten salt reactors were trouble in the 1960's and they remain trouble today. If they are deployed, they would likely result in various safety and security risks. And they would produce several different waste streams, all of which would require extensive processing and would face disposal related challenges." I urge you to extend the comment period beyond 14 days to allow input from those of us who will suffer the consequences of these reactors.	As stated in Section 2.1.1, the primary objective of the proposed action is to reduce the technical, regulatory, and operational/human factors risks to support a future commercial reactor design. DOE prepared the EA to assess the environmental impacts of the proposed action. MSRE was a graphite moderated, thermal spectrum, fluoride salt reactor. As stated in Section 2.1.1, the MCRE project is a fast-spectrum circulating fuel reactor. DOE is leveraging the experience with MSRE where appropriate; however, additional research is still needed to generate data on key phenomena relevant to the design and safe operation of the molten chloride fast reactor (MCFR) to aid in future licensing and commercial deployment of this technology. Section 2.1.6 states hazard evaluations would be performed per DOE-STD-1189-2016 and a DSA be prepared to comply with 10 CFR 830 to ensure protection of the public, workers, and environment for the MCRE project. DOE adheres to all applicable waste management statutes. Generated waste would be managed and dispositioned as addressed in Sections 2.1.10 and 3.8 of the EA, and all waste from the MCRE project has a path for disposition. As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.
17	3-25-2023	Alida Bockino	As several renowned physicists have so aptly said, Molten salt reactors were trouble in the 1960's and they remain trouble today. If they are deployed, they would likely result in various safety and security risks. And they would produce several different waste streams, all of which would require extensive processing and would face disposal related challenges."	As stated in Section 2.1.1, the primary objective of the proposed action is to reduce the technical, regulatory, and operational/human factors risks to support a future commercial reactor design. DOE prepared the EA to assess the environmental impacts of the proposed action. MSRE was a graphite moderated, thermal spectrum, fluoride salt reactor. As stated in Section 2.1.1, the MCRE project is a fast-spectrum circulating fuel reactor. DOE is

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			Radioactive waste is a huge concern, especially considering that Idaho's aquifer, the lifeblood of Idaho, percolates beneath this nuclear activity. Workers have been cleaning up a legacy of waste for decades; it's senseless to create more dangerous waste that will stay in Idaho. I urge you to reject this proposal and protect the health and safety of the citizens of Idaho who will suffer the negative consequences of these reactors.	leveraging the experience with MSRE where appropriate; however, additional research is still needed to generate data on key phenomena relevant to the design and safe operation of the molten chloride fast reactor (MCFR) to aid in future licensing and commercial deployment of this technology. DOE takes its responsibility for the safety and health of the workers and the public seriously. Section 2.1.6 states hazard evaluations would be performed per DOE-STD-1189-2016 and a DSA be prepared to comply with 10 CFR 830 to ensure protection of the public, workers, and environment for the MCRE project. DOE adheres to all applicable waste management statutes. Generated waste would be managed and dispositioned as addressed in Sections 2.1.10 and 3.8 of the EA, and waste from MCRE project has a path for disposition.
18	3-25-2023	Michael McClay	Please Extend the Public Comment Period on the Molten Lava project.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.

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19	3-25-2023	Deanna Smith	Please extend the public comment period on this critical decision. At a time when the world needs to be focusing on real solutions to energy - from continuing to elevate strategies and technologies to use less as we have been doing for the last 30 - 40 years quite successfully to continuing to grow solar, wind and other sources with far fewer environmental consequences we should NOT be cutting corners to develop a technology that has yet to be determined safe or even necessary. The history of nuclear has been fraught with problems that remain unsolved today. Bringing this experimental technology to Idaho could be potentially devastating to our ground water and as such our agriculture. Idahoans need more than 14 days to review and comment on this draft proposal in order to ensure our ground water, agriculture and any other potential environmental threat is fully addressed. As an Idahoan, I urge DOE to choose the NO ACTION ALTERNATIVE on this draft.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS. Evaluating nuclear energy's place in the energy market is out of scope of this effort. Analysis of alternate renewable energies is outside the scope of this analysis. The purpose of this EA is to assess the environmental impacts of the proposed action. As stated in Section 2.1.4, proposed activities would be contained entirely within the LOTUS testbed, FMF, and other analytical facilities at INL, as appropriate; and no liquid discharges would occur under normal operations. Furthermore, Section 3.2 states that the MCRE project would not include activities that physically or chemically alter ground or surface waters. The proposed project activities would not affect the Snake River Aquifer. DOE acknowledges your support of the no action alternative.
20	3-25-2023	Michael McClay	Please Extend the Public Comment Period on the Molten Lava project.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.
21	3-26-2023	Ann DeBolt	I am writing to let you know that more than 14 days are needed to properly review and comment on your draft Environmental Assessment to develop a molten chloride reactor in Idaho. This proposed action needs a proper review period of 60 days minimum. Otherwise, I urge you to select the No Action Alternative, or to develop a proper EIS.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS. DOE acknowledges your support of the no action alternative.

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22	3-26-2023	Diane M. Jones	As an Idahoan, I am truly concerned about the possibility of a new, experimental reactor being considered for the DOE site in E. Idaho Right above the Snake River aquifer. Generating nuclear waste to produce power is a short-sighted attempt to alleviate our climate problem. Please focus on safe, renewable energy, not nuclear. And not in Idaho.	As stated in Section 2.1.4, proposed activities would be contained entirely within the LOTUS testbed, FMF, and other analytical facilities at INL, as appropriate; no liquid discharges would occur under normal operations. Section 3.2 states that the MCRE project would not include activities that physically or chemically alter ground or surface waters. The proposed project activities would not affect the Snake River Aquifer. However, DOE recognizes the importance of the Snake River Plain Aquifer and will add a brief description in the Regional Setting section. DOE adheres to all applicable waste management statutes. Generated waste would be managed and dispositioned as addressed in Sections 2.1.10 and 3.8 of the EA, and waste from MCRE project has a path for disposition. As stated in Section 2.1.2 the MCRE project would not have power conversion equipment. The MCRE project is intended to reduce the technical, regulatory, and operational/human factors risks to support a future commercial reactor design, not generate power. The MCRE project would not be able to produce electrical power for public consumption. Evaluating nuclear energy's place in the energy market is out of scope of this effort. Analysis of alternate renewable energies is outside the scope of this analysis. The purpose of this EA is to assess the environmental impacts of the proposed action.
23	3-26-2023	Vicki Watson	I would urge you to extend the public comment period for this project…Idaho is no one's state to experiment 9h	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.

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24	3-26-2023	Molly Swabb	Fuel to feed this molten chloride, aka molten salt, nuclear reactor experiment comes from highly enriched uranium feedstock. The waste created stays in Idaho. No power goes to Idaho homes. Idaho is merely a testbed for Gates' Wyoming Terrapower project (currently stalled for lack of fuel)	As stated in Section 2.1.3, the fuel salt for the MCRE project is made from HEU feedstock that is currently in storage at INL. DOE adheres to all applicable waste management statutes. Generated waste would be managed and dispositioned as addressed in Sections 2.1.10 and 3.8 of the EA, and waste from MCRE project has a path for disposition. As stated in Section 2.1.8.4 the irradiated fuel salt would have significant value for future advanced reactor or advanced fuel cycle R&D programs. As such the irradiated fuel salt would be managed on site for future programmatic use following established plans and procedures. DOE manages HEU and other nuclear materials in accordance with all legal, regulatory, and safe/secure operational requirements in accordance with DOE Order 470.4B, *Safeguards and Security Programs*. As stated in Section 2.1.2 the MCRE project would not have power conversion equipment. The MCRE project is intended to reduce the technical, regulatory, and operational/human factors risks to support a future commercial reactor design, not to generate power. The MCRE project would not be able to produce electrical power for public consumption. The MCRE project is unrelated to the Natrium project, currently being planned for construction in Wyoming.
25	3-27-2023	Kristian Priest	We must have more time to review this plan. Respectfully, 14 days to review it is simply not enough time. Please consider this matter.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.

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26	3-27-2023	Molly Swabb	Fuel to feed this molten chloride, aka molten salt, nuclear reactor experiment comes from highly enriched uranium feedstock. The waste created stays in Idaho. No power goes to Idaho homes. Idaho is merely a testbed for Gates' Wyoming Terrapower project (currently stalled for lack of fuel)	As stated in Section 2.1.3, the fuel salt for the MCRE project is made from HEU feedstock that is currently in storage at INL. DOE adheres to all applicable waste management statutes. Generated waste would be managed and dispositioned as addressed in Sections 2.1.10 and 3.8 of the EA, and waste from MCRE project has a path for disposition. As stated in Section 2.1.8.4 the irradiated fuel salt would have significant value for future advanced reactors or advanced fuel cycle R&D programs. As such the irradiated fuel salt would be managed on site for future programmatic use following established plans and procedures. DOE manages HEU and other nuclear materials in accordance with all legal, regulatory, and safe/secure operational requirements in accordance with DOE Order 470.4B, *Safeguards and Security Programs*. As stated in Section 2.1.2 the MCRE project is intended to reduce the technical, regulatory, and operational/human factors risks to support a future commercial reactor design, not generate power. The MCRE project would not have power conversion equipment and would not be able to produce electrical power for public consumption. The MCRE project is unrelated to the Natrium project, currently being planned to be constructed in Wyoming.
27	3-27-2023	Marie Bundy	I'm contacting today to request an extension to the public comment period for the Experimental Nuclear Tech in Eastern ID. More time is needed to properly review the document and to reach the large rural population in Idaho.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.

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28	3-27-2023	David Lash	The MCRE environmental assessment states that the project will create up to 10 jobs. However it does not guarantee that Idahoans will be selected to benefit from those jobs. Since toxic waste created from the MCRE experiment will stay in Idaho, Idaho bears a high level of risk. In exchange for 10 jobs, Idaho will be responsible for the security of fissionable materials, their disposal, and their potential threat to ground and surface water that sustain the66illene, agriculture, and wildlife of Eastern Idaho. In addition, giving the Idaho public only 2 weeks to give a thorough review of and comment on the proposed environmental assessment is unreasonable. A large part of the Eastern Idaho population is rural. They may not rely on email to communicate and may have limited connectivity to access the assessment document online. It seems to me this is a disadvantage to the public when deciding if the MCRE project is in their best interest.	INL is a leader in Idaho's business community that includes diverse people, perspectives, and ideas. INL strives to hire the most qualified people to the mission of laboratory. DOE adheres to all applicable waste management statutes. Generated waste would be managed and dispositioned as addressed in Sections 2.1.10 and 3.8 of the EA, and waste from MCRE project has a path for disposition. As stated in Section 2.1.8.4, the irradiated fuel salt would have significant value for future advanced reactor or advanced fuel cycle R&D programs. As such the irradiated fuel salt would be managed on site for future programmatic use following established plans and procedures. DOE manages HEU and other nuclear materials in accordance with all legal, regulatory, and safe/secure operational requirements in accordance with DOE Order 470.4B, *Safeguards and Security Programs*. As stated in Section 2.1.4, proposed activities would be contained entirely within the LOTUS testbed, FMF, and other analytical facilities at INL, as appropriate; and no liquid discharges would occur under normal operations. Section 3.2 states that the MCRE project would not include activities that physically or chemically alter ground or surface waters. The proposed project activities would not affect the Snake River Aquifer. As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.

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29	3-27-2023	Clark Snelgrove	I wanted to write and lend my support for the proposed Molten Chloride Reactor Experiment at the Idaho National Laboratory. We hear many things about crises in the environment such as global warming but it is rare for those crying for drastic action to even honestly discuss nuclear power. As you are well aware the data is clear that nuclear power is the safest form of energy generation. You also know that it is the only proven non-fossil fuel energy technology that is scalable. It is the only technology that could actually reduce carbon emissions at scale. Nuclear power has been under attack for almost five decades. The opponents of nuclear power have used legitimate concerns about the technology to smear its reputation with false narratives of catastrophic harm and insurmountable challenges. This false and misleading propaganda has been repeated so many times that few in the general public even question its validity. I believe that most government agencies that deal with nuclear have not done a sufficient job of teaching the public about the truth associated with nuclear power and to honestly address the real concerns such potential exposure to radiation from production of energy and the handling of the spent fuel. An honest appraisal would show that if handled properly these radiological issues are almost non-existent. Even when the inevitable accidents do happen the real harm to the public has never been detected and is probably so small that other risk factors in energy production dwarfs them. For these reasons I believe the Department of Energy, Nuclear Regulatory Commission, and dozens of other federal and state agencies need to stop hindering the development of nuclear power based on unsubstantiated claims of harm. Those that oppose nuclear power have been very successful at pushing for regulations that are effectively stalling the development of nuclear power without presenting any meaningful discussion of the costs verses benefits. I all in favor of strong safety regulations when they can be shown that they improve safety at a reasonable cost. I believe that environmental impact of nuclear power can be shown to be much less than other energy technologies. We should support this project as well as other promising projects.	DOE acknowledges your comment.
30a	3-27-2023	Tami Thatcher	*See letter titled Public Comment Submittal on the U.S. Department of Energy Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project, DOE/EA-2209 issued March 23* *Note: Comments in letter have been arranged here by theme in order to better provide a DOE Response.* The MCRE project is a "relatively small, low-power density, low burn-up" 200-kilowatt thermal nuclear reactor experiment fueled with a molten uranium chloride salt. Most power generating stations are from 60 mega-watts to 1200 megawatts. This tiny but time and money wasting project will never be deployed in time to address climate change. Now, the Department of Energy has all the time and money to waste on a time-wasting project that will never be commercial scale within decades, and far too late to address climate change. It is as though the DOE is seeking to line the pockets of profiteering investors rather than address the nation's problems.	The scope of this EA is to analyze the material effects of the proposed action to the affected environment. This EA does not address the economics, affordability, or nuclear power's effect on climate change.

Comment ID Number	Date	Name and Affiliation (if provided)	Comment	DOE Response
30b	3-27-2023	Tami Thatcher	*See letter titled Public Comment Submittal on the U.S. Department of Energy Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project, DOE/EA-2209 issued March 23* *Note: Comments in letter have been arranged here by theme in order to better provide a DOE Response.* This project uses glove boxes. And the shortage of glove boxes and the difficulty of getting work done was the excuse given recently by the Department of Energy's National Nuclear Security Agency for allowing extremely high risk of over 3000 rem of plutonium airborne releases to New Mexico. The problem in New Mexico was allowed to exceed DOE regulations using the "exigent circumstances processes" all because it was deemed inconvenient to obtain seismically qualified glove boxes at the Los Alamos National Laboratory.	As stated in Section 2.1.8, gloveboxes will be used in the Fuel Manufacturing Facility (FMF) for the fuel salt synthesis and in the LOTUS testbed to load the fuel into the reactor. As stated in Section 2.1.4, FMF is a Hazard Category 2 nuclear facility with a ventilation system exhaust stack with an effluent monitoring system compliant with ANSI/HPS N13.1-2011. Section 21.5 states that the reactor would be integrated into the LOTUS testbed ventilation system exhaust stack that will have an effluent monitoring system compliant with ANSI/HPS N13.1-2011. In Section 3.3.2, the estimated dose to an offsite member of the public from proposed operations is expected to be significantly less than 10 mrem/year regulatory standard. For the purpose of the analysis, the estimated dose is conservative and is anticipated to be greater than the actual measured emissions during proposed operations. In total, DOE will adhere to all applicable air emission statutes.
30c	3-27-2023	Tami Thatcher	*See letter titled Public Comment Submittal on the U.S. Department of Energy Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project, DOE/EA-2209 issued March 23* *Note: Comments in letter have been arranged here by theme in order to better provide a DOE Response.* The waste this project will create will likely end up shallowly buried in Idaho at the US Ecology Grand View hazardous waste dump. The small amount of radioactive waste is only because of the extremely small scale of the research. Any commercially viable scale of the technology will produce highly radioactive waste on a large scale for which there is no method of appropriate containment or disposal. The radioactive waste is stated to become the responsibility of the Department of Energy. As the record at the Idaho National Laboratory and its other sites has long shown, this is no assurance whatsoever that the waste will be timely and properly dealt with.	DOE adheres to all applicable waste management statutes. Generated waste would be managed and dispositioned as addressed in Sections 2.1.10 and 3.8 of the EA, and waste from the MCRE project has a path for disposition. The scope of this EA is to analyze the material effects of the proposed action to the affected environment. Potential impacts attributed to proposed activities associated with managing, storage and disposal of radioactive and hazardous waste would not be greater than those analyzed in the *Final Waste Management Programmatic Environmental Impact Statement* (DOE/EIS-0200) (DOE, 1007). Any analysis for commercial nuclear power facilities is outside the scope of this EA.

30d	3-27-2023	Tami Thatcher	*See letter titled Public Comment Submittal on the U.S. Department of Energy Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project, DOE/EA-2209 issued March 23* *Note: Comments in letter have been arranged here by theme in order to better provide a DOE Response.* The radiation dose absorbed by the body is the "rem" but it is not a "Roentgen Equivalent Man." A Roentgen is a measure of absorbed dose in air. A rem is manipulated far beyond what is the absorbed dose in air, or even in tissue. The Department of Energy continues to misunderstand the radiation units it uses. The Department of Energy's repeated use antiquated terminology "Roentgen-equivalent-man" for rem leaves open for interpretation what level of absorbed dose forms the bases for the Department of Energy's dose. A roentgen corresponds to 87.7 ergs per gram of air absorbed dose, whereas a rad corresponds to 100 ergs/gram. The EA leaves unstated whether it is still using Roentgens or whether it now defines rem in terms of the definition of a sievert. This draft EA also fails to explain how organ dose received from the inhalation or ingestion of radioactive material can yield far higher organ doses than would be received from natural sources of radiation. For example, thyroid doses received from inhalation or ingestion of radioactive iodine or americium-241 can far exceed the thyroid organ dose that occurs from naturally occurring radiation and yet yield an estimated low whole body dose. The problem is especially acute in the unborn, developing child, who may dose from the failure to thrive due to hypothyroid issues, and die before a cancer develops. Radiation worker doses need to include the neutron doses as well as gamma and beta absorbed doses. The gonad doses need to be provided and the uncertainties of these doses, not just the whole body dose. In fact, the material that will be handled in the glove boxes appears that high energy gamma from decay progeny of uranium-238 and of uranium-236 (and U-232) may be significant. (Bismouth-214 and Thallium-208 provide high energy gamma's, which the Department of Energy appears to ignore yet are known to create unacceptably high radiation doses in nuclear fuel fabrication. Furthermore, these radionuclides are not subject to environmental monitoring programs because they belong in "natural" uranium and thorium decay chains. So, their releases to the environment in unnaturally high amounts are ignored by the Department of Energy, despite their health damaging effects. This EA goes to great lengths to not express the full listing of all radionuclides and their amounts that will be produced by the project. Yet, without the burnup and other information, no reader can estimate each radionuclide and its curie amount that will be produced and must be disposed of. The EA is deficient in many ways, and the choice to not describe and fully characterize the radionuclides to be disposed of and their curie amounts and concentrations makes the determination of proper disposal impossible and must be clarified.	As stated in the "Helpful Information for the Reader" section, dose is defined as the amount of radiation energy absorbed by the body and the unit of measurement is the Roentgen Equivalent Man (rem). For the purpose of this document, dose is reported in millirem (mrem). The terminology used in this EA is consistent with federal standards (e.g., 40 CFR 61 Subpart H). DOE takes its responsibility for the safety and health of workers and the public seriously. DOE considered the latest available scientific information on biology and physics of radiation exposure to workers and off-site personnel. As stated in Section 3.10, proposed operations would be performed per DOE Order 458.1, *Radiation Protection of the Public and the Environment*, and 10 CFR Part 835 *Occupational Radiation Protection.* The estimated dose to workers and off-site personnel as performed in this document were prepared following established, and scientifically accepted, processes and procedures. Furthermore, the estimated dose to workers and off-site personnel are expected to be far below regulatory standards.

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30e	3-27-2023	Tami Thatcher	*See letter titled Public Comment Submittal on the U.S. Department of Energy Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project, DOE/EA-2209 issued March 23* *Note: Comments in letter have been arranged here by theme in order to better provide a DOE Response.* Figure 10, Earthquakes occurring from 1850 to 202 with magnitudes greater than 2.0, shows far fewer earthquakes on the Snake River Plain than the surrounding mountains. It is conveyed that the INL should not be very prone to large seismic events. Despite this, the Idaho National Laboratory is refusing, even for this very small 200-kilowatt reactor, to provide a completed seismic evaluation of the proposed facility that the MCRE will be located in. Nor will the decades of concrete, cable and structural aging be taken into account, likely, if the Department of Energy ever completes a seismic evaluation of the facility at the INL that the experiment will be housed in. The EA simply states that "The evaluation of the ZPPR cell under seismic loads is currently being performed." This is unacceptable and inexcusable. No one has the results of the analysis that is "currently being performed." But, it is "business as usual" for the Idaho National Laboratory and the Department of Energy. Using 150 years of seismic experience is inadequate to conclude that no impacts due to seismic events would occur and DOE knows better. Is the scanty detail in the EA being used as an excuse to not perform adequate seismic evaluations of the existing facility the DOE plans to conduct this experiment in? Furthermore, the DOE has a long record of not performing or enforcing seismic requirements for safety buildings or for the safety systems, such as fire protection systems, needed in response to accidents. The excuses made in this EA are unacceptable despite the wrong impression the document seeks to make, that the INL has few seismic events. In fact, it is not easy to provide adequately seismically robust buildings, equipment and fire protection at the INL site because of relatively high seismic forces that are estimated to occur at relatively high likelihoods. If seismic impacts are not expected, then it should be a simple matter to complete the seismic analysis and provide computational assurance that the experiment will not be vulnerable to seismic events, which the EA appears to claim would be tiny. If the seismic event are so tiny and infrequent, why can't INL and DOE provide a completed analysis and one that would be protective for relatively larger, but infrequent earthquakes, of Performance Category 4, or that large nuclear reactors should be designed to?	DOE is dedicated to maintaining records of facility configuration and maintaining transparency in operations. The MCRE project will comply with all applicable DOE Orders and Standards including DOE-STD-1020-2016 for seismic design. Facilities are operated in accordance with their approved safety basis authorization and maintained to reduce the likelihood and consequences of an accident—including from a seismic event. As stated in Section 3.6 DOE states that historically there have been ground shaking at the INL Site caused by earthquakes and that INL's seismic network has located microearthquakes throughout the Eastern Snake River Plain. An evaluation of the ZPPR cell under seismic loads is being performed to support the seismic design. The LOTUS testbed is expected to withstand vibratory ground motions as specified by the American Society of Civil Engineers. The recently published Probabilistic Seismic Hazard Analysis (PSHA) for the INL is used to support the seismic evaluation for LOTUS. The PSHA provides information in regard to seismic history, vibratory ground motions, and seismic hazard analysis of the ZPPR cell. The PSHA is incorporated by reference in the Final Environmental Assessment.

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30f	3-27-2023	Tami Thatcher	*See letter titled Public Comment Submittal on the U.S. Department of Energy Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project, DOE/EA-2209 issued March 23* *Note: Comments in letter have been arranged here by theme in order to better provide a DOE Response.* In an emergency, the small MCRE experiment may, in fact, divert scant and precious resources needed to protect other nuclear hazards of the Materials and Fuels Complex from a fire and/or seismic event. The way this EA fails to provide seismic safety for the MCRE and then also fails to examine the MFC seismic problems overall is shameful. It is yet another illustration of inadequate safety analysis and hazard mitigation at Department of Energy facilities. The EA fails to acknowledge decades of repeated inadequate emergency preparation at the Idaho National Laboratory for site emergencies in terms of training, decontamination, radiological medical treatment, inadequate emergency radiological monitoring during and after the emergency.	The INL Emergency Management Program implements DOE policy and requirements for an emergency management system and, as discussed in Section 3.10.4, complies with DOE O 151.D, *Comprehensive Emergency Management System*, and other DOE and regulatory requirements. The basic objective of the EA is to provide the public and DOE decision makers with a description of the MCRE project and information about potential impacts on public health and safety and the environment. 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. MCRE will comply with all applicable DOE Orders and Standards including DOE STD-1020-2016 for seismic design.

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31	3-28-2023	Hannah Smay, Digital Organizer Nuclear Information Resource Service	*See letter titled DOE/EA-2209: Draft Environmental Assessment* *Note: Comments in letter may have been arranged by theme in order to better provide a DOE Response.* Request for Extension of Comment Period on The United States Department of Energy (DOE) *Draft Environmental Assessment for the Molten Chloride Reactor Experiment* (MCRE) Project at the Idaho National Laboratory. The Nuclear Information and Resource Service (NIRS) requests that the United States Department of Energy extend the public comment period on the above-referenced Draft Environmental Assessment by a minimum of sixty (60) days beyond the currently scheduled public comment deadline. The 14-day public comment period for the MCRE draft environmental assessment began on March 17, 2023, and concludes on March 31, 2023. The U.S. Department of Energy (DOE) has previously given longer public comment periods and extended comment periods. 14 days is an exceptionally short window to gather thoughtful and informed comments from local residents, tribes, and other interested parties. The DOE is asking for public comment on the MCRE Draft EA, which contains a variety of complex technological and scientific matters regarding a new and novel reactor design that has never been operated in the US before. A 14-day comment period does not provide adequate time for the public to meaningfully participate in this decision-making process, and instead poses a significant barrier for many people to access the EA and submit comments, and is thus inconsistent with adequate, lawful public participation. NIRS requests that DOE extend the public comment period for at least an additional 60 days. The MCRE has the potential to affect the safety and environmental resources of residents throughout southern Idaho. Too, the decommissioning process, in particular the storage and transport of irradiated and spent fuel, will fall under the responsibilities of many state and local governments. We need to engage experts, which requires additional time and resources, for commenting. Thank you for your consideration of this request.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.
32	3-28-2023	Denise Jakobsberg	Please extend the comment period to build a molten chloride nuclear reactor in Idaho. The communities have the right to know and a right to decide if they want a reactor that they don't even benefit from. Fourteen days is not enough time for people to know or comment. Or is that the DOEs intention? Please do the right thing; put democracy back where it belongs.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS.

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33	3-29-2023	Joanie Fauci	Please accept my comment to choose the No Action Alternative to the Molten Chloride Reactor at INL. Regardless of how promising this technology, there will still be hazardous waste we do not know how to deal with. That should be our number one priority, especially over our aquifer. Clean water is much more precious than energy!	DOE acknowledges your support of the no action alternative. DOE adheres to all applicable waste management statutes. Generated waste would be managed and dispositioned as addressed in Sections 2.1.10 and 3.8 of the EA, and waste from MCRE project has a path for disposition. The scope of this EA is to analyze the material effects of the proposed action to the affected environment. As stated in Section 2.1.4, proposed activities would be contained entirely within the LOTUS testbed, FMF, and other analytical facilities at INL, as appropriate; and no liquid discharges would occur under normal operations. Section 3.2 states that the MCRE project would not include activities that physically or chemically alter ground or surface waters. The proposed project activities would not affect the Snake River Aquifer.
34	3-30-2023	Leigh Anne Lloveras, Nuclear Energy Analyst, The Breakthrough Institute	*See letter titled Comment on the Draft Environmental Assessment for the Molten Chloride Reactor Experiment Project* The Breakthrough Institute (BTI) appreciates this opportunity to comment on the draft environmental assessment (EA) for the Molten Chloride Reactor Experiment Project (MCRE). BTI is an independent 501(c)(3) global research center that advocates for appropriate regulation and oversight of nuclear reactors to enable the new and continued use of safe and clean nuclear energy. BTI acts in the public interest and does not receive funding from industry. The MCRE project is a small reactor, even by microreactor standards, with a power level of 200-kilowatt thermal. It would be constructed in an existing cell and this draft EA finds that many of its effects would be minor and "indistinguishable from the existing environment of INL Site operations." This is a logical and reasonable conclusion. As such, the finding of no significant impact to the quality of the human environment is appropriate. While the direct environmental impact of the project is slight, the scientific benefit is immense. The MCRE project is also a valuable endeavor due to its potential to provide useful experience and data for the commercial licensing efforts of molten salt technologies. Since the Nuclear Regulatory Commission (NRC) has never licensed a commercial nuclear reactor that isn't a light-water technology, the insights from a national lab run project would likely be of great use to the NRC when it is making its licensing decisions. The BTI would also like to recognize the appropriateness of the staff's decision to start with an EA instead of an environmental impact statement (EIS). EAs should be used instead of EISs to the maximum extent practicable to avoid unnecessary regulatory burden and reduce cost to the taxpayer.	DOE acknowledges your comment.
35	3-31-2023	Philip Carlson, Board Certified Radiologist and Internist Professor Emeritus Univ. of Wisconsin	The molten salt technology has been proven to be a viable solution to the energy needs of the world and must be researched fully at conservative low power levels at INL. The technology not only has the capability to provide electricity but also to recycle spent nuclear fuel and supply process heat for other processes. The small volume of reactor fission products can be stored safely and potentially can be repurposed for other medical and industrial uses.	DOE acknowledges your comment.

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			I strongly support the completion of the MCFR as a consumer of electricity and as a medical doctor.	
36	3-31-2023	Ada Hackett	The Molten Chloride Fast Reactor design has a very exciting combination of potential safety, high grade heat, fuel efficiency, and compactness benefits. It seems like it could be the pinnacle of power dense energy generation, and I'm glad you are working on a pathfinder reactor to figure out how we can build these things. Keep up the good work!	DOE acknowledges your comment.
37	3-31-2023	Betty Slifer	The reactor proposed by Bill Gates for Idaho Falls, Idaho is a VERY bad idea. For one and major thing, Idaho does not have, will not have, enough water for this reactor.	As stated in Section 2.1.4 the proposed operational activities supported by the INL would occur at MFC located on the INL Site. As stated in Section 3.7.2, MCRE does not require water for its operation.
38	3-31-2023	Doug Muir	I believe that this project needs to go through the testing it needs because we need to keep ahead of foreign country's in reactor technologies.	DOE acknowledges your comment.
39	3-31-2023	Peter Rickards	Hi Danielle & MORE team, Once again DOE has illegally ignored the "alpha recoil" safety flaw, that should have stopped your plans, since it violates and exceeds the legal limit of citizen exposure to hot radioactive particles! Here are the details that I have submitted to ALL INL NEPA hearings for decades at https://www.peterforidaho.com/plutonium_flies_through_hepa_filters_says_doe The full list of ignored scoping question DOCUMENTS.is at https://www.peterforidaho.com/unanswered_documented_environmental_impacts_issues Here is an example of a DOE million-dollar NEPA whitewash at https://www.peterforidaho.com/doe_refuses_to_answer_scoping_questions_again Please expose the truth and stop exposing innocent downwind children! Dr. Peter Rickards	DOE takes its responsibility for the safety and health of workers and the public seriously. DOE considered the latest available scientific information on biology and physics of radiation exposure to workers and offsite personnel. As stated in Section 3.10, proposed operations would be performed per DOE Order 458.1, *Radiation Protection of the Public and the Environment*, and 10 CFR Part 835 *Occupational Radiation Protection*. In Section 3.3.2, the estimated dose to an offsite member of the public from proposed operations is expected to be significantly less than 10 mrem/year regulatory standard. For the purpose of the analysis, the estimated dose is conservative and is anticipated to be greater than the actual measured emissions during proposed operations. In total, DOE will adhere to all applicable air emission statutes. The estimated dose to workers and offsite personnel as performed in this document were prepared following established, and scientifically accepted, processes and procedures. Furthermore, the estimated dose to workers and offsite personnel are expected to be far below regulatory standards. DOE evaluated the environmental impacts of airborne releases from production of high assay low-enriched uranium fuel in the *Final Environmental Assessment for the Use of Department of Energy-Owned High-Assay Low-Enriched Uranium Stored at Idaho National Laboratory* (DOE/EA2087, January 2019). DOE evaluated the potential impacts to human health and the environment from the proposed MCRE project and found effectively no increase in cumulative impacts to the public or collocated workers from radioactive air emissions during normal operations, as discussed in Sections 3.2 and 3.10 of the EA.
40	4-2-2023	Josephine Lowe	There is nothing remotely clean about nuclear energy until radioactive waste can be sent to outer space. The shelf life for nuclear waste causes it to be a threat to clean air, soil, and water far into the millennium to come. Let's be honest, nuclear energy is neither safe nor sustainable. Put our money towards developing better battery storage and efficient energy transmission.	As stated in Section 2.1.1, the primary objective of the proposed action is to reduce the technical, regulatory, and operational/human factors to support a future commercial reactor design. The scope of this EA is to analyze the material effects of the proposed action to the affected environment. This EA does not address the economics, affordability, nuclear power's effect on climate change, or energy efficiencies leaving that decision to those proposing to use nuclear power. The basic objective of the EA is to provide the public and DOE decision makers with a description of the MCRE project and information about potential impacts on public health

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			Thank you, and be honest with the science -	and safety and the environment. 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.
41	4-4-2023	Trevor Casper	My name is Trevor Casper. I am a longtime resident of Idaho Falls, a nuclear engineering PhD student at the University of Idaho, and an employee at the Naval Reactors Facility located at the Idaho National Laboratory. I strongly support the development of the MCRE program and siting of this project at the INL. This area has been time tested as an appropriate and safe environmental location for nuclear projects. The Eastern Idaho area possesses strong technical expertise in nuclear technology, and the overall population tends to be very favorable towards these projects. The MCRE project is the kind of next-generation reactor research that our nation needs to be conducting to retain international nuclear leadership as well as to develop the nuclear technologies our world needs in order to accelerate the transition to carbon-free power sources and combat climate change.	DOE acknowledges your comment.
42	4-12-2023	Brian Cam	Please build ASAP as the USA is falling behind CHINA #1 in all phases Nuclear POWER and research.	DOE acknowledges your comment.

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43	4-12-2023	Paul Menser, Members of the American Nuclear Society Idaho Section	Dear Committee Members, As one of the oldest American Nuclear Society sections in the United States, we wish to voice our support for locating the Molten Chloride Reactor Experiment (MCRE) at Idaho National Laboratory. We could not be more enthusiastic about the promise this new project represents. MCRE will be one of the first new reactors built in Idaho in more than 40 years. Although our research portfolio is much broader than it was in the days of the Atomic Energy Commission, we who comprise the nuclear faithful are eager to get back to our roots. The people at INL know how to build and operate nuclear test reactors with minimal disruption to local ecosystems and cultural resources. Since 1951, when Experimental Breeder Reactor-I generated electricity from fission, the lab has been on the leading edge of nuclear technology and research. For decades, INL has closely monitored the effect of its operations on the environment – not just within the border, but far afield in every direction. Large sections of land within our 890 square miles have been expertly characterized for seismic and hydrological activity, and new studies are being continuously performed out of our commitment to environmental protection. Whether it's the Advanced Test Reactor (ATR) or the Transient Reactor Test Facility (TREAT), we have extensive documentation and are proud to say we have met the demands of the National Environmental Policy Act. The MCRE project is funded by the U.S. Department of Energy's Advanced Reactor Demonstration Program (ARDP) and is being pursued to provide scientific data for TerraPower's Molten Chloride Fast Reactor (MCFR), a technology that could provide low-cost, clean energy for a sustainable future. When completed in late 2025, MCRE will be the world's first low-power, fast-spectrum, salt-fueled nuclear fission test reactor to go into operation. If the United States is to continue leading the world in the advancement of nuclear power, the success of projects like MCRE is necessary. Research like this is what INL was created to do, and we couldn't be more excited about the future. We urge you to approve this project in your environmental assessment so we can get on with what we do best. Sincerely, Members of the American Nuclear Society Idaho Section	DOE acknowledges your comment.

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44a	4-13-2023	Richard Stover, Idaho Governor's Office of Energy & Mineral Resources	*See letter subject State of Idaho Comments Regarding the Draft Environmental Assessment for the Molten Chloride Reactor Experiment Project at the Idaho National Laboratory Site (DOE/EA-2209)* *Note: Comments in letter may have been arranged by theme in order to better provide a DOE Response.* All spent nuclear fuel (SNF) generated as a result of the MCRE Project must comply with all requirements of the Idaho 1995 Settlement Agreement and related subsequent memorandum of agreement, supplemental agreement, addendum, and agreements.	As stated in Section 2.1.8.4, the irradiated fuel salt would only be lightly irradiated and be managed similar to other materials currently at the INL. The irradiated fuel salt would have significant value for future advance reactor or advanced fuel cycle R&D programs such as re-use or support fuel cycle research. As such the irradiated fuel salt would be managed on site for future programmatic use following established plans and procedures. The fuel salt is also a candidate for uranium recovery because of the lightly irradiated nature for the material. DOE manages HEU and other nuclear materials in accordance with all legal, regulatory, and safe/secure operational requirements in accordance with DOE Order 470.4B, *Safeguards and Security Programs*. As stated in Sections 2.1.8.4 and 2.1.8.5, the irradiated fuel salt would be stored in specially made containers that are easily retrievable for future re-use while also protecting workers and the environment from radiological contamination. Based on the current irradiated materials stored at the INL, it is anticipated that the irradiated fuel salt can be stored safely and in a manner that would prevent any radiological contamination. If the material should be determined to no longer have a programmatic value for future use (either as fuel salt or as feedstock to the uranium recovery processes), then the DOE waste determination process would be invoked, and the material would be managed accordingly and stored in a compliant manner while awaiting final disposition. Any potential issues that may arise concerning the 1995 Idaho Settlement Agreement and related subsequent memorandum of agreement, supplemental agreement, addendum, and agreements would be addressed with the State of Idaho.
44b	4-13-2023	Richard Stover, Idaho Governor's Office of Energy & Mineral Resources	*See letter subject State of Idaho Comments Regarding the Draft Environmental Assessment for the Molten Chloride Reactor Experiment Project at the Idaho National Laboratory Site (DOE/EA-2209)* *Note: Comments in letter may have been arranged by theme in order to better provide a DOE Response.* Section 3 of the document, "Affected Environment and Environmental Consequences," addresses and describes the regional setting and several resources of concern. However, this section does not appear to describe or address the Snake River Plain Aquifer, which underlies the INL and represents a vital environmental resource for the state of Idaho. As such, this section of the Draft Environmental Assessment requires revision to include a detailed discussion of this resource, similar to that provided for "Ecological Resources," "Geological and Soil Resource," etc.	As stated in 3.2, a detailed discussion of the Ground and Surface Water Resources was not warranted because the proposed project would occur entirely within existing facilities at MFC. Furthermore, the proposed project would not require water for its use and no ground or surface water resources are expected to be affected from integration, operation, irradiated fuel salt storage, or decommissioning. The proposed project activities would not affect the Snake River Aquifer. However, DOE recognizes the importance of the Snake River Plain Aquifer and will add a brief description in the Regional Setting section.
44c	4-13-2023	Richard Stover, Idaho Governor's Office of Energy & Mineral Resources	*See letter subject State of Idaho Comments Regarding the Draft Environmental Assessment for the Molten Chloride Reactor Experiment Project at the Idaho National Laboratory Site (DOE/EA-2209)* *Note: Comments in letter may have been arranged by theme in order to better provide a DOE Response.*	DOE will ensure that all air permitting requirements are met. For reference, air permitting at INL is accomplished through the Air Permitting Applicability Determination (APAD) process, which documents the state and federal air regulatory requirements or exemption from air permitting requirements, as applicable, for proposed activities that have the

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			As stated in Section 3.3 for air quality, INL would conduct permit applicability for each source for both 40 CFR 61 (EPA delegated) and the current Facility Emission Cap (FEC) permit as well as the Permit to Construct (PTC) programs (DEQ). In the event a PTC or a FEC modification is required, INL representatives will need to contact DEQ in advance of this determination and schedule a pre-application meeting.	potential for air emissions. This process is required for all activities that would create a new air pollution emission sources, modify a source, or otherwise emit regulated air pollutants. The APAD identifies regulated air pollutants and the regulatory requirements that apply to current, proposed, and modified INL Sources and activities. DOE evaluates this information, in conjunction with project-specific information, to determine whether a permit is required or whether an exemption applies. The APAD is kept on file for the lifetime of the source if the APAD documents an exemption from air permitting requirements. For stationary air emission sources whose emissions do not qualify for an exemption, in accordance with 40 CFR 61.96, an Approval to Construct for radionuclides must be obtained before commencing construction. Other agency approvals may be required in accordance with 40 CFR 60, 40 CFR 61, and 40 CFR 63. After completing the APAD or receiving any necessary permits, EPA approval, or completing other appropriate agency notifications, DOE develops necessary compliance methodologies and proceeds with the proposed activity according to applicable permits and other approvals.
45	4-13-2023	Alan Kuperman, Associate Professor, LBJ School of Public Affairs Coordinator, Nuclear Proliferation Prevention Project	*See letter subject Proposed Idaho Reactor (MCRE) Violates U.S. Nonproliferation Policy of HEU Minimization* *Note: Comments in letter may have been arranged by theme in order to better provide a DOE Response.* The EA is deficient in ignoring the significant environmental consequences that could result from a central aspect of the proposed action – the use in this new research facility of fuel containing more than 600 kilograms (kg) of nuclear weapons-grade, 93%-enriched, highly enriched uranium (HEU) – which would violate 45 years of U.S. government nonproliferation policy and practice, thereby increasing risks of nuclear proliferation and nuclear terrorism that could have catastrophic environmental consequences. Since 1978, the U.S. government has avoided building new research reactors using HEU fuel, has opposed other countries doing so, and has refused to export HEU fuel for any such new reactors – on grounds that the resulting HEU commerce would increase risks of nuclear proliferation and nuclear terrorism that could threaten U.S. national security. A guiding principle of this U.S. HEU minimization policy has been to avoid exceptions, on grounds that if any country were granted an exception for a facility, then other countries would demand exceptions too, potentially unravelling the policy. That is why, even though the U.S. government's original goal was to reduce foreign use of HEU, the policy was first implemented by converting two U.S. research reactors from HEU fuel to low-enriched uranium (LEU) fuel that is unsuitable for nuclear weapons. In the 1990s, the U.S. government did consider building one new research reactor with HEU fuel, the Advanced Neutron Source at Oak Ridge National Laboratory, but as reported in 1995, "opposition to the use of highly-enriched uranium in the reactor's core led to its cancellation." The U.S. government has since expanded the ban on HEU fuel to nearly all new nuclear facilities. In 2012, the DOE announced that new medical-isotope production facilities must avoid HEU. Similarly, in 2019, the U.S. Army announced that its future mobile nuclear power reactors must avoid HEU fuel. Indeed, in recent decades, the U.S. government has permitted only two exceptions to the ban on new reactors using HEU fuel. One occurred in	Nuclear nonproliferation and the preparation of a Nonproliferation Impact Assessment are issues that are considered beyond the scope of this EA. As stated in Section 2.1.3, the fuel salt for the MCRE project is made from HEU feedstock that is currently in storage at INL and no new HEU will be produced as a result of the proposed action. DOE manages HEU and all irradiated materials in accordance with all legal, regulatory, and safe/secure operations requirements. MCRE requires the use of higher enrichment fuel to keep the size of the experimental reactor small while ensuring that key phenomena such as thermal hydraulics and neutronics are representative of the commercial design. Additionally, the smaller physical size leads to a reduced radioactive source term. Analysis has shown that if MCRE was fueled with high-assay low-enriched uranium (HALEU) instead of HEU, the reactor core would be roughly three times taller, three times wider, and contain 40 times the volume of fuel salt. This would significantly increase not only the construction cost, but also the source term and volume of irradiated fuel salt requiring storage until future reuse. DOE would retain ownership of all HEU material throughout the MCRE project. As stated in the EA, DOE's National Reactor Innovation Center is establishing the Laboratory for Operation and Testing in the United States (LOTUS) test bed. LOTUS is being designed to ensure safe operation of test and experimental reactors, such as MCRE, that use high security materials for operation. Security and safeguards would be employed at all facilities used by the MCRE project to handle nuclear materials in quantities that require safeguards protections in accordance with DOE Order 470.4B, Safeguards and Security Programs. Further, MCRE is not a research reactor but will be an experimental reactor that is planning to operate for a limited time, after which it will be decommissioned. A primary purpose of an Environmental Assessment is to determine whether a proposed action has significant environmental impacts, which would require preparation of an Environmental Impact Statement. As stated in Section 1.1 of the EA, the document was prepared in accordance with 10 CFR 1021 and 40 CFR 1500 - 1508. Under these

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			2018, when NASA tested a microreactor fueled by 30 kg of 93%-enriched HEU for barely one day (28 hours), which triggered so much concern that the White House later issued a Presidential Memorandum declaring that future space reactors should avoid HEU fuel. The other exception, on national security grounds, is new Navy propulsion reactors that continue to be fueled with HEU while NNSA researches the feasibility of using LEU. The EA indicates that the amount of HEU for the proposed facility is enormous, exceeding 600 kg, thereby magnifying the consequences for U.S. nonproliferation policy. On p. 13, the EA states that, "each furnace is limited to 9 kg of HEU per batch. With these restrictions, it is anticipated that a minimum of 72 batches (runs) of the synthesis process will be needed." This implies that at least 648 kg (i.e., 72 x 9) of HEU will be utilized in fuel for the facility. The U.S. Nuclear Regulatory Commission required that the highest security (Category I) be applied to as little as 5 kg of HEU, which according to independent experts is sufficient for a nuclear weapon. This means the proposed action in the EA would utilize enough HEU for more than 100 nuclear weapons, thereby creating a dangerous precedent and a potential excuse for other countries to produce large quantities of weapons-grade uranium, which subsequently could be diverted or stolen for nuclear weapons. The draft EA ignores entirely how the proposed fuel would contradict and undermine longstanding U.S. nonproliferation policy, and thus fails to assess the resulting increased risks of nuclear proliferation and nuclear terrorism, which could have significant consequences for human health and the environment. If the United States were to build this new research facility for commercial nuclear power, using over 600 kg of weapons-grade HEU, other countries would demand the right to produce such amounts of HEU for similar purposes, which would increase the risk of states and terrorists acquiring and using nuclear weapons. Even a single nuclear weapon of World War II-era design, detonated in an American city, could kill hundreds of thousands of people and compel evacuation of millions more. Accordingly, DOE must prepare an Environmental Impact Statement (EIS) that includes assessment of such potentially significant impacts on human health and the environment. Moreover, the EIS must examine alternatives that would avert or reduce these significant impacts on human health and the environment, by avoiding HEU entirely, which the EA fails to do. Since the MCRE is intended to produce experimental findings to facilitate a future Molten Chloride Fast Reactor (MCFR), which itself intends to avoid HEU fuel for both its demonstration-size and full-size facilities, it should be possible to redesign the MCRE to avoid HEU fuel too, for example by increasing the amount of fuel. In conjunction with preparation of the EIS, DOE also should prepare a Nonproliferation Impact Assessment of the proposed action and its alternatives. Previously, DOE has prepared such assessments in at least six instances in conjunction with an EIS on a proposed action that, like the MCRE, raises potential nuclear proliferation risks. As DOE officials explained in 2009, such an assessment "draws on nonproliferation objectives of the U.S. Government as the basis for a policy evaluation of proliferation risk" of the proposed action, during DOE's preparation of the EIS. As DOE elaborated in 2000 in response to	regulations, DOE has the discretion when determining to prepare an Environmental Assessment.

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			members of Congress, such an assessment can "provide additional pertinent information to the Secretary of Energy so that he may make an informed decision with respect to the alternatives presented in the" EIS. As DOE further declared in 1998, such an assessment "fulfills the DOE commitment to assess the nonproliferation aspects of the various technology options the Department is considering." To honor that solemn obligation to the American people, DOE must not issue a decision on the proposed action, nor complete an EIS on the proposed action, prior to formally assessing the nuclear proliferation risks of the proposed action and its alternatives.	

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46	4-13-2023	David Kramer, Physics Today	Hi, I'm looking into the MCRE project at INL. The draft EA says it would use a total of 600 kg of weapons-grade uranium. I would like someone to respond to concerns about the proliferation concerns of building a new research reactor fueled by HEU. How can DOE justify building a research reactor fueled by HEU, let alone such large amounts of HEU, when it has been for decades converting research reactors all over the world, and in the US, to LEU fuel, and continues to do so? US policy has been to eliminate HEU from all civilian use. Is this a case of "do as I say and not as I do?" Why shouldn't other nations point to the example the US sets with MCRE and seek to build their own HEU-fueled reactors? Do as I say and not as I do? Why not use LEU, or HALEU in MCRE instead? Cost? Added cost hasn't been a valid excuse for avoiding the use of HEU in other places. Thanks, David Kramer Physics Today	Thank you for your questions concerning the use of highly enriched uranium (HEU) in the Molten Chloride Reactor Experiment (MCRE). As stated in Section 1.1 of the EA, a team led by Southern Company was selected for an Advanced Reactor Demonstration Program (ARDP) Risk Reduction award to design, build and operate MCRE at the Idaho National Laboratory (INL). MCRE requires the use of higher enrichment fuel to keep the size of the experimental reactor small while ensuring that key phenomena such as thermal hydraulics and neutronics are representative of the commercial design. Additionally, the smaller physical size leads to a reduced radioactive source term. Analysis has shown that if MCRE was fueled with high-assay low-enriched uranium (HALEU) instead of HEU, the reactor core would be roughly three times taller, three times wider, and contain 40 times the volume of fuel salt. This would significantly increase not only the construction cost, but also the source term and volume of irradiated fuel salt requiring storage until future re-use. DOE would retain ownership of all HEU material throughout the MCRE project and no DOE owned HEU would be available for a civilian reactor. It is important to note that the commercial design being informed by MCRE, the molten chloride fast reactor (MCFR), would not use HEU but would use HALEU for operation. The higher enrichments are only required for the experimental reactor. Additionally, a key distinction between the research reactors referenced in your email and MCRE is that MCRE is not a research reactor built to perform scientific irradiation over years or decades. Rather, it is an experimental reactor, which will be operated for a short period of time to generate critical integral data to support design and licensing of future commercial MCFR demonstrations. Hence, MCRE is planned to operate for a limited time and then be decommissioned and removed. Further, to support operation of MCRE and other advanced reactor technologies, DOE's National Reactor Innovation Center is establishing the Laboratory for Operation and Testing in the United States (LOTUS) test bed. LOTUS is being designed specifically to host and ensure safe operation of test and experimental reactors that use HEU. The use of LEU or HALEU for the MCRE project is outside the scope of this EA. As well as nonproliferation and considerations for cost or economic viability of alternative fuel options. The purpose of the EA is assess the potential impacts associated with proposed project which is to reduce the risks of technical, licensing, and operational/human factors to support a commercial reactor design As stated in Section 2.1.3, the fuel salt for the MCRE project is made from HEU feedstock that is currently in storage at INL and no new HEU will be produced as a result of the proposed action. DOE manages HEU and all irradiated materials in accordance with all legal and regulatory requirements. Security and safeguards would be employed at all facilities used by the MCRE project to handle nuclear materials in quantities that require safeguards protections in accordance with DOE Order 470.4B, *Safeguards and Security Programs*

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47a	4-14-2023	Ava Traverso, Snake River Alliance	*See letter titled DOE/EA-2209: Draft Environmental Assessment* *Note: Comments in letter have been arranged here by theme in order to better provide a DOE Response* Request to the United States Department of Energy (DOE) to a) extend the public comment period on the above-referenced Draft Environmental Assessment by an additional 60 days beyond the currently scheduled public comment deadline and b) conduct a full Environmental Impact Statement (EIS) for the Molten Chloride Reactor Experiment (MCRE) Project at the Idaho National Laboratory (INL). The Snake River Alliance, Nuclear Information and Resource Service (NIRS), and other organizations listed below request that the United States Department of Energy (DOE) conduct a full Environmental Impact Statement (EIS), as determined under the National Environmental Policy Act (NEPA), to examine the MCRE's significant environmental impacts to the ground and surface water, ecosystems, workers, air, and species. In addition, we request that DOE extend the public comment period on the above-referenced Draft Environmental Assessment by an additional 60 days beyond the currently scheduled public comment deadline. The 28-day public comment period for the MCRE draft environmental assessment began on March 17, 2023, and concludes on April 14, 2023. The U.S. Department of Energy (DOE) has previously given longer public comment periods and extended comment periods. Though extended from the original 14 days, 28 days is an exceptionally short window to gather thoughtful and informed comments from residents, tribes, and other interested parties on a complex, first-of-its-kind nuclear project with long-lasting material impacts, including the creation of nuclear waste and irradiated materials. The DOE is asking for public comment on the MCRE Draft EA, which contains a variety of complex technological and scientific matters regarding a new and novel reactor design that has never been operated in the US before. A 28-day comment period does not provide adequate time for the public to meaningfully evaluate all of the potential environmental impacts of the MCRE and DOE's conclusions in the Draft EA, nor to participate in this decision-making process. Instead, it poses a significant barrier for many people to access the EA and submit comments, and is thus inconsistent with adequate, lawful public participation.	As stated in Section 1.1 of the EA, the document was prepared in accordance with 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, and DOE extended the public comment period an additional two weeks. DOE will have an additional public comment period on the proposed Finding of No Significant Impact. In accordance with 40 CFR 1501.6(2), DOE shall "make the finding of no significant impact available for public review 30 days before the agency makes its final determination" because the proposed action is closely similar to one that normally requires the preparation of an EIS. A primary purpose of an Environmental Assessment is to determine whether a proposed action has significant environmental impacts, which would require preparation of an Environmental Impact Statement. As stated in Section 1.1 of the EA, the document was prepared in accordance with 10 CFR 1021 and 40 CFR 1500 - 1508. Under these regulations, DOE has the discretion when determining to prepare an Environmental Assessment. DOE adheres to all applicable waste management statutes. Generated waste would be managed and dispositioned as addressed in Sections 2.1.10 and 3.8 of the EA, and waste from MCRE project has a path for disposition. Potential impacts attributed to proposed activities associated with managing, storage and disposal of radioactive and hazardous waste would not be greater than those analyzed in the *Final Waste Management Programmatic Environmental Impact Statement* (DOE/EIS-0200) (DOE, 1007). Furthermore, any potential impact to air quality, water resources, socioeconomics, worker and public health and safety, environmental justice, and transportation would be significantly less than what was projected in DOE/EIS-0200. Furthermore, any potential impact to air quality, water resources, socioeconomics, worker and public health and safety, environmental justice, and transportation would be significantly less than what was projected in DOE/EIS-0200.

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			The signing organization to these comments call upon DOE to extend the public comment period for at least an additional 60 days. In the alternative, DOE should revise its conclusion in the Draft EA, and determine that a full environmental impact statement (EIS) is required for this project. This will require DOE to conduct the appropriately thorough and detailed analysis, as well as provide ample time, information, and opportunities for meaningful public engagement in scoping, development, and review of a Draft EIS. The MCRE has the potential to affect environmental resources throughout southern Idaho. Additionally, the decommissioning process, in particular the storage and transport of irradiated and spent fuel, will fall under the responsibilities of many state and local governments. We need to engage experts, which requires additional time and resources, for commenting. Thank you for your consideration of this request.	
47b	4-14-2023	Ava Traverso, Snake River Alliance	*See letter titled DOE/EA-2209: Draft Environmental Assessment* *Note: Comments in letter have been arranged here by theme in order to better provide a DOE Response* The potential environmental consequences of improper handling, storage, and stewardship of radioactive materials -- including the use of at least 648 kg of high-enriched uranium (HEU) to produce 2.6 metric tons (MT) of nuclear fuel, which the MCRE will fabricate onsite -- are too severe to leave unanalyzed. While the EA cites the application of criticality controls measures at the MCF on a very general basis, it does not address questions about the potential, likelihood, and impacts of criticality occurring during fuel synthesis and fabrication. Factors such as human error and shortfalls in administrative and procedural controls do not appear in the draft EA. Criticality incidents and other accidents have been known to occur in radioactive waste handling and nuclear fuel production within the industry, even when precise procedural guidelines and controls such as those described in a very general way in the EA have been in practice for many years. For instance, a criticality accident occurred at Japan Nuclear Fuel Conversion Co.'s (JCO) Tokaimura enrichment plant in 1999, when workers failed to follow procedure in combining uranyl nitrate mixtures, containing 16 kg of uranium enriched to 18.8% U235. This is less than would be present in each batch of HEU (18 kg) that FMF guidelines allow to be handled in the gloveboxes to be used for producing the MCRE fuel mixture, as specified in the EA. By mass of U235, the amount of fissile material involved in the Tokaimura event is several times less than the amounts to be permitted in the gloveboxes and furnace for producing the MCRE fuel mixture. The Tokaimura criticality event continued for approximately 19 hours, with neutron dose rates at the site boundary reaching 4.0 – 4.5 milliSieverts/hour several hours after the start of the event. The accident resulted in the deaths of two workers from radiation poisoning, and the hospitalization of a third worker for radiation sickness. In total, 667 workers, first responders, and local residents were exposed to radiation. More than 160 area residents were forced to evacuate during the incident. JCO eventually paid out over $117 million to settle claims for damages from nearly 7,000 people.	As stated in Section 2.1.8.4 the irradiated fuel salt would have significant value for future advanced reactor or advanced fuel cycle R&D programs. Section 2.1.8.2 describes the limits for HEU that may be present in each glovebox section during the fuel synthesis process. These restrictions, along with other SSCs identified in the hazard evaluations for the MCRE project (Section 2.1.6), will ensure safety throughout the MCRE project. As described in Section 3.10.3, the consequences of a hypothetical accident initiated by operator error, equipment failure, or a severe natural phenomena hazard are identified to support the development of the Documented Safety Analysis. As stated in Section 3, the irradiated fuel salt would be managed on site for future programmatic use in a manner similar to other irradiated materials at the INL following established plans and procedures. DOE manages HEU and other nuclear materials in accordance with all legal, regulatory, and safe/secure operational requirements in accordance with DOE Order 470.4B, *Safeguards and Security Programs*. These materials would be contained in specially designed irradiated salt containers that will secure the material for long-term storage while also protecting workers and the environment from radiological contamination. No impacts to water resources, ecological resources, air quality, worker and public health and safety, transportation, or other resource areas are expected from the proposed irradiated fuel salt. Furthermore, the consequences identified in Section 3.10.3 would be considered as bounding to any potential operator error.

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			DOE's own record regarding handling of radioactive materials and special nuclear material evidences the potential for human error leading to releases of radiation. The 2014 fire and explosion at DOE's Waste Isolation Pilot Plant in New Mexico resulted in radiation exposure of workers and the release of radiation to the environment, including plutonium and other transuranics. The incident was found to have been caused by workers improperly packaging the radioactive waste with an unapproved packing material, resulting in the exothermic chemical reaction and explosion after the waste containers had been placed inside the repository. The tragic SL-1 criticality accident at Idaho National Lab in 1961 also resulted from a worker error in following operating procedures. The new and novel procedures involving fuel production, reactor operations, and transfer, packaging, and storage of nuclear fuel and radioactive waste all warrant the level of thorough, detailed analysis in an environmental impact statement. The failure of the EA to consider the potential for human error in following the procedures and administrative controls that are described at a fairly general level is inadequate, particularly in light of the new and novel features of the MCRE and the history of criticality incidents and other catastrophic accidents at DOE and other nuclear facilities.	

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47c	4-14-2023	Ava Traverso, Snake River Alliance	*See letter titled DOE/EA-2209: Draft Environmental Assessment* *Note: Comments in letter have been arranged here by theme in order to better provide a DOE Response* The MCRE creates unnecessary, superfluous, and novel radioactive waste disposal streams. The anticipated 570 milligrams of fission product that will be generated by the project operation are of great environmental concern. The EA states: "The material will be stored in a configuration that facilitates easy retrieval for programmatic reuse at an appropriate INL facility, for future uranium recovery activities, or eventual direct disposition in a future deep geologic repository without the need to repackage. The long-term management of irradiated fuel salt will depend on the future application of this material and will be comparably managed to similar materials that currently reside at INL. The appropriate storage location for this material will be determined upon finalization of the reactor design and test plan. This information will better inform the expected characteristics of the material, enabling identification of viable storage locations based on those characteristics and other programmatic considerations." This analysis is inadequate to truly assess the environmental impacts of the fission material being stored indefinitely at INL. Considerations that require a full EIS include: a) impacts on ground and surface water of the Snake River Plain, including the Snake River Aquifer which is an EPA-designated "sole-source aquifer," provides drinking water to 300,000 Idahoans, and has historically been contaminated by DOE activities at INL and b) communities that are currently targeted to host "a future deep geologic repository" and consolidated interim storage facilities. The fact that the storage location for this material has yet to be determined and the lack of specific long-term management protocols and plans require a much more in-depth environmental analysis of the potential options for storing and managing the fissile material. It is irresponsible to approve a project that creates long-lasting, radioactive, environmentally hazardous materials without a specific, analyzed plan for the long term management of said materials.	Section 2.1.8.4 lists several locations at the INL Site that are capable of storing irradiated fuel salt until a programmatic reuse is identified. As stated, the specific facility has not yet been identified, but it is anticipated that any potential impacts would be within those identified in DOE/EIS-0306. As stated in Section 2.1.4, proposed activities would be contained entirely within the LOTUS testbed, FMF, and other analytical facilities at INL, as appropriate; and no liquid discharges would occur under normal operations. Section 3.2 states that the MCRE project would not include activities that physically or chemically alter ground or surface waters. The proposed project activities would not affect the Snake River Aquifer. The handling of radiological materials and special nuclear material at facilities other than the INL is outside the scope of this EA. The EA for the MCRE project does consider existing, and current, plans and procedures for the handling of these materials at the INL. Existing plans and procedures adhere to all statutory requirements, DOE orders and guidance, as well as facility specific requirements. The reactor design and procedures for its integration, operation, and decommissioning are based on DOE's vast experience with MSRs. As stated in Section 2.1.1, the primary objective of the proposed action is to reduce the technical, regulatory, and operational/human factors, to support a future commercial reactor design. The location and use of a future disposition facility are outside the scope of this EA.

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47d	4-14-2023	Ava Traverso, Snake River Alliance	*See letter titled DOE/EA-2209: Draft Environmental Assessment* *Note: Comments in letter have been arranged here by theme in order to better provide a DOE Response* Further analysis is needed to examine the environmental impacts of siting of MCRE at the ZPPR cell. While the EA states that the ZPPR cell, the assumed site of the NRIS-LOTUS testbed where MCRE operational activities will take place, is a "suitable location" for the MCRE project. According to the Accident Investigation of the November 8, 2011, Plutonium Contamination in the Zero Power Physics Reactor Facility, at the Idaho National Laboratory, however, the safety and design basis of the ZPPR facility came under scrutiny, and was judged to need a "reassessment of the likelihood, severity, and risk of accidents and the effectiveness of hazard controls" (p. 70, Table 3-1). Further, the accident investigation concluded that the "ZPPR Facility safety basis does not quantify credit associated with the ZPPR Workroom South Hood for mitigating accidental releases of radioactive material, nor does it provide technical bases for qualifying the Workroom South Hood as a defense-in-depth SSC" and stated that: "DOE-ID needs to utilize all necessary resources to confirm the validity of ZPPR Facility safety basis assumptions prior to the resumption of fuel handling other than for recovery from this accident." The ZPPR cell is a 54-year old piece of infrastructure with a history of radiological accidents and worker exposures, and investigations have questioned the basis of safety under which the siting of the MCRE project is proposed. Further analysis is needed to ensure that the ZPPR Facility is able to contain the specific pressures, materials, and fuel fabrication processes involved in the operation, construction, fuel fabrication, and decommissioning of the MCRE and adequately shield the outside environment from radiological releases and protect workers.	By project requirements, the testbed facility will be inspected and tested to demonstrate that ability to perform credited safety functions. As stated in Section 2.1.6, a hazard evaluation, as part of a DSA, is prepared for the MCRE project in compliance with DOE-STD-1189-2016. The hazard evaluation is performed for the identification and selection of SSCs that ensure the reactor can be built and safely operated in the LOTUS testbed. The LOTUS testbed, as described in Section 2.1.4, is designed with extensive functional safety systems and the MCRE project, as part of the hazard evaluation, will be analyzed to demonstrate that the project does not challenge those systems. Furthermore, the consequences identified in Section 3.10.3 would be considered as bounding to any potential operator error. As stated in Section 2.1.8, the fuel salt for the MCRE project will be performed in a separate nuclear facility in specially designed gloveboxes with the appropriate containment and HEPA filtration. These activities would not be performed in fume hoods. Furthermore, as stated, fuel salt will not be synthesized using plutonium or other transuranic isotopes.

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47e	4-14-2023	Ava Traverso, Snake River Alliance	*See letter titled DOE/EA-2209: Draft Environmental Assessment* *Note: Comments in letter have been arranged here by theme in order to better provide a DOE Response* These two above concerns are inadequately addressed in the EA. The potential for accidents, releases, and the management of fission material must be further examined, and the impacts of these on Ground and Surface Water must be analyzed, not excluded from analysis. The impacts on air quality and populations of aquatic and terrestrial biotic of radiological air emissions from fuel salt synthesis and from the operation of MCRE may be more significant than the EA states due to the unexamined concerns about the ZPPR Facility safety and neglected radioactive waste management plan for fission material. Too, the concerns about the ZPPR Facility must be taken into account in the analysis of worker and public health and safety. The MCRE EA fails to adequately address and sufficiently examine multiple significant environmental concerns: the safety of the proposed site of the project at the ZPPR cell and the impacts of generating 570 mg of fission product. These unaddressed concerns put workers, local ecosystems and the Snake River Aquifer at unnecessary risk. Providing a full EIS is the only way forward for DOE to work ethically and safely with Idahoans on this project, and to foster collaboration. Further, in order to truly encourage public participation, the comment period must be extended past the revised 28 days. A further 60 day extension would give the appropriate amount of time for citizens and other concerned parties to properly educate themselves and provide meaningful and well-researched comments, especially given the novel design of this reactor experiment.	Unabated radioactive air emissions from fuel salt synthesis to co-located workers and members of the public were estimated and determined to be extremely low when compared to regulatory limits. The projected radioactive air emissions as described in Section 3.3 of the EA are extremely conservative and were calculated without accounting for abatement via HEPA filters with a control efficiency of at least 99.97%, the cover gas systems, negative air pressure, and effluent monitoring systems. With abatements in place it is expected that the actual dose to a co-located worker or member of the public would be significantly less than estimated. Others aspects of these comments are addressed above.

Via email MCRE@id.doe.gov

Re: [DOE/EA-2209: Draft Environmental Assessment]

Request for Extension of Comment Period on The United States Department of Energy (DOE *Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE)* Project at the Idaho National Laboratory.

The Snake River Alliance respectfully requests that the United States Department of Energy extend the public comment period on the above-referenced Draft Environmental Assessment by a minimum of sixty (60) days beyond the currently scheduled public comment deadline.

The Snake River Alliance represents over 1000 members, supporters, and volunteers and has served as Idaho's Nuclear Watchdog and Clean Energy Champion for over forty years. We envision an Idaho where our people and our environment are free from the threat of nuclear waste and contamination, and our communities are healthy, strong, and prosperous because of our reliance on clean and renewable energy.

The Idaho National Laboratory (INL) was built in 1949 on 890 square miles of public land in southern Idaho's high desert plain. Beneath that plain lies the Snake River Aquifer, the second-largest unified aquifer on the North American continent. This EPA-designated sole-source aquifer flows beneath INL, providing water for the Magic Valley, drinking water for more than 300,000 Idahoans, and supporting one of the state's richest agricultural regions with a growing population and diverse economy. The Shoshone-Bannock peoples have lived on and used the land for time immemorial.

The 14-day public comment period for the MCRE draft environmental assessment began on March 17, 2023, and concludes on March 31, 2023. The U.S. Department of Energy (DOE) has given longer public comment periods and extended comment periods in the past. In early 2021 DOE extended the public comment period for the *Draft Versatile Test Reactor Environmental Impact Statement* (Draft VTR EIS) from 57 days to 71 days.

The Department of Energy is asking for public comment on the MCRE Draft EA, which contains a variety of complex technological and scientific matters, and is an experiment that puts our EPA-designated sole-source aquifer at risk. Much of Idaho is rural, and lacks stable internet access. A 14 day comment period poses a significant barrier for many people to access the EA and submit comments. The development of thoughtful comments in the 14-day comment period provided is unachievable and is thus inconsistent with adequate, lawful public participation.

The Snake River Alliance respectfully requests that DOE extend the public comment period for at least an additional 60 days, similar to the Draft VTR EIS. Thank you for considering this request.

Leigh Ford, Executive Director
Snake River Alliance
On Shoshone and Bannock land
(208) 297-3614 (cell)
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Snakeriveralliance.org

cc: Ava Traverso, Snake River Alliance Energy Program Manager
Hannah Smay, Snake River Alliance Board President

Re: Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project – request to extent comment period (1 of 1)

Nuclear Energy Information Service

Illinois' Nuclear Power Watchdog since 1981

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23 March 2023

Willettia Amos
U.S. Department of Energy-Idaho Operations Office
1955 Fremont Ave.
MS 1235, 83415-1222

RE: Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project -- request to extend comment period

Greetings Ms. Amos:

We hope this letter finds you well.

Nuclear Energy Information Service requests an extension of time to review the above named DEA. We request an extension from the listed 14 days out to 60 days.

It is more than unreasonable to expect the lay public to gather resources and experts to competently review a highly technical subject in the 14 day span prescribed in the DOE's announcement and even pretend that truly critical analysis and informed consent could be obtained. The only thing achieved by the 14-day comment window is a check-box exercise, not meaningful public comment.

Therefore we request that the new date be extended to May 15, 2023, 60 days after the March 15 announcement and posting.

Thank you for your consideration of this request.
Be well,

David A. Kraft, Director

Cc:
Sen. Richard Durbin
Sen. Tammy Duckworth

Public Comment Submittal on the U.S. Department of Energy Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project, DOE/EA-2209 issued March 2023.

Comment submittal by Tami Thatcher, March 27, 2023 (due March 31).

Send to MCRE@id.doe.gov

The MCRE project is a "relatively small, low-power density, low burn-up" 200-kilowatt thermal nuclear reactor experiment fueled with a molten uranium chloride salt. Most power generating stations are from 60 mega-watts to 1200 megawatts. This tiny but time and money wasting project will never be deployed in time to address climate change.

This project uses glove boxes. And the shortage of glove boxes and the difficulty of getting work done was the excuse given recently by the Department of Energy's National Nuclear Security Agency for allowing extremely high risk of over 3000 rem of plutonium airborne releases to New Mexico. The problem in New Mexico was allowed to exceed DOE regulations using the "exigent circumstances processes" all because it was deemed inconvenient to obtain seismically qualified glove boxes at the Los Alamos National Laboratory.

Now, the Department of Energy has all the time and money to waste on a time-wasting project that will never be commercial scale within decades, and far too late to address climate change. It is as though the DOE is seeking to line the pockets of profiteering investors rather than address the nation's problems.

The waste this project will create will likely end up shallowly buried in Idaho at the US Ecology Grand View hazardous waste dump. The small amount of radioactive waste is only because of the extremely small scale of the research. Any commercially viable scale of the technology will produce highly radioactive waste on a large scale for which there is no method of appropriate containment or disposal.

The radiation dose absorbed by the body is the "rem" but it is not a "Roentgen Equivalent Man." A Roentgen is a measure of absorbed dose in air. A rem is manipulated far beyond what is the absorbed dose in air, or even in tissue. The Department of Energy continues to misunderstand the radiation units it uses. The Department of Energy's repeated use antiquated terminology "Roentgen-equivalent-man" for rem leaves open for interpretation what level of absorbed dose forms the bases for the Department of Energy's dose. A roentgen corresponds to 87.7 ergs per gram of air absorbed dose, whereas a rad corresponds to 100 ergs/gram. The EA leaves unstated whether it is still using Roentgens or whether it nows defines rem in terms of the definition of a sievert.

This draft EA also fails to explain how organ doses received from the inhalation or ingestion of radioactive material can yield far higher organ doses than would be received from natural sources of radiation. For example, thyroid doses received from inhalation or ingestion of radioactive iodine or americium-241 can far exceed the thyroid organ dose that occurs from naturally occurring radiation and yet yield an estimated low whole body dose. The problem is

especially acute in the unborn, developing child, who may die from the failure to thrive due to hypothyroid issues, and die before a cancer develops.

Figure 10, Earthquakes occurring from 1850 to 202 with magnitudes greater than 2.0, shows far fewer earthquakes on the Snake River Plain than the surrounding mountains. It is conveyed that the INL should not be very prone to large seismic events. Despite this, the Idaho National Laboratory is refusing, even for this very small 200-kilowatt reactor, to provide a completed seismic evaluation of the proposed facility that the MCRE will be located in. Nor will the decades of concrete, cable and structural aging be taken into account, likely, if the Department of Energy ever completes a seismic evaluation of the facility at the INL that the experiment will be housed in. The EA simply states that "The evaluation of the ZPPR cell under seismic loads is currently being performed." This is unacceptable and inexcusable. No one has the results of the analysis that is "currently being performed." But, it is "business as usual" for the Idaho National Laboratory and the Department of Energy. Using 150 years of seismic experience is inadequate to conclude that no impacts due to seismic events would occur and DOE knows better.

Is the scanty detail in the EA being used as an excuse to not perform adequate seismic evaluations of the existing facility the DOE plans to conduct this experiment in?

Furthermore, the DOE has a long record of not performing or enforcing seismic requirements for safety buildings or for the safety systems, such as fire protection systems, needed in response to accidents. The excuses made in this EA are unacceptable despite the wrong impression the document seeks to make, that the INL has few seismic events. In fact, it is not easy to provide adequately seismically robust buildings, equipment and fire protection at the INL site because of relatively high seismic forces that are estimated to occur at relatively high likelihoods.

In an emergency, the small MCRE experiment may, in fact, divert scant and precious resources needed to protect other nuclear hazards of the Materials and Fuels Complex from a fire and/or seismic event. The way this EA fails to provide seismic safety for the MCRE and then also fails to examine the MFC seismic problems overall is shameful. It is yet another illustration of inadequate safety analysis and hazard mitigation at Department of Energy facilities.

The EA fails to acknowledge decades of repeated inadequate emergency preparation at the Idaho National Laboratory for site emergencies in terms of training, decontamination, radiological medical treatment, inadequate emergency radiological monitoring during and after the emergency.

If seismic impacts are not expected, then it should be a simple matter to complete the seismic analysis and provide computational assurance that the experiment will not be vulnerable to seismic events, which the EA appears to claim would be tiny. If the seismic event are so tiny and infrequent, why can't INL and DOE provide a completed analysis and one that would be protective for relatively larger, but infrequent earthquakes, of Performance Category 4, or that large nuclear reactors should be designed to?

Radiation worker doses need to include the neutron doses as well as gamma and beta absorbed doses. The gonad doses need to be provided and the uncertainties of these doses, not just the whole body dose. In fact, the material that will be handled in the glove boxes appears that high

energy gamma from decay progeny of uranium-238 and of uranium-236 (and U-232) may be significant. (Bismouth-214 and Thallium-208 provide high energy gamma's, which the Department of Energy appears to ignore yet are known to create unacceptably high radiation doses in nuclear fuel fabrication. Furthermore, these radionuclides are not subject to environmental monitoring programs because they belong in "natural" uranium and thorium decay chains. So, their releases to the environment in unnaturally high amounts are ignored by the Department of Energy, despite their health damaging effects.

The radioactive waste is stated to become the responsibility of the Department of Energy. As the record at the Idaho National Laboratory and its other sites has long shown, this is no assurance whatsoever that the waste will be timely and properly dealt with.

This EA goes to great lengths to not express the full listing of all radionuclides and their amounts that will be produced by the project. Yet, without the burnup and other information, no reader can estimate each radionuclide and its curie amount that will be produced and must be disposed of. The EA is deficient in many ways, and the choice to not describe and fully characterize the radionuclides to be disposed of and their curie amounts and concentrations makes the determination of proper disposal impossible and must be clarified.

Re: DOE/EA-22-9: Draft Environmental Assessment (1 of 1)

TO:
Willettia Amos
U.S. Department of Energy-Idaho Operations Office
1955 Fremont Ave., MS 1235, 83415-1222

FROM:
Nuclear Information and Resource Service
hannahs@nirs.org

RE: DOE/EA-2209: Draft Environmental Assessment

DATE: March 28, 2023

Request for Extension of Comment Period on The United States Department of Energy (DOE) *Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE)* Project at the Idaho National Laboratory.

The Nuclear Information and Resource Service (NIRS) requests that the United States Department of Energy extend the public comment period on the above-referenced Draft Environmental Assessment by a minimum of sixty (60) days beyond the currently scheduled public comment deadline.

The 14-day public comment period for the MCRE draft environmental assessment began on March 17, 2023, and concludes on March 31, 2023. The U.S. Department of Energy (DOE) has previously given longer public comment periods and extended comment periods. 14 days is an exceptionally short window to gather thoughtful and informed comments from local residents, tribes, and other interested parties. The DOE is asking for public comment on the MCRE Draft EA, which contains a variety of complex technological and scientific matters regarding a new and novel reactor design that has never been operated in the US before. A 14-day comment period does not provide adequate time for the public to meaningfully participate in this decision-making process, and instead poses a significant barrier for many people to access the EA and submit comments, and is thus inconsistent with adequate, lawful public participation.

NIRS requests that DOE extend the public comment period for at least an additional 60 days. The MCRE has the potential to affect the safety and environmental resources of residents throughout southern Idaho. Too, the decommissioning process, in particular the storage and transport of irradiated and spent fuel, will fall under the responsibilities of many state and local governments. We need to engage experts, which requires additional time and resources, for commenting. Thank you for your consideration of this request.

Hannah Smay
Digital Organizer
Nuclear Information and Resource Service
6930 Carroll Ave., Suite 340
Takoma Park, MD,20912
hannahs@nirs.org

Subject: Comment on the Draft Environmental Assessment for the Molten Chloride Reactor Experiment (1 of 2)

BREAKTHROUGH INSTITUTE

March 30, 2023

Willettia Amos
U.S. Department of Energy-Idaho Operations Office
1955 Fremont Ave., MS 1235
Idaho Falls, ID 83415

Subject: Comment on the Draft Environmental Assessment for the Molten Chloride Reactor Experiment Project

The Breakthrough Institute (BTI) appreciates this opportunity to comment on the draft environmental assessment (EA) for the Molten Chloride Reactor Experiment Project (MCRE). BTI is an independent 501(c)(3) global research center that advocates for appropriate regulation and oversight of nuclear reactors to enable the new and continued use of safe and clean nuclear energy. BTI acts in the public interest and does not receive funding from industry.

The MCRE project is a small reactor, even by microreactor standards, with a power level of 200-kilowatt thermal. It would be constructed in an existing cell and this draft EA finds that many of its effects would be minor and "indistinguishable from the existing environment of INL Site operations." This is a logical and reasonable conclusion. As such, the finding of no significant impact to the quality of the human environment is appropriate.

While the direct environmental impact of the project is slight, the scientific benefit is immense. The MCRE project is also a valuable endeavor due to its potential to provide useful experience and data for the commercial licensing efforts of molten salt technologies. Since the Nuclear Regulatory Commission (NRC) has never licensed a commercial nuclear reactor that isn't a light-water technology, the insights from a

BREAKTHROUGH INSTITUTE

national lab run project would likely be of great use to the NRC when it is making its licensing decisions.

The BTI would also like to recognize the appropriateness of the staff's decision to start with an EA instead of an environmental impact statement (EIS). EAs should be used instead of EISs to the maximum extent practicable to avoid unnecessary regulatory burden and reduce cost to the taxpayer.

Sincerely,

Leigh Anne Lloveras
Nuclear Energy Analyst
The Breakthrough Institute

Subject: State of Idaho Comments Regarding the Draft Environmental Assessment for the Molten Chloride Reactor Experiment Project at the Idaho National Laboratory Site (DOE/EA-2209) (1 of 2)

IDAHO GOVERNOR'S OFFICE OF ENERGY & MINERAL RESOURCES

BRAD LITTLE
Governor

RICHARD STOVER
Administrator

304 N. 8th Street, Suite 250
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(208) 332-1660
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April 13, 2023

U.S. Department of Energy – Idaho Operations Office
Attn: Willettia Amos
1955 Freemont Ave.
MS 1235, 83415-1222

Subject: State of Idaho Comments Regarding the Draft Environmental Assessment for the Molten Chloride Reactor Experiment Project at the Idaho National Laboratory Site (DOE/EA-2209)

Thank you for the opportunity to provide comments on the Draft Environmental Assessment for the Molten Chloride Reactor Experiment (MCRE) Project at the Idaho National Laboratory (INL) Site (DOE/EA-2209). The following comments were developed in coordination with the Idaho Governor's Office of Energy and Mineral Resources (OEMR) and the Idaho Department of Environmental Quality (DEQ). OEMR submits these comments on behalf of the state of Idaho pursuant to its responsibility to coordinate all state comments involving energy resources in accordance with Executive Order 2020-17.

All spent nuclear fuel (SNF) generated as a result of the MCRE Project must comply with all requirements of the Idaho 1995 Settlement Agreement and related subsequent memorandum of agreement, supplemental agreement, addendum, and agreements.

Section 3 of the document, "Affected Environment and Environmental Consequences," addresses and describes the regional setting and several resources of concern. However, this section does not appear to describe or address the Snake River Plain Aquifer, which underlies the INL and represents a vital environmental resource for the state of Idaho. As such, this section of the Draft Environmental Assessment requires revision to include a detailed discussion of this resource, similar to that provided for "Ecological Resources," "Geological and Soil Resource", etc.

As stated in Section 3.3 for air quality, INL would conduct permit applicability for each source for both 40 CFR 61 (EPA delegated) and the current Facility Emission Cap (FEC) permit as well as the Permit to Construct (PTC) programs (DEQ). In the event a PTC or a FEC modification is required, INL representatives will need to contact DEQ in advance of this determination and schedule a pre-application meeting.

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

Sincerely,

Richard Stover
Administrator
Idaho Governor's Office of Energy and Mineral Resources

Re: Proposed Idaho Reactor (MCRE) Violates U.S. Nonproliferation Policy of HEU Minimization (1 for 3)

NUCLEAR PROLIFERATION PREVENTION PROJECT

April 13, 2023

Willettia Amos
U.S. Department of Energy – Idaho Operations Office
1955 Fremont Ave.
MS 1235, 83415-1222
Via email: MCRE@id.doe.gov

Re: Proposed Idaho Reactor (MCRE) Violates U.S. Nonproliferation Policy of HEU Minimization

Dear Ms. Amos,

This submission responds to the March 16, 2023, announcement by the Department of Energy (DOE) of the public comment period for the "Draft Environmental Assessment (EA) for the Molten Chloride Reactor Experiment (MCRE) Project at the Idaho National Laboratory" (DOE/EA-2209, Revision 0). This submission is filed in a timely manner, prior to the deadline of April 14, 2023.

The EA is deficient in ignoring the significant environmental consequences that could result from a central aspect of the proposed action – the use in this new research facility of fuel containing more than 600 kilograms (kg) of nuclear weapons-grade, 93%-enriched, highly enriched uranium (HEU) – which would violate 45 years of U.S. government nonproliferation policy and practice, thereby increasing risks of nuclear proliferation and nuclear terrorism that could have catastrophic environmental consequences.

Since 1978, the U.S. government has avoided building new research reactors using HEU fuel, has opposed other countries doing so, and has refused to export HEU fuel for any such new reactors – on grounds that the resulting HEU commerce would increase risks of nuclear proliferation and nuclear terrorism that could threaten U.S. national security.[1] A guiding principle of this U.S. HEU minimization policy has been to avoid exceptions, on grounds that if any country were granted an exception for a facility, then other countries would demand exceptions too, potentially unravelling the policy. That is why, even though the U.S. government's original goal was to reduce foreign use of HEU, the policy was first implemented by converting two U.S. research reactors from HEU fuel to low-enriched uranium (LEU) fuel that is unsuitable for nuclear weapons. In the 1990s, the U.S. government did consider building one new research reactor with HEU fuel, the Advanced Neutron Source at Oak Ridge National Laboratory, but as reported in 1995, "opposition to the use of highly-enriched uranium in the reactor's core led to its cancellation."[2]

[1] Alan J. Kuperman, "Nuclear Nonproliferation via Coercion and Consensus: The Success and Limits of the RERTR Program (1978–2004)," in *International Cooperation on WMD Nonproliferation*, ed. Jeffrey W. Knopf (Athens, GA: University of Georgia Press, 2016): 46-71.

[2] Peter Rodgers, "US cancels another megaproject," *Physics World* 8, 3 (March 1995), p. 5.

The U.S. government has since expanded the ban on HEU fuel to nearly all new nuclear facilities. In 2012, the DOE announced that new medical-isotope production facilities must avoid HEU.[3] Similarly, in 2019, the U.S. Army announced that its future mobile nuclear power reactors must avoid HEU fuel.[4] Indeed, in recent decades, the U.S. government has permitted only two exceptions to the ban on new reactors using HEU fuel. One occurred in 2018, when NASA tested a microreactor fueled by 30 kg of 93%-enriched HEU for barely one day (28 hours),[5] which triggered so much concern that the White House later issued a Presidential Memorandum declaring that future space reactors should avoid HEU fuel.[6] The other exception, on national security grounds, is new Navy propulsion reactors that continue to be fueled with HEU while NNSA researches the feasibility of using LEU.[7]

The EA indicates that the amount of HEU for the proposed facility is enormous, exceeding 600 kg, thereby magnifying the consequences for U.S. nonproliferation policy. On p. 13, the EA states that, "each furnace is limited to 9 kg of HEU per batch. With these restrictions, it is anticipated that a minimum of 72 batches (runs) of the synthesis process will be needed." This implies that at least 648 kg (i.e., 72 x 9) of HEU will be utilized in fuel for the facility. The U.S. Nuclear Regulatory Commission requires that the highest security (Category I) be applied to as little as 5 kg of HEU,[8] which according to independent experts is sufficient for a nuclear weapon.[9] This means the proposed action in the EA would utilize enough HEU for more than 100 nuclear weapons, thereby creating a dangerous precedent and a potential excuse for other countries to produce large quantities of weapons-grade uranium, which subsequently could be diverted or stolen for nuclear weapons.

The draft EA ignores entirely how the proposed fuel would contradict and undermine longstanding U.S. nonproliferation policy, and thus fails to assess the resulting increased risks of nuclear proliferation and nuclear terrorism, which could have significant consequences for human health and the environment. If the United States were to build this new research facility for commercial nuclear power, using over 600 kg of weapons-grade HEU, other countries would demand the right to produce such amounts of HEU for similar purposes, which would increase the risk of states and terrorists acquiring and using nuclear weapons. Even a single nuclear weapon of World War II-era design, detonated in an American city, could kill hundreds of thousands of people and compel evacuation of millions more.

Accordingly, DOE must prepare an Environmental Impact Statement (EIS) that includes assessment of such potentially significant impacts on human health and the environment. Moreover, the EIS must examine alternatives that would avert or reduce these significant impacts on human health and the environment, by avoiding HEU entirely, which the EA fails to do. Since the MCRE is intended to produce

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[3] U.S. Department of Energy, "NNSA's Molybdenum-99 Program: Establishing a Reliable Domestic Supply of Mo-99 Produced Without Highly Enriched Uranium," https://www.energy.gov/nnsa/nnsas-molybdenum-99-program-establishing-reliable-domestic-supply-mo-99-produced-without (accessed April 12, 2023).

[4] U.S. Secretary of Defense, "Request for Solutions: Pele Program Phase 1," May 2019.

[5] David I. Poston, Marc A. Gibson, Thomas Godfroy, and Patrick R. McClure, "KRUSTY Reactor Design," *Nuclear Technology*, 206 (2020), pp. S13-S30.

[6] White House, "Space Policy Directive–6, National Strategy for Space Nuclear Power and Propulsion," December 16, 2020. Alan J. Kuperman, "Avoiding HEU in Space Reactors: An Emerging Consensus," in *NETS - 2021, Nuclear and Emerging Technologies for Space, Conference Proceedings* (American Nuclear Society, Aerospace Nuclear Science and Technology Division, 2021).

[7] Letter from U.S. Congress to the Secretary of the Navy and the NNSA Administrator, January 27, 2023, https://sites.utexas.edu/nppp/files/2023/01/HEU-naval-Foster-Merkley-letter-2023-Jan.pdf.

[8] "Categorization of Nuclear Material," 10 CFR 110, Appendix M, https://www.ecfr.gov/current/title-10/chapter-I/part-110/appendix-Appendix%20M%20to%20Part%20110.

[9] Thomas B. Cochran and Christopher E. Paine, "The amount of plutonium and highly-enriched uranium needed for pure fission nuclear weapons," Natural Resources Defense Council, 1995.

experimental findings to facilitate a future Molten Chloride Fast Reactor (MCFR), which itself intends to avoid HEU fuel for both its demonstration-size and full-size facilities,[10] it should be possible to redesign the MCRE to avoid HEU fuel too, for example by increasing the amount of fuel.

In conjunction with preparation of the EIS, DOE also should prepare a Nonproliferation Impact Assessment of the proposed action and its alternatives. Previously, DOE has prepared such assessments in at least six instances in conjunction with an EIS on a proposed action that, like the MCRE, raises potential nuclear proliferation risks.[11] As DOE officials explained in 2009, such an assessment "draws on nonproliferation objectives of the U.S. Government as the basis for a policy evaluation of proliferation risk" of the proposed action, during DOE's preparation of the EIS.[12] As DOE elaborated in 2000 in response to members of Congress, such an assessment can "provide additional pertinent information to the Secretary of Energy so that he may make an informed decision with respect to the alternatives presented in the" EIS.[13] As DOE further declared in 1998, such an assessment "fulfills the DOE commitment to assess the nonproliferation aspects of the various technology options the Department is considering."[14] To honor that solemn obligation to the American people, DOE must not issue a decision on the proposed action, nor complete an EIS on the proposed action, prior to formally assessing the nuclear proliferation risks of the proposed action and its alternatives.

Thank you for this opportunity to provide public comment.

Sincerely,

Alan J. Kuperman

Alan J. Kuperman
Coordinator, Nuclear Proliferation Prevention Project

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[10] Jeff Latkowski, "TerraPower's Molten Chloride Fast Reactor (MCFR)," National Academies meeting on Merits and Viability of Different Nuclear Fuel Cycles and Technology Options and the Waste Aspects of Advanced Nuclear Reactors, February 22, 2021, p. 4, https://www.nationalacademies.org/documents/embed/link/LF2255DA3DD1C41C0A42D3BEF0989ACAECE3053A6A9B/file/DB0D308269688B2BD7B1AF60BAA143D48890C2DE80BB?noSaveAs=1.

[11] U.S. Department of Energy, Office of Arms Control and Nonproliferation, "The National Ignition Facility (NIF) and the Issue of Nonproliferation," December 1995, https://www.osti.gov/biblio/187216. U.S. Department of Energy, Office of Arms Control and Nonproliferation, "Nonproliferation and Arms Control Assessment of Weapons-Usable Fissile Material Storage and Excess Plutonium Disposition Alternatives," DOE/NN-0007, January 1997, https://www.osti.gov/biblio/425259. U.S. Department of Energy, Office of Arms Control and Nonproliferation, "Nonproliferation Impacts Assessment for the Management of the Savannah River Site Aluminum-based Spent Nuclear Fuel," DOE/NN-99001919, December 1998, https://www.osti.gov/biblio/319653. U.S. Department of Energy, Office of Arms Control and Nonproliferation, "Nonproliferation Impacts Assessment for the Treatment and Management of Sodium-Bonded Spent Nuclear Fuel," DOE/EIS-0306D, July 1999. U.S. Department of Energy, Office of Arms Control and Nonproliferation "Nuclear Infrastructure Nonproliferation Impact Assessment," DOE/NE-0119, September 2000. U.S. Department of Energy, Office of Nonproliferation and International Security, "Draft Nonproliferation Impact Assessment for the Global Nuclear Energy Partnership Programmatic Alternatives," December 2008, https://curie.pnnl.gov/system/files/documents/not%20yet%20assigned/gnep_npia.pdf.

[12] M. Goodman, A. Scheinman, and J. Sprinkle, "A Nonproliferation Impact Assessment of the GNEP Alternatives," Los Alamos National Laboratory, LA-UR-09-03011, Proceedings of GLOBAL 2009, Paris, France, Paper 9476, September 6–11, 2009, p. 2.

[13] U.S. Department of Energy, "Final Programmatic Environmental Impact Statement: Accomplishing Expanded Civilian Nuclear Energy Research and Development and Isotope Production Missions in the United States, Including the Role of the Fast Flux Test Facility," EIS-0310, December 1, 2000, p. 2-182.

[14] DOE/NN-99001919, p. 1-4.

RE: DOE/EA-2209: Draft Environmental Assessment (1 of 7)

TO:
Willettia Amos
U.S. Department of Energy-Idaho Operations Office
1955 Fremont Ave., MS 1235, 83415-1222
Via email: MCRE@id.doe.gov

FROM:
Nuclear Information and Resource Service
Hannah Smay
hannahs@nirs.org

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RE: DOE/EA-2209: Draft Environmental Assessment (2 of 7)

Maggie Gundersen
Fairewinds Energy Education
maggie@fairewindsenergy.org

Joni Arends
Concerned Citizens for Nuclear Safety
jarends@nuclearactive.org

RE: DOE/EA-2209: Draft Environmental Assessment

DATE: April 14, 2023

Request to the United States Department of Energy (DOE) to a) extend the public comment period on the above-referenced Draft Environmental Assessment by an additional 60 days beyond the currently scheduled public comment deadline and b) conduct a full Environmental Impact Statement (EIS) for the Molten Chloride Reactor Experiment (MCRE) Project at the Idaho National Laboratory (INL).

The Snake River Alliance, Nuclear Information and Resource Service (NIRS), and other organizations listed below request that the United States Department of Energy (DOE) conduct a full Environmental Impact Statement (EIS), as determined under the National Environmental Policy Act (NEPA), to examine the MCRE's significant environmental impacts to the ground and surface water, ecosystems, workers, air, and species. In addition, we request that DOE extend the public comment period on the above-referenced Draft Environmental Assessment by an additional 60 days beyond the currently scheduled public comment deadline.

The 28-day public comment period for the MCRE draft environmental assessment began on March 17, 2023, and concludes on April 14, 2023. The U.S. Department of Energy (DOE) has previously given longer public comment periods and extended comment periods. Though extended from the original 14 days, 28 days is an exceptionally short window to gather thoughtful and informed comments from residents, tribes, and other interested parties on a complex, first-of-its-kind nuclear project with long-lasting material impacts, including the creation of nuclear waste and irradiated materials.

The potential environmental consequences of improper handling, storage, and stewardship of radioactive materials -- including the use of at least 648 kg of high-enriched uranium (HEU) to produce 2.6 metric tons (MT) of nuclear fuel, which the MCRE will fabricate onsite -- are too severe to leave unanalyzed. While the EA cites the application of criticality controls measures at the MCF on a very general basis, it does not address questions about the potential, likelihood, and impacts of criticality occurring during fuel synthesis and fabrication. Factors such as human error and shortfalls in administrative and procedural controls do not appear in the draft EA.

Criticality incidents and other accidents have been known to occur in radioactive waste handling and nuclear fuel production within the industry, even when precise procedural guidelines and controls such as those described in a very general way in the EA have been in practice for many years. For instance, a

criticality accident occurred at Japan Nuclear Fuel Conversion Co.'s (JCO) Tokaimura enrichment plant in 1999, when workers failed to follow procedure in combining uranyl nitrate mixtures, containing 16 kg of uranium enriched to 18.8% U235.[1] This is less than would be present in each batch of HEU (18 kg) that FMF guidelines allow to be handled in the gloveboxes to be used for producing the MCRE fuel mixture, as specified in the EA. By mass of U235, the amount of fissile material involved in the Tokaimura event is several times less than the amounts to be permitted in the gloveboxes and furnace for producing the MCRE fuel mixture.

The Tokaimura criticality event continued for approximately 19 hours, with neutron dose rates at the site boundary reaching 4.0-4.5 milliSieverts/hour several hours after the start of the event.[2] The accident resulted in the deaths of two workers from radiation poisoning, and the hospitalization of a third worker for radiation sickness. In total, 667 workers, first responders, and local residents were exposed to radiation.[3] More than 160 area residents were forced to evacuate during the incident.[4] JCO eventually paid out over $117 million to settle claims for damages from nearly 7,000 people.[5]

DOE's own record regarding handling of radioactive materials and special nuclear material evidences the potential for human error leading to releases of radiation. The 2014 fire and explosion at DOE's Waste Isolation Pilot Plant in New Mexico resulted in radiation exposure of workers and the release of radiation to the environment, including plutonium and other transuranics.[6] The incident was found to have been caused by workers improperly packaging the radioactive waste with an unapproved packing material, resulting in the exothermic chemical reaction and explosion after the waste containers had been placed inside the repository. The tragic SL-1 criticality accident at Idaho National Lab in 1961 also resulted from a worker error in following operating procedures.

The new and novel procedures involving fuel production, reactor operations, and transfer, packaging, and storage of nuclear fuel and radioactive waste all warrant the level of thorough, detailed analysis in an environmental impact statement. The failure of the EA to consider the potential for human error in following the procedures and administrative controls that are described at a fairly general level is inadequate, particularly in light of the new and novel features of the MCRE and the history of criticality incidents and other catastrophic accidents at DOE and other nuclear facilities.

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[1] International Atomic Energy Agency. "Report on the Preliminary Fact Finding Mission Following the Accident at the Nuclear Fuel Processing Facility in Tokaimura, Japan." Vienna, Austria. 1999. https://www.iaea.org/publications/5957/report-on-the-preliminary-fact-finding-mission-following-the-accident-at-the-nuclear-fuel-processing-facility-in-tokaimura-japan

[2] Shun-Ichi Tanaka. "Summary of the JCO Criticality Accident in Tokai-mura and a Dose Assessment." Journal of Radiation Research, Volume 42, Issue Suppl, September 2001, Pages S1–S9. https://doi.org/10.1269/jrr.42.S1

[3] Koichi Hasegawa and Yuko Takubo. "JCO Criticality Accident and Local Residents: Damages, Symptoms and Changing Attitudes." Citizens' Nuclear Information Center. Tokyo. June 2001. https://cnic.jp/english/publications/pdffiles/jco_residents_font.pdf

[4] IAEA 1999.

[5] Times Wire Services. "6 Ex-Employees Arrested in '99 Japan Nuclear Accident." *Los Angeles Times*. October 12, 2000. https://www.latimes.com/archives/la-xpm-2000-oct-12-mn-35471-story.html

[6] Office of Environmental Management. "Accident Investigation Report, Phase 2: Radiological Release Event at the Waste Isolation Pilot Plant, February 14, 2014." U.S. Department of Energy. April 2015. https://www.wipp.energy.gov/special/aib_wipp%20rad_event%20report_phase%20ii.pdf

The DOE is asking for public comment on the MCRE Draft EA, which contains a variety of complex technological and scientific matters regarding a new and novel reactor design that has never been operated in the US before. A 28-day comment period does not provide adequate time for the public to meaningfully evaluate all of the potential environmental impacts of the MCRE and DOE's conclusions in the Draft EA, nor to participate in this decision-making process. Instead, it poses a significant barrier for many people to access the EA and submit comments, and is thus inconsistent with adequate, lawful public participation.

The signing organization to these comments call upon DOE to extend the public comment period for at least an additional 60 days. In the alternative, DOE should revise its conclusion in the Draft EA, and determine that a full environmental impact statement (EIS) is required for this project. This will require DOE to conduct the appropriately thorough and detailed analysis, as well as provide ample time, information, and opportunities for meaningful public engagement in scoping, development, and review of a Draft EIS. The MCRE has the potential to affect environmental resources throughout southern Idaho. Additionally, the decommissioning process, in particular the storage and transport of irradiated and spent fuel, will fall under the responsibilities of many state and local governments. We need to engage experts, which requires additional time and resources, for commenting. Thank you for your consideration of this request.

Concerns

1. Further analysis is needed to examine the environmental impacts of siting of MCRE at the ZPPR cell. While the EA states that the ZPPR cell, the assumed site of the NRIS-LOTUS testbed where the MCRE reactor operational activities will take place, is a "suitable location" for the MCRE project. According to the Accident Investigation of the November 8, 2011, Plutonium Contamination in the Zero Power Physics Reactor Facility, at the Idaho National Laboratory, however, the safety and design basis of the ZPPR facility came under scrutiny, and was judged to need a "reassessment of the likelihood, severity, and risk of accidents and the effectiveness of hazard controls" (p. 70, Table 3-1)[7]. Further, the accident investigation concluded that the "ZPPR Facility safety basis does not quantify credit associated with the ZPPR Workroom South Hood for mitigating accidental releases of radioactive material, nor does it provide technical bases for qualifying the Workroom South Hood as a defense-in-depth SSC" and stated that: "DOE-ID needs to utilize all necessary resources to confirm the validity of ZPPR Facility safety basis assumptions prior to the resumption of fuel handling other than for recovery from this accident." The ZPPR cell is a 54-year old piece of infrastructure with a history of radiological accidents and worker exposures[8], and investigations have questioned the basis of safety under which the siting of the MCRE project is proposed. Further analysis is needed to ensure that the ZPPR Facility is able to contain the specific pressures, materials, and fuel fabrication processes involved in the operation, construction, fuel fabrication, and decommissioning of the MCRE and adequately shield the outside environment from radiological releases and protect workers.

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[7] U.S. Department of Energy Office of Health, Safety, and Security. Accident Investigation of the November 8, 2011, Plutonium Contamination in the Zero Power Physics Reactor Facility, at the Idaho National Laboratory, January 2012. https://www.energy.gov/sites/default/files/2014/04/f14/INL_AI_Report_11-08-2011.pdf

[8] Jessica Murri. "Half-Life: How an Accident at the Idaho National Laboratory Changed a Family." *Boise Weekly*. April 16, 2014. https://snakeriveralliance.org/2014/12/boise-weekly-inl-accident/

2. The MCRE creates unnecessary, superfluous, and novel radioactive waste disposal streams. The anticipated 570 milligrams of fission product that will be generated by the project operation are of great environmental concern. The EA states:

> "The material will be stored in a configuration that facilitates easy retrieval for programmatic reuse at an appropriate INL facility, for future uranium recovery activities, or eventual direct disposition in a future deep geologic repository without the need to repackage. The long-term management of irradiated fuel salt will depend on the future application of this material and will be comparably managed to similar materials that currently reside at INL.
>
> The appropriate storage location for this material will be determined upon finalization of the reactor design and test plan. This information will better inform the expected characteristics of the material, enabling identification of viable storage locations based on those characteristics and other programmatic considerations."

This analysis is inadequate to truly assess the environmental impacts of the fission material being stored indefinitely at INL. Considerations that require a full EIS include: a) impacts on ground and surface water of the Snake River Plain, including the Snake River Aquifer which is an EPA-designated "sole-source aquifer,"[9] provides drinking water to 300,000 Idahoans, and has historically been contaminated by DOE activities at INL[10] and b) communities that are currently targeted to host "a future deep geologic repository" and consolidated interim storage facilities. The fact that the storage location for this material has yet to be determined and the lack of specific long-term management protocols and plans require a much more in-depth environmental analysis of the potential options for storing and managing the fissile material. It is irresponsible to approve a project that creates long-lasting, radioactive, environmentally hazardous materials without a specific, analyzed plan for the long term management of said materials.

These two above concerns are inadequately addressed in the EA. The potential for accidents, releases, and the management of fission material must be further examined, and the impacts of these on Ground and Surface Water must be analyzed, not excluded from analysis. The impacts on air quality and populations of aquatic and terrestrial biotic of radiological air emissions from fuel salt synthesis and from the operation of the MCRE reactor may be more significant than the EA states due to the unexamined concerns about the ZPPR Facility safety and neglected radioactive waste management plan for fission material. Too, the concerns about the ZPPR Facility must be taken into account in the analysis of worker and public health and safety.

Conclusion

The MCRE EA fails to adequately address and sufficiently examine multiple significant environmental concerns: the safety of the proposed site of the project at the ZPPR cell and the impacts of generating 570 mg of fission product. These unaddressed concerns put workers, local ecosystems and the Snake River

[9] The Office of Ground Water, U.S. Environmental Protection Agency, "Support Document for Designation of the Eastern Snake River Plain as a Sole Source Aquifer." 1990. https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=94000ZFP.txt

[10] Larry J. Mann and L. DeWayne Cecil. U.S. Geological Survey Water-Resources Investigations Report 90-4090. "Tritium in Ground Water at the Idaho National Engineering Laboratory, Idaho." 1990. https://inldigitallibrary.inl.gov/PRR/92909.pdf

Aquifer at unnecessary risk. Providing a full EIS is the only way forward for DOE to work ethically and safely with Idahoans on this project, and to foster collaboration. Further, in order to truly encourage public participation, the comment period must be extended past the revised 28 days. A further 60 day extension would give the appropriate amount of time for citizens and other concerned parties to properly educate themselves and provide meaningful and well-researched comments, especially given the novel design of this reactor experiment.

Thank you for considering these comments.

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