VOLUME II
APPENDICES

U.S. DEPARTMENT OF ENERGY
WASHINGTON, DC 20585

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE RECAPITALIZATION OF INFRASTRUCTURE SUPPORTING NAVAL SPENT NUCLEAR FUEL HANDLING

JUNE 2015

DOE/EIS-0453-D

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DRAFT
Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling

Volume II
Appendices

June 2015

Prepared by:
U.S. Department of Energy
Naval Nuclear Propulsion Program

COVER SHEET

RESPONSIBLE AGENCY: U.S. Department of Energy (DOE), Naval Nuclear Propulsion Program (NNPP)

TITLE: Draft Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Idaho National Laboratory (DOE/EIS-0453-D)

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ABSTRACT:

The Naval Nuclear Propulsion Program (NNPP), also known as the Naval Reactors Program, is a joint United States (U.S.) Navy and Department of Energy (DOE) organization with responsibility for all matters pertaining to naval nuclear propulsion from design through disposal (cradle-to-grave). The NNPP's mission is to provide the U.S. with safe, effective, and affordable naval nuclear propulsion plants and to ensure their continued safe and reliable operation through lifetime support, research and development, design, construction, specification, certification, testing, maintenance, and disposal.

This Draft Environmental Impact Statement (EIS) evaluates the potential environmental impacts associated with recapitalizing the infrastructure needed to ensure the long-term capability of the NNPP to support naval spent nuclear fuel handling for at least the next 40 years (i.e., the proposed action). The NNPP is committed to manage naval spent nuclear fuel in a manner that is consistent with the *Department of Energy (DOE) Programmatic Spent Nuclear Fuel Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Programs Final Environmental Impact Statement (*DOE/EIS-0203-F) and to comply with the 1995 Settlement Agreement, as amended in 2008, among the State of Idaho, the DOE, and the Navy concerning the management of naval spent nuclear fuel.

Consistent with the Record of Decision for DOE/EIS-0203-F, naval spent nuclear fuel is shipped by rail from shipyards and prototypes to the Expended Core Facility (ECF) on the Idaho National Laboratory for processing. The proposed action is needed because significant upgrades are necessary to the ECF infrastructure to continue safe and environmentally responsible naval spent nuclear fuel handling until at least 2060.

To allow the NNPP to continue to unload, transfer, prepare, and package naval spent nuclear fuel for disposal, three alternatives were identified and are evaluated in the Draft EIS:

1. No Action Alternative – Maintain the naval spent nuclear fuel handling capabilities of ECF by continuing to use the current ECF infrastructure while performing only preventative and corrective maintenance.

2. Overhaul Alternative – Recapitalize the naval spent nuclear fuel handling capabilities of ECF by overhauling ECF with major refurbishment projects for the ECF infrastructure and water pools to keep the infrastructure and water pools in safe working order and provide the needed long-term capabilities for transferring, preparing, and packaging naval spent nuclear fuel.

3. New Facility Alternative – Recapitalize the naval spent nuclear fuel handling capabilities of ECF by constructing and operating a new facility at one of two potential locations at the Naval Reactors Facility (NRF).

This Draft EIS evaluates the environmental impacts (direct, indirect, and cumulative) that result from recapitalizing the naval spent nuclear fuel handling capabilities. The EIS presents a comparison of the environmental impacts from these alternatives. The impacts to human health and the environment for all these alternatives would primarily be small. In this Draft EIS, the preferred alternative to recapitalize naval spent nuclear fuel handing capabilities is to build a new facility (New Facility Alternative) at Location 3/4.

SCOPING PROCESS:

The DOE published a Notice of Intent (NOI) to prepare an EIS for naval spent nuclear fuel handling and examination recapitalization in 75 Fed. Reg. 42082 (July 20, 2010). The purpose of this NOI was to announce the NNPP's intent to prepare an EIS for the recapitalization of the infrastructure supporting naval spent nuclear fuel handling and examination and to solicit comments on the scope of the EIS.

During preparation of the Draft EIS, it was determined that the NNPP plan for a single EIS that addressed the recapitalization of the infrastructure supporting both naval spent nuclear fuel handling and examination was not feasible. When the EIS was initially scoped in 2010, the NNPP plans showed the evaluation of alternatives for examination recapitalization being developed in parallel with the development of the Draft EIS such that planning for the recapitalization of the examination capabilities would closely follow planning for the recapitalization of the naval spent nuclear fuel handling capabilities. However, due to fiscal restraints on the DOE budget, project schedules changed such that the proposed action progressed further than evaluations for examination recapitalization. The examination recapitalization evaluations have not developed at a pace sufficient to conduct a proper NEPA evaluation concurrent with the proposed action. A final set of alternatives for the examination recapitalization has not been established, and pre-conceptual design information is not available upon which impacts can be evaluated. An amended NOI was published in 77 Fed. Reg. 27448 (May 10, 2012). The purpose of the amended NOI was to announce the NNPP's intent to reduce the scope of the EIS to include only the recapitalization of naval spent nuclear fuel handling capabilities in the proposed action. The NNPP has used the input received during both scoping periods to prepare the Draft EIS.

PUBLIC INVOLVEMENT:

A 45-day public comment period on this Draft EIS begins with the publication of the Environmental Protection Agency Notice of Availability (NOA) in the *Federal Register*. Comments on this Draft EIS must be received within 45 days of the publication of the Environmental Protection Agency NOA in the *Federal Register*.

This Draft EIS is available on the ECF Recapitalization website at www.ecfrecapitalization.us. All comments postmarked or received during the comment period will be considered in preparing the Final EIS. NNPP will consider any comments postmarked after the comment period to the extent practicable. The locations and times of the public hearings on the Draft EIS will be identified in the *Federal Register,* the ECF Recapitalization website, and through other media, such as local newspaper notices. In addition to the public hearings, comments on the Draft EIS can be submitted via U.S. mail or e-mail as indicated below:

U.S. Mail:
Erik Anderson
Department of the Navy
Naval Sea Systems Command
1240 Isaac Hull Ave. SE
Stop 8036
Washington Navy Yard, DC 20376-8036

E-Mail:
ecfrecapitalization@unnpp.gov

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ACRONYMS

AEA	Atomic Energy Act
ALARA	As Low As Reasonably Achievable
AQRVs	Air Quality Related Values
ARF	Airborne Release Fraction
ATR	Advanced Test Reactor
B.A.	Bachelor of Arts
BEA	Bureau of Economic Analysis or Battelle Energy Alliance
BLM	Bureau of Land Management
B.S.	Bachelor of Science
CAA	Clean Air Act
CCA	Candidate Conservation Agreement
CED	Committed Effective Dose
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CFA	Central Facilities Area
C.F.R.	Code of Federal Regulations
CH	Contact-handled
CRMP	Cultural Resources Management Plan
CSRF	Cask Shipping and Receiving Facility
CT	Computed Tomography
CVN	Carrier Vessel - Nuclear
DART	Days Away, Restricted, or on-the-job Transfer
D&D	Decontamination and Decommissioning
dBA	Decibels on an A-Weighted Scale
DI	Deionized (water)
DOE	Department of Energy
DOP	Dioctylphthalate
DOT	Department of Transportation
DR	Damage Ratio
EA	Environmental Assessment
EBR	Experimental Breeder Reactor
ECF	Expended Core Facility
ED	Effective Dose
EDG	Emergency Diesel Generator
EF	Emission Factor
EIS	Environmental Impact Statement
EMR	Environmental Monitoring Report
EO	Executive Order
EPA	Environmental Protection Agency
ERA	Ecological Risk Assessment
ESA	Endangered Species Act
ESER	Environmental Surveillance, Education and Research
ESRP	Eastern Snake River Plain
FFA/CO	Federal Facility Agreement and Consent Order
FFCA	Federal Facilities Compliance Act
FLM	Federal Land Manager
FY	Fiscal Year
GHG	Greenhouse Gas

ACRONYMS (cont.)

GTCC	Greater Than Class C
GWP	Global Warming Potential
HAP	Hazardous Air Pollutant
HDPE	High Density Polyethylene
HEPA	High-Efficiency Particulate Air
HFC	Hydrofluorocarbon
HVAC	Heating, Ventilation and Air Conditioning
ICDC	Idaho Conservation Data Center
ICMR	Institutional Control Monitoring Report
ICPP	Idaho Chemical Processing Plant
ICRP	International Commission on Radiological Protection
IDA	Intentionally Destructive Act
IDAPA	Idaho Administrative Procedures Act
IDEQ	Idaho Department of Environmental Quality
IFWO	Idaho Fish and Wildlife Office
INEEL	Idaho National Engineering and Environmental Laboratory
INL	Idaho National Laboratory
INPS	Idaho Native Plant Society
INTEC	Idaho Nuclear Technology and Engineering Center
IWD	Industrial Waste Ditch
J.D.	Juris Doctorate (Law Degree)
LA	License Application
LCC	Lambert Conformal Conic
LLW	Low-Level (Radioactive) Waste
LNT	Linear-non-threshold
LPF	Leak Path Factor
LTEM	Long Term Ecological Monitoring
LS	Limit State
M.A.	Master of Arts
MACT	Maximum Achievable Control Technology
MAP	Mitigation Action Plan
MAR	Material-At-Risk
M.B.A.	Master of Business Administration
MCL	Maximum Contaminant Level
MCW	Maximally-Exposed Co-Located Worker
MDL	Method Detection Limit
MEI	Maximally Exposed Off-site Public Individual (INL)
MEng	Master of Engineering
MFC	Materials and Fuels Complex
MLLW	Mixed Low-Level (Radioactive) Waste
MOI	Maximally Exposed Off-site Individual (NRF)
M.S.	Master of Science
MT CO_2e	Metric Tons of CO_2 Equivalent
MTHM	Metric Tons of Heavy Metal
MWMP	Mixed Waste Management Plan
NA	Not Applicable
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NESHAP	National Emissions Standards for Hazardous Air Pollutants

ACRONYMS (cont.)

NHPA	National Historic Preservation Act
NLCD	National Land Cover Data
NNPP	Naval Nuclear Propulsion Program
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPA	Nearest Public Access individual
NPDES	National Pollutant Discharge Elimination System
NPH	Natural Phenomenon Hazard
NPL	National Priorities List
NPS	National Park Service
NRC	Nuclear Regulatory Commission
NRF	Naval Reactors Facility
NRHP	National Register of Historic Places
OLM	Ozone Limiting Method
OSB	Overpack Storage Building
OSE	Overpack Storage Expansion
OSHA	Occupational Safety and Health Administration
PAG	Protective Action Guideline
PC	Performance Category
PCB	Polychlorinated Biphenyl
PCS	Primary Constituent Standard
PFC	Perfluorocarbon
Ph.D.	Doctorate of Philosophy
PM	Particulate Matter
PSD	Prevention of Significant Deterioration
PSHA	Probabilistic Seismic Hazard Analysis
RCRA	Resource Conservation and Recovery Act
RF	Respirable Fraction
RH	Remote-handled
ROD	Record of Decision
ROI	Region of Influence
RWMC	Radioactive Waste Management Complex
SA	Supplemental Analysis
SBTC	Shielded Basket Transfer Container
SDC	Seismic Design Category
SDWA	Safe Drinking Water Act
SFPF	Spent Fuel Packaging Facility
SGCA	Sage-grouse Conservation Area
SHPO	State Historic Preservation Office
SI	International System of Units
SIP	State Implementation Plan
SOX	Stand-Off Experiment
SRPA	Snake River Plain Aquifer
SRS	Savannah River Site
SSCs	Structures, Systems, and Components
STC	Shielded Transfer Container
STP	Site Treatment Plan
TAN	Test Area North
TAP	Toxic Air Pollutants

ACRONYMS (cont.)

TED	Total Effective Dose
TRC	Total Recordable Cases
TREAT	Transient Reactor Test Facility
TRU	Transuranic
TSCA	Toxic Substances Control Act
U.S.	United States
USACOE	United States Army Corps of Engineers
U.S.C.	United States Code
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VOC	Volatile Organic Compound
VRM	Visual Resource Management
WAG	Waste Area Group

CONVERSION CHART

Metric to English / English to Metric

Area

Multiply	by	To Find	Multiply	by	To Find
square kilometers	0.386	square miles	square miles	2.590	square kilometers
square meters	10.764	square feet	square feet	0.093	square meters
hectares	2.471	acres	acres	0.405	hectares

Length

Multiply	by	To Find	Multiply	by	To Find
centimeters	0.394	inches	inches	2.540	centimeters
meters	3.281	feet	feet	0.305	meters
kilometers	0.621	miles	miles	1.609	kilometers

Volume

Multiply	by	To Find	Multiply	by	To Find
liters	0.264	gallons	gallons	3.785	liters
cubic meters	1.308	cubic yards	cubic yards	0.765	cubic meters

Weight/Mass

Multiply	by	To Find	Multiply	by	To Find
metric tons	1.102	U.S. tons (short)	U.S. tons (short)	0.907	metric tons
kilograms	0.001102	U.S. tons (short)	U.S. tons (short)	907.185	kilograms
kilograms	2.205	pounds	pounds	0.4536	kilograms
grams	0.0353	ounces	pounds	453.59	grams
grams	0.0022	pounds	ounces	28.35	grams

Temperature

Multiply	by	To Find	Multiply	by	To Find
[degrees Kelvin - 273.15]	1.8, then add 32	degrees Fahrenheit	[degrees Fahrenheit - 32]	0.556, then add 273.15	degrees Kelvin
degrees Celsius	1.8, then add 32	degrees Fahrenheit	[degrees Fahrenheit - 32]	0.556	degrees Celsius

Units of Radiation

1 Curie	=	3.7×10^{10} disintegrations per second
1 Curie	=	3.7×10^{10} Becquerels
1 Becquerel	=	1 disintegration per second
1 rad	=	0.01 gray
1 rem	=	0.01 Sievert
1 gray	=	1 joule per kilogram

Metric to Metric

metric ton	=	1000 kilograms

English to English

U.S. ton (short)	=	2000 pounds
U.S. ton (long)	=	2240 pounds

Metric Prefixes

mega	=	multiplication factor of 1,000,000 (1×10^{6})
kilo	=	multiplication factor of 1,000 (1×10^{3})
centi	=	multiplication factor of 0.01 (1×10^{-2})
milli	=	multiplication factor of 0.001 (1×10^{-3})
micro	=	multiplication factor of 0.000 001 (1×10^{-6})
pico	=	multiplication factor of 0.000 000 000 001 (1×10^{-12})

APPENDIX A

PUBLIC SCOPING

A.1 Background and Summary

This appendix provides information on the efforts taken to comply with the National Environmental Policy Act (NEPA) requirements for the solicitation and accumulation of comments on the scope of the Environmental Impact Statement (EIS) for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Idaho National Laboratory (INL).

The Notice of Intent (NOI) was published in 75 Fed. Reg. 42082 (July 20, 2010). At that time, the NOI included recapitalization of both naval spent nuclear fuel handling and examination capabilities of the Expended Core Facility (ECF). The NOI and Legal Notice placed in area newspapers provided a toll-free telephone number, a mailing address, and an e-mail address to allow interested members of the public to provide comments on the scope of this EIS. In addition, three public scoping meetings were held in Idaho to solicit written and verbal comments on the proposed action. The comment period officially ended on September 3, 2010; however, the Naval Nuclear Propulsion Program (NNPP) chose to incorporate comments received after that date.

During the comment period, the NNPP received two comments by mail and 10 comments by e-mail. No comments were received at the Idaho Falls public scoping meeting, three comments were received at the Pocatello public scoping meeting, and two comments were received at the Twin Falls public scoping meeting.

Table A-1 provides a list of comments received during the public scoping period. Section A.2 provides the comments received by mail and e-mail (in as-received form), comments provided during the public scoping meetings (from transcripts recorded by court recorders), and the NNPP responses.

The NNPP published an Amended NOI in 77 Fed. Reg. 27448 (May 10, 2012) to revise the scope of the EIS to just that necessary to support the recapitalization of the naval spent nuclear fuel handling capabilities of ECF. The amended NOI was placed in area newspapers and provided a mailing address and an e-mail address to allow interested members of the public to provide comments on the scope of the EIS. The comment period on the revised scope of the EIS ended on June 11, 2012. During the comment period, the NNPP received two comments by mail and two comments by e-mail. Table A-2 provides a list of comments received during the public scoping period for the amended NOI.

Table A-1: Comments Received on Scope of the EIS

Medium	Number of Comments	Person/Group Commenting	Date
Mail	2	#1: William L. Duke President IAM&AW Local	08/20/10
		#2: Theogene Mbabaliye, Ph.D. United States (U.S.) Environmental Protection Agency (EPA) Region 10 (Duplicate comments also received by e-mail.)	09/02/10
E-mail	10	#1: B.J. Howerton Environmental Services Manager, Bureau of Indian Affairs	07/22/10
		#2: Richard Provencher	08/26/10
		#3: Theogene Mbabaliye, Ph.D. U.S. EPA Region 10 (Duplicate comments also received by mail.)	09/02/10
		#4: Roger Turner	09/02/10
		#5: Dr. Peter Rickards Idaho Families for the Safest Energy	09/03/10
		#6: Katherine Daly	09/03/10
		#7: Beatrice Brailsford Snake River Alliance	09/03/10
		#8: Dr. Peter Rickards Idaho Families for the Safest Energy	09/03/10
		#9: Kit Deslauriers	09/06/10
		#10: Chuck Broscious	09/08/10
Idaho Falls Meeting	None		
Pocatello Meeting	3	#1: Beatrice Brailsford Snake River Alliance	08/25/10
		#2: Roger Turner	08/25/10
		#3: Bill Downs	08/25/10
Twin Falls Meeting	2	#1: Dr. Peter Rickards	08/26/10
		#2: Bill Chisholm	08/26/10

Table A-2: Comments Received on the Amended NOI

Medium	Number of Comments	Person/Group Commenting	Date
Mail	2	#1: Sandra Blazius	06/05/12
		#2: Richard B. Provencher Idaho Operations Office, U.S. Department of Energy (DOE)	06/05/12
E-mail	2	#1 Unknown	05/13/12
		#2 Beatrice Brailsford Snake River Alliance	06/11/12

Section A.3 provides the comments received on the amended NOI by mail and e-mail (in as-received form), and the NNPP responses.

A.2 Initial Public Scoping Comments and Responses

This section provides comments received during the initial public scoping period and the associated NNPP responses. Personal contact information (i.e., home address, phone number, e-mail address) is redacted to protect personal and private information. Similar information provided by organizations is not redacted.

Mail Comment #1

International Association of Machinists and Aerospace Workers

Grand Teton Local 2006
745 W. Bridge, Suite I
P.O. Box 931
Blackfoot, ID 83221
(208) 243-0482

Date: August 20, 2010

To: Mr. Gregory F. Holden
Naval Sea Systems Command
1240 Isaac Hull Avenue, SE
Washington Navy Yard, DC

Subject: IAM&AW Local 2006 membership support for the Recapitalization of Naval Spent Fuel Handling and Examination Facilities at the Idaho National Laboratory.

Sir,

The membership of IAM&AW Local 2006 and their working families, support "Alternative One" for both the Spent Fuel Handling and Examination Facilities projects to be located at the Naval Reactors Facility (NRF). If the Examination Facility is located at a site other than NRF, our membership would request that consideration be given to maintaining the Collective Bargaining agreement that is in place between IAM&AW Local 2006 and Bechtel Marine Propulsion Corporation, at that locale.

The Machinist Union has a long standing reputation of support for Navy missions; from building new Navy Warships, to refurbishing used Navy vessels, to ensuring that spent Naval Nuclear fuel is handled properly after receipt at the Naval Reactor Facility, on the Idaho National Laboratory (INL). Our membership stands ready to assist the Navy Nuclear Propulsion Program (NNPP) and the sailors who protect our country, obtain their goals and mission requirements, by providing personnel who are highly trained and qualified per NNPP standards.

These two recapitalization projects will bring much needed jobs to Southeast Idaho and the INL. Once complete, these facilities will maintain or possibly expand the workforce at NRF, which will benefit the economy of Southeast Idaho.

IAM&AW Local 2006 appreciates the invitation to be included in these preliminary proceedings and wants to express gratitude for your consideration in the early planning stages.

Sincerely,

William L. Duke
President
IAM&AW Local 2006

Cc: M. Wardle, IAM&AW GLR
Local 2006 File

Response to Mail Comment #1

The commenter's support for the recapitalization project is noted. As indicated in Chapter 2 of the Draft EIS, the proposed action does not include sites off of the Naval Reactors Facility (NRF).

Mail Comment #2

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
ECOSYSTEMS, TRIBAL AND
PUBLIC AFFAIRS

9/02/2010

Gregory F. Holden (08U-Naval Reactors)
Naval Sea Systems Command
1240 Isaac Hull Avenue, SE, Stop 8036
Washington Navy Yard, DC 20376-8036

Subject: Proposed Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the INL in Idaho (EPA Project No.: 94-032-DOE)

Dear Mr. Holden:

The U.S. Environmental Protection Agency (EPA) has reviewed the Department of Energy (DOE) Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for the proposed **Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination** at the Idaho National Laboratory (INL) Site in Idaho. Our review was conducted in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act (CAA). Section 309 requires EPA to review and comment in writing on the environmental impacts associated with all major federal actions.

According to the NOI, DOE proposes to evaluate potential environmental impacts of a proposal to sit and construct new facilities for transferring, preparing, examining, and packaging Naval spent nuclear fuel and other irradiated materials at INL. The existing Expended Core Facility (ECF) infrastructure has been in service for over 50 years and is a growing maintenance burden. Recapitalization of this infrastructure would ensure continued naval nuclear-powered operations and missions for the next 40 years or more and support DOE's commitments identified in the State of Idaho, DOE, and Navy's 1995 Settlement Agreement and related amendments on the bringing, handling, and removal of Navy spent nuclear fuel materials at INL.

The NOI has identified a tentative list of resource areas/issues to be addressed. The list is an appropriate starting point for analyzing the effects of the proposed action and its alternatives. Our attached scoping comments are provided to inform DOE of issues that EPA believes are important and should be considered in the NEPA analysis for the project. Thank you for the opportunity to provide comments at this stage of the EIS development. If you have questions or concerns regarding our comments, please contact me at (206) 553-6322.

Sincerely,

/S/
Theogene Mbabaliye, NEPA Reviewer
Environmental Review and Sediment Management Unit

EPA Scoping Comments on the proposed Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the Idaho National Laboratory in Idaho

Environmental effects

1 The EIS should include environmental effects and mitigation measures. This would involve delineation and description of the affected environment, indication of resources that would be impacted, the nature of the impacts, and a listing of mitigation measures for the impacts. The NOI indicates that the proposed project has the potential to impact a variety of resources, including water, air, wildlife and their habitat, and human health. These and other impacts should be minimized.

Water resources impacts

Preventing water quality degradation is one of EPA's primary concerns. Section 303(d) of the Clean Water Act (CWA) requires States (and Tribes with approved water quality standards) to identify water bodies that do not meet water quality standards and to develop water quality restoration plans to meet established water quality criteria and associated beneficial uses. 2.a The EIS must disclose which waters may be impacted by the project, the nature of potential impacts, and specific pollutants likely to impact those waters. 2.b It should also report those water bodies potentially affected by the project that are listed on the State's and any Tribe's most current EPA approved 303(d) list. The EIS document should describe existing restoration and enhancement efforts for those waters, how the proposed project will coordinate with on-going protection efforts, and any mitigation measures that will be implemented to avoid further degradation of impaired waters. Also, please note that anti-degradation provisions of the CWA prohibit degrading water quality in waterbodies where water quality standards are currently being met.

Public drinking water supplies and/or their source areas often exist in many watersheds. Source water areas might exist within the watershed in which the proposed infrastructure would be located. Source water is water from streams, rivers, lakes, springs, and aquifers that is used as a supply of drinking water. The 1996 amendments to the Safe Drinking Water Act (SDWA) require federal agencies to protect sources of drinking water for communities. Since construction and operation of the project may impact sources of drinking water, EPA recommends that DOE contact the Idaho Department of Environmental Quality (IDEQ) to help identify source water protection areas within the project area. The EIS document should identify all:

2.c
- a) Source water protection areas within the project area.
- b) Activities that could potentially affect source water areas.
- c) Potential contaminants that may result from the proposed project.
- d) Measures that would be taken to protect the source water protection areas in the draft EIS.

The project area is located within the Eastern Snake River Plain Aquifer, which has been
designated as a Sole Source Aquifer by EPA. This aquifer is vulnerable to being contaminated
from surface activities such as septic sewage disposal, herbicide applications and potential spills
2.e of toxic substances. Since groundwater may be impacted by the project, the EIS should fully
analyze impacts to groundwater, including reasonably foreseeable direct, indirect and cumulative
impacts to groundwater and surface water resources. Guidance documents that address
contaminant levels in soil to protect groundwater include: "*Soil Screening Guidance for Radionuclides: User's Guide*" (OSWER Directive No. 9355.4-16A), October 2000, and "*Soil Screening Guidance for Radionuclides: Technical Background Document*" (OSWER Directive No. 9355.4-16), October 2000. These documents can be found online at: http://www.epa.gov/superfund/health/contaminants/radiation/radssg.htm.

Construction of facilities and access roads, and road use may also compact the soil, thus
changing hydrology, runoff characteristics, and ecological function of the area, affecting flows
2.d and delivery of pollutants to water bodies. The EIS should note that, under the CWA, any
construction project disturbing a land area of one or more acres requires a construction storm
water discharge permit or the National Pollutant Discharge Elimination System (NPDES) permit
for discharges to waters of the United States. The EIS should document the project's consistency
2.c with applicable storm water permitting requirements and should discuss specific mitigation
measures that may be necessary or beneficial in reducing adverse impacts to water quality and
aquatic resources.

Hazardous Materials

3.a The EIS should address potential direct, indirect and cumulative impacts of hazardous
waste from construction and operation of the project. The document should identify projected
hazardous waste types and volumes, and expected storage, disposal, and management plans. It
3.b should address the applicability of state and federal hazardous waste requirements. Appropriate
mitigation should be evaluated, including measures to minimize the generation of hazardous
3.c waste (i.e., hazardous waste minimization). Alternate industrial processes using less toxic
materials should also be considered.

Since the handling of radioactive materials may affect the parties involved with the
project, as well as the public who would access the project area during and after project
3.d construction, the EIS should include information ensuring the public that no hazardous materials
would be released in the environment as a result of the proposed project activities. During the
spent nuclear fuel receipt, transfer, and repackaging operations, it is possible that gaseous, liquid,
and solid low-level radioactive waste would be generated. The EIS should discuss probable
impacts from exposure to such waste, potential pathways and periods of exposure. Any waste
3.e generated should be managed to limit the amounts and maintain exposures as low as reasonably
achievable (or ALARA), especially if the waste contains radionuclides of concern, such as
iodine-129 and tritium.

During the proposed project operations, accidents may also occur and result in release of
highly radioactive waste (spent fuel) to the environment. The EIS for the project should describe
3.f measures that will be taken to ensure that the chances of such an accident would be kept to a
minimum, but also to ensure that the workers involved in transferring, preparing, examining, and

packaging naval spent nuclear fuel and other irradiated materials, including those loading and unloading shipments are protected.

Seismic Risk

Because the INL Site may be within an active tectonically active area, it is possible that project activities could cause increased seismicity (earthquake activity). The magnitude of such
4.a activity is usually low, ranging from 1 - 3 on the Richter scale. However, we recommend that the EIS discuss the potential for seismic risk and how this risk will be evaluated, monitored, and managed to ensure that critical facilities, including nuclear facilities, remain safe during and after
4.b any earthquake. A seismic map should either be referenced or included in the EIS.

Air quality and human health impacts

5.a The EIS should provide a detailed discussion of ambient air conditions (baseline or existing conditions), National Ambient Air Quality Standards (NAAQS), and criteria pollutant
5.b non-attainment areas in the project area. The EIS should estimate emissions of criteria pollutants for the project site and discuss the timeframe for release of these emissions over the lifespan of
5.c the project (40 years). The EIS should also analyze the potential impacts to air quality (including cumulative and indirect impacts) from the project construction and operation.

5.d The EIS should specify emission sources and quantify these emissions. Such an evaluation is necessary to assure compliance with State and federal air quality regulations, and to disclose the potential impacts from temporary or cumulative degradation of air quality. The EIS should include:

- Detailed information about ambient air conditions, NAAQS, and criteria pollutant non-attainment areas in and around the project area.
- Data on emissions of criteria pollutants from the proposed project and discuss the timeframe for release of these emissions over the lifespan of the project.
- 5.e Specific information about pollutant from mobile sources, stationary sources, and ground disturbance. This source specific information should be used to identify appropriate mitigation measures and areas in need of the greatest attention.
- 5.f An Equipment Emissions Mitigation Plan that identifies actions to reduce diesel particulate, carbon monoxide, hydrocarbons, and NOx associated with construction activities.
- 5.g Evaluation of radioactive emissions, including the effects of radon emissions.

Cumulative Impacts

The Council on Environmental Quality (CEQ) definition of *cumulative impact* is "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions". Cumulative impacts result from individually minor but collectively significant actions taking place over time. The
6 cumulative impacts analysis should therefore provide the context for understanding the magnitude of the impacts of the alternatives by analyzing the impacts of other past, present, and

reasonably foreseeable projects or actions at and near the site, then considering those cumulative impacts in their entirety. Where adverse cumulative impacts may exist, the EIS should disclose the parties that would be responsible for avoiding, minimizing, and mitigating those adverse impacts.

EPA has also issued guidance on how we are to provide comments on the assessment of cumulative impacts, *Consideration of Cumulative Impacts in EPA Review of NEPA Documents*, which can be accessed online at: http://www.epa.gov/compliance/resources/policies/nepa/cumulative.pdf. This guidance states that in order to assess the adequacy of the cumulative impacts assessment, five key areas should be considered. EPA tries to assess whether the cumulative effects' analysis:

a) Identifies resources, if any, that are being cumulatively impacted.

b) Determines the appropriate geographic (within natural ecological boundaries) area and the period over which the effects have occurred and will occur.

c) Looks at all past, present, and reasonably foreseeable future actions that have affected, are affecting, or would affect resources of concern.

d) Describes a benchmark or baseline.

e) Includes scientifically defensible threshold levels.

Climate Change Effects

Scientific evidence supports the concern that continued increases in greenhouse gas emissions resulting from human activities contribute to climate change. Effects of climate change may include changes in hydrology, sea level, weather patterns, precipitation rates, and
7.a chemical reaction rates. Therefore, the EIS document should consider how resources affected by climate change could potentially influence the proposed project and vice versa, especially within
7.b sensitive areas. Also, the EIS should quantify and disclose greenhouse gas emissions from the project and discuss mitigation measures to reduce emissions.

Coordination with Tribal Governments

8 The EIS should describe the process and outcome of government-to-government consultation between DOE and each of the tribal governments that would be affected by the project, issues that were raised, if any, and how those issues were addressed.

Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* (November 6, 2000), was issued in order to establish regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, and to strengthen the U.S. government-to-government relationships with Indian tribes.

Environmental Justice and Public Participation

9 The EIS should include an evaluation of environmental justice populations within the geographic scope of the project. If such populations exist, the EIS should address the potential

for disproportionate adverse impacts to minority and low-income populations, and the approaches used to foster public participation by these populations.

One tool available to locate Environmental Justice populations is the Environmental Justice Geographic Assessment tool, which is available online at: http://epamap14.epa.gov/ejmap/entry.html. Also, Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994), directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects on minority and low-income populations, allowing those populations a meaningful opportunity to participate in the decision-making process.

Monitoring

The proposed project has the potential to impact a variety of resources and for an extended period. Because of that, we recommend that the project be designed to include an environmental inspection and mitigation monitoring program to ensure compliance with all
10 mitigation measures and assess their effectiveness. The EIS document should describe the monitoring program and how it will be used as an effective feedback mechanism so that any needed adjustments can be made to the project to meet environmental objectives throughout the life of the project.

Response to Mail Comment #2

Responses to EPA's comments follow:

Item #1:

The affected environment is described in Chapter 3. Environmental effects to resources are described in Chapter 4. Potential mitigation measures are addressed in Chapters 3, 4, and 6.

Item #2.a:

Section 4.4 describes which waters may be impacted, the nature of potential impacts, and specific pollutants that could impact these waters.

Item #2.b:

Water bodies on the State's or Tribes' most current EPA approved 303(d) list are not affected by the proposed action.

Item #2.c:

Wellhead and source water protection areas for NRF are described in Section 3.4. Source water protection areas for NRF are delineated in the INL Source Water Assessment (DOE 2003a) in accordance with the methods provided in guidelines of the Idaho Wellhead Protection Plan (IDEQ 1997) and the Idaho Source Water Assessment Plan (IDEQ 1999). Protection measures taken at NRF include spill prevention and cleanup programs; wastewater discharge management plan; waste management programs; and a drinking water monitoring program; these plans and programs conform to applicable federal and state requirements and some are subject to EPA and state of Idaho compliance inspections. Activities that could potentially affect these source water protection areas, along with potential contaminants that may result from the proposed action, are described in Section 4.4.

Item #2.d:

As noted in Section 4.4, no wastewater or storm water would be discharged to waters of the U.S. for any of the proposed alternatives.

Item #2.e:

Impacts to groundwater are analyzed in Section 4.4. Reasonably foreseeable direct, indirect and cumulative impacts to groundwater resources are analyzed in Chapter 5. As identified in Section 3.4 and 4.4 surface water would not be impacted. There could be small impacts to groundwater from non-radiological constituents since best management practices would continue to be used to protect groundwater. There would be negligible impacts on groundwater from radiological constituents if preventive and corrective maintenance are not sufficient to prevent a minor water pool leak. NRF controls contamination with programs that conform to applicable federal and state requirements, and some are subject to EPA and state of Idaho compliance inspections (Sections 4.3.2 and 4.3.3).

Item #3.a:

Section 4.14 discusses potential direct and indirect impacts of hazardous waste from construction and operation of the proposed action and identifies projected hazardous waste types and volumes. Section 5.2.10 addresses cumulative impacts of hazardous waste. Waste storage, disposal, and management plans for hazardous waste are described in Sections 3.14 and 4.14.

Item #3.b:

Applicability of state and federal hazardous waste requirements are addressed in Appendix C.

Item #3.c:

As discussed in Section 3.14, NRF has ongoing actions to minimize the generation of hazardous waste including, where practical, the use of less toxic materials. Those actions are applicable to all of the alternatives under consideration.

Item #3.d:

The potential for release of hazardous or radioactive materials to the environment from the proposed action is described in Section 4.6. The naval spent nuclear fuel handling operations are designed to minimize the potential for release of hazardous constituents in any form. In addition, the NNPP minimizes waste generation from operations. NNPP radiological controls are described in Section 3.13. These controls maintain exposures as low as reasonably achievable (ALARA). Impacts from exposure to radiation, including a description of potential pathways and assumed exposure times, are provided in Appendix F.

Item #3.e:

Radiological and hazardous waste along with naval spent nuclear fuel are managed in accordance with strict control to maintain exposures to ALARA. These controls are effective at managing all radionuclides of concern. As described in Section 4.13, NNPP occupational and public exposures are significantly below regulatory requirements.

Item #3.f:

Appendix F provides an evaluation of a range of hypothetical accident scenarios associated with radiological aspects of the proposed action. It describes emergency preparedness to ensure that workers and the public would be properly protected in the event of an accident. In addition, it describes mitigative measures that could be taken to limit exposure in the event of an accident. Section 3.13 describes the strict NNPP controls that minimize the chance of an accident resulting in a release of radioactivity.

Item #4.a:

Excavation for the new facility alternative would be accomplished with heavy equipment and without blasting; therefore, there would be no increase to seismicity from construction. Similarly, facility operations, described in Chapter 2, would not increase seismicity. The seismic hazards assessment for INL is described in Section 3.3.3. Safety, during and after earthquakes, is addressed by the DOE use of seismic design categories; facility structures, systems, and components are designed accordingly, as discussed in Section 4.3. The seismic impacts and method of evaluation associated with each alternative and time period are described in Sections 4.3.1 through 4.3.3.

Item #4.b:

A seismic map is provided in Section 3.3.

Item #5.a:

Section 3.6.2 describes ambient air conditions and the National Ambient Air Quality Standards (NAAQS). As stated in Section 3.6.2, the project area is in attainment; there are no non-attainment areas.

Item #5.b:

Section 4.6 provides an estimate of annual criteria pollutant emissions from the proposed action.

Item #5.c:

Potential direct and indirect impacts from construction and operation to air quality are analyzed in Section 4.6. Section 5.2.5 discusses potential cumulative impacts to air quality from construction and operation.

Item #5.d:

Section 4.6.1 and Appendix E specify the emission sources and quantity of non-radiological emissions. Section 4.6.2 and Appendix F specify the emission sources and quantity of radiological emissions.

Item #5.e:

Section 4.6.1 and Appendix E provide specific information about pollutants from mobile sources, stationary sources, and ground disturbance. Mitigation measures are addressed in Chapter 6.

Item #5.f:

Idaho does not have a specific requirement for an Equipment Emissions Mitigation Plan for reducing diesel particulate, carbon monoxide, hydrocarbons, and NOx from construction activities. Best management practices for control of fugitive dust during construction per Idaho Administrative Procedures Act Sections 650 and 651 and any permit requirements would be followed during construction. This is addressed in Section 4.6.

Item #5.g:

Section 4.6.2, Section 4.13.2, and Appendix F provide an evaluation of radiological impacts on air quality and public health impacts. Section 4.6.2 identifies those radionuclides that can be released to the air directly or indirectly. Radon gas emissions are not discussed because radon emissions are not expected for the proposed action.

Item #6:

Cumulative impacts are analyzed in Chapter 5.

Item #7.a:

Climate change impacts are described in Sections 3.6.2.2 and 4.6.1.1.

Item #7.b:

The greenhouse gas evaluations for the proposed action are provided in Section 4.6.

Item #8:

Government-to-government consultation between Naval Reactors and the Shoshone-Bannock Tribes is described in Section 4.8.

Item #9:

Section 4.12 evaluates environmental justice populations within the scope of the proposed action.

Item #10:

Chapter 7 discusses the environmental measurement and monitoring programs that are currently in place at NRF. These monitoring programs could change over time in response to updated regulatory requirements or new discharge points regardless of which alternative is chosen. Results of monitoring would be used to verify proper controls are in place or to take action to ensure the protection of the environment and the public.

E-Mail Comment #1

From:	Howerton, B [BJ.Howerton@bia.gov]
Sent:	Thursday, July 22, 2010 12:15 PM
To:	ECF Recapitalization
Cc:	Speaks, Stanley; Fox, Dean; Hernandez, Frederick; Ben, Gerald
Subject:	Dept of Energy, NOI EIS Spent Fuel/INL
Attachments:	NOI EIS DOE pdf; NOI EIS DOE full copy.pdf

Regarding the Notice of Intent To Prepare an Environmental Impact Statement for the Recapitalization of Infrastructure

Supporting Naval Spent Nuclear Fuel Handling and Examination at the Idaho National Laboratory, the Bureau of Indian Affairs (BIA) would like to be placed on your mailing list to receive information on the proposed project.

Thank you for the invitation to attend a public meeting to comment on the scope of the planned EIS including identification of reasonable alternative and specific issues that should be addressed in the EIS. It is the BIA's intention to attend one of the following meetings to provide concerns and comments. However, if no BIA personnel are available we will comment on line. Thank you for the information.

August 24, 2010

6 p.m.-9 p.m.

Shilo Inn, 780 Lindsay Blvd., Idaho

Falls, ID 83404.

August 25, 2010

6 p.m.-9 p.m.

Red Lion, 1555 Pocatello Creek Road,

Pocatello, ID 83201.

August 26, 2010

6 p.m.-9 p.m.

Canyon Springs Red Lion, 1357 Blue

Lakes Blvd. North, Twin Falls, ID

83301.

Dr. BJ Howerton, MBA

Environmental Services Mgr.

BIA, NWRO

Portland, OR

(503) 231-6749

United States Department of the Interior

OFFICE OF THE SECRETARY

Office of Environmental Policy and Compliance
1849 C Street, NW – MS 2462-MIB
WASHINGTON, D.C. 20240

TAKE PRIDE IN AMERICA

9043.1
PEP/NRM

July 21, 2010

ELECTRONIC MAIL MEMO

To: Assistant Secretary Indian Affairs
Director, Fish and Wildlife Service
Director, National Park Service
Director, Geological Survey
Director, Bureau of Land Management
Commissioner, Bureau of Reclamation

From: Team Leader, Natural Resources Management
Office of Environmental Policy and Compliance

Subject: Notice of Intent to Prepare an Environmental Impact Statement (EIS) for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the Idaho National Laboratory, Butte County, Idaho
(ER 10/629)(Agency due date: **September 3, 2010)**

The Department of Energy (DOE) has published in the July 20, 2010 Federal Register (75 FR 42082) a notice of intent to prepare an EIS for the subject project. You may view the notice at: http://edocket.access.gpo.gov/2010/pdf/2010-17523.pdf

This notice gives you an early opportunity to provide technical assistance and/or to participate from your areas of special expertise or jurisdiction. If significant involvement is indicated, you should also participate in the follow-up scoping activities.

Comments should be made directly to the person listed in the notice by **September 3, 2010**.

Please provide a copy of any comments you make to this Office.

/S/07/21/10

Vijai N. Rai

cc: Regional Environmental Officer, POR

OEPC-Staff Contact: Vijai N. Rai, 202-208-6661, vijai_rai@ios.doi.gov

Response to E-Mail Comment #1

The Bureau of Indian Affairs is on the distribution list for the Draft EIS and the Final EIS. No other comments were received.

E-Mail Comment #2

From: Richard Provencher [redacted]
Sent: Thursday, August 26, 2010 8:10 AM
To: ECF Recapitalization
Subject: Public Comment on Expended Core Facility Scoping Study

I have evaluated and considered the alternatives being proposed by the Naval Nuclear Propulsion Program in the scoping study for the new expended core facility and concur with the alternatives being proposed for further evaluation under NEPA. The Navy has safely operated its expended core operations at the INL site for many years, and it is good to see that they plan to continue to use the advantages of the INL site to support this critical national defense mission for many years to come. The INL site has been comprehensively studied over many years, and possesses the infrastructure and isolation to support such a program. The environmental impacts of the current Navy operations at the NRF facility have been evaluated and determined to be manageable. In addition, Navy has many years of demonstrated safe and environmentally protective operations of its mission work at the INL site which provides a very good basis for continued operation and shows that they are a good steward of the aquifer, overall environment, and public safety. As the Navy has operated such a facility at the INL site for many years, the environmental impacts have obviously been
1 evaluated and shown to be acceptable and manageable. To the degree that the proposed new ECF involves quantities and throughputs of materials that exceed what has been evaluated in the past, this increment should be bounded and evaluated in the NEPA process to adequately ensure that this critical mission work is covered well into the future and that its operations continue to be environmentally protective. In addition, Navy may want to consider evaluating
2 and choosing a combination or hybrid of the siting alternatives to ensure NEPA coverage of possible decisions and outcomes.

Overall, I support Navy moving forward into the draft EIS stage of this evaluation, and support the siting alternatives and list of potential impacts to be evaluated in the study.

Richard B. Provencher

U.S. Citizen and Idaho Falls Resident

Response to E-Mail Comment #2

The commenter's support for the recapitalization project is noted.

Item #1:

Quantities and throughputs related to the naval spent nuclear fuel handling operations expected in the future are used as a basis for the impact analyses in Chapter 4.

Item #2:

The siting alternatives are described in Section 2.2 of this EIS. For the recapitalization of naval spent nuclear fuel handling capabilities, the NNPP has determined that a hybrid of siting options is not a reasonable alternative. However, an evaluation of a hybrid of siting alternatives may be considered for the recapitalization of examination facilities when it is evaluated separately.

E-Mail Comment #3

From: Mbabaliye.Theogene@epamail.epa.gov
[mailto:Mbabaliye.Theogene@epamail.epa.gov]
Sent: Thursday, September 02, 2010 8:16 PM
To: Holden, Greg H CIV SEA 08 NR
Cc: Brandt.Kit@epamail.epa.gov; Reichgott.Christine@epamail.epa.gov
Subject: Re: NNPP Recapitalization Project

Hi again Mr. Holden!

Attached, please find EPA scoping comments on your proposed Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the Idaho National Laboratory Site. A hard copy of the same comments is also being mailed to you under separate cover using the US Postal Service. In the mean time, contact me if you have questions about our comments.

(See attached file: 94-032-DOE Scoping for Recapitalization of Navy Infrastructure.doc)

Theo Mbabaliye, Ph.D.
US EPA Region 10
1200 6th Ave., Suite 900
Seattle, WA 98101-3140
Phone: (206) 553-6322
Fax: (206) 553-6984

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 10
1200 Sixth Avenue, Suite 900
Seattle, WA 98101-3140

OFFICE OF
ECOSYSTEMS, TRIBAL AND
PUBLIC AFFAIRS

9/02/2010

Gregory F. Holden (08U-Naval Reactors)
Naval Sea Systems Command
1240 Isaac Hull Avenue, SE, Stop 8036
Washington Navy Yard, DC 20376-8036

Subject: Proposed Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the INL in Idaho (EPA Project No.: 94-032-DOE)

Dear Mr. Holden:

The U.S. Environmental Protection Agency (EPA) has reviewed the Department of Energy (DOE) Notice of Intent (NOI) to prepare an Environmental Impact Statement (EIS) for the proposed **Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination** at the Idaho National Laboratory (INL) Site in Idaho. Our review was conducted in accordance with our responsibilities under the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act (CAA). Section 309 requires EPA to review and comment in writing on the environmental impacts associated with all major federal actions.

According to the NOI, DOE proposes to evaluate potential environmental impacts of a proposal to sit and construct new facilities for transferring, preparing, examining, and packaging Naval spent nuclear fuel and other irradiated materials at INL. The existing Expended Core Facility (ECF) infrastructure has been in service for over 50 years and is a growing maintenance burden. Recapitalization of this infrastructure would ensure continued naval nuclear-powered operations and missions for the next 40 years or more and support DOE's commitments identified in the State of Idaho, DOE, and Navy's 1995 Settlement Agreement and related amendments on the bringing, handling, and removal of Navy spent nuclear fuel materials at INL.

The NOI has identified a tentative list of resource areas/issues to be addressed. The list is an appropriate starting point for analyzing the effects of the proposed action and its alternatives. Our attached scoping comments are provided to inform DOE of issues that EPA believes are important and should be considered in the NEPA analysis for the project. Thank you for the opportunity to provide comments at this stage of the EIS development. If you have questions or concerns regarding our comments, please contact me at (206) 553-6322.

Sincerely,

/S/
Theogene Mbabaliye, NEPA Reviewer
Environmental Review and Sediment Management Unit

EPA Scoping Comments on the proposed Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the Idaho National Laboratory in Idaho

Environmental effects

1 The EIS should include environmental effects and mitigation measures. This would involve delineation and description of the affected environment, indication of resources that would be impacted, the nature of the impacts, and a listing of mitigation measures for the impacts. The NOI indicates that the proposed project has the potential to impact a variety of resources, including water, air, wildlife and their habitat, and human health. These and other impacts should be minimized.

Water resources impacts

Preventing water quality degradation is one of EPA's primary concerns. Section 303(d) of the Clean Water Act (CWA) requires States (and Tribes with approved water quality standards) to identify water bodies that do not meet water quality standards and to develop water quality restoration plans to meet established water quality criteria and associated beneficial uses. 2.a The EIS must disclose which waters may be impacted by the project, the nature of potential impacts, and specific pollutants likely to impact those waters. It should also report those water bodies potentially affected by the project that are listed on the State's and any Tribe's most 2.b current EPA approved 303(d) list. The EIS document should describe existing restoration and enhancement efforts for those waters, how the proposed project will coordinate with on-going protection efforts, and any mitigation measures that will be implemented to avoid further degradation of impaired waters. Also, please note that anti-degradation provisions of the CWA prohibit degrading water quality in waterbodies where water quality standards are currently being met.

Public drinking water supplies and/or their source areas often exist in many watersheds. Source water areas might exist within the watershed in which the proposed infrastructure would be located. Source water is water from streams, rivers, lakes, springs, and aquifers that is used as a supply of drinking water. The 1996 amendments to the Safe Drinking Water Act (SDWA) require federal agencies to protect sources of drinking water for communities. Since construction and operation of the project may impact sources of drinking water, EPA recommends that DOE contact the Idaho Department of Environmental Quality (IDEQ) to help identify source water protection areas within the project area. The EIS document should identify all:

2.c

a) Source water protection areas within the project area.
b) Activities that could potentially affect source water areas.
c) Potential contaminants that may result from the proposed project.
d) Measures that would be taken to protect the source water protection areas in the draft EIS.

The project area is located within the Eastern Snake River Plain Aquifer, which has been designated as a Sole Source Aquifer by EPA. This aquifer is vulnerable to being contaminated from surface activities such as septic sewage disposal, herbicide applications and potential spills

2.e of toxic substances. Since groundwater may be impacted by the project, the EIS should fully analyze impacts to groundwater, including reasonably foreseeable direct, indirect and cumulative impacts to groundwater and surface water resources. Guidance documents that address contaminant levels in soil to protect groundwater include: "*Soil Screening Guidance for Radionuclides: User's Guide*" (OSWER Directive No. 9355.4-16A), October 2000, and "*Soil Screening Guidance for Radionuclides: Technical Background Document*" (OSWER Directive No. 9355.4-16), October 2000. These documents can be found online at: http://www.epa.gov/superfund/health/contaminants/radiation/radssg.htm.

Construction of facilities and access roads, and road use may also compact the soil, thus changing hydrology, runoff characteristics, and ecological function of the area, affecting flows

2.d and delivery of pollutants to water bodies. The EIS should note that, under the CWA, any construction project disturbing a land area of one or more acres requires a construction storm water discharge permit or the National Pollutant Discharge Elimination System (NPDES) permit for discharges to waters of the United States. The EIS should document the project's consistency

2.c with applicable storm water permitting requirements and should discuss specific mitigation measures that may be necessary or beneficial in reducing adverse impacts to water quality and aquatic resources.

Hazardous Materials

3.a The EIS should address potential direct, indirect and cumulative impacts of hazardous waste from construction and operation of the project. The document should identify projected hazardous waste types and volumes, and expected storage, disposal, and management plans. It

3.b should address the applicability of state and federal hazardous waste requirements. Appropriate mitigation should be evaluated, including measures to minimize the generation of hazardous

3.c waste (i.e., hazardous waste minimization). Alternate industrial processes using less toxic materials should also be considered.

Since the handling of radioactive materials may affect the parties involved with the project, as well as the public who would access the project area during and after project

3.d construction, the EIS should include information ensuring the public that no hazardous materials would be released in the environment as a result of the proposed project activities. During the spent nuclear fuel receipt, transfer, and repackaging operations, it is possible that gaseous, liquid, and solid low-level radioactive waste would be generated. The EIS should discuss probable impacts from exposure to such waste, potential pathways and periods of exposure. Any waste generated should be managed to limit the amounts and maintain exposures as low as reasonably

3.e achievable (or ALARA), especially if the waste contains radionuclides of concern, such as iodine-129 and tritium.

During the proposed project operations, accidents may also occur and result in release of highly radioactive waste (spent fuel) to the environment. The EIS for the project should describe

3.f measures that will be taken to ensure that the chances of such an accident would be kept to a minimum, but also to ensure that the workers involved in transferring, preparing, examining, and packaging naval spent nuclear fuel and other irradiated materials, including those loading and unloading shipments are protected.

Seismic Risk

Because the INL Site may be within an active tectonically active area, it is possible that project activities could cause increased seismicity (earthquake activity). The magnitude of such
4.a activity is usually low, ranging from 1 - 3 on the Richter scale. However, we recommend that the EIS discuss the potential for seismic risk and how this risk will be evaluated, monitored, and managed to ensure that critical facilities, including nuclear facilities, remain safe during and after
4.b any earthquake. A seismic map should either be referenced or included in the EIS.

Air quality and human health impacts

5.a The EIS should provide a detailed discussion of ambient air conditions (baseline or existing conditions), National Ambient Air Quality Standards (NAAQS), and criteria pollutant
5.b non-attainment areas in the project area. The EIS should estimate emissions of criteria pollutants for the project site and discuss the timeframe for release of these emissions over the lifespan of
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The EIS should specify emission sources and quantify these emissions. Such an evaluation is necessary to assure compliance with State and federal air quality regulations, and to
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- Data on emissions of criteria pollutants from the proposed project and discuss the timeframe for release of these emissions over the lifespan of the project.
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- 5.g Evaluation of radioactive emissions, including the effects of radon emissions.

Cumulative Impacts

The Council on Environmental Quality (CEQ) definition of *cumulative impact* is "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions". Cumulative impacts result from individually minor but collectively significant actions taking place over time. The
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reasonably foreseeable projects or actions at and near the site, then considering those cumulative impacts in their entirety. Where adverse cumulative impacts may exist, the EIS should disclose the parties that would be responsible for avoiding, minimizing, and mitigating those adverse impacts.

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a) Identifies resources, if any, that are being cumulatively impacted.
b) Determines the appropriate geographic (within natural ecological boundaries) area and the period over which the effects have occurred and will occur.
c) Looks at all past, present, and reasonably foreseeable future actions that have affected, are affecting, or would affect resources of concern.
d) Describes a benchmark or baseline.
e) Includes scientifically defensible threshold levels.

Climate Change Effects

Scientific evidence supports the concern that continued increases in greenhouse gas emissions resulting from human activities contribute to climate change. Effects of climate change may include changes in hydrology, sea level, weather patterns, precipitation rates, and
7.a chemical reaction rates. Therefore, the EIS document should consider how resources affected by climate change could potentially influence the proposed project and vice versa, especially within
7.b sensitive areas. Also, the EIS should quantify and disclose greenhouse gas emissions from the project and discuss mitigation measures to reduce emissions.

Coordination with Tribal Governments

8 The EIS should describe the process and outcome of government-to-government consultation between DOE and each of the tribal governments that would be affected by the project, issues that were raised, if any, and how those issues were addressed.

Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments* (November 6, 2000), was issued in order to establish regular and meaningful consultation and collaboration with tribal officials in the development of federal policies that have tribal implications, and to strengthen the U.S. government-to-government relationships with Indian tribes.

Environmental Justice and Public Participation

9 The EIS should include an evaluation of environmental justice populations within the geographic scope of the project. If such populations exist, the EIS should address the potential

for disproportionate adverse impacts to minority and low-income populations, and the approaches used to foster public participation by these populations.

One tool available to locate Environmental Justice populations is the Environmental Justice Geographic Assessment tool, which is available online at: http://epamap14.epa.gov/ejmap/entry.html. Also, Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations* (February 11, 1994), directs federal agencies to identify and address disproportionately high and adverse human health or environmental effects on minority and low-income populations, allowing those populations a meaningful opportunity to participate in the decision-making process.

Monitoring

The proposed project has the potential to impact a variety of resources and for an extended period. Because of that, we recommend that the project be designed to include an environmental inspection and mitigation monitoring program to ensure compliance with all
10 mitigation measures and assess their effectiveness. The EIS document should describe the monitoring program and how it will be used as an effective feedback mechanism so that any needed adjustments can be made to the project to meet environmental objectives throughout the life of the project.

Response to E-Mail Comment #3

Items #1-10:

This comment duplicates Mail Comment #2. Please refer to the responses to Mail Comment #2.

E-Mail Comment #4

From: ROGER TURNER KAYE TURNER [redacted]
Sent: Thursday, September 02, 2010 11:01 PM
To: ECF Recapitalization
Cc: [redacted]
Subject: Comment on EIS Scoping -Navy Spent Nuclear Fuel Recapitalization
Attachments: navy-SNF-Scope910.doc

Mr. Gregory F. Holden (OBU-Naval Reactors) Naval Sea Systems Command 1240 Isaac Hull Avenue, SE, Stop 8036 Washington Navy Yard, DC 20376-8036

Submitted by email to ecfrecapitalization@unnpp.gov

SUBJECT: Scoping Comments for Recapitalization of Infrastructure supporting Spent Nuclear Fuel Handling

Mr. Greg Holden:

Please find attached my comments on the Navy Scoping for Recapitalization.

Please let me know if you have any problems opening the attachment.

Regards,

Roger Turner

September 2, 2010

Roger Turner
[redacted]

Mr. Gregory F. Holden (O8U-Naval Reactors)
Naval Sea Systems Command
1240 Isaac Hull Avenue, SE, Stop 8036
Washington Navy Yard, DC 20376-8036

Submitted by email to ecfrecapitalization@unnpp.gov

SUBJECT: Scoping Comments for Recapitalization of Infrastructure supporting Spent Nuclear Fuel Handling

Mr. Holden:

Thankyou for this opportunity to comment on this important Navy project.

Intro | The Notice of Intent (NOI) lacks sufficient detail, particularly with respect to the range of alternatives, with Spent Nuclear Fuel (SNF) handling and storage to allow the public to provide well-informed comments on the specifics of the project, but the U.S. Navy Nuclear Power and Propulsion (NNPP) have an opportunity to clearly address all the elements of it in the pending EIS.

1. This new EIS must be specific and cannot rely heavily on the older 1995 EIS.

1.a | The 1995 Programmatic EIS cannot be relied on to reference site specific changes needed in this Recapitalization EIS. In order to meet NEPA requirements the new EIS must be specific as to the projects and upgrades, along with their costs and environmental impacts. The Programmatic EIS focused primarily on the broad issue of where to put certain SNF in the United States. It did not provide detail, nor provide tiering, for the foreseeable specific projects. An example of this lack of detail is the dry storage project, from Table 5.3.1 of appendix C, of the old EIS:

> "Design, construct and operate a facility for the preparation of naval spent nuclear fuel for shipment to storage facilities.".

The above sentence was most detail the EIS provided. There was no schedule, no tiering of the project, no detailing of the individual sub-project costs, no specific hard look at environmental impacts. The lack of detail is not just in dry storage but in each aspect of the Navy SNF process at the INL.

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Consequently, in order to adhere to NEPA, the new EIS must get down to details, otherwise,
the Navy is just adding more mystery to the project, rather than clarifying them. It must
1.b answer what, where, when, how, for the Navy's Spent Nuclear Fuel, including the cumulative
environmental impacts. The EIS must contain a "detailed statement" including, inter alia, the
environmental impacts of the proposed project, and all reasonable alternatives to the project
(42 U.S.C. § 4332(c)).

Another example of the disconnection between the Programmatic EIS (hereafter, "PEIS") of
1.c 1995 and the present conditions, is the PEIS, anticipated that a final repository for SNF
would be progressing if not finalized by this time. But now Yucca Mountain will not likely
be licensed and Congress has not authorized the funding to investigate an alternative site.

With the failure of Yucca Mountain, many of the original assumptions are erroneous. A final repository will not likely be ready by 2035 (the old deadline to remove all Navy SNF). The continued reliance on temporary storage designs, as approved by the PEIS, are no longer valid.

2. Information lacking on Expended Core Facility with a gap in NEPA review;

The programmatic EIS of 1995 specified, in Table 5.3.1-1, a project for the Expended Core
Facility, that included design and construction in order to handle Navy SNF. Now, a NEPA
2.a review is proposed to "recapitalize" this same facility. Hence, the new EIS needs to detail
what was actually constructed at the ECF and "covered" under the old Programmatic EIS,
and what has gone into disrepair, or is about to go into disrepair, at this same facility that,
according to the new EIS, needs improved "infrastructure"?

The following must be answered: What did the Navy build at the ECF over the last 15 years
2.b since the PEIS and what do they need to build now? How many water pools are at the ECF?
What are the construction details? Does the ECF meet seismic code and new regulations for
2.c storing SNF? Does the Navy send waste from the ECF to the RWMC, or other INL sites,
2.d and if so, what classification is this waste and volume? The latter issue should be reviewed
under the NEPA requirements for cumulative environmental impacts.

The EIS process of reviewing Spent Nuclear Fuel, needs to stop vague references to improvements at the ECF, but without ever really describing them, documenting the costs, the schedules, the waste streams, alternatives, or the cumulative environmental impacts.

3. New EIS should describe wet pool capacity and process.

The 1995 EIS reviewed and approved an increase in the rack capacity at building 666 in order
to store Navy SNF. Does the Recapitalization project require new pool storage/handling at
3 the ECF? Why can't the building at 666, with its expanded racks, handle that capacity?
The Recapitalization EIS should describe the capacity and purpose of pool storage needs at
both facilities.

4. NEPA review needed on Idaho Settlement Agreement, Yucca Mountain related to
4 **Navy Spent Nuclear Fuel**

One of the big drivers of the Programmatic EIS was the Settlement Agreement between the Navy, DOE and Idaho. Since then, the parties changed the Agreement to open the door to receiving Navy Spent Nuclear Fuel after the deadline in the original Agreement. This

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extension, along with an almost certain failure of Yucca Mountain or any other foreseeable final SNF repository changes the scope of the INL's purpose from an temporary storage site...to a more permanent one. There should be NEPA review by the Navy that expands on the environmental consequences of this extension of purpose at the INL, otherwise the EIS review is completely open ended with respect to the life-span of SNF handling and storage, and associated impact to the environment and safety.

5. **No Need to inspect all Navy Spent Fuel.**
The draft EIS should provide a full explanation of the need for transporting all of this Spent Nuclear Fuel (SNF) waste to Idaho. The situation has changed since completion of the Programmatic EIS. It seems apparent that the Navy does not need to examine each fuel rod that has been removed from a ship, but rather only a representative sample, unless it's an
5 experimental one. The EIS should consider the additional alternative of sending a representative number of fuel rods to Idaho for examination but cut out and keep the remaining spent fuel at the Navy shipyards temporarily until a national waste repository is licensed for final disposal. (In any case, there should be established a Spent Fuel Review Group, that includes staff from the state of Idaho and other scientists to review the need to ship SNF to Idaho because otherwise there may be a tendency for the Navy to send all the SNF to Idaho, all of the time, without justification.)

After over fifty years of experience in de-fueling these ships' reactors, the Navy has a fairly well-defined classification system for submarines and surface vessels and corresponding propulsion, fuel, and cladding characteristics that precludes the need for each fuel rod to be sent to INL for examination and storage.

6. **EIS needs to compare inspection alternatives at the Navy Shipyards and INL.**
6 Much of the fuel rods that do require inspection may be completed with low-technical equipment and the EIS should review an alternative to perform this task at the shipyards in combination with on-site temporary storage there. It is very unlikely that the Navy would gain significant data by performing rigorous high-technical inspection of each fuel rod before assigning it to storage.

7. **EIS should separately address storage and inspection needs.**
The EIS should not combine the need to examine fuel rods with the storage of them: they must be separately addressed. It should not be inferred that since the Navy wants to examine their fuel rods at the INL, that they then be automatically assigned for "temporary" storage at
7 the INL. It may be that a less expensive alternative, in the long run, for the Navy is to have at least one shipyard on each coast of the U.S. that stores the majority of the fuel rods (those that are not individually examined), until they can be shipped to the final certified waste repository. If some of the de-fueled SNF needs examined, but only by a technically simple means (i.e. visual or photographic) the EIS should address the possibility of doing such an examination at the shipyard, without the need to ship it to Idaho for storage.

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8. EIS should clearly define wet and dry storage needs, criteria and alternatives.

8.a The timing between defueling of the SNF at the shipyards, transport to the INL and the appropriate holding period in water pools before inspection and final transfer to dry storage -all needs to be fully reviewed in the EIS.

8.b Are the fuel rods that are scheduled for examination always held in water pools prior to that examination and for how long? Are they retrieved from dry storage for examination? Does the Navy have or need additional retrievable dry storage?

8.c The EIS needs to clearly explain the dry storage acceptance criteria in terms of thermal heat and rod integrity. The time-line requirements need to be reviewed for these step-wise transfers to dry storage and new alternatives explored.

8.d The EIS needs to examine the dry cell infrastructure and security requirements and explore the alternative of dry-cell storage at the Navy yards.

9. The "No Action Alternative" must be changed in EIS.

9.a The NEPA and court cases are clear in their prohibition of Federal projects that are carried out in small steps, which if combined into a single project, would require NEPA review. The No-Action Alternative proposed likely exceeds that threshold. Please include cost estimates for each overhaul project anticipated with the "No Action Alternative.

9.b Does the Navy propose modification or expansion of dry storage or the pool storage as part of the "No Action Alternative"? If so, this should not be classified as a No-Action Alternative because it goes beyond routine maintenance up-grades.

9.a The EIS should revise what is now "No-Action" to a separate alternative such as the "Minor Overhaul Alternative"; and then the "No Action" alternative should be limited to simple maintenance of the existing system (but not re-building, significantly expanding, or overhauling it).

Summary. Much has changed since the Programmatic EIS of 15 years ago: The Idaho Settlement Agreement was revised, the failure of the Yucca Mountain site to be licensed, with no alternate site under review, and the Navy has spent millions of dollars on refurbishing the infrastructure at the INL in order to receive Spent Nuclear Fuel. Because the Programmatic EIS was intended to be a broad review of Navy Spent Fuel handling and storage, one that focused primarily on National SNF siting issues, very limited project descriptions were identified or reviewed in detail. But NEPA requires details, and the public needs them in order to provide learned input on INL's role in handling, examining, and storing SNF. The Navy and DOE have an affirmative obligation to comprehensively review the impacts and alternatives of the transport, core cutting, examination, storage and waste stream of Naval SNF. The Addendum to the Idaho Settlement opened the door to receiving SNF after the 2035 deadline - an open ended schedule, not yet reviewed by the NEPA process.

In any case, the Navy must provide detailed review of the Recapitalization project, without relying on a vague and dated programmatic EIS. So far, the public has not been provided with

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the details of the past 15 years of work at the ECF, Building 666, or other SNF infrastructure improvements, upgrades, in violation of NEPA. The Council on Environmental Quality ("CEQ") regulations implementing NEPA, provide that the consideration of alternatives is "the heart of the environmental impact statement." 40 C.F.R. § 1502.14. The Navy now has an opportunity to truly involve the public in their decision-making by providing the detailed review of Navy SNF processing and associated infrastructure; and to provide a wider range of alternatives than that proposed in the Notice of Intent for a Recapitalization EIS.

Thankyou for providing public hearings in several sites, including Pocatello, and for the opportunity to comment.

Cc: Susan Burke, INL Coordinator

Response to E-Mail Comment #4

Responses to Roger Turner's comments follow:

Introductory Item:

The information provided in the NOI was sufficient to allow informed comments on the scope of the planned EIS.

Item #1.a:

As discussed in Section 1.4, this EIS has been prepared to fulfill NEPA requirements as related to the recapitalization of naval spent nuclear fuel handling capabilities. It provides specific descriptions of impacts (direct, indirect, and cumulative) from reasonable alternatives. It uses updated information without heavy reliance on DOE 1995.

Item # 1.b:

Detailed unclassified information on naval spent nuclear fuel management, including a description of naval spent nuclear fuel receipt, handling, and processing for dry storage at ECF, was included in Appendix D of DOE 1995. Sections 1.1.3 and 1.1.4 of this EIS provide current unclassified information on naval spent nuclear fuel management, including a description of facilities where these activities are performed.

Cumulative impacts for the proposed action are addressed in Chapter 5 of this EIS.

Item #1.c:

DOE 1995 evaluated the transportation of naval spent nuclear fuel to the INL for examination and storage. Based on the evaluations in DOE 1995, the decisions in ROD 1995 to transport naval spent nuclear fuel to the INL were not dependent upon having a geologic repository at Yucca Mountain. In fact, ROD 1995 states that relative ranking of the alternatives would remain the same for possible future naval spent nuclear fuel disposal scenarios.

Item #2.a:

Section 1.1.4 of the EIS documents the current ECF configuration and current and planned naval spent nuclear fuel handling infrastructure at NRF. The commenter refers to Table 5.3.1-1 of DOE 2005a. The only entry in that table relevant to the NNPP at NRF is the Expended Core Facility Dry Cell Project. In the description of the project status, it states that "process limitations identified with the Dry Cell Facility and the volume of naval spent nuclear fuel that must be processed and loaded into canisters for dry storage led Naval Reactors to the conclusion that continuation of fuel processing in water pools was more likely to support the objectives of the Idaho Settlement Agreement and support fleet operating schedules than dry fuel processing. Construction is continuing to implement canister loading and dry storage operations at production levels." That entry describes the cancellation of the dry cell project and construction of the Spent Fuel Packaging Facility described in Section 1.1.4. The entry further describes how the change in direction is bounded by the analysis in DOE 1996.

Item #2.b:

Section 1.1.4 of the EIS documents the current ECF configuration and current and planned naval spent nuclear fuel handling infrastructure at NRF. These descriptions cover what has been constructed at ECF and NRF relative to naval spent fuel handling operations in the past 15 years.

As described in Section 1.1.4, the ECF water pools were constructed in four stages, referred to as Water Pools #1 through #4. The total length of the ECF water pool is now approximately 130 meters (420 feet), with pool depths ranging from approximately 6 to 14 meters (20 to 45 feet). ECF is currently approximately 305 meters (1000 feet) long and 60 meters (190 feet) wide, with an 18-meter (59-foot) high bay running the length of the building.

Item #2.c:

As noted in Section 1.1.4, the water pools at ECF were constructed sequentially between 1957 and 1979, and range in age from 35 years to 57 years. Each stage of expansion met the seismic code applicable at the time. The ECF water pools have never undergone a complete refurbishment; and, therefore, have not been upgraded to industry standards for storing spent nuclear fuel. However, a seismic analysis of the ECF water pool reinforced concrete structures and adjacent building steel superstructure concluded that the reinforced concrete portion of the pools and adjacent building superstructure meet the seismic strength requirements of DOE 2002b for a Performance Category 3 structure. The analysis verified that the ECF reinforced concrete pools and adjacent building superstructure would maintain structural stability in a design basis earthquake. Additionally, the ECF overhead cranes were determined to remain on the crane rails during a design basis earthquake. For a new facility, structures, systems, and components important to safety would be designed to the appropriate natural phenomena hazard category using current design and construction standards.

Item #2.d:

As discussed in Section 3.14, NRF generates Remote-Handled Low-Level Waste that is currently disposed of at the RWMC. In addition, non-hazardous waste is sent to the INL landfill at the Central Facilities Area for disposal. Cumulative impacts from waste management are discussed in Chapter 5.

Item #3:

The capacity of the ECF water pool is described in Section 1.1.4. The capacity of the New Facility Alternative water pool is described in Section 2.1.3. The naval spent nuclear fuel handling management process is described in Section 1.1.3.

Building 666 is located at Idaho Nuclear Technology and Engineering Center (INTEC), not NRF. In accordance with ROD 1997a, naval spent nuclear fuel at INTEC is being returned to NRF to be loaded into canisters for temporary dry storage to meet the requirements of SA 1995 and SAA 2008.

As discussed in Section 2.2, new facility alternative locations other than NRF, including INTEC, were evaluated but eliminated from further analysis.

Item #4:

NEPA evaluation is neither necessary nor appropriate for the 1995 Settlement Agreement (SA 1995). SA 1995 resolved NEPA concerns related to DOE 1995.

As discussed in Section 1.5.3 of the EIS, actions related to dry storage of naval spent nuclear fuel at NRF and actions related to transportation and disposal of naval spent nuclear fuel at Yucca Mountain are outside the scope of this EIS. In particular, actions to develop interim storage facilities or geologic repositories (as suggested by the Blue Ribbon Commission on America's Nuclear Future (BRC 2012)) in lieu of the planned geologic repository at Yucca Mountain will be subject to their own NEPA analysis.

In DOE 1995 and DOE 1996, environmental impacts associated with dry storage normal operations and hypothetical accident scenarios were evaluated for several container system alternatives with varying naval spent nuclear fuel capacities. For dry storage operations, arrays of 345 to 585 dry storage containers were evaluated. The NNPP does not expect to have more than 585 dry storage containers by 2048. Since each container system would be designed to meet 10 C.F.R. § 72 licensing requirements for storage of spent nuclear fuel, the analyses were insensitive to container system capacity and quantity. The delay in opening a geologic repository until 2048 would not result in changes to impacts described for the containers evaluated in DOE 1996. Therefore, the previous EIS analyses and conclusions remain valid.

Item #5:

The commenter is incorrect in stating that since the completion of the 1995 EIS the situation has changed such that the Navy does not need to examine each fuel rod that has been removed from a ship, but rather only a representative sample. The current in-service conditions experienced by naval nuclear fuel are more demanding than in the past. The designs of naval nuclear fuel systems continue to evolve, and some desirable performance characteristics (e.g., a life-of-the-ship fuel design for aircraft carriers) have not yet been achieved. The continuing comprehensive program of examining all naval spent nuclear fuel provides information that validates naval nuclear fuel designs and performance models. This validation is essential to support resolution of emergent fleet problems, further refinement of the models, and development of the next generation of naval nuclear fuel designs.

Item #6:

The commenter is incorrect in stating that most spent fuel inspections may be completed with low-technical equipment. Very complex and sophisticated equipment is needed to obtain needed information from examination of naval spent nuclear fuel while protecting workers from the high radiation fields associated with naval spent nuclear fuel. The infrastructure for such inspections does not exist at the naval shipyards. However, this infrastructure does exist at several locations on the INL. As indicated in the original NOI, the U.S. Navy will include those locations when alternatives for recapitalization of the examination program infrastructure are evaluated.

Item #7:

As noted in Section 1.5.3, alternatives for management of spent nuclear fuel managed by the DOE, including naval spent nuclear fuel, were comprehensively evaluated in DOE 1995. Based on that evaluation, ROD 1995 chose to implement regionalized spent fuel management by fuel type. Under that alternative, naval spent nuclear fuel is managed at the NRF at INL. There are no factors that warrant reconsideration of that decision.

Item #8.a:

Sections 1.1.3 and 1.2 describe the process for unloading naval spent nuclear fuel from shipping containers into water pools at ECF. The NNPP complies with the restrictions of SA 1995 limiting the time naval spent nuclear fuel can remain in the water pool to a period of 6 years with an exception for a volume of not more than 750 kilograms heavy metal of naval spent nuclear fuel in archival wet or dry storage as necessary for comparison to support fuel designs under development or in use in the U.S. Navy fleet. The archival fuels are not subject to the 6-year time-frame limit.

Item #8.b:

The scope of this EIS no longer includes recapitalization of examination infrastructure. In addition, discussion of dry storage is outside the scope of this EIS, as described in Section 1.5.3.

Item #8.c:

Dry storage is outside the scope of this EIS, as described in Section 1.5.3.

Item #8.d:

As noted in Section 1.5.3, alternatives for management of spent nuclear fuel managed by the DOE, including naval spent nuclear fuel, were comprehensively evaluated in DOE 1995. Based on that evaluation, ROD 1995 chose to implement regionalized spent fuel management by fuel type. Under that alternative, naval spent nuclear fuel is managed at NRF at INL. There are no factors that warrant reconsideration of that decision.

Item #9.a:

The No Action Alternative, as currently defined in Section 2.1, limits efforts to preventative and corrective maintenance. This level of effort may not keep the infrastructure in safe working order until 2060 (i.e., maintenance alone may not be sufficient to sustain the proper functioning of structures, systems, and components). In addition, this level of effort will not provide the capability to unload M-290 shipping containers. Therefore, the No Action Alternative is an unreasonable alternative that does not meet the purpose and need for the proposed action. While the concept of a minor overhaul does not warrant analysis as a stand-alone alternative since it is bound by the Overhaul Alternative, it is described in Section 2.3 as part of the scope of the New Facility Alternative. The NNPP would continue to operate ECF during new facility construction, during a transition period, and after the new facility is operational for examination work. To keep the ECF infrastructure in safe working order during these time periods, some limited upgrades and refurbishments may be necessary. Details are not currently available regarding which specific actions will be taken; therefore, they are not explicitly analyzed as part of the New Facility Alternative. However, the environmental impacts from these upgrades and refurbishments are considered to be bounded by the environmental impacts described for the Refurbishment Period of the Overhaul Alternative in Chapter 4.

Item #9.b:

Planned expansions to dry storage are consistent with ROD 1997a. In ROD 1997a, the DOE and the Navy decided that all canisters loaded with naval spent nuclear fuel would be stored in a developed area east of ECF prior to shipment to an interim storage site or geologic repository. Consistent with the evaluation, the first dry storage facility, known as the Overpack Storage

Building (OSB), was constructed in 2001, adjacent to ECF. Since 2001, two Overpack Storage Expansion (OSE) buildings have been constructed. An additional OSE is planned if needed to accommodate the growing number of concrete overpacks loaded with naval spent nuclear fuel canisters. The temporary dry storage of naval spent nuclear fuel in the OSB and OSEs is consistent with the evaluation in DOE 1996 and enables the NNPP to continue to meet its obligations in SA 1995 for dry storage.

E-Mail Comment #5

From: Peter Rickards [redacted]
Sent: Friday, September 03, 2010 4:27 PM
To: ECF Recapitalization
Cc: [redacted]
Subject: Written public comment for Navy EIS for INL

IDAHO FAMILIES FOR THE SAFEST ENERGY

Official scoping issues to supplement my oral presentation in Twin Falls please.
While we admire, appreciate, and love the brave Navy patriots, please answer the following scoping questions in your EIS.

1 1) There are no seaports for nuclear submarines in Idaho. Instead of building new facilities at INL for $2 Billion, please analyze relocating and clustering Navy fuel operations at the DOE's Savannah River facility. This is presently not under consideration in your EIS, which is illegal by NEPA law, ie, an "irretrievable commitment of resources" stacking the deck for future clustering around the $2 Billion spent in Idaho

2 2) Specifically analyze worst case scenario accidents or terrorism, or disgruntled employee sabotage, comparing that fallout spreading from Idaho across the country and cities, vs the fallout at SR's east coast, where that has a chance to blow away from cities out to the ocean.

3 3) Analyze INL vs SR to see that clustering the Navy operations on the east coast will save money and safety risks from transporting the dangerous spent fuel across the country to Idaho.

4 4) Please see the documented science references below. Please analyze inhalation of one lone particle of the spent fuel's pu-238 to see it would exceed the 10 mrem public exposure limit, since the HEPA filters can NOT contain plutonium at the 99.97% bragged about in all EIS's so far. Note the particle size problem from criticalities that the DOE has refused to answer yet in all previous EIS's.

5 5) Please analyze pu-238 inhalation from transportation accidents where a fire lasts 2 hours, and as the DOE documents admit, allowing an unbounded release of the spent fuel. That is why clustering at SR and greatly lessening the transport miles is important to analyze.

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http://rpd.oxfordjournals.org/content/83/3/221.abstract

Variability in PuO2 Intake by Inhalation: Implications for Worker Protection at the US Department of Energy

1. B.R. Scott
<http://rpd.oxfordjournals.org/search?author1=B.R.+Scott&sortspec=date&submit=Submit> and
2. A.F. Fencl
<http://rpd.oxfordjournals.org/search?author1=A.F.+Fencl&sortspec=date&submit=Submit>

Abstract

This paper describes the stochastic exposure (SE) paradigm where, at most, small numbers of airborne toxic particles are presented for inhalation. The focus is on alpha-emitting plutonium dioxide (PuO2) particles that may be inhaled by Department of Energy (DOE) workers. Consideration of the SE paradigm is important because intake of only a few highly radioactive PuO2 particles such as 238PuO2, could greatly exceed the annual limit on intake (ALI) used to control worker exposure. For the SE paradigm, credible intake distributions evaluated over the population at risk are needed, rather than unreliable point estimates of intake. Credible distributions of radiation doses and health risks are also needed. Because there are limited data on humans who inhaled PuO2, these distributions must be calculated. Calculated distributions are presented that relate to the intake of radioactivity via inhaling polydisperse PuO2 particles. The results indicate that a large variability in radioactivity intake is expected when relatively small numbers of PuO2 particles are inhaled. For the SE paradigm, one cannot know how many PuO2 particles were inhaled by an individual involved in a given inhalation exposure scenario. Thus, rather than addressing questions such as 'Did the calculated worker's intake of 238PuO2 exceed the ALI?', it is better to address questions such as 'What is the probability that 238PuO2 intake by a given worker occurred and exceeded the ALI?' Mathematical tools for addressing the latter question are presented, and examples of their applications are provided, with emphasis on possible DOE worker exposures at the Rocky Flats facility near Denver, Colorado. The alpha-emitting isotopes 238Pu, 239Pu, 240Pu and 242Pu are found at Rocky Flats. Although 238Pu is thought to be present in relatively small amounts there, intake via inhalation of only a few 238PuO2 particles could greatly exceed the ALI.

* Radiation Protection Dosimetry
<http://www.oxfordjournals.org/our_journals/rpd/terms.html>
*

I needed to share some vital information on HEPA filter problems and plutonium transport in water

that effects the true plutonium emissions from the proposed pit facility and the plutonium laced low

level and Transuranic waste generated. I am a podiatrist in Twin Falls , Idaho. As a citizen, and as a

member of the CDC advisory panel on INEEL, I have gathered some vital documents on HEPA filter

problems and Pu transport problems . I hope you will address these issues. The HEPA filter issues

really effects almost all nuclear projects. Please contact me for more details if desired, but here is an

overview.

To get an air quality permit, the project has to show they do not expose the public to more than 10

mrem of radiation from normal operations (and my memory says that there is a 100 mrem limit to

anticipated accidents). The filters are bragged to be 99.97% efficient for 0.3 micron particles, and

2

more efficient for both smaller and larger particles. This allows them to calculate a very low rate of

release, qualifying easily for a permit.

Here are the 2 main areas of filter problems, that remain unquantified. I have called for testing the

filters, in lab, for these problems, at all so-called Environmental Impact scoping hearings. To date,

these questions have remained unanswered.

1) Most folks know that the filters can burn, but even if the fire is contained and put out by

sprinklers, that humidity can ruin the filters. The DOE's May 1999 Defense Nuclear Facilities Safety

Board(DNFSB/TECH-23) had this to say, on page 2-5, " When installed fire suppression systems are

activated to protect systems, structures, and components inside confinement, the moisture-laden air

carried downstream to the HEPA filters can seriously degrade filter preformance-at a time when

high-efficiency filter performance is crucial." All this is "despite the fact that water repellents are

applied to the medium during manufacturing." This does not stop the DOE from saying that the 3

HEPA filters in a row combine for 10 to the minus 9th power filtering efficiency (99.9999999999%).

Criticalities (not in report) are also another unquantified accident, that could be quantified truthfully

in lab settings. I have a great DOE paper from an FL Horn, replicating a criticality with plutonium.

On day one, the particles were between 0.1 micron down to less than 0.005 micron. Plutonium is a

heavy metal, and often a wind resuspension factor of 1 per million particles is assigned in the EIS. In

this FL Horn experiment, the plutonium particles were so light, that in this windless closed cell, they

floated for 3 days , bouncing around on the brownian motion of the air molecules! They slowly

aggregated and precipitated, but that was in this closed cell.

3

2) "Alpha recoil " is a DOE term, for the ability of alpha emitters, like plutonium, to "creep " through

4 HEPA filters in a row! Nobody knows how much plutonium comes out of the last filter. We need to

make the DOE reveal the plutonium releases for normal operations, in a lab. The DOE has known of

this problem since the 1970's, but has chosen to ignore it. I have 2 papers from DOE on this. One is

from WJ McDowell, from Oak Ridge. For the 14th ERDA Air Cleaning Conference, he writes a paper

called " Penetration of HEPA filters By Alpha Recoil Aerosols." He says "Tests at Oak Ridge National

Laboratory have confirmed that alpha-emitting particulate matter does penetrate High-efficiency

filter media, such as that used by HEPA filters...Filter retention efficiencies drastically lower than

the 99.9% quoted for ordinary particulate matter were observed with Pb-212, Es-253, and Pu-238

Constans continuo, lentus demissus

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sources, indicating that the phenomenon is common to all of these..." It seems as if the alpha particle,

from the radioactive decay, literally knocks the particles loose. As it creeps through any filters that is

in it's way, the DOE thinks that smaller pieces of the plutonium particles, break off the original

particle, increasing the joy of downwinders.

Another DOE paper comes from Arthur H Biermann, at Lawrence Livermore, from Dec,11,1991. His

paper is called,"Alpha migration through Air Filters: A Numerical simulation." He says ," It is

obvious from the review of the literature that evidence exists of the migration of alpha radionuclide

species through high efficiency filter media." Both papers have many DOE references, and both call

for quantifying the true releases , in lab experiments. The experiments are do-able, but, so far, the

4

DOE ain't gonna do it.

I have asked for Dr Liu, at the University of Minn. to be commissioned to study these issues. He uses

a "total capture" technique for downstream particle counting. This is key to true efficiency detection

,or lack of. The present laser counter can detect down to 0.1 microns. Dr Liu can go to 0.007 micron.

Seems the minimal efficiency size goes down from 0.3 micron, each time particle size detection ability

increases...

The FL Horn experiment I mentioned replicates a criticality, and has Pu under the electron

microscope. It ranges, on day one, from 0.1 to LESS THAN 0.005 micron, a bottomless scale! The Pu

particles slowly aggregate, but much was still floating for THREE DAYS on the brownian motion of

the air molecules, in this closed cell experiment. We need to quantify normal and accident filtering

truefully, for the first time in nuclear history, and we should use this panel to do it. The DOE

Beirmann paper mentions, as a theory, that the bigger pieces of Pu, that get caught in the first filter,

may break off smaller pieces via this alpha recoil. That throws another flaw in the true dose to the

public during normal operations, over 30 years. This effects all nuclear facilities, past and present.

While the DOE ignores this, a recent study was conducted in the UK. Y. Yamada et al published

"Re-entrainment of 239PuO2 particles captured on HEPA filter fibres." (Radiation Protection

Dosimetry Vol 82 No 1, pp25-29,1999). While I will present what I think are the shortcomings of the

Yamada study, they clearly acknowledge the true efficiency of Pu filtering has NOT been quantified

before. However, Yamada reported two different resuspension rates. The higher, dust loaded rate

was a staggering resuspension of 1 particle per hundred per hour!

Firstly, it is significant that the Yamada study on the re-entrainment of PuO2, detected a PER

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HOUR rate of Pu resuspension. There is not supposed to be a PER HOUR rate of resuspension, of

any kind. The DOE permit applications state that 99.97% efficiency is the MINIMUM, PERIOD.

This qualifies them to claim that the 10 mrem limit to public exposure will not be exceeded. This

appears to be drastically contradicted by the continual plutonium resuspension rates, especially at

higher dust loading , which replicates historical use of filters left in place for decades. Note p.28

states," For example, the dispersion rate at twice dust loading was calculated to have increased by 13

times. It was confirmed that re-entrainment was strongly affected by dust loading." My main

criticism is that the experiment only lasted 20 days. The paper , ironically, does site and

acknowledge, the 1976 McDowell paper I love. That McDowell paper notes that regular testing

missed the alpha creep because of the short duration of their testing. McDowell left his test up for

one year.

The Yamada test , however, seems to have enough sensitivity to detect alpha creep, at all flows, even

in this limited 20 day experiment. I question their conclusion #1, which dismisses the lower rate of

re-entrainment. They conclude, " Therefore, it was concluded that plutonium particles captured on

fiber filters near the front surface hardly penetrate the filter."

Constans continuo, lentus demissus

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I believe their dismissal misses the red flags I see. In a mere 20 day experiment, it is noteworthy that

ANY plutonium gained full penetration of this filter, at this low rate. As McDowell notes, a longer

time frame reveals more alpha creep. This 20 day experiment is unrealistic, since no where in the

DOE are HEPA filters changed every 20 days. This low rate, short run, underestimates the true, long

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term penetration by alpha emitters. I noted Yamada's reference 4, the Fliescher study , that supports

the probable fragmentation of smaller plutonium particles, from the larger original plutonium

particles. This is the Bierman paper's theory , as well.

This clearly calls for Dr Liu's ultrasmall, ultrasensitive "total capture" technique, to capture ALL

sizes of particles, to be done over an extensive period of time, that replicates actual normal use. How

else are we going to determine the true efficiency, of this documented alpha creep problem?

Three important points come to mind.

1)Do the other beta and gamma emitters, that are impacted on the filter, with the alpha emitters,

also leave the filters undetected? Does that not require further testing?

2) Do more radioactive alpha emitters, like the Pu-238, have even higher rates of resuspension? Does

this not call for more testing?

3) Since this Yamada paper confirms alpha creep, why have the DOE downstream monitors not

detect any whispering of this plutonium, through the filters? The CDC swears that the monitoring

proves their is no alpha creep "footprint" on the monitors, declaring their faith in the monitors. I

believe the phrase , "below detectable limits", applies to the downstream monitors, and their inability

to reveal the true exposure to the public, of inhalable alpha emitters.

The second issue is the recent discoveries by DOE revealing plutonium transport in water is much

easier than previously believed. The standard of 100 nanocuries per gram of waste material was

created in 1984. The reason given to justify the change was a calculation that the 100 nano standard

would give an acceptable dose of 500 mrem from animal intrusion and resuspension This definetly

ignores the water pathway. More important, it ignores the total quantity of plutonium which will be

left over the local water, buried as low level waste.

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These decisions are only required to try to calculate radiation doses the public, in a thousand year

time frame, if it is below 100 nano/gram. Unfortunately, as mentioned , the plutonium particles,

which are potentially deadly and cancer causing, if inhaled and embedded in your lungs, remain

radioactive for over 240,00 years.

We have been told for years that plutonium is an actinide, that binds to clay and rocks, immobilizing

the plutonium, protecting the local aquifer. These decisions by the DOE have unfortunately ignored

two recent , contradictory DOE studies, that both show how easily plutonium moves with water.

Understanding these important contradictions is key to protecting local water supply and public

health for centuries to come.

These two separate studies actually reveal a double trouble scenario, because both the soluble forms ,

and the insoluble forms of plutonium can move with water. The A. B. Kersting study , was done at

the Nevada Test Site(1). This study found that insoluble plutonium had migrated 1.3 km (roughly

one mile) bound to clay as a colloid and was suspended and floating in this sluggish aquifer, 30 years

after being introduced to the underground environment. This is a profound, and dangerous

discovery, that should change our nearsightedness about plutonium over our aquifer. These

plutonium colloids ranged in size from greater than one micron, down to 0.007 microns. The DOE

acknowledges that inhalation of plutonium is the most dangerous pathway of human exposure.

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Plutonium colloids in our aquifer would be available for inhalation from the common use of sprinkle

irrigation, and even canal irrigation that later dries, allowing newly surfaced plutonium to be

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resuspended in the wind. The fact that these are insoluble particles of plutonium, means that each particle contains millions of plutonium atoms. That makes inhalation more dangerous because , while the single strike alpha disintegration of a single radon gas atom is dangerous, an embedded plutonium particle provides a point of perpetual radiation and alpha destruction. The Kersting paper notes the old thinking of the DOE, siting the McDowell-Boyer paper. They say , "it has been argued that plutonium introduced into the subsurface environment is relatively immobile owing to its low solubility in ground water and strong sorption onto rocks." Kersting notes there are two previous studies of field observations contradicting that premise (2, 3).

I have heard the DOE, CDC, State, and ATSDR verbally dismiss the Kersting study as "due to the bomb testing." However , Kersting addresses the issue, stating that in the 40 years of bomb testing, previous testing only found that "radionuclides were detected at a maximum of a few hundred metres from the original detonation site. "Having isolated the specific isotope ratio of the Benham bomb test debris, there is no doubt of its origin. The Kersting team concludes , "The possibility that the Pu from the Benham test site was blasted and deposited greater than 1.3 km away, in two distinct aquifers separated by 300 m vertically and 30 m horizontally seems highly unlikely." Most importantly, Kersting concludes," Pu transport models that only take into account sorption and solubility may therefore underestimate the extent to which this species is able to migrate in ground water."

The second study I will refer to, is from DOE's Los Alamos lab, by John M. Haschke (4). While Kersting showed the mobility of insoluble plutonium, Haschke revealed that Pu in our environment can change oxidation states in the presence of airborne water vapor and become very soluble in

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water, enhancing mobility. This discovery contradicts the present textbooks, according Dr Madic (5) ,

who wrote the accompanying "Perspective" , when the Haschke study was published in Science.

Textbook knowledge had only found PuO2 in the environment, in oxidation states III and IV. Madic

writes how this must affect how we view everything, from the new plutonium laden MOX nuclear

reactors, to nuclear storage. Madic states," Until now, it was assumed that plutonium would not be

very mobile in the underground geological environment because of the insolubility of Pu(IV)

compounds. But Haschke et al. demonstrate that water can oxidize PuO2 into PuO2+x, in which more

than 25% of the plutonium can exist as Pu(VI), an ion that is far more soluble, and thus mobile, than

Pu(IV). This new property will have important implications for the long term storage of plutonium."

So when will the DOE apply this information to protect our water and our health ? We need above

ground, inspectable and retrievable storage for the billions of plutonium particles dumped over our

water. To ignore these studies is inexcusable.

There is one more paper I will quote, from Dr Runde. I went to the Wolfgang Runde article called

"The Chemical Interaction of Plutonium in the Environment." It is from a Los Alamos conference on

plutonium transport. That can be referenced at

http://lib-www.lanl.gov/pubs/number26.htm Runde

acknowledges the colloid transport was fast, and concludes, "What is clear is that transport models to

date have underestimated the extent of colloidal transport on plutonium mobility." Let me put his

conclusion in context, and quote Dr Runde to a fuller extent. Dr Runde, on page 408 (or 17 of 20 on

the computer download) says. " We are also trying to better understand the sorption/desorption

reactions of actinides with colloids and the actinides' resulting transport characteristics. This area of

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environmental migration received attention with the discovery of plutonium in a borehole at the

Nevada Test Site (Kersting et al. 1999). The plutonium had evidently migrated 1.3 kilometers in only

30 years." Runde continues," As discussed in the article by Maureen McGraw, we now believe that

colloid transport was responsible for this remarkably fast movement of plutonium through the water

saturated rock. It is not clear, however, whether the transport was facilitated by intrinsic plutonium

colloids or natural (clay or zeolite) colloids. What is clear is that transport models to date have

underestimated the extent of colloidal transport on plutonium mobility."

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The only reference to the uniqueness of bomb testing is the initial time it takes to reach plutonium

exposure to water. Runde notes that the underground explosion allowed the plutonium to be left in

water, while a waste repository would differ, because the "radionuclides would be isolated, at least

initially, from the hydrogeologic environment.".(p490) Runde also mentions a new concern for Pu

migration, and that is microbes acting as " mobile colloids. " While they may act as a barrier, they

may aid transport. Runde says, "As such, they act as mobile or even self propelled colloids. (p 409,

18/20). That is another reason we should simply re-barrel the plutonium waste, instead of shallow

burial. Runde concludes, " More sophisticated models are needed to account for all the potential

migration paths away from an actinide source. Theoretical and experimental scientists will be

challenged for years by demands of developing these models.(p 410, 19/20)

Gee , I look forward to when they finish the job.

Sincerely,

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Dr Peter Rickards DPM

[redacted]

1)A.B. Kersting et al. , Lawrence Livermore National Laboratory, Nature, vol 397 Jan 7, 1999, p56-59.

2)McDowell-Boyer , Environmental Science Technol. , 26 , 586-595 (1992)

3)Ryan et al, Physiochem. Eng. Aspects, 107 , 1-56 (1996)

4)JM Haschke et al. ,Science 287, Jan 14 2000

5)C Madic, Science 287 , Jan14, 2000

Response to E-Mail Comment #5

Responses to Dr. Rickard's comments follow:

Item #1:

As noted in Section 1.5.3, alternatives for management of spent nuclear fuel managed by the DOE, including naval spent nuclear fuel, were comprehensively evaluated in DOE 1995. Based on that evaluation, ROD 1995 chose to implement regionalized spent fuel management by fuel type. Under that alternative, naval spent nuclear fuel is managed at the NRF at INL. There are no factors that warrant reconsideration of that decision.

Item #2:

As noted in Section 1.5.3, alternatives for management of spent nuclear fuel managed by the DOE, including naval spent nuclear fuel, were comprehensively evaluated in DOE 1995. The consequences of accidental releases were considered in that evaluation; it was found that the consequences of centralizing spent fuel management at the Savannah River Site (SRS) were higher than the consequences of centralizing spent fuel management at INL. Based on the evaluation in DOE 1995, ROD 1995 chose to implement regionalized spent fuel management by fuel type. Under that alternative, naval spent nuclear fuel is managed at the NRF at INL. There are no factors that warrant reconsideration of that decision.

Item #3:

As noted in Section 1.5.3, alternatives for management of spent nuclear fuel managed by the DOE, including naval spent nuclear fuel, were comprehensively evaluated in DOE 1995. Transportation related impacts were considered in that evaluation. Based on the evaluation in DOE 1995, ROD 1995 chose to implement regionalized spent fuel management by fuel type. Under that alternative, naval spent nuclear fuel is managed at the NRF at INL. There are no factors that warrant reconsideration of that decision.

Item #4:

The articles were reviewed to determine their applicability to the EIS. The articles discuss radiation exposure due to inhalation of plutonium, water transport of plutonium, and High-Efficiency Particulate Air (HEPA) filter efficiency for alpha particles.

Inhalation of Plutonium

The B.R. Scott article (Scott & Fencl 1999) identified by the commenter models the amount of plutonium intake by workers in an environment where there are few particles available for inhalation - a condition in which the authors consider a statistical (i.e., stochastic) approach for estimating intake is more appropriate than a deterministic approach. The model uses an assumed distribution of particle sizes which are available for inhalation. The range in assumed particle sizes leads to large variability in calculated radioactivity intake when few particles are inhaled. Since inhalation occurs in discrete particles that have a log normal distribution, most workers will inhale smaller particles while a few workers may inhale large particles. Of those particles inhaled, only a portion would be deposited in a section of the respiratory tract that contributes to an internal dose. The authors correctly note that in addition to the variability in intake, there is uncertainty on where particles deposit in the respiratory tract. Since the location of deposition significantly affects the dose received from the particle, the authors do not attempt to estimate the doses associated with the intake and subsequent deposition. The authors do not conclude in the paper that inhalation of a single particle of ^{238}Pu would exceed the 10 millirem public exposure limit established in 40 C.F.R. § 61.102. However, if a large enough particle were to be deposited in the lungs, an individual's exposure could exceed 10 millirem.

Section F.3 of the EIS discusses the generally accepted models and assumptions used for estimation of risk posed to workers and the public from releases of radioactivity during routine naval spent nuclear fuel handling operations and hypothetical accident scenarios. The generally accepted model for particle dispersion used in the EIS is the Gaussian model for a plume which is one of the most common modeling methods. For example, the Gaussian model is used by both the DOE (DOE 2004c) and Nuclear Regulatory Commission (NRC 2011). In addition, the latest guidance for converting radioactivity inhaled to dose received was used in the EIS analysis (ICRP 1995). This includes the use of dose conversion factors for appropriate particle sizes for environmental release as recommended by the ICRP (ICRP 1993).

Additionally, the larger particles discussed in the article "associated with the upper tail of the intake distribution do not necessarily reflect a higher health risk as many of the high intake events are associated with deposition of large particles in the nose, which is a radioresistant site." Therefore, if a member of the public were to inhale a large particle, the particle would be unlikely to be deposited in the lungs. The article is also specific to exposure to workers. As discussed in the article, the particle size and radioactivity distribution are likely to be very different for an accident resulting in public exposure.

Water Transport of Plutonium

The articles present information about the transport of radionuclides through the environment into groundwater. However, as the articles state, the transport of radionuclides is dependent on many factors influenced by the chemistry of a particular location and environment. Exposure from radioactive emissions onto surface water and into groundwater was evaluated in the EIS. Conservative assumptions were used to reflect uncertainty in transport methods through the soil and aquifer below NRF. Individual radionuclide transport properties (excluding radioactive decay) were not considered for the water transport to allow for conservative modeling (e.g., not modeling any potential delay from perched water zones, instantaneous solubility, and rapid transport time to the individuals of interest based on empirical data).

HEPA Filtration

For routine naval spent nuclear fuel handling operations, the impacts reported are based on actual emissions scaled to future operations. For hypothetical accident scenarios involving an intact facility structure with HEPA filters, this EIS models HEPA filters as being 99.9 percent effective for particulates (a more conservative assumption than the 99.97 percent higher filtration efficiency frequently reported in DOE documents). In addition, multiple HEPA filter units in series are conservatively modeled as a single unit; and no credit is taken in the model for multiplicative protection from a series of HEPA filters. For hypothetical accidental scenarios involving damage to a facility structure, this EIS takes no credit for HEPA filters and does not include HEPA filtration.

The NNPP requires that HEPA filters to the environment be tested frequently for proper air flow, pressure, and filtration effectiveness. Testing to verify that the HEPA filters are operating effectively occurs upon initial installation, after any modification of the system, and annually. Additionally, the NNPP replaces the HEPA filters whenever the filters do not pass inspection, if damage is detected or suspected, according to schedule, or if the radiation level in the filter reaches a set-point.

Item #5:

As discussed in Section 1.5.3, transportation of naval spent nuclear fuel to INL is outside the scope of this EIS; therefore, no off-site transportation accidents are evaluated. Appendix F evaluates releases of radionuclides due to hypothetical accident scenarios and intentional destructive acts. ^{238}Pu is included in the source term for an inter-facility (i.e., between two facilities located on NRF property) transfer accident which includes a fire involving naval spent nuclear fuel. The fire scenario is discussed in Section F.5.4.7; however, since the ^{238}Pu contributes less than 1 percent of the dose, it is not shown in the Section F.5.4 table. In the development of accident scenarios, the NNPP models a total amount of material released based on a hypothetical amount of damage to the naval spent nuclear fuel that is independent of scenario duration.

A 15-minute plume duration (e.g., exposure time to an individual) is modeled as representative of a fire that occurs on NRF property. The material modeled to be released during this exposure time (i.e., activity released from damage to the naval spent nuclear fuel) accounts for mechanical damage to the naval spent nuclear fuel and overheating from a fire during the accident. The model is conservative due to the robustness of the naval nuclear fuel design and the containment provided by the shielded transfer container design. Assuming a 2-hour burn time for the vehicular crash on NRF property is unreasonable considering the emergency response capabilities available at NRF and the INL.

E-Mail Comment #6

From: Kathy Daly [redacted]
Sent: Friday, September 03, 2010 4:29 PM
To: ECF Recapitalization
Subject: Public Scoping and proposed EIS

Dear Mr. Holden,

I'm writing this afternoon in regard to the proposed EIS for the recapitalization of the infrastructure supporting the Naval spent nuclear fuel at the Idaho National Laboratory.

I attended the August 25th public scoping meeting sponsored by the Naval Nuclear Propulsion Program. Thank you for holding a Pocatello meeting. It is much appreciated! At the scoping meeting I learned of the four alternatives under consideration for the recapitalization project.

1 I'm hopeful the draft EIS will retain the "No Action" alternative as a viable means of recapitalization.

2 I hope it will provide thorough examination of potential environmental impacts on the fragile high desert surroundings...the Snake River Aquifer included.

Thank you for your time and interest. I look forward to commenting on the proposed EIS.

Sincerely,

Katherine Daly

-- Kathy Daly Email: [redacted]

Response to E-Mail Comment #6

Item #1:

The commenter's interest in the No Action Alternative is noted. The No Action Alternative, as currently defined in Section 2.1, limits efforts to preventative and corrective maintenance. This level of effort may not keep the infrastructure in safe working order until 2060 (i.e., maintenance alone may not be sufficient to sustain the proper functioning of structures, systems, and components). In addition, this level of effort will not provide the capability to unload M-290 shipping containers. Therefore, the No Action Alternative is an unreasonable alternative that does not meet the purpose and need for the proposed action.

Item #2:

Potential environmental impacts of all analyzed alternatives on the surrounding environment and the Snake River Aquifer are discussed in Chapter 4.

E-Mail Comment #7

From: Beatrice Brailsford [redacted]
Sent: Friday, September 03, 2010 8:46 PM
To: ECF Recapitalization
Subject: Snake River Alliance scoping comments
Attachments: nuclear navy 2010 final.pdf

Beatrice Brailsford

Snake River Alliance

Box 425

Pocatello, ID 83204

208/233-7212

[redacted]

SNAKE RIVER ALLIANCE
IDAHO'S NUCLEAR WATCHDOG

September 3, 2010

Gregory F. Holden (O8U-Naval Reactors)
Naval Sea Systems Command
1240 Isaac Hull Avenue, SE, Stop 8036
Washington Navy Yard, DC 20376-8036

Submitted by email to ecfrecapitalization@unnpp.gov

Snake River Alliance Scoping Comments on the Environmental Impact Statement on recapitalization of the infrastructure supporting spent nuclear fuel (SNF) handling and examination at the Idaho National Laboratory (INL)

Dear Mr. Holden:

On behalf of the members of the Snake River Alliance, I submit the following comments and questions regarding the scope of the EIS on nuclear navy spent fuel infrastructure recapitalization.

First, let me repeat our appreciation for the nuclear navy's decision to hold multiple public meetings in Idaho. Activities at the Idaho National Laboratory and its ongoing role as the nuclear navy's final Port of Call are areas of broad concern here, and we commend your responsiveness to those concerns.

1 There is a slight implication in the preliminary material that examination and storage of nuclear navy SNF at INL is required under the 1995 Settlement Agreement. That is most certainly not the case.

2 My understanding is that a very small percentage of SNF is examined in depth, and that question should be discussed in the EIS.

3 Though the programmatic decision to ship nuclear navy spent fuel to Idaho for indefinite storage was made in the 1995 DOE Programmatic EIS for Spent Nuclear Fuel Management, the environmental effects of receiving, handling, examining, packaging, and storing nuclear navy spent fuel were only cursorily covered in the site-wide portion of the 1995 study and have not been revisited in a supplement analysis. The effects of transportation do not seem to have been evaluated since 1999. The current EIS must fully evaluate all impacts of shipping, receiving, handling, examining, packaging, and storing

4 nuclear navy spent fuel at INL (10 CFR 1021.330). A narrative of what has changed over the years would be helpful. In addition, all effects of the waste streams from all these activities must be fully analyzed. An important element of this analysis is the length of time these activities—not just construction—would occur. As part of the scope of this study, the nuclear navy must provide all analyses and policy statements that tell us what the US fleet will be like in 40 and 50 years.

The "time scope" in the EIS must also include a full discussion of the fact that, once "packaging" is complete, nuclear navy spent nuclear fuel, as always, is all wrapped up with no place to go. The

5 2008 Addendum to the Settlement Agreement (at least until it is amended again) states that "after January 1, 2035, the Navy may maintain a volume of Naval spent fuel at INL of not more than 9 metric tons heavy metal (MTHM) for a timeframe reasonably necessary for examination, processing, and queuing for shipment to a repository or storage facility outside Idaho." What percentage of nuclear navy SNF already at INL does this amount represent? What percentage is it of total nuclear navy SNF inventory reasonably expected in 2035 (based on the analyses and policy statements that will be included in the upcoming EIS)? What is a "reasonably necessary timeframe," particularly for storage, in measurable terms (in years, for instance)?

6 The "no-action alternative" is in fact an *action* alternative. A more appropriate "no-action alternative" is maintenance of the current structures. "Overhaul… refurbishments…upgrades" are actions and should be analyzed as a separate alternative.

7 The preliminary material seems to imply that the nuclear navy could not refuel its fleet without new storage facilities in Idaho for spent nuclear fuel. Idaho plays no role in refueling nuclear navy vessels.

Again, thank you for having public meetings in Idaho Falls, Pocatello, and Twin Falls, Idaho, on this proposal.

Respectfully submitted,

Beatrice Brailsford
Program Director

Response to E-Mail Comment #7

Responses to the Snake River Alliance's comments follow:

Item #1:

The commenter is correct that the 1995 Settlement Agreement does not require examination and storage of naval spent nuclear fuel at INL. As noted in Section 1.5.3 of the draft EIS, alternatives for management of spent nuclear fuel managed by the DOE, including naval spent nuclear fuel, were comprehensively evaluated in DOE 1995. Based on that evaluation, ROD 1995 chose to implement regionalized spent fuel management by fuel type. Under that alternative, naval spent nuclear fuel is managed at the NRF at INL. The 1995 Settlement Agreement documents conditions agreed to among the Navy, the DOE, and the state of Idaho on the implementation of that decision.

Item #2:

Section 1.1.3 describes the nature and extent of examinations performed on naval spent nuclear fuel.

Item #3:

With the exception of transportation and dry storage, all of the activities identified in the comment, including the management and disposition of waste, are evaluated in the EIS for both the construction period and the 40 year operational life of the new or refurbished facilities. Transportation and dry storage of naval spent nuclear fuel are outside the scope of this EIS as the nature and scope of those activities are unaffected by the proposed action and there are no factors that would change the conclusions of prior analyses of those activities.

Item #4:

The makeup of the U.S. fleet is outside the scope of the EIS and any description of what the fleet will look like in 40 to 50 years would be speculative. However, given the Navy's current shipbuilding plan, the lifetime of warships (USS ENTERPRISE, the first nuclear-powered aircraft carrier, remained in service for 50 years), and the military capabilities provided by nuclear propulsion, it is reasonable to conclude that nuclear-powered warships will remain a vital element of the U.S. fleet for the foreseeable future.

Item #5:

Per SAA 2008, after January 1, 2035, the U.S. Navy may maintain a volume of naval spent nuclear fuel at INL of not more than 9 metric tons heavy metal (MTHM) for a time-frame reasonably necessary for examination, processing, and queuing for shipment to a geologic repository or interim storage facility outside Idaho.

Currently, the INL has an inventory of approximately 30 MTHM of naval spent nuclear fuel. This naval spent nuclear fuel is in the process of being packaged for dry storage by 2023 in accordance with SA 1995.

By 2035, the NNPP would have an inventory of approximately 66 MTHM of naval spent nuclear fuel on the INL if an interim storage facility or geologic repository is not available. By 2048, this total would be approximately 78 MTHM. The majority of this inventory would be in dry storage awaiting shipment to an interim storage facility or geologic repository.

Although the NNPP has the necessary loading facilities at NRF and transportation casks, the timeframe reasonably necessary for shipment of naval spent nuclear fuel to a repository or storage facility outside of Idaho is dependent on the availability of such facilities. The timing of availability of those facilities is uncertain. At the time of this Draft EIS, the NRC is considering the DOE application to construct a geologic repository at Yucca Mountain. The President's Blue Ribbon Commission on America's Nuclear Future (Commission) evaluated alternatives to the repository at Yucca Mountain. The DOE strategy for implementing the recommendations of the Commission estimated that a pilot interim storage capability could be operational by 2021, a consolidated interim storage facility could be operational by 2025, and an alternate geologic repository could be operational by 2048.

Item #6:

The No Action Alternative, as currently defined in Section 2.1, limits efforts to preventative and corrective maintenance. This level of effort may not keep the infrastructure in safe working order until 2060 (i.e., maintenance alone may not be sufficient to sustain the proper functioning of structures, systems, and components). In addition, this level of effort will not provide the capability to unload M290 shipping containers. Therefore, the No Action Alternative is an unreasonable alternative that does not meet the purpose and need for the proposed action.

Item #7:

As described in Chapter 1, the operations at Idaho are directly linked to the refueling and defueling operations of the nuclear U.S. Navy through the use of shipping containers. Without the proper capacity in Idaho to unload shipping containers and return them to the shipyards at a tempo necessary to support the fleet, the ability to defuel submarines and aircraft carriers would be impacted.

E-Mail Comment #8

From:	Peter Rickards [redacted]
Sent:	Friday, September 03, 2010 9:59 PM
To:	ECF Recapitalization
Cc:	[redacted]
Subject:	Supplement on ATR safety flaws for alternative 2 - Re: Written public comment for Navy EIS for INL...

Official supplement to public comment please...
As I said in my verbal comments at the official hearing in Twin Falls, but forgot to put in writing today, the Navy needs to address all the safety flaws at the old rickety ATR, that is your alternative 2 for where to build your proposed upgrades.

1a To truly analyze the environmental impacts from clustering your work at the Advanced Test Reactor, please include all the FOIA'd safety flaw revelations uncovered by Idaho's Environmental Defense Institute at http://www.environmental-defense-institute.org/ , and Wyoming's Keep Yellowstone Nuclear Free at www.yellowstonenuclearfree.com <http://www.yellowstonenuclearfree.com/>

Here is the url for two of EDI's fine work,(under "Publications" if the link fails,) at EDI Excerpts of DOE Operations Reports Related to the Advanced Test Reactor Revision 11. 8/15/10. pdf <http://www.environmental-defense-institute.org/publications/EDI%20Exerpts%20INL%20Op.Rpts.Rev-11.pdf>
And EDI Comments on Court Released ATR Documents, XXIII, 4-5-10. pdf <http://www.environmental-defense-institute.org/publications/EDI%20Com.FOIA%20Doc.XXIII.pdf>

Sincerely...Peter

On Fri, Sep 3, 2010 at 2:26 PM, Peter Rickards [redacted]

IDAHO FAMILIES FOR THE SAFEST ENERGY

Official scoping issues to supplement my oral presentation in Twin Falls please.
While we admire, appreciate, and love the brave Navy patriots, please answer the following scoping questions in your EIS.

1 1) There are no seaports for nuclear submarines in Idaho. Instead of building new facilities at INL for $2 Billion, please analyze relocating and clustering Navy fuel operations at the DOE's Savannah River facility. This is presently not under consideration in your EIS, which is illegal by NEPA law, ie, an "irretrievable commitment of resources" stacking the deck for future clustering around the $2 Billion spent in Idaho

2 2) Specifically analyze worst case scenario accidents or terrorism, or disgruntled employee sabotage, comparing that fallout spreading from Idaho across the country and cities, vs the fallout at SR's east coast, where that has a chance to blow away from cities out to the ocean.

3 3) Analyze INL vs SR to see that clustering the Navy operations on the east coast will save money and safety risks from transporting the dangerous spent fuel across the country to Idaho.

4 4) Please see the documented science references below. Please analyze inhalation of one lone particle of the spent fuel's pu-238 to see it would exceed the 10 mrem public exposure limit, since the HEPA filters can NOT contain plutonium at the 99.97% bragged about in all EIS's so far. Note the particle size problem from criticalities that the DOE has refused to answer yet in all previous EIS's.

5 5) Please analyze pu-238 inhalation from transportation accidents where a fire lasts 2 hours, and as the DOE documents admit, allowing an unbounded release of the spent fuel. That is why clustering at SR and greatly lessening the transport miles is important to analyze.

http://rpd.oxfordjournals.org/content/83/3/221.abstract

Variability in PuO2 Intake by Inhalation: Implications for Worker Protection at the US Department of Energy

1. B.R. Scott
<http://rpd.oxfordjournals.org/search?author1=B.R.+Scott&sortspec=date&submit=Submit> and
2. A.F. Fencl
<http://rpd.oxfordjournals.org/search?author1=A.F.+Fencl&sortspec=date&submit=Submit>

Abstract

This paper describes the stochastic exposure (SE) paradigm where, at most, small numbers of airborne toxic particles are presented for inhalation. The focus is on alpha-emitting plutonium dioxide (PuO2) particles that may be inhaled by Department of Energy (DOE) workers. Consideration of the SE paradigm is important because intake of only a few highly radioactive PuO2 particles such as 238PuO2, could greatly exceed the annual limit on intake (ALI) used to control worker exposure. For the SE paradigm, credible intake distributions evaluated over the population at risk are needed, rather than unreliable point estimates of intake. Credible distributions of radiation doses and health risks are also needed. Because there are limited data on humans who inhaled PuO2, these distributions must be calculated. Calculated distributions are presented that relate to the intake of radioactivity via inhaling polydisperse PuO2 particles. The results indicate that a large variability in radioactivity intake is expected when relatively small numbers of PuO2 particles are inhaled. For the SE paradigm, one cannot know how many PuO2 particles were inhaled by an individual involved in a given inhalation exposure scenario. Thus, rather than addressing questions such as 'Did the calculated worker's intake of 238PuO2 exceed the ALI?', it is better to address questions such as 'What is the probability that 238PuO2 intake by a given worker occurred and exceeded the ALI?' Mathematical tools for addressing the latter question are presented, and examples of their applications are provided, with emphasis on possible DOE worker exposures at the Rocky Flats facility near Denver, Colorado. The alpha-emitting isotopes 238Pu, 239Pu, 240Pu and 242Pu are found at Rocky Flats. Although 238Pu is thought to be present in relatively small amounts there, intake via inhalation of only a few 238PuO2 particles could greatly exceed the ALI.

* Radiation Protection Dosimetry
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I needed to share some vital information on HEPA filter problems and plutonium transport in water

that effects the true plutonium emissions from the proposed pit facility and the plutonium laced low

level and Transuranic waste generated. I am a podiatrist in Twin Falls , Idaho. As a citizen, and as a

member of the CDC advisory panel on INEEL, I have gathered some vital documents on HEPA filter

problems and Pu transport problems . I hope you will address these issues. The HEPA filter issues

really effects almost all nuclear projects. Please contact me for more details if desired, but here is an

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To get an air quality permit, the project has to show they do not expose the public to more than 10

mrem of radiation from normal operations (and my memory says that there is a 100 mrem limit to

anticipated accidents). The filters are bragged to be 99.97% efficient for 0.3 micron particles, and

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more efficient for both smaller and larger particles. This allows them to calculate a very low rate of

release, qualifying easily for a permit.

Here are the 2 main areas of filter problems, that remain unquantified. I have called for testing the

filters, in lab, for these problems, at all so-called Environmental Impact scoping hearings. To date,

these questions have remained unanswered.

1) Most folks know that the filters can burn, but even if the fire is contained and put out by

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floated for 3 days , bouncing around on the brownian motion of the air molecules! They slowly

aggregated and precipitated, but that was in this closed cell.

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Constans continuo, lentus demissus

Page 4

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criticism is that the experiment only lasted 20 days. The paper , ironically, does site and

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missed the alpha creep because of the short duration of their testing. McDowell left his test up for

one year.

The Yamada test , however, seems to have enough sensitivity to detect alpha creep, at all flows, even

in this limited 20 day experiment. I question their conclusion #1, which dismisses the lower rate of

re-entrainment. They conclude, " Therefore, it was concluded that plutonium particles captured on

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ANY plutonium gained full penetration of this filter, at this low rate. As McDowell notes, a longer

time frame reveals more alpha creep. This 20 day experiment is unrealistic, since no where in the

DOE are HEPA filters changed every 20 days. This low rate, short run, underestimates the true, long

6

term penetration by alpha emitters. I noted Yamada's reference 4, the Fliescher study , that supports

the probable fragmentation of smaller plutonium particles, from the larger original plutonium

particles. This is the Bierman paper's theory , as well.

This clearly calls for Dr Liu's ultrasmall, ultrasensitive "total capture" technique, to capture ALL

sizes of particles, to be done over an extensive period of time, that replicates actual normal use. How

else are we going to determine the true efficiency, of this documented alpha creep problem?

Three important points come to mind.

1)Do the other beta and gamma emitters, that are impacted on the filter, with the alpha emitters,

also leave the filters undetected? Does that not require further testing?

2) Do more radioactive alpha emitters, like the Pu-238, have even higher rates of resuspension? Does

this not call for more testing?

3) Since this Yamada paper confirms alpha creep, why have the DOE downstream monitors not

detect any whispering of this plutonium, through the filters? The CDC swears that the monitoring

proves their is no alpha creep "footprint" on the monitors, declaring their faith in the monitors. I

believe the phrase , "below detectable limits", applies to the downstream monitors, and their inability

to reveal the true exposure to the public, of inhalable alpha emitters.

The second issue is the recent discoveries by DOE revealing plutonium transport in water is much

easier than previously believed. The standard of 100 nanocuries per gram of waste material was

created in 1984. The reason given to justify the change was a calculation that the 100 nano standard

would give an acceptable dose of 500 mrem from animal intrusion and resuspension This definetly

ignores the water pathway. More important, it ignores the total quantity of plutonium which will be

left over the local water, buried as low level waste.

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These decisions are only required to try to calculate radiation doses the public, in a thousand year

time frame, if it is below 100 nano/gram. Unfortunately, as mentioned , the plutonium particles,

which are potentially deadly and cancer causing, if inhaled and embedded in your lungs, remain

radioactive for over 240,00 years.

We have been told for years that plutonium is an actinide, that binds to clay and rocks, immobilizing

the plutonium, protecting the local aquifer. These decisions by the DOE have unfortunately ignored

two recent , contradictory DOE studies, that both show how easily plutonium moves with water.

Understanding these important contradictions is key to protecting local water supply and public

health for centuries to come.

These two separate studies actually reveal a double trouble scenario, because both the soluble forms ,

and the insoluble forms of plutonium can move with water. The A. B. Kersting study , was done at

the Nevada Test Site(1). This study found that insoluble plutonium had migrated 1.3 km (roughly

one mile) bound to clay as a colloid and was suspended and floating in this sluggish aquifer, 30 years

after being introduced to the underground environment. This is a profound, and dangerous

discovery, that should change our nearsightedness about plutonium over our aquifer. These

plutonium colloids ranged in size from greater than one micron, down to 0.007 microns. The DOE

acknowledges that inhalation of plutonium is the most dangerous pathway of human exposure.

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Plutonium colloids in our aquifer would be available for inhalation from the common use of sprinkle

irrigation, and even canal irrigation that later dries, allowing newly surfaced plutonium to be

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resuspended in the wind. The fact that these are insoluble particles of plutonium, means that each

particle contains millions of plutonium atoms. That makes inhalation more dangerous because ,

while the single strike alpha disintegration of a single radon gas atom is dangerous, an embedded

plutonium particle provides a point of perpetual radiation and alpha destruction. The Kersting paper

notes the old thinking of the DOE, siting the McDowell-Boyer paper. They say , "It has been argued

that plutonium introduced into the subsurface environment is relatively immobile owing to its low

solubility in ground water and strong sorption onto rocks." Kersting notes there are two previous

studies of field observations contradicting that premise (2, 3).

I have heard the DOE, CDC, State, and ATSDR verbally dismiss the Kersting study as "due to the

bomb testing." However , Kersting addresses the issue, stating that in the 40 years of bomb testing,

previous testing only found that "radionuclides were detected at a maximum of a few hundred

metres from the original detonation site. "Having isolated the specific isotope ratio of the Benham

bomb test debris, there is no doubt of its origin. The Kersting team concludes , "The possibility that

the Pu from the Benham test site was blasted and deposited greater than 1.3 km away, in two

distinct aquifers separated by 300 m vertically and 30 m horizontally seems highly unlikely." Most

importantly, Kersting concludes," Pu transport models that only take into account sorption and

solubility may therefore underestimate the extent to which this species is able to migrate in ground

water."

The second study I will refer to, is from DOE's Los Alamos lab, by John M. Haschke (4). While

Kersting showed the mobility of insoluble plutonium, Haschke revealed that Pu in our environment

can change oxidation states in the presence of airborne water vapor and become very soluble in

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water, enhancing mobility. This discovery contradicts the present textbooks, according Dr Madic (5) ,

who wrote the accompanying "Perspective" , when the Haschke study was published in Science.

Textbook knowledge had only found PuO_2 in the environment, in oxidation states III and IV. Madic

writes how this must affect how we view everything, from the new plutonium laden MOX nuclear

reactors, to nuclear storage. Madic states," Until now, it was assumed that plutonium would not be

very mobile in the underground geological environment because of the insolubility of Pu(IV)

compounds. But Haschke et al. demonstrate that water can oxidize PuO_2 into PuO_{2+x}, in which more

than 25% of the plutonium can exist as Pu(VI), an ion that is far more soluble, and thus mobile, than

Pu(IV). This new property will have important implications for the long term storage of plutonium."

So when will the DOE apply this information to protect our water and our health ? We need above

ground, inspectable and retrievable storage for the billions of plutonium particles dumped over our

water. To ignore these studies is inexcusable.

There is one more paper I will quote, from Dr Runde. I went to the Wolfgang Runde article called

"The Chemical Interaction of Plutonium in the Environment." It is from a Los Alamos conference on

plutonium transport. That can be referenced at

http://lib-www.lanl.gov/pubs/number26.htm Runde

acknowledges the colloid transport was fast, and concludes, "What is clear is that transport models to

date have underestimated the extent of colloidal transport on plutonium mobility." Let me put his

conclusion in context, and quote Dr Runde to a fuller extent. Dr Runde, on page 408 (or 17 of 20 on

the computer download) says, " We are also trying to better understand the sorption/desorption

reactions of actinides with colloids and the actinides' resulting transport characteristics. This area of

10

environmental migration received attention with the discovery of plutonium in a borehole at the

Nevada Test Site (Kersting et al. 1999). The plutonium had evidently migrated 1.3 kilometers in only

30 years." Runde continues," As discussed in the article by Maureen McGraw, we now believe that

colloid transport was responsible for this remarkably fast movement of plutonium through the water

saturated rock. It is not clear, however, whether the transport was facilitated by intrinsic plutonium

colloids or natural (clay or zeolite) colloids. What is clear is that transport models to date have

underestimated the extent of colloidal transport on plutonium mobility."

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The only reference to the uniqueness of bomb testing is the initial time it takes to reach plutonium

exposure to water. Runde notes that the underground explosion allowed the plutonium to be left in

water, while a waste repository would differ, because the "radionuclides would be isolated, at least

initially, from the hydrogeologic environment.".(p490) Runde also mentions a new concern for Pu

migration, and that is microbes acting as " mobile colloids. " While they may act as a barrier, they

may aid transport. Runde says, "As such, they act as mobile or even self propelled colloids. (p 409,

18/20). That is another reason we should simply re-barrel the plutonium waste, instead of shallow

burial. Runde concludes, " More sophisticated models are needed to account for all the potential

migration paths away from an actinide source. Theoretical and experimental scientists will be

challenged for years by demands of developing these models.(p 410, 19/20)

Gee , I look forward to when they finish the job.

Sincerely,

11

Dr Peter Rickards DPM

[redacted]

1)A.B. Kersting et al. , Lawrence Livermore National Laboratory, Nature, vol 397 Jan 7, 1999, p56-59.

2)McDowell-Boyer , Environmental Science Technol. , 26 , 586-595 (1992)

3)Ryan et al, Physiochem. Eng. Aspects, 107 , 1-56 (1996)

4)JM Haschke et al. ,Science 287, Jan 14 2000

5)C Madic, Science 287 , Jan14, 2000

Response to E-Mail Comment #8

Item #1a:

This comment relates to potential options for recapitalization of the examination infrastructure at ECF. As noted in the amended NOI published on May 10, 2012 in 77 Fed. Reg. 27448, that action has been deferred and is no longer in the scope of this EIS.

Items #1-5:

The remainder of this comment duplicates E-Mail Comment #5. Please refer to the responses to E-Mail Comment #5.

E-Mail Comment #9

From: Kit Deslauriers [redacted]
Sent: Monday, September 06, 2010 8:28 PM
To: Peter Rickards; ECF Recapitalization
Cc: [redacted]
Subject: Re: Written public comment for Navy EIS for INL...

Same for this one, although this is available in the thread that I just forwarded to you.
Kit

On 9/3/10 2:26 PM, "Peter Rickards" [redacted] wrote:

IDAHO FAMILIES FOR THE SAFEST ENERGY

Official scoping issues to supplement my oral presentation in Twin Falls please.
While we admire, appreciate, and love the brave Navy patriots, please answer the following scoping questions in your EIS.

1 1) There are no seaports for nuclear submarines in Idaho. Instead of building new facilities at INL for $2 Billion, please analyze relocating and clustering Navy fuel operations at the DOE's Savannah River facility. This is presently not under consideration in your EIS, which is illegal by NEPA law, ie, an "irretrievable commitment of resources" stacking the deck for future clustering around the $2 Billion spent in Idaho

2 2) Specifically analyze worst case scenario accidents or terrorism, or disgruntled employee sabotage, comparing that fallout spreading from Idaho across the country and cities, vs the fallout at SR's east coast, where that has a chance to blow away from cities out to the ocean.

3 3) Analyze INL vs SR to see that clustering the Navy operations on the east coast will save money and safety risks from transporting the dangerous spent fuel across the country to Idaho.

4 4) Please see the documented science references below. Please analyze inhalation of one lone particle of the spent fuel's pu-238 to see it would exceed the 10 mrem public exposure limit, since the HEPA filters can NOT contain plutonium at the 99.97% bragged about in all EIS's so far. Note the particle size problem from criticalities that the DOE has refused to answer yet in all previous EIS's.

5 5) Please analyze pu-238 inhalation from transportation accidents where a fire lasts 2 hours, and as the DOE documents admit, allowing an unbounded release of the spent fuel. That is why clustering at SR and greatly lessening the transport miles is important to analyze.

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http://rpd.oxfordjournals.org/content/83/3/221.abstract

Variability in PuO2 Intake by Inhalation: Implications for Worker Protection at the US Department of Energy

1. B.R. Scott <http://rpd.oxfordjournals.org/search?author1=B.R.+Scott&sortspec=date&submit=Submit> and
2. A.F. Fencl <http://rpd.oxfordjournals.org/search?author1=A.F.+Fencl&sortspec=date&submit=Submit>

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ANY plutonium gained full penetration of this filter, at this low rate. As McDowell notes, a longer

time frame reveals more alpha creep. This 20 day experiment is unrealistic, since no where in the

DOE are HEPA filters changed every 20 days. This low rate, short run, underestimates the true, long

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term penetration by alpha emitters. I noted Yamada's reference 4, the Fliescher study , that supports

the probable fragmentation of smaller plutonium particles, from the larger original plutonium

particles. This is the Bierman paper's theory , as well.

This clearly calls for Dr Liu's ultrasmall, ultrasensitive "total capture" technique, to capture ALL

sizes of particles, to be done over an extensive period of time, that replicates actual normal use. How

else are we going to determine the true efficiency, of this documented alpha creep problem?

Three important points come to mind.

1)Do the other beta and gamma emitters, that are impacted on the filter, with the alpha emitters,

also leave the filters undetected? Does that not require further testing?

2) Do more radioactive alpha emitters, like the Pu-238, have even higher rates of resuspension? Does

this not call for more testing?

3) Since this Yamada paper confirms alpha creep, why have the DOE downstream monitors not

detect any whispering of this plutonium, through the filters? The CDC swears that the monitoring

proves their is no alpha creep "footprint" on the monitors, declaring their faith in the monitors. I

believe the phrase , "below detectable limits", applies to the downstream monitors, and their inability

to reveal the true exposure to the public, of inhalable alpha emitters.

The second issue is the recent discoveries by DOE revealing plutonium transport in water is much

easier than previously believed. The standard of 100 nanocuries per gram of waste material was

created in 1984. The reason given to justify the change was a calculation that the 100 nano standard

would give an acceptable dose of 500 mrem from animal intrusion and resuspension This definetly

ignores the water pathway. More important, it ignores the total quantity of plutonium which will be

left over the local water, buried as low level waste.

7

These decisions are only required to try to calculate radiation doses the public, in a thousand year

time frame, if it is below 100 nano/gram. Unfortunately, as mentioned , the plutonium particles,

which are potentially deadly and cancer causing, if inhaled and embedded in your lungs, remain

radioactive for over 240,00 years.

We have been told for years that plutonium is an actinide, that binds to clay and rocks, immobilizing

the plutonium, protecting the local aquifer. These decisions by the DOE have unfortunately ignored

two recent , contradictory DOE studies, that both show how easily plutonium moves with water.

Understanding these important contradictions is key to protecting local water supply and public

health for centuries to come.

These two separate studies actually reveal a double trouble scenario, because both the soluble forms ,

and the insoluble forms of plutonium can move with water. The A. B. Kersting study , was done at

the Nevada Test Site(1). This study found that insoluble plutonium had migrated 1.3 km (roughly

one mile) bound to clay as a colloid and was suspended and floating in this sluggish aquifer, 30 years

after being introduced to the underground environment. This is a profound, and dangerous

discovery, that should change our nearsightedness about plutonium over our aquifer. These

plutonium colloids ranged in size from greater than one micron, down to 0.007 microns. The DOE

acknowledges that inhalation of plutonium is the most dangerous pathway of human exposure.

Constans continuo, lentus demissus

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Plutonium colloids in our aquifer would be available for inhalation from the common use of sprinkle

irrigation, and even canal irrigation that later dries, allowing newly surfaced plutonium to be

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resuspended in the wind. The fact that these are insoluble particles of plutonium, means that each

particle contains millions of plutonium atoms. That makes inhalation more dangerous because ,

while the single strike alpha disintegration of a single radon gas atom is dangerous, an embedded

plutonium particle provides a point of perpetual radiation and alpha destruction. The Kersting paper

notes the old thinking of the DOE, siting the McDowell-Boyer paper. They say , "it has been argued

that plutonium introduced into the subsurface environment is relatively immobile owing to its low

solubility in ground water and strong sorption onto rocks." Kersting notes there are two previous

studies of field observations contradicting that premise (2, 3).

I have heard the DOE, CDC, State, and ATSDR verbally dismiss the Kersting study as "due to the

bomb testing." However , Kersting addresses the issue, stating that in the 40 years of bomb testing,

previous testing only found that "radionuclides were detected at a maximum of a few hundred

metres from the original detonation site. "Having isolated the specific isotope ratio of the Benham

bomb test debris, there is no doubt of its origin. The Kersting team concludes , "The possibility that

the Pu from the Benham test site was blasted and deposited greater than 1.3 km away, in two

distinct aquifers separated by 300 m vertically and 30 m horizontally seems highly unlikely." Most

importantly, Kersting concludes," Pu transport models that only take into account sorption and

solubility may therefore underestimate the extent to which this species is able to migrate in ground

water."

The second study I will refer to, is from DOE's Los Alamos lab, by John M. Haschke (4). While

Kersting showed the mobility of insoluble plutonium, Haschke revealed that Pu in our environment

can change oxidation states in the presence of airborne water vapor and become very soluble in

9

water, enhancing mobility. This discovery contradicts the present textbooks, according Dr Madic (5) ,

who wrote the accompanying "Perspective" , when the Haschke study was published in Science.

Textbook knowledge had only found PuO2 in the environment, in oxidation states III and IV. Madic

writes how this must affect how we view everything, from the new plutonium laden MOX nuclear

reactors, to nuclear storage. Madic states," Until now, it was assumed that plutonium would not be

very mobile in the underground geological environment because of the insolubility of Pu(IV)

compounds. But Haschke et al. demonstrate that water can oxidize PuO2 into PuO2+x, in which more

than 25% of the plutonium can exist as Pu(VI), an ion that is far more soluble, and thus mobile, than

Pu(IV). This new property will have important implications for the long term storage of plutonium."

So when will the DOE apply this information to protect our water and our health ? We need above

ground, inspectable and retrievable storage for the billions of plutonium particles dumped over our

water. To ignore these studies is inexcusable.

There is one more paper I will quote, from Dr Runde. I went to the Wolfgang Runde article called

"The Chemical Interaction of Plutonium in the Environment." It is from a Los Alamos conference on

plutonium transport. That can be referenced at

http://lib-www.lanl.gov/pubs/number26.htm Runde

acknowledges the colloid transport was fast, and concludes, "What is clear is that transport models to

date have underestimated the extent of colloidal transport on plutonium mobility." Let me put his

conclusion in context, and quote Dr Runde to a fuller extent. Dr Runde, on page 408 (or 17 of 20 on

the computer download) says, " We are also trying to better understand the sorption/desorption

reactions of actinides with colloids and the actinides' resulting transport characteristics. This area of

10

environmental migration received attention with the discovery of plutonium in a borehole at the

Nevada Test Site (Kersting et al. 1999). The plutonium had evidently migrated 1.3 kilometers in only

30 years." Runde continues," As discussed in the article by Maureen McGraw, we now believe that

colloid transport was responsible for this remarkably fast movement of plutonium through the water

saturated rock. It is not clear, however, whether the transport was facilitated by intrinsic plutonium

colloids or natural (clay or zeolite) colloids. What is clear is that transport models to date have

underestimated the extent of colloidal transport on plutonium mobility."

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The only reference to the uniqueness of bomb testing is the initial time it takes to reach plutonium

exposure to water. Runde notes that the underground explosion allowed the plutonium to be left in

water, while a waste repository would differ, because the "radionuclides would be isolated, at least

initially, from the hydrogeologic environment.".(p490) Runde also mentions a new concern for Pu

migration, and that is microbes acting as " mobile colloids. " While they may act as a barrier, they

may aid transport. Runde says, "As such, they act as mobile or even self propelled colloids. (p 409,

18/20). That is another reason we should simply re-barrel the plutonium waste, instead of shallow

burial. Runde concludes, " More sophisticated models are needed to account for all the potential

migration paths away from an actinide source. Theoretical and experimental scientists will be

challenged for years by demands of developing these models.(p 410, 19/20)

Gee , I look forward to when they finish the job.

Sincerely,

11

Dr Peter Rickards DPM

[redacted]

1)A.B. Kersting et al. , Lawrence Livermore National Laboratory, Nature, vol 397 Jan 7, 1999, p56-59.

2)McDowell-Boyer , Environmental Science Technol. , 26 , 586-595 (1992)

3)Ryan et al, Physiochem. Eng. Aspects, 107 , 1-56 (1996)

4)JM Haschke et al. ,Science 287, Jan 14 2000

5)C Madic, Science 287 , Jan14, 2000

Response to E-Mail Comment #9

Items #1-5:

This comment duplicates E-Mail Comment #5. Please refer to the responses to E-Mail Comment #5.

E-Mail Comment #10

From: Chuck Broscious
Sent: Wednesday, September 08, 2010 6:25 AM
To: ECF Recapitalization
Subject: EIS

Please send me a copy of this EIS to:
Chuck Broscious
[redacted]

Response to E-Mail Comment #10

The commenter has been included on the distribution list for the Draft and Final EIS.

Pocatello Meeting Comment #1

MS. BRAILSFORD: Thank you.

My name is Beatrice Brailsford. I'm with the Snake River Alliance.

The Alliance will be submitting written comments, scoping comments by September 3rd, right? Okay.

But I did want to take this opportunity to thank you for having a public meeting in Pocatello. This, I think, has been a very good meeting, and we do appreciate this particular meeting. Thank you.

Response to Pocatello Meeting Comment #1

The commenter's interest in the proposed action is noted. E-Mail Comment #7 contains the written comments provided by the Snake River Alliance.

Pocatello Meeting Comment #2

MR. TURNER: Hello. I'm Roger Turner. I live in Pocatello. Thank you for the opportunity to comment today on this proposal.

I particularly want to thank -- thank you for including the issues on the -- in the scoping for potential impacts of emissions on air, and water quality, on plants, animals, their habitats, including species as -- as listed in your documents; that you indicate that you can -- that you take a close and hard look at the potential impacts from accidents and the potential impacts of terrorism or sabotage; the potential effects of the public health from exposure to hazardous -- hazardous and radiological releases; and potential safety of impacts to workers; as well as cultural resources and the compliance with applicable regulations. I appreciate you including that.

One of the things that I wanted to take a look at is -- just a second here.

Oh. I hope that the -- the draft EIS

1 and scoping take a close look at the details of the need for this project. I think that one of the things that's been raised by the -- by this project is that there's several complex substructures for this process and infrastructure that includes the examination of spent nuclear fuel and irradiated materials.

2 And this includes the preparation of irradiated materials; the receipt and unloading of spent nuclear fuel; the examination of those fuels using visual, microscopic, metallurgical techniques in the preparation of small fuel and non-fuel test samples for insertion into test reactors where they -- they are irradiated.

It would require, you know, the structure for -- for removing spent fuel from the -- from the Naval shipments. And then placing them either in dry storage or the examination area. And then it would also require the transport and removal from the examination area into the dry storage area.

And so I guess it would be my suggestion that you include a level of detail for each of those particular substructures so that the public can examine the need for this -- this large proposal.

One of the issues that concerns me is
that although is -- with respect to that also is
the alternatives. Some of the reasons that were
listed -- that were listed for the alternatives
include the no-action alternative, which is just
3 to overhaul all of those substructures that I
just listed. The concern I have is that this in
itself sounds so complex as to require an EIS in
itself if you are going to overhaul such a
complex facility.

In order to alleviate the concern about
that, I suggest that scoping include a level of
detail about the -- the -- what would need to be
overhauled and the status of their condition;
4 what's already recently been overhauled and what
hasn't; perhaps a schedule of the past
overhauling of those facilities and their -- an
exist -- a close examination of -- of the
existing facilities.

The other item that I suggest that you
include in this is, there's a very limited amount
in this draft EIS that addresses waste. Although
5 the posters here were very good about -- and your
presentation was excellent about the -- that

agreement and the need for removal of waste, I think additional examination of waste handling would be an important addition to this. And that

6 would include, you know, what -- what improvements, if any, have been made in the technology of pool storage and the chemistry of it.

And the -- and there has been -- the reason for that is there have been some historical problems with respect to corrosion of wet storage in the past. And also, the -- I

7 believe that the EIS should include an examination of dry storage technologies.

And so in summary, I think there needs to be a closer look at waste handling and waste storage and accumulative effects of those.

I think that's all I have today. Thank you.

Response to Pocatello Meeting Comment #2

Responses to Roger Turner's comments follow:

Item #1:

The purpose and need for the proposed action are provided in Section 1.3.

Item #2:

A detailed description of the naval spent nuclear fuel handling process is provided in Chapter 1. Chapter 1 also includes a discussion of those items that are in and out of scope for this evaluation.

Item #3:

The No Action Alternative, as currently defined in Section 2.1, limits efforts to preventative and corrective maintenance. This level of effort may not keep the infrastructure in safe working order until 2060 (i.e., maintenance alone may not be sufficient to sustain the proper functioning of structures, systems, and components). In addition, this level of effort will not provide the capability to unload M-290 shipping containers. Therefore, the No Action Alternative is an unreasonable alternative that does not meet the purpose and need for the proposed action.

Item #4:

Chapter 1 describes ECF and the related facilities at NRF used for management of naval spent nuclear fuel. The only facility that would be overhauled by the proposed action is ECF. The nature and scope of the overhaul alternative is described in Chapter 2.

Item #5:

Waste management is discussed in Section 3.14. Impacts from waste management are presented in Section 4.14. Cumulative impacts from waste management are covered in Section 5.2.10.

Item #6:

Modern water pools have liners. Information about water pool leaks from commercial spent nuclear fuel pools is provided in Appendix F, Section F.5.4.12. As described in Chapter 2, the water pool for both the New Facility and Overhaul Alternatives would have a water-tight barrier between the water in the pool and the concrete walls of the water pool. In addition, a groundwater monitoring system would actively monitor the site for leaks. It is expected that the combination of the water pool liner, concrete walls, and groundwater monitoring would prevent water pool water from leaking, undetected, into the environment. Further, the integrity of the water pool liner and structure would be ensured by maintaining a low-corrosive environment in the water pool water through proper water chemistry control.

Item #7:

The NNPP continues to temporarily store naval spent nuclear fuel in a dry configuration awaiting shipment to an interim storage facility or geologic repository. As identified in Section 1.5.3, dry storage technologies were evaluated in DOE 1996. The NNPP is not changing its dry storage method from that described in DOE 1996. An examination of dry storage technologies is outside of the scope of this EIS.

Pocatello Meeting Comment #3

MR. DOWNS: Yeah, I'm Bill Downs. I'm familiar with that with the Toastmasters.

I -- I think it's interesting, and I think Mr. Turner brought up some things that are a good point in that --

Well, okay. I'll give you a history of me. I spent 18 years at the Advanced Test Reactor, so I handled a lot of fuel. I was a reactor operator. And so I know that that can be done safely. Okay. I'm still standing, and I don't have a third arm or anything like that.

I live 20 -- 25 miles away from the Advanced Test Reactor. I live just south of the East Butte out of -- out there on the desert west of Blackfoot. If I was scared of that place, I wouldn't live there. But I live around there, and I've lived there for close to 30 years.

I was involved in a reduction in force in 2003. We banded together and formed a group where we all helped each other in an attempt to find jobs. And the one thing that we found really fascinating was that people, I'm going to call it in town, in Idaho Falls, mostly, is where

1 we live, did not know what's going on out there on the desert. And some of those people have been here all their life, since before INL was out there.

And I thought that was -- we were flabbergasted because when we are explaining what our qualities were, they had no idea how that applied to anything in town. You know, they -- they -- really they kind of looked at us kind of strange.

So -- and when he asks for more information, I think that should be applied. There should be some kind of a program -- I know at -- at HER, we would have even high school groups come and tour the place. Okay. Now, some of that is, you know, beyond, you know, economic reason or whatever. But people in town need to know what's going on out there so they can realize that there's an opportunity for Southeast Idaho.

The technology out there, the knowledge, and the opportunity for expansion, I think are -- are unlimited if people knew so that they could promote that. I know that the Snake River Alliance is here. They are probably more knowledgeable than the average person. But even if they knew -- you know, people like me, there's a couple other guys I've met here that work out there, we have no desire to get hurt. Okay.

And we're Idahoans. We love this land. I was talking with your HR rep. I'm over 50 so, you know, the first thing to go is your memory, but he introduced himself. And he acknowledged that the people that stay out there probably lived here before. They love Idaho. The people that come from outside learn to love Idaho and stay here.

A lot of national -- other national companies have attempted to close down their offices here in Pocatello, Idaho Falls. But then all of a sudden they realize, you know, we can't find anyplace else in the nation that gets the work done. The work ethic here is phenomenal. Okay. So we've got a lot of pluses.

And we as a people need to promote INL. All right. The safety there is incredible. If we applied the safety rules here in town that we had to live up to out there, that you guys have to live up to, people would just be -- well, they'd wonder how they ever lived, you know, from one day to the next.

2 The other thing why I think this would be an opportunity is, we have values here in Idaho. We -- everybody in this crowd probably has very similar values. When the Navy had the school out there, those values got implanted into

those sailors. Which, you know, I was there in the fleet for a while, a short while, but those values add to the fleet. Okay.

If we can bring anything in here, it gets recognized nationally. Our values get implanted to other people. Almost -- almost, I could say, on a national extent.

So we as a people, the few of us that are here ought to be talking about what went on here to our neighbors so that our neighbors are interested in the next time something comes up. Because we would like -- well, we don't want everybody to show up here, you know, from other parts.

But what if our values spread to other parts of the nation? Okay. We'd probably all get along a little bit better. And I think you're probably looking at me like, okay, he's really idealistic or whatever. But I know it's the truth. Okay. I saw it in the fleet. I saw what the potentials of non-values are. And I saw that those values did get spread. The work ethic here is phenomenal.

I mean, Mr. Turner, you look like a farmer or a rancher. That work ethic gets applied to the site. Most of our mechanics were farmers or ranchers that -- well, their sons. Their son says, I don't want to work on the farm anymore, so they've gone out there, and they straightened out the engineers on what would work.

And I'm not kidding you, you know. An engineer has got an incredible amount of knowledge, and he wants to apply a new idea. A farmer, you know, has busted his knuckles on their equipment, he says, nah. So the two of them come together, and the INL is a place that nobody can really close down. Because I know that there's been attempts to do that. The work ethic keeps it alive.

We've got a great thing out there. We want to keep our sons and daughters here. I know I'm going to the Idaho State University right now. And you talk with the young ones. Well, when you get your degree, what are you going to do? Well, I'm going to have to leave town because the jobs aren't here.

We need to promote ourselves to keep our young ones here, to keep our values here, to make this place grow. This is not an ideal retirement community. If everybody young leaves, those of us that are older are going to have to work to keep this place alive or there's not going to be anybody to support us because all the young ones left.

And some people may think that sounds far fetched. But no, half of my kids moved out of town because there's nothing here for them and the lifestyle. I can talk with just about anybody else, you know, that's got the same color of hair as me. They -- their kids are not sticking around.

INL has national and yeah. Even Washington knows where INL is. We can say something about ourselves. We can keep this place alive, we can make it grow. We can -- we need to get people to live in town who know what the work ethic is out there.

So when Mr. Turner was talking about -- you had pictures of people that probably look like his neighbor. And he can identify with that. Your neighbors are working out there, and they're doing it safely.

My light is flashing, so I'll quit. Thank you.

Response to Pocatello Meeting Comment #3

Item #1:

This document provides a significant amount of unclassified information related to the operations of the NNPP at NRF. In addition, this document cites a large number of publically available references which provide information about the INL.

Item #2:

Section 4.10 describes the economic impacts of the proposed action including potential job growth.

Twin Falls Meeting Comment #1

DR. RICKARDS: No trouble. And I would like to extend my appreciation for you coming to Twin Falls. And also all of the folks in -- in the Armed Forces, we are all indebted to you for your services and your sacrifices.

So basically, though, on the Environmental Impact Statement -- and I should say, I'm Peter Rickards, a local podiatrist, spokesman for Idaho Families For The Safest Energy.

And basically I will -- am going to e-mail by technical comments in, and I'm just going to verbalize them here. I've had a good time talking with your staff and mentioning some of the technical scoping questions that I'm asking. And I also related to them that none of this technical scoping questions would be answered. In my 22 years of doing this, not one has been answered.

And basically, you are stating that you're in compliance with the '95 settlement
1 agreement. And that appears to have limited your focus on the request that -- from our politicians that wrote that agreement that you keep the Naval facility here.

But the NEPA law is a great law signed by Richard Nixon in 1970. And you really are by law obligated to review all of the options available to you. And you are mandated to review all of the environmental impacts.

And I'll remind you also, because you want to focus through the 1995 settlement
2 agreement, if you look at Section J(4) of that settlement agreement, if you analyze in this one whether you should cluster the nuclear Navy in Savannah River, South Carolina versus Idaho, and -- and basically redo all of the environmental impacts of the transportation of that fuel, basically there are no ports in Idaho.

In South Carolina, you're right on the ocean where they -- then they can pull up in Charleston and possibly even modify Savannah River to do that. But you have to take all that fuel and transport it across the country to Idaho. I have talked to the engineers who designed the true cast and the new cast and -- and the vulnerabilities of a fire that goes for two hours, basically, will get an unbounded release of all the fuel in there.

They have the testing for those casts, the fire is put out in 30 minutes. That's literally because the documentation shows that at two hours, you do have up to an 1,800 degree fire such as the one in the Baltimore Tunnel and -- and several other fires that can take -- can -- can happen just by who runs into you.

3

You-all could be the safest drivers transporting this. But the waste trucks, the situations you run into can't be controlled, and there are scenarios just even coming in from the West Coast when you go over the Snake River near Glenns Ferry. I've talked to those engineers, you know, they do a 30-foot drop test onto a spike.

But if you drop those off of the bridge onto the jagged rocks of the Snake River Canyon, you drop a lot more than 30 feet. And the rip and roll action can spew that cast wide open. Fires can do it.

And basically, Section J(4) of the Idaho Settlement Agreement says that any Environmental Impact Statement that makes any inclusion different than what we've settled on is -- is okay to enforce. And that Idaho has to agree with that. And if they disagree with it, the DOE can take them to court.

So basically, if you truthfully look at

the environmental impacts of a worst case
accident -- worst case accident scenario, you're
a disgruntled employee disrupting the facility
4 from your lover's triangle or for whatever
reason, if you look at a terrorist strike, if you
look at any kind of accident that the
environmental impacts from the fallout in Idaho
will float across Salt Lake City, Chicago, the
whole country.

And if you do that in Savannah River,
the chances of that blowing out into the ocean
and -- and avoiding the human exposure, at least
5 in the intense degree that it would for a huge
population downwind of Idaho, you must conclude
that the Environmental Impact Statement would be
safer in Savannah River than in Idaho.

And if you draw that conclusion, Idaho can't object. You -- just because they've put in writing that we want to be the Naval facility, they actually have to agree with it. They actually put Section J(4) in because they want all the nuclear projects here. But it also can be used against them to take them out of the state as well.

I think you're actually going to see

since Yucca Mountain is closed, that an Environmental Impact Statement will come to the conclusion it's best to leave it in Idaho, and we're going to be stuck with it, and we've already agreed to do that.

But I'm going to ask just technical questions on the HEPA filters that are used in these facilities. I'm going to get to that in a second.

But really on the basic level alternative to the clusters, the examination at the ATR, and your use of the ATR, I beg you to look at the documentation at www.yellowstonenuclearfree.com or the Idaho based
6 Environmental Defense Institute.

They basically have exposed the ATR for what it is. It is not a national jewel. It is a rickety old building that is hanging by a shoestring. And it has a tin roof for containment. And a worst case accident scenario presently, without your presence there and your spent fuel there, can release millions of curies of radioactive. And that's right out of their documents. They're presently now trying to patch it up.

6

I was actually the first one in on this when they had the plutonium-238 scoping hearings for clustering plutonium-238 production at the ATR. And I got an anonymous tip from a worker. Please check into things. You know, they're all telling you this is safe and the crown jewel of our facility, but some crap happened about a month ago.

So I put in my Freedom of Information Act on the occurrence reports for the previous year, and low and behold, a month before these hearings where they guaranteed us that it was safest, best facility ever, three workers found bolts on the floor. And when they tried to figure out where the bolts at the ATR, what -- what are these bolts doing on the floor? They actually found that they fell out of the earthquake support beams.

You've got to think about that, you know, you're counting on those beams to hold the facility up to prevent a million curie -- a multimillion curie release. And they fell out of a stationary building. And you haven't even started shaking them yet. And that is the tip of the iceberg.

6 They have computer panels and safety stuff hanging by a thread, the facility is old, part of the pipes are uninspectable. It's ridiculous.

And what I think you're doing here is actually illegal, like I said in the beginning. 7 They have illegally retooled the INL with infrastructure to attempt to cluster all of the nuclear dirty work here. So that when you come along with your impact statement and you go, oh, look at the great infrastructure at INL. This is perfect. We can built right around that. And that's illegal. They -- they didn't scope the impact statements for that. They haven't looked at the big picture, and you are not allowed to piecemeal your way in. They're not allowed to spend that money on making us the spent fuel place. And -- and not -- and then use that as a basis for clustering things around here.

So those are some of the scoping hearings. 8 On the technical stuff on the HEPA filters and the plutonium-238, which was a minority isotope on your spent fuel. But I'm going to give you Dr. Bob Scott's paper peer reviewed for radiation dosimetry and an official

cabinet of science member, and he's actually a
very pronuclear, hormesis believer.

And I've talked to Dr. Scott
personally. He did a worker analysis for
plutonium-238 inhalation at Rocky Flats for DOE
workers. And by far, that's a plutonium-239
facility. Plutonium-238 is 275 times more
radioactive and more destructive in your lung
because of the short half-life.

And even though it's a minority
isotope, I think it's much less than 1 percent of
the inventory there, what he says in the paper is
8 real clear. Any time a worker inhales any
plutonium, some it's going to be 238. And that
dose, even with three particles inhaled will
exceed the 5,000 millirem dose of the worker. So
you take him off that here. Literally that means
that these microscopic particles -- I'm getting
the yellow light, so I'll slow it down or wrap it
up.

But basically the fact of the matter
is, you're only legally allowed to give
10 millirems to the public. All the scoping
hearings to date, like at the plutonium-238
facility where it's concentrated said the worst

case accident scenario, the HEPA filters will work great to .1 times ten to the minus 9th millirem exposure is the maximum exposure. I mean, it's a boldfaced lie. They're -- they're using tricks like population of person rem doses
8 versus what is one particle of plutonium-238 that dose inside of one citizen's lung when it comes out of the HEPA filters.

And the HEPA filters cannot contain plutonium. The alpha emitter knocks itself out of the filters, according to DOE documents from way back to 1970, it goes back into the air and creeps through floor filters in a room.

So those are some of the things. I appreciate you coming to Twin. And I'm looking forward to losing my bet and seeing all of my impact statements answered for the first time in 22 years.

Response to Twin Falls Meeting Comment #1

As stated above, Dr. Rickards provided additional comments via e-mail. Responses to those comments are provided in this Appendix under E-Mail Comments #5 and #8.

Item #1:

As noted in Section 1.5.3, alternatives for management of spent nuclear fuel managed by the DOE, including naval spent nuclear fuel, were comprehensively evaluated in DOE 1995. Based on that evaluation, ROD 1995 chose to implement regionalized spent fuel management by fuel type. Under that alternative, naval spent nuclear fuel is managed at the NRF at INL. There are no factors that warrant reconsideration of that decision.

Item #2:

As noted in Section 1.5.3, alternatives for management of spent nuclear fuel managed by the DOE, including naval spent nuclear fuel, were comprehensively evaluated in DOE 1995. The consequences of accidental releases were considered in that evaluation; it was found that the consequences of centralizing spent fuel management at SRS were higher than the consequences of centralizing spent fuel management at INL. Based on the evaluation in DOE 1995, ROD 1995 chose to implement regionalized spent fuel management by fuel type. Under that alternative, naval spent nuclear fuel is managed at the NRF at INL. There are no factors that warrant reconsideration of that decision.

Item #3:

As noted in Section 1.5.3, alternatives for management of spent nuclear fuel managed by the DOE, including naval spent nuclear fuel, were comprehensively evaluated in DOE 1995. Transportation- related impacts were considered in that evaluation. Based on that evaluation, ROD 1995 chose to implement regionalized spent fuel management by fuel type. Under that alternative, naval spent nuclear fuel is managed at the NRF at INL. There are no factors that warrant reconsideration of that decision.

Item #4:

Hypothetical accident scenarios, including intentionally destructive acts, are considered in Section 4.13 and Appendix F. The footprint of the release and extent of environmental impact are described in Appendix F.

Item #5:

Refer to the response to Item #2.

Item #6:

This comment relates to potential options for recapitalization of the examination infrastructure at ECF. As noted in the amended NOI published on May 10, 2012 in 77 Fed. Reg. 27448, that action has been deferred and is no longer in the scope of this EIS.

Item #7:

As noted in Section 1.5.3, alternatives for management of spent nuclear fuel managed by the DOE, including naval spent nuclear fuel, were comprehensively evaluated in DOE 1995. Transportation- related impacts were considered in that evaluation. Based on that evaluation, ROD 1995 chose to implement regionalized spent fuel management by fuel type. Under that alternative, naval spent nuclear fuel is managed at the NRF at INL. There are no factors that warrant reconsideration of that decision.

Item #8:

Inhalation of Plutonium

The B.R. Scott article (Scott & Fencl 1999) identified by the commenter models the amount of plutonium intake by workers in an environment where there are few particles available for inhalation - a condition in which the authors consider a statistical (i.e., stochastic) approach for estimating intake is more appropriate than a deterministic approach. The model uses an assumed distribution of particle sizes which are available for inhalation. The range in assumed particle sizes leads to large variability in calculated radioactivity intake when few particles are inhaled. Since inhalation occurs in discrete particles that have a log normal distribution, most workers will inhale smaller particles while a few workers may inhale large particles. Of those particles inhaled, only a portion would be deposited in a section of the respiratory tract that contributes to an internal dose. The authors correctly note that in addition to the variability in intake, there is uncertainty on where particles deposit in the respiratory tract. Since the location of deposition significantly affects the dose received from the particle, the authors do not attempt to estimate the doses associated with the intake and subsequent deposition. The authors do not conclude in the paper that inhalation of a single particle of ^{238}Pu would exceed the 10 millirem public exposure limit established in 40 C.F.R. § 61.102. However, if a large enough particle were to be deposited in the lungs, an individual's exposure could exceed 10 millirem.

Section F.3 of the EIS discusses the generally accepted models and assumptions used for estimation of risk posed to workers and the public from releases of radioactivity during routine naval spent nuclear fuel handling operations and hypothetical accident scenarios. The generally accepted model for particle dispersion used in the EIS is the Gaussian model for a plume which is one of the most common modeling methods. For example, the Gaussian model is used by both the DOE (DOE 2004c) and Nuclear Regulatory Commission (NRC 2011). In addition, the latest guidance for converting radioactivity inhaled to dose received was used in the EIS analysis (ICRP 1995). This includes the use of dose conversion factors for appropriate particle sizes for environmental release as recommended by the ICRP (ICRP 1993).

Additionally, the larger particles discussed in the article "associated with the upper tail of the intake distribution do not necessarily reflect a higher health risk as many of the high intake events are associated with deposition of large particles in the nose, which is a radioresistant site." Therefore, if a member of the public were to inhale a large particle, the particle would be unlikely to be deposited in the lungs. The article is also specific to exposure to workers. As discussed in the article, the particle size and radioactivity distribution are likely to be very different for an accident resulting in public exposure.

HEPA Filtration

For routine naval spent nuclear fuel handling operations, the impacts reported are based on actual emissions scaled to future operations. For hypothetical accident scenarios involving an intact facility structure with HEPA filters, this EIS models HEPA filters as being 99.9 percent effective for particulates (a more conservative assumption than the 99.97 percent higher filtration efficiency frequently reported in DOE documents). In addition, multiple HEPA filter units in series are conservatively modeled as a single unit; and no credit is taken in the model for multiplicative protection from a series of HEPA filters. For hypothetical accidental scenarios involving damage to a facility structure, this EIS takes no credit for HEPA filters and does not include HEPA filtration.

The NNPP requires that HEPA filters to the environment be tested frequently for proper air flow, pressure, and filtration effectiveness. Testing to verify that the HEPA filters are operating effectively occurs upon initial installation, after any modification of the system, and annually. Additionally, the NNPP replaces the HEPA filters whenever the filters do not pass inspection, if damage is detected or suspected, according to schedule, or if the radiation level in the filter reaches a set-point.

Twin Falls Meeting Comment #2

MR. CHISHOLM: My name is Bill Chisholm, and I have a lot -- a lot -- I have a lot of history of the eco-actions here in Idaho. In fact, I decorated one of your train cars back in 1992, I believe it was. It was just sort of a preclude -- prelude to the -- to the agreement that you have.

You know, because we're -- we're very concerned here in Idaho that -- that Dr. Rickards says, somehow we're sort of become de facto sort of nuclear waste repository for us. You know, the year before -- private waste was coming in,
1 the Navy waste was coming in. And then we don't want to become a de facto repository with the Snake River Aquifer and that has serious concerns along with some of the concerns that Dr. Rickards
2 has regarding the -- the potential for any air contamination that would go out of the facility.

3 You know, I'm -- I'm really believe strongly that -- that you have to -- you have to consider the other options, and you can't just consider Idaho and INL as part of this process, is you also have to take a look at what other options were out there to make a good facility -- or good decision on behalf of the public. So that, you know, perhaps include the Savannah River in the process.

1 But we have -- we have -- we have this document, we have this 1995 agreement. But, you know, it was an agreement that, you know, all -- all the -- all the plutonium was supposed to be cleaned up. And -- and agreements have a tendency somehow that they're made -- they're made in the present, but you know, what goes down the road, 1935 (sic) was 25 years away. You know, a lot of things can change.

And -- and what happens too often, in my opinion, is they make these agreements in the present, but nobody -- nobody that signed the agreement is going to be around to make sure the agreement is -- is enforced in the future. So I think we have -- have to, at least as part of that as a cumulative impact and take a look at -- at what -- what mechanisms are in place to be sure that that waste leaves.

We don't have a -- we don't have a repository currently for the -- for the nation's -- nation's waste, and -- and everybody who wants to keep putting that off for the next generation to -- and that's -- I've been -- forever. There's always new peop -- there's always new people on the government side of the equation.

So I want to make sure that we address the cumulative fact, is there -- is there options outside of Idaho. And to follow up on what

4 Dr. Rickards thinks about it. You know, the most catastrophic has potential. I was a wild land fire fighter. You know, I had a fire in my own backyard this year. I never had seen before, so things can change, and those things need to be considered in an honest process.

So thank you.

Response to Twin Falls Meeting Comment #2

Item #1:

Although the NNPP has the necessary loading facilities at NRF and transportation casks, the timeframe reasonably necessary for shipment of naval spent nuclear fuel to a repository or storage facility outside of Idaho is dependent on the availability of such facilities. The timing of availability of those facilities is uncertain. At the time of this Draft EIS, the NRC is considering the DOE application to construct a geologic repository at Yucca Mountain. The President's Blue Ribbon Commission on America's Nuclear Future evaluated alternatives to the repository at Yucca Mountain. The DOE strategy for implementing the recommendations of the Commission estimated that a pilot interim storage capability could be operational by 2021, a consolidated interim storage facility could be operational by 2025, and an alternate geologic repository could be operational by 2048.

Item #2:

The environmental impacts from air emissions are discussed in Section 4.6.

Item #3:

As noted in Section 1.5.3, alternatives for management of spent nuclear fuel managed by the DOE, including naval spent nuclear fuel, were comprehensively evaluated in DOE 1995. Transportation-related impacts were considered in that evaluation. Based on that evaluation, ROD 1995 chose to implement regionalized spent fuel management by fuel type. Under that alternative, naval spent nuclear fuel is managed at the NRF at INL. There are no factors that warrant reconsideration of that decision.

Item #4:

Hypothetical accident scenarios, including intentionally destructive acts, are considered in Section 4.13 and Appendix F.

A.3 Public Comments on the Amended NOI and Responses

This section provides comments received during the public comment period for the Amended NOI and the associated NNPP responses.

Mail Comment #1 to Amended NOI

Date: June 4, 2012

To: Ms. Samantha O'Hara (C8U-Naval Reactors)
Naval Sea Systems Command
1240 Isaac Hall Avenue, SE
Stop 8036
Washington Navy Yard, DC 20376-8036

From: Sandra Blazius
[redacted]

Dear Ms. O'Hara:

A Mr. Christopher Henvit of the Naval Nuclear Propulsion Program sent me a letter with enclosures regarding the Revised NOI of the EIS for the Recapitalization of the Naval Spent Nuclear Fuel Handling and Examination Facilities at INEL here in Idaho. He invited my comments. I hope that my comments will be appropriate to the kind of input you are looking for from the general public.

1 Firstly... I am 100% behind the re-funding of these projects. I consider the refurbishing of the aging infrastructure of extreme importance and urgency. Not only to maintain our readiness for national defense and to keep the nuclear-powered fleet in tip condition -- but on the home front, to guard against a terrible accident, killing thousands of people.

2 The leaking, aging canisters are the most worrisome to me, right now. In 2005 - I first heard of "6 leaking canisters" at INEL via our town newspaper. At the DOE Meeting in July, 2005, held at CSI in Twin Falls, we heard that the amount of radiation leaking into the acquifer was miniscule -- but happening... no longer conjecture. I have heard or read nothing more about this since. But the problem is not just leakage into the acquifer. To me the leaking canisters are a "signature" of the radioactive waste inside heating up and corroding the canister, and a sign of a potential explosion of one or more of the containers in the near future - from being stored in there so long. A plutonium release would happen killing thousands downwind.

I am without hesitation in support of Alternative(1), for a brand new ECF facility to be built... no matter the cost. Our lives are worth more! The aging infrastructure of INEL is frightening. Alternative(1) is the safest way -- for all of us -- the workers and the public at large. Your decision to split the EIS into two is a sound one, as time is of the essence. I am hoping new canisters will be a part of the re-building and refurbishing.

My other comments are these:

3 - Winds can come at times toward the SW from INEL -- could carry radioactive emissions straight toward the Magic Valley - Twin Falls area.

4 - Water quality is already affected by the leaking into the acquifer - although the amount is miniscule - any amount of radiation is harmful, and small amounts cause cancer in the population over time.

In summary, I am 100% in support of funding both projects... and the sooner the better. I repeat that I am strongly for Alternative(1), the safest possible. The leaking canisters concern me greatly, as with a large plutonium release, thousands of people, animals, plants would die, and leave the area uninhabitable for a long time.

Thank you for contacting me.

Sincerely,
Sandra Blazius
Sandra Blazius

(70 yr. old retired senior in Twin Falls community).
20 yr. resident - So. Idaho
page 1 of 1

Response to Mail Comment #1 to Amended NOI

Responses to Sandra Blazius' comments follow:

Item #1:

The commenter's support of the proposed action is noted.

Item #2:

The incident with the six leaking canisters did not occur at NRF. Dry storage in canisters is outside the scope of this EIS; dry storage container systems for management of naval spent nuclear fuel were evaluated in DOE 1996. Canisters are made of corrosion-resistant material and backfilled with an inert gas. Therefore, they are not susceptible to the problems identified by the commenter. Appendix F provides an evaluation of routine naval spent nuclear fuel handling operations and hypothetical accident scenarios associated with radiological aspects of the recapitalization of naval spent nuclear fuel handling capabilities.

Item #3:

The analyses in Sections 4.6 and 4.13 account for variability in wind direction.

Item #4:

Section 3.4 discusses NRF groundwater monitoring for both chemical and radioactive contaminants. As discussed in Section 4.4, no radiological effluent would be discharged to the Snake River Plain Aquifer. No wastewater or storm water would be discharged to waters of the U.S.

Mail Comment #2 to Amended NOI

United States Government **Department of Energy**

memorandum

Idaho Operations Office

Date: June 5, 2012

Subject: Department of Energy Comment on the Revised Scope of Environmental Impact Statement for the Recapitalization of Naval Spent Nuclear Fuel Handling and Examination Facilities at the Idaho National Laboratory (IS-12-024)

To: Samantha O'Hara
Naval Sea Systems Command
ATTN: 08U-Naval Reactors
1240 Isaac Hull Avenue, SE, Stop 8036
Washington Navy Yard, DC 20376-8036

This letter formally provides Department of Energy (DOE) comments to the revised scope of the Environmental Impact Statement (EIS) for the Recapitalization of Naval Spent Nuclear Fuel Handling and Examination Facilities at the Idaho National Laboratory (INL). The EIS revision defers recapitalization of Navy examination capabilities for naval spent fuel at the Naval Reactors Facility (NRF) and moves consideration of that recapitalization to the cumulative effects section of the EIS. DOE is interested in the EIS revision because the NRF is located at the INL and some supporting resources are shared by the DOE and Naval Nuclear Power Propulsion (NNPP) at the INL. Both organizations work with nuclear fuel, irradiated material performance and spent fuel storage, and their post-irradiation examination needs are similar.

DOE's strategy is to establish world-leading PIE capabilities to advance nuclear fuels and materials. Towards that end, numerous facilities and equipment upgrades have been completed and others are underway at the Idaho National Laboratory. The Irradiated Materials Characterization Laboratory (IMCL) is a prototyping PIE facility and its construction is nearing completion. We currently are conducting an alternatives analysis for an advanced post irradiation capability. Therefore, DOE recommends that NNPP continue to work with DOE to
1 determine if existing and planned DOE capabilities can support NNPP's nuclear fuels and materials examination needs. In addition, other facilities and capabilities exist at the INL site that could help offset or supplement your needs and we are available to discuss those options as your project moves forward.

The contractor project director for the Advanced PIE Capability analysis is Michael Patterson at (208) 526-5525 or mw.patterson@inl.gov. I invite you to contact him to discuss specific areas of joint collaboration. Because the project has only received approval of Critical

Decision 0 (CD-0), a federal project director has yet to be named. The federal point of contact for this effort is W. Greg Bass at (208) 526-7184 or basswg@id.doe.gov.

Richard B. Provencher
Manager

cc: Brady Haynes, NRF-IBO
Christopher M. Henvit, NRF-IBO
Mike W. Patterson, BEA
Vincent F. Tone, BEA
Mitchell K. Meyer, BEA
Kemal O. Pasamehmetoglu, BEA
David J. Hill, BEA
John J. Grossenbacher, BEA

Response to Mail Comment #2 to Amended NOI

Item #1:

The NNPP will continue to work with the DOE to determine how existing and planned DOE capabilities can support NNPP's nuclear fuels and material examination needs.

E-Mail Comment #1 to Amended NOI

AGENCY: Department of Energy.
ACTION: Amended Notice of Intent to Revise the Scope of an
Environmental Impact Statement.
justice
Potential safety and health impacts to workers.
Compliance with applicable Federal and state regulations.
Agency:USCBP
Document ID:USCBP-2012-0018-0001
Your Comment Tracking Number:8100c560
Procurement Integrity Act RECOMMENDATION Docket Services processes

Procurement Integrity Act
Decision
Matter of: Y&K Maintenance, Inc.
File: B-405310.6
Date: February 2, 2012

DECISION
Y&K Maintenance, Inc., of Seoul, Korea, protests the award of a
contract to SEM Service Co.,
Ltd., of Seoul, Korea, under request for proposals (RFP) No. W91QVN-
11-R-0135, issued by the
Department of the Army, for operation and maintenance
(O&M) of the Medical Command-Korea (MEDDAC-K) facilities in the
Republic of Korea.
We sustain the protest in part and deny it in part.

Re: Medical Reimbursement EEOICP Roles [Incident: 120130-000245]

https://questions.medicare.gov/app/account/questions/detail/i_id/55857

283 - USASHD,USASHD-217 Operations Office Managers

THANK YOU !

IAEA safeguards We have received your application for an account for
the FBO>GovernmentSystem. Please verify the following information:
Agency:Administrative Office of the U. S. Courts> Office: Top Level>
Location: 53095 D-U-N-S No. 63-108-7863 Company Info 276 9 Yeon-dong
Cheju
organization: Oriental Economic Institute (Keomgyosil) addressl: 276 9
Yeon-dong city: Cheju
state: VA zip: 690814 country: korea visory RYU CHAN HONG

jeju localhost rych67

Response to E-Mail Comment #1 to Amended NOI

This e-mail is not relevant to the EIS and does not require a response.

E-Mail Comment #2 on Amended NOI

From:	Beatrice Brailsford [bbrailsford@snakeriveralliance.org]
Sent:	Monday, June 11, 2012 5:56 PM
To:	ECF Recapitalization
Subject:	Snake River Alliance revised recapitalization scoping comments
Attachments:	nuclear navy revised recapitalization comments.pdf; ATT1707762.txt

Dear Ms. O'Hara,

Could you please acknowledge receipt of these comments? (I'm not quite sure what the "u" in "unnpp" stands for.)

SNAKE RIVER ALLIANCE

June 11, 2012

Ms. Samantha O'Hara (08U-Naval Reactors)
Naval Sea Systems Command
1240 Isaac Hull Avenue, SE
Stop 8036
Washington Navy Yard, DC 20376-8036

Via email: ecfrecapitalization@unnpp.gov

Snake River Alliance Scoping Comments on the Environmental Impact Statement for the recapitalization of the infrastructure supporting spent nuclear fuel at the Idaho National Laboratory

Dear Ms. O'Hara:

On behalf of the members of the Snake River Alliance, I submit the following comments and questions regarding the scope of the EIS on nuclear navy spent fuel infrastructure recapitalization.

I have attached the Alliance's September 3, 2010, comments on the original recapitalization proposal. Many of those comments remain applicable to the current proposal and should be responded to in the draft environmental impact statement.

1 The Amended Notice of Intent states that "funding uncertainties have made the timing of
the Examination Recapitalization Project speculative in nature." When did this uncertainty
first become apparent? It appears the decision to limit the scope of the recapitalization
2 project was effectively made before the environmental assessment for the Replacement
Capability for Disposal of Remote-Handled Low-Level Radioactive Waste Generated at the
Department of Energy's Idaho Site. Is this correct? Are there any projections of when
3 funding might be available?

As you know, the spent fuel *examination* capability has long been the justification for bringing nuclear navy spent fuel to the Idaho National Laboratory.

350 9th Avenue North, Suite B10
Boise, ID 83702
208/344-9161

Box 425
Pocatello, ID 83204
208/233-7212

4 Now that a new examination facility has been delayed or will not be built at all, the nuclear navy must provide a thorough evaluation of the state of the current facility.

5 The draft EIS should describe in detail any changes in the number of spent fuel
examinations that will take place because of aging of the Naval Reactors Facility (NRF) or
the extended use of the fuel itself. Any such changes will undoubtedly change the size of
6 the NRF waste stream. How will this affect the replacement remote-handled low level
waste facility at the Idaho National Laboratory?

7 What percentage of the recapitalization project will be funded by the Department of Defense?

Respectfully submitted,

Beatrice Brailsford
Nuclear program director

Response to E-Mail Comment #2 to Amended NOI

Responses to the Snake River Alliance's comments are provided below. Comments originally provided on September 3, 2010, although not attached here, are addressed in the response to E-Mail Comment #7.

Item #1:

The NNPP sought a funding level of approximately $60M in fiscal year (FY) 2012 to support the recapitalization of naval spent nuclear fuel capabilities. Budget reductions in FY 2012 resulted in a 50 percent reduction to approximately $30M. This reduction left a limited amount of resources used to progress the recapitalization of naval spent nuclear fuel handling at a slower pace than originally planned. Furthermore, the Budget Control Act of 2011 (Pub. L. 112-25, August 2, 2011) and the November 21, 2011 announcement by the Joint Select Committee on Deficit Reduction further indicated at least a decade of significant across-the-board constraints on the federal budget. These indicators suggested that sufficient resources would not be available to concurrently progress the recapitalization of examination capabilities.

Item #2:

The decision to limit the scope of the EIS was made in December 2011. However, the decision on the EIS scope has no impact on DOE 2011a for the reasons described in the response to Item 6, below.

Item #3:

The NNPP believes that the funding picture for the recapitalization of naval spent nuclear fuel handling capabilities will be clarified in FY 2015. Until then, the NNPP cannot reasonably project when resources might become available for examination recapitalization conceptual design work.

Item #4:

The environmental impacts of operating the current examination infrastructure without overhaul or recapitalization are reflected in the Section 3 discussion of the affected environment. In the absence of a recapitalization or overhaul project, the NNPP would maintain the examinations infrastructure to ensure continued effective protection of workers, the public, and the environment.

Item #5:

The NNPP expects to continue to fully utilize the examination capacity available at ECF for the foreseeable future. The current in-service conditions experienced by naval nuclear fuel, including its extended use, are more demanding than in the past. The designs of naval nuclear fuel systems continue to evolve and some desirable performance characteristics (e.g., a life-of-the-ship fuel design for aircraft carriers) have not yet been achieved. The continuing comprehensive program of examining all naval spent nuclear fuel provides information that validates naval nuclear fuel designs and performance models. This validation is essential to support resolution of emergent fleet problems, further refinement of the models, and development of the next generation of naval nuclear fuel designs. The aging of the examinations infrastructure may lead to temporary reductions or interruptions in planned examination activity to allow repair or replacement of failed equipment or systems.

Item #6:

The size of the NRF waste stream to the replacement remote-handled low level waste facility at the INL is unaffected by the pace of examination work. Approximately 98 percent of the waste disposed at that facility is related to the processing of spent fuel for dry storage and disposal.

Item #7:

The recapitalization of naval spent nuclear fuel handling capabilities is planned to be funded through the DOE.

APPENDIX B

CONSULTATION AND COORDINATION LETTERS

B.1 Threatened and Endangered Species Consultation

Department of Energy
Naval Reactors
Idaho Branch Office
Post Office Box 2469
Idaho Falls, Idaho 83403-2469

NR:IBO-12/215
December 12, 2012

David Kampwerth, Field Supervisor
U.S. Fish and Wildlife Service
Eastern Idaho Field Office
4425 Burley Dr., Suite A
Chubbuck, Idaho 83202

SUBJECT: REQUEST FOR INFORMAL CONSULTATION ON THE DETERMINATION OF IMPACT ON FEDERALLY LISTED SPECIES AND THEIR DESIGNATED CRITICAL HABITAT FOR THE *DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR THE RECAPITALIZATION OF INFRASTRUCTURE SUPPORTING NAVAL SPENT NUCLEAR FUEL HANDLING AT THE IDAHO NATIONAL LABORATORY (INL)*

Dear Mr. Kampwerth:

The Department of Energy (DOE) office of Naval Reactors is seeking informal consultation with your office in compliance with Section 7 of the Endangered Species Act (ESA). The Naval Nuclear Propulsion Program (NNPP) is preparing an Environmental Impact Statement (EIS) for recapitalizing the spent fuel handling capabilities of the Expended Core Facility (ECF) at the Idaho National Laboratory (INL). The EIS will contain an analysis of impacts on listed and proposed candidate, threatened, and endangered plant and animal species.

Introduction and Project Description

The NNPP proposes to recapitalize the infrastructure for preparing, examining, and packaging naval spent nuclear fuel and other irradiated materials, to ensure these capabilities are maintained for the vital NNPP mission of supporting the naval nuclear-powered fleet. The recapitalization is expected to be carried out as two projects. The first project would be the Spent Fuel Handling Recapitalization Project; the second project would be the Examination Recapitalization Project. The Spent Fuel Handling Recapitalization Project would ensure that interfaces and exchanges between handling and examination are factored into detailed designs, to ensure that both projects can be carried out in an environmentally responsible and cost effective manner.

An amended Notice of Intent (NOI) for the project was published in the Federal Register on May 10, 2012. The purpose of the amended

NOI was to announce the NNPP's intent to reduce the scope of the EIS to include only the Spent Fuel Handling Recapitalization Project. The Examination Recapitalization Project was retained in the ecological survey report (Enclosure (I)) as a reasonably foreseeable project for use in the EIS cumulative impacts analysis.

Three alternatives for the Spent Fuel Handling Recapitalization Project will be analyzed in the EIS:

1. Maintain ECF without a change to the present course of action or management of the facility. Spent fuel handling capabilities of ECF would continue to use the current ECF infrastructure while performing corrective maintenance and repairs necessary to keep the infrastructure in good working order (i.e., actions sufficient to sustain the proper functioning of structures, systems, and components). (No Action Alternative)

2. Overhaul ECF by implementing major refurbishment projects for the ECF infrastructure and water pools to provide the needed long-term capabilities for transferring, preparing, and packaging naval spent nuclear fuel (Overhaul Alternative).

3. Site a new Spent Fuel Handling Recapitalization Project facility at NRF (New Facility Alternative).

The NNPP has determined that there are no threatened or endangered plant or animal species, and no designated critical habitat for such species in the potential project areas. The NNPP is seeking concurrence with this finding from the U.S. Fish and Wildlife Service (USFWS). Evidence supporting this finding is discussed below and is based on the USFWS species list for Idaho counties (Attachment (I)), potential disturbance areas for project alternatives (Attachment (II)), habitat requirements for listed species, and ecological surveys of the proposed building sites (Enclosure (1)).

Review of Listed Species

To prepare for consultation with your office, a list of threatened, endangered, proposed, and candidate plant and animal species for Idaho counties was obtained from the USFWS, Idaho Fish and Wildlife Office (IFWO) web page on September 10, 2012, for proposed Federal Actions (Attachment (I)). The list was evaluated for plant and animal species that are known to occur in Butte, Bingham, Bonneville, Custer, and Jefferson counties. The INL is located in Butte County. The additional four counties surrounding INL were also assessed to narrow the statewide county list to those that might have similar habitat to INL.

One threatened plant species, Ute ladies' tresses (*Spiranthese diluvialis*) was identified as occurring in three of the counties. This orchid grows only in moist soils associated with wetlands or floodplains of perennial streams in intermountain valleys, or in wet open meadows. This species requires soils that are moist to the surface throughout the growing season (USDA 2011). There is no habitat within the INL boundaries that would support this species. One candidate tree species, whitebark pine (*Pinus albicaulis*), was identified as occurring in Butte, Bonneville and Custer counties. However, this tree occurs in subalpine forests at elevations between 7000 and 12,000 feet. There is no habitat on the INL that would support this species. No threatened, endangered, proposed, or candidate plant species are known to occur, or are expected to occur on INL.

Two threatened and three candidate animal species were identified in the counties that were evaluated. The Canada lynx (*Lynx canadensis*) and grizzly bear (*Ursus arctos horribilis*) are listed as threatened and were identified as occurring in one or more of the counties evaluated. The Canada lynx is typically found in forested habitats, while the grizzly bear is typically found in a variety of habitats within the Greater Yellowstone area. There is no suitable habitat on INL for these two species, and they are not expected to occur on the site. No designated critical habitat for threatened or endangered species, as defined in the ESA, exists on INL.

The greater sage-grouse (*Centrocercus urophasianus*), yellow billed cuckoo (*Coccyzus americanus*), and wolverine (*Gulo gulo*) are listed as candidate species by the USFWS; they were identified as occurring in four to five of the surrounding counties (depending on the species). The greater sage-grouse is known to occur on INL and is discussed below. The yellow-billed cuckoo typically occurs in riparian woodlands and shrubs. The wolverine is typically found in northern boreal forests and subarctic and alpine tundra. There is no suitable habitat on INL for the yellow-billed cuckoo or wolverine, and they are not expected to occur on the site.

The USFWS recently announced that pygmy rabbits (*Brachylagus idahoensis*) do not warrant protection under the ESA. However, because of conservation concerns for this sagebrush obligate species, impacts will be addressed in the EIS. Field surveys (see below) were conducted for pygmy rabbits at the potential project locations at NRF to support the impact analysis.

Ecological Resource Surveys

To describe current ecological resource conditions and support evaluation of impacts of ECF Recapitalization Project alternatives, Gonzales-Stoller Surveillance, LLC (GSS) was contracted to perform wildlife and vegetation surveys. Surveys of the potential disturbance areas for the alternatives were conducted in 2011 and a report was issued. Potential disturbance areas were further defined and additional surveys were conducted in 2012 to ensure coverage. The initial report was revised with the 2012 survey results and issued as revision 1. This report is provided in enclosure (1). Field surveys were conducted at NRF alternative locations in 2011 during March (winter surveys for pygmy rabbit), April - May (listening surveys for greater sage-grouse), and June (wildlife and rare plants). Vegetation and wildlife (including greater sage-grouse and pygmy rabbit) surveys were conducted again at NRF in June 2012. Wildlife and rare plant surveys were also conducted at the ATR Complex in June 2011 and included in the report. However, this site is no longer under consideration as a potential building location in the current EIS and is only used for potential cumulative impacts in the EIS.

Existing surveys and reports describing vegetation communities, greater sage-grouse lek locations, breeding bird populations, and pygmy rabbit populations around NRF were reviewed and used in addition to the field surveys to describe ecological conditions and habitat at the potential building locations. Attachment II figures 1, 2, and 3 show the area at NRF that was surveyed compared to potential disturbance area for the Overhaul Alternative, the New Facility Alternative at NRF Location 3/4 and the New Facility Alternative at NRF location 6, respectively. The field surveys of potential construction areas found no evidence of rare or sensitive plant species at NRF. Additionally, no evidence was found of greater sage-grouse leks or nesting. No greater sage-grouse sign was found in the potential disturbance area for the Overhaul Alternative (attachment II, figure 1). Evidence of transitory use by greater sage-grouse was found at the construction support areas (e.g., laydown area, batch plant, stockpile) for NRF Location 3/4 (attachment II, figure 2) and NRF location 6 (attachment II, figure 3). A single pygmy rabbit burrow was found in the construction support area for NRF Location 3/4 (attachment II, figure 2) and a number of locations in the construction support area for NRF location 6 (attachment II, figure 3). Based on this information, the NNPP determined that the project alternatives are not likely to adversely impact the greater sage-grouse on the INL. There is potential for pygmy rabbit burrows to be impacted should NRF location 6 be selected for the New Facility Alternative. This would be a local impact and not likely to adversely affect pygmy rabbits on the INL. NRF location 3/4 is the preferred location.

Candidate Conservation Agreement

The NNPP is participating in establishing a Candidate Conservation Agreement (CCA) between the DOE Idaho Operations Office and the USFWS for the greater sage-grouse on the INL. When the CCA is finalized, the NNPP would follow the conservation measures that are applicable to the proposed project. The potential building locations are next to the existing NRF facility and are in areas that would be excluded from most conservation measures in the proposed CCA.

Request for Concurrence

In accordance with section 7 of the ESA, please provide feedback on the following NNPP determinations:

- A Biological Assessment or further section 7 consultation pursuant to the Endangered Species Act of 1973 is not required since there are no threatened or endangered species or critical habitat present in the project area
- The proposed alternatives are not likely to adversely affect the greater sage-grouse
- The proposed alternatives are not likely to adversely affect the pygmy rabbit

Please do not hesitate to contact me at 208-533-5969, if you have any questions or comments or need additional information. Thank you for your assistance.

Sincerely,

C. M. Henvit, Acting Manager
Naval Reactors Idaho Branch Office

Attachments: (I) Endangered, Threatened, Proposed, and Candidate Species With Associated Proposed and Critical Habitats in Idaho. U.S. Fish and Wildlife Service - Idaho Fish and Wildlife Office. www.fws.gov/idaho/species/IdahoSpeciesList.pdf. Dated 09/06/2012. Downloaded 09/10/2012.

(II) Potential Disturbance Areas for Project Alternatives

Enclosure: (1) GSS-NRF-148-r.1. Ecological Surveys to Support the ECF Recapitalization Environmental Impact Statement. Gonzales-Stoller Surveillance, LLC. Idaho Falls, Idaho. September 2012

United States Department of the Interior
FISH AND WILDLIFE SERVICE
Eastern Idaho Field Office
4425 Burley Dr., Suite A
Chubbuck, Idaho 83202
Telephone (208) 237-6975
http://IdahoES.fws.gov

JAN 22 2013

C. M. Henvit
Acting Manager
Naval Reactors, Idaho Branch Office
Department of Energy
P.O. Box 2469
Idaho Falls, Idaho 83403-2469

Subject: Determination of Impact on Federally Listed Species and Their Designated Critical Habitat for the Draft Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Idaho National Laboratory, Butte County, Idaho (NR – IBO-12/215)
TAILS # 14420-2013-TA-0084

Dear Mr. Henvit:

This letter responds to the Department of Energy (DOE) office of Naval Reactors' request for informal consultation in accordance with section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531 et seq.; [Act]). In a letter dated December 12, 2012, received by the Fish and Wildlife Service (Service) on December 14, 2012, DOE requested informal consultation on the determination of impact to federally listed species from the recapitalization of infrastructure supporting spent fuel handling at the Idaho National Laboratory (INL), Butte County, Idaho. Ecological surveys of the project area accompanied your letter.

The DOE is analyzing the impacts of (1) maintaining spent fuel handling capabilities at the Expended Core Facility (ECF) at the Naval Reactors Facility (NRF), (2) overhauling spent fuel handling capabilities at the ECF, or (3) constructing new spent fuel handling facilities at the NRF. All alternatives would involve disturbance, including construction support areas, occurring at or immediately adjacent to existing facilities.

The DOE determined that there are no federally listed plant or animal species, and no designated critical habitat, in the proposed project area. The DOE requested concurrence with their determination of no effect to Ute ladies' tresses (*Spiranthese diluvialis*), Canada lynx (*Lynx canadensis*), and grizzly bear (*Ursus arctos horribilis*). The regulations implementing section 7 of the Act do not require the Service to review or concur with no effect determinations. However, the Service does appreciate being informed of the determination for these species. Based on the proposed project location, ecological surveys of the area, and habitat requirements for these species, the Service does not disagree with your determination.

The DOE determined that there is no suitable habitat on the INL for the federal candidate species whitebark pine (*Pinus albicaulis*), yellow-billed cuckoo (*Coccyzus americanus*), or North American wolverine (*Gulo gulo*). The Act does not require consultation on candidate species. However, the Service does appreciate being informed of the determination for these species.

Greater sage-grouse (*Centrocercus urophasianus*), a federal candidate species, are known to occur on the INL. Ecological surveys conducted in the proposed project area found signs of transitory use by greater sage-grouse. No leks or nesting areas were found within the proposed project area; the nearest known lek occurs 4.5 km to the west. The DOE requested concurrence with their determination that the proposed alternatives are not likely to adversely affect greater sage-grouse. However, the Act does not require consultation on candidate species. The Service acknowledges your determination and appreciates being provided information on sage-grouse habitat and use on the INL. Based on the proposed project location, and the results of ecological surveys conducted in the area, the Service anticipates a minimal loss of sage-grouse habitat resulting from implementation of the proposed alternatives.

The Service appreciates your efforts to establish a Candidate Conservation Agreement (CCA) for the greater sage-grouse on the INL. Currently, only a draft CCA exists. The Service urges you to continue your efforts to develop a final CCA that will benefit sage-grouse on the INL and provide a greater degree of certainty on conservation measures applicable to existing INL facilities.

In 2010, the Service concluded that the pygmy rabbit (*Brachylagus idahoensis*) does not warrant protection under the Act. Your letter states that because of conservation concerns for this sagebrush obligate species, potential impacts to the pygmy rabbit will be addressed in the environmental impact statement for the proposed project. The DOE requested concurrence with their determination that the proposed alternatives are not likely to adversely affect the pygmy rabbit. The regulations implementing section 7 of the Act do not require consultation on species not listed under the Act. The Service acknowledges your determination and appreciates your consideration of this species. Based on the proposed project location, and the results of ecological surveys conducted in the area, the Service anticipates a minimal loss of pygmy rabbit habitat resulting from implementation of the proposed alternatives.

Because the DOE determined that there is no effect to federally listed plant or animal species, or designated critical habitat, consultation is not required at this time. Consultation may become necessary in the future if your proposed action or area of impact is modified, or if a new species is listed or critical habitat is designated that may be affected by the proposed action.

If you have any questions regarding your responsibilities under section 7 of the Act, or require further information, please contact Laura Berglund at (208) 237-6975 extension 114. Thank you for your interest in the conservation of threatened and endangered species.

Sincerely,

David Kampwerth
Field Supervisor

cc: Service, Boise (Pyron)

B.2 National Historic Preservation Act Consultation

Department of Energy
Washington, DC 20585

June 22, 2011

Ms. Susan Pengilly
Deputy State Historic Preservation Officer and Compliance Coordinator
Idaho State Historical Society
210 Main Street
Boise, ID 83702

SUBJECT: Draft Cultural Resources Report for the Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the Idaho National Laboratory

Dear Ms. Pengilly:

The Department of Energy (DOE) Naval Nuclear Propulsion Program (NNPP) is seeking documented consultation with your office regarding the Draft Cultural Resources Report for the Expended Core Facility (ECF) Recapitalization Environmental Impact Statement (EIS). The proposed project is the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the Idaho National Laboratory (INL).

The Naval Nuclear Propulsion Program (NNPP) proposes to recapitalize the infrastructure for transferring, preparing, examining, and packaging naval spent nuclear fuel and other irradiated materials, to ensure these capabilities are maintained for the vital NNPP mission of supporting the naval nuclear-powered fleet. The recapitalization is expected to be carried out as two projects. The first project would be the Spent Fuel Handling Recapitalization Project; the second project would be the Examination Recapitalization Project. The Spent Fuel Handling Recapitalization Project would ensure that interfaces and exchanges between handling and examination are factored into detailed designs, to ensure that both projects can be carried out in an environmentally responsible and cost effective manner.

The EIS will consider the environmental effects related to siting and construction of new facilities for both of the Recapitalization Projects. The NNPP will evaluate two siting combinations in detail, along with a No-Action Alternative.

- Alternative 1 - Locate the Spent Fuel Handling Recapitalization Project and the Examination Recapitalization Project at the Naval Reactors Facility (NRF) at the INL.
- Alternative 2 - Locate the Spent Fuel Handling Recapitalization Project at the NRF and the Examination Recapitalization Project at the Advanced Test Reactor Complex at the INL.
- No-Action Alternative - Overhaul the ECF. Overhauling includes continuing to repair, maintain, refurbish, and upgrade the ECF as necessary to provide the needed long-term capabilities for transferring, examining, preparing, and packaging naval spent nuclear fuel.

The locations for facility placement will be addressed in the EIS. NNPP proposes to address impacts to environmental resources, to include impacts on cultural resources, such as historic, archaeological, and Native American culturally important sites.

The purpose of this letter is to initiate communication with your office. The Draft Cultural Resources Report (attached) provides the identified archaeological resources and the approaches recommended to minimize impacts to them. The NNPP is seeking feedback on any additional archaeological resources that may be located in the project area.

As identified in the report, additional targeted archaeological reconnaissance is planned for some identified resources. The NNPP would like to complete this reconnaissance in time to incorporate the results into the Draft EIS. Therefore, the reconnaissance is planned for this summer, approximately one month after the transmittal of this letter.

We intend to use the EIS process to comply with Section 106 of the National Historic Preservation Act of 1966. After assessing information you provide, we will determine any additional actions that are necessary to comply with the Section 106 consultation process. If you have any questions or comments, or need additional information, please contact Alan Denko at 202-781-6214.

Sincerely,

Alan Denko
Naval Reactors

Attachment (I) INL/EXT-10-20650 dated June 2011. Cultural Resource Investigations for Potential Naval Reactors Spent Fuel Handling and Examination Facilities at the Idaho National Laboratory - Draft.

cc:
Carolyn Smith, Tribal DOE Program-Heritage Tribal Office
Brenda Pace, BEA Cultural Resource Management

www.history.idaho.gov

Idaho • State Historical SOCIETY

July 15, 2011

C.L. "Butch" Otter
Governor of Idaho

Janet Gallimore
Executive Director

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State Historic Preservation Office and Historic Sites Archeological Survey of Idaho
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Statewide Sites:
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• Pierce Courthouse
• Rock Creek Station and
• Stricker Homesite

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North Idaho Office
112 West 4th Street, Suite #7
Moscow, Idaho 83843
Office: (208) 882-1540
Fax: (208) 882-1763

Alan Denko
Naval Reactors
Washington DC 20585

RE: Draft Cultural Resources Report for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the Idaho National Laboratory

Dear Mr. Denko:

Thank you for sending the draft report documenting preliminary archaeological survey of the alternative locations for the proposed Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the Idaho National Laboratory. We support the recommendations for additional investigations as presented in the report.

We look forward to receiving the other archaeological reports associated with this project. If you have any questions, please feel free to contact me at 208-334-3847, ext. 107.

Sincerely,

Susan Pengilly

Susan Pengilly
Deputy SHPO and
Compliance Coordinator

Cc: Julie Williams, Battelle

DEPARTMENT OF ENERGY
NAVAL REACTORS
IDAHO BRANCH OFFICE
POST OFFICE BOX 2469
IDAHO FALLS, IDAHO 83403-2469

NR:IBO-13/067
April 30, 2013

Ms. Susan Pengilly
Deputy State Historic Preservation Officer and Compliance Coordinator
Idaho State Historical Society
210 Main Street
Boise, ID 83702

SUBJECT: CULTURAL RESOURCE INVESTIGATIONS FOR RECAPITALIZATION OF INFRASTRUCTURE SUPPORTING NAVAL SPENT NUCLEAR FUEL HANDLING AT THE NAVAL REACTORS FACILITY ON THE IDAHO NATIONAL LABORATORY

Dear Ms. Pengilly,

The Department of Energy (DOE) Naval Nuclear Propulsion Program (NNPP) is seeking documented consultation with your office regarding the cultural resource investigations for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling Environmental Impact Statement (EIS) in accordance with Section 106 of the Historic Preservation Act.

Introduction and Project Description

The NNPP proposes to recapitalize the infrastructure for transferring, preparing, examining, and packaging naval spent nuclear fuel and other irradiated materials, to ensure these capabilities are maintained for the vital NNPP mission of supporting the naval nuclear-powered fleet. The recapitalization will be carried out as two projects.

The NNPP was initially pursuing the two recapitalization projects in the same time frame; however, since the initiation of the NEPA process, the project schedules have changed such that planning for spent fuel handling recapitalization has progressed further than planning for examination recapitalization. Preparing one EIS that includes both recapitalization projects would require decisions about examination recapitalization too early in the design process, prior to having sufficient information to fully analyze the environmental impacts. Additionally, funding uncertainties have made the timing of examination recapitalization speculative in nature. To ensure an EIS is completed in support of the Navy's need for spent fuel handling recapitalization, it was necessary to reduce the scope of the EIS to cover just that proposed action.

Susan Pengilly,
Idaho State Historical Society

NR:IBO-13/067
April 30, 2013
Page 2

The EIS will consider the environmental effects related to the proposed action. The alternatives being evaluated have been revised to remove aspects related to examination recapitalization and to address public comments received during initial EIS scoping. The NNPP will evaluate a No Action Alternative, an Overhaul Alternative, and a New Facility Alternative:

- No-Action Alternative – Maintain the spent fuel handling capabilities of the Expended Core Facility (ECF) by continuing to use the current ECF infrastructure while performing corrective maintenance and repairs necessary to keep the infrastructure in good working order (i.e., actions sufficient to sustain the proper functioning of structures, systems, and components).

- Overhaul Alternative – Overhaul the spent fuel handling capabilities of the ECF at Naval Reactors Facility (NRF) by implementing major infrastructure and water pool refurbishment projects while performing corrective maintenance and repair actions as necessary.

- New Facility Alternative – Construct and operate a new facility for spent fuel handling capabilities at one of two potential locations at NRF on the Idaho National Laboratory (INL).

The locations for facility placement will be addressed in the EIS.

<u>Cultural Resource Surveys and Investigations</u>

The NNPP proposes to address impacts to environmental resources including impacts on cultural resources, such as historic, archaeological, and Native American culturally important sites. To support the impact evaluation, the NNPP worked with the INL Contractor, Battelle Energy Alliance (BEA) to conduct cultural resource surveys in the potential areas of disturbance. Based on these surveys, additional investigations were completed as applicable to make determinations about eligibility for listing on the National Register of Historic Places. These surveys and additional investigations were conducted in two phases based on changing project information. Over the course of the investigations, tribal representatives from the Heritage Tribal Office (HeTO) toured all of the archaeological sites scheduled for data recovery and provided valuable hands-on assistance during mapping and test excavations.

In June 2011, the NNPP transmitted the first survey report and notified you of the plan to do additional investigations. This letter transmits a second report including the results of the second phase of surveys and all the additional investigations at the potentially significant prehistoric sites located in areas potentially impacted by the proposed action. As identified in the report, the purpose of the investigations was to identify cultural resources and assess the eligibility of the archaeological sites for nomination to the National Register by determining if additional buried cultural materials were present and of any value to future research in the region.

Susan Pengilly, NR:IBO-13/067
Idaho State Historical Society April 30, 2013
Page 3

The attached report is marked Official Use Only to ensure that the NNPP does not release or allow the release of any information pertaining to the exact location of any archaeological sites to the public. The attached report shall be maintained in a manner which prevents release to unauthorized individuals.

The survey area that encompasses the areas of potential effects associated with the proposed action contains 51 archaeological resources - 21 prehistoric isolate locations, two historic isolate locations, 22 prehistoric sites, two historic sites associated with Euro American settlement, three historic resources associated with World War II and the post-war period, and one modern rock cairn.

The isolate locations are unlikely to yield additional information and have been evaluated as ineligible for nomination to the National Register (list is provided in Section 7.4 of the attached report). Seven sparse scatters of prehistoric artifacts that appear to be restricted to a shallow surface zone are also evaluated as ineligible for nomination to the National Register (see Section 7.4 of the attached report).

Seven prehistoric sites, the two historic sites representing Euro American settlement, the two historic resources and a historic road associated with the Arco Naval Proving Ground during World War II and the post-war period, and the modern cairn exhibit some potential for yielding additional information and were evaluated as potentially eligible for nomination, pending additional data recovery and research (see Section 7.4 of the attached report). These sites would be outside of the area of potential effect for the proposed action and would be avoided during construction of the proposed project.

Test excavations reported in Section 7.2 of the attached report demonstrate that eight of the prehistoric archaeological sites are unlikely to yield any additional information beyond that which has been collected during the intensive data recovery reported and the surveys that preceded this work. Further excavation is not merited and would not contribute to the study of regional prehistory or INL-specific research domains. Based on the testing results, all eight of the sites are evaluated as ineligible for nomination to the National Register.

INL lands are included within the aboriginal homeland of the Shoshone-Bannock Tribes. Although no Native American cultural resources have been specifically identified within the areas potentially impacted by the proposed action, representatives from the Shoshone-Bannock Tribes HeTO have indicated that prehistoric archaeological sites, native plants and animals, water, and other natural landscape features across the INL area continue to fill important roles in tribal heritage and ongoing cultural traditions. The EIS will address these tribal concerns.

Conclusions from Cultural Resource Surveys and Investigations

The area of potential effect for cultural resources associated with the Overhaul Alternative includes approximately 47 acres to the north and northeast of the existing NRF perimeter. Proposed project developments are limited to a new security boundary

system in this area. No archaeological resources are located in the Overhaul Alternative area of potential effect. The archaeological investigations support a finding of no effects to historic properties and no adverse impacts to known resources of cultural significance for the Overhaul Alternative.

All of the archaeological resources identified within the New Facility Alternative Location 3/4 area of potential effect are evaluated as ineligible for nomination to the National Register due to limited research potential and lack of integrity. These evaluations are supported by test excavations completed at six of the identified archaeological sites. The seventh archaeological site was not visible on the current landscape during recent surveys and appears to have been originally restricted to a shallow surface zone that has been subject to widespread changes as a result of erosion, freeze-thaw action, bioturbation, and modern activities. The short segment of West Monument Road that passes through the temporary disturbance area for the New Facility Alternative Location 3/4 is highly modified for current activities at NRF and is evaluated as ineligible for nomination to the National Register. Unmodified segments of the road are well preserved to the northeast of the temporary disturbance area of the proposed action. The remaining resources are isolate locations that have been collected for permanent curation and possible future study. The archaeological investigations support a finding of no adverse effects to historic properties and no adverse impacts to any known resources of cultural significance for the New Facility Alternative Location 3/4.

All of the archaeological resources identified within the New Facility Alternative Location 6 area of potential effect are evaluated as ineligible for nomination to the National Register due to limited research potential and lack of integrity. These evaluations are supported by test excavations completed at one of the identified archaeological sites. The remaining resources are isolate locations that have been collected for permanent curation and possible future study. The archaeological investigations support a finding of no adverse effects to historic properties and no adverse impacts to known resources of cultural significance for the New Facility Alternative Location 6.

Although direct impacts are unlikely, there is potential for undesirable indirect effects to cultural resources that are located just outside the areas of potential effect. Since project-related activity, levels are projected to increase significantly during construction and the overall developed footprint of NRF would expand permanently, any archaeological resources or natural resources of potential concern to the Shoshone-Bannock Tribes or others located near the newly developed perimeter could be affected indirectly due to the increased activity in these previously undeveloped areas. In particular, artifacts may be subject to unauthorized collection or affected by off-road vehicle use and other small ground disturbing activities that commonly occur around developed areas.

Request for Concurrence

We request your concurrence with the conclusions from the cultural resource surveys and investigations described above.

Susan Pengilly,
Idaho State Historical Society

NR:IBO-13/067
April 30, 2013
Page 5

Additionally, on the basis of the additional investigations, we request concurrence that the eight prehistoric archeological sites discussed in Section 7.2 of the attached report are unlikely to yield any additional information beyond that which has been collected during intensive data recovery documented in the attached report and the surveys that proceeded. Further excavation is not merited and would not contribute to the study of regional prehistory or INL-specific research domains. On the basis of the additional investigations, all eight of the sites are evaluated as ineligible for nomination to the National Register.

Your response is requested by June 3, 2013. If you have any questions or comments or need additional information, please do not hesitate to contact me at 208-533-5969.

Sincerely,

Christopher M. Henvit

C. M. Henvit
Naval Reactors Idaho Branch Office

Enclosure (I) INL/LTD-12-27685 dated April 2013. Cultural Resource Investigations for Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Naval Reactors Facility on the Idaho National Laboratory.

Copy to:
The Honorable Nathan Small, Chairman, Fort Hall Business Council (w/o enclosure)
Ms. Carolyn Smith, Heritage Tribal Office (w/o enclosure)
Ms. Brenda Pace, BEA Cultural Resource Management (w/o enclosure)
W. Preacher, Tribal DOE Director (w/o enclosure)
R. L. Pence, DOE-ID (w/o enclosure)

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C.L. "Butch" Otter
Governor of Idaho

Janet Gallimore
Executive Director

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[redacted]

Statewide Sites:
• Franklin Historic Site
• Pierce Courthouse
• Rock Creek Station and
• Stricker Homesite

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June 4, 2013

Mr. C. M. Henvit
Department of Energy
Naval Reactors Idaho Branch Office
Post Office Box 2469
Idaho Falls, ID 83403-2496

RE: Cultural Resource Investigations for Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Naval Reactors Facility on the Idaho National Laboratory.

Dear Mr. Henvit,

Thank you for your letter, cultural resources report and additional materials regarding the proposed undertaking's compliance with Section 106 of the National Historic Preservation Act (36 CFR 800). We have reviewed the report prepared by the Idaho National Laboratory Cultural Resource Management Office. They should be commended for preparing a well written, organized, and clear report.

We concur with the recommendation of not eligible to the National Register of Historic Places (National Register) for the following sites and isolates:

INL-09-04-01, INL-12-04-08, INL-95-52-07, 10BT1038, 10BT942, 10BT943, 10BT944,10BT945, 10BT946, 10BT947, 10BT948, 10BT949, 10BT964, INL-11-01-02, INL-11-01-03, INL-12-04-07, INL-12-04-12, INL-91-12-01, INL-91-12-02, INL-91-12-03, INL-95-52-06, INL-91-12-04, 10BT1379, 10BT935, 10BT936, 10BT938, 10BT939, 10BT965, INL-11-01-04, INL-12-04-01, INL-12-04-02, INL-12-04-03, INL-12-04-04, INL-12-04-05, INL-12-04-09, INL-91-12-05

We concur that the National Register eligibilities of the following sites are undetermined and agree that the prehistoric archaeological sites should be tested and that research should be conducted on the historic sites and modern cairn to determine eligibility:

10BT933, 10BT934, 10BT937, 10BT941, INL-11-01-01, INL-95-52-09, INL-95-52-10, 10BT1037, 10BT951, INL-12-04-06

We do not concur with the recommendation that the following sites are not eligible for the National Register. We recommend that these sites be tested to determine their eligibilities:

10BT940, 10BT950, INL-12-04-10, INL-12-04-11, INL-95-52-08

We concur with the recommendation that the No Action Alternative will have "No Adverse Effect" on *Historic Properties* if no new developments are proposed and no major external structural changers or demolition of existing building or structures are planned.

We concur with the recommendation of "No Adverse Effect" to *Historic Properties* for the Overhaul Alternative or the New Facility Location Alternative (3/4 or 6) if the "Recommendations for Additional Protective Measures" identified in Section 8.3 of the cultural resource report are adopted (36 CFR 800.5.b).

We suggest that funding be provided to analyze the artifacts and cultural material collected during the recordation and evaluation of the sites identified and evaluated during this study. This analysis would provide valuable information on the cultural context of the area and potentially aid in the development of an expedited process for evaluating the National Register eligibilities of sites and potential project effects for future undertakings.

We appreciate your consulting with our office. We would appreciate an additional bound copy of the cultural resources report for our library. Please double check the pagination (resets on page 41) and insure page 97 is included. If you have any questions feel free to contact me at 208-334-3847 x107 or ethan.morton@ishs.idaho.gov.

Sincerely,

Ethan Morton
Compliance Archaeologist

B.3 Tribal Government Consultation

Department of Energy
Washington, DC 20585

June 22, 2011

The Honorable Nathan Small
Chairman Fort Hall Business Council
Shoshone Bannock Tribes
P.O. Box 306
Fort Hall, ID 83203-0306

SUBJECT: Draft Cultural Resources Report for the Environmental Impact Statement for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the Idaho National Laboratory

Dear Chairman Small,

The Department of Energy (DOE) Naval Nuclear Propulsion Program (NNPP) is seeking documented consultation with federally-recognized Indian Tribes ("Tribes") regarding the Draft Cultural Resources Report for the Expended Core Facility (ECF) Recapitalization Environmental Impact Statement (EIS). The proposed project is the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling and Examination at the Idaho National Laboratory (INL).

The Naval Nuclear Propulsion Program (NNPP) proposes to recapitalize the infrastructure for transferring, preparing, examining, and packaging naval spent nuclear fuel and other irradiated materials, to ensure these capabilities are maintained for the vital NNPP mission of supporting the naval nuclear-powered fleet. The recapitalization is expected to be carried out as two projects. The first project would be the Spent Fuel Handling Recapitalization Project; the second project would be the Examination Recapitalization Project. The Spent Fuel Handling Recapitalization Project would ensure that interfaces and exchanges between handling and examination are factored into detailed designs, to ensure that both projects can be carried out in an environmentally responsible and cost effective manner.

The EIS will consider the environmental effects related to siting and construction of new facilities for both of the Recapitalization Projects. The NNPP will evaluate two siting combinations in detail, along with a No-Action Alternative.

- Alternative 1 - Locate the Spent Fuel Handling Recapitalization Project and the Examination Recapitalization Project at the Naval Reactors Facility (NRF) at the INL.
- Alternative 2 - Locate the Spent Fuel Handling Recapitalization Project at the NRF and the Examination Recapitalization Project at the Advanced Test Reactor Complex at the INL.
- No-Action Alternative - Overhaul the ECF. Overhauling includes continuing to repair, maintain, refurbish, and upgrade the ECF as necessary to provide the needed long-term capabilities for transferring, examining, preparing, and packaging naval spent nuclear fuel.

The locations for facility placement will be addressed in the EIS. NNPP proposes to address impacts to environmental resources, to include impacts on cultural resources, such as historic, archaeological, and Native American culturally important sites.

The purpose of this letter is to initiate communication with the Shoshone-Bannock Tribes. The Draft Cultural Resources Report (attached) provides the identified archaeological resources and the approaches recommended to minimize impacts to them. The NNPP is seeking feedback on any additional Native American cultural resources that may be located in the project area.

As identified in the report, additional targeted archaeological reconnaissance is planned for some identified resources. The NNPP would like to complete this reconnaissance in time to incorporate the results into the Draft EIS. Therefore, the reconnaissance is planned for this summer, approximately one month after the transmittal of this letter. The exact dates of these activities will be provided to the Shoshone-Bannock Tribes through the INL Cultural Resource Management Office during regularly scheduled Cultural Resources Working Group (CRWG) meetings, when project information will be provided to tribal representatives and invitations to participate in the additional cultural resource investigations will be extended.

We intend to use the EIS process to comply with Section 106 of the National Historic Preservation Act of 1966. After assessing information you provide, we will determine any additional actions that are necessary to comply with the Section 106 consultation process. If you have any questions or comments, or need additional information, please contact Alan Denko at 202-781-6214.

Sincerely,

Alan Denko

Alan Denko
Naval Reactors

Attachment (I) INL/EXT-10-20650 dated June 2011. Cultural Resource Investigations for Potential Naval Reactors Spent Fuel Handling and Examination Facilities at the Idaho National Laboratory - Draft.

cc:
Ms. Caroline Smith, Shoshone-Bannock Tribe Heritage Tribal Office
Brenda Pace, BEA Cultural Resource Management

DEPARTMENT OF ENERGY
NAVAL REACTORS
IDAHO BRANCH OFFICE
POST OFFICE BOX 2469
IDAHO FALLS, IDAHO 83403-2469

NR:IBO-13/068
April 30, 2013

The Honorable Nathan Small
Chairman Fort Hall Business Council
Shoshone-Bannock Tribes
P.O. Box 306
Fort Hall, ID 83203-0306

SUBJECT: CULTURAL RESOURCE INVESTIGATIONS FOR THE RECAPITALIZATION OF INFRASTRUCTURE SUPPORTING NAVAL SPENT NUCLEAR FUEL HANDLING AT THE NAVAL REACTORS FACILITY ON THE IDAHO NATIONAL LABORATORY

Dear Chairman Small,

The Department of Energy (DOE) Naval Nuclear Propulsion Program (NNPP) is seeking documented consultation with the Shoshone-Bannock federally recognized Indian Tribes ("Tribes") regarding the cultural resource investigations for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling Environmental Impact Statement (EIS).

Introduction and Project Description

The NNPP proposes to recapitalize the infrastructure for transferring, preparing, examining, and packaging naval spent nuclear fuel and other irradiated materials, to ensure these capabilities are maintained for the vital NNPP mission of supporting the naval nuclear-powered fleet. The recapitalization will be carried out as two projects.

The NNPP was initially pursuing the two recapitalization projects in the same time frame; however, since the initiation of the NEPA process, the project schedules have changed such that planning for spent fuel handling recapitalization has progressed further than planning for examination recapitalization. Preparing one EIS that includes both recapitalization projects would require decisions about examination recapitalization too early in the design process, prior to having sufficient information to fully analyze the environmental impacts. Additionally, funding uncertainties have made the timing of examination recapitalization speculative in nature. To ensure an EIS is completed in support of the Navy's need for spent fuel handling recapitalization, it was necessary to reduce the scope of the EIS to cover just that proposed action.

Honorable Nathan Small,
Shoshone Bannock Tribes

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Page 2

The EIS will consider the environmental effects related to the proposed action. The alternatives being evaluated have been revised to remove aspects related to examination recapitalization and to address public comments received during initial EIS scoping. The NNPP will evaluate a No Action Alternative, an Overhaul Alternative, and a New Facility Alternative:

- No-Action Alternative – Maintain the spent fuel handling capabilities of the Expended Core Facility (ECF) by continuing to use the current ECF infrastructure while performing corrective maintenance and repairs necessary to keep the infrastructure in good working order (i.e., actions sufficient to sustain the proper functioning of structures, systems, and components).

- Overhaul Alternative – Overhaul the spent fuel handling capabilities of the ECF at Naval Reactors Facility (NRF) by implementing major infrastructure and water pool refurbishment projects while performing corrective maintenance and repair actions as necessary.

- New Facility Alternative – Construct and operate a new facility for spent fuel handling capabilities at one of two potential locations at NRF on the Idaho National Laboratory (INL).

The locations for facility placement will be addressed in the EIS.

Cultural Resource Surveys and Investigations

The NNPP proposes to address impacts to environmental resources including impacts on cultural resources, such as historic, archaeological, and Native American culturally important sites. To support the impact evaluation, the NNPP worked with the INL Contractor, Battelle Energy Alliance (BEA) to conduct cultural resource surveys in the potential areas of disturbance. Based on these surveys, additional investigations were completed as applicable to make determinations about eligibility for listing on the National Register of Historic Places. These surveys and additional investigations were conducted in two phases based on changing project information. Over the course of the investigations, tribal representatives from the Heritage Tribal Office (HeTO) toured all of the archaeological sites scheduled for data recovery and provided valuable hands-on assistance during mapping and test excavations.

In June 2011, the NNPP transmitted the first survey report and notified you of the plan to do additional investigations. This letter transmits a second report including the results of the second phase of surveys and all the additional investigations at the potentially significant prehistoric sites located in areas potentially affected by the proposed action. As identified in the report, the purpose of the investigations was to identify cultural resources and assess the eligibility of the archaeological sites for nomination to the National Register by determining if additional buried cultural materials were present and of any value to future research in the region.

Honorable Nathan Small,
Shoshone Bannock Tribes

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April 30, 2013
Page 3

The attached report is marked Official Use Only to ensure that the NNPP does not release or allow the release of any information pertaining to the exact location of any archaeological sites to the public. The attached report shall be maintained in a manner which prevents release to unauthorized individuals.

The survey area that encompasses the areas of potential effects associated with the proposed action contains 51 archaeological resources - 21 prehistoric isolate locations, two historic isolate locations, 22 prehistoric sites, two historic sites associated with Euro American settlement, three historic resources associated with World War II and the post-war period, and one modern rock cairn.

The isolate locations are unlikely to yield additional information and have been evaluated as ineligible for nomination to the National Register (list is provided in Section 7.4 of the enclosed report). Seven sparse scatters of prehistoric artifacts that appear to be restricted to a shallow surface zone are also evaluated as ineligible for nomination to the National Register (see Section 7.4 of the enclosed report).

Seven prehistoric sites, the two historic sites representing Euro American settlement, the two historic resources and a historic road associated with the Arco Naval Proving Ground during World War II and the post-war period, and the modern cairn exhibit some potential for yielding additional information and were evaluated as potentially eligible for nomination, pending additional data recovery and research (see Section 7.4 of the enclosed report). These sites would be outside of the area of potential effect for the proposed action and would be avoided during construction of the proposed project.

Test excavations reported in Section 7.2 of the enclosed report demonstrate that eight of the prehistoric archaeological sites are unlikely to yield any additional information beyond that which has been collected during the intensive data recovery reported and the surveys that preceded this work. Further excavation is not merited and would not contribute to the study of regional prehistory or INL-specific research domains. Based on the testing results, all eight of the sites are evaluated as ineligible for nomination to the National Register.

INL lands are included within the aboriginal homeland of the Shoshone-Bannock Tribes. Although no Native American cultural resources have been specifically identified within the areas potentially impacted by the proposed action, representatives from the Shoshone-Bannock Tribes HeTO have indicated that prehistoric archaeological sites, native plants and animals, water, and other natural landscape features across the INL area continue to fill important roles in tribal heritage and ongoing cultural traditions. The EIS will address these tribal concerns.

Conclusions from Cultural Resource Surveys and Investigations

The area of potential effect for cultural resources associated with the Overhaul Alternative includes approximately 47 acres to the north and northeast of the existing NRF perimeter. Proposed project developments are limited to a new security boundary

system in this area. No archaeological resources are located in the Overhaul Alternative area of potential effect. The archaeological investigations support a finding of no effects to historic properties and no adverse impacts to known resources of cultural significance for the Overhaul Alternative.

All of the archaeological resources identified within the New Facility Alternative Location 3/4 area of potential effect are evaluated as ineligible for nomination to the National Register due to limited research potential and lack of integrity. These evaluations are supported by test excavations completed at six of the identified archaeological sites. The seventh archaeological site was not visible on the current landscape during recent surveys and appears to have been originally restricted to a shallow surface zone that has been subject to widespread changes as a result of erosion, freeze-thaw action, bioturbation, and modern activities. The short segment of West Monument Road that passes through the temporary disturbance area for the New Facility Alternative Location 3/4 is highly modified for current activities at NRF and is evaluated as ineligible for nomination to the National Register. Unmodified segments of the road are well-preserved to the northeast of the temporary disturbance area of the proposed action. The remaining resources are isolate locations that have been collected for permanent curation and possible future study. The archaeological investigations support a finding of no adverse effects to historic properties and no adverse impacts to any known resources of cultural significance for the New Facility Alternative Location 3/4.

All of the archaeological resources identified within the New Facility Alternative Location 6 area of potential effect are evaluated as ineligible for nomination to the National Register due to limited research potential and lack of integrity. These evaluations are supported by test excavations completed at one of the identified archaeological sites. The remaining resources are isolate locations that have been collected for permanent curation and possible future study. The archaeological investigations support a finding of no adverse effects to historic properties and no adverse impacts to known resources of cultural significance for the New Facility Alternative Location 6.

Although direct impacts are unlikely, there is potential for undesirable indirect effects to cultural resources that are located just outside the areas of potential effect. Since project-related activity, levels are projected to increase significantly during construction and the overall developed footprint of NRF would expand permanently, any archaeological resources or natural resources of potential concern to the Shoshone-Bannock Tribes or others located near the newly developed perimeter could be affected indirectly due to the increased activity in these previously undeveloped areas. In particular, artifacts may be subject to unauthorized collection or impacted by off-road vehicle use and other small ground disturbing activities that commonly occur around developed areas.

Government-to-Government Consultation

Naval Reactors Idaho Branch Office would like to hold a meeting with the Shoshone-Bannock Tribes to discuss any additional information you may have about specific Native American cultural resources and tribally important natural resources at NRF to

Honorable Nathan Small,
Shoshone Bannock Tribes

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April 30, 2013
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ensure we adequately address impacts in the EIS. I will contact the Tribes by June 3, 2013 to schedule the meeting. After assessing the information the Tribes provide at the meeting, we will determine any additional actions that are necessary to comply with the government-to-government consultation process. Please do not hesitate to contact me at 208-533-5969 if you have any questions or comments or need additional information.

Sincerely,

Christopher M. Henvit

C. M. Henvit
Naval Reactors Idaho Branch Office

Enclosure (I) INL/LTD-12-27685 dated April 2013. Cultural Resource Investigations for Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Naval Reactors Facility on the Idaho National Laboratory.

Copy to:
Ms. Carolyn Smith, Heritage Tribal Office (w/o enclosure)
Ms. Susan Pengilly, Deputy State Historic Preservation Officer (w/o enclosure)
Ms. Brenda Pace, BEA Cultural Resource Management (w/o enclosure)
W. Preacher, Tribal DOE Director (w/o enclosure)
R. L. Pence, DOE-ID (w/o enclosure)

DEPARTMENT OF ENERGY
NAVAL REACTORS
IDAHO BRANCH OFFICE
POST OFFICE BOX 2469
IDAHO FALLS, IDAHO 83403-2469

NR:IBO-13/069
April 30, 2013

Ms. Carolyn Smith
Heritage Tribal Office
Shoshone-Bannock Tribes
P. O. Box 306
Fort Hall, ID 83203-0306

SUBJECT: CULTURAL RESOURCE INVESTIGATIONS FOR THE RECAPITALIZATION OF INFRASTRUCTURE SUPPORTING NAVAL SPENT NUCLEAR FUEL HANDLING AT THE NAVAL REACTORS FACILITY ON THE IDAHO NATIONAL LABORATORY

Dear Ms. Smith,

The Department of Energy (DOE) Naval Nuclear Propulsion Program (NNPP) is seeking documented consultation with the Shoshone-Bannock federally recognized Indian Tribes ("Tribes") regarding the cultural resource investigations for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling Environmental Impact Statement (EIS).

Introduction and Project Description

The NNPP proposes to recapitalize the infrastructure for transferring, preparing, examining, and packaging naval spent nuclear fuel and other irradiated materials, to ensure these capabilities are maintained for the vital NNPP mission of supporting the naval nuclear-powered fleet. The recapitalization will be carried out as two projects.

The NNPP was initially pursuing the two recapitalization projects in the same time frame; however, since the initiation of the NEPA process, the project schedules have changed such that planning for spent fuel handling recapitalization has progressed further than planning for examination recapitalization. Preparing one EIS that includes both recapitalization projects would require decisions about examination recapitalization too early in the design process, prior to having sufficient information to fully analyze the environmental impacts. Additionally, funding uncertainties have made the timing of examination recapitalization speculative in nature. To ensure an EIS is completed in support of the Navy's need for spent fuel handling recapitalization, it was necessary to reduce the scope of the EIS to cover just that proposed action.

Carolyn Smith,
Heritage Tribal Office

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April 30, 2013
Page 2

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The locations for facility placement will be addressed in the EIS.

Cultural Resource Surveys and Investigations

The NNPP proposes to address impacts to environmental resources including impacts on cultural resources, such as historic, archaeological, and Native American culturally important sites. To support the impact evaluation, the NNPP worked with the INL Contractor, Battelle Energy Alliance (BEA) to conduct cultural resource surveys in the potential areas of disturbance. Based on these surveys, additional investigations were completed as applicable to make determinations about eligibility for listing on the National Register of Historic Places. These surveys and additional investigations were conducted in two phases based on changing project information. Over the course of the investigations, tribal representatives from the Heritage Tribal Office (HeTO) toured all of the archaeological sites scheduled for data recovery and provided valuable hands-on assistance during mapping and test excavations.

In June 2011, the NNPP transmitted the first survey report and notified you of the plan to do additional investigations. This letter transmits a second report including the results of the second phase of surveys and all the additional investigations at the potentially significant prehistoric sites located in areas potentially impacted by the proposed action. As identified in the report, the purpose of the investigations was to identify cultural resources and assess the eligibility of the archaeological sites for nomination to the National Register by determining if additional buried cultural materials were present and of any value to future research in the region.

Carolyn Smith,
Heritage Tribal Office

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April 30, 2013
Page 3

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Test excavations reported in Section 7.2 of the enclosed report demonstrate that eight of the prehistoric archaeological sites are unlikely to yield any additional information beyond that which has been collected during the intensive data recovery reported and the surveys that preceded this work. Further excavation is not merited and would not contribute to the study of regional prehistory or INL-specific research domains. On the basis of the testing results, all eight of the sites are evaluated as ineligible for nomination to the National Register.

INL lands are included within the aboriginal homeland of the Shoshone-Bannock Tribes. Although no Native American cultural resources have been specifically identified within the areas potentially impacted by the proposed action, representatives from the Shoshone-Bannock Tribes HeTO have indicated that prehistoric archaeological sites, native plants and animals, water, and other natural landscape features across the INL area continue to fill important roles in tribal heritage and ongoing cultural traditions. The EIS will address these tribal concerns.

<u>Conclusions from Cultural Resource Surveys and Investigations</u>

The area of potential effect for cultural resources associated with the Overhaul Alternative includes approximately 47 acres to the north and northeast of the existing NRF perimeter. Proposed project developments are limited to a new security boundary

system in this area. No archaeological resources are located in the Overhaul Alternative area of potential effect. The archaeological investigations support a finding of no effects to historic properties and no adverse impacts to known resources of cultural significance for the Overhaul Alternative.

All of the archaeological resources identified within the New Facility Alternative Location 3/4 area of potential effect are evaluated as ineligible for nomination to the National Register due to limited research potential and lack of integrity. These evaluations are supported by test excavations completed at six of the identified archaeological sites. The seventh archaeological site was not visible on the current landscape during recent surveys and appears to have been originally restricted to a shallow surface zone that has been subject to widespread changes as a result of erosion, freeze-thaw action, bioturbation, and modern activities. The short segment of West Monument Road that passes through the temporary disturbance area for the New Facility Alternative Location 3/4 is highly modified for current activities at NRF and is evaluated as ineligible for nomination to the National Register. Unmodified segments of the road are well preserved to the northeast of the temporary disturbance area of the proposed action. The remaining resources are isolate locations that have been collected for permanent curation and possible future study. The archaeological investigations support a finding of no adverse effects to historic properties and no adverse impacts to any known resources of cultural significance for the New Facility Alternative Location 3/4.

All of the archaeological resources identified within the New Facility Alternative Location 6 area of potential effect are evaluated as ineligible for nomination to the National Register due to limited research potential and lack of integrity. These evaluations are supported by test excavations completed at one of the identified archaeological sites. The remaining resources are isolate locations that have been collected for permanent curation and possible future study. The archaeological investigations support a finding of no adverse effects to historic properties and no adverse impacts to known resources of cultural significance for the New Facility Alternative Location 6.

Although direct impacts are unlikely, there is potential for undesirable indirect effects to cultural resources that are located just outside the areas of potential effect. Since project-related activity levels are projected to increase significantly during construction and the overall developed footprint of NRF would expand permanently, any archaeological resources or natural resources of potential concern to the Shoshone-Bannock Tribes or others located near the newly developed perimeter could be affected indirectly due to the increased activity in these previously undeveloped areas. In particular, artifacts may be subject to unauthorized collection or impacted by off-road vehicle use and other small ground disturbing activities that commonly occur around developed areas.

Government-to-Government Consultation

Naval Reactors Idaho Branch Office would like to hold a meeting with the Shoshone-Bannock Tribes to discuss any additional information you may have about specific

Carolyn Smith,
Heritage Tribal Office

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April 30, 2013
Page 5

Native American cultural resources and tribally important natural resources at NRF to ensure we adequately address impacts in the EIS. I will contact you by June 3, 2013 to schedule the meeting. After assessing the information you provide at the meeting, we will determine any additional actions that are necessary to comply with the government-to-government consultation process. Please do not hesitate to contact me at 208-533-5969 if you have any questions or comments or need additional information.

Sincerely,

Christopher M. Henvit

C. M. Henvit
Naval Reactors Idaho Branch Office

Enclosure (I) INL/LTD-12-27685 dated April 2013. Cultural Resource Investigations for Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Naval Reactors Facility on the Idaho National Laboratory.

Copy to:
The Honorable Nathan Small, Chairman, Fort Hall Business Council (w/o enclosure)
Ms. Susan Pengilly, Deputy State Historic Preservation Officer (w/o enclosure)
Ms. Brenda Pace, BEA Cultural Resource Management (w/o enclosure)
W. Preacher, Tribal DOE Director (w/o enclosure)
R. L. Pence, DOE-ID (w/o enclosure)

DEPARTMENT OF ENERGY
NAVAL REACTORS
IDAHO BRANCH OFFICE
POST OFFICE BOX 2469
IDAHO FALLS, IDAHO 83403-2469

NR:IBO-14/006
June 9, 2014

The Honorable Nathan Small
Chairman Fort Hall Business Council
Shoshone-Bannock Tribes
P.O. Box 306
Fort Hall, ID 83203-0306

SUBJECT: CULTURAL RESOURCE INVESTIGATIONS FOR THE RECAPITALIZATION OF INFRASTRUCTURE SUPPORTING NAVAL SPENT NUCLEAR FUEL HANDLING AT THE NAVAL REACTORS FACILITY ON THE IDAHO NATIONAL LABORATORY

Dear Chairman Small,

On Wednesday, October 2, 2013, I met with you and other members of the Fort Hall Business Council. The purpose of the meeting was to consult with the Shoshone-Bannock federally recognized Indian Tribes regarding cultural resource investigations for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling Environmental Impact Statement (EIS). A summary of the background and discussion is provided in enclosure 1.

During technical consultation with the Shoshone-Bannock Heritage Tribal Office, the Naval Nuclear Propulsion Program (NNPP) agreed that the New Facility Alternative proposed in the EIS would have small unavoidable impacts to Native American cultural resources and committed to document the impact in the Draft EIS. The NNPP would like to obtain FHBC's endorsement of the conclusions reached by the Shoshone-Bannock Heritage Tribal Office and agreement that government-to-government consultation is complete.

As agreed to with the Fort Hall Business Council, the following NNPP actions will be tracked to completion:

1. For the New Facility Alternative, the NNPP will implement the additional protective measures, identified in Section 8.3 of the 2013 Cultural Resources Investigations Report, including conducting cultural resource sensitivity training for personnel to discourage unauthorized artifact collection, off-road vehicle use, and other activities that may affect cultural resources.

The Honorable Nathan Small,
Shoshone-Bannock Tribes

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Page 2

2. The NNPP will work with DOE-ID to reach a collaborative means to satisfy NNPP's commitment to set up a path forward or means to prepare or train successors to staff the Tribal Department of Energy Office. NNPP proposes to set a follow on meeting with the Fort Hall Business Council to discuss alternative options to do this.

Please do not hesitate to contact me at 208-533-5969 if you have any questions or comments.

Sincerely,

Christopher M. Henvit

C. M. Henvit
Naval Reactors Idaho Branch Office

Enclosure (1) Meeting Minutes from October 2, 2013 meeting with the Fort Hall Business Council, "Cultural Resource Investigations for Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Naval Reactors Facility on the Idaho National Laboratory"

Copy to:
Ms. Carolyn Smith, Heritage Tribal Office
Mr. Willie Preacher, Tribal DOE Director
Ms. Brenda Pace, BEA Cultural Resource Management
R. B. Provencher, DOE-ID
R. V. Furstenau, DOE-ID
J. R. Cooper, DOE-ID
R. L. Pence, DOE-ID

Enclosure 1 to NR:IBO-14/006

Cultural Resource Investigations for Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Naval Reactors Facility on the Idaho National Laboratory
Shoshone-Bannock Fort Hall Business Council
Wednesday, October 2, 2013
9:00 a.m.

Purpose

To document consultation with the Shoshone-Bannock federally recognized Indian Tribes regarding cultural resource investigations for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling Environmental Impact Statement (EIS).

Background

The Naval Nuclear Propulsion Program (NNPP) is responsible for all aspects of U.S. Navy nuclear power and propulsion. These responsibilities include design, maintenance, and safe operation of nuclear propulsion systems throughout their operational life cycles. A crucial component of this mission, naval spent nuclear fuel handling, occurs at the end of a nuclear propulsion system's useful life. After the naval spent nuclear fuel has been removed from an aircraft carrier or submarine, NNPP spent fuel handling includes the subsequent transfer, preparation, and packaging required for dry storage.

Since 1957, naval spent nuclear fuel removed from naval reactors at shipyards or prototype and training sites has been transported via rail in specially designed shipping containers to the Naval Reactors Facility (NRF) at the Idaho National Laboratory (INL). The shipping containers are staged on rail sidings located inside the developed area of NRF, then transferred to the Expended Core Facility (ECF). Access to the ECF for these large shipping containers is provided by large roll-up doors. The naval spent nuclear fuel is removed from the shipping containers and placed into a water pool at the ECF, where it is stored in temporary storage ports.

Proposed Action

The NNPP is proposing to recapitalize the current naval spent nuclear fuel handling capabilities provided by ECF. Action is needed because the ECF infrastructure as currently configured cannot support the use of the new M-290 shipping containers. M-290 shipping containers will be used instead of M-140 shipping containers for aircraft carrier fuel. The use of the new M-290 shipping containers will eliminate disassembly work at the shipyards resulting in the shipment of longer naval spent nuclear fuel to ECF. M-290 shipping containers cannot be unloaded into ECF without major infrastructure changes.

Enclosure 1 to NR:IBO-14/006

Additionally, the ECF infrastructure is reaching the end of its useful life. The maintenance and repair burden necessary to maintain ECF for long-term operation is increasing. Age-related deterioration of structures, systems, and components and outdated infrastructure designs present a challenge to the continuity of ongoing ECF spent fuel handling operations.

Safe and environmentally responsible naval spent nuclear fuel handling capabilities are required until as least 2060. Based on the life-cycle of current and new designs and planned construction of aircraft carriers and submarines, the ability to perform naval spent nuclear fuel handling will be required into the foreseeable future. For example, next-generation aircraft carriers have a ship life of approximately 50 years and the next scheduled aircraft carrier delivery is 2015.

Alternatives

The No Action Alternative would result in the continued use of the current ECF infrastructure and would include performing corrective maintenance and repairs as needed to keep the infrastructure in safe working order. Under the No Action Alternative, the NNPP would sustain the proper functioning of structures, systems, and components; however, the No Action Alternative does not provide the needed long-term capabilities for transferring, preparing, and packaging naval spent nuclear fuel.

The Overhaul Alternative would result in the recapitalization of the naval spent nuclear fuel handling capabilities of the ECF by overhauling the ECF with major infrastructure and water pool refurbishment projects. The Overhaul Alternative would provide the needed long-term capabilities for transferring, preparing, and packaging naval spent nuclear fuel.

Under the New Facility Alternative, the NNPP would construct and operate a new facility for naval spent nuclear fuel handling capabilities at one of two potential locations at NRF. Some additional areas (e.g., laydown, batch plant, craft parking, stockpile) would only be temporarily disturbed and would be revegetated with native species.

Cultural Resource Investigations

Cultural resource investigations were completed by INL's Cultural Resource Management Office. The surveys and investigations were completed between 2011 and 2013. Brenda Pace was the principal investigator and she directed the field work, analyses, and report preparation.

The Shoshone-Bannock Tribe's Heritage Tribal Office (LaRae Bill, Romelia Martinez, and Carolyn Smith) provided assistance during the field work conducted by the INL Cultural Resource Management Office. The Heritage Tribal Office was comfortable with the NNPP choice to use Brenda Pace to conduct the investigations because they are familiar with her and her team.

Enclosure 1 to NR:IBO-14/006

The 2011 Cultural Resource Survey Report was transmitted to the Fort Hall Business Council on June 22, 2011. The cultural resource surveys that were conducted at NRF in 2011 were documented in this report. The report recommendation was to conduct test excavations on the cultural resource sites that could be potentially eligible for the National Register of Historic Places to determine eligibility.

The 2013 Cultural Resource Investigations Report is based on additional survey work and test excavations that were conducted by the INL Cultural Resource Management Office. NNPP transmitted the report to the Fort Hall Business Council, the Heritage Tribal Office, and the State Historic Preservation Office on April 30, 2013.

There were no archaeological resources located in the Overhaul Alternative disturbance area. The investigations support a finding of no adverse effects to historic properties and a finding of no adverse impacts to known resources of cultural significance.

The survey area that encompasses the two potential disturbance areas of the New Facility Alternative contains 51 archaeological resources. These resources include: 21 prehistoric isolate locations; 2 historic isolate locations; 22 prehistoric sites; 2 historic sites associated with Euro American settlement; 3 historic resources associated with World War II and the post-war period; and 1 modern rock cairn. The investigations support a finding of no adverse effects to historic properties and a finding of no adverse impacts to known resources of cultural significance.

State Historic Preservation Officer (SHPO) Response

NNPP received a response to the Cultural Resource Investigations report from the Idaho State Historic Preservation Officer (SHPO) on June 4, 2013. The response from the SHPO included concurrence on the NNPP finding of no adverse effect to historic properties and no adverse impacts to any known resources of cultural significance for the No Action Alternative. The SHPO also concurred on the finding of no adverse effect to historic properties and no adverse impacts to any known resources of cultural significance for the Overhaul Alternative and the New Facility Alternative if the recommendations for additional protective measures, identified in Section 8.3 of the 2013 Cultural Resources Investigations Report are adopted. Specifics of these recommendations were discussed, including the details regarding the recommendation to minimize disturbance to plant species important to the Shoshone-Bannock Tribes by implementation of good housekeeping practices, and/or revegetation of disturbed areas with native plant species, and the possible implementation of seasonal and time of day restrictions on ground disturbance to minimize disturbance to wildlife species.

The NNPP is planning to revegetate disturbed areas with native plant species. The NNPP is also planning to implement good housekeeping practices during construction. The NNPP discussed the need for seasonal and time-of-day restrictions on ground disturbance. These restrictions would only be implemented to protect the greater sage-grouse. The NNPP considers the Candidate Conservation Agreement (CCA) being developed by DOE-ID with the USFWS to be the appropriate document to follow

Enclosure 1 to NR:IBO-14/006

regarding the protection of the greater sage-grouse. The CCA, as currently written, would not require seasonal or time-of-day restrictions on ground disturbance for the proposed action because the disturbances are not within 1 kilometer of a breeding habitat or lek. Therefore, the NNPP does not plan to implement any seasonal or time-of-day restrictions on ground disturbance.

Heritage Tribal Office Response

The NNPP met with members of the Director, Tribal Department of Energy Program (Willie Preacher) and the Heritage Tribal Office Cultural Resources Coordinator (Carolyn Smith) on Thursday, June 13, 2013 to identify and assess Native American cultural resources and concerns. The meeting participants discussed the historical record described in the INL Cultural Resources Management Plan, which supports the conclusion that the INL site, including the proposed disturbance areas, is located within a large original territory of the Shoshone-Bannock people and archaeological and other cultural resources that reflect the importance of the area to the Tribes are located there. NNPP agreed that the proposed recapitalization of infrastructure supporting naval spent nuclear fuel handling at NRF on INL would have small unavoidable impacts to Native American cultural resources (small archaeological sites and ecological resources) identified in the survey areas for the New Facility Alternative, and agreed to document the impact in the Draft EIS. Willie Preacher and Carolyn Smith indicated their general support for the project. The discussion, agreements and actions were documented in meeting minutes signed by Chairman Small, Willie Preacher, Carolyn Smith and NNPP (Christopher Henvit).

Discussion

When discussing the current state of the ECF infrastructure and the significant maintenance that is currently required, the Fort Hall Business Council asked if the water pool at ECF was cracked and whether the water pool was leaking to the environment. NNPP responded that similar to other INL sites, NRF periodically samples groundwater to assess the affect of NRF operations on human health and the environment and provides the sample results to the Environmental Protection Agency and the Idaho Department of Environmental Quality in accordance with a Federal Facility Agreement/Consent Order. The sample results continue to demonstrate that operations at NRF are protective of human health and the environment. In addition, NRF closely compares water additions to the water pool with known evaporation rates to provide an indicator for detecting a leak to the environment between sampling events.

The concerns regarding the aging infrastructure that were discussed during the meeting highlight why the NNPP wants to recapitalize the facility. The maintenance will continue to be costly if the NNPP continues to use a facility that is over 50 years old.

During the discussion of the work that is done at ECF, it was mentioned that Carolyn Smith of the Heritage Tribal Office and Willie Preacher, Tribal DOE Program Director were able to tour the facility to gain a better understanding of the operations conducted

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in ECF. These tours were conducted on September 13, 2013. The Fort Hall Business Council also expressed interest in a tour of the facility. Naval Reactors, Idaho Branch Office will work with the Fort Hall Business Council if they would like to schedule an unclassified tour of ECF.

During the discussion of the M-290 shipping containers, the Fort Hall Business Council asked if the bigger M-290 shipping containers meant that more high level waste will be shipped into Idaho. A clarification was provided that the naval spent nuclear fuel being shipped to Idaho is only from the Navy and only from aircraft carriers and submarines, there is no commercial fuel being shipped with it. In addition, the Navy has a limit on the amount of spent fuel that can be shipped that is based on the agreements with the State of Idaho and the Shoshone-Bannock Tribes. The amounts of spent fuel planned to be shipped are consistent with these agreements.

The Fort Hall Business Council also asked if the M-290 shipping containers would have more naval spent nuclear fuel since it is a bigger container. The Fort Hall Business Council had concerns that the consequences of an accident would elevate since the M-290 shipping containers are bigger than the M-140 shipping containers. The clarification was provided that the bigger M-290 shipping containers would not contain more naval spent nuclear fuel. Rather, the shipping container would transport aircraft carrier spent nuclear fuel assemblies without prior disassembly. In addition, naval spent nuclear fuel is always sealed within the container, which prevents radioactive contamination from entering the environment. Shielding from radiation allows workers to be stationed in close proximity while performing naval spent fuel handling operations. There are controls in place to ensure that the work performed during these operations is in accordance with the procedures. The Fort Hall Business Council inquired about who handles these operations at ECF. Bechtel Marine Propulsion Corporation (BMPC), Naval Reactor's Prime Contractor handles the operations at ECF, and the BMPC workforce is highly trained and skilled for these operations.

During the discussion of the M-290 shipping containers, the Fort Hall Business Council asked why the NNPP is using the M-290 shipping containers and inquired about the timeframe of a geological repository. The NNPP plans to use the M-290 for two purposes. The first purpose is to transport naval spent nuclear fuel from aircraft carriers without prior disassembly of the non-fuel structural components from the naval spent nuclear fuel assemblies. Elimination of this disassembly operation at the shipyard results in more efficient shipyard defueling and refueling operations, which are necessary to meet the current refueling schedules for the fleet in support of national defense. M-290 shipping containers would also be used to ship canisters of processed naval spent nuclear fuel to an interim storage facility or a geological repository. The current timeframe projected for a repository to be available if Yucca Mountain is not licensed is 2048

The Fort Hall Business Council asked where the M-290 shipping containers would go if the No Action Alternative was selected. The No Action Alternative does not meet NNPP's need because it would not provide the infrastructure necessary to support the

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naval nuclear reactor defueling and refueling schedules required to meet the operational needs of the U.S. Navy. Additionally, the No Action Alternative does not meet the NNPP's need because the ECF infrastructure as currently configured cannot support use of the new M-290 shipping containers and the ECF infrastructure is reaching the end of its useful life. For added clarity, the National Environment Policy Act which governs the preparation of environmental impact statements requires the government to define and analyze a No Action Alternative to look at the impacts of doing nothing. The real choice here is building a new up-to-date facility or refurbishing and maintaining the existing facility.

During the discussion, the Fort Hall Business Council questioned what the "CSRF" was. CSRF stands for the Cask Shipping and Receiving Facility and it will support the use of the new, longer M-290 shipping containers. The CSRF will unload canisters of unprocessed fuel from the M-290 shipping containers, load canisters of processed naval spent nuclear fuel into the M-290 shipping containers, and prepare the M-290 shipping containers for return empty to a shipyard or for shipment to an interim storage facility or a geologic repository. The CSRF is currently being constructed to the east of ECF. CSRF construction was covered in the Addendum to the Environmental Assessment for the Use of a More Efficient Shipping Container System for Spent Nuclear Fuel from Naval Aircraft Carriers, dated October 2009. The Addendum to the Environmental Assessment was sent to the Shoshone-Bannock Tribes.

During discussion of the New Facility Alternative, the Fort Hall Business Council asked who will decide where the proposed facility would go. The Environmental Impact Statement (EIS) is a detailed environmental analysis for the proposed action that will assist in decision-making and will describe the positive and negative environmental effects of the proposed action and alternatives. The EIS shows the NNPP what the impacts will be. The NNPP ultimately decides where the facility will go. The EIS process allows all the affected parties the opportunity to provide input for NNPP consideration before that decision is made.

The Fort Hall Business Council asked what would happen to the proposed facility if there were an earthquake. Several accident scenarios are analyzed in the EIS, including a beyond design basis event, like an extremely large earthquake. The proposed facility water pool would be designed to high seismic standards to retain water in the event of a design basis earthquake.

During the discussion of the cultural resource investigations, the Fort Hall Business Council asked what happens to the sites that are not in the proposed disturbance areas. If the sites would not be disturbed, the INL Cultural Resources Management team did not dig in these areas during the investigations. The Business Council also asked if there are possible campsites. The INL Cultural Resources Management representative clarified that most of the sites in the survey area are very small and are representative of hunting activities; the campsites that have been found on INL are closer to the river.

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The Fort Hall Business Council inquired if the NNPP consults with the neighboring communities regarding the proposed facility. In addition to the public meetings already held to receive input on the scope of the EIS, the NNPP plans to hold public meetings to allow the public to submit comments on the Draft EIS. In addition, the Draft EIS will be sent to state and local stakeholders and will be made available for the public to give them the opportunity to provide feedback.

The Fort Hall Business Council expressed their concern regarding cultural sites at the INL. The Business Council would like for the NRF employees and the construction workforce to receive training on the importance of the cultural history at INL. There are limited cultural resources at INL because many have been collected previously or destroyed.

> **Action:** The NNPP will include cultural resource sensitivity training for NRF personnel as part of an all hands annual environmental training to discourage unauthorized artifact collection, off-road vehicle use, and other activities that may impact cultural resources.

In addition, if cultural resources were identified during construction, the construction contractor would implement a Stop Work Procedure to guide the assessment and protection of any unanticipated discoveries of cultural materials during ground disturbing activities in accordance with the INL Cultural Resources Management Plan. Upon discovery of a resource, the following steps would be taken: 1) Stop work in the area the resource is found; 2) Immediately Call the INL Cultural Resources Management Archaeologist and Naval Reactors; 3) Maintain a 30 to 50 meter buffer around the artifact discovered (work can continue outside of the buffer); 4) Cultural Resources Management office will evaluate the significance of the resource and provide a protection plan or initiate the Native American Graves Protection and Repatriation Act within 2 working days of discovery (the Cultural Resource Management office's current practice is to evaluate the resource within 24 hours); 5) Naval Reactors would notify interested parties (to include the SHPO and the Shoshone-Bannock Tribes) and invite these interested parties to participate in the activities associated with the discovery.

The Fort Hall Business Council made a suggestion that a "kiosk" may be displayed at NRF to reinforce the cultural importance and history of the INL. Employees at NRF as well as construction workers for the proposed facility would be able to access the kiosk to learn about the cultural history of the area. The NNPP believes that including cultural resource sensitivity training for NRF personnel as part of annual environmental training to reinforce the cultural importance and of the INL would be more effective than a kiosk that not all employees may look at. Construction workers for the proposed new facility would receive cultural resource sensitivity training that would include the Stop Work Procedure that is discussed above.

The Fort Hall Business Council expressed that they rely heavily on the expertise of their staff, to include the Heritage Tribal Office and the Director of the Tribal Department of Energy Program. The Business Council recognized that the staff provided the NNPP

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with valuable information and guidance in this process. The Business Council discussed their concerns about filling these positions in the future and would like the NNPP to provide two scholarships in the amount of $2000 each to members of the Shoshone-Bannock Tribes. The Business Council expressed that these scholarships would help fill positions and ensure that the staff is fully committed to the interest of the Shoshone-Bannock Tribes.

The NNPP notes the United States Department of Energy funds the Tribal Department of Energy Office through a cooperative agreement with the Shoshone-Bannock Tribes. The NNPP has discussed the Business Council request to provide scholarships to train replacement staff with the Department of Energy Idaho Operations Office (DOE-ID) who agreed to work with the NNPP to assist the Tribes in developing a succession planning program within existing budget constraints.

Action: NNPP proposes to set a follow on meeting with the Fort Hall Business Council to discuss alternative options to train replacement staff for the Tribal Department of Energy Office.

Final Meeting Minutes

Cultural Resource Investigations for Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Naval Reactors Facility on the Idaho National Laboratory
Shoshone-Bannock Heritage Tribal Office
Thursday, June 13, 2013
9:30 a.m.

Participants:

Naval Reactors, Idaho Branch Office
Mr. Christopher Henvit
Mr. Steve Mathis

Bechtel Marine Propulsion Corporation
Ms. Laura Iannacci, Environmental Impact Statement (EIS) Manager
Ms. Christina Yakunich, Cultural Resources Lead

Battelle Energy Alliance / INL Cultural Resources Management
Ms. Brenda Pace, Principal Investigator

Tribal DOE / Heritage Tribal Office
Mr. Willie Preacher
Ms. Carolyn Smith
Ms. Romelia Martinez

Purpose:

Discuss cultural resource investigations performed to support the Draft EIS being prepared for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at the Naval Reactors Facility on the Idaho National Laboratory. Determine the significance of the resources to the Shoshone-Bannock Tribes and obtain the Tribes support for the recapitalization project.

During the meeting, a set of powerpoint slides were reviewed. These powerpoint slides are provided in Enclosure 1. A summary of the background, discussion, agreements, and actions is provided below.

Background

The Naval Nuclear Propulsion Program (NNPP) is responsible for all aspects of U.S. Navy nuclear power and propulsion. These responsibilities include design, maintenance, and safe operation of nuclear propulsion systems throughout their operational life cycles. A crucial component of this mission, naval spent nuclear fuel handling, occurs at the end of a nuclear propulsion system's useful life. After the naval spent nuclear fuel has been removed from an aircraft carrier or submarine, NNPP spent fuel handling includes the subsequent transfer, preparation, and packaging required for dry storage.

Since 1957, naval spent nuclear fuel removed from naval reactors at shipyards or prototype and training sites has been transferred from ships or prototype sites in specially designed shipping containers and transported to at the Naval Reactors Facility (NRF) at the Idaho National Laboratory (INL) via rail. The shipping containers are staged on rail sidings located inside the developed area of NRF, then transferred to Expended Core Facility (ECF). Access to ECF for these large shipping containers is provided by large roll-up doors. The naval spent nuclear fuel is removed from the shipping containers and placed into a water pool at the ECF, where it is stored in temporary storage ports.

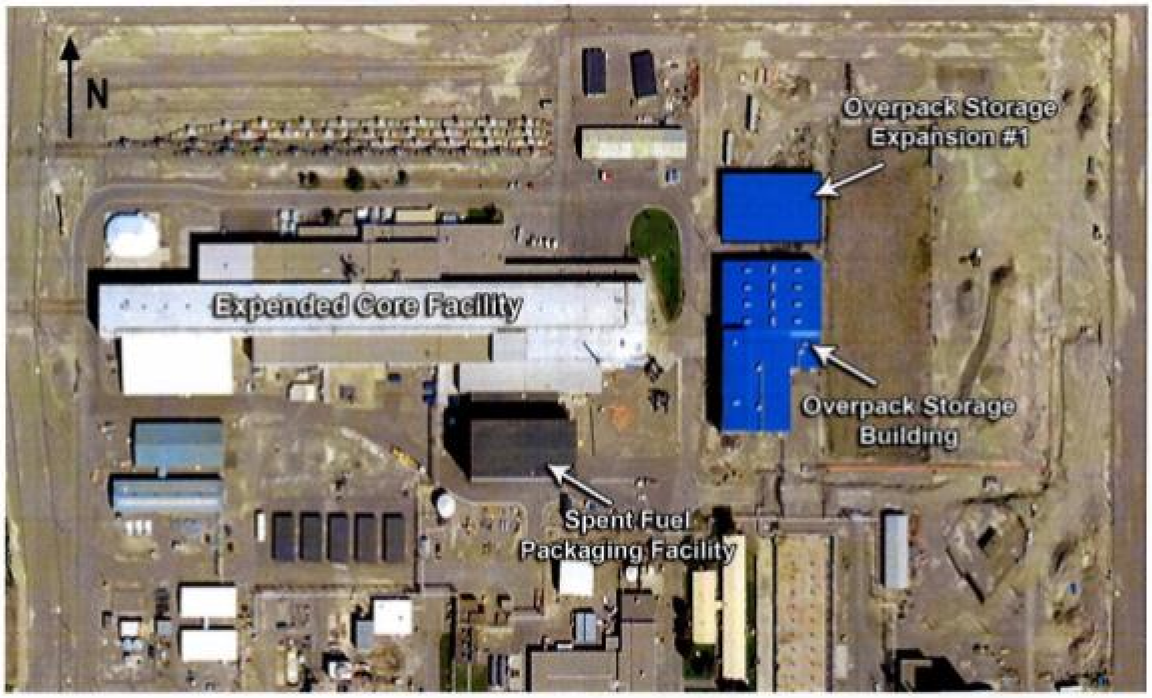

Figure 1: Current ECF and Major Spent Fuel Handling Support Facilities at NRF

Proposed Action

The NNPP is proposing to recapitalize the current naval spent nuclear fuel handling capabilities provided by ECF. The proposed action is needed because the ECF infrastructure as currently configured cannot support the use of the new M-290 shipping containers. M-290 shipping containers will be used instead of M-140 shipping containers for aircraft carrier fuel. The use of the new M-290 shipping containers will eliminate disassembly work at the shipyards resulting in the shipment of longer naval spent nuclear fuel. ECF cannot currently unload the M-290 shipping containers without major infrastructure changes.

The ECF infrastructure is reaching the end of its useful life without significant upgrades. The NNPP has identified that the maintenance and repair burden necessary to sustain ECF as a viable resource for long-term operation is increasing. Age-related deterioration of structures, systems, and components and outdated infrastructure designs present a challenge to the continuity of ongoing ECF spent fuel handling operations.

Safe and environmentally responsible naval spent nuclear fuel handling capabilities are required until as least 2060. Based on the life-cycle of current and new designs and planned construction of aircraft carriers and submarines, the ability to perform naval spent nuclear fuel handling will be required into the foreseeable future. For example, next-generation aircraft carriers have a ship life of approximately 50 years and the next scheduled aircraft carrier is 2015.

Alternatives

The No Action Alternative would maintain the naval spent nuclear fuel handling capabilities of ECF by continuing to use the current ECF infrastructure and performing corrective maintenance and repairs necessary to keep the infrastructure in safe working order. Under the No Action Alternative, the NNPP would sustain the proper functioning of structures, systems, and components; however, the No Action Alternative does not provide the needed long-term capabilities for transferring, preparing, and packaging naval spent nuclear fuel. There would be no land disturbance under the No Action Alternative due to no new construction areas; therefore, there would be no impact to cultural resources.

The Overhaul Alternative would recapitalize the naval spent nuclear fuel handling capabilities of the ECF by overhauling the ECF with major refurbishment projects for the ECF infrastructure and the ECF water pool. The Overhaul Alternative provides the needed long-term capabilities for transferring, preparing, and packaging naval spent nuclear fuel.

Under the New Facility Alternative, the NNPP would construct and operate a new facility for naval spent nuclear fuel handling capabilities at one of two potential locations at NRF on the INL. Location 3/4 is the preferred location because it is in closer proximity to existing facilities. Slide 10 shows the proposed disturbance areas for the New Facility Alternative at Location 3/4. Some areas (e.g., laydown, batch plant, craft parking, stockpile) would only be temporarily disturbed and would be revegetated with native species. Location 6 does not have existing facility assets available for incorporation into the new facility. Slide 11 shows the proposed disturbance areas for the New Facility Alternative at Location 6. Some areas (e.g., laydown, batch plant, craft parking, stockpile) would only be temporarily disturbed and would be revegetated with native species.

Cultural Resource Investigations

Cultural resource investigations were completed by INL's Cultural Resource Management Office. The surveys and investigations were completed between 2011 and 2013. Brenda Pace was the principal investigator and she directed field work, analyses, and report preparation.

The Shoshone-Bannock Tribe's Heritage Tribal Office (LaRae Bill, Romelia Martinez, and Carolyn Smith) provided important assistance during field work conducted by the INL Cultural Resource Management Office. The Heritage Tribal Office was comfortable with the NNPP choice to use Brenda Pace to conduct the investigations because they are familiar with her and her team.

The 2011 Cultural Resource Survey Report was transmitted to the Fort Hall Business Council on June 22, 2011. Cultural resource surveys were conducted at NRF in 2011 and were documented in this report. The report recommendation was to conduct test excavations on the cultural resource sites that could be potentially eligible for the National Register of Historic Places to determine eligibility.

The 2013 Cultural Resource Investigations Report is based on additional survey work and test excavations that were conducted by the INL Cultural Resource Management Office. The report was transmitted to the Shoshone-Bannock Fort Hall Business Council and the Heritage Tribal Office on April 30, 2013.

The survey area (see Slide 14) that encompasses the potential disturbance areas of the proposed action contains 51 archaeological resources (see Slides 16 and 17). These resources include: 21 prehistoric isolate locations; 2 historic isolate locations; 22 prehistoric sites; 2 historic sites associated with Euro American settlement; 3 historic resources associated with World War II and the post-war period; and 1 modern rock cairn.

A cultural resource site is an area of human activity represented by material evidence; evidence of cultural features or more than 10 artifacts within 100 square meters. An isolate location is an area of short-term human activity represented by material evidence; less than 10 artifacts within 100 square meters.

Cultural Resource Investigation Results

Overhaul Alternative

There were no archaeological resources located in the Overhaul Alternative disturbance area. The investigations support a finding of no adverse effects to historic properties and a finding of no adverse impacts to known resources of cultural significance.

New Facility Alternative Location 3/4

There were 18 cultural resources identified at Location 3/4 (see Slide 21), 10 are isolate locations, seven are archaeological sites, and one is a segment of West Monument Road. Test excavations were completed at six of the seven archaeological sites. The seventh site was not visible on the current landscape during recent surveys. The archaeological sites and isolate locations are evaluated as ineligible for nomination to the National Register of Historic Places due to the limited research potential and lack of integrity. The segment of West Monument Road in Location 3/4 was evaluated as ineligible for nomination to the National Register because the segment that passes through the disturbance area is highly modified. The investigations support a finding of no adverse effects to historic properties and a finding of no adverse impacts to known resources of cultural significance.

New Facility Alternative Location 6

There were four cultural resources identified at Location 6 (see Slide 23), three are isolate locations and one is an archaeological site. Test excavations were completed at the archaeological site. All resources are evaluated as ineligible for nomination to the National Register due to limited research potential and lack of integrity. The investigations support a finding of no adverse effects to historic properties and a finding of no adverse impacts to known resources of cultural significance.

Discussion:

When discussing shipments of naval spent nuclear fuel to NRF, the Heritage Tribal Office asked if reactor compartments were also shipped to NRF. A clarification was provided that the naval spent nuclear fuel shipments do not include reactor compartments. Reactor compartments are shipped by barge to Hanford. There is no connection between reactor compartment shipments and naval spent nuclear fuel shipments.

During the discussion of the M-290 shipping containers, the Heritage Tribal Office asked why the NNPP is using the M-290 shipping containers and inquired about the timeframe of a geological repository. The NNPP plans to use the M-290 for two purposes. The first purpose is to transport naval spent nuclear fuel from aircraft carriers without prior disassembly of the non-fuel structural components from the naval spent nuclear fuel assemblies. Elimination of this disassembly operation at the shipyard results in more efficient defueling and refueling operations, which are necessary to meet the current refueling schedules for the fleet in support of national defense. M-290 shipping containers would also be used to ship canisters of processed naval spent nuclear fuel to an interim storage facility or a geological repository. 2048 is the earliest date advertised for availability of a geological repository.

While discussing the new M-290 shipping containers that will be used to ship naval spent nuclear fuel, the Heritage Tribal Office asked for pictures of the M-290 shipping container and the M-140 shipping container.

> **Action**: NNPP will provide pictures of M-140 and M-290 shipping containers. Figure 2 shows M-140 shipping container, Figure 3 shows M-290 shipping container.

Figure 2: M-140 Shipping Container

Figure 3: M-290 Shipping Container

During the discussion of what work is done at ECF, Carolyn Smith of the Heritage Tribal Office expressed interest in taking a tour of ECF. She explained that it would be beneficial for the Shoshone-Bannock Tribes to have a better understanding of the operations conducted in ECF.

Action: Naval Reactors, Idaho Branch Office will work with the Shoshone-Bannock Heritage Tribal Office to schedule an unclassified tour of ECF.

During the discussion of Slide 24, the Heritage Tribal Office could not agree with the statements that no Native American cultural resources were identified within the survey area and there are no impacts to tribal heritage and ongoing cultural traditions. The NNPP acknowledged that the cultural resource report did not address the significance of the resources found to the Tribes. The NNPP solicited information from the Tribes about the significance of the resources. The Tribes noted that all of the resources have information to give. Isolates are indicative of previous land use. The Heritage Tribal Office acknowledged that isolates can move over time; however, they stated isolates could be indicative of a site larger than what was recorded during the cultural resource investigations. The current location of the INL site was a major corridor used for subsistence purposes by the Shoshone-Bannock people moving across Idaho. The entire area was also used by the Shoshone-Bannock Tribes for hunting. The Tribes consider objects that are of religious, traditional, or historic importance to include traditional plants, wildlife, and landscapes. The Shoshone-Bannock Tribes recognize the INL lies within their original territory, which contains cultural resources important to the Tribes.

Action: Based on the information provided from the Tribes, the NNPP proposed to acknowledge small impacts to Native American cultural resources identified in the survey areas for Location 3/4 and Location 6 in the Draft EIS. The Draft EIS will also note that even though the small archaeological sites that have been identified within the proposed disturbance areas are not eligible for the National Register, the historical record described in the INL Cultural Resources Management Plan supports the conclusion that the INL site, including the proposed disturbance areas, is located within a large original territory of the Shoshone-Bannock people and archaeological and other cultural resources that reflect the importance of the area to the Tribes are located there.

The Heritage Tribal Office noted that they preferred that the artifacts not be collected and stored in a curation facility; they would rather see the resources left on the INL, near their original place on the ground.

Action: The NNPP will consider the request to leave resources on the INL near their original location.

The Heritage Tribal Office asked where the NNPP is in the National Environmental Policy Act (NEPA) process for the proposed action. The Draft EIS is currently being prepared and should be available to the public in mid-June, 2014. When the Draft EIS is available for public comment, a copy will be forwarded to the Shoshone-Bannock Tribes by letter. The NNPP will hold public meetings in Idaho in the Summer of 2014.

Naval Reactors Idaho Branch Office received a response for the Cultural Resource Investigations for Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling at NRF on INL from the Idaho State Historic Preservation Officer (SHPO) on June 4, 2013. The response included concurrence on no adverse effect for the No Action Alternative as well as concurrence on no adverse effect for the Overhaul Alternative and the New Facility Alternative if the recommendations for additional protective measures, identified in Section 8.3 of the cultural resources report are adopted. Slide 26 of the presentation provides the Section 8.3 recommendation summary from the cultural resources report.

Specifics of these recommendations were discussed, including the details regarding the recommendation to minimize disturbance to plant and wildlife species important to the Shoshone-Bannock Tribes by possible implementation of seasonal and time of day restrictions on ground disturbance, good housekeeping, and/or revegetation of disturbed areas with native plant species. The NNPP is planning to revegetate disturbed areas with native plant species. The NNPP is also planning to implement good housekeeping practices during construction. The NNPP discussed the need for seasonal and time of day restrictions on ground disturbance. These restrictions would be to protect the greater sage-grouse. The NNPP considers the Candidate Conservation Agreement (CCA) being developed by DOE-ID with the USFWS to be the appropriate document to follow regarding the protection of the greater sage-grouse. The CCA, as currently written, would not require any seasonal or time-of-day restrictions on ground disturbance for the proposed action because the disturbances are not within 1 kilometer of a lek. Therefore, the NNPP does not plan to implement any seasonal or time-of-day restrictions on ground disturbance.

The Tribes asked what actions the construction contractor would take if cultural resources were identified during construction. The NNPP stated that the construction contractor would implement a Stop Work Procedure to guide the assessment and protection of any unanticipated discoveries of cultural materials during ground disturbing activities in accordance with the INL Cultural Resources Management Plan. Upon discovery of a resource, the following steps would be taken: 1) Stop work in the area the resource is found; 2) Immediately Call the INL Cultural Resources Management Archaeologist and Naval Reactors; 3) Maintain a 30 to 50 meter buffer around the artifact discovered (work can continue outside of the buffer); 4) Cultural Resources Management office will evaluate the significance of the resource and provide a protection plan or initiate the Native American Graves Protection and Repatriation Act within 2 working days of discovery (the Cultural Resource Management office's current practice is to evaluate the resource within 24 hours); 5) Naval Reactors would notify interested parties (to include the SHPO and the Shoshone-Bannock Tribes) and invite these interested parties to participate in the activities associated with the discovery.

During this discussion, the Heritage Tribal Office suggested that Shoshone-Bannock tribal monitors could assist with monitoring on site during ground disturbance activities of the proposed action.

> **Action:** Consistent with the INL Cultural Resources Management Plan, the NNPP will provide the Shoshone-Bannock Tribes Heritage Tribal Office the opportunity to monitor key ground disturbance activities that may occur at NRF in support of recapitalization activities.

Agreement

The NNPP noted that the purpose of the meeting was to identify and assess Native American cultural resources and concerns and obtain the Shoshone-Bannock Tribe's support for the recapitalization of infrastructure supporting naval spent nuclear fuel handling at NRF.

The Director, Tribal Department of Energy Program (Willie Preacher) and Cultural Resources Coordinator (Carolyn Smith) iterated the Shoshone-Bannock Tribe's view that any land disturbance activity on Tribal ancestral lands would have some negative impact to the Shoshone-Bannock Tribe's cultural heritage due to the historic use of the land as a major corridor for the Shoshone-Bannock Tribes. Willie Preacher and Carolyn Smith agreed that the proposed recapitalization of infrastructure supporting naval spent nuclear fuel handling at NRF on INL would have small impacts to Native American cultural resources identified in the survey areas for Location 3/4 and Location 6 and indicated their general support for the proposed action. The Draft EIS will note that even though the small archaeological sites that have been identified within the proposed disturbance areas are not eligible for the National Register, the historical record described in the INL Cultural Resources Management Plan supports the conclusion that the INL site, including the proposed disturbance areas, is located within a large original territory of the Shoshone-Bannock people and archaeological and other cultural resources that reflect the importance of the area to the Tribes are located there.

The NNPP conducted a meeting with the Fort Hall Business Council on Wednesday, October 2, 2013. The meeting included participants from the Fort Hall Business Council, Naval Reactors Idaho Branch Office, Tribal DOE Program Director, Heritage Tribal Office, Bechtel Marine Propulsion Corporation, and INL Cultural Resources Management. The purpose of the meeting was to document consultation with the Shoshone-Bannock federally recognized Indian Tribes regarding cultural resource investigations for the Recapitalization of Infrastructure Supporting Naval Spent Nuclear Fuel Handling Environmental Impact Statement (EIS). The NNPP agreed to provide a letter to the Fort Hall Business Council to document the consultation.

Summary of Actions

NNPP actions:

1. Provide pictures of M-140 and M-290 shipping containers. (Complete – See Figures 2 and 3)
2. The NNPP will coordinate with the Heritage Tribal Office to arrange an unclassified tour of ECF. (Complete)
3. Include the general importance of the archaeological sites on INL to the Tribes and the details that the INL was a major corridor for Shoshone-Bannock Tribes moving across Idaho in the EIS. (ECD – Summer 2014)
4. Consider the request to leave resources on the INL near their original location. (Complete. Upon further evaluation, the NNPP concluded they cannot comply with the request because it is in conflict with 36 CFR 79 since the artifacts that are collected would no longer be 'protected' or in a secure place).
5. Send presentation to Heritage Tribal Office with Official Use Only maps removed. (Complete)
6. Consistent with the INL Cultural Resources Management Plan, NNPP will provide the Shoshone-Bannock Tribes Heritage Tribal Office the opportunity to monitor key ground disturbance activities that may occur at NRF in support of recapitalization activities. (ECD – 2016)
7. Provide draft meeting minutes to the Heritage Tribal Office by June 28, 2013. (Complete)

Heritage Tribal Office actions:

1. Provide comments on the draft meeting minutes to NNPP (Complete)
2. Discuss this technical consultation with the Fort Hall Business Council and determine if additional action is necessary to complete government-to-government consultation. (Complete)

Signatures:

[signature] 6/6/14

The Honorable Nathan Small
Chairman Fort Hall Business Council
Shoshone-Bannock Tribes

Date

[signature] 6-6-14

Mr. Willie Preacher
Director, Tribal Department of Energy Program
Shoshone-Bannock Tribes

Date

[signature] 6-10/14

Ms. Carolyn Smith
Heritage Tribal Office
Shoshone-Bannock Tribes

Date

[signature] 6/10/14

Mr. Christopher Henvit
Idaho Branch Office
Naval Reactors

Date

B.4 Other Coordination

Department of Energy
NAVAL REACTORS
IDAHO BRANCH OFFICE
POST OFFICE BOX 2469
IDAHO FALLS, IDAHO 83403-2469

NR:IBO-13/054
April 04, 2013

Susan Burke
INL Oversight Coordinator
DEQ State Office
Boise, Idaho 83706

SUBJECT: NON-RADIOLOGICAL AIR QUALITY MODELING FOR RECAPITALIZATION OF INFRASTRUCTURE SUPPORTING NAVAL NUCLEAR FUEL HANDLING DRAFT ENVIRONMENTAL IMPACT STATEMENT

Dear Ms. Burke:

The U.S. Department of Energy (DOE) Office of Naval Reactors is seeking coordination with your office on three air quality modeling reports that describe protocols and results for pollutant impacts at Idaho National Laboratory (INL) public receptor locations and Federal Class I Areas. The Naval Nuclear Propulsion Program (NNPP) is preparing an Environmental Impact Statement (EIS) for recapitalizing the naval spent nuclear fuel handling capabilities of the Expended Core Facility (ECF) at the INL. The EIS will contain an analysis of impacts on air quality at INL public receptor locations and Federal Class I Areas in the vicinity of the INL. The EIS analysis will be based on the three air quality modeling reports which were generated to support the National Environmental Policy Act (NEPA) process.

The NNPP proposes to recapitalize the infrastructure for preparing, examining, and packaging naval spent nuclear fuel and other irradiated materials, to ensure these capabilities are maintained for the vital NNPP mission of supporting the naval nuclear-powered fleet. The recapitalization is expected to be carried out as two parts. The first part would be the recapitalization of infrastructure supporting naval spent nuclear fuel handling, which includes the Spent Fuel Handling Recapitalization Project; the second part would be the recapitalization of infrastructure supporting naval spent nuclear fuel examinations.

This coordination was first initiated in October, 2011 following publication of a Notice of Intent (NOI) for the project in 2010. Due to changes in EIS scope and overall ECF

Susan Burke,
INL Oversight Coordinator

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Recapitalization project funding and timeline, coordination was postponed until an amended NOI was published in the Federal Register.

An amended NOI was published in the Federal Register on May 10, 2012. The purpose of the amended NOI was to announce the NNPP's intent to reduce the scope of the EIS to include only the recapitalization of naval spent nuclear fuel handling capabilities. Interfaces and exchanges between recapitalization of naval spent nuclear fuel handling and examination capabilities will be factored into designs, to ensure that both parts can be carried out in an environmentally responsible and cost effective manner. The recapitalization of examination capabilities will be considered as a reasonably foreseeable future action in the cumulative impacts of the EIS for the recapitalization of naval spent nuclear fuel handling capabilities. Therefore, the recapitalization of examinations capabilities was retained in air quality modeling reports. Three alternatives will be analyzed in the EIS:

1. Maintain ECF without a change to the present course of action or management of the facility. Spent fuel handling capabilities of ECF would continue to use the current ECF infrastructure while performing corrective maintenance and repairs necessary to keep the infrastructure in good working order (i.e., actions sufficient to sustain the proper functioning of structures, systems, and components). (No Action Alternative)

2. Overhaul ECF by implementing major refurbishment projects for the ECF infrastructure and water pools to provide the needed long-term capabilities for transferring, preparing, and packaging naval spent nuclear fuel. (Overhaul Alternative)

3. Site a new Spent Fuel Handling Recapitalization Project facility at NRF. (New Facility Alternative)

The NNPP would like to re-initiate this coordination based on non-radiological air quality modeling that was completed in January 2013.

Three modeling reports including protocols, inputs, and results are provided in enclosures 1, 2, and 3. Estimated new source emissions based on best available information and existing INL emission sources were used. Enclosure 1 contains an evaluation of impacts from criteria, toxic, and prevention of significant deterioration (PSD) air pollutants at INL public receptor locations along with an evaluation of criteria and PSD air pollutant impacts at near field (less than or equal to 50 kilometers from the source) Craters of the Moon receptor locations. Enclosure 2 contains an evaluation of impacts on visibility at near field Craters of the Moon receptor locations and a screening assessment for PSD and visibility impacts at far field (greater than 50 kilometers from the source) Federal Class I Areas. Near field visibility impacts were modeled using VISCREEN. Enclosure 3 contains an evaluation of PSD air pollutant impacts at far field Federal Class I Areas using CALPUFF. Methods outlined in FLAG 2010 were followed for impacts at Federal

Class I Areas. Additionally, the National Park Service was consulted on methods used for modeling air quality at Federal Class I Areas.

The AERMOD (EPA 2004a) model with meteorological data processed through the AERMET (EPA 2004b) preprocessor was used for criteria, toxic, and PSD air pollutants at INL receptor locations and near field Craters of the Moon. In general, NNPP used:

- AERMOD Version 11103,
- Meteorological data for 2000-2004 provided to Battelle Energy Alliance (BEA) by Idaho Department of Environmental Quality (IDEQ) with substitution of on-site INL surface data,
- AERMET Version 06341,
- INL public receptor locations provided by IDEQ in a memo dated May 23, 2011.

AERMOD version 12060 was released in 2012 after modeling with AERMOD version 11103 was completed. A benchmark between the two versions was run, and the predicted concentrations between the two versions were identical. Therefore, the 11103 version was retained for the EIS analysis.

Impacts of criteria pollutants and fugitive dust were modeled for construction. On-road vehicle emission factors (e.g., construction worker commuting and material deliveries) were estimated using the EPA model MOBILE6.2. In 2011, EPA recommended MOVES2010a for assessing the criteria air pollutant impacts of vehicle emissions in NEPA documents, with a 2 year grace period for implementation, ending in December 2012. The Draft EIS for this project has been in preparation and review during the 2 year grace period. EPA recommended that if a model other than MOVES2010a (e.g., MOBILE6.2) is used in a Draft EIS that is released during the grace period, it is acceptable to carry that model through to the Final EIS. While the Draft EIS will be published for public comment in 2014 after the 2 year grace period ends, the NNPP is proposing that the use of MOBILE6.2 in the EIS be carried through the final document. On-road emissions estimated for the construction time-frame are small and use of a different model should not impact concentrations at public receptor locations (see Enclosure 1 for emissions).

Note that the modeling is not intended for permitting purposes. Permit evaluations will be performed once the project has developed further and a Record of Decision has been published. Review of the modeling reports at this time is requested to ensure that IDEQ's expectations with respect to NEPA analysis are met to mitigate the risk of receiving significant comments on the Draft EIS that could delay the publication of the Final EIS if additional modeling is required. The NNPP requests feedback from IDEQ by May 24, 2013.

Susan Burke,
INL Oversight Coordinator

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Please don't hesitate to contact me at 208-533-5363 or by e-mail at robert.ramsey@nrp.doe.gov if you have any questions or comments or need additional information. I will follow-up with you by May 10, 2013 to discuss:

- The use of AERMOD version 11103
- The use of AERMOD version 11103 with a version of AERMET that is compatible with the meteorological data for 2000 to 2004 provided to BEA by IDEQ.
- The use of MOBILE6.2 to estimate on-road vehicle emissions during construction
- Other concerns that IDEQ might have regarding the modeling reports.

Thank you for your assistance.

R. E. Ramsey
Idaho Branch Office

References: FLAG 2010. U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service. Federal Land Managers' Air Quality Related Values Work Group (FLAG): Phase I Report – Revised (2010). Natural Resource Report NPS/NRPC/NRR-2010/232. National Park Service, Denver, Colorado.

Enclosure 1 INL/LTD-12-26728. Evaluation of Criteria Toxic and Prevention of Significant Deterioration Air Pollutant Emissions for the Expended Core Facility Recapitalization Environmental Impact Statement. January 2013. (Official Use Only)

Enclosure 2 INL/LTD-12-26766. Evaluation of Visibility Impacts for the Expended Core Facility (ECF) Recapitalization Environmental Impact Statement. January 2013. (Official Use Only)

Enclosure 3 INL/LTD-12-26741. Evaluation of Prevention of Significant Deterioration (PSD) Increment Levels In Class I Areas for the Expended Core Facility (ECF) Recapitalization Environmental Impact Statement. January 2013. (Official Use Only)

Susan Burke,
INL Oversight Coordinator

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B-74

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

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C. L. "BUTCH" OTTER, GOVERNOR
CURT FRANSEN, DIRECTOR

August 2, 2013

VIA EMAIL

Mr. R.E. Ramsey, Idaho Branch Office
U.S. Department of Energy, Naval Reactors
P.O. Box 2469
Idaho Falls, Idaho 83403-2469

RE: Naval Nuclear Propulsion Program (NNPP) EIS for Recapitalizing Naval Spent Nuclear Fuel Handling Capabilities of the Expended Core Facility (ECF) at the INL: DEQ Review of Non-Radiological Air Quality Modeling (AERMOD only)

Dear Mr. Ramsey:

On April 4, 2013 the Department of Environmental Quality (DEQ) received a request for DEQ to review three modeling reports supporting the Draft EIS: 1) AERMOD dispersion modeling evaluating near-field impacts from criteria pollutants, state-regulated air toxics, and prevention of significant deterioration (PSD) air pollutants at public receptor locations on the INL and at nearby Craters of the Moon National Monument, 2) a screening assessment for PSD and visibility impacts at Federal Class I areas greater than 50 kilometers (km) away, with near-field visibility impacts modeled using VISCREEN, and 3) CALPUFF modeling for PSD impacts at Federal Class I areas more than 50 km away. On June 3, 2012, DEQ received electronic copies of the modeling files and emissions inventories.

DEQ's review was limited to an overview of the modeling approaches used for the near-field analyses, i.e., the AERMOD dispersion modeling described in item (1) above, in light of Idaho's approved State Implementation Plans (SIPs) applicable to stationary sources and regional haze. Requirements and guidance for Idaho's program are found in the regulations contained in IDAPA 58.01.01 (Idaho Air Rules),[1] policies described in Idaho's Air Quality Modeling Guideline,[2] and EPA user guides and guidance documents for AERMOD and its suite of supporting programs.[3] The acceptability of ambient impact analyses for federal Class I areas (items 2 and 3) are determined by federal land managers (FLMs), typically with the National Park Service (NPS) serving in a lead role.

The modeling protocols and analyses have been reviewed and DEQ has the following comments:

Summary: Concerns were identified with regard to the modeling approach for roadways, reduction in plume concentrations through deposition for PM_{10} and $PM_{2.5}$, and using outdated versions of AERMET for meteorological data processing. The analyses, however, appear to have substantially overestimated the total emissions of criteria pollutants that would be subject to evaluation under Idaho's approved SIPs, especially if new boilers and emergency diesel generators are purchased for the new construction alternatives rather than relocating existing older units.

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[1] IDAPA 58.01.01, Rules for the Control of Air Pollution in Idaho, effective April 4, 2013, accessible at http://adminrules.idaho.gov/rules/current/58/0101.pdf

[2] State of Idaho, Guideline for Performing Air Quality Impact Analyses, Doc. ID AQ-011, rev. 2, July 2011, accessible at http://www.deq.idaho.gov/media/355037-modeling-guideline.pdf

[3] U.S. Environmental Protection Agency, Technology Transfer Network, Support Center for Regulatory Atmospheric Modeling, http://www.epa.gov/scram001/

In addition, all existing emergency generators at the INL were presumed to operate every day between the hours of 8 a.m. and 4 p.m. This is a very conservative approach for evaluating compliance with the 1-hr NO_2 NAAQS for these intermittent sources.

DEQ recommends reprocessing the meteorological data set used to model Scenario 6 (cumulative impacts) NO_x emissions using the most current version of AERMET and its supporting programs, adjust diesel engine generator emissions for the SFHP and EP new facility alternatives to reflect installing EPA-certified engines, and rerun Scenario 6 to confirm that the design value (8^{th} high) 1-hr NO_2 ambient impacts are less than 188 $\mu g/m^3$. The background ozone concentration should be set to at least 41.8 ppb (see Comment 9(e)). A cumulative analysis typically includes adding a background concentration to account for naturally-occurring emissions of pollutants (e.g., arid soils in sagebrush-steppe ecosystems are believed to be important sources of NO emissions[4]) as well as long-range transport from sources not explicitly modeled. Given the very conservative approach to modeling the intermittent sources, however, adding a "rural" 1-hr NO_2 background concentration of a few ppb does not seem reasonable.

Comment 1. Compliance with Idaho's approved SIP for Stationary Sources. The proposed project is located in an area that is unclassifiable or in attainment for all criteria pollutants and averaging times. Idaho does not require dispersion modeling of fugitive dusts from roadways unless the facility is located in a PM_{10} or $PM_{2.5}$ nonattainment area, is a designated facility per section 008 of the Idaho Air Rules, or the roadway dust is likely to be a large contributor to facility emissions during normal operations (e.g., at a mine site). Nor does Idaho require dispersion modeling of mobile source emissions for construction or operation of a stationary source.

In addition, Idaho's program does not require dispersion modeling for temporary emissions associated with construction activities (see Comment 10, Regional Haze SIP). Portable emissions sources used in construction, e.g., a concrete batch plant, hot-mix asphalt plant, or crusher, would be required to comply with enforceable limits contained in their own air quality permits, or in the case of a crusher, with Idaho's permit by rule (PBR) for nonmetallic mineral processing units. (Note that the PBR for crushing plants has not yet been approved as part of Idaho's SIP).

Comment 2. State-regulated Toxic Air Pollutants (TAPs). Idaho's allowable increments specified in sections 585 and 586 of the Idaho Air Rules for emissions of state-regulated TAPs apply only to *new emissions* of TAPs not previously emitted from a stationary source as a result of constructing or modifying a stationary source, and to the *increase in TAPs* emissions associated with a particular modification. There are no requirements to address facility-wide TAPs emissions for existing sources, nor are there requirements to include the impacts of TAPs from co-contributing sources. As noted in the next two comments, demonstration of compliance with Idaho TAPs increments is no longer required for TAPs emitted from boilers or engine generators located at the INL.

Comment 3. State-regulated Toxic Air Pollutants (TAPs) emitted from engine generators. Except for "existing" emergency generators in service at residential, commercial, or institutional facilities, DEQ has determined that all state-regulated toxic air pollutants (TAPs) emitted from diesel engine generators are regulated by a federal New Source Performance Standard (NSPS) and/or National Emission Standard for Hazardous Air Pollutants (NESHAP), because these engines are subject to 40 CFR 60, Subpart IIII (NSPS for new diesel engines) and/or 40 CFR 63, Subpart ZZZZ (area source MACT for pre-2006 engines). In accordance

[4] Smart, David R., *et al*, Resource limitations to nitric oxide emissions from a sagebrush-steppe ecosystem, *Biogeochemistry* **47:** 63-86, 1999, https://www.biology.usu.edu/files/uploads/Faculty/Stark-J/Smart1999-Resource limitation to NO prod.pdf

with Section 210.20 of the Idaho Air Rules, no further demonstration of preconstruction compliance is required for these TAPs emissions.

Comment 4. State-regulated Toxic Air Pollutants (TAPs) emitted from boilers. DEQ has determined that all state-regulated toxic air pollutants (TAPs) emitted from boilers at area sources of HAPs are regulated by a federal New Source Performance Standard (NSPS) and/or National Emission Standard for Hazardous Air Pollutants (NESHAP), because these boilers are subject to emission limits and/or work practice standards contained in 40 CFR 63, Subpart JJJJJJ (6J). In accordance with Section 210.20 of the Idaho Air Rules, no further demonstration of preconstruction compliance is required for these TAPs emissions.

Comment 5. Emissions Increase.

a. The increase in emissions for this project was calculated using baseline actual emissions based on the maximum yearly operational times and emissions during the years 2005-2009. This is a quite conservative approach. Baseline actual emissions, as defined in section 007 of the Idaho Air Rules, are typically calculated based on a consecutive 24-month period.

b. For a new emissions unit (e.g., new boilers and generators installed if "new SFHP" and/or "new EP" are the alternatives selected), the baseline actual emissions for purposes of determining the emissions increase that will result from the initial construction and operation of such unit shall equal zero (0); and, thereafter, for all other purposes, shall equal the unit's potential to emit (PTE). DEQ was unable to determine whether the scaling factors used to estimate projected actual boiler and diesel generator emissions were based on the ratings of the "new" boilers or generators.

c. Based on EPA guidance[5], PTE for emergency generators should be set to 500 hours per year, which includes routine testing and maintenance (limited to a maximum of 100 hours per year for engines subject to NSPS IIII or JJJJ and/or NESHAP ZZZZ), as well as emergency operations.

d. Existing and new diesel emergency engine generators subject to NSPS IIII and/or NESHAP ZZZZ are restricted to using ultra-low sulfur diesel (ULSD) fuel containing a maximum 0.0015% S. The AP-42 value used for sulfur emissions of small diesel engines (0.29 lb/MMBtu) should be multiplied by a factor of (0.0015%)/(0.5%) = 0.003 to reflect this fuel standard.

e. New diesel emergency engine generators will be subject to NSPS IIII and will be required to be EPA certified. These generators can be expected to have much lower criteria pollutant emissions compared to the pre-1990 diesel generators currently installed at NRF (e.g., 90% or greater reduction in PM_{10} /$PM_{2.5}$ emissions).

f. Concrete batch plant emissions for this project presumed no controls for silo-filling or truck loading of cement (emission factors of 0.47 lb PM_{10} and 0.31 lb PM_{10} per ton loaded, respectively). In practice, emissions from vents on cement and cement supplement (e.g., flyash, lime) silos are controlled by cartridge filters on the vents or emissions are routed to a baghouse (emission factor of 0.00034 lb PM_{10} per ton of cement, 0.0089 lb PM_{10} per ton of supplement), and truck loading typically includes the use of a boot or similar enclosure to reduce loss of fine materials (approximately 75% control).

For the ratio of cement to cement supplement presumed in AP-42 (1865 lbs coarse aggregate, 1428 lbs sand, 491 lbs cement, 73 lbs supplement, and 20 gallons of water =

[5] U.S. EPA, Calculating Potential to Emit (PTE) for Emergency Generators, John S. Seitz, September 6, 1995, http://www.epa.gov/region07/air/title5/t5memos/emgen.pdf and Steven C. Riva (EPA) to William O'Sullivan (NJ DEP), February 14, 2006, http://www.epa.gov/region07/air/nsr/nsrmemos/generator.pdf.

total 4024 lbs per cubic yard of concrete, the emission factor for cement and supplement silo filling can be estimated as:

Silo: 0.00034 x 491/(491+73) + 0.0089 x 73/(491+73) = 0.0015 lb PM_{10} per ton loaded

The controlled emission factor for truck loadout can be estimated as:

Truck Loadout: 0.31 x (1-0.75) = 0.08 lb PM_{10} per ton loaded

Applying these more realistic assumptions reduces PM emissions from silo filling and truck loadout as follows:

	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
Uncontrolled emissions (modeled for this project)		
Silo Filling	33.6	6.7
Truck loading	22.2	4.4
	55.8	11.1
Controlled emissions		
Silo Filling	0.11	0.02
Truck/Mixer loading	5.7	1.15
	5.8	1.2

g. MOBILE 6.2 used for mobile source emissions. As noted in the transmittal letter for the non-radiological air quality modeling reports,[6] EPA recommended in 2011 that MOVES2010a should be used for criteria pollutant impacts from vehicle emissions in NEPA documents, with a two-year grace period for implementation ending in December 2012. NNPP is proposing to carry the MOBILE 6.2 emissions through for this project, although the Draft EIS is not expected to be issued for public comment until 2014, stating that the "[o]n-road emissions estimated for the construction time-frame are small and use of a different model should not impact concentrations at public receptor locations." Additional discussion should be provided to support this assertion.

EPA's comparison of MOVES2010a and MOBILE 6.2 emission estimates[7] suggests that MOVES2010a emissions of NO_x from both light-duty and heavy duty trucks are higher, $PM_{2.5}$ emission estimates are significantly higher for both light- and heavy-duty vehicles, and PM emission rates for heavy duty trucks are higher due to including deterioration effects and additional information regarding emissions for stop-and-go conditions.

Comment 6. Increases in emissions that would be subject to requirements under Idaho's SIP-approved Stationary Source program for normal operation of the three SFHP alternatives plus either overhauling or constructing a new EP are shown in Table 1. Crusher emissions have also been included in the table because the PBR for such plants is not yet part of Idaho's approved SIP.

6 R.E. Ramsey to Susan Burke, Non-Radiological Air Quality Modeling for Recapitalization of Infrastructure Supporting Naval Nuclear Fuel Handling Draft Environmental Impact Statement, NR:IBO-13/054, April 4, 2013

7 How do MOVES2010 or MOVES2010a emission estimates compare to those of MOBILE 6.2?, accessible at http://moves.supportportal.com/link/portal/23002/23024/Article/32001/How-do-MOVES2010-or-MOVES2010a-emission-estimates-compare-to-those-of-MOBILE6-2

Table 1. EMISSIONS INCREASE IN CRITERIA POLLUTANTS[a]						
Alternatives:	No Action	Overhaul SFHP & Overhaul EP	New SFHP & Overhaul EP	New SFHP & New EP	Crusher, Total (Years 2016-2018)	"Below Regulatory Concern"
Pollutant:	Emissions Increase (Ton/yr)	Emissions Increase (Ton/yr)	Emissions Increase (Ton/yr)	Emissions Increase (Ton/yr)	Emissions Increase (Ton/yr)	Emissions Increase (Ton/yr)
SO_2, presumed = SO_x	- 0 -	- 0 -	0.053	0.056	---	4
NO_2, presumed = NO_x	- 0 -	- 0 -	6.3	6.7	---	4
CO	- 0 -	- 0 -	1.6	1.7	---	10
PM_{10}	- 0 -	- 0 -	0.58	0.62	2.06	1.5
$PM_{2.5}$	- 0 -	- 0 -	0.40	0.43	0.32	1.0
Lead	- 0 -	- 0 -	3.2E-04	3.4E-04	---	6.0E-02
Sulfuric acid mist	- 0 -	- 0 -	9.3E-04	9.9E-04	---	0.7

[a] Increases in emissions taken from Fuel Combustion Emissions_NNPP_EIS.xlsx and crushing emissions are from Construction Emissions_SFHP_NRF Area 6 (06-13-2011).xlsx. For the purposes of Table 1, crushing emissions for the three-year period 2012-2018 are presumed to occur during a single year.

As shown in the table, the increased emissions of criteria pollutants for the alternatives considered are well below ten percent of the significant emissions rate for all criteria pollutants except for NO_2, and with the inclusion of crushing emissions, PM_{10}.

Significant Impact Levels (SILs)/Significant Contribution Levels (SCLs). The $PM_{2.5}$ 24-hour and annual significant impact levels SILs were vacated and remanded by the D.C. Circuit U.S. Court of Appeals in a decision issued on January 22, 2013. This decision most directly affects "major" projects subject to the Prevention of Significant Deterioration (PSD) program. For minor source permitting, DEQ has determined the vacated SILs will still be used as a screening tool to evaluate when a cumulative impact analysis must be performed, but a SIL will not be used exclusively as a level below which impacts of a new source or modification can be considered as not causing or significantly contributing to a $PM_{2.5}$ NAAQS violation.

Additional considerations used to evaluate the need for a cumulative impact analysis will included the following: 1) other potentially co-contributing sources in the area; 2) background concentrations for the area impacted; 3) results of the SIL analysis in relation to other sources and background concentrations; 4) presence of sensitive receptors in the area such as residences, schools, hospitals, parks, etc.

DEQ has determined that there are no large sources of emissions located near the NRF, background concentrations at the INL are well below the applicable NAAQS, and there are no sensitive human receptors in the immediate vicinity of the NRF. If the high 1[st] high ambient impact for a pollutant and averaging time is less than the SIL (called the significant contribution level, or SCL, in the Idaho Air Rules), a cumulative impact/full-impact analysis would not be required for that pollutant and averaging time.

Comment 7. Use of AERMOD version 11103. DEQ requires that dispersion modeling analyses be conducted with the most current version of AERMOD (see section 6.2 of Idaho's modeling guideline). The near-field modeling analyses for this project used AERMOD version 11103, which was released on April 13, 2011. Three more versions of AERMOD were released before the dispersion modeling was completed in January 2013:

- Version 11353, released December 19, 2011, incorporated bug fixes to the MAXDCONT option for urban applications, modified subroutine OUTQA to correct erroneous error message if PLOTFILE was the only relevant option used with the FILEFORM keyword, modified subroutine O3VALS to correct the test for the number of parameters to allow for the ANNUAL option, modified subroutine METEXT to increment the hour index and year index if the MAXDCONT option is used, and modified subroutine PRTO3VALS to use the O3FLAG variable that identifies the user-specified option for defining temporally-varying background ozone concentrations.

- Version 12060, released February 29, 2012, incorporated bug fixes to the MAXDCONT_LOOP and O3READ subroutines, and to subroutine LTOPG (determines the stability-dependent distance for transitioning to a virtual point source approximation for area sources under the FASTAREA or FASTALL options. Enhancements included modifying subroutines to allow defining all sources as urban, and to allow the user to specify the number of years of met data being processed for a particular run (reduces memory storage requirements), eliminated the arrays of profile met data by hour-of-year, level, and year for use with the MAXDCONT option (reduces memory storage requirements), and modified subroutine OUMAXD_CONT to include checks that ensure the range of ranks specified is at least equal to the design value rank plus four for the specified pollutant.

- Version 12345, released December 10, 2012, incorporated bug fixes to wind speed adjustments based on the assumption that input wind speeds that are vector (or resultant) mean winds have been removed, as scalar mean wind speeds are preferred for use in steady-state Gaussian dispersion models. Winds collected at National Weather Service (NWS) and Federal Aviation Administration (FAA) ASOS sites represent scalar mean wind speeds. An option was added to allow the user to specify that input winds are vector mean wind speeds. Subroutine HRLOOP was modified to correct a problem with missing hourly ozone data during MAXDCONT post-processing.

  Modified subroutines DAYRNG, METEXT, and SET_DATES to correct a bug associated with use of the DAYRANGE keyword for multiple years of met data, where the YR/MN/DY conversion to Julian may be incorrect. Modified subroutine HRQREAD to check for large negative hourly emissions (< -90), which may be used as missing indicators. Since AERMOD allows inputs of negative emissions for use in emission credit calculations, negative values used as missing indicators in the HOUREMIS file result in negative hourly concentrations in previous AERMOD versions. Warning messages are generated and the emission rate is set to zero (0) for these cases.

  Modified subroutine EVALFL to address a potential problem with URBAN applications where the L_MorningTrans logical variable was not defined. Modified MAIN program and subroutine PRESET to check for duplicated STARTING keywords on the SO or RE pathways, since that would reset the array limits for setup arrays to zero during the PRESET phase, resulting in array subscript out-of-bounds runtime errors.

  Enhancements included incorporating two new BETA (non-Default) options to address concerns regarding model performance under low wind speed conditions.

Date stamps in the AERMOD files for this project indicate that these analyses were completed on various dates during the period between August 2011 and January 2013. The modeling report confirms that there were no differences in modeled design concentrations produced by AERMOD versions 11103 and 12060 for emissions of PM_{10}, $PM_{2.5}$, CO, 1-hr NOx, NOxSOx (annual), and lead from the NRF boilers. The analyses for this project used met data based on scalar mean wind speeds, rural rather than urban default values, and did not make use of hourly emissions input files or the MAXDCONT option, i.e., the analyses did not use some of the AERMOD subroutines that were modified over the course of this project. The analyses did, however, make use of the FASTALL/FASTAREA option as well as inputting a background ozone value for PVMRM analyses for 1-hr NO_2 for some sources. Additional discussion should be provided to discuss whether AERMOD v. 12060 would have produced the same results as AERMOD v. 11059 when using these two options.

Comment 8. Use of meteorological data processed using AERMET v. 06341. A newer version of AERMET was available prior to commencement of modeling for this project in August 2011:

- AERMET version 11059 was released on February 28, 2011, which incorporated bug fixes to calculate hourly averages using the "hour-ending" instead of the "hour-beginning" convention, corrected the procedure for calculating hourly averages from subhourly values for sigma-theta, corrected processing of subhourly wind data to properly code hours as calm when more than half of the samples for the hour are non-missing but below the wind threshold, corrected several issues associated with the extraction of ONSITE data that could result in erroneous values being assigned to ONSITE variables, improved error handling and reporting for the processing of ONSITE data, corrected problems associated with processing ONSITE precipitation data, including the fact that subhourly precipitation values were averaged rather than summed to determine the hourly value, and that negative values were also included in the summed value (before averaging) if the missing data code was not properly specified, corrected a problem with the SUBNWS option to avoid using the BULKRN (bulk Richardson Number) option using ONSITE delta-T data when the ONSITE winds are missing and the reference winds are based on SURFACE data. Vertical profiles of ONSITE temperatures, sigma-theta, and sigma-w are also skipped if the reference winds are based on SURFACE data. These changes are intended to avoid internal inconsistencies in the characterization of the boundary layer that may occur with some combinations of SURFACE and ONSITE data.

The modeling report states that met processing was restricted to AERMET v. 06341 because the Idaho Falls Regional Airport data for 2000-2004 provided by DEQ were in SAMSON format (which is not compatible with AERMET v. 11059). This is not a valid reason for using an outdated version of AERMET, as National Weather Service (NWS) surface data collected at the Idaho Falls Airport could easily have been downloaded in the appropriate format (TD-3505) from the Integrated Surface Database ftp site[8] or ordered from the National Climatic Data Center (NCDC).

The modeling report should discuss whether hourly or subhourly data was obtained for the four INL met towers (GRID3, LOFT, EBR, and RWMC) used as "onsite" met for project dispersion modeling, and identify whether these data meet minimum 90% completeness requirements. If subhourly data were obtained, the report should discuss how these data were handled, and whether/how the bugs identified in AERMET v. 06341 for processing subhourly ONSITE data may have affected the dispersion modeling results.

The description of the upper air data collected at the Boise Airport (KBOI) should include whether the available data were downloaded for "all levels," or "mandatory and significant" levels, to ensure adequate resolution of the vertical profile. The use of upper air data based on "mandatory levels only" is not acceptable for AERMOD modeling applications.

Comment 9. Modeling approach.

a. The "chi-over-Q" approach used in the modeling analyses provides quite conservative estimates of the maximum ambient air impacts. Using this approach, the maximum

[8] National Climatic Data Center, NOAA Satellite and Information Service, Integrated Surface Database (ISD), accessible at ftp://ftp.ncdc.noaa.gov/pub/data/noaa/ , Idaho Falls Regional Airport (KIDA) = 725785 24145

modeled ambient impacts (design values) from any source are added to the maximum modeled impacts from all other sources at each receptor without regard to when those maxima occurred.

b. Dispersion modeling for PM_{10} and $PM_{2.5}$ included reductions in the plume concentrations due to deposition. DEQ's understanding is that this approach was discussed in advance and approved by John Notar at the National Park Service. While this is a reasonable approach for estimating potential impacts to soils and vegetation, deposition should not be included in modeling for comparison with National Ambient Air Quality Standards (NAAQS) or state-regulated TAPs standards.

c. Polygonal area source (AREAPOLY) used to model roadway emissions. Roadway emissions were modeled as a single thin polygon comprising Highway 20 from the eastern boundary of the INL to the intersection with Main Street (about 7.1 miles/ 11.4 km), then north on Main Street to Lincoln Boulevard, extending northward along Lincoln Boulevard to the NRF (about 9.2 miles/14.8 km).

For the AREAPOLY option, EPA guidance[9] notes "the numerical integration algorithm can handle elongated areas with aspect ratios of up to 10 to 1." Although the width of the polygon source varies, the polygon is about 400 meters wide along most of the roadway lengths. If the east-west and north-south areas had been split into two polygons, the aspect ratio for the Hwy 20 area source would be about 29:1 and the north-south polygon aspect ratio about 37:1. The modeling report should explain in some detail whether the integration algorithm is adequate or appropriate for approximating emissions from these roadways as a single AREAPOLY source.

d. NO_2 emissions from diesel generators were modeled as occurring every day for all hours between 8 a.m. to 4 p.m. This is a very conservative approach for demonstrating compliance with the 1-hr NO_2 NAAQS for these intermittent sources. For example, the operational time for current emissions from the NRF diesel engines is shown in the spreadsheet at 66.1 hours with total NOx emissions of 3.85 g/sec (30.6 lb/hr). This appears to be consistent with routine testing on a weekly or less frequent basis, with few or no cases of operation due to loss of offsite power.

e. The ozone background value used for Level 3 (PVMRM) modeling for 1-hr NO_2 ambient impacts was set to 30 ppb based on a study conducted in the Treasure Valley during the 2007 ozone season. Year-round ozone monitoring at Craters of the Moon, however, suggests that background ozone levels near the INL may be considerably higher than in the Treasure Valley. The 3-year average of the 98th percentile ozone value for the years 2009-2011 is 65.7 $\mu g/m^3$. The 3-year average of the mean ozone values for the same period is 41.8 ppb.[10]

Comment 10. Compliance with Idaho's Regional Haze SIP. The Idaho Air Rules incorporate only sections 301, Definitions; 304(a), Identification of integral vistas by FLMs; 307, New Source Review for major sources and major modifications; and 308, Regional haze program requirements, of 40 CFR 51, Protection of Visibility. Idaho's Regional Haze SIP[11] details baseline visibility, pollutants of particular concern, source apportionment, and long-term strategies to improve visibility in mandatory Class I areas.

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9 U.S. EPA, User's Guide for the AMS/EPA Regulatory Model – AERMOD, EPA-454/B-03-001, September 2004, aermod_userguide_under-revision.pdf, contained in the User's Guide Addendum zipped file accessible at http://www.epa.gov/ttn/scram/dispersion_prefrec.htm

10 EPA, Technology Transfer Network (TTN) Air Quality System (AQS), zipped files for 2009-2011, Parameter: Ozone (44201) – hourly, extracted data for Monitor No. 16-023-0101 (Craters of the Moon), accessible at http://www.epa.gov/ttn/airs/airsaqs/detaildata/downloadaqsdata.htm

11 State of Idaho, Department of Environmental Quality, Regional Haze Plan, October 8, 2010, accessible at http://www.deq.idaho.gov/air-quality/air-pollutants/haze.aspx

Facilities located within the INL are not subject to Prevention of Significant Deterioration (PSD) requirements for any criteria pollutant. Analyses for impacts to visibility at mandatory Class I areas, including nearby Craters of the Moon National Monument, are therefore not required for this project under Idaho's approved program for stationary sources.

Long-term strategies for reducing visibility impacts are described in Idaho's Regional Haze Plan, and include measures to mitigate the impacts of construction activities. These measures are codified in sections 650 and 651 of the Idaho Air Rules, which require all reasonable precautions be taken to prevent particulate matter from becoming airborne. In determining what is reasonable, the rules specifically identify activities and "the proximity to mandatory Class I Federal Areas" as factors to be considered. "Reasonable" measures to control fugitive dust from the proposed project must in particular consider the close proximity to nearby Craters of the Moon National Monument and the Sawtooth Wilderness Area.

Crushing and screening activities are subject to section Idaho Air Rules section 795, Permit by Rule Requirements for nonmetallic mineral processing plants, which include fuel sulfur and opacity limits for engine generators (note these limits are superseded by more stringent requirements for engines subject to 40 CFR 60, Subpart IIII or JJJJ and/or 40 CFR 63, Subpart ZZZZ), and fugitive dust best management practices contained in Idaho Air Rules section 799.

As noted in the Regional Haze Plan, nitrates and sulfates appear to have a greater impact than coarse particulate matter on visibility at Craters of the Moon. Nitrate and sulfate aerosols are also $PM_{2.5}$ precurors, although $PM_{2.5}$ was not specifically addressed in the 2010 plan. Small reductions in sulfate and nitrate are expected to have a greater impact on visibility improvement at Craters than similar reductions in PM_{10}. Efforts to reduce the production of nitrates and sulfates during construction activities should be considered, e.g., use ultra-low sulfur diesel (ULSD), limit engine idling, provide line power for temporary offices and site lighting wherever possible, and limit the use of non-EPA certified engines for powering construction equipment and lighting.

If you have any questions regarding these comments, please don't hesitate to contact me.

Sincerely,

Cheryl Robinson

Cheryl A. Robinson, P.E.
NSR Modeling Analyst, Air Quality Division

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B-84

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NR:IBO-14/049
March 11, 2014

Cheryl A. Robinson, P.E.
NSR Modeling Analyst, Air Quality Division
State of Idaho Department of Environmental Quality
1410 North Hilton
Boise, ID 83706

SUBJECT: DOCUMENTATION OF CHANGES TO NON-RADIOLOGICAL AIR QUALITY MODELING IN THE FINAL ENVIRONMENTAL IMPACT STATEMENT FOR THE RECAPITALIZATION OF INFRASTRUCTURE SUPPORTING NAVAL SPENT NUCLEAR FUEL HANDLING

REFERENCES: (a) INL/LTD-12-26728. Rood, A.S. "Evaluation of Criteria, Toxic, and Prevention of Significant Deterioration (PSD) Air Pollutant Emissions for the Expended Core Facility Recapitalization Environmental Impact Statement." Idaho National Laboratory, Idaho Falls, Idaho. January 2013.

(b) State of Idaho Department of Environmental Quality. Naval Nuclear Propulsion Program (NNPP) EIS for Recapitalizing Naval Spent Nuclear Fuel Handling Capabilities of the Expended Core Facility (ECF) at the INL: DEQ Review of Non-Radiological Air Quality Modeling (AERMOD only). Letter from C. A. Robinson, P.E. (DEQ) to R.E. Ramsey (IBO), dated August 2, 2013.

Dear Ms. Robinson:

This letter documents our discussion on February 6, 2014, regarding comments that were made by the Idaho Department of Environmental Quality (IDEQ) on the Naval Nuclear Propulsion Program (NNPP) non-radiological air quality modeling report (Reference (a)). Reference (a) was prepared to support the assessment of impacts to non-radiological air quality in an Environmental Impact Statement (EIS) that is being drafted by the NNPP. The Draft EIS addresses recapitalizing the spent fuel handling capabilities of the Expended Core Facility at the Idaho National Laboratory (INL). IDEQ comments on reference (a) were received in reference (b).

Based on the NNPP review of IDEQ comments and discussion with you, we concluded that several of the comments were applicable to future actions to obtain appropriate air permits once it has been decided whether a new facility will be constructed and after any such facility has been designed. Some comments were concluded to be directed at the EIS; however, the Draft EIS is expected to go to printing soon. The NNPP will address those comments in the Final EIS rather than delay publication of the Draft EIS.

During the teleconference on February 6, 2014, we discussed which comments were applicable to the EIS and which would apply to future air permitting actions. In addition, we discussed the NNPP plan to address those comments directed at the EIS in the Final EIS. This letter documents the agreements that were made during the teleconference. Note that reference (b) and this letter will be included in Appendix B of the Draft EIS to document the NNPP consultations with IDEQ.

Background and Discussion

Reference (a) contains an evaluation of impacts from criteria, toxic, and prevention of significant deterioration (PSD) air pollutants at INL public receptor locations, along with an evaluation of criteria and PSD air pollutant impacts at near field (less than or equal to 50 kilometers from the source) receptor locations for Craters of the Moon National Monument. AERMOD, Version 11103, with meteorological data processed through the AERMET preprocessor, Version 06341, was used to model pollutant concentrations at receptor locations. For the project construction period, on-road vehicle (e.g., commuting and material deliveries) emissions were estimated using MOBILE 6.2.

Comments Requiring No Changes to the EIS

During the teleconference, it was agreed that IDEQ comments 1-5f, 6, 9a, 9c-e, and 10 in reference (b) were directed towards future air permitting actions if a new facility were to be designed and constructed. These comments included IDEQ recommendations for reducing the conservatisms in emissions estimates and in the modeling protocol that would be used in any future air permitting evaluations. IDEQ agreed that the conservative methods and modeling protocol that were used in reference (a) were appropriate for bounding impacts for the EIS.

Comments Requiring Changes to the EIS

IDEQ comments 7 and 8 in reference (b) regarded the use of outdated versions of AERMOD and AERMET in reference (a). IDEQ acknowledged the NNPP concern that model versions change frequently, and re-running complicated models each time there is a change is not necessary for an EIS which is comparing the relative impacts of different alternatives and is being developed over a multi-year time period. IDEQ agreed that it would be sufficient for the EIS to provide acknowledgement of the version updates to AERMOD and AERMET and provide a sensitivity analysis between the versions used and version 12345 to show if there would be significant differences in the modeled pollutant concentrations at receptor locations. IDEQ pointed out that the latest version (13350) of AERMOD and AERMET should not be used due to issues that have been identified by the Environmental Protection Agency (EPA) with the updates. The NNPP proposed doing this sensitivity analysis for Scenario 6 (cumulative impacts) from reference (a) for 1-hour NO_2 ambient impacts. This represents the worst-case scenario for air quality impacts in the EIS. IDEQ agreed to this approach. A statement on meteorological data completeness will also be added to the Final EIS to address comment 8. The sensitivity analysis and statement on data completeness will be added to Appendix E in the Final EIS.

IDEQ comment 5g in reference (b) regarded the use of MOBILE 6.2 instead of MOVES2010a to estimate on-road vehicle emissions. MOVES2010a is the current model required for use by the EPA. IDEQ pointed out that the emissions estimates for on-road vehicles would be greater using MOVES2010a compared to MOBILE 6.2. However, the modeling of pollutant concentrations from on-road vehicle emissions during the construction period used conservative assumptions and these emissions are not subject to IDEQ permitting. IDEQ agreed that it would be sufficient for the EIS to use the analysis in reference (a), but include a sensitivity analysis between use of MOBILE 6.2 and MOVES2010a to show that the differences would not be significant, rather than re-running the entire analysis for the construction scenario. This sensitivity analysis will be included in Appendix E in the Final EIS.

IDEQ Comment 9b in reference (b) concerned the use of $PM_{2.5}$ and PM_{10} deposition in dispersion modeling. IDEQ stated that $PM_{2.5}$ and PM_{10} deposition should not be used in air permit application modeling calculations. IDEQ recommended that a note be included in the EIS that the $PM_{2.5}$ and PM_{10} concentrations would be higher assuming no deposition, however, the concentrations would still be below the standards. A sensitivity analysis will be performed for Scenario 6 (cumulative impacts) from reference (a) for $PM_{2.5}$ and PM_{10} without deposition to show that concentrations would be below the standards. This will be provided in Appendix E in the Final EIS.

In summary, IDEQ agreed that comments 1-5f, 6, 9a, 9c-e, and 10 in reference (b) did not require any change to the EIS, and that comments 7, 8, 5g, and 9b would be addressed (as described above) in the Final EIS.

Thank you for your comments and please do not hesitate to contact me at (208) 533-5363 if you have any questions or comments regarding the air quality modeling in the EIS.

R. E. Ramsey
Idaho Branch Office

C. A. Robinson, P. E.
Idaho Department of Environmental Quality

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March 11, 2014
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NR:IBO-13/055
April 04, 2013

Andrea Stacy
NPS Air Resources Division
Permitting and NEPA
PO Box 25287
Denver, Colorado 80225-0287

SUBJECT: NON-RADIOLOGICAL AIR QUALITY MODELING FOR RECAPITALIZATION OF INFRASTRUCTURE SUPPORTING NAVAL NUCLEAR FUEL HANDLING DRAFT ENVIRONMENTAL IMPACT STATEMENT

Dear Ms. Stacy:

The U. S. Department of Energy (DOE) Office of Naval Reactors is seeking coordination with your office on three air quality modeling reports that describe protocols and results for Prevention of Significant Deterioration (PSD) pollutant and visibility impacts at Federal Class I Areas. The Naval Nuclear Propulsion Program (NNPP) is preparing an Environmental Impact Statement (EIS) for recapitalizing the naval spent nuclear fuel handling capabilities of the Expended Core Facility (ECF) at the Idaho National Laboratory (INL). The EIS will contain an analysis of impacts on air quality at Federal Class I Areas in the vicinity of the INL. The EIS analysis will be based on the three air quality modeling reports, which were generated to support the National Environmental Policy Act (NEPA) process.

The NNPP proposes to recapitalize the infrastructure for preparing, examining, and packaging naval spent nuclear fuel and other irradiated materials, to ensure these capabilities are maintained for the vital NNPP mission of supporting the naval nuclear-powered fleet. The recapitalization is expected to be carried out as two parts. The first part would be the recapitalization of infrastructure supporting naval spent nuclear fuel handling, which includes the Spent Fuel Handling Recapitalization Project; the second part would be the recapitalization of infrastructure supporting naval spent nuclear fuel examinations.

This coordination was first initiated in October 2011 following publication of a Notice of Intent (NOI) for the project in 2010. Since then, personnel from Naval Reactors Facility (NRF) and Battelle Energy Alliance (BEA) have been in contact with John Notar who was identified as the National Park Service (NPS) contact for technical modeling questions. Mr. Notar provided information and NPS expectations for air quality analysis at Federal Class I Areas.

Due to changes in EIS scope and overall ECF Recapitalization Project funding and timeline, coordination was postponed until an amended NOI was published in the Federal Register.

An amended NOI was published in the Federal Register on May 10, 2012. The purpose of the amended NOI was to announce the NNPP's intent to reduce the scope of the EIS to include only the recapitalization of naval spent nuclear fuel handling capabilities. Interfaces and exchanges between recapitalization of naval spent nuclear fuel handling and examination capabilities will be factored into designs, to ensure that both parts can be carried out in an environmentally responsible and cost effective manner. The recapitalization of examination capabilities will be considered as a reasonably foreseeable future action in the cumulative impacts of the EIS for the recapitalization of naval spent nuclear fuel handling capabilities. Therefore, the recapitalization of examinations capabilities was retained in air quality modeling reports. Three alternatives will be analyzed in the EIS:

1. Maintain ECF without a change to the present course of action or management of the facility. Spent fuel handling capabilities of ECF would continue to use the current ECF infrastructure while performing corrective maintenance and repairs necessary to keep the infrastructure in good working order (i.e., actions sufficient to sustain the proper functioning of structures, systems, and components). (No Action Alternative)

2. Overhaul ECF by implementing major refurbishment projects for the ECF infrastructure and water pools to provide the needed long-term capabilities for transferring, preparing, and packaging naval spent nuclear fuel. (Overhaul Alternative)

3. Site a new Spent Fuel Handling Recapitalization Project facility at NRF. (New Facility Alternative)

The NNPP would like to re-initiate this coordination based on non-radiological air quality modeling that was completed in January 2013.

NNPP has addressed impacts on air quality at Federal Class I Areas using the tiered approach described in FLAG 2010. First, a screening assessment using emissions over distance (Q/D) for Federal Class I Areas greater than 50 kilometers from the source was used to evaluate whether visibility, deposition, or ozone impacts would need to be modeled. This assessment showed that Q/D was less than 10 for the alternatives, even when combined with emissions from

Andrea Stacy,
NPS Air Resources Division

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April 04, 2013
Page 3

other INL facilities. After confirmation from Mr. Notar that no further assessment of visibility, deposition, or ozone impacts would be needed for Federal Class I Areas greater than 50 kilometers from the source, PSD pollutant concentrations were modeled for these areas using CALPUFF. For Federal Class I Areas less than 50 kilometers from the source, visibility impacts were modeled using VISCREEN, and impacts of criteria and PSD pollutants were modeled using AERMOD. Because the VISCREEN screening thresholds were met, further visibility analysis was unnecessary for Federal Class I Areas less than 50 kilometers from the source. The modeling reports (Enclosures 1, 2, and 3) describe the modeling protocols, inputs, and results for AERMOD, VISCREEN, and CALPUFF, respectively, used for Federal Class I areas. The Q/D assessment is included in both the VISCREEN and CALPUFF reports as they are intended to be stand alone reports. Note that the AERMOD report also includes the model for INL public receptors, which may not be of interest to the NPS.

Note that the modeling is not intended for permitting purposes. Permit evaluations will be performed once the project has developed further and a Record of Decision has been published. Review of the modeling reports at this time is requested to ensure that the NPS's expectations with respect to NEPA analysis are met to mitigate the risk of receiving significant comments on the Draft EIS that could delay the publication of the Final EIS if additional modeling is required. The NNPP requests feedback from the NPS by May 24, 2013.

Please don't hesitate to contact me at 208-533-5363 or by e-mail at robert.ramsey@nrp.doe.gov if you have any questions or comments or need additional information. I will follow-up with you by May 10, 2013, to discuss whether the NPS has any concerns with the modeling approach.

Sincerely,

R. E. Ramsey
Idaho Branch Office

References: FLAG 2010. U.S. Forest Service, National Park Service, and U.S. Fish and Wildlife Service. Federal Land Managers' Air Quality Related Values Work Group (FLAG): Phase I Report – Revised (2010). Natural Resource Report NPS/NRPC/NRR-2010/232. National Park Service, Denver, Colorado.

Enclosure 1 INL/LTD-12-26728. Evaluation of Criteria Toxic and Prevention of Significant Deterioration Air Pollutant Emissions for the Expended Core Facility Recapitalization Environmental Impact Statement. January 2013. (Official Use Only)

Enclosure 2 INL/LTD-12-26766. Evaluation of Visibility Impacts for the Expended Core Facility (ECF) Recapitalization Environmental Impact Statement. January 2013. (Official Use Only)

Enclosure 3 INL/LTD-12-26741. Evaluation of Prevention of Significant Deterioration (PSD) Increment Levels In Class I Areas for the Expended Core Facility (ECF) Recapitalization Environmental Impact Statement. January 2013. (Official Use Only)

Andrea Stacy,
NPS Air Resources Division

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April 04, 2013
Page 5

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United States Department of the Interior

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IN REPLY REFER TO:

Mr. Robert Ramsey
Naval Reactors
Idaho Branch Office
PO Box 2469
Idaho Falls Idaho 83403-2469

Dear Mr. Ramsey,

We appreciate this opportunity to comment upon Idaho National Laboratory's (INL) "Evaluation of Visibility Impacts for the Expended Core Facility (ECF) Recapitalization Environmental Impact Statement" and the "Evaluation of Prevention of Significant Deterioration (PSD) Increment Levels in Class I Areas for the Expended Core Facility (ECF) Recapitalization Environmental Impact Statement".

The National Park Service (NPS) administers three Class I areas which are located within 110 kilometers (km) of the proposed INL Spent Fuel Handling Recapitalization (SFHP) facility at the INL's Navel Reactors Facility (NRF). The NPS Class I units are Craters of the Moon National Monument (NM), Yellowstone National Park (NP) and Grand Tetons National Park (NP). A large portion of Craters of the Moon NM lies less than 50 km from the proposed INL SFHP facility. INL addressed the impacts to the National Ambient Air Quality Standards (NAAQS) and the Class I increments from the proposed action of construction of the SFHP using the Environmental Protection Agency's (EPA) guideline model AERMOD for areas less than 50 km in Craters of the Moon NM and applied the EPA Long Range Transport model CALPUFF to address the impacts to the NAAQS and PSD increments for the area in Craters of the Moon NM farther than 50 km from the SFHP and all of Yellowstone NP and Grand Tetons NP.

INL followed the recommendations in the Federal Land Managers 2010 (FLAG) guidance document to determine if the proposed action of construction of the SFHP would trigger the need for a visibility air quality related values analysis (AQRV). The FLAG guidance states that the sum of emissions (Q) of visibility impairing pollutants of SO_2, NO_x, PM_{10}, $PM_{2.5}$, H_2SO_4, elemental carbon, and organic carbon, based on the permitted 24 hour emission rates converted to annual tons per year emission rate divided by the distance in kilometers (D), which is Q/D. The Class I area with the largest Q/D is Craters of the Moon NM with a value of 2.70 for scenario 8b. Therefore, a regional haze analysis for Craters of the Moon NM, Yellowstone NP, and Grand Tetons NP is not required. The Q/D calculation is only to determine if an AQRV analysis is required for receptors greater than 50 km from the source. It does not release a source from the obligation to address Class I AQRV impacts (i.e., deposition of total nitrogen and total sulfur), and an increment analysis for receptors that are located less than 50 km from the source (i.e., a near-field assessment).

We concur with the methodology and the results of the AERMOD air quality impact analyses for the 18 scenarios that indicate that impacts of the criteria pollutants at Craters of the Moon NM are far below the NAAQS for all averaging periods with, with exception of the 1-hour NO_2 impacts from 2 of the possible SFHP scenarios which are slightly greater than one half of the NAAQS which is 190 micrograms per cubic meter (ug/m^3). The AERMOD air quality analysis indicates that the impacts from any of the SFHP scenarios are far below the Class I increments for all criteria pollutants and averaging periods.

We also concur with the methodology and the results for the CALPUFF air quality impact analyses for the 18 scenarios that indicate that impacts of the criteria pollutants for the applicable areas in Craters of the Moon NM and for all areas in Yellowstone NP and Grand Tetons NP. The long range transport analysis with CALPUFF indicates that the impacts to the NAAQS for the criteria pollutants are well below the standards for all pollutants and averaging periods. The CALPUFF analysis to address impacts to the PSD Class I increments are well below the limits for all pollutants and averaging periods.

Air Quality Related Values (AQRV) Impacts

Visibility

A regional haze analysis for the three NPS Class one areas was not required because the Q/D values are less than 10.0 following the recommendations from the FLM's FLAG 2010 guidance document. FLAG 2010 does require a coherent plume analysis for sources locating at distances less than 50 km from Class I areas. Most of Craters of the Moon NM is less than 50 km from the proposed SFHP facility. Therefore INL performed a coherent visibility analysis with the EPA VISCREEN model. INL ran the VISCREEN model using the background visual range of 253.5 km annual average from Table 10 in the FLAG 2010 document. The initial VISCREEN run was the default Level 1 analysis using the default meteorological condition of "F" stability and wind speed of 1.0 meters per second (m/sec). The SFHP facility failed the Level 1 analysis with an impact of a delta E and a contrast of C.

INL then performed a Level 2 VISCREEN analysis using a worst case 1% meteorological condition of "E" stability and 2.0 m/sec wind speed. The maximum \ delta "E"/ change in color is 1.275 against a "terrain" background for scenario 8b which is below visibility impact threshold of 2.0. The maximum absolute |C| contrast impact was for several of the proposed scenarios (2, 5, 6, and & 7) all with a maximum contrast of -0.011 which is below the visibility impact threshold of 0.05. Therefore, the NPS is satisfied the construction of the proposed SFHP will not cause a coherent plume impact at Craters of the Moon NM.

Acid Deposition

The NPS is waiving the need for an acid deposition analysis of total nitrogen and total sulfur due to the very low emission of NO_x and SO_2 and H_2SO_4 and the very low annual concentration impacts at Craters of the Moon NM.

For further information regarding National Park Service's comments please contact me at (303) 969-2079.

Sincerely,

John Notar
Meteorologist, NPS Resources Division

APPENDIX C

APPLICABLE LAWS, REGULATIONS, AND REQUIREMENTS

This Appendix describes the laws, regulations, and other requirements that could potentially apply to the proposed action. Federal laws and regulations are summarized in Section C.2; Executive Orders (EOs) in Section C.3; United States (U.S.) Department of Energy (DOE) regulations and orders in Section C.4; and state environmental laws, regulations, and agreements in Section C.5. Emergency management and response laws, regulations, and EOs are discussed in Section C.6. Potentially applicable permitting and approval requirements are discussed in Section C.7.

C.1 Introduction

There are a number of federal environmental laws, EOs, and DOE Directives that affect environmental protection, health, safety, compliance, and consultation at the Idaho National Laboratory (INL). In some cases, the Naval Nuclear Propulsion Program (NNPP), as a semi-autonomous organization within the DOE, has sole authority to take action (e.g., under the Atomic Energy Act (AEA)). In other cases, the U.S. Environmental Protection Agency (EPA) has authority to regulate; in others, EPA has delegated its authority to regulate to the state of Idaho (e.g., under the Resource Conservation and Recovery Act (RCRA)). In still other cases, state law applies. The major federal and state laws and regulations, EOs, and other requirements that currently apply or may apply in the future to the actions evaluated in this Environmental Impact Statement (EIS) are briefly discussed in the following sections.

C.2 Applicable Federal Laws and Regulations

Federal environmental, safety, and health laws and regulations that could apply to the proposed action are discussed in this section.

National Environmental Policy Act of 1969, as amended (42 U.S.C. § 4321 *et seq.*). The National Environmental Policy Act (NEPA) establishes a national policy promoting awareness of the environmental consequences of human activity on the environment and consideration of environmental impacts during the planning and decision-making stages of a project. It requires federal agencies to prepare an EIS for major federal actions with potentially significant environmental impacts on the human environment. This EIS has been prepared in accordance with NEPA requirements, Council on Environmental Quality (CEQ) regulations (40 C.F.R. § 1500 *et seq.*), and DOE provisions for implementing the procedural requirements of NEPA (10 C.F.R. § 1021, DOE Order 451.1B). Reasonable alternatives and their potential environmental impacts are discussed.

Clean Air Act of 1970, as amended (42 U.S.C. § 7401 *et seq.*). The Clean Air Act (CAA) is intended to "protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population." Section 118 of the CAA (42 U.S.C. § 7418) requires that each federal agency with jurisdiction over any property or facility engaged in any activity that might result in the discharge of air pollutants comply with "all federal, state, interstate, and local requirements with regard to the control and abatement of air pollution."

The CAA requires: (1) EPA to establish National Ambient Air Quality Standards (NAAQS) as necessary to protect the public health, with an adequate margin of safety, from any known or anticipated adverse effects of a regulated pollutant (42 U.S.C. § 7409 *et seq.*); (2) establishment of national standards of performance for new or modified stationary sources of atmospheric pollutants

(42 U.S.C. § 7411); (3) specific emission increases to be evaluated so as to prevent a significant deterioration in air quality (42 U.S.C. § 7470 *et seq.*); and (4) specific standards for releases of hazardous air pollutants (including radionuclides) (42 U.S.C. § 7412). In Idaho, these standards are implemented through regulations and plans developed by the state with EPA approval. The CAA requires sources to meet standards and obtain permits to satisfy those standards.

Emissions of air pollutants are regulated by EPA under 40 C.F.R. § 50 through 99. Radionuclide emissions from DOE facilities are regulated under the National Emission Standards for Hazardous Air Pollutants (NESHAP) Program under 40 C.F.R. § 61.

Safe Drinking Water Act of 1974, as amended (42 U.S.C. § 300(f) *et seq.*). The primary objective of the Safe Drinking Water Act (SDWA) is to protect the quality of public drinking water supplies and sources of drinking water. The implementing regulations, delegated to the state of Idaho by EPA, establish standards applicable to public water systems. These regulations include maximum contaminant levels (including those for radioactivity) in public water systems, which are defined as water systems that have at least 15 service connections used by year-round residents or regularly serve at least 25 year-round residents. The EPA regulations implementing the SDWA are found in 40 C.F.R. § 100 through 149.

Wild and Scenic Rivers Act of 1968 (16 U.S.C § 1271 - 1287). The Wild and Scenic Rivers Act establishes a National Wild and Scenic Rivers System and prescribes the method and standards through which additional rivers may be identified and added to the system. The list of rivers in the system are identified in 16 U.S.C § 1274.

Atomic Energy Act of 1954 (42 U.S.C. § 2011 *et seq.*). Under the AEA, DOE is authorized to establish standards to protect health or minimize dangers to life or property for activities under DOE's jurisdiction. Through a series of DOE Orders, a system of standards and requirements has been established to ensure safe design and operation of DOE facilities. For activities at the Naval Reactors Facility (NRF), this authority within DOE is assigned to the NNPP by the National Nuclear Security Administration Act (50 USC § 2401 *et seq.*).

Low-Level Radioactive Waste Policy Act of 1980, as amended (42 U.S.C. § 2021 *et seq.*). The Low-Level Radioactive Waste Policy Act amended the AEA to specify that the federal government is responsible for disposal of low-level radioactive waste generated by its activities.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (42 U.S.C. § 9601 *et seq.*). The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) is designed to promote the cleanup of hazardous waste sites. Among other things, CERCLA requires that federal agencies investigate and clean up contamination at their facilities. Federal facilities that are significantly contaminated may be placed on the CERCLA National Priorities List (NPL). For such facilities, CERCLA requires that EPA and the federal facility enter into an interagency agreement to cover the cleanup. States are often included as signatories to those agreements.

Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. § 6901 *et seq.*). The Solid Waste Disposal Act of 1965, as amended, governs the transportation, treatment, storage, and disposal of hazardous and non-hazardous waste. Under RCRA of 1976 that amended the Solid Waste Disposal Act of 1965, EPA defines and identifies hazardous waste; establishes standards for its transportation, treatment, storage, and disposal; and requires permits for persons engaged in hazardous waste activities. Section 3006 of RCRA (42 U.S.C. § 6926) allows states to establish and administer these permit programs with EPA approval. The EPA regulations implementing RCRA are found in 40 C.F.R. § 260 through 283. Regulations imposed on a generator or on a treatment, storage, and/or disposal facility vary according to the type and quantity of material or waste generated, treated, stored, and/or disposed. The method of treatment, storage, and/or disposal also impacts the extent and complexity of the requirements.

Federal Facility Compliance Act of 1992 (42 U.S.C. § 6961 *et seq.*). This act requires DOE to prepare treatment plans for sites which generate or store mixed wastes; mixed wastes contain chemically hazardous and radioactive constituents. The Federal Facility Compliance Act (FFCA) requires Site Treatment Plans to be submitted to the regulatory state or EPA for approval.

Hazardous Material Transportation Act of 1975 (49 U.S.C. § 5105 *et seq.*). Transportation of hazardous and radioactive materials and substances is governed by the Department of Transportation (DOT). The Hazardous Material Transportation Act requires DOT to prescribe uniform national regulations for transportation of hazardous materials (including radioactive materials). Most state and local regulations regarding such transportation that are not substantively the same as DOT regulations are preempted (i.e., rendered void) (49 U.S.C. § 5125). In effect, this allows state and local governments to enforce the federal regulations, not to change or expand upon them.

This program is administered by the DOT Research and Special Programs Administration, which coordinates its regulations with those of the Nuclear Regulatory Commission (NRC) (under the AEA) and EPA (under RCRA) when covering the same activities.

DOT regulations (found in 49 C.F.R. § 171 through 178, and 49 C.F.R. § 383 through 397) contain requirements for identifying a material as hazardous or radioactive. These regulations interface with the NRC regulations for identifying material, but DOT hazardous material regulations govern the hazard communication (e.g., marking, hazard labeling, vehicle placarding, and emergency response telephone number) and shipping requirements.

The NRC regulations applicable to radioactive materials transportation are found in 10 C.F.R. § 71. These regulations include detailed packaging design certification testing requirements. Complete documentation of design and safety analysis and the results of the required testing are submitted to NRC to certify the packaging for use. This certification testing involves the following components: heat, free drop onto an unyielding surface, immersion in water, puncture by dropping the package onto a steel bar, and gas tightness. EPA regulations governing off-site transportation of hazardous waste are found at 40 C.F.R. § 262.

Pollution Prevention Act of 1990 (42 U.S.C. § 13101 *et seq.*). The Pollution Prevention Act establishes a national policy for waste management and pollution control. Source reduction is given first preference, followed by environmentally safe recycling, with disposal or releases to the environment as a last resort. Oil pollution prevention regulations (40 C.F.R. § 112) establish procedures to prevent the discharge of oil and require preparation and implementation of spill prevention, control, and countermeasures plans.

Toxic Substances Control Act of 1976 (15 U.S.C. § 2601 *et seq.*). The Toxic Substances Control Act (TSCA) provides EPA with the authority to require testing of chemical substances entering the environment and to regulate them as necessary. EPA is also authorized to impose limitations on the use and disposal of polychlorinated biphenyls (PCBs) which are found at 40 C.F.R. § 761.

National Historic Preservation Act of 1966, as amended (16 U.S.C. § 470 *et seq*.). The National Historic Preservation Act (NHPA) provides that sites with significant national historic value be placed on the National Register of Historic Places *(*NRHP*).* This register is maintained by the Secretary of the Interior. The major provisions of the NHPA for DOE consideration are Sections 106 and 110. Both sections aim to ensure that historic properties are appropriately considered in planning federal initiatives and actions. Section 106 is a specific, issue-related mandate to which federal agencies must adhere. It is a reactive mechanism driven by a federal action. Section 110, in contrast, sets out broad federal agency responsibilities with respect to historic properties. It is a proactive mechanism with emphasis on ongoing management of historic preservation sites and activities at federal facilities. No permits or certifications are required under the NHPA.

Section 106 requires the head of any federal agency having direct or indirect jurisdiction over a proposed federal or federally assisted undertaking to ensure compliance with the provisions of the NHPA. It compels federal agencies to "take into account" the effect of their projects on historical and archaeological resources and to give the Advisory Council on Historic Preservation the opportunity to comment on such effects. Section 106 mandates consultation during federal actions if the undertaking has the potential to affect a historic property. This consultation normally involves State and/or Tribal Historic Preservation Officers and may include other organizations and individuals such as local governments, Native American tribes, and Native Hawaiian organizations. If an adverse effect is found, the consultation often ends with the execution of a memorandum of agreement that states how the adverse effect will be resolved.

The regulations implementing Section 106 are found at 30 C.F.R. § 800.

Antiquities Act of 1906, as amended (16 U.S.C. § 431 to 433). This act protects historic and prehistoric ruins, monuments, and antiquities, including paleontological resources, on federally controlled lands from appropriation, excavation, injury, and destruction without permission.

Historic Site Act of 1935 (16 U.S.C. § 461 to 467). This act establishes national policy to preserve for public use historic sites, buildings, and objects of national significance for the inspiration and benefit of the people of the U.S.

Archaeological and Historic Preservation Act of 1960, as amended (16 U.S.C. § 469 to 469c). This act protects sites that have historic or prehistoric importance that might otherwise be lost or destroyed as a result of federal actions.

Archaeological and Resources Protection Act of 1979, as amended (16 U.S.C. § 470 *et seq.*). This act requires a permit for any excavation or removal of archaeological resources from federal or Native American lands. Excavations must be undertaken for the purpose of furthering archaeological knowledge in the public interest, and resources removed remain the property of the U.S. The law requires that whenever any federal agency finds that its activities may cause irreparable loss or destruction of significant scientific, prehistoric, or archaeological data, the agency must notify the U.S. Department of the Interior (DOI) and may request that the Department undertake the recovery, protection, and preservation of such data. Consent must be obtained from the Native American tribe or the federal agency having authority over the land on which a resource is located before issuance of a permit; the permit must contain the terms and conditions requested by the tribe or federal agency.

Endangered Species Act of 1973, as amended (16 U.S.C. § 1531 *et seq*.). The Endangered Species Act (ESA) is intended to prevent the further decline of endangered and threatened species and to restore those species and their critical habitats. Section 7 of the ESA requires federal agencies having reason to believe that a prospective action may affect an endangered or threatened species or its critical habitat to consult with the U.S. Fish and Wildlife Service (USFWS) or the National Marine Fisheries Service to ensure that the action does not jeopardize the species or destroy its habitat (50 C.F.R. § 17). Despite reasonable and prudent measures to avoid or minimize such impacts, if the species or its habitat would be jeopardized by the action, a formal review process is specified.

Migratory Bird Treaty Act of 1918, as amended (16 U.S.C. § 703 *et seq.*). The Migratory Bird Treaty Act, as amended, is intended to protect birds that have common migration patterns between the U.S. and Canada, Mexico, Japan, and Russia. Under this act, taking, killing, or possessing migratory birds is unlawful unless and except as permitted by regulation.

Bald and Golden Eagle Protection Act of 1973, as amended (16 U.S.C. § 668 through 668d). The Bald and Golden Eagle Protection Act, as amended, makes it unlawful to take, pursue, molest, or disturb bald (American) and golden eagles, their nests, or their eggs anywhere in the U.S. A permit must be obtained from the DOI to relocate a nest that interferes with resource development or recovery operations.

Federal Noxious Weed Act of 1974, as amended (7 U.S.C. § 2801 through 2814). This act provides for control and management of non-indigenous weeds that injure or have the potential to injure the interests of agriculture and commerce, wildlife resources, or the public health. Federal agencies are required to develop management programs to control undesirable plants on federal lands under the agency's jurisdiction.

American Indian Religious Freedom Act of 1978 (42 U.S.C. 1996). This act reaffirms American Indian religious freedom under the First Amendment and sets U.S. policy to protect and preserve the inherent and constitutional right of American Indians to believe, express, and exercise their traditional religions. This act requires that federal actions avoid interfering with access to sacred locations and traditional resources that are integral to the practice of tribal religions.

Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. § 3001). This act establishes a means for Native Americans to request the return or repatriation of human remains and other cultural items presently held by federal agencies or federally assisted museums or institutions. This act also contains provisions regarding the intentional excavation and removal of, inadvertent discovery of, and illegal trafficking in Native American human remains and cultural items. Major actions under this law include: (a) establishing a review committee with monitoring and policymaking responsibilities; (b) developing regulations for repatriation, including procedures for identifying lineal descent or cultural affiliation needed for claims; (c) providing oversight of museum programs designed to meet the inventory requirements and deadlines of this law; and (d) developing procedures to handle unexpected discoveries of graves or grave goods during activities on federal or tribal lands. All federal agencies that manage land and/or are responsible for archaeological collections obtained from their lands or generated by their activities must comply with this act.

Occupational Safety and Health Act of 1970 (29 U.S.C. § 651 *et seq.*). The Occupational Safety and Health Act establishes standards for safe and healthful working conditions in places of employment throughout the U.S. This act is administered and enforced by the Occupational Safety and Health Administration (OSHA), a U.S. Department of Labor agency. Section 4(b)(1) of this act exempts DOE and its contractors from the occupational safety requirements of OSHA. However, the DOE and NNPP have established their own occupational safety and health programs for facilities and activities authorized pursuant the AEA as provided in 42 U.S.C.§ 2201. The standards under these programs are generally consistent with those prescribed by OSHA.

Noise Control Act of 1972, as amended (42 U.S.C. § 4901 *et seq.*). Section 4 of the Noise Control Act of 1972, as amended, directs all federal agencies to carry out "to the fullest extent within their authority" programs within their jurisdictions in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health and welfare.

C.3 Applicable Executive Orders

Executive Order 11514 (Protection and Enhancement of Environmental Quality, March 5, 1970, as amended by Executive Order 11991, May 24, 1977). This Order requires federal agencies to continually monitor and control their activities to: (1) protect and enhance the quality of the environment, and (2) develop procedures to ensure the fullest practicable provision of timely public information and understanding of the federal plans and programs that may have potential environmental impacts so that the views of interested parties can be obtained.

Executive Order 11593 (National Historic Preservation, May 13, 1971). This Order directs federal agencies to locate, inventory, and nominate qualified properties under their jurisdiction or control to the NRHP. This process requires DOE to provide the Advisory Council on Historic Preservation the opportunity to comment on the possible impacts of the proposed activity on any potential eligible or listed resources.

Executive Order 11988 (Floodplain Management, May 24, 1977). This Order (implemented by DOE in 10 C.F.R. § 1022) requires federal agencies to establish procedures to ensure that the potential effects of flood hazards and floodplain management are considered for any action undertaken in a floodplain, and that floodplain impacts be avoided to the extent practicable.

Executive Order 11990 (Protection of Wetlands, May 24, 1977). This Order (implemented by DOE in 10 C.F.R. § 1022) requires federal agencies to avoid any short-term or long-term adverse impacts on wetlands wherever there is a practicable alternative. Each agency must also provide opportunity for early public review of any plans or proposals for new construction in wetlands.

Executive Order 12088 (Federal Compliance with Pollution Control Standards, October 13, 1978, as amended by Executive Order 12580, Superfund Implementation, January 23, 1987). This Order directs federal agencies to comply with applicable administrative and procedural pollution control standards established by, but not limited to, the CAA, Noise Control Act, Clean Water Act, SDWA, TSCA, and RCRA.

Executive Order 12344 (Naval Nuclear Propulsion Program, February 1, 1982) (codified under 50 U.S.C. § 2406 and 2511). This Order sets forth the authorities and responsibilities of the NNPP as an integrated program of the U.S. Department of Navy and the DOE.

Executive Order 12699 (Seismic Safety of Federal and Federally Assisted or Regulated New Building Construction, January 5, 1990, as amended by Executive Order 13289, February 28, 2003). This Order requires federal agencies to reduce risks to occupants of buildings owned, leased, or purchased by the federal government or buildings constructed with federal assistance and to persons who would be affected by failures of federal buildings in earthquakes; to improve the capability of existing federal buildings to function during or after an earthquake; and to reduce earthquake losses of public buildings, all in a cost-effective manner. Each federal agency responsible for the design and construction of a federal building shall ensure that the building is designed and constructed in accordance with appropriate seismic design and construction standards.

Executive Order 12898 (Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, February 11, 1994, as amended by Executive Order 12948, January 30, 1995). This Order requires each federal agency to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority and low-income populations.

Executive Order 13007 (Indian Sacred Sites, May 24, 1996). To the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, this Order requires federal agencies with statutory or administrative responsibility for the management of federal lands to (1) accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and (2) avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, agencies are also required to maintain the confidentiality of sacred sites.

Executive Order 13045 (Protection of Children from Environmental Health Risks and Safety Risks, April 21, 1997, as amended by Executive Order 13296, April 18, 2003). This Order requires each federal agency to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children and to ensure that its policies, programs, activities, and standards address disproportionate environmental health or safety risks to children.

Executive Order 13112 (Invasive Species, February 3, 1999). This Order directs federal agency action to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause.

Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments, November 6, 2000). This Order directs federal agency action to establish regular and meaningful consultation and collaboration with Indian tribal governments in the development of regulatory practices that significantly affect their communities; strengthen the U.S. government-to-government relationship with Indian tribes, and reduce the imposition of unfunded mandates upon Indian tribes.

Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds, January 10, 2001). This Order imposes requirements on federal agencies for those activities that have or are likely to have a measurable negative effect on migratory bird populations.

Executive Order 13423 (Strengthening Federal Environmental, Energy, and Transportation Management, January 26, 2007). This Order sets forth the federal government policy to conduct environmental, transportation, and energy-related activities in an environmentally, economically, and fiscally sound, integrated, continuously improving, efficient and sustainable manner. The Order establishes goals and requirements for each agency in implementing this policy.

Executive Order 13514 (Federal Leadership in Environmental, Energy, and Economic Performance, October 5, 2009). This Order establishes an integrated strategy toward sustainability in the federal government and makes reduction in greenhouse gas emissions a priority for federal agencies. In implementing the policy set forth in the Order, the Order requires among other things that agencies develop strategic sustainability performance plans and establishes goals for preparation and implementation of those plans.

C.4 Potentially Applicable DOE Regulations and Orders

The AEA of 1954, as amended, authorizes DOE to prescribe such regulations and orders as it deems necessary to govern any activity authorized pursuant to the AEA, including standards and restrictions governing the design, location, and operation of facilities used in the conduct of such activities in order to protect health and to minimize the dangers to life or property.

DOE regulations are found in 10 C.F.R. For the purpose of this EIS, relevant regulations include "Nuclear Safety Management" (10 C.F.R. § 830), "Occupational Radiation Protection" (10 .F.R. § 835), "Compliance with the National Environmental Policy Act" (10 C.F.R. § 1021), and "Compliance with Floodplains/Wetlands Environmental Review Requirements" (10 C.F.R. § 1022).

DOE Orders are a part of a system of departmental directives which establish, communicate, and institutionalize policies, requirements, and procedures across the DOE and its contractors. The DOE Orders potentially applicable to the proposed action are listed in Table C-1.

Table C-1: DOE Orders and Directives Potentially Applicable to the Proposed Action

DOE Order/Number	Subject	Date
O 413.3B	Program and Project Management for the Acquisition of Capital Assets	November 29, 2010
O 420.1B	Facility Safety	Change 1 - April 19, 2010
O 420.1C	Facility Safety	December 4, 2012
O 435.1	Radioactive Waste Management	Change 1 - August 28, 2001
O 436.1	Departmental Sustainability	May 2, 2011
O 440.1B	Worker Protection Management for DOE (Including the National Nuclear Security Administration) Federal Employees	Change 1 - August 21, 2012
O 450.1A	Environmental Protection Program	June 4, 2008
O 450.2	Integrated Safety Management	April 15, 2011
O 451.1B	National Environmental Policy Act Compliance Program	Change 2 - June 25, 2010
O 458.1	Radiation Protection of the Public and the Environment	Change 2 – June 6, 2011
O 460.1C	Packaging and Transportation Safety	May 14, 2010
O 460.2A	Departmental Materials Transportation and Packaging Management	December 22, 2004
O 144.1	Department of Energy American Indian Tribal Government Interaction and Policy	November 6, 2009
O 410.2	Management of Nuclear Materials	August 17, 2009
O 151.1C	Comprehensive Emergency Management	November 11, 2005

C.5 State Environmental Laws, Regulations, and Agreements

Certain environmental requirements, including some discussed in Section C.3, have been delegated to state authorities for implementation and enforcement. A list of potentially applicable Idaho state environmental laws, regulations, and tribal agreements is provided in Table C-2.

Table C-2: Potentially Applicable State Environmental Laws, Regulations, and Tribal Agreements

Law/Regulation/Agreement	Citation	Requirements
Idaho Environmental Protection and Health Act	Idaho Code (IC), Title 22, Agriculture and Horticulture, Chapter 24, Noxious Weeds	Noxious weed monitoring plan is required.
Idaho Environmental Protection and Health Act	IC, Title 39, Health and Safety, Chapter 1, Department of Health and Welfare, Sections 39-105	Provides for development of air pollution control permitting regulations.
Rules for the Control of Air Pollution in Idaho	Idaho Administrative Procedure Act (IDAPA) 58, Department of Environmental Quality, Title 1, Chapter 1 (58.01.01)	Provides rules and permitting programs to control the emissions of air pollutants in Idaho.
Idaho Water Pollution Control Act	IC, Title 39, Chapter 36, Water Quality	Establishes a program to enhance and preserve the quality and value of water resources.
Water Quality Standards and Wastewater Treatment Requirements	IDAPA 58.01	Establishes water quality standards and wastewater treatment requirements.
Transportation of Hazardous Waste	IC, Title 18, Crimes and Punishment, Chapter 39, Highways and Bridges, Section 18-3905; IC, Title 49, Motor Vehicles, Chapter 22, Hazardous Materials/Hazardous Waste Transportation Enforcement	Regulates transportation of hazardous materials/hazardous waste on highways.
Idaho Hazardous Waste Management Act	IC, Title 39, Chapter 44, Hazardous Waste Management	Requires proper controls for the management of solid and hazardous waste.
Rules and Standards for Hazardous Waste	IDAPA 58.01.05	Requires proper controls for the management of solid and hazardous waste.
Various Acts Regarding Fish and Game	IC, Title 36, Fish and Game, Chapters 9, Protection of Fish, 11, Protection of Animals and Birds, and 24, Species Conservation	Establishes protection of wildlife from certain methods of take. Establishes species management plan requirements.
Endangered Species Act	IC, Title 67, State Government and State Affairs, Chapter 8, Executive and Administrative Officers, Section 67-818	Establishes state responsibility and coordination of policy and programs related to threatened and endangered species.
Rules for Classification and Protection of Wildlife	IDAPA 13, Department of Fish and Game, 13.01.06	Establishes authority for the Idaho Fish and Game Commission to adopt rules concerning the taking of wildlife species and classification of wildlife species.

Table C-2: Potentially Applicable State Environmental Laws, Regulations, and Tribal Agreements (cont.)

Law/Regulation/Agreement	Citation	Requirements
Idaho Historic Preservation Act	IC, Title 67, Chapter 46, Preservation of Historic Sites	Requires consultation with responsible local governing body.
Agreement in Principle Between the Shoshone-Bannock Tribes and DOE	December 3, 2007	Establishes understanding and commitment between the Tribes and DOE.
Settlement Agreement Among the State of Idaho, the DOE, and the Navy	October 17, 1995, amended 2008	Allows Idaho National Engineering and Environmental Laboratory (INEEL) (now INL) to receive spent nuclear fuel and mixed waste from off-site and establishes schedules for the treatment of existing high-level radioactive waste, transuranic waste, and mixed waste, and the removal of spent nuclear fuel from the State.
Federal Facility Agreement and Consent Order	December 9, 1991	Establishes a procedural framework for developing, prioritizing, implementing, and monitoring appropriate response actions at the INL in accordance with CERCLA, RCRA, and the Idaho Hazardous Waste Management Act.
Idaho Site Treatment Plan and Consent Order for Federal Facility Compliance Plan	November 1, 1995 - issued to INEEL (now INL) and Argonne National Laboratory-West (now Materials and Fuels Complex (MFC))	Addresses compliance with the FFCA and mixed waste treatment issues by implementing the INL Site Treatment Plan.

C.6 Emergency Management and Response Laws, Regulations, and Executive Orders

This section discusses the laws, regulations, and EOs that address the protection of public health and worker safety and require the establishment of emergency plans. These laws, regulations, and EOs relate to the operation of facilities (including NNPP facilities) that engage directly or indirectly in the production of special nuclear material.

C.6.1 Federal Emergency Management and Response Laws

Emergency Planning and Community Right-to-Know Act of 1986 (U.S.C. § 11001 *et seq.*) (also known as "SARA Title III"). Emergency Planning and Community Right-to-Know Act requires emergency planning and notice to communities and government agencies concerning the presence and release of specific chemicals. EPA implements this act under regulations found in 40 C.F.R. § 355, 370, and 372. Under Subtitle A of this act, federal facilities are required to provide various information (such as inventories of specific chemicals used or stored and releases that occur from these sites) to the state emergency response commission and to the local emergency planning committee to ensure that emergency plans are sufficient to respond to unplanned releases of hazardous substances. Implementation of the provisions of this act began voluntarily in 1987, and inventory and annual emissions reporting began in 1988. DOE requires compliance with Title III as a matter of DOE policy at its contractor-operated facilities

Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1988 (42 U.S.C. § 5121). This act, as amended, provides an orderly, continuing means of providing federal government assistance to state and local governments in managing their responsibilities to alleviate suffering and damage resulting from disasters. The President, in response to a state governor's request, may declare an "emergency" or "major disaster" to provide federal assistance under this act. This act provides for the appointment of a federal coordinating officer who will operate in the designated area with a state coordinating officer for the purpose of coordinating state and local disaster assistance efforts with those of the federal government.

C.6.2 Federal Emergency Management and Response Regulations

Quantities of Radioactive Materials Requiring Consideration of the Need for an Emergency Plan for Responding to a Release (10 C.F.R. § 30.72, Schedule C). This section of the regulations provides a list that is the basis for both the public and private sector to determine whether the radiological materials they handle must have an emergency response plan for unscheduled releases, and is one of the threshold criteria documents for DOE hazards assessments required by DOE Order 151.1, "Comprehensive Emergency Management System."

Executive Order 12656 (Assignment of Emergency Preparedness Responsibilities, November 18, 1988). This Order assigns emergency preparedness responsibilities to federal departments and agencies. For DOE nuclear facilities, these responsibilities are assigned to the DOE.

C.7 Applicable Permitting and Approval Requirements

The New Facility Alternative is the only alternative that would require new permits, permit modifications, or approvals. Permits that have been identified as necessary for the New Facility Alternative are listed in Table C-3.

Table C-3: New Permits, Permit Modifications, or Approvals for the New Facility Alternative

Permit, Modification or Approval	Responsible Agency	Regulation or Sources
Permit to Construct a Non-Radionuclide Air Emissions Source[1]	Idaho Department of Environmental Quality (IDEQ)	IDAPA 58.01.01 - Rules for the Control of Air Pollution in Idaho
Amendment to Tier I Operating Permit[1]	IDEQ	IDAPA 58.01.01 - Rules for the Control of Air Pollution in Idaho
Major Modification to Reuse Permit for Industrial Wastewater Facility[2]	IDEQ	IDAPA 58.01.17 - Recycled Water Rules
Approval of Material Modification to Municipal Wastewater Treatment Facility[3]	IDEQ	IDAPA 58.01.16 - Wastewater Rules
Approval of Simple Water Main Extension to Public Drinking Water System and/or Service Line Connection[4,5]	IDEQ/IPB	IDAPA 58.01.08 - Idaho Rules for Public Drinking Water Systems/Memorandum of Understanding between the IBP and IDEQ.
Construction Permits: Electrical, Plumbing, and Heating, Ventilation, and Air-Conditioning (HVAC)	Idaho Division of Building Safety	IDAPA 07.01.01 IDAPA 07.02.04 IDAPA 07.07.01

[1] Only required for the New Facility Alternative if the contractors selected to provide portable rock-crushing equipment and concrete batch plant operations operate under Permit By Rule or a general Permit to Construct.

[2] Required for the New Facility Alternative from infrastructure changes necessary to get wastewater to the Industrial Waste Ditch

[3] A new municipal wastewater force main and additional service connections are required for the New Facility Alternative (Section 4.11). The new force main is considered a "material modification" to the NRF sewage system.

[4] A water main extension would be necessary to connect the existing drinking water system to the new facility. The required connection would be considered a "simple water main extension" because it does not require the addition of system components designed to control quantity or pressure, including booster stations, new sources, pressure reducing stations, or reservoirs.

[5] Service line connection (from main to building) falls under the jurisdiction of the Idaho Division of Building Safety – Plumbing Bureau (IPB).

APPENDIX D

SUMMARY OF CULTURAL RESOURCE INVESTIGATIONS

D.1 Introduction

This Appendix documents a summary of the cultural resource investigations conducted to support the evaluation of impacts from the proposed action. This information was provided to the Idaho State Historic Preservation Office (SHPO) and the Shoshone-Bannock Tribes as documented in Appendix B along with their responses.

D.2 Background and Objectives

The National Environmental Policy Act (NEPA) requires consideration of whether an action could potentially violate federal, state, or local laws or requirements (40 C.F.R § 1508.27) or require a federal permit, license, or other entitlements (40 C.F.R. § 1502.25). Protection and conservation of cultural and historic resources is achieved through Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended; its implementing regulations (36 C.F.R. § 800) require that federal agencies consider the effects of their undertakings on historic properties (e.g., cultural resources that have been included in or that have been determined to be eligible for inclusion in the National Register of Historic Places (NRHP, or National Register)).

Battelle Energy Alliance (BEA), Cultural Resource Management Office, performed archival investigations for Naval Reactors Facility (NRF) areas being considered for the proposed action. With the archival investigations, BEA assessed overall cultural resource sensitivity in the vicinity of NRF.

Follow-on field investigations were limited to the temporary disturbance areas for the New Facility Alternative (Location 3/4 and Location 6) and for the Overhaul Alternative. The general purpose of the field investigations was to provide site-specific information from which the Naval Nuclear Propulsion Program (NNPP) could draw conclusions regarding potential impacts to cultural resources. Specific objectives were to:

- Identify cultural resources within the temporary disturbance areas associated with the proposed action.
- Conduct a preliminary assessment of the potential effects of land disturbance on any identified cultural resources, particularly those listed on or eligible for listing on the NRHP.
- Develop specific recommendations for strategies to complete National Register assessments of identified resources and general recommendations to avoid or reduce unavoidable adverse effects.

Two reports were prepared during the evaluation of potential impacts. The first report was prepared based on surveys conducted in 2011 (INL 2011). A second report was prepared documenting some additional survey work and additional investigations (INL 2013d). To the extent feasible, temporary disturbance areas would be located to minimize impacts to cultural resources. These reports describe methods and results of the archival search and field investigations. The full reports were provided to the Idaho SHPO and the Shoshone-Bannock Tribes. Table D-1 provides a summary of the resources found during cultural resource investigations.

It was determined through the evaluation in Section 4.8, information in the cultural resource survey report, information in the cultural resource investigations report, and consultation with the Idaho SHPO and the Shoshone-Bannock Tribes that there would be no adverse effect to historic properties eligible for listing on the NRHP impacted by the proposed action. Even though the small archaeological sites that have been identified are not eligible for the NRHP, the historical record described in the Idaho National Laboratory (INL) Cultural Resources Management Plan supports the conclusion that INL, including the proposed disturbance areas, is located within a large original territory of the Shoshone-Bannock people and archaeological and other cultural resources that reflect the importance of the area to the Tribes are located there. The Shoshone-Bannock Tribes agreed that the construction of the new facility at NRF would have small unavoidable impacts to Native American cultural resources (small archaeological sites and ecological resources) identified in the survey areas for Location 3/4 and Location 6 of the New Facility Alternative.

Table D-1: Summary of Cultural Resource Surveys and Investigations

Site Number	Description	Status	National Register Evaluation	Recommendation
10-BT-944	General Prehistoric (12,000 - 150 BP) Lithic Scatter South of NRF	Originally recorded in 1985 as a dense scatter of 200 flakes and expedient flake tools (Reed & Ringe 1985). Test excavations completed in 2012: seventy 30 x 30 centimeter shovel probes and two 1 x 1 meter test pits; no cultural features or strata identified (INL 2012, INL 2013d). The resource is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
10-BT-945	Middle Prehistoric (7,500 - 1,300 BP) Campsite East of NRF	Originally recorded in 1985 as a scatter of 40 flakes and dart point fragments (Reed & Ringe 1985). Test excavations completed in 2011 (due to the location of the resource in the temporary disturbance area): fifteen 30 x 30 centimeter shovel probes and one 1 x 1 meter test pit; no cultural features or strata identified (INL 2013d).	Ineligible	No further work
10-BT-947	Late Prehistoric (1,300 - 150 BP) Campsite East of NRF	Originally recorded in 1985 as a scatter of six flakes and two arrow point fragments (Reed & Ringe 1985). Test excavations completed in 2011 (due to the location of the resource in the temporary disturbance area): fifteen 30 x 30 centimeter shovel probes and one 1 x 1 meter test pit; no cultural features or strata identified (INL 2013d).	Ineligible	No further work

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
10-BT-948	General Prehistoric (12,000 - 150 BP) Lithic Scatter East of NRF	Originally recorded in 1985 as a scatter of 10 flakes (Reed & Ringe 1985). Test excavations completed in 2011 (due to the location of the resource in the temporary disturbance area): twenty 30 x 30 centimeter shovel probes and one 1 x 1 meter test pit; no cultural features or strata identified (INL 2013d).	Ineligible	No further work
10-BT-1038	Middle Prehistoric III (3,500 - 1,300 BP) Lithic Scatter East of NRF	Originally recorded in 1985 as a scatter of 29 flakes and an Elko Corner-notched point fragment (Reed et al. 1987). Test excavations completed in 2011: fifty 30 x 30 centimeter shovel probes and one 1 x 1 meter test pit; no cultural features or strata identified (INL 2013d). The resource is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-09-04-01	General Prehistoric (12,000 - 150 BP) Lithic Scatter West of NRF	Originally recorded in 2009 as a scatter of 25 flakes (INL 2011). Test excavations completed in 2011 (due to the location of the resource in the temporary disturbance area): twelve 30 x 30 centimeter shovel probes and one 1 x 1 meter test pit; no cultural features or strata identified (INL 2013d).	Ineligible	No further work

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
INL-91-12-01	General Prehistoric (12,000 - 150 BP) Campsite East of NRF	Originally recorded in 1991 as a scatter of 20 flakes and expedient scraping tools with two concentrations of fire-cracked rock indicating possible fire hearths (Ringe 1995). Test excavations completed in 2012 (due to the location of the resource in the temporary disturbance area): twenty-two 30 x 30 centimeter shovel probes and one 1 x 1 meter test pit; no cultural features or strata identified (INL 2013d).	Ineligible	No further work
INL-91-12-02	General Prehistoric (12,000 - 150 BP) Campsite East of NRF	Originally recorded in 1991 as a scatter of ten flakes and a few fragments of fire-cracked rock that may represent a fire hearth (Ringe 1995). Test excavations completed in 2012 (due to the location of the resource in the temporary disturbance area): five 30 x 30 centimeter shovel probes, one 1 x 1 meter test pit, with no subsurface artifacts found and no cultural features or strata identified (INL 2013d).	Ineligible	No further work

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
10-BT-949	General Prehistoric (12,000 - 150 BP) Lithic Scatter East of NRF	Originally recorded in 1985 as a scatter of approximately 20 flakes and a nondiagnostic biface fragment (Reed & Ringe 1985). Surface conditions in this area have changed since this site was originally recorded. Thin scatter of artifacts could not be re-identified in 2010, 2011, or 2012 (INL 2011, INL 2013d) in the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-91-12-05	General Prehistoric (12,000 - 150 BP) Campsite Southeast of NRF	Originally recorded in 1991 as a dispersed scatter of three flakes and one fire-cracked cobble possibly indicating a fire hearth (Ringe 1995). Surface conditions in this area have changed since this site was originally recorded. Sparse scatter of artifacts could not be re-identified in 2012 (INL 2013d). The resource is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
10-BT-933	General Prehistoric (12,000 - 150 BP) Lithic Scatter North of NRF	Originally recorded in 1985 as a scatter of 45 flakes and one utilized flake (Reed & Ringe 1985). Re-identified in 2011 and 2012 as a small scatter of flakes (INL 2011, INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, it is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible
10-BT-934	Late Prehistoric II (750 - 150 BP) Campsite North of NRF	Originally recorded in 1985 as three activity areas including dense flake concentrations, formal and expedient scraping tools, a knife, biface fragments, two Desert Side-notched arrow point fragments, and an arrow perform (Reed & Ringe 1985). Re-identified in 2012 as a dense artifact scatter (INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, it is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
10-BT-937	General Prehistoric (12,000 - 150 BP) Campsite North of NRF	Originally recorded in 1985 as a scatter of 40 flakes, two nondiagnostic biface fragments, an exhausted lithic core, and fire-cracked rock fragments suggesting that a fire hearth may be present (Reed & Ringe 1985). Re-identified in 2012 as a small scatter of artifacts (INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, it is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible
10-BT-940	Middle Prehistoric (7500 - 1300 BP) Lithic Scatter Northwest of NRF	Originally recorded in 1985 as a thin scatter of 17 flakes, a large notched dart point fragment, and an expedient flake tool (Reed & Ringe 1985). Re-identified in 2012 as a sparse scatter of flakes (INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, the site is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
10-BT-941	General Prehistoric (12,000 - 150 BP) Campsite Northwest of NRF	Originally recorded in 1985 as a dispersed scatter of 20 flakes and utilized flakes (Reed & Ringe 1985). Re-identified in 2012 as a small scatter of artifacts (INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, it is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible
10-BT-950	General Prehistoric (12,000 - 150 BP) Lithic Scatter Northwest of NRF	Originally recorded in 1985 as a scatter of 14 flakes (Reed & Ringe 1985). Re-identified in 2012 as a sparse scatter of flakes (INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, the site is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
10-BT-951	Historic (circa 1908) Canal construction camp Northwest of NRF	Originally recorded in 1985 as a canal construction camp with a rock feature, a dense scatter of domestic debris, and other cultural features (Reed & Ringe 1985). Re-identified in 2012 as a dense scatter of artifacts and cultural features (INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, it is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible
10-BT-1037	Historic (circa 1909) Homestead Northeast of NRF	Originally recorded in 1985 as a homestead with a probable root cellar, corral, and a dense scatter of domestic artifacts (Reed et al. 1987, Ringe & Holmer 1988). Re-identified in 2011 and 2012 as a dense scatter of historic artifacts and cultural features (INL 2011, INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, it is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
INL-95-52-08	General Prehistoric (12,000 - 150 BP) Lithic Scatter Southwest of NRF	Originally recorded in 1995 as a dispersed scatter of five flakes and a nondiagnostic biface fragment (Ringe 1995). Re-identified as a sparse scatter of flakes in 2012 (INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, the site is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible
INL-95-52-09	Late Prehistoric I (1300 - 750 BP) Campsite Southwest of NRF	Originally recorded in 1995 as a campsite with ten flakes, two Rosegate Corner-notched arrow points, and a possible fire hearth (Ringe 1995). Re-identified in 2011 and 2012 as a sparse scatter of flakes (INL 2011, INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, it is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
INL-95-52-10	General Prehistoric (12,000 - 150 BP) Campsite Southwest of NRF	Originally recorded in 1995 as a dispersed scatter of 20 flakes, burned bone, and fire-cracked rock fragments indicating a possible fire hearth (Ringe 1995). Re-identified in 2011 and 2012 as a small scatter of artifacts (INL 2011, INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, it is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible
INL-11-01-01	General Prehistoric (12,000 - 150 BP) Campsite East of NRF	Originally recorded in 2011 as a scatter of 12 flakes and a piece of fire-cracked rock indicating a possible fire hearth (INL 2011). Re-identified in 2012 as a sparse scatter of artifacts (INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, it is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
INL-12-04-10	General Prehistoric (12,000 - 150 BP) Campsite Northwest of NRF	Sparse and dispersed scatter of five flakes and a fire-cracked rock fragment indicating a possible fire hearth identified during intensive surveys in 2012 (INL 2013d). Due to potentially datable subsurface deposits, limited test excavations were conducted. The resource is potentially eligible for nomination to the NRHP; however, the test excavations resulted in no substantial cultural deposits that would merit NRHP listing. The resource is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible
INL-12-04-11	General Prehistoric (12,000 - 150 BP) Campsite Northwest of NRF	Sparse scatter of four flakes and a fire-cracked rock fragment indicating a possible fire hearth identified in intensive surveys in 2012 (INL 2013d). Due to potentially datable subsurface deposits, limited test excavations were conducted. The resource is potentially eligible for nomination to the NRHP; however, the test excavations resulted in no substantial cultural deposits that would merit NRHP listing. The resource is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
INL-12-04-12	Historic (circa 1942-1949) Road	West Monument Road, a development associated with the Arco Naval Proving Ground, recorded during intensive surveys in 2012 (INL 2013d). The resource is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
10-BT-935	Late Prehistoric (1300 - 150 BP) Isolate Location	Small notched arrow point was collected in 1985 (Reed & Ringe 1985). No new artifacts were identified in this area in 2012. Location is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
10-BT-936	General Prehistoric (12,000 - 150 BP) Isolate Location	Retouched flake was collected in 1985 (Reed & Ringe 1985). No new artifacts were identified in this area in 2012. Location is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
10-BT-938	Middle Prehistoric (7500 - 1300 BP) Isolate Location	Large notched dart point fragment was collected in 1985 (Reed & Ringe 1985). No new artifacts were identified in this area in 2012. Location is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
10-BT-939	General Prehistoric (12,000 - 150 BP) Isolate Location	Nondiagnostic biface midsection was collected in 1985 (Reed & Ringe 1985). No new artifacts were identified in this area in 2012. Location is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
10-BT-942	Middle Prehistoric II (5000 - 3500 BP) Isolate Location	Stemmed-indented base dart point collected in 1985 (Reed & Ringe 1985). No new artifacts were identified in this area in 2010 or 2011 (INL 2011). Location is unlikely to yield additional information despite being located in the temporary disturbance areas for the proposed action.	Ineligible	No further work

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
10-BT-943	General Prehistoric (12,000 - 150 BP) Isolate Location	Retouched flake collected in 1985 (Reed & Ringe 1985). No artifacts were identified in this area in 2010 or 2011 (INL 2011). Location is unlikely to yield additional information despite being located in the temporary disturbance areas for the proposed action.	Ineligible	No further work
10-BT-946	General Prehistoric (12,000 - 150 BP) Isolate Location	Nondiagnostic biface tip collected in 1985 (Reed & Ringe 1985). No artifacts were identified in this area in 2010 or 2011 (INL 2011). Location is unlikely to yield additional information despite being located in the temporary disturbance areas for the proposed action.	Ineligible	No further work
10-BT-964	General Prehistoric (12,000 - 150 BP) Isolate Location	Retouched flake collected in 1985 (Reed et al. 1987). No artifacts were identified in this area in 2010 or 2011 (INL 2011). Location is unlikely to yield additional information despite being located in the temporary disturbance areas for the proposed action.	Ineligible	No further work

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
10-BT-965	General Prehistoric (12,000 - 150 BP) Isolate Location	Conjoining nondiagnostic biface fragments collected in 1985 (Reed et al. 1987). No artifacts were identified in this area in 2012. Location is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
10-BT-1379	Middle Prehistoric (7500 – 1300 BP) Isolate Location	Large notched projectile point collected in 1988 (Ringe & Holmer 1988). No artifacts were identified in this area in 2012. Location is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-91-12-03	Historic (circa 1880 - 1920) Isolate Location	Half-pint solarized milk bottle collected in 1991 (Ringe 1995). No new artifacts were identified in this area in 2010 or 2011 (INL 2011). Location is unlikely to yield additional information despite being located in the temporary disturbance areas for the proposed action.	Ineligible	No further work

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
INL-91-12-04	General Prehistoric (12,000 - 150 BP) Isolate Location	Nondiagnostic biface midsection collected in 1995 (Ringe 1995). No artifacts were identified in this area in 2010 or 2011 (INL 2011). Location is unlikely to yield additional information despite being located in the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-95-52-06	General Prehistoric (12,000 - 150 BP) Isolate Location	Nondiagnostic biface midsection collected in 1995 (Ringe 1995). No artifacts were identified in this area in 2010 or 2011 (INL 2011). Location is unlikely to yield additional information despite being located in the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-95-52-07	Late Prehistoric II (750 - 150 BP) Isolate Location	Desert Side-notched arrow point fragment collected in 1995 (Ringe 1995). No artifacts were identified in this area in 2012. Location is unlikely to yield additional information despite being located in the temporary disturbance areas for the proposed action.	Ineligible	No further work

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
INL-11-01-02	General Prehistoric (12,000 - 150 BP) Isolate Location	Nondiagnostic biface fragment identified in 2011 (INL 2011). Artifact was collected in 2012. Location is unlikely to yield additional information despite being located in the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-11-01-03	General Prehistoric (12,000 - 150 BP) Isolate Location	Nondiagnostic scraping tool identified in 2011 (INL 2011). Artifact was collected in 2012. Location is unlikely to yield additional information despite being located in the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-11-01-04	General Prehistoric (12,000 - 150 BP) Isolate Location	Three nondiagnostic unmodified flakes identified in 2011 (INL 2011). No new artifacts identified in this area in 2012. Location is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-12-04-01	General Prehistoric (12,000 - 150 BP) Isolate Location	Nondiagnostic biface fragment identified in 2012 (INL 2013d). Location is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
INL-12-04-02	General Prehistoric (12,000 - 150 BP) Isolate Location	Six nondiagnostic unmodified flakes identified in 2012 (INL 2013d). Location is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-12-04-03	Historic (circa 1942 – 1952) Isolate Location	Ceramic insulator identified in 2012 (INL 2013d). The resource is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-12-04-04	Historic (circa 1942 – 1949) Isolate Location	Three concrete panels (approximately 1 x 6 meter x 20 centimeter) identified in 2012 (INL 2013d). The resource is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-12-04-05	Historic (circa 1942 – 1949) Isolate Location	Cement survey monument identified in 2012 (INL 2013d). The resource is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-12-04-06	Modern (circa 1960 – 2000) Rock Feature	Rock cairn constructed by NRF employee identified in 2012 (INL 2013d). The resource is potentially eligible for nomination to the NRHP; however, it is located outside the temporary disturbance areas for the proposed action.	Potentially eligible	Avoidance is feasible

Table D-1: Summary of Cultural Resource Surveys and Investigations (cont.)

Site Number	Description	Status	National Register Evaluation	Recommendation
INL-12-04-07	Late Prehistoric II (750 - 150 BP) Isolate Location	Desert Side-notched arrow point fragment collected in 2012 (INL 2013d). Location is unlikely to yield additional information despite being located in the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-12-04-08	Middle Prehistoric (7500 – 1300 BP) Isolate Location	Large notched dart point collected in 2012 (INL 2013d). Location is unlikely to yield additional information despite being located in the temporary disturbance areas for the proposed action.	Ineligible	No further work
INL-12-04-09	Late Prehistoric II (750 - 150 BP) Isolate Location	Desert Side-notched arrow point fragment identified in 2012 (INL 2013d). Location is unlikely to yield additional information and is located outside the temporary disturbance areas for the proposed action.	Ineligible	No further work

APPENDIX E

AIR QUALITY ANALYSIS FOR NON-RADIOLOGICAL POLLUTANTS

E.1 Introduction

Air quality modeling is performed to estimate non-radiological air pollutant concentrations at public receptor locations and Federal Class I areas as a result of air emissions from the proposed action. The Region of Influence (ROI) for the analysis includes public receptor locations and roads as defined for the Idaho National Laboratory (INL) in IDEQ 2011. The ROI also includes the following Federal Class I areas: Craters of the Moon National Monument, Grand Teton National Park, and Yellowstone National Park. The overall objective of the analyses is to demonstrate that National Ambient Air Quality Standard (NAAQS), Toxic Air Pollutants (TAPs), and Prevention of Significant Deterioration (PSD) increments are not exceeded for the various alternatives either separately or cumulatively when added to INL releases. The analyses provide an estimate of impacts based on estimates of facility emissions for the alternatives and emissions from other INL facilities.

Alternatives Analyzed

Three alternatives are analyzed: No Action Alternative, the Overhaul Alternative, and the New Facility Alternative. The following time-frames and durations are used when evaluating air quality impacts in Section 4.6.1 related to these alternatives:

<u>No Action Alternative</u>

The time period evaluated for the No Action Alternative is 45 years.

<u>Overhaul Alternative</u>

- The time period evaluated for the Overhaul Alternative is 45 years.
- The refurbishment period would take place over 33 years in parallel with Expended Core Facility (ECF) operations.
- The post-refurbishment operational period addresses the 12 years after refurbishment when only operational activities would take place in ECF.

<u>New Facility Alternative</u>

- The time period evaluated for the New Facility Alternative is 45 years.
- The construction period would be approximately 3 years and would occur in parallel with ECF operations.
- The transition period would be approximately 5 to 12 years and would overlap with ECF operations.
- The new facility operational period represents the time when all naval spent nuclear fuel handling operations have moved to a new facility and examination work continues in ECF.

Emission Estimates for the Proposed Actions

Air pollutant emissions are estimated on an annual basis for the refurbishment period and the post-refurbishment operational period of the Overhaul Alternative, the construction period of the New Facility Alternative, new facility operational period, and INL facilities (which include Naval Reactors Facility (NRF) and ECF) in Section E.2. Air pollutants generated during the transition period and operational period of the New Facility Alternative would be in addition to those described for ECF. The INL baseline emissions include those estimated for all NRF operations (including ECF). Therefore, the transition period is accounted for in the cumulative (new facility operations modeled with other INL facilities) concentration comparisons to air quality standards. This approach provides a reasonable estimate of the pollutant concentrations at receptor locations from all INL activities.

Modeling Methodology

Three computer modeling codes are used to estimate non-radiological air pollutant concentrations at public receptor locations and Federal Class I areas as a result of air emissions from the proposed action: AERMOD, VISCREEN, and CALPUFF. Sections E.3, E.4, and E.5 contain the modeling methodology for AERMOD (EPA 2004a), VISCREEN (EPA 1992a), and CALPUFF Version 5.8, Level 070623 (Scire et al. 2000a and Scire et al. 2000b). The modeling methodology is documented in INL 2013a, INL 2013b, and INL 2013c. AERMOD is used to model impacts of criteria, toxic, and PSD air pollutants at INL public receptor locations and near field (≤ 50 kilometers (31 miles) from the source) Federal Class I areas. VISCREEN is used to model visibility impacts at near field Federal Class I areas. CALPUFF is used to model PSD at far field (> 50 kilometers (31 miles) from the source) Federal Class I areas. A screening test to evaluate whether visibility, deposition, or ozone impacts would be needed for far field Federal Class I areas (Grand Teton National Park and Yellowstone National Park) was used per recommendations in FLAG 2010, and is included in Section E.4.

E.2 Source Term Development

E.2.1 Source Terms for Emissions from INL Facilities

This section describes the development of source terms for emissions from the INL facilities (including NRF). Primary sources of criteria and toxic pollutants at INL include fuel oil-fired boilers; diesel engines; emergency diesel generators (EDGs); and miscellaneous small gasoline, diesel, and propane combustion sources. The boilers are used to generate steam for heating facilities and are the main source of non-radiological air pollutant emissions at INL. Diesel engines are used at the Advanced Test Reactor (ATR) Complex to generate electricity for reactor operations. EDGs are used at INL facilities as emergency electrical power sources, and periodic testing contributes to criteria and toxic air pollutant emissions. The miscellaneous combustion sources include non-vehicle sources such as small portable generators, air compressors, and welders. These sources for all INL facilities are used to generate current emissions. Air emissions (based on fuel use) from INL facilities for 2005-2009 were reviewed to find the maximum emissions for use in the air dispersion models.

Criteria air pollutants include: sulfur dioxide (SO_2), nitrogen dioxide (NO_2), two size ranges for particulate matter (PM_{10} and $PM_{2.5}$), carbon monoxide (CO), lead (Pb), and ozone (O_3). Particulate matter (PM) with an aerodynamic diameter less than or equal to 10 micrometers are referred to as PM_{10} and those that are less than or equal to 2.5 micrometers are referred to as $PM_{2.5}$. Because O_3 is not directly emitted or monitored, volatile organic compounds (VOCs) and nitrogen oxides (NO_x), which are O_3 precursors, are considered. Certain standards apply to long-term (annual average) conditions; other standards are short-term and apply to conditions that persist for periods ranging from 1 hour to 3 months, depending on the toxic properties of the pollutant in question.

PSD pollutants include PM_{10}, $PM_{2.5}$, SO_2, and NO_2. Maximum allowable PSD pollutant concentration increases or increments are specified for the nation as a whole (designated Federal Class II areas), and more stringent increment limits (as well as ceilings) are prescribed for national resources, such as national forests, parks, and monuments (designated Federal Class I areas). Air pollutant standards are presented in Section 3.6.2. Modeling results for INL and NRF are provided in Section 3.6.3 and 3.6.4, respectively. Modeling results for the proposed action are compared to the standards in Section 4.6.

Toxic air pollutants are listed in Table E.2-1. The list of toxic air pollutants in Table E.2-1 is not exhaustive for INL and includes only those that could be emitted as part of the proposed action. Use of various chemical products such as cleaners, lubricants, and adhesives produce small amounts of toxic air pollutants; but the amounts used are small and, therefore, are not included in the analysis. Welding naval spent nuclear fuel canisters at NRF also produces small amounts of toxic air pollutants. These emissions are small based on the maximum number of canisters processed per year in 2005 through 2009 and are intermittent over the course of a year. These emissions are not expected to increase due to the proposed action. Therefore, welding emissions are not included in the analysis.

Table E.2-1: Toxic Air Pollutants

Carcinogens	Non-Carcinogens
Acetaldehyde (C_2H_4O)	Acrolein (C_3H_4O)
As as arsenic trioxide (As_2O_3)	Ammonia (NH_3)
Benzene (C_6H_6)	Chromium (Cr)
Be as beryllium oxide (BeO)	Copper (Cu)
1,3-Butadiene (C_4H_6)	Ethylbenzene (C_8H_{10})
Cd as cadmium oxide (CdO)	Manganese (Mn)
Formaldehyde (HCOH)	Naphthalene ($C_{10}H_8$)
Nickel (Ni)	Selenium (Se)
Polycyclic aromatic compounds (PACs)	Toluene (C_7H_8)
	Xylene (C_8H_{10})
	Zn as zinc oxide (ZnO)

Emission factors and emission calculation methods for fuel combustion sources from EPA 2010 (Section 1.3, Fuel Oil Combustion) are used. The general equation for emission estimation is:

$$E = A \times EF \times (1 - ER/100)$$ **Equation E-1**

Where:

E = emissions
A = activity rate (e.g., gallons of fuel per year or Btu's per year)
EF = emission factor
ER = overall emission reduction efficiency (%)

ER is set to zero based on the conservative assumption that fuel combustion sources at INL do not have stack abatement. The EFs for criteria, PSD, and toxic air pollutants are provided in Table E.2-2.

Annual fuel use (A in Equation E-1) for INL air pollutant sources at each facility is provided in Table E.2-3.

Table E.2-2: Emission Factors for Boilers, EDGs, and Miscellaneous Fuel Combustion Sources

Pollutant Name	Boilers	EDGs and Diesel Engines	EDGs and Miscellaneous Fuel Combustion Sources		
	Grade 1/2 Fuel Oil[1]	Large[2] Diesel Engines	Small[3] Diesel Engines	Gasoline Engines	Propane Combustion
	lb/1000 gal, unless otherwise noted	lb/10^6 Btu, unless otherwise noted	lb/10^6 Btu, unless otherwise noted	lb/10^6 Btu	lb/1000 gal
Sulfur oxides (SOx)	2.16×10^{-1}	1.50×10^{-3}	2.9×10^{-1}	8.4×10^{-2}	1.0×10^{-1}
Sulfur dioxide (SO_2)	2.13×10^{-1}	1.40×10^{-3}	2.755×10^{-1}	7.98×10^{-2}	1.0×10^{-1}
Sulfuric acid (H_2SO_4)	3.73×10^{-3}	1.0×10^{-4}	1.78×10^{-2}	5.1×10^{-3}	
Nitrogen oxides (NOx)	20	3.2	4.41	1.63	1.3×10^{1}
Nitrogen dioxide (NO_2)	1				
Ammonia (NH_3)	8.0×10^{-1}				
Carbon monoxide (CO)	5	8.5×10^{-1}	9.5×10^{-1}	9.9×10^{-1}	7.5
VOCs	2.0×10^{-1}	8.19×10^{-2}	3.276×10^{-2}		8.0×10^{-1}
Benzene (C_6H_6)	2.14×10^{-4}	7.76×10^{-4}	9.33×10^{-4}		
Toluene (C_7H_8)	6.20×10^{-3}	2.81×10^{-4}	4.09×10^{-4}		
Xylenes (C_8H_{10})	1.09×10^{-4}	1.93×10^{-4}	2.85×10^{-4}		
1,3-Butadiene (C_4H_6)		3.91×10^{-5}	3.91×10^{-5}		
Formaldehyde (HCOH)	6.10×10^{-2}	7.89×10^{-5}	1.18×10^{-3}		
Acetaldehyde (C_2H_4O)		2.52×10^{-5}	7.67×10^{-4}		
Acrolein (C_3H_4O)		7.88×10^{-6}	9.25×10^{-5}		
Ethylbenzene (C_8H_{10})	6.36×10^{-5}				
Naphthalene ($C_{10}H_8$)	1.13×10^{-3}	1.30×10^{-4}	8.48×10^{-5}		
Polyaromatic compounds (PACs)	1.65×10^{-5}	8.53×10^{-6}	1.10×10^{-5}		

Note: Gray shaded areas indicate the pollutant is not emitted or an emission factor is not available.
Source: EPA 2010, unless otherwise noted.
[1] Ultra low sulfur fuel containing less than 15 parts per million (ppm) sulfur is used.
[2] Greater than 600 horsepower.
[3] Less than 600 horsepower.
lb=pound; Btu=British thermal unit; gal=gallons

Table E.2-2: Emission Factors for Boilers, EDGs, and Miscellaneous Fuel Combustion Sources (cont.)

Pollutant Name	Boilers	EDGs and Diesel Engines	EDGs and Miscellaneous Fuel Combustion Sources		
	Grade 1/2 Fuel Oil[1]	Large[2] Diesel Engines	Small[3] Diesel Engines	Gasoline Engines	Propane Combustion
	lb/1000 gal, unless otherwise noted	lb/10^6 Btu, unless otherwise noted	lb/10^6 Btu, unless otherwise noted	lb/10^6 Btu	lb/1000 gal
PM_{10}	2.30	5.73×10^{-2}	3.1×10^{-1}	1.0×10^{-1}	7.0×10^{-1}
$PM_{2.5}$	1.55	5.56×10^{-2}	3.1×10^{-1}	1.0×10^{-1}	7.0×10^{-1}
As as arsenic trioxide (As_2O_3)	10.6 (10^{12} Btu)	10.6 (10^{12} Btu)	10.6 (10^{12} Btu)		
Be as beryllium oxide (BeO)	8.3 (10^{12} Btu)	8.3 (10^{12} Btu)	8.3 (10^{12} Btu)		
Cd as cadmium oxide (CdO)	3.4 (10^{12} Btu)	3.4 (10^{12} Btu)	3.4 (10^{12} Btu)		
Chromium (Cr)	3 (10^{12} Btu)	3 (10^{12} Btu)	3 (10^{12} Btu)		
Copper (Cu)	6 (10^{12} Btu)	6 (10^{12} Btu)	6 (10^{12} Btu)		
Pb as lead monoxide (PbO)	9.7 (10^{12} Btu)	9.7 (10^{12} Btu)	9.7 (10^{12} Btu)		
Manganese (Mn)	6 (10^{12} Btu)	6 (10^{12} Btu)	6 (10^{12} Btu)		
Nickel (Ni)	3 (10^{12} Btu)	3 (10^{12} Btu)	3 (10^{12} Btu)		
Selenium (Se)	15 (10^{12} Btu)	15 (10^{12} Btu)	15 (10^{12} Btu)		
Zn as zinc oxide (ZnO)	5.0 (10^{12} Btu)	5.0 (10^{12} Btu)	5.0 (10^{12} Btu)		

Note: Gray shaded areas indicate the pollutant is not emitted or an emission factor is not available.
Source: EPA 2010, unless otherwise noted.
[1] Ultra low sulfur fuel containing less than 15 parts per million (ppm) sulfur is used.
[2] Greater than 600 horsepower.
[3] Less than 600 horsepower.
lb=pound; Btu=British thermal unit; gal=gallons

Table E.2-3: Annual Fuel Use for INL Air Pollutant Sources

Source	INL Facility							
	CFA	INTEC	TAN/SMC	RWMC	NRF	ATR Complex	CITRC	MFC
	liters per year (gallons per year)							
Boilers and Large Diesel Engines[1]	567,810 (150,000)	4,921,020 (1,300,000)	1,362,744 (360,000)	3,028,320 (800,000)	2,281,866 (602,807)	984,204 (260,000)		
Large[2] Engine EDGs		28,141 (7434)	999 (264)		17,439 (4607)	2037 (538)		999 (264)
Small[3] Engine EDGs	4997 (1320)		999 (264)			3997 (1056)	999 (264)	15,990 (4224)
Miscellaneous Fuel Combustion Equipment	40,027 (10,574)	8559 (2261)		947,550 (250,317)	29,583 (7815)	2854 (754)		5580 (1474)

Note: Gray cells indicate absence of source.

ATR = Advanced Test Reactor
CFA = Central Facilities Area
INTEC = Idaho Nuclear Technology and Engineering Center
TAN = Test Area North
SMC = Specific Manufacturing Capability
RWMC = Radioactive Waste Management Complex
NRF = Naval Reactors Facility
CITRC = Critical Infrastructure Test Range Complex
MFC = Materials and Fuels Complex

[1] Large diesel engines are only operated at the ATR Complex.
[2] Greater than 600 horsepower.
[3] Less than 600 horsepower.

Air pollutant release rates in grams per second are determined from estimated emissions and estimated equipment operating hours for each facility. Release rates are used as input for most of the air dispersion modeling and are provided in INL 2013a. Other units are also used depending on the analysis (e.g., tons per year are used for visibility screening). Operating hours for equipment at each facility are provided in Table E.2-4. Annual INL emissions are provided in Table E.2-5 and Table E.2-6

Table E.2-4: Annual Hours of Operation for INL Air Pollutant Sources

Source	INL Facility							
	CFA	INTEC	TAN/SMC	RWMC	NRF	ATR Complex	CITRC	MFC
	hours per year							
Boilers and Large Diesel Engines[1]	8760	8760	7943	8760	4693	6339		
Large[2] Engine EDGs		63	40		66	8		40
Small[3] Engine EDGs	200		40			160	40	640
Miscellaneous Fuel Combustion Equipment	2600	2600		2600	2340	2600		2600

Note: Gray cells indicate absence of source.

ATR = Advanced Test Reactor
CFA = Central Facilities Area
INTEC = Idaho Nuclear Technology and Engineering Center
TAN = Test Area North
SMC = Specific Manufacturing Capability
RWMC = Radioactive Waste Management Complex
NRF = Naval Reactors Facility
CITRC = Critical Infrastructure Test Range Complex
MFC = Materials and Fuels Complex

[1] Large diesel engines are only operated at the ATR Complex.
[2] Greater than 600 horsepower.
[3] Less than 600 horsepower.

Table E.2-5: Sums of INL Boiler, Large Diesel Engine, and EDG Emissions

Pollutant Name	INL Boilers and Large Diesel Engines			INL EDGs		
	kilograms per year	pounds per year	tons per year	kilograms per year	pounds per year	tons per year
Sulfur oxides (SOx)	3.4×10^{2}	7.5×10^{2}	3.7×10^{-1}	1.3×10^{2}	2.9×10^{2}	1.4×10^{-1}
Sulfur dioxide (SO_2)	3.3×10^{2}	7.4×10^{2}	3.7×10^{-1}	1.2×10^{2}	2.7×10^{2}	1.4×10^{-1}
Sulfuric acid (H_2SO_4)	6.9	1.5×10^{1}	7.6×10^{-3}	7.9	1.8×10^{1}	8.8×10^{-3}
Nitrogen oxides (NOx)	7.8×10^{4}	1.7×10^{5}	8.6×10^{1}	4.5×10^{3}	9.9×10^{3}	5.0
Nitrogen dioxide (NO_2)	1.5×10^{3}	3.2×10^{3}	1.6			
Ammonia (NH_3)	1.2×10^{3}	2.6×10^{3}	1.3			
Carbon monoxide (CO)	2.1×10^{4}	4.6×10^{4}	2.3×10^{1}	1.1×10^{3}	2.5×10^{3}	1.2
VOCs	1.6×10^{3}	3.6×10^{3}	1.8	2.1×10^{2}	4.7×10^{2}	2.3×10^{-1}
Benzene (C_6H_6)	1.3×10^{1}	2.8×10^{1}	1.4×10^{-2}	1.0	2.3	1.2×10^{-3}
Toluene (C_7H_8)	1.4×10^{1}	3.0×10^{1}	1.5×10^{-2}	4.1×10^{-1}	9.0×10^{-1}	4.5×10^{-4}
Xylenes (C_8H_{10})	3.3	7.2	3.6×10^{-3}	2.8×10^{-1}	6.3×10^{-1}	3.1×10^{-4}
1,3-Butadiene (C_4H_6)	6.3×10^{-1}	1.4	7.0×10^{-4}	4.9×10^{-2}	1.1×10^{-1}	5.4×10^{-5}
Formaldehyde (HCOH)	9.0×10^{1}	2.0×10^{2}	9.9×10^{-2}	5.9×10^{-1}	1.3	6.5×10^{-4}
Acetaldehyde (C_2H_4O)	4.1×10^{-1}	9.0×10^{-1}	4.5×10^{-4}	3.6×10^{-1}	7.9×10^{-1}	4.0×10^{-4}
Acrolein (C_3H_4O)	1.3×10^{-1}	2.8×10^{-1}	1.4×10^{-4}	4.7×10^{-2}	1.0×10^{-1}	5.2×10^{-5}
Ethylbenzene (C_8H_{10})	9.3×10^{-2}	2.0×10^{-1}	1.0×10^{-4}			
Naphthalene ($C_{10}H_8$)	3.7	8.3	4.1×10^{-3}	1.4×10^{-1}	3.2×10^{-1}	1.6×10^{-4}
Polycyclic aromatic compounds (PACs)	1.6×10^{-1}	3.6×10^{-1}	1.8×10^{-4}	1.2×10^{-2}	2.6×10^{-2}	1.3×10^{-5}
PM_{10}	3.1×10^{3}	6.9×10^{3}	3.5	1.8×10^{2}	4.1×10^{2}	2.0×10^{-1}
$PM_{2.5}$	2.9×10^{3}	6.5×10^{3}	3.2	1.8×10^{2}	4.0×10^{2}	2.0×10^{-1}
As as arsenic trioxide (As_2O_3)	2.2	5.0	2.5×10^{-3}	1.3×10^{-2}	2.9×10^{-2}	1.5×10^{-5}
Be as beryllium oxide (BeO)	1.8	3.9	2.0×10^{-3}	1.0×10^{-2}	2.3×10^{-2}	1.2×10^{-5}
Cd as cadmium oxide (CdO)	7.3×10^{-1}	1.6	8.0×10^{-4}	4.3×10^{-3}	9.5×10^{-3}	4.8×10^{-6}
Chromium (Cr)	6.4×10^{-1}	1.4	7.0×10^{-4}	3.8×10^{-3}	8.3×10^{-3}	4.2×10^{-6}
Copper (Cu)	1.3	2.8	1.4×10^{-3}	7.5×10^{-3}	1.7×10^{-2}	8.3×10^{-6}
Pb as lead monoxide (PbO)	2.5	5.6	2.8×10^{-3}	1.2×10^{-2}	2.7×10^{-2}	1.3×10^{-5}
Manganese (Mn)	1.3	2.8	1.4×10^{-3}	7.5×10^{-3}	1.7×10^{-2}	8.3×10^{-6}
Nickel (Ni)	6.4×10^{-1}	1.4	7.0×10^{-4}	3.8×10^{-3}	8.3×10^{-3}	4.2×10^{-6}
Selenium (Se)	3.2	7.0	3.5×10^{-3}	1.9×10^{-2}	4.2×10^{-2}	2.1×10^{-5}
Zn as zinc oxide (ZnO)	1.1	2.3	1.2×10^{-3}	6.3×10^{-3}	1.4×10^{-2}	6.9×10^{-6}

Notes: Gray shaded cells indicate pollutant is not emitted or no emission factor is available.

Table E.2-6: Sums of INL Miscellaneous Fuel Combustion Emissions and Sum of all Source Emissions for INL Facilities

Pollutant Name	Sum of INL Miscellaneous Fuel Combustion Emissions			Sum of all Source Emissions for INL Facilities[2]		
	kilograms per year	pounds per year	tons per year[1]	kilograms per year	pounds per year	tons per year[1]
Sulfur oxides (SOx)	4.3×10^{2}	9.4×10^{2}	4.7×10^{-1}	8.9×10^{2}	2.0×10^{3}	9.9×10^{-1}
Sulfur dioxide (SO_2)	4.0×10^{2}	8.9×10^{2}	4.5×10^{-1}	8.6×10^{2}	1.9×10^{3}	9.5×10^{-1}
Sulfuric acid (H_2SO_4)	2.5×10^{1}	5.6×10^{1}	2.8×10^{-2}	4.0×10^{1}	8.9×10^{1}	4.4×10^{-2}
Nitrogen oxides (NOx)	7.8×10^{3}	1.7×10^{4}	8.6	9.0×10^{4}	2.0×10^{5}	9.9×10^{1}
Nitrogen dioxide (NO_2)				1.5×10^{3}	3.2×10^{3}	1.6
Ammonia (NH_3)				1.2×10^{3}	2.6×10^{3}	1.3
Carbon monoxide (CO)	2.3×10^{3}	5.0×10^{3}	2.5	2.4×10^{4}	5.3×10^{4}	2.7×10^{1}
VOCs	5.5×10^{2}	1.2×10^{3}	6.0×10^{-1}	2.4×10^{3}	5.2×10^{3}	2.6
Benzene (C_6H_6)	1.3	2.9	1.4×10^{-3}	1.5×10^{1}	3.4×10^{1}	1.7×10^{-2}
Toluene (C_7H_8)	5.7×10^{-1}	1.3	6.3×10^{-4}	1.5×10^{1}	3.2×10^{1}	1.6×10^{-2}
Xylenes (C_8H_{10})	4.0×10^{-1}	8.8×10^{-1}	4.4×10^{-4}	4.0	8.7	4.4×10^{-3}
1,3-Butadiene (C_4H_6)	5.5×10^{-2}	1.2×10^{-1}	6.0×10^{-5}	7.4×10^{-1}	1.6	8.1×10^{-4}
Formaldehyde (HCOH)	1.6	3.6	1.8×10^{-3}	9.2×10^{1}	2.0×10^{2}	1.0×10^{-1}
Acetaldehyde (C_2H_4O)	1.1	2.4	1.2×10^{-3}	1.8	4.1	2.0×10^{-3}
Acrolein (C_3H_4O)	1.3×10^{-1}	2.8×10^{-1}	1.4×10^{-4}	3.0×10^{-1}	6.7×10^{-1}	3.3×10^{-4}
Ethylbenzene (C_8H_{10})				9.3×10^{-2}	2.0×10^{-1}	1.0×10^{-4}
Naphthalene ($C_{10}H_8$)	1.2×10^{-1}	2.6×10^{-1}	1.3×10^{-4}	4.0	8.8	4.4×10^{-3}
Polycyclic aromatic compounds (PACs)	1.5×10^{-2}	3.4×10^{-2}	1.7×10^{-5}	1.9×10^{-1}	4.2×10^{-1}	2.1×10^{-4}
PM_{10}	5.2×10^{2}	1.2×10^{3}	5.8×10^{-1}	3.8×10^{3}	8.5×10^{3}	4.2
$PM_{2.5}$	5.2×10^{2}	1.2×10^{3}	5.8×10^{-1}	3.6×10^{3}	8.0×10^{3}	4.0
As as arsenic trioxide (As_2O_3)	1.5×10^{-2}	3.2×10^{-2}	1.6×10^{-5}	2.3	5.0	2.5×10^{-3}
Be as beryllium oxide (BeO)	1.2×10^{-2}	2.6×10^{-2}	1.3×10^{-5}	1.8	4.0	2.0×10^{-3}
Cd as cadmium oxide (CdO)	4.8×10^{-3}	1.1×10^{-2}	5.3×10^{-6}	7.4×10^{-1}	1.6	8.1×10^{-4}
Chromium (Cr)	4.2×10^{-3}	9.2×10^{-3}	4.6×10^{-6}	6.5×10^{-1}	1.4	7.1×10^{-4}
Copper (Cu)	8.4×10^{-3}	1.8×10^{-2}	9.2×10^{-6}	1.3	2.9	1.4×10^{-3}
Pb as lead monoxide (PbO)	1.4×10^{-2}	3.0×10^{-2}	1.5×10^{-5}	2.6	5.7	2.8×10^{-3}
Manganese (Mn)	8.4×10^{-3}	1.8×10^{-2}	9.2×10^{-6}	1.3	2.9	1.4×10^{-3}
Nickel (Ni)	4.2×10^{-3}	9.2×10^{-3}	4.6×10^{-6}	6.5×10^{-1}	1.4	7.1×10^{-4}
Selenium (Se)	2.1×10^{-2}	4.6×10^{-2}	2.3×10^{-5}	3.2	7.1	3.6×10^{-3}
Zn as zinc oxide (ZnO)	6.9×10^{-3}	1.5×10^{-2}	7.7×10^{-6}	1.1	2.4	1.2×10^{-3}

Notes: Gray shaded cells indicate either pollutant is not emitted or no emission factor is available.
[1] Tons per year are short tons (2,000 lbs).
[2] Sums from combined emissions of Tables E.2-5 and E.2-6.

E.2.2 Source Terms for the ECF Baseline and Evaluated Alternatives

Currently, naval spent nuclear fuel handling and examination operations at NRF are conducted in ECF. NRF operates three fuel oil-fired boilers, four large EDGs, and miscellaneous small gasoline, diesel, and propane combustion sources. The boilers are used to generate steam to heat several of the site buildings, including ECF, and are the main source of non-radiological air pollutant emissions at NRF. The four EDGs are used as emergency electrical power sources. Periodic testing of the EDGs also contributes to non-radiological air pollutant emissions at NRF. The miscellaneous combustion sources include non-vehicular sources such as air compressors or heaters used in NRF activities that are not related to ECF operations. None of the fuel combustion sources have stack abatement; therefore, unabated emissions are calculated to establish current ECF conditions.

E.2.2.1 ECF Baseline Source Terms

Criteria, Toxic, and PSD Air Pollutants

Sections 3.6.4.1 and 3.6.4.2 present ECF baseline emissions for criteria and PSD air pollutants, and toxic air pollutants, respectively. This section describes how these emissions are derived from the baseline NRF emissions also presented in Sections 3.6.4.1 and 3.6.4.2. Consistent with development of source terms for emissions from INL facilities, maximum annual emissions based on NRF fuel usage for 2005-2009 are used. Based on NRF boiler operations, it was determined that about one-third of overall steam demand is dedicated to ECF. NRF boiler emissions are multiplied by 0.333 to get emissions attributable to ECF.

Currently, NRF has four 1000-kilowatt EDGs and is at maximum capacity for emergency power. ECF requires 45 percent of the total 4,000 kilowatts to remain in operation if power is lost. Based on this, ECF would need 1800 kilowatts of EDG power. NRF EDG emissions are multiplied by 0.45 to get emissions attributable to ECF.

Miscellaneous combustion sources are not included since they do not result from naval spent nuclear fuel handling operations.

Emissions for boilers and EDGs for the ECF are provided in Table E.2-7 and Table E.2-8.

Table E.2-7: Estimated Boiler Emissions for ECF

Pollutant Name	Emissions		
	pounds per year	kilograms per year	grams per second
Sulfur oxides (SOx)	4.3×10^{1}	2.0×10^{1}	1.2×10^{-3}
Sulfur dioxide (SO_2)	4.3×10^{1}	1.9×10^{1}	1.1×10^{-3}
Sulfuric acid (H_2SO_4)	7.4×10^{-1}	3.3×10^{-1}	2.0×10^{-5}
Nitrogen oxides (NOx)	4.0×10^{3}	1.8×10^{3}	1.1×10^{-1}
Nitrogen dioxide (NO_2)	2.0×10^{2}	9.1×10^{1}	5.4×10^{-3}
Ammonia (NH_3)	1.6×10^{2}	7.3×10^{1}	4.3×10^{-3}
Carbon monoxide (CO)	1.0×10^{3}	4.6×10^{2}	2.7×10^{-2}
VOCs	4.0×10^{1}	1.8×10^{1}	1.1×10^{-3}
Benzene (C_6H_6)	4.3×10^{-2}	2.0×10^{-2}	1.2×10^{-6}
Toluene (C_7H_8)	1.2	5.7×10^{-1}	3.3×10^{-5}
Xylenes (C_8H_{10})	2.2×10^{-2}	9.9×10^{-3}	5.9×10^{-7}
1,3-Butadiene (C_4H_6)			
Formaldehyde (HCOH)	1.2×10^{1}	5.6	3.3×10^{-4}
Acetaldehyde (C_2H_4O)			
Acrolein (C_3H_4O)			
Ethylbenzene (C_8H_{10})	1.3×10^{-2}	5.8×10^{-3}	3.4×10^{-7}
Naphthalene ($C_{10}H_8$)	2.3×10^{-1}	1.0×10^{-1}	6.1×10^{-6}
Polycyclic aromatic compounds (PACs)	3.3×10^{-3}	1.5×10^{-3}	8.9×10^{-8}
PM_{10}	4.6×10^{2}	2.1×10^{2}	1.2×10^{-2}
$PM_{2.5}$	3.1×10^{2}	1.4×10^{2}	8.4×10^{-3}
As as arsenic trioxide (As_2O_3)	2.9×10^{-1}	1.3×10^{-1}	7.7×10^{-6}
Be as beryllium oxide (BeO)	2.3×10^{-1}	1.0×10^{-1}	6.1×10^{-6}
Cd as cadmium oxide (CdO)	9.3×10^{-2}	4.2×10^{-2}	2.5×10^{-6}
Chromium (Cr)	8.1×10^{-2}	3.7×10^{-2}	2.2×10^{-6}
Copper (Cu)	1.6×10^{-1}	7.4×10^{-2}	4.4×10^{-6}
Pb as lead monoxide (PbO)	2.6×10^{-1}	1.2×10^{-1}	7.1×10^{-6}
Manganese (Mn)	1.6×10^{-1}	7.4×10^{-2}	4.4×10^{-6}
Nickel (Ni)	8.1×10^{-2}	3.7×10^{-2}	2.2×10^{-6}
Selenium (Se)	4.1×10^{-1}	1.8×10^{-1}	1.1×10^{-5}
Zn as zinc oxide (ZnO)	1.4×10^{-1}	6.1×10^{-2}	3.6×10^{-6}

Note: Gray shaded cells indicate pollutant is not emitted or an emission factor is not available.

Table E.2-8: Estimated EDG Emissions for ECF

Pollutant Name	Emissions		
	Overhaul Alternative		
	pounds per year	kilograms per year	grams per second
Sulfur oxides (SOx)	4.3×10^{-1}	2.0×10^{-1}	8.2×10^{-4}
Sulfur dioxide (SO_2)	4.1×10^{-1}	1.9×10^{-1}	7.8×10^{-4}
Sulfuric acid (H_2SO_4)	2.6×10^{-2}	1.2×10^{-2}	5.0×10^{-5}
Nitrogen oxides (NOx)	9.1×10^{2}	4.1×10^{2}	1.7
Nitrogen dioxide (NO_2)			
Ammonia (NH_3)			
Carbon monoxide (CO)	2.4×10^{2}	1.1×10^{2}	4.6×10^{-1}
VOCs	2.3×10^{1}	1.1×10^{1}	4.4×10^{-2}
Benzene (C_6H_6)	2.2×10^{-1}	1.0×10^{-1}	4.2×10^{-4}
Toluene (C_7H_8)	8.0×10^{-2}	3.6×10^{-2}	1.5×10^{-4}
Xylenes (C_8H_{10})	5.5×10^{-2}	2.5×10^{-2}	1.0×10^{-4}
1,3-Butadiene (C_4H_6)	1.1×10^{-2}	5.0×10^{-3}	2.1×10^{-5}
Formaldehyde (HCOH)	2.2×10^{-2}	1.0×10^{-2}	4.3×10^{-5}
Acetaldehyde (C_2H_4O)	7.2×10^{-3}	3.2×10^{-3}	1.4×10^{-5}
Acrolein (C_3H_4O)	2.2×10^{-3}	1.0×10^{-3}	4.3×10^{-6}
Ethylbenzene (C_8H_{10})			
Naphthalene ($C_{10}H_8$)	3.7×10^{-2}	1.7×10^{-2}	7.0×10^{-5}
Polycyclic aromatic compounds (PACs)	2.4×10^{-3}	1.1×10^{-3}	4.6×10^{-6}
PM_{10}	1.6×10^{1}	7.4	3.1×10^{-2}
$PM_{2.5}$	1.6×10^{1}	7.2	3.0×10^{-2}
As as arsenic trioxide (As_2O_3)	3.0×10^{-3}	1.4×10^{-3}	5.7×10^{-6}
Be as beryllium oxide (BeO)	2.4×10^{-3}	1.1×10^{-3}	4.5×10^{-6}
Cd as cadmium oxide (CdO)	9.7×10^{-4}	4.4×10^{-4}	1.9×10^{-6}
Chromium (Cr)	8.5×10^{-4}	3.9×10^{-4}	1.6×10^{-6}
Copper (Cu)	1.7×10^{-3}	7.7×10^{-4}	3.2×10^{-6}
Pb as lead monoxide (PbO)	2.8×10^{-3}	1.2×10^{-3}	5.3×10^{-6}
Manganese (Mn)	1.7×10^{-3}	7.7×10^{-4}	3.2×10^{-6}
Nickel (Ni)	8.5×10^{-4}	3.9×10^{-4}	1.6×10^{-6}
Selenium (Se)	4.3×10^{-3}	1.9×10^{-3}	8.1×10^{-6}
Zn as zinc oxide (ZnO)	1.4×10^{-3}	6.4×10^{-4}	2.7×10^{-6}

Notes: Gray shaded cells indicate pollutant is not emitted or an emission factor is not available.

E.2.2.2 No Action Alternative Source Terms

The evaluation for the No Action Alternative covers: (1) ECF operations with preventative and corrective maintenance sufficient to sustain the proper functioning of ECF structures, systems, and components, and (2) the potential for ECF operations to cease if preventative and corrective maintenance are no longer sufficient to sustain the proper functioning of ECF structures, systems, and components. The impacts described below would be the same during ECF operations or if ECF operations cease.

There would be no change in unabated air pollutant emissions from boiler and EDG sources. Therefore, air pollutant emissions from the No Action Alternative would not change from current ECF emissions (Table E.2-7 and Table E.2-8). Total NRF emissions are included in those for INL in Table E.2-5 and Table E.2-6.

E.2.2.3 Overhaul Alternative Source Terms

Refurbishment Period

The activities associated with the refurbishment period of the Overhaul Alternative would occur within the ECF with the exception of the construction of the new security boundary system. There would be a small increase in emissions generated from the construction of the new security boundary system. These emissions would be intermittent and would occur over a period of approximately 1 year. Therefore, air pollutant emissions during the refurbishment period would be small enough to eliminate further evaluation and would be similar to current ECF emissions (Table E.2-7 and Table E.2-8).

Post-Refurbishment Operational Period

There would be no change in unabated air pollutant emissions from boiler and EDG sources for the post-refurbishment operational period of the Overhaul Alternative compared to the current ECF since the entire ECF would continue to be heated and would need emergency standby power. Therefore, air pollutant emissions during overhaul post-refurbishment operational period would not change from current ECF emissions (Table E.2-7 and Table E.2-8).

E.2.2.4 New Facility Alternative Source Terms

Construction Period

Emissions for the construction period are based on totals distributed over a 3-year construction period. It is recognized that project schedules could change, with potentially longer construction periods than originally planned. However, total throughputs, mileage, and other activity rates are expected to be conservative. With a longer than 3-year construction period, total emissions would be spread over a longer period, thus decreasing pollutant concentrations at receptor locations. Emissions were estimated for both Location 3/4 and Location 6. There are only small differences in construction emissions between the two locations, and the bounding case is presented below.

<u>Fugitive Dust (PM_{10} and $PM_{2.5}$) Emissions</u>

Impacts from fugitive dust are evaluated using concentrations of particulate matter in ambient air. Fugitive dust modeling uses area source terms versus point (e.g., stacks) or line (e.g., vehicle emissions) source terms.

The majority of fugitive dust during construction would be produced by:

- Earth moving
- Wind erosion of bare ground
- Concrete batch plant and stone-crushing operations

Haul roads and unpaved roads used on the construction site are assumed to be within the construction area and are not considered as separate sources of fugitive dust.

Earth-Moving Activities

Earth-moving activities involve operation of heavy construction equipment on exposed soil. See Table E.2-9 for equipment and construction activities. Methods for calculating fugitive dust emissions for earth-moving activities outlined in EPA 2010 were used. Fugitive dust emissions for earth-moving activities are calculated using Equation E-1, with activity rates (A), emission factors (EF) and emission reduction efficiency (ER) values described below. Activity rates for earth-moving activities are derived from information on hours of vehicle operation, tons of material moved, or vehicle-miles traveled. Conservative parameter values based on the notional facility designs are established to bound PM_{10} and $PM_{2.5}$ activity rates. Activity rates for each parameter are provided in Table E.2-9.

Table E.2-9: Activity Parameters for Earth-Moving Activities During the Construction Period of the New Facility Alternative

Equipment	Construction Activity	Activity Parameter
Bulldozer	Surface excavation and rough grading	632 hours
Excavators	Loading dump trucks	173,144 tons
Front-end loaders	Loading dump trucks	655,283 tons
Dump trucks	Unloading fill material	828,428 tons
Compactor	Material compacting	2700 hours
Grader	Surface grading	31 miles

Equations recommended in EPA 2010 for dust-generating operations using heavy equipment on exposed soils are used to calculate emission factors for different sizes of particulate matter. Fugitive dust emissions are assumed to be uncontrolled; therefore, emission reduction efficiency in Equation E-1 is set to zero. PM_{10} and $PM_{2.5}$ emission factors for earth-moving activities are based on guidance in EPA 2010 and are provided in Table E.2-10.

Table E.2-10: PM_{10} and $PM_{2.5}$ Emission Factors for Earth-Moving Activities During the Construction Period of the New Facility Alternative

Activity / Equipment	PM_{10}	$PM_{2.5}$	Units
Surface excavation and rough grading / Bulldozer	0.753	0.414	pounds per hour
Loading dump trucks/Excavators	0.00045	0.00007	pounds per ton
Loading dump trucks/Front-end loaders	0.00045	0.00007	pounds per ton
Unloading fill material/Dump trucks	0.00045	0.00007	pounds per ton
Compacting/Compactor	0.753	0.414	pounds per hour
Surface grading/Grader	1.543	0.167	pounds per mile

PM_{10} and $PM_{2.5}$ emissions from earth-moving activities during construction are provided in Table E.2-11.

Table E.2-11: Annual PM_{10} and $PM_{2.5}$ Emissions from Earth-Moving Activities During the Construction Period of the New Facility Alternative

Emissions			
PM_{10}		$PM_{2.5}$	
kilograms per year	pounds per year	kilograms per year	pounds per year
500	1100	227	499

Wind Erosion of Bare Ground

Areas where wind erosion of bare ground could occur during the construction period include all disturbance areas, whether temporary or permanent, including cleared areas, roadways, rail lines, power lines, piping, batch plant footprint, gravel pit, and stockpiles.

Equations and calculation steps for wind erosion of bare ground are from EPA 2010. PM_{10} and $PM_{2.5}$ emissions for wind erosion of bare ground during construction are provided in Table E.2-12.

Table E.2-12: Annual PM_{10} and $PM_{2.5}$ Emissions from Wind Erosion of Bare Ground During the Construction Period of the New Facility Alternative

Emissions			
PM_{10}		**$PM_{2.5}$**	
kilograms per year	pounds per year	kilograms per year	pounds per year
2600	5720	390	858

Concrete Batch Plant and Stone-Crushing Operations

Fugitive dust emissions from concrete batch plant and stone-crushing operations are based on the processes involved in each operation and the type and mass of material throughput (Table E.2-13). Concrete batch plant emissions are calculated using Equation E-1, with A = material throughput, EF = emission factors based on processes from EPA 2010, and ER = 0 (e.g., no controls in place).

Table E.2-13: Material Throughputs for Concrete Batch Plant and Stone-Crushing Operations for the Construction Period of the New Facility Alternative

Operation	Material	Quantity	
		metric tons	U.S. tons
concrete batch plant	sand, cement, and aggregate	220,373	242,969
stone-crushing	gravel and aggregate	258,925	285,474

PM_{10} and $PM_{2.5}$ emission factors from EPA 2010, for concrete batch plant and stone-crushing operations are provided in Table E.2-14. The larger of the PM_{10} emission factors for mixer loading (central mix) and truck loading (truck mix) is conservatively used. $PM_{2.5}$ emission factors for batch plants are not available in EPA 2010 and are to be scaled from PM_{10} values using the particle size multiplier from EPA 2010 for central mix operations (i.e., 0.38/1.92 = 0.20).

Uncontrolled emission factors for PM_{10} are taken from EPA 2010 for most stone-crushing processes. In cases when PM_{10} emission factors are not available (i.e., truck loading -fragmented stone and secondary crushing), the emission factors are chosen based on similar operations. $PM_{2.5}$ emission factors are not available in EPA 2010 for uncontrolled processes. $PM_{2.5}$ emission factors are estimated by scaling the PM_{10} emission factor for uncontrolled processes by the respective $PM_{2.5}$ to PM_{10} emission factor ratio for controlled processes. If controlled emission factors are not available for a process, the scaling factor is conservatively set to 1.00.

Table E.2-14: Emission Factors for Concrete Batch Plant and Stone-Crushing Operations During the Construction Period of the New Facility Alternative

Process	Emission Factors		
	PM_{10}	$PM_{2.5}$	
	pounds per ton	scaling factor	pounds per ton
Concrete Batch Plant			
Cement unloading to storage silo	0.47	0.20	0.094
Sand transfer	0.00099	0.20	0.000198
Aggregate transfer	0.0033	0.20	0.00066
Weigh hopper loading	0.0028	0.20	0.00056
Truck/Mixer loading	0.31	0.20	0.062
Stone Crushing			
Digging (assuming wet drilling)	0.00008	1.00	0.00008
Truck loading – fragmented stone	0.000016	0.28	0.000005
Truck unloading – fragmented stone	0.000016	0.28	0.000005
Conveyor transfer point #1	0.0011	0.28	0.0003
Secondary crushing	0.0024	0.19	0.0004
Conveyor transfer point #2	0.0011	0.28	0.0003
Tertiary crushing	0.0024	0.19	0.0004
Conveyor transfer point #3	0.0011	0.28	0.0003
Screening	0.0087	0.07	0.0006
Conveyor transfer point #4	0.0011	0.28	0.0003
Truck loading – crushed stone	0.0001	0.28	0.00003
Source: Table 11.19.2-2 in EPA 2010. See text for exceptions.			

Total PM_{10} and $PM_{2.5}$ emissions (tons) are summed across processes for concrete batch plant and stone-crushing operations. The total emissions are evenly distributed across a conservative 3-year construction period and converted to emission rates (kilograms per year). PM_{10} and $PM_{2.5}$ emissions for concrete batch plant and stone-crushing operations are provided in Table E.2-15.

Table E.2-15: Annual PM_{10} and $PM_{2.5}$ Emissions from Concrete Batch Plant and Stone-Crushing Operations for the Construction Period of the New Facility Alternative

Emissions							
Concrete Batch Plant Operations				Stone-Crushing Operations			
PM_{10}		$PM_{2.5}$		PM_{10}		$PM_{2.5}$	
kilograms per year	pounds per year	kilograms per year	pounds per year	kilograms per year	pounds per year	kilograms per year	pounds per year
19,340	42,548	3869	8512	782	1720	123	271

<u>Vehicle Emissions</u>

On-Road Vehicles

On-road vehicle emissions are generated for construction vehicles used for hauling and delivery of materials, and for construction workforce travel to and from the construction site for each alternative.

A U.S. Environmental Protection Agency (EPA) model (MOBILE6.2) for diesel-fueled and gasoline-fueled on-road vehicles is used to calculate vehicle emission factors for the construction period. The model estimates vehicle emission factors based on fuel type, vehicle type, vehicle speed, and climatological normals for temperature and humidity.

In December 2010, EPA approved the use of the MOVES2010a emission model for CO, PM_{10}, and $PM_{2.5}$ transportation conformity hot-spot analyses by state and local agencies outside of California, and established a 2-year grace period for implementing the change. In EPA 2011a, MOVES2010a is recommended for assessing the criteria air pollutant impacts of vehicle emissions in National Environmental Policy Act (NEPA) documents, with a 2-year grace period for implementation, ending in December 2012. EPA 2011a states that if a model other than MOVES2010a (e.g., MOBILE6.2) is used in a Draft Environmental Impact Statement (EIS) that is released during the grace period, it is acceptable to carry that model through to the Final EIS. This Draft EIS was in preparation and review during the 2-year grace period, but will be published outside of the grace period.

The maximum CO concentration (highest criteria pollutant emissions for on-road vehicles) at receptor locations estimated for combined construction sources (including on-road vehicles) would be about 1.3 percent and 0.9 percent of the NAAQS for 1-hour and 8-hour averaging, respectively (INL 2013a). Additionally, construction emissions from on-road vehicles would be relatively short-term. Based on low pollutant concentrations and short construction period, it was determined that recalculating the on-road vehicle emissions using MOVES2010a would not likely impact model results such that NAAQS would not be met. Therefore, the use of MOBILE6.2 in the Draft EIS will be carried through to the Final EIS.

On-road vehicle emissions are calculated using Equation E-1, with A = total vehicle-miles travelled (VMT), EF = emission factors generated by MOBILE6.2, and ER = 0.

On-road vehicles considered for the construction period are dump trucks, concrete trucks, asphalt trucks, and general delivery trucks. For workforce travel during construction, light-duty gas vehicles, light-duty gas trucks, and light-duty diesel trucks are considered. A vehicle split of 25 percent light- gas vehicles, 40 percent light-duty gas trucks, and 35 percent light-duty diesel trucks is assumed for workforce travel.

Total mileage estimates for on-road vehicles during the construction period are provided in Table E.2-16.

Table E.2-16: Estimates for On-Road Vehicles for the Construction Period of the New Facility Alternative

Equipment (quantity)	Construction Activity	Estimate	
		kilometers	miles
Dump trucks (15)	Material hauling	227,207	141,210
Concrete trucks (10)	Concrete mixing/hauling	172,163	107,000
Asphalt trucks (3)	Asphalt hauling	25,487	15,840
Delivery trucks (varies)	Delivery of construction materials	489,651	304,320
Workforce travel	Commute – light-duty gas vehicles	13,834,182	8,598,000
Workforce travel	Commute – light-duty gas trucks	22,134,691	13,756,800
Workforce travel	Commute – light-duty diesel trucks	19,367,855	12,037,200

EPA recommended MOBILE6.2 model inputs for fuel types are:

gasoline Reid Vapor Pressure = 9.0, gasoline sulfur = 30 parts per million, and diesel sulfur ≤ 15 parts per million (ultra-low diesel sulfur mandated for on-road vehicles starting in 2007). Average on-road vehicle speed is assumed to be 45 miles per hour for construction trucks and 65 miles per hour for commuting workers. Climatological normals for temperature and humidity were obtained from the INL Central Facilities Area (CFA) meteorological tower.

On-road vehicle emission factors generated from MOBILE6.2 for criteria pollutants and VOCs are provided in Table E.2-17.

Table E.2-17: Average[1] On-Road Vehicle Emission Factors Generated From MOBILE6.2 for the Construction Period of the New Facility Alternative

Vehicle Type	Emission Factors grams per mile					
	CO	NO_x	$PM_{2.5}$	PM_{10}	SO_2	VOCs
HDDV	0.419	2.207	0.0631	0.0940	0.0132	0.206
LDGV	7.443	0.355	0.0112	0.0247	0.0068	0.321
LDGT	8.917	0.583	0.0113	0.0248	0.0095	0.496
LDDT	0.475	0.530	0.0294	0.0445	0.0056	0.204

HDDV = Heavy-duty diesel vehicles
LDGV = Light-duty gasoline vehicles (passenger cars)
LDGT = Light-duty gasoline trucks
LDDT = Light-duty diesel trucks
[1] The average emission factors are based on 3 years of construction. Actual years that construction would occur may vary from those used.

On-road vehicle emissions are converted from grams per mile to kilograms per year and are provided in Table E.2-18.

Table E.2-18: On-Road Vehicle Emissions for the Construction Period of the New Facility Alternative

Air Pollutant	Emissions kilograms per year	Emissions pounds per year
CO	64,205	141,251
NO_x	6236	13,719
PM_{10}	381	838
$PM_{2.5}$	214	471
SO_2	89	196
VOCs	4053	8917

Off-Road Vehicles

Off-road vehicle emissions are generated for construction equipment used for moving, grading, and compacting earthen materials.

Emission factors for off-road construction vehicles are modeled using EPA's NONROAD 2008 emission factor model based on Bonneville County, Idaho. The model estimates vehicle emission factors based on fuel type, heavy equipment type, and temperature normals.

Off-road vehicle emissions are calculated using Equation E-1, with A = equipment operating hours, EF = emission factors generated by NONROAD 2008, and ER = load factors in the NONROAD model ACTIVITY database file.

Off-road vehicles considered for the construction period are bulldozers, compactors (plate and smooth drum with 6-foot and 12-foot lifts), excavators, front-end loaders, graders, asphalt spreaders, and asphalt rollers. Hours of operation for off-road vehicle emission calculations are developed from assumptions regarding vehicle type, operating rates, area for each operation, excavation volumes, and load capacity (where applicable).

The hours of operation for each type of equipment in Table E.2-19 are determined from the operating rates and area to be graded, excavated, or compacted; or the volume of material that would need to be loaded and hauled. Estimated hours of operation for off-road vehicles for the entire construction period are provided in Table E.2-19.

Table E.2-19: Operating Hour Estimates for Off-Road Vehicles for the Construction Period of the New Facility Alternative

Equipment (quantity)	Operating Hours
Bulldozers (3)	632
Compactors 6-inch lift (1)	542
Compactors 12-inch lift (1)	978
Compactors Plate (5)	1178
Excavators (1)	148
Front-end Loaders (4)	1517
Graders (1)	2299
Asphalt Spreaders (1)	80
Asphalt Rollers (2)	80

Temperature data for use in NONROAD were obtained from the INL CFA meteorological tower. Fuel type, Source Classification Code (SCC), and NONROAD load factors for each type of vehicle are provided in Table E.2-20. Load factors are based on statistical values listed in the NONROAD model ACTIVITY database file for the specific SCC and are used as the last term in Equation E-1.

EPA recommended NONROAD model inputs for fuel types are:
gasoline Reid Vapor Pressure = 9.0, gasoline sulfur = 30 parts per million, off-road diesel sulfur = 500 parts per million. Emission factors generated from the NONROAD model are provided in Table E.2-21.

Table E.2-20: NONROAD Model Parameter Descriptions

Equipment Description	Fuel	Source Classification Code	NONROAD Load Factor
			percent
Bulldozers	Diesel	2270002069	59
Compactor – Smooth Drum (12-foot lifts)	Diesel	2270002015	59
Compactor – Smooth Drum (6-foot lifts)	Diesel	2270002015	59
Compactor – Plate (walk behind)	Gasoline	2265002009	55
Excavators	Diesel	2270002036	59
Front-end Loaders	Diesel	2270002066	21
Graders	Diesel	2270002048	59
Asphalt Spreader (paver)	Diesel	2270002003	59
Asphalt Roller (paving equipment)	Diesel	2270002021	59

Table E.2-21: Off-Road Vehicle Emission Factors Generated From NONROAD

Equipment	CO	NO_x	$PM_{2.5}$[1]	PM_{10}	SO_2	VOCs
	grams per hour					
Bulldozers	142	329	37	35.8	21	27
Compactor – Smooth Drum (12-inch lifts)	69	132	16	15.5	8	11
Compactor – Smooth Drum (6-inch lifts)	69	132	16	15.5	8	11
Compactor – Plate (walk behind)	731	8	1	1.0	0	26
Excavators	69	165	24	23.2	14	16
Front-end Loaders	77	83	14	13.6	4	15
Graders	76	198	28	27.1	16	20
Asphalt Spreader (paver)	73	157	20	19.4	11	14
Asphalt Roller (paving equipment)	58	112	13	12.6	6	10

[1] $PM_{2.5}$ emission factors are scaled from PM_{10} emission factors using the NONROAD model Total PM_{10} and $PM_{2.5}$ Emission Report for Bonneville County, Idaho.

Emissions are converted to kilograms per year and rounded up to the nearest 5 kilograms. Off-road vehicle emissions are provided in Table E.2-22.

Table E.2-22: Air Pollutant Emissions for Off-Road Vehicles for the Construction Period of the New Facility Alternative

Air Pollutant	Emissions	
	kilograms per year	pound per year
CO	243	535
NO_x	190	418
PM_{10}	25	55
$PM_{2.5}$	25	55
SO_2	14	31
VOCs	24	53

Diesel Generators and Batch Plant Operations

Power for batch plant operations would either be supplied by a diesel generator or by connecting into the existing electrical grid. For conservatism, the use of a diesel generator is assumed. A water heater powered by either propane or diesel fuel would be needed for the batch plant during winter months. For conservatism, the use of diesel fuel is assumed. During construction, the new facility would need to be heated for worker comfort. This heat would be supplied initially by a diesel generator. Emission factors from Table E.2-2 for boilers and small diesel engines are used for the water heater and two diesel generators, respectively. Annual operating hours and fuel use are provided in Table E.2-23. Emissions are provided in Table E.2-24.

Table E.2-23: Annual Hours of Operation and Fuel Use for Water Heater and Diesel Generators for the Construction Period of the New Facility Alternative

Source	Run Time	Fuel Use	Fuel Use
	hours per year	liters per year	gallons per year
Water Heater	827	62,584	16,533
Batch Plant Diesel Generator	2480	292,899	77,376
New Facility Diesel Generator	2928	345,810	91,354

Table E.2-24: Estimated Emissions for Batch Plant and New Facility Heating for the Construction Period of the New Facility Alternative

Pollutant Name	Emissions								
	Batch Plant Water Heater			Batch Plant Diesel Generator			Heating Diesel Generator		
	lb/yr	kg/yr	g/sec	lb/yr	kg/yr	g/sec	lb/yr	kg/yr	g/sec
Sulfur oxides (SOx)	3.6	1.6	5.4×10^{-4}	3.1×10^{3}	1.4×10^{3}	1.6×10^{-1}	3.6×10^{3}	1.6×10^{3}	1.6×10^{-1}
Sulfur dioxide (SO_2)	3.5	1.6	5.4×10^{-4}	2.9×10^{3}	1.3×10^{3}	1.5×10^{-1}	3.4×10^{3}	1.6×10^{3}	1.5×10^{-1}
Sulfuric acid (H_2SO_4)	6.1×10^{-2}	2.8×10^{-2}	9.3×10^{-6}	1.9×10^{2}	8.5×10^{1}	9.6×10^{-3}	2.2×10^{2}	1.0×10^{2}	9.6×10^{-3}
Nitrogen oxides (NO_x)	3.3×10^{2}	1.5×10^{2}	5.0×10^{-2}	4.7×10^{4}	2.1×10^{4}	2.4	5.5×10^{4}	2.5×10^{4}	2.4
Nitrogen dioxide (NO_2)	1.7×10^{1}	7.5	2.5×10^{-3}						
Ammonia (NH_3)	1.3×10^{1}	6.0	2.0×10^{-3}						
Carbon monoxide (CO)	8.3×10^{1}	3.7×10^{1}	1.3×10^{-2}	1.0×10^{4}	4.6×10^{3}	5.1×10^{-1}	1.2×10^{4}	5.4×10^{3}	5.1×10^{-1}
Volatile organic compounds (VOCs)	3.3	1.5	5.0×10^{-4}	3.5×10^{3}	1.6×10^{3}	1.8×10^{-1}	4.1×10^{3}	1.9×10^{3}	1.8×10^{-1}
Benzene (C_6H_6)	3.5×10^{-3}	1.6×10^{-3}	5.4×10^{-7}	9.9	4.5	5.0×10^{-4}	1.2×10^{1}	5.3	5.0×10^{-4}
Toluene (C_7H_8)	1.0×10^{-1}	4.6×10^{-2}	1.6×10^{-5}	4.3	2.0	2.2×10^{-4}	5.1	2.3	2.2×10^{-4}
Xylenes (C_8H_{10})	1.8×10^{-3}	8.2×10^{-4}	2.7×10^{-7}	3.0	1.4	1.5×10^{-4}	3.6	1.6	1.5×10^{-4}
Propylene (C_3H_6)	3.0×10^{-5}	1.3×10^{-5}	4.5×10^{-9}	2.7×10^{1}	1.2×10^{1}	1.4×10^{-3}	3.2×10^{1}	1.5×10^{1}	1.4×10^{-3}
1,3-Butadiene (C_4H_6)				4.1×10^{-1}	1.9×10^{-1}	2.1×10^{-5}	4.9×10^{-1}	2.2×10^{-1}	2.1×10^{-5}
Formaldehyde (HCOH)	1.0	4.6×10^{-1}	1.5×10^{-4}	1.3×10^{1}	5.7	6.4×10^{-4}	1.5×10^{1}	6.7	6.4×10^{-4}
Acetaldehyde (C_2H_4O)				8.1	3.7	4.1×10^{-4}	9.6	4.4	4.1×10^{-4}
Acrolein (C_3H_4O)				9.8×10^{-1}	4.4×10^{-1}	5.0×10^{-5}	1.2	5.3×10^{-1}	5.0×10^{-5}
Ethylbenzene (C_8H_{10})	1.1×10^{-3}	4.8×10^{-4}	1.6×10^{-7}						
1,1,1-Trichloroethane ($C_2H_3Cl_3$)	3.9×10^{-3}	1.8×10^{-3}	5.9×10^{-7}						
Naphthalene ($C_{10}H_8$)	1.9×10^{-2}	8.5×10^{-3}	2.8×10^{-6}	9.0×10^{-1}	4.1×10^{-1}	4.6×10^{-5}	1.1	4.8×10^{-1}	4.6×10^{-5}
Polycyclic aromatic compounds (PACs)	2.7×10^{-4}	1.2×10^{-4}	4.2×10^{-8}	1.2×10^{-1}	5.3×10^{-2}	5.9×10^{-6}	1.4×10^{-1}	6.3×10^{-2}	5.9×10^{-6}
PM_{10}	3.8×10^{1}	1.7×10^{1}	5.8×10^{-3}	3.3×10^{3}	1.5×10^{3}	1.7×10^{-1}	3.9×10^{3}	1.8×10^{3}	1.7×10^{-1}
$PM_{2.5}$	2.6×10^{1}	1.2×10^{1}	3.9×10^{-3}	3.3×10^{3}	1.5×10^{3}	1.7×10^{-1}	3.9×10^{3}	1.8×10^{3}	1.7×10^{-1}
Chromium (Cr)	6.7×10^{-3}	3.0×10^{-3}	1.0×10^{-6}	3.2×10^{-2}	1.4×10^{-2}	1.6×10^{-6}	3.8×10^{-2}	1.7×10^{-2}	1.6×10^{-6}
Copper (Cu)	1.3×10^{-2}	6.1×10^{-3}	2.0×10^{-6}	6.4×10^{-2}	2.9×10^{-2}	3.2×10^{-6}	7.5×10^{-2}	3.4×10^{-2}	3.2×10^{-6}
Mercury (Hg) as Hg	6.7×10^{-3}	3.0×10^{-3}	1.0×10^{-6}	3.2×10^{-2}	1.4×10^{-2}	1.6×10^{-6}	3.8×10^{-2}	1.7×10^{-2}	1.6×10^{-6}
Manganese (Mn)	1.3×10^{-2}	6.1×10^{-3}	2.0×10^{-6}	6.4×10^{-2}	2.9×10^{-2}	3.2×10^{-6}	7.5×10^{-2}	3.4×10^{-2}	3.2×10^{-6}
Nickel (Ni)	6.7×10^{-3}	3.0×10^{-3}	1.0×10^{-6}	3.2×10^{-2}	1.4×10^{-2}	1.6×10^{-6}	3.8×10^{-2}	1.7×10^{-2}	1.6×10^{-6}

Notes: Gray shaded cells indicate pollutant is not emitted or an emission factor is not available.
lb/yr = pounds per year.
kg/yr = kilograms per year.
g/sec=grams per second.

Table E.2-24: Estimated Emissions for Batch Plant and New Facility Heating for the Construction Period of the New Facility Alternative (cont.)

Pollutant Name	Emissions								
	Batch Plant Water Heater			Batch Plant Diesel Generator			Heating Diesel Generator		
	lb/yr	kg/yr	g/sec	lb/yr	kg/yr	g/sec	lb/yr	kg/yr	g/sec
Selenium (Se)	3.3×10^{-2}	1.5×10^{-2}	5.1×10^{-6}	1.6×10^{-1}	7.2×10^{-2}	8.1×10^{-6}	1.9×10^{-1}	8.5×10^{-2}	8.1×10^{-6}
As as arsenic trioxide (As_2O_3)	2.4×10^{-2}	1.1×10^{-2}	3.6×10^{-6}	1.1×10^{-1}	5.1×10^{-2}	5.7×10^{-6}	1.3×10^{-1}	6.0×10^{-2}	5.7×10^{-6}
Be as beryllium oxide (BeO)	1.9×10^{-2}	8.4×10^{-3}	2.8×10^{-6}	8.8×10^{-2}	4.0×10^{-2}	4.5×10^{-6}	1.0×10^{-1}	4.7×10^{-2}	4.5×10^{-6}
Cd as cadmium oxide (CdO)	7.6×10^{-3}	3.5×10^{-3}	1.2×10^{-6}	3.6×10^{-2}	1.6×10^{-2}	1.8×10^{-6}	4.3×10^{-2}	1.9×10^{-2}	1.8×10^{-6}
Pb as lead monoxide (PbO)	2.2×10^{-2}	9.8×10^{-3}	3.3×10^{-6}	1.0×10^{-1}	4.7×10^{-2}	5.2×10^{-6}	1.2×10^{-1}	5.5×10^{-2}	5.2×10^{-6}
Zn as zinc oxide (ZnO)	1.1×10^{-2}	5.0×10^{-3}	1.7×10^{-6}	5.3×10^{-2}	2.4×10^{-2}	2.7×10^{-6}	6.2×10^{-2}	2.8×10^{-2}	2.7×10^{-6}

Notes: Gray shaded cells indicate pollutant is not emitted or an emission factor is not available.
lb/yr = pounds per year.
kg/yr = kilograms per year.
g/sec=grams per second.

Certain toxic pollutants would be emitted from cement unloading to a storage silo and truck/mixer loading operations. These emissions are calculated using the emission factors presented in Table E.2-25 for material throughput of 301,612 tons for cement unloading and material throughput of 65,034 tons for truck/mixer loading. Emissions are provided in Table E.2-26.

Table E.2-25: Toxic Pollutant Emission Factors for Batch Plant Material Handling

Pollutant Name	Unloading Cement	Truck/Mixer Loading
	pounds per ton	pounds per ton
Arsenic	1.68×10^{-6}	1.22×10^{-5}
Beryllium	1.79×10^{-8}	2.44×10^{-7}
Cadmium	2.34×10^{-7}	3.42×10^{-8}
Total Chromium	2.52×10^{-7}	1.14×10^{-5}
Lead	7.36×10^{-7}	3.62×10^{-6}
Manganese	2.02×10^{-4}	6.12×10^{-5}
Nickel	1.76×10^{-5}	1.19×10^{-5}
Total Phosphorus	1.18×10^{-5}	3.84×10^{-5}
Selenium		2.62×10^{-6}
Note: Gray shaded cells indicate pollutant is not emitted or an emission factor is not available.		

Table E.2-26: Toxic Pollutant Emissions for Batch Plant Material Handling

Pollutant Name	Emissions	
	kilograms per year	pounds per year
Arsenic	1.3×10^{-1}	2.9×10^{-1}
Beryllium	2.1×10^{-3}	4.6×10^{-3}
Cadmium	8.8×10^{-3}	1.9×10^{-2}
Total Chromium	7.6×10^{-2}	1.7×10^{-1}
Lead	4.8×10^{-2}	1.1×10^{-1}
Manganese	7.8	1.7×10^{1}
Nickel	7.2×10^{-1}	1.6
Total Phosphorus	6.6×10^{-1}	1.5
Selenium	1.5×10^{-2}	3.3×10^{-2}

Transition Period

Impacts during the transition period of the New Facility Alternative are analyzed by modeling the new facility operations emissions with INL emissions to get cumulative concentrations of pollutants at receptor locations. Source terms for new facility operations emissions are generated from the 5-year maximum criteria and toxic emissions from fuel combustion for heating ECF (fuel oil-fired boilers) and from testing EDGs that would power ECF should a site-wide power failure occur. These maximum emissions are scaled for new facility operations for use in the dispersion modeling. Information on facility size, operations, and power requirements is used to establish reasonable scaling factors for emissions. Conservatisms (e.g., extra kilowatts for EDGs) are built in to account for uncertainties.

It is assumed that emissions for new facility operations would not change based on the location at NRF (i.e., Location 3/4 or Location 6). The conceptual facility designs are similar enough at each location that differences in air pollutant emissions would be small and not likely to influence concentrations at receptor locations.

Scaling factors for pollutant emissions are developed by considering area, air volumes, and EDG energy requirements of ECF currently being used for naval spent nuclear fuel handling activities along with conservative estimates of the area, air volumes, and EDG energy requirements of a new facility. Naval spent nuclear fuel handling operations are estimated to take place in about 92 percent of the ECF area, with the remaining 8 percent dedicated to examination operations. The following assumptions are made:

- Change in the volume of air to be heated is proportional to the amount of pollutants emitted by the boilers
- Change in emergency power requirements is proportional to the amount of pollutants emitted by the EDGs

Scaling factors for the New Facility Alternative boilers and EDGs are provided in Table E.2-27.

Table E.2-27: Emission Scaling Factors for Boilers and EDGs from New Facility Operations

Source	Emission Scaling Factors
Boilers	2.392[1]
EDGs	1.50[2]

[1] Scaling factors are multiplied by ECF emissions.
[2] Scaling factors are multiplied by NRF emissions.

Based on NRF boiler operations, it was determined that about one-third of overall steam demand is dedicated to ECF.

Based on engineering and design calculations, it was determined that the ratio of air volume of the conceptual new facility to the volume of air in the ECF would be about 2.6. As mentioned above, naval spent nuclear fuel handling operations take place in about 92 percent of the ECF area. The scaling factor for new facility emissions in Table E.2-27 is determined by multiplying the volume ratio by 0.92 (2.6 x 0.92 = 2.392). The scaling factor is multiplied by boiler emissions for heating ECF (per individual pollutant) to get an estimate of emissions from new facility operations.

Based on the conceptual design information for the new facility, two EDGs totaling 4000 kilowatts of capacity would be needed to supply standby emergency power. EDGs could also be needed for fire water pumps or other systems not yet identified. Therefore, EDG emissions for a new facility are based on a 6,000-kilowatt need; the scaling factor is provided in Table E.2-27.

Source terms for boilers and EDGs for the transition period of the New Facility Alternative are provided in Table E.2-28 and Table E.2-29.

Table E.2-28: Boiler Emissions for the Transition Period of the New Facility Alternative

Pollutant Name	Emissions		
	pounds per year	kilograms per year	grams per second
Sulfur oxides (SOx)	1.0×10^{2}	4.7×10^{1}	2.8×10^{-3}
Sulfur dioxide (SO_2)	1.0×10^{2}	4.6×10^{1}	2.7×10^{-3}
Sulfuric acid (H_2SO_4)	1.8	8.0×10^{-1}	4.7×10^{-5}
Nitrogen oxides (NOx)	9.6×10^{3}	4.4×10^{3}	2.6×10^{-1}
Nitrogen dioxide (NO_2)	4.8×10^{2}	2.2×10^{2}	1.3×10^{-2}
Ammonia (NH_3)	3.8×10^{2}	1.7×10^{2}	1.0×10^{-2}
Carbon monoxide (CO)	2.4×10^{3}	1.1×10^{3}	6.5×10^{-2}
VOCs	9.6×10^{1}	4.4×10^{1}	2.6×10^{-3}
Benzene (C_6H_6)	1.0×10^{-1}	4.7×10^{-2}	2.8×10^{-6}
Toluene (C_7H_8)	3.0	1.4	8.0×10^{-5}
Xylenes (C_8H_{10})	5.2×10^{-2}	2.4×10^{-2}	1.4×10^{-6}
1,3-Butadiene (C_4H_6)			
Formaldehyde (HCOH)	2.9×10^{1}	1.3×10^{1}	7.9×10^{-4}
Acetaldehyde (C_2H_4O)			
Acrolein (C_3H_4O)			
Ethylbenzene (C_8H_{10})	3.1×10^{-2}	1.4×10^{-2}	8.2×10^{-7}
Naphthalene ($C_{10}H_8$)	5.4×10^{-1}	2.5×10^{-1}	1.5×10^{-5}
Polycyclic aromatic compounds (PACs)	7.9×10^{-3}	3.6×10^{-3}	2.1×10^{-7}
PM_{10}	1.1×10^{3}	5.0×10^{2}	3.0×10^{-2}
$PM_{2.5}$	7.4×10^{2}	3.4×10^{2}	2.0×10^{-2}
As as arsenic trioxide (As_2O_3)	6.9×10^{-1}	3.1×10^{-1}	1.8×10^{-5}
Be as beryllium oxide (BeO)	5.4×10^{-1}	2.5×10^{-1}	1.5×10^{-5}
Cd as cadmium oxide (CdO)	2.2×10^{-1}	1.0×10^{-1}	6.0×10^{-6}
Chromium (Cr)	1.9×10^{-1}	8.8×10^{-2}	5.2×10^{-6}
Copper (Cu)	3.9×10^{-1}	1.8×10^{-1}	1.0×10^{-5}
Pb as lead monoxide (PbO)	6.3×10^{-1}	2.9×10^{-1}	1.7×10^{-5}
Manganese (Mn)	3.9×10^{-1}	1.8×10^{-1}	1.0×10^{-5}
Nickel (Ni)	1.9×10^{-1}	8.8×10^{-2}	5.2×10^{-6}
Selenium (Se)	9.7×10^{-1}	4.4×10^{-1}	2.6×10^{-5}
Zn as zinc oxide (ZnO)	3.2×10^{-1}	1.5×10^{-1}	8.7×10^{-6}

Note: Gray shaded cells indicate pollutant is not emitted or an emission factor is not available.

Table E.2-29: EDG Emissions for the Transition Period of the New Facility Alternative

Pollutant Name	Emissions		
	pounds per year	kilograms per year	grams per second
Sulfur oxides (SOx)	1.4	6.5×10^{-1}	2.7×10^{-3}
Sulfur dioxide (SO_2)	1.4	6.2×10^{-1}	2.6×10^{-3}
Sulfuric acid (H_2SO_4)	8.8×10^{-2}	4.0×10^{-2}	1.7×10^{-4}
Nitrogen oxides (NOx)	3.0×10^{3}	1.4×10^{3}	5.8
Nitrogen dioxide (NO_2)			
Ammonia (NH_3)			
Carbon monoxide (CO)	8.0×10^{2}	3.7×10^{2}	1.5
VOCs	7.8×10^{1}	3.5×10^{1}	1.5×10^{-1}
Benzene (C_6H_6)	7.3×10^{-1}	3.3×10^{-1}	1.4×10^{-3}
Toluene (C_7H_8)	2.7×10^{-1}	1.2×10^{-1}	5.1×10^{-4}
Xylenes (C_8H_{10})	1.8×10^{-1}	8.3×10^{-2}	3.5×10^{-4}
1,3-Butadiene (C_4H_6)	3.7×10^{-2}	1.7×10^{-2}	7.1×10^{-5}
Formaldehyde (HCOH)	7.5×10^{-2}	3.4×10^{-2}	1.4×10^{-4}
Acetaldehyde (C_2H_4O)	2.4×10^{-2}	1.1×10^{-2}	4.5×10^{-5}
Acrolein (C_3H_4O)	7.5×10^{-3}	3.4×10^{-3}	1.4×10^{-5}
Ethylbenzene (C_8H_{10})			
Naphthalene ($C_{10}H_8$)	1.2×10^{-1}	5.6×10^{-2}	2.3×10^{-4}
Polycyclic aromatic compounds (PACs)	8.1×10^{-3}	3.7×10^{-3}	1.5×10^{-5}
PM_{10}	5.4×10^{1}	2.5×10^{1}	1.0×10^{-1}
$PM_{2.5}$	5.3×10^{1}	2.4×10^{1}	1.0×10^{-1}
As as arsenic trioxide (As_2O_3)	1.0×10^{-2}	4.5×10^{-3}	1.9×10^{-5}
Be as beryllium oxide (BeO)	7.9×10^{-3}	3.6×10^{-3}	1.5×10^{-5}
Cd as cadmium oxide (CdO)	3.2×10^{-3}	1.5×10^{-3}	6.2×10^{-6}
Chromium (Cr)	2.8×10^{-3}	1.3×10^{-3}	5.4×10^{-6}
Copper (Cu)	5.7×10^{-3}	2.6×10^{-3}	1.1×10^{-5}
Pb as lead monoxide (PbO)	9.2×10^{-3}	4.2×10^{-3}	1.8×10^{-5}
Manganese (Mn)	5.7×10^{-3}	2.6×10^{-3}	1.1×10^{-5}
Nickel (Ni)	2.8×10^{-3}	1.3×10^{-3}	5.4×10^{-6}
Selenium (Se)	1.4×10^{-2}	6.4×10^{-3}	2.7×10^{-5}
Zn as zinc oxide (ZnO)	4.7×10^{-3}	2.1×10^{-3}	9.0×10^{-6}

Note: Gray shaded cells indicate pollutant is not emitted or an emission factor is not available.

New Facility Operational Period

The new facility operational period represents the time when all naval spent nuclear fuel handling operations have moved to a new facility and only examination work continues in the ECF. ECF would continue to be heated and require EDG testing to support the examination work. Since portions of the water pool in the high bay would still be needed to support examination work, a conservative assumption is made that air pollutant emissions during the new facility operational period would be the same as the boiler and EDG emissions described for the transition period.

E.3 AERMOD Protocol

Proposed action emissions and INL emissions are evaluated using AERMOD, Version 11103, with meteorological data processed through the AERMET (EPA 2004b) preprocessor, Version 06341. A more recent version of AERMOD (Version 12060) was released in 2012 while modeling was in process. A benchmark between the two versions was run and the predicted air pollutant concentrations between the two versions were identical (INL 2013a). Therefore, Version 11103 was retained for this analysis. Criteria and toxic air pollutant concentrations are modeled for public receptor locations for comparison with regulatory standards in Section 4.6. PSD air pollutant concentrations at public receptor locations on Federal Class II areas and near field Federal Class I areas (Craters of the Moon National Monument) are also modeled.

E.3.1 Meteorological Data

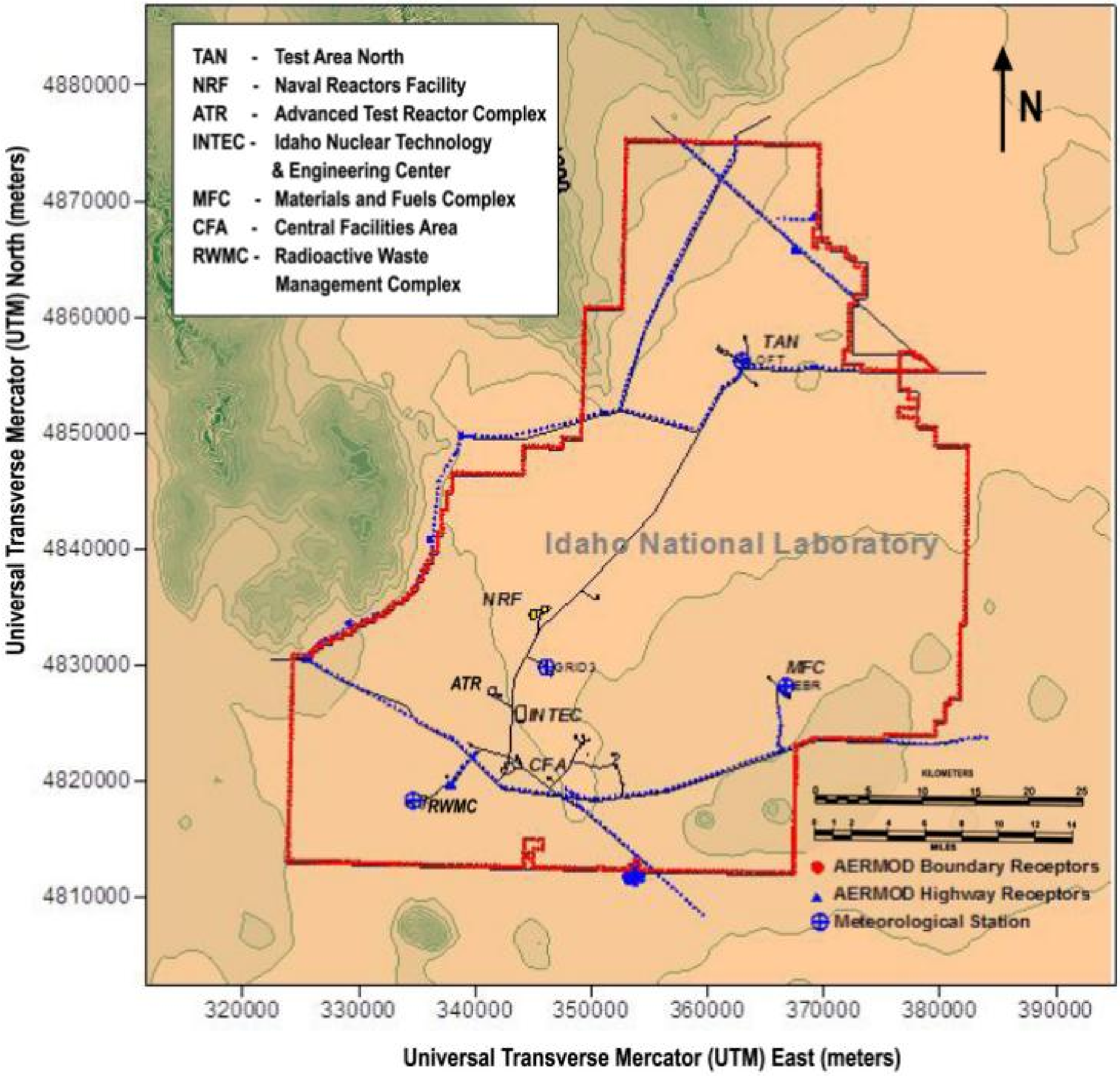
A 5-year meteorological data set for the Idaho Falls area was provided by the Idaho Department of Environmental Quality (IDEQ) in AERMOD format for 2000-2004 (Geomatrix 2008). Five years of continuous meteorological data from a nearby airport or 1-year of site-specific data are considered by the state of Idaho to be sufficient to perform air quality assessments (IDEQ 2002). These data include (1) surface data from the Idaho Falls airport, (2) upper-air data from Boise International Airport, and (3) on-site data from the National Oceanic and Atmospheric Administration (NOAA) 15-meter (50-feet) tower located along the greenbelt in downtown Idaho Falls. The IDEQ provided not only the AERMOD data file, but the raw meteorological data and AERMET input files for processing the data. The meteorological data from the on-site Idaho Falls greenbelt station is not representative of INL facilities. Therefore, meteorological data from the INL mesonet network (NOAA 2011) are substituted for use in AERMOD (Table E.3-1 and Figure E.3-1). The INL mesonet network data were provided by NOAA (Idaho Falls office). The surface data (Idaho Falls Airport) and upper air data (Boise International Airport) that were provided in the IDEQ data set are used in the AERMET processing of INL on-site data. The surface data at the Idaho Falls Airport provides cloud cover data that are used by AERMET to compute turbulence statistics. The upper air data from the Boise International Airport provide the vertical atmospheric structure in the morning and afternoon. The INL mesonet data are used for surface wind directions and speed.

Table E.3-1: INL Mesonet Meteorological Station Locations and Storage Files

Facility	NOAA Meteorological Station[1]	Meteorological File	Location (latitude, longitude)
INTEC, ATR, CFA, NRF	GRID3	GRI2000.MET GRI2001.MET GRI2002.MET GRI2003.MET GRI2004.MET	43.6049˚N, 112.9067˚W
TAN	LOFT	LOF2000.MET LOF2001.MET LOF2002.MET LOF2003.MET LOF2004.MET	43.846˚N, 112.705˚W
MFC	EBR	EBR2000.MET EBR2001.MET EBR2002.MET EBR2003.MET EBR2004.MET	43.594˚N, 112.651˚W
RWMC	RWMC	RWM2000.MET RWM2001.MET RWM2002.MET RWM2003.MET RWM2004.MET	43.499˚N, 113.0453˚W

[1] Measurement height at each station is 15 meters (50 feet).

ATR = Advanced Test Reactor
CFA = Central Facilities Area
INTEC = Idaho Nuclear Technology and Engineering Center
TAN = Test Area North
RWMC = Radioactive Waste Management Complex
NRF = Naval Reactors Facility
MFC = Materials and Fuels Complex
EBR = Experimental Breeder Reactor



Source: INL 2013a

Figure E.3-1: INL Facilities, Meteorological Stations, and Public Receptor Locations Along Boundaries and Highways

Surface data (roughness height, albedo, terrain, etc.) are processed for each individual meteorological station using the AERSURFACE utility and National Land Cover Data (NLCD) data file, idaho_NLCD92.tif. The NLCD data are derived from the early to mid-1990s Landsat Thematic Mapper satellite data and is a 21-class land cover classification scheme applied consistently over the U.S. The spatial resolution of the data is 30 meters and mapped in the Albers Conic Equal Area projection, NAD 83. The NLCD are provided on a state-by-state basis at WebGIS 2009. The input parameters for AERSURFACE are presented in Table E.3-2.

Table E.3-2: AERSURFACE Input Parameters

Parameter	Value	Units and Comments
Coordinate type	Latitude Longitude	Decimal degrees, see Table E.3-1 for coordinates
Datum	NAD83	
Study radius	1.0	kilometers
Vary by sector?	Yes	
Number of sectors	12	30-degree sectors
Temporal resolution	Seasonal	
Continuous snow cover	Yes	Continuous snow cover is assumed during the winter months
Airport	No	
Surface moisture	Average	

AERMET Processing

The surface data provided by IDEQ are processed with AERMET Version 06341. AERMET processing used the same parameter values that were used in the IDEQ processing. These parameters include the threshold wind speed (0.447 meters per second), and the range of acceptable values for on-site data. These ranges are provided in Table E.3-3.

Table E.3-3: AERMET Processing Parameters

Parameter (units)	Range (missing data designation)
Wind speed (meters per second)	RANGE WS 0 <= 50 (99999)
Wind direction range (degrees)	RANGE WD 0 <= 360 (99999)
Temperature range (Celsius)	RANGE TT -30 < 49 (99999)
Delta temperature range (Celsius)	RANGE DT01 -2 < 5 (99999)
Standard deviation wind angle (degrees)	RANGE SA 0 <= 90 (99999)
Solar radiation (watts per square meters)	RANGE INSO -1 < 1250 (99999)
Relative humidity (percent)	RANGE RH 0 <= 100 (999)
Pressure (millibars)	RANGE PRES 8500 < 10999 (9999)

E.3.2 AERMOD Modeling

The 5-year site-specific meteorological data set for each facility as specified in Table E.3-1, and the receptors as illustrated in Figure E.3-1, are used in AERMOD. Individual emission sources at each of the named facilities in Table E.3-1 are modeled. The model is run for individual pollutants and averaging times assuming unit release rates, and then scaled to actual release rates. See INL 2013a Appendix A for INL release rates per facility and source.

E.3.2.1 Receptor Locations

Receptor locations for INL were obtained from IDEQ in the file "U S DEPT OF ENERGY-INL-DEFAULT AMBIENT AIR RECEPTORS - DEQ May 2011.zip" (IDEQ 2011). The receptors are shown in Figure E.3-1. The receptors are divided into two types: (1) site boundary receptors, and (2) public highway receptors. Site boundary and public highway receptors total 1374. These hypothetical receptors provide a conservative bound for all actual off-INL public receptor locations.

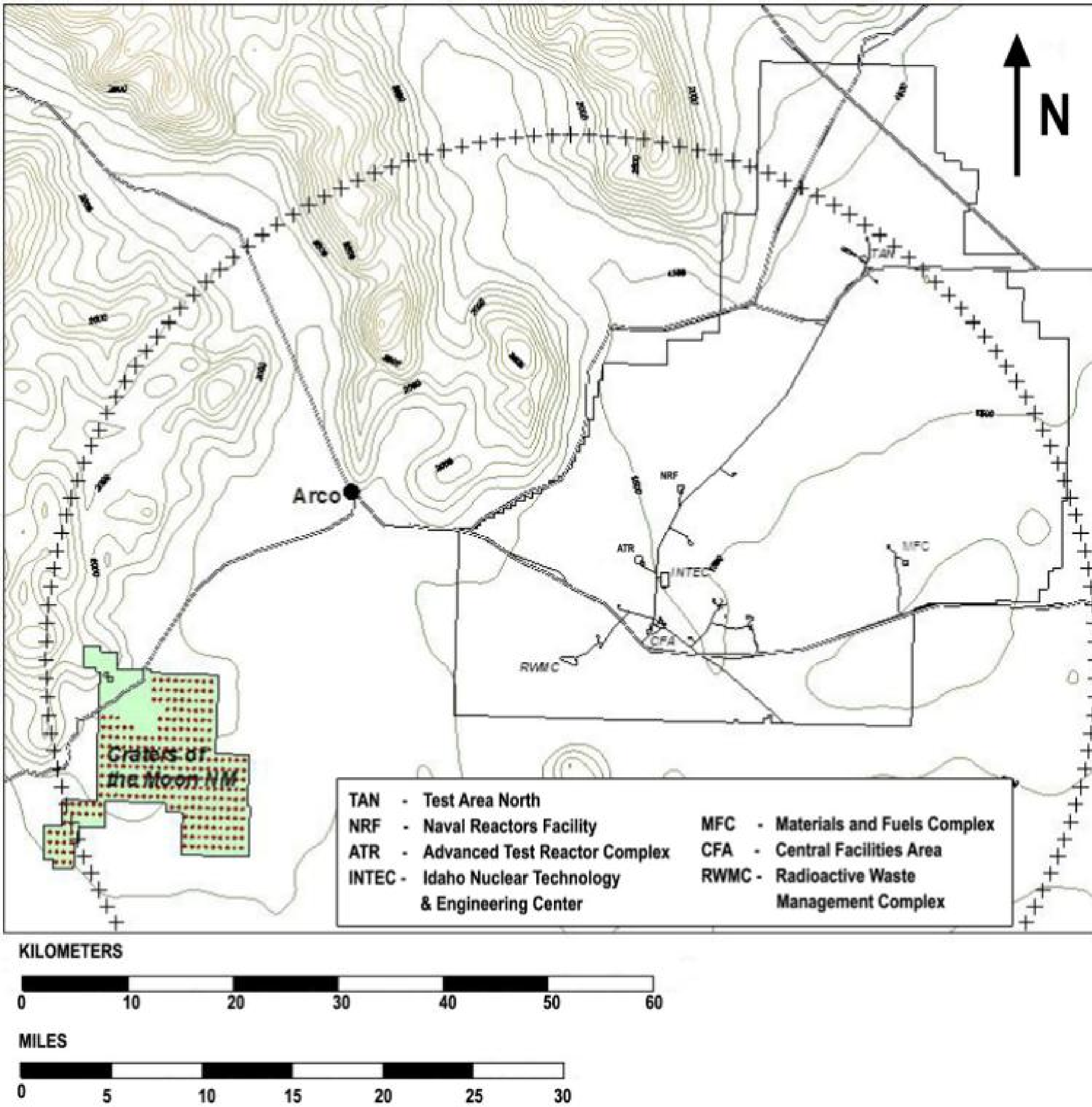
PSD impacts at the near field Federal Class I area are evaluated using the same AERMOD meteorological data for each facility described earlier and a receptor network provided by the National Park Service (NPS) (NPS 2012) . These Federal Class I area receptors are illustrated in Figure E.3-2.

E.3.2.2 Source Characterization

Source terms for the proposed action emissions and INL emissions are presented in Section E.2. See Appendix A of INL 2013a for individual facility source release rates used for the INL modeling. For all facilities and the proposed action, boilers are assumed to operate 24 hours per day, 365 days per year. Actual stack parameters and estimated emissions are used in the INL AERMOD runs. NRF stack parameters and projected emissions are used for the proposed action.

EDGs are routinely tested during normal working hours and releases from these sources are modeled using the actual release parameters. Testing typically involves starting the generator during normal working daylight hours and running the generator for 15 to 30 minutes. If the exhaust stack is horizontal, then a small exit velocity is assumed and an effective stack diameter is calculated based on the total flow rate (exit velocity × actual stack diameter). Horizontal stacks or stacks with rain caps are assumed to have zero vertical momentum plume rise. These sources are assumed to be tested only during working hours (Monday through Friday, 8 a.m. to 4 p.m.). If more than one generator is present at a given facility and the stack parameters differed between generators, then the average of the two stacks is used. Hourly release rates are used for these sources. For longer averaging times (i.e. 24-hour, annual), the same maximum hourly release rate is conservatively assumed.

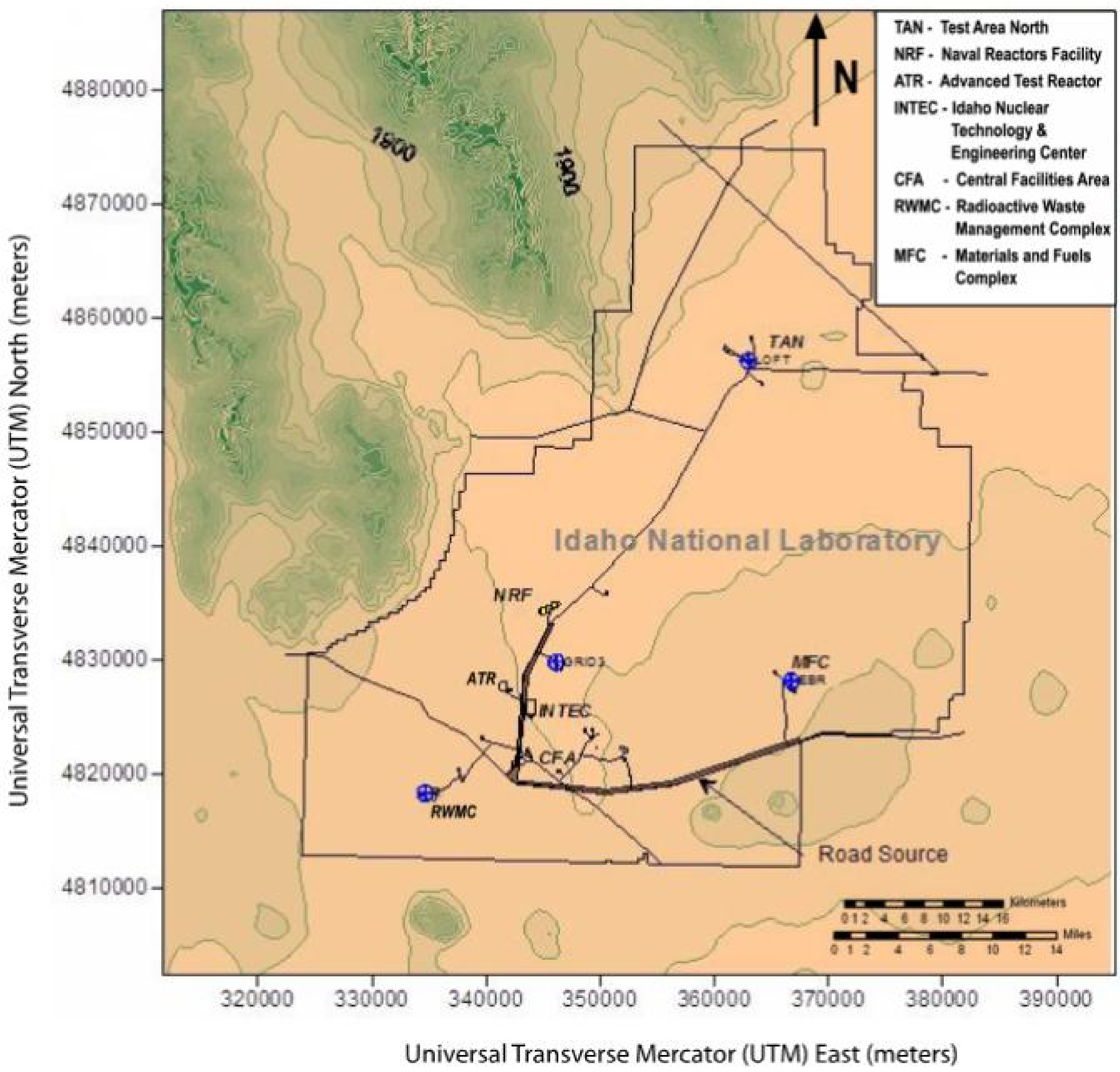
Miscellaneous combustion sources are modeled assuming all emissions emanated from a 1-meter (3.3-foot) high point source located at the center of the facility. Zero vertical momentum plume rise is assumed, and the release temperature is conservatively assumed to be 200 Fahrenheit (366 Kelvin), which is relatively cool for a combustion source. Miscellaneous combustion sources are assumed to operate during working hours. Hourly release rates are used for these sources. For longer averaging times (i.e. 24-hour, annual), the same maximum hourly release rate is conservatively assumed.



Source: INL 2013a
Note: The delineated circular area represents a 50-kilometer (31-mile) radius around Radioactive Waste Management Complex (RWMC).

Figure E.3-2: Craters of the Moon National Monument Near Field and Far Field Receptors

Construction period emissions (e.g., wind erosion emissions, concrete batch and crushing emissions, and off-road vehicle emissions) are modeled as an area source that encompasses the construction footprint. On-road vehicle emissions are modeled as a very thin area polygon area source (essentially a line (Figure E.3-3)) with a 1-meter (3.3-foot) release height. On-road vehicle emissions are limited to 5 a.m. to 7 p.m. to represent main transport to and from the work site and hauling material from Idaho Falls. It is assumed material would be hauled from Idaho Falls because U.S. Highway 20 is the main route to INL. Because on-road vehicle impacts are based on an estimate of the number of commuters and material loads that would be needed, pollutant concentrations would be the same regardless of the route.



Source: INL 2013a

Note: The source conservatively terminates at the INL site boundary south of the Materials and Fuels Complex (MFC) facility.

Figure E.3-3: Location of the On-Road Vehicle Emission Source

Building wake effects are not modeled explicitly for any of the sources, but are analyzed separately to confirm that the overall impact of including building wake effects would not result in a regulatory limit being exceeded (INL 2013a). It is concluded that including building wake effects would not result in predicted concentrations exceeding NAAQS limits. Additionally, other model uncertainties and conservatisms far outweigh small increases in concentrations that could occur due to building wake effects.

E.3.2.3 Dispersion Modeling

Individual sources, stack parameters, and construction areas associated with the different sources that are used in dispersion modeling are presented in Table E.3-4. Multiple model runs of the same source are necessary to get the different averaging times (i.e., 1-hour, 8-hour, 24-hour, etc.), deposition characteristics, and ranking (1st highest, 6th highest, 8th highest, etc.) for comparison of each air pollutant to regulation standards.

Table E.3-4: Parameters for Air Pollutant Emission Sources at INL

Source Name	Stack Height	Diameter	Temperature	Velocity	UTM East	UTM North	Area
	meters	meters	degrees Kelvin	meters per second	meters	meters	square meters
CFA Boilers	10.4	0.305	436	6.94	343500	4821930	N/A
INTEC Boilers	15.2	0.61	464	22.9	343810	4826080	N/A
TAN Boilers	9.14	0.61	466	6.31	363150	4856160	N/A
RWMC Boilers	15.5	0.56	450	9.39	335214	4817838	N/A
NRF Boilers	9.14	1.07	644	18.7	345400	4834600	N/A
ATR Generators	9.14	0.43	489	23.3	341390	4827820	N/A
ATR EDGs	4.64	0.15	810	67.8	341270	4827896	N/A
CFA EDGs	3.58	0.126	841	53.2	343113	4821377	N/A
CITRIC EDGs	3.58	0.126	841	53.2	343113	4821377	N/A
INTEC EDGs	6.10	0.457	785	43.5	343787	4825844	N/A
MFC EDGs[1]	1	1	366	0	365913	4828301	N/A
SMC EDGs	4.42	0.2	791	71.8	360911	4857538	N/A
NRF EDGs[2]	7.32	14.1	749	0.025	345400	4834600	N/A
ATR Misc Sources	1	1	366	0	341270	4827896	N/A
CFA Misc Sources	1	1	366	0	343113	4821377	N/A
INTEC Misc Sources	1	1	366	0	343787	4825844	N/A
MFC Misc Sources	1	1	366	0	365913	4828301	N/A

[1] Uses the miscellaneous source release parameters for MFC EDGs.
[2] Horizontal exhaust pipe. Effective diameter calculated assuming a 0.025 meters per second release velocity.
[3] Area source, UTM coordinates represent the southwest corner of construction footprint.
[4] Roads modeled as a thin area polygon source (Figure E.3-3). Area is calculated using the coordinates of the polygon and Surfer®mapping sequence.

ATR = Advanced Test Reactor; CFA = Central Facilities Area; INTEC = Idaho Nuclear Technology and Engineering Center; TAN = Test Area North; SMC = Specific Manufacturing Capability; RWMC = Radioactive Waste Management Complex; NRF = Naval Reactors Facility; CITRC = Critical Infrastructure Test Range Complex; MFC = Materials and Fuels Complex

Table E.3-4: Parameters for Air Pollutant Emission Sources at INL (cont.)

Source Name	Stack Height	Diameter	Temperature	Velocity	UTM East	UTM North	Area
	meters	meters	degrees Kelvin	meters per second	meters	meters	square meters
RWMC Misc Sources	1	1	366	0	335299	4818098	N/A
NRF Misc Sources	1	1	366	0	345400	4834600	N/A
New Facility Boilers	9.14	1.07	644	18.7	345400	4834600	N/A
TAN Misc Sources	1	1	366	0	362930	4856320	N/A
New Facility EDGs	7.32	14.1	749	0.025	345400	4834600	N/A
Overhaul, Boilers	9.14	1.07	644	18.7	345400	4834600	N/A
Overhaul, EDGs	7.32	14.1	749	0.025	345400	4834600	N/A
New Facility Construction[3] – Location 6	N/A	N/A	N/A	N/A	344752	4833957	276,000
Roads[4] (construction)	N/A	N/A	N/A	N/A	N/A	N/A	1.58×10^{7}

[1] Used the miscellaneous source release parameters for MFC EDGs.
[2] Horizontal exhaust pipe. Effective diameter calculated assuming a 0.025 meters per second release velocity.
[3] Area source, UTM coordinates represent the southwest corner of construction footprint.
[4] Roads modeled as a thin area polygon source (Figure E.3-3). Area is calculated using the coordinates of the polygon and Surfer®mapping sequence.

ATR = Advanced Test Reactor; CFA = Central Facilities Area; INTEC = Idaho Nuclear Technology and Engineering Center; TAN = Test Area North; SMC = Specific Manufacturing Capability; RWMC = Radioactive Waste Management Complex; NRF = Naval Reactors Facility; CITRC = Critical Infrastructure Test Range Complex; MFC = Materials and Fuels Complex

For each source modeled, seven separate "simulated pollutants" are run in AERMOD, having either different averaging times or deposition characteristics (Table E.3-5). The criteria pollutants, NO_2, PM_{10}, and $PM_{2.5}$, required specific runs to incorporate pollutant-specific characteristics for deposition and chemical transformation. Parameter specifics for these pollutants are discussed in the following sections.

Table E.3-5: Air Pollutants and Averaging Times Used in AERMOD

Pollutant Type ID	Pollutants Included	Averaging Times	Notes
SO2	SO_2, TAPs (non-carcinogens)	1-hour, 24-hour, 3-hour	The 1-hour average is the 4th highest value representing the 99th percentile. The 3-hour and 24-hour averages are the maximum concentrations and are also used to model non-carcinogenic TAPs.
NOX	NO_2	1-hour	8th highest 1-hour average concentration representing the 98th percentile of the maximum 1-hour average concentration in a 24-hour period. Assumes a NO_X to NO_2 conversion ratio of 0.8 based on EPA 2011b.
NOXSOX	NO_2, SO_2, TAPs (carcinogens)	Annual	Annual average concentration across 5-year data set. Also used to estimate carcinogenic TAPs.
CO	CO	1-hour, 8-hour	Maximum 1-hour and 8-hour concentration.
PB	PB	Month	Maximum monthly average concentration used to compare with the rolling 3-month average limit.
PM10	PM_{10}	24-hour, Annual	Maximum 24-hour and annual concentration. Includes deposition and plume depletion. Assume the particle size distribution given in Appendix B of Wesley et al. 2002. Fine particle mass fraction = 0.80. Mass mean particle diameter = 0.4 micrometer.
PM25	$PM_{2.5}$	24-hour, Annual	Maximum 24-hour and annual concentration. Includes deposition and plume depletion. Assume the particle size distribution given in Appendix B of Wesley et al. 2002. Fine particle mass fraction = 0.80. Mass mean particle diameter = 0.4 micrometer.

NO_2 Modeling

For NO_2 modeling, the tiered approach recommended by EPA 2011b is used. Tier 1 assumes 100 percent conversion of NO_x to NO_2, while Tier 2 assumes a NO_x to NO_2 ambient ratio of 0.8. Tier 3 uses NO_x chemistry models, Plume Volume Molar Ratio Method and the Ozone Limiting Method (OLM) within AERMOD, along with background ozone concentrations and in-stack NO_x/NO_2 ratios to estimate ambient NO_2 concentrations. The Tier 2 approach is primarily used in this assessment.

For demonstrating compliance with the 1-hour NO_2 standard, the Tier 2 methodology allows comparison of the 8^{th} highest 1-hour average value of NO_2/NO_x (98^{th} highest 1-hour average concentration in a 24-hour period) to the standard. For the annual average standard, 100 percent conversion from NO_2 to NO_x is modeled.

Because the 1-hour average NO_2 concentration is close to exceeding the standard for INL emissions, a second AERMOD run was performed using the Tier 3 methodology. In this assessment, all NO_2 sources with their actual release rates are included in a single AERMOD simulation. Output from this simulation also included gridded receptors so that the spatial distribution of NO_2 across INL could be visualized.

Sources for NO_2 modeling included all INL facilities and the road source limited to hours of 6 to 8 a.m. and 4 to 6 p.m. (to simulate commuter traffic to and from INL). The Tier 3 methodology used the OLM NO_2 atmospheric chemistry model (an option in AERMOD) and all sources are run simultaneously. Other parameters include an in-stack NO_2/NO_X ratio of 0.5 (EPA 2011b), and a background ozone concentration of 30 parts per billion. The background ozone concentration is the average value from a study on ozone in Treasure Valley, Idaho and is the approximate average taken from Table 3-1 in Kavouras et al. 2008.

Particulate Matter Less than 10 Micrometers and 2.5 Micrometers

Deposition is not considered for any of the pollutants except PM_{10} and $PM_{2.5}$. Based on guidance in AERMOD user documentation and EPA 2012, the particle size distribution selected for fugitive dust as provided by Wesley et al. 2002 is used in this assessment. Method 2 is used to determine the particle size distribution from a fine mass fraction and representative mass mean particle diameter. Wesley et al. 2002 provides a fine particle mass fraction of 0.8 and a representative mass mean particle diameter of 0.4 micrometers.

Other Pollutants

Dispersion factor (χ/Q, or concentration divided by source term in units of second per cubic meters) values for some modeled pollutants are used to model other pollutants. For example, the NOXSOX annual average χ/Q values are used to model annual average concentrations of SO_2, NO_2, and carcinogenic TAPs because the averaging criteria and the dispersion characteristic for these pollutants are essentially the same. For non-carcinogens, the 24-hour SO_2 χ/Q is used. Ambient air concentrations of lead are based on a 3-month rolling average. The monthly average air concentration is used as a conservative bounding estimate of this value. The CO 8-hour average χ/Q is used for these pollutants.

Post-Processing

Output from AERMOD is summarized in terms of the dispersion factor for each source, averaging time, pollutant type, and receptor location. The dispersion factors are entered into a Microsoft Access database by source, averaging time, pollutant type, and receptor location.

The concentration from a single source is computed by

$$\chi_{i,j,k,l} = \chi / Q_{i,j,k,l} \times Q_{i,j,l}$$ **Equation E-2**

Where:

$\chi_{i,j,k,l}$ = the concentration (grams per cubic meters) for source *i*, averaging time *j*, receptor *k*, and pollutant *l*

$\chi/Q_{i,j,k,l}$ = the dispersion factor (seconds per meter) for source *i*, averaging time *j*, receptor *k* , and pollutant *l*, and

$Q_{i,j,l}$ = the source term (grams per cubic meters) for source *i,* averaging time *j*, and pollutant *l*.

The concentration from all sources ($\chi_{T\,j,k,l}$) is calculated by summing across all sources by receptor and averaging time.

$$\chi_{T\,j,k,l} = \sum_{i=1}^{n} \chi_{i,j,k,l}$$ **Equation E-3**

Where:

n = the number of sources

The maximum concentration across receptors is determined from the distribution of $\chi_{Tj,k,l}$ values. Total concentrations as given in Equation E-3 are coincident in space but not time. This is a conservative approach because the highest concentration from a source at a given receptor location does not necessarily coincide in time with the maximum concentration from another source at the same receptor location. For carcinogenic toxic air pollutants, maximum concentrations are reported regardless of whether the receptor is located on a highway where no person is expected to reside. This is a conservative assumption because the carcinogenic TAP limits are based on annual average lifetime exposure.

Concentrations of criteria pollutants, non-carcinogenic toxic air pollutants, and carcinogenic toxic air pollutants are calculated using the AERMOD χ/Q values at each of the IDEQ receptors (Figure E.3-1), the emission rates, and Equations E-2 and E-3.

E.4 Far Field Federal Class I Screening Assessment and VISCREEN Modeling Protocol

Under the Clean Air Act, the Federal Land Manager (FLM) and federal officials with direct responsibility for management of Federal Class I areas (e.g., national parks, monuments, and wilderness areas) have an affirmative responsibility to protect the Air Quality Related Values (AQRVs) (including visibility) of such lands. This includes the evaluation of impacts on visibility, ozone concentrations, and deposition from the construction and operations of a proposed major emitting facility. The FLM's decision regarding whether there is an adverse impact on AQRVs from air pollutants emitted from the proposed facility is considered by the permitting authority in the decision making process.

Visibility, ozone, and deposition impacts from the Overhaul and New Facility Alternatives in Federal Class I areas are evaluated using the methodology outlined by the FLM's AQRV Work Group (FLAG 2010).

E.4.1 FLAG Methodology

An initial screening assessment for far field Federal Class I areas was developed in FLAG 2010. The screening assessment is a first step used to determine whether modeling will be needed to adequately evaluate air pollution impacts. The screening assessment uses the ratio of pollutant emissions (Q) to distance (D) between the new source and Federal Class I areas. If Q/D is less than 10, then additional modeling is not usually required by the FLM; the FLM consider that there would be no impact on AQRVs at the Federal Class I area from the proposed source. Emissions of SO_2, NO_x, PM_{10}, and H_2SO_4 are summed to determine Q. If Q/D is greater than 10, then modeling is needed to evaluate air pollution impacts on AQRVs at far field Federal Class I areas. There is no simple screening test for near field Federal Class I areas. For these areas, initial screening for visibility impacts is performed using VISCREEN (EPA 1992a). The National Park Service waived the need for a near field acid deposition analysis due to the very low emissions of SO_x, H_2SO_4, and NO_x and the very low annual concentration impacts at Craters of the Moon National Monument (Appendix B).

For visibility assessments, the general procedure recommended by the Federal Land Managers Air Quality Work Group (FLAG) is as follows:

- Apply the Q/D screening test for far field Federal Class I areas. If Q/D is greater than 10, consult with the appropriate regulatory agency and with the FLM for the affected Federal Class I area(s) or other affected area for confirmation of preferred analysis or modeling procedures.
- For near field Federal Class 1 areas, obtain FLM recommendations for the specified reference levels and if applicable, FLM recommended plume/observed geometries and model receptor locations.
- Apply the applicable EPA steady-state models (e.g., VISCREEN) for regions within the Federal Class I area that are affected by plumes (source to receptor distance <50 kilometers (31 miles)) or layers that are viewed against a background.
- For regions of the Federal Class I area where visibility impairment from the source would cause a general alteration of the appearance of the scene (e.g., regional haze, generally > 50 kilometers (31 miles)), apply a non-steady-state air quality model (e.g., CALPUFF) with chemical transformation capabilities which yield ambient concentrations of visibility-impairing pollutants.
- If the modeling results are above levels of concern, continue to consult with the regulatory agencies to discuss other considerations.

For near field Federal Class I area visibility assessment the simplest model to apply is VISCREEN. If critical values for VISCREEN are not met, further analysis using PLUVUE II (EPA 1992b) would be required. Two phases of assessment are recommended for application of VISCREEN. Level I screening is designed to provide a conservative estimate of plume visual impacts and is achieved by using the worst-case meteorological conditions (stability class F and 1 meter per second wind speed) coupled with the wind blowing in the direction of the Federal Class I area. The screening level estimates of the change in the color difference index (ΔE) and contrast value (C) are compared to screening criteria. If the modeled ΔE value and the absolute value of the contrast ($|C|$) are less than 2.0 and 0.5 respectively, then the FLM is not likely to request further near field visibility analyses.

Failure of VISCREEN Level I screening leads to Level II screening, which requires site-specific meteorology coupled with actual emission characteristics of the facility. Failure to meet the criteria of Level II screening would lead to a Level III analysis using PLUVUE II. A Level III analysis represents a more realistic assessment of visibility impacts. Levels I, II, and III screening apply only to near field Federal Class I areas.

E.4.2 Q/D Screening Assessment for Far Field Federal Class I Areas

Visibility-impacting pollutants from operations include NO_x, SO_x, PM_{10}, and H_2SO_4. New facility construction sources that could impair visibility include fugitive dust, on-road and off-road vehicles, and batch plant/stone crushing operations. Construction emissions that could impair visibility would be short-term with emissions decreasing over time as construction progressed. Source terms calculated as the sums of all pollutants that could impact visibility for each alternative, INL, and alternatives plus INL are provided in Table E.4-1. The sums include boiler, EDG, and construction (where appropriate) emissions for the proposed action. Boilers, EDGs, and miscellaneous combustion sources are included for the INL model.

Minimum distance from the eastern site boundary to the western boarders of either Grand Teton National Park or Yellowstone National Park is 110 kilometers (68 miles). A portion of Craters of the Moon National Monument lies outside the 50-kilometer (31-mile) radius of the nearest INL facility (RWMC) (Figure E.3-2). The distances,110 kilometers (68 miles) and 50 kilometers (31 miles), are used as conservative distances to far field Federal Class I areas for all alternatives and INL in the Q/D assessment (Table E.4-1).

Q/D values are less than 10 for the proposed action and cumulative scenarios with INL (Table E.4-1), indicating that AQRVs would not be impacted at far field Federal Class I areas and further visibility and deposition analyses are not necessary.

Table E.4-1: Total NO_x, SO_x, PM_{10}, and H_2SO_4 Source Term and Q/D Analysis

Description	NO_x		PM_{10}		SO_x		H_2SO_4		Total[1]	Q/D at 110 km	Q/D at 50 km
	kg/yr	lb/yr	kg/yr	lb/yr	kg/yr	lb/yr	kg/yr	lb/yr	tons/yr		
INL Emissions	8.99×10^4	1.98×10^5	3.84×10^3	8.47×10^3	8.94×10^2	1.97×10^3	4.02×10^1	8.86×10^1	1.04×10^2	0.95	2.09
New Facility Operations at NRF[2] Plus INL	9.56×10^4	2.11×10^5	4.37×10^3	9.63×10^3	9.42×10^2	2.09×10^3	4.10×10^1	9.04×10^1	1.11×10^2	1.01	2.23
Overhaul Operations[3] Plus INL	8.99×10^4	1.98×10^5	3.84×10^3	8.47×10^3	8.94×10^2	1.97×10^3	4.02×10^1	8.86×10^1	1.04×10^2	0.95	2.09
New Facility Construction at Location 6 Plus INL	1.43×10^5	3.15×10^5	3.07×10^4	6.77×10^4	4.04×10^3	8.91×10^3	2.26×10^2	4.99×10^2	1.96×10^2	1.78	3.92
New Facility Construction at Location 6 Only	5.28×10^4	1.16×10^5	2.69×10^4	5.93×10^4	3.15×10^3	6.94×10^2	1.86×10^2	4.11×10^2	9.16×10^1	0.83	1.83
New Facility Operations Only	5.73×10^3	4.94×10^3	5.26×10^2	4.78×10^2	4.77×10^1	4.39×10^1	8.41×10^{-1}	1.85	6.95	0.06	0.14
Overhaul Operations Only	2.24×10^3	1.98×10^5	2.17×10^2	8.47×10^3	1.99×10^1	1.97×10^3	3.47×10^{-1}	7.65×10^{-1}	2.73	0.02	0.05

[1] Total of NO_x, PM_{10}, SO_x, and H_2SO_4 source term converted to tons per year.
[2] Transition period.
[3] Refurbishment and post-refurbishment operational period.
kg/yr = kilograms per year.
lb/yr = pounds per year.
tons/yr = tons per year.
km = kilometers.

E.4.3 VISCREEN Modeling Protocol

For Level 1 visibility screening, the default VISCREEN parameters are used along with user-specified values where appropriate. User-specified parameters included the source-to-observer distance, the minimum distance from the source to the Federal Class I area, background visibility range, and NO_x, primary NO_2, PM_{10}, SO_4, and soot release rates from diesel construction equipment. SO_4 is considered equal to the sulfuric acid (H_2SO_4) source terms in Section E.2. Soot release rates are estimated as 42 percent of the $PM_{2.5}$ release rates, based on guidance in EPA 2002. The soot component is subtracted from the total PM_{10} release rate to avoid double counting the releases. User-specified parameter and default parameters are presented in Table E.4-2 and source terms are presented in Table E.4-3. Distances from each source to the nearest Craters of the Moon National Monument boundary are presented in Table E.4-4. The source term for the VISCREEN Level 1 analysis included boilers for operations and diesel construction equipment for new facility construction. As recommended by the NPS, release rates are converted to maximum 24-hour releases in units of grams per second, and intermittent sources are not included in the source term. These sources operate infrequently and intermittently; and, therefore, do not represent long-term plume impacts.

For simplicity and conservatism, emissions from all sources in the VISCREEN simulations are summed across all facilities and placed at the facility (RWMC) nearest to Craters of the Moon National Monument. As stated earlier, Level 1 screening threshold values stipulated in the FLAG document are $\Delta E < 2.0$ (background extinction) and $|C| < 0.05$ (color contrast). Color contrast values vary between negative and positive depending on the situation. If C is negative, then blue light is removed due to scattering from particles present in the atmosphere. If C is positive, then blue light is added due to scattering from particles present in the atmosphere. The addition or subtraction of blue light results in a diminished contrast between objects and the sky and therefore causes visibility impairment. ΔE is always positive and represents light extinction (absorption) caused mainly by the presence of NO_2 in the atmosphere. A detailed discussion of the mathematical models for light extinction is provided in EPA 1980.

Table E.4-2: Default and User-Specified Input Parameters for the VISCREEN Level 1 Analysis

Parameter	Input	Comments
Minimum distance from source to Federal Class I boundary	32 kilometers (20 miles)	All sources are conservatively assumed to be at the INL facility nearest to the Craters of the Moon National Monument eastern boundary. The proposed new facility sources would be farther from the Federal Class I boundary.
Source-observer distance	32 kilometers (20 miles)	The observer is placed at the Craters of the Moon National Monument eastern boundary.
Distance from the source to most distant Federal Class I boundary	50 kilometers (31 miles)	Maximum distance calculated for plume impacts.
Background visual range	253.3 kilometers (157.5 miles)	Average of monthly average visual range for Craters of the Moon National Monument as provided in the FLAG 2010, Table 10.
Primary soot values	43% of $PM_{2.5}$ grams per second	EPA 2002, Table 6.
Background ozone	0.04 parts per million	VISCREEN default value.
Plume-source-observer angle	11.25 degrees	VISCREEN default value.
Stability class	F	VISCREEN default value.
Wind speed	1 meter per second (3.28 feet per second)	VISCREEN default value.

Table E.4-3: VISCREEN Source Terms

Scenario Description	PM_{10}	NO_x	Primary NO_2	Soot[1]	SO_4[2]
	grams per second				
INL emissions	7.82×10^{-2}	3.18	5.43×10^{-2}	4.98×10^{-2}	2.65×10^{-4}
New facility operations plus INL	9.93×10^{-2}	3.42	6.72×10^{-2}	5.84×10^{-2}	3.13×10^{-4}
Overhaul operations plus INL	7.82×10^{-2}	3.18	5.43×10^{-2}	4.98×10^{-2}	2.65×10^{-4}
New facility construction at Location 6 plus INL	2.65	8.34	5.68×10^{-2}	2.01×10^{-1}	1.94×10^{-2}
New facility construction at Location 6 only	2.57	5.16	2.52×10^{-3}	1.51×10^{-1}	1.91×10^{-2}
New facility operations only	2.11×10^{-2}	2.45×10^{-1}	1.29×10^{-2}	8.60×10^{-3}	4.74×10^{-5}
Overhaul operations only	8.81×10^{-3}	1.02×10^{-1}	5.39×10^{-3}	3.60×10^{-3}	1.98×10^{-5}

[1] The soot source term is estimated as 43 percent of the $PM_{2.5}$ releases. The soot mass release rate is subtracted from the PM_{10} release rate to avoid double counting.
[2] SO_4 source term is considered equal to the sulfuric acid (H_2SO_4) source term.

Table E.4-4: Distance from Craters of the Moon National Monument to INL Facilities

Location	UTM East	UTM North	Distance to Eastern Boundary	
	meters		kilometers	miles
Craters of the Moon National Monument, Eastern Boundary	304,378	4,809,098	0	0
RWMC	335,033	4,818,101	32.0	19.9
CFA	343,143	4,821,300	40.6	25.2
ATR	341,506	4,827,625	41.5	25.8
NRF	345,598	4,834,470	48.4	30.1
INTEC	343,961	4,825,690	42.9	26.7
MFC	366,952	4,827,327	65.2	40.5
ATR = Advanced Test Reactor; CFA = Central Facilities Area; INTEC = Idaho Nuclear Technology and Engineering Center; RWMC = Radioactive Waste Management Complex; NRF = Naval Reactors Facility MFC= Materials and Fuels Complex				

Failure of VISCREEN Level 1 screening leads to Level 2 screening. Level 2 screening uses the VISCREEN model with site-specific meteorology coupled with actual emission characteristics of the facility. For Level 2 screening, site-specific meteorology is incorporated. Level 2 screening is required for the new facility construction sources. All other alternatives meet Level 1 screening thresholds when evaluated alone or cumulatively with INL emissions.

For Level 2 screening, the worst-case dispersion conditions ranked in order of decreasing severity with the frequency of occurrence of these conditions are used (Table E.4-5). The conditions must be associated with the wind direction that could transport emissions toward the Federal Class I area. The largest emission source for new facility construction would be PM_{10} emitted by the concrete batch plant which is assumed to operate no more than 10 hours per day from 7 a.m. to 5 p.m. Therefore, frequency of occurrence of worst-case meteorological conditions considered the time the wind blew from the source in the direction of the Federal Class I area during the hours from 7 a.m. to 5 p.m.

The wind direction angle from the nearest Federal Class I Area boundary to NRF is 58.4 degrees. Visibility impacts are assumed to be possible for a sector width (22.5 degree sectors) on either side of the center line. Therefore the minimum wind direction angle is 58.4-22.5 = 35.9 degrees and the maximum wind direction angle is 58.4+22.5 = 80.9 degrees.

A 5-year meteorological data set from 1997 to 2001 taken at the Grid 3 meteorological tower (10-meter (32.8-feet) height) which is located south of NRF is used in the analysis. As stated in the VISCREEN guidance, acceptable results are achieved when the Level 1 screening thresholds for ΔE and $|C|$ are not exceeded using Level 2 screening meteorology that does not exceed a cumulative frequency of occurrence greater than 0.01 or 1 percent. Stability class E with a wind speed of 2 meters (6.6 feet) per second is the most conservative conditions that met the screening thresholds, and is used in the analysis. Stability class E with a wind speed of 3 meters (9.8 feet) per second also had a cumulative frequency less than 0.01. However, the more conservative conditions are selected. Screening Level 2 meteorology is presented in Table E.4-5.

Table E.4-5: Screening Level 2 Meteorology Used for New Facility Construction

Stability	Wind speed meters per second	Hours	Frequency[1]	Cumulative Frequency	Transport Time hours
F	1	91	0.0021	0.0021	13.44
F	2	35	0.0008	0.0029	6.72
F	3	0	0.0000	0.0029	4.48
E	1	82	0.0019	0.0047	13.44
E	2	55	0.0013	0.0060	6.72
E	3	61	0.0014	0.0074	4.48
D	1	154	0.0035	0.0109	13.44

[1] Frequency is based on 43,824 hours of data.

E.5 CALPUFF Protocol

PSD air pollutant concentrations at far field Federal Class I areas are modeled using CALPUFF Version 5.8, as recommended by the NPS (INL 2013c). CALMET Version 5.8 is used to model meteorological parameters and post processing is done with CALPOST. Model parameters are specified by the NPS and the EPA.

The model domain encompassed the boundaries of Craters of the Moon National Monument, Grand Teton National Park, and Yellowstone National Park. The domain is sufficiently large (approximately 100 kilometers (62 miles)) such that the Lambert Conformal Conic (LCC) coordinate system is selected to account for distortion due to the curvature of the earth, and to match the units in the gridded meteorological data (see below). Parameters for the LCC system and the grid parameters are presented in Table E.5-1. The EPA recommended 4-kilometer (2.5-mile) grid spacing for CALPUFF long-range transport is used.

The domain is illustrated in Figure E.5-1. For plotting purposes, coordinates are transformed from LCC to UTM coordinates using the CALPUFF utility program, Coords.exe.

Terrain data were obtained from the U.S. Geological Survey in the form of 1-degree (90-meter resolution) digital elevation model files. Thirty digital elevation model files are needed to cover the domain. These files are processed through the CALPUFF terrain preprocessor, TERREL, which produced a gridded terrain data file in the LCC coordinate system. Elevation contours are plotted in Figure E.5-1. DEM files that are used are listed in INL 2013c.

The NPS provided 3 years (2004-2006) of surface, upper air, and extracted Meteorological Mesoscale Model 5 (MM5) data that are used in the CALMET simulation. The MM5 data provide gridded, three-dimensional wind fields across the entire model domain. The gridded three-dimensional wind field has a much larger impact on long-range plume transport compared to surface meteorological stations.

Surface meteorological data provided by the NPS were obtained from airports in the SAMSON format and processed through the SMERGE data processor to produce a surface meteorological data file. Those stations in the domain are illustrated in Figure E.5-1.

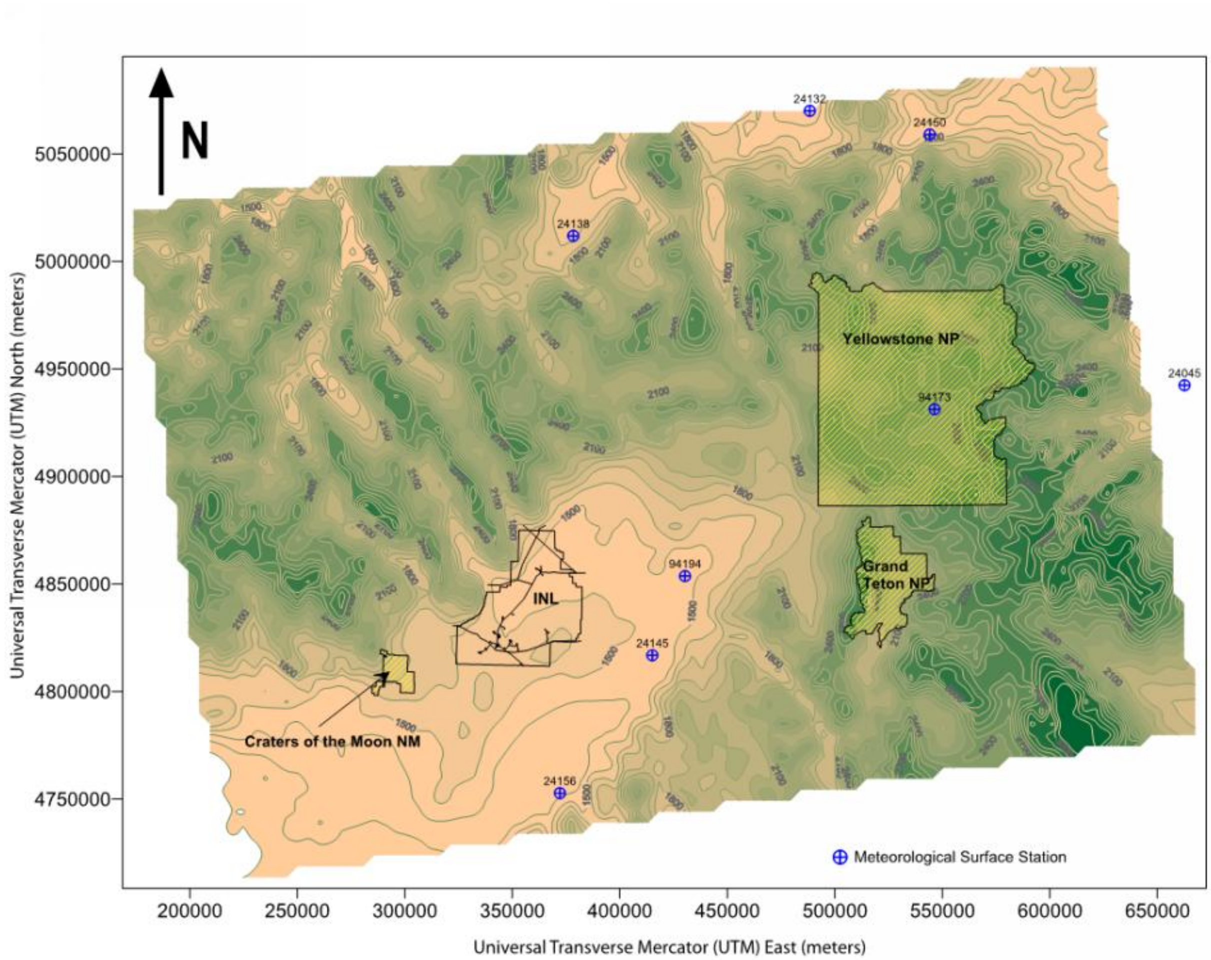
The receptor network for Federal Class I areas was provided by the NPS (NPS 2012). A total of 1692 receptors are identified; 270 receptors are identified within the Craters of the Moon National Monument, 505 receptors are identified for Grand Teton National Park, and 894 receptors are identified for Yellowstone National Park. Grid spacing is 2.6 kilometers (1.6 miles) for Yellowstone National Park, and 0.67 kilometers (0.4 miles) for Grand Teton National Park and Craters of the Moon National Monument. Receptor coordinates are provided in the Geodetic (latitude to longitude) coordinate system and are converted to LCC and UTM using the Coords.exe utility in CALPUFF.

Source terms (construction and operations), stack data, and facility locations described above are used in the CALPUFF model. Chemical transformation mechanisms are included in the simulation using the EPA default MESOPUFF II scheme. The MESOPUFF II scheme takes the concentrations of NOx, and SO_2 and converts these compounds to HNO_3, NO_3, and SO_4. The pollutants NO_x, SO_2, and HNO_3 are modeled as gases while NO_3 and SO_4 are modeled as particulates. $PM_{2.5}$ and PM_{10} (listed as fine and course particulate matter respectively) are also modeled. Deposition and plume depletion processes are included in the simulation. Physical properties for pollutants are in Table E.5-2.

CALPOST files for criteria pollutants were provided by the NPS. Separate files were provided for NO_X/NO_2, SO_2, $PM_{2.5}$, and PM_{10}. Concentrations for the different averaging times were output at each of the Federal Class I receptors defined by the NPS. The maximum concentration in each Federal Class I area is extracted for each of the model scenarios. The CALPOST input files are available in INL 2013c.

Table E.5-1: Coordinate System and Domain Parameters Used in CALPUFF

Parameter	Value (units)	Comments
Coordinate system	Lambert Conformal Conic (LLC)	
Matching parallels	33 N, 45 N	Provided by NPS
Latitude and longitude of projection origin	40 N, 97 W	Provided by NPS
Datum region	World Geodetic System-84	
Southwest Corner coordinate	-1422.59 kilometers West, 408.6 kilometers North	LCC coordinates, UTM coordinates 166.7759 kilometers, 4706.502 kilometers (Zone 12)
Grid spacing	4 kilometers (2.5 mile)	EPA 2009
Number of X nodes	116	Site-specific based on grid spacing and domain extent
Number of Y nodes	81	Site-specific based on grid spacing and domain extent
Number of vertical layers	10	EPA 2009
Vertical levels	20.0, 40.0, 80.0, 160.0, 320.0, 640.0, 1200.0, 2000.0, 3000.0, 4000.0 meters	EPA 2009



Source: INL 2013c

Figure E.5-1: CALPUFF Model Domain for PSD Analysis of Federal Class I Areas

Table E.5-2: Physical Properties of Pollutants Modeled in CALPUFF Used for Deposition and Plume Depletion Calculations

Pollutant	Diffusivity[1] square centimeters per second	α*[1]	Reactivity[1]	Mesophyll Resistance[1] seconds per centimeter	Henry's Law Constant[1,2]	Geometric Mass Median Diameter[3] micrometers	SC[4], Liquid per second	SC[4], Frozen per second
SO_2	0.1509	1000	8.0	0.0	0.04		3.0×10^{-5}	0.0
SO_4						0.48	1.0×10^{-4}	3.0×10^{-5}
HNO_3	0.1628	1.0	18.0	0.0	0.0000001		6.0×10^{-5}	0.0
NO_X	0.1656	1.0	8.0	5.0	3.5		1.0×10^{-4}	3.0×10^{-5}
NO_3						0.48	1.0×10^{-4}	3.0×10^{-5}
PM_{10}						3.0	1.0×10^{-4}	3.0×10^{-5}
$PM_{2.5}$						0.48	1.0×10^{-5}	3.0×10^{-5}

Source: INL 2013c
Note: Gray cells indicate property does not apply.
[1] Applies only to dry deposition of gases.
[2] Dimensionless.
[3] Applies only to dry deposition of particles. The geometric standard deviation is 2.0 in all cases.
[4] Scavenging coefficient for particles and gases.

APPENDIX F

EVALUATION OF ROUTINE NAVAL SPENT NUCLEAR FUEL HANDLING OPERATIONS AND HYPOTHETICAL ACCIDENT CONDITIONS

F.1 Introduction

In over 6500 reactor-years of operation of naval reactors and more than 820 shipments of naval spent nuclear fuel, there has never been a nuclear reactor accident, criticality accident, or any other release of radioactivity having a significant effect on the quality of the environment (NNPP 2013). However, the consequences of radiation exposure and contamination are of interest to the general public; therefore, this Appendix addresses the potential radiological impacts to workers, the public, and the environment from routine naval spent nuclear fuel handling operations and hypothetical accidents for the proposed action to supplement Section 4.13.2.

Analyses of routine naval spent nuclear fuel handling operations, hypothetical accidents, and intentionally destructive acts (IDAs) (e.g., acts of sabotage or terrorism) are performed to estimate the potential consequences due to release of radioactive materials. The results of these analyses are presented in terms of both consequence (cancer that might be expected for an individual or population group) and risk (the increased chance of getting cancer defined as the product of the probability of occurrence of the accident times the consequence of the accident). Impacts to land which could be contaminated due to hypothetical accidents and IDAs are also discussed.

Section F.2 provides information about the nature of radiation, explains the basic concepts used to evaluate radiation health effects, and provides perspective on the calculation of cancer and risk.

Section F.3 provides the analysis methods used to evaluate radiation exposures from routine naval spent nuclear fuel handling operations, hypothetical accident scenarios, and IDAs. It describes the individuals and groups for which radiation exposures are calculated, radiation exposure pathways, computer programs used in the evaluation, and input data for the calculations.

Section F.4 provides analysis results for the evaluation of radiation exposures from routine naval spent nuclear fuel handling operations. Section 4.13.2 describes radiological exposures for the time periods associated with each alternative. These radiological exposures are split into radiation exposures to workers inside the naval spent nuclear fuel handling facilities (i.e., Expended Core Facility (ECF) or the new facility) and radiation exposures to individuals outside the naval spent nuclear fuel handling facilities. The radiation exposures to workers inside the naval spent nuclear fuel handling facilities are fully evaluated in Section 4.13.2; therefore, no additional discussion of radiation exposures to workers inside the facilities is provided in this Appendix. This Appendix focuses on the radiation exposures to individuals outside the naval spent nuclear fuel handling facilities for the post-refurbishment operational period of the Overhaul Alternative, the transition period of the New Facility Alternative, and the new facility operational period. These are the time periods for which there would be increases to the baseline radiation exposures described in Section 3.13.

Section F.5 provides analysis results for the evaluation of radiation exposures from hypothetical accident scenarios. It describes how the hypothetical accidents were selected for evaluation and the development of source terms. For each of the 12 hypothetical accident scenarios and IDAs, a description of the scenario is provided along with the scenario source term, probability, and results.

Section F.6 describes emergency preparedness and how protective action measures are not modeled in the analysis. Section F.7 describes the uncertainties associated with the radiation exposure analysis. Section F.8 describes updates to modeling methodology made since the publication of DOE 1995.

Population projections for 2010 are used to estimate the radiological effects on the General Population within 80.5 kilometers (50 miles) of the Naval Reactors Facility (NRF). Emissions for routine naval spent nuclear fuel handling operations are estimated based on routine annual releases from ECF in 2009 scaled to future activities. The New Facility Alternative would have more effective ventilation systems for naval spent nuclear fuel handling operations than ECF. Since the radiation exposures are based on ECF emissions, the radiation exposures presented in this Appendix would be conservative for routine naval spent nuclear fuel handling operations associated with the New Facility Alternative (transition period and new facility operational period).

The nature of naval spent nuclear fuel handling operations would be the same for each alternative. In general, the evaluation of hypothetical accidents applies to all alternatives and the hypothetical accidents are conservatively modeled to have the same risks regardless of alternative with the following exceptions. When necessary, the hypothetical accident scenarios account for the differences in the water pool structure between alternatives. For the drained water pool scenario, the probability varies between alternatives. For the minor water pool leak scenario, the consequences vary between alternatives. The impacts of the inter-facility transport accident scenario only apply to the New Facility Alternative because transportation between facilities of naval spent nuclear fuel for examination would only be applicable if a new facility is constructed.

For the No Action Alternative where the risks are presented consistent with the other alternatives, the risks may be conservative because the No Action Alternative does not support unloading M-290 shipping containers. For example, scenarios where the material-at-risk is the entire water pool inventory, the water pool would contain less carrier length fuel than is assumed in the water pool inventory supporting the consequence analysis. In addition, for scenarios where the probability is based on the number of shipping container unloadings, the number of shipping containers unloaded would be less than assumed.

The description of methodology for hypothetical accidents is applicable to IDAs. Since Location 3/4 and Location 6 are in close proximity to one another, the differences in weather and distance for the alternatives have no affect on the analysis results.
Much of the data in this Appendix is presented using scientific notation. Scientific notation is commonly used to represent very large or small numbers. It consists of a number multiplied by the appropriate power of 10. For example, 0.0000035 would be represented as 3.5×10^{-6} and 3,500,000 would be represented as 3.5×10^{6}. Significant digits are the number of digits needed to express the precision of the calculation. Each calculated result is rounded to two significant digits in this Appendix. Numbers in some tables may be slightly different than if the calculation were performed as written; some multi-step calculations use more significant figures than shown, and the results for each step are rounded for presentation in this Appendix.

F.2 Radiation and Human Health

This section provides information about the nature of radiation, explains basic concepts used to evaluate radiation health effects, and provides perspective on the calculation of cancer and risk.

F.2.1 Nature of Radiation

Radiation is the emission and propagation of energy through matter or space as waves or particles. Radiation generally results from processes that occur naturally. The most commonly recognized form of radiation is electromagnetic radiation emitted over a specific range of wavelengths and energies. Visible light is part of the spectrum of electromagnetic radiation. Radiation of longer wavelengths and lower energy includes infrared radiation (known for heating material when the material and the radiation interact) and radio waves. Electromagnetic radiation of shorter wavelengths and higher energy (which are more penetrating) includes ultraviolet radiation (which causes sunburn) and forms of ionizing radiation such as x-rays and gamma radiation.

Ionizing radiation is radiation that has sufficient energy to displace electrons from atoms or molecules to produce ions. The ions have the ability to interact with other atoms or molecules; in biological systems, this interaction can cause damage in tissue or to an organism.

Radioactivity is the property or characteristic of an unstable atom to undergo spontaneous transformation (to disintegrate or decay) with the emission of energy as radiation to reach a more stable state. The result of the process, called radioactive decay, is the spontaneous transformation of an unstable atom (a radionuclide) into a different nuclide, accompanied by the release of energy (as radiation) as the atom reaches a more stable, lower energy configuration.

Radiation that originates outside of an individual's body is called external or direct radiation. Such radiation can come from an x-ray machine or from radioactive materials (materials or substances that contain radionuclides), such as radioactive waste or radionuclides in soil. When radioactive materials are deposited on a surface that surface is said to be contaminated. Contamination is material that contains radiation emitting nuclides.

Internal radiation originates inside a person's body following intake of radioactive material or radionuclides through ingestion or inhalation. Once in the body, the fate of a radioactive nuclide is determined by its chemical structure and how it is metabolized. The residence time of a radionuclide in the body is commonly called the biological half-life. If the material is soluble, it might be dissolved in bodily fluids and transported to and deposited in various body organs; if it is insoluble, it might move through the gastrointestinal tract or into the lungs.

F.2.2 Radiation Measuring Units

A variety of units are used to measure radiation. These units determine the amount, type, and intensity of radiation. Amounts of radiation or its effects can be measured in units of Curies, radiation absorbed dose (rad), or dose equivalent (roentgen equivalent man, or rem). The Curie describes the rate at which a material is emitting nuclear radiation (i.e., activity). The Curie is defined as exactly 3.7×10^{10} disintegrations (decays) per second. The rad is the unit that measures the amount of energy imparted to matter per unit mass. The total energy absorbed per unit quantity of matter is referred to as absorbed dose (or simply dose). One rad is equal to the amount of radiation that leads to the deposition of 0.01 joule of energy per kilogram of absorbing material. The roentgen equivalent man (rem) is the unit that measures the absorbed dose and the relative effectiveness of the type of ionizing radiation in damaging biological systems. One rem of one type of radiation has the same biological effects as 1 rem of any other kind of radiation. This allows comparison of the biological effects of radionuclides that emit different types of radiation. The term used for reporting the collective dose (i.e., the sum of individual doses received in a given time period) by a specified population from radiation exposure to a radiation source is person-rem.

For example, if 100 workers each received 0.1 rem, the collective dose would be 10 person-rem (100 people x 0.1 rem).

The units of radiation measure in the International System (SI) of Units are: Becquerel (a measure of source intensity), gray (a measure of absorbed dose), and Sievert (a measure of dose equivalent). In accordance with United States (U.S.) Department of Energy (DOE) convention, all radiation units presented in this Appendix are in terms of Curies, rad, rem, and person-rem. The conversions of the units used in this Appendix to SI units are provided in Table F.2-1.

Table F.2-1: Conversions to SI Units

1 Curie (Ci)	=	3.7×10^{10} disintegrations per second
	=	3.7×10^{10} Becquerels (1 Becquerel = 1 disintegration per second)
1 rad	=	0.01 gray (1 gray = 1 joule per kilogram)
1 rem	=	0.01 Sievert (Sv)

The average American receives a total of approximately 620 millirem per year from natural and man-made radiation sources. Approximately 310 millirem per year are from radiation exposure to natural sources (background). The largest natural sources are radon-222 and its radioactive decay products in homes and buildings, which contribute about 230 millirem per year. Additional natural sources include radioactive material in the earth (primarily the uranium and thorium decay series, and potassium-40) and cosmic rays from space filtered through the atmosphere. Approximately 310 millirem per year are from man-made radiation sources. Man-made radiation exposure is mostly from medical procedures such as computed tomography (CT) scans and nuclear medicine which contribute approximately 300 millirem per year to the dose of an average American. (NCRP 2009)

F.2.3 Radiation Dose Definitions

In quantifying the effects of radiation on humans, other terms are used to describe the dose from radiation exposure to radiation. For consistency, this Appendix uses terminology consistent with International Commission on Radiological Protection (ICRP) Publication 60 (ICRP 1991). A list of the terminology used in ICRP Publication 60 (ICRP 1991) and the terminology used in earlier guidance is shown in Table F.2-2. Although the terminology has changed, the usage is unchanged.

Table F.2-2: Radiation Dose Terminology

ICRP 60 Terminology	Previous Terminology
Tissue Weighting Factor	Weighting Factor
Effective Dose	Effective Dose Equivalent
Committed Effective Dose	Committed Effective Dose Equivalent
Total Effective Dose	Total Effective Dose Equivalent

Tissue weighting factors are used for various body organs and tissues to account for that individual organ's or tissue's proportion of risk versus the total risk when the whole body is irradiated uniformly. Organ doses are calculated for individual organs such as the lungs, stomach, small intestine, upper large intestine, lower large intestine, bone surface, red bone marrow, testes, ovaries, muscle, thyroid, bladder, kidneys, and liver. The summation of each specific organ dose, weighted by the relative risk to that organ compared to an equivalent whole-body radiation exposure, is a whole body dose. To determine the overall effect from routine naval spent nuclear fuel handling operations or hypothetical accident scenarios, whole body doses are presented in this Appendix.

A whole body dose from external radiation is called the effective dose (ED). The ED occurs instantaneously during the period when the body is exposed to direct radiation from an external radiation field. The whole body dose from internal radiation is called the committed effective dose (CED). The CED is from ingestion or inhalation of radioactive material during the radiation exposure period, and is calculated over a remaining lifetime of the individual to account for radionuclides that have long half-lives and long residence times in the body (Sections F.3.3.3 and F.3.3.5). Total effective dose (TED) is the sum of the ED and CED. All estimates of dose presented in this Appendix, unless specifically noted otherwise, are TEDs quantified in terms of rem or millirem. A millirem is one one-thousandth of a rem.

The factors used to convert estimates of radionuclide intake (by inhalation or ingestion) or external radiation exposure to dose estimates are called dose conversion factors. The ICRP and federal agencies such as the U.S. Environmental Protection Agency (EPA) publish these factors. The internal dose conversion factors used in this Appendix are based on recommendations made by the ICRP in 1990, published in 1991 (ICRP Publication 60 (ICRP 1991)), and subsequent reports based on the 1990 recommendations (ICRP Publication 68 (ICRP 1994), ICRP Publication 71 (ICRP 1995), and ICRP Publication 72 (ICRP 1996)). The external dose conversion factors for dose from external, direct radiation are based on earlier ICRP and EPA Guidance (ICRP Publication 26 (ICRP 1977), EPA 1993).

F.2.4 Radiation Exposure Limits

Radiation exposure limits for members of the public and radiation workers are developed independently by each federal agency based on the recommendations of councils of radiation experts including the ICRP and the National Council on Radiation Protection and Measurements. Radiation exposure limits are set by DOE (including the Naval Nuclear Propulsion Program (NNPP)), EPA, and the U.S. Nuclear Regulatory Commission (NRC) for radiation workers and members of the public. The DOE regulates airborne emission of radioactivity to members of the public located near a DOE site to levels that are less than the EPA annual dose limit of 10 millirem (40 C.F.R. § 61.102). The DOE and NRC both have occupational exposure limits of 5 rem per year (10 C.F.R. § 835.202 and 10 C.F.R. § 20.1201, respectively). Workers at NRF are also restricted to the NNPP limits of 5 rem per year with the additional stipulation not to exceed 3 rem in a single quarter (NNPP 2011b). NNPP radiological control practices also assure that the site meets NRC limits on commercial radiological facilities which limits public exposure at the site boundary to 0.1 rem per year (10 C.F.R. § 20.1301); this limit is used in the calculation of impacted land area following a hypothetical accident scenario provided in Section F.5.6.

To keep radiation exposure as low as reasonable achievable (ALARA), workers at NRF work towards local control levels that are much lower than the 5-rem annual limit (e.g., 100 millirem) and depend on each worker’s specific job assignment. Additionally, no NNPP personnel have exceeded 2 rem annually (40 percent of the NNPP annual 5-rem limit) since 1979 (NNPP 2011b).

F.2.5 Evaluation of Health Effects from Radiation Exposure

Radiation interacts directly and indirectly with the atoms that form cells. In a direct action, the radiation interacts directly with the atoms of the DNA molecule or some other component critical to the survival of the cell. Since the DNA molecules make up a small part of the cell, the probability of direct action is small. Because most of the cell is made up of water, there is a much higher probability that radiation would interact with water. In an indirect action, radiation interacts with water and breaks the bonds that hold water molecules together, producing reactive free radicals that are chemically toxic and destroy the cell. The body has mechanisms to repair damage caused by radiation.

Consequently, the biological effects of radiation on living cells may result in one of three outcomes: (1) injured or damaged cells repair themselves, resulting in no residual damage; (2) cells die, much like millions of body cells do every day, being replaced through normal biological processes and causing no health effects; or (3) cells incorrectly repair themselves, which results in damaging or changing the genetic code (DNA) of the irradiated cell. Stochastic effects, that is, effects that may or may not occur based on chance, may occur when an irradiated cell is incorrectly repaired rather than killed. The most significant stochastic effect of radiation exposure is that an incorrectly repaired cell may, after a prolonged delay, develop into a cancer cell. (NRC 2011)

Detrimental health effects are calculated based on the radiation exposure dose results to an individual or population group. The dose-to-health effect conversion factors used for calculations of health effects are taken from ICRP Publication 103 (ICRP 2007). Health effects from radiation exposure are used to summarize and compare results in this Appendix. Cancer is reported because cancer is the principal potential health detriment which may result from radiation exposure.

In determining a means of assessing health effects from radiation exposure, the ICRP has developed detriment-adjusted factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of non-fatal cancers upward to account for the total harm experienced as a consequence of developing the cancer. The cancer factors overstate the expected incidence of fatal cancer in the population and the use of these factors to estimate the incidence of fatal cancer (discussed in Section F.2.6) is conservative for comparison.

Table F.2-3 lists the health effect factors used in the analysis of both the routine naval spent nuclear fuel handling operations and the hypothetical accident scenarios. Different factors are used for workers and for members of the public, with a larger factor used for members of the public to account for cancer rates in children and senior individuals. Heritable effects are also shown so that the total health effects can be calculated if desired. Heritable effects are harmful genetic effects that are transmitted to subsequent generations. The number of total health effects (cancer plus heritable effects) for members of the public may be obtained by multiplying the cancer by the factor of 1.04, which is the ratio of total health effects to cancer (5.7/5.5). In this Appendix, the doses are provided to allow independent evaluation using any relation between radiation exposure and health effects.

Table F.2-3: Conversion Factors for Health Effects From Ionizing Radiation

Health Effect	Conversion Factor[1,2]	
	Worker	Members of the Public
	probability per rem	
Cancer	4.1×10^{-4}	5.5×10^{-4}
Heritable Effects	0.1×10^{-4}	0.2×10^{-4}
Total Health Effects	4.2×10^{-4}	5.7×10^{-4}

[1] For high individual radiation exposures to external radiation (greater than or equal to 20 rem), the factors are multiplied by a factor of two. General Population radiation exposures are not modified because the large drop in radiation exposure with increasing distances results in radiation exposure rates below 20 rem. See Section F.7.4 for more information on uncertainties.
[2] In determining a means of assessing health effects from radiation exposure, the ICRP has developed a weighting method for lethal and life impairing cancers. The values in this table are averaged over both sexes.

To determine the likelihood that an individual would develop cancer from radiation exposure, the conversion factor is multiplied by the individual dose (rem). For the General Population, the conversion factor is multiplied by the General Population dose (person-rem) to estimate the cancer that is expected to develop in a specific population.

F.2.6 Perspective on Calculations of Cancer and Risk

The topics of human health effects caused by radiation and the risks associated with routine naval spent nuclear fuel handling operations or hypothetical accident scenarios associated with naval spent nuclear fuel handling are discussed many times throughout this Environmental Impact Statement (EIS). It is important to understand these concepts and how they are used to understand the information presented in this document. It is also valuable to have some frame of reference or comparison for understanding how the risks compare to the risks of daily life.

The method used to calculate the risk of any impact is fundamental to all of the evaluations presented and follows standard accepted practices. The first step is to determine the probability that a specific event would occur. For example, the probability that a routine task, such as operating a crane, would be performed sometime during a year of routine naval spent nuclear fuel handling operations at a facility would be 1.0. Which means that the action would certainly occur. The probability that an accident would occur is less than 1.0. Accidents occur only occasionally and some of the more severe accidents, such as a catastrophic earthquake, might occur at any location only once in hundreds, thousands, or millions of years.

Once the probability of an event has been determined, the next step is to predict the consequences of the event being considered. One important measure of consequences chosen for this EIS is the cancer induced by radiation. The cancer that might be caused by routine naval spent nuclear fuel handling operations or any hypothetical accident can be calculated using a standard technique based on the amount of radiation exposure estimated to occur from all conceivable pathways and the number of people who could be affected, as discussed in Section F.2.5.

To illustrate the calculation of risk, several examples are presented. The lifetime risk of dying in a motor vehicle accident can be calculated from the likelihood of an individual being in an accident and the consequences, or number of fatalities, per accident. There were 22,555 motor vehicle accidents during 2010 in the state of Idaho resulting in 209 deaths (OHS 2010). Assuming only one person is involved in each accident, the probability of a person in Idaho being in a motor vehicle accident is 22,555 accidents divided by approximately 1,546,000 persons in Idaho (USCB 2011), or 0.015 per year. The probability of an accident causing a fatality is 0.0093 (209 deaths divided by 22,555 accidents). Multiplying the probability of the accident (0.015 per year) by the consequences of the accident (0.0093 deaths per accident) by the number of years the person is exposed to the risk (78.5 years is considered to be an average lifetime (CDC 2010)) gives the lifetime risk for any individual of being killed in a motor vehicle accident. From this calculation, the lifetime risk of an individual dying in a motor vehicle accident in Idaho is about 0.011 or 1 chance in 91.

A second example illustrates the risk from the burning of fossil fuels, such as natural gas or coal, to create electricity. Naturally occurring radioactive material is released into the air during combustion. This radioactivity (estimated to produce about 0.5 millirem (0.0005 rem) of radiation dose to the average American each year (NCRP 2009)) finds its way into our bodies through food and the air we breathe. The probability of exposure to this radioactivity is essentially 1.0 since these fuels are burned every day all over the country. The cancer risk from exposure to this radioactivity is calculated by multiplying the average radiation exposure per year (0.0005 rem per year) by the average lifetime (78.5 years), and the cancer estimated to be caused by each rem of radiation exposure (0.00055 cancers estimated to be caused by each rem (Table F.2-3)). This calculation results in a consequence of 0.000022 cancers per individual lifetime from the burning of fossil fuels. Risk can then be calculated by multiplying the probability (1.0) by the consequence (0.000022 cancers). This risk equates to about 2.2×10^{-5} or 1 chance in 46,000 of developing cancer from radioactivity during a lifetime of exposure to burning fossil fuels.

As a further comparison, the naturally occurring radioactive materials in agricultural fertilizer and waste products from phosphate mining contribute about 1 millirem per year to an average American's exposure to radiation (NCRP 2009). A calculation similar to the one in the preceding paragraph shows that the use of fertilizer to produce food crops in the U.S. and the waste products from phosphate mining results in a risk of cancer of about 4×10^{-5}, or 1 chance in 25,000.

The average American's risk of developing fatal cancer from a lifetime of normal activity is 1 chance in 6.7, or 0.15 over his or her lifetime (ACS 2011). Therefore, there is a much greater risk of developing fatal cancer from a lifetime of normal activity than from the two examples of radiation exposure provided above. Using the probability of 1 chance in 6.7, approximately 2.3×10^{4} (22,650) fatal cancers would be expected to develop during a lifetime of normal activity unrelated to NRF emissions for the General Population (approximately 151,000 people) living within an 80.5-kilometer (50-mile) radius surrounding NRF.

Risks from hypothetical accidents associated with naval spent nuclear fuel handling operations can be developed using the same methodology described above. The individual risk from hypothetical accidents associated with naval spent nuclear fuel handling operations can be compared to the risk of developing fatal cancer over an individual's lifetime. Annual risk calculations are presented to allow comparisons between hypothetical accident scenarios. This EIS uses the conservative value for cancer from ICRP 2007 to compare to the risk of developing fatal cancer from everyday life. The cancer health conversion factor of 0.00055 cancers per rem overstates the expected incidence of fatal cancer in the population, and the use of this factor to estimate the incidence of fatal cancer is conservative.

F.3 Analysis Methods or Evaluation of Radiation Exposure

Routine naval spent nuclear fuel handling operations and hypothetical accident scenarios are evaluated to assess the possible radiation exposure to individuals due to the release of radioactive materials. This section describes the methods used in these evaluations.

F.3.1 Radiation Exposures to be Calculated

Radiation exposure to the following individual groups is calculated for routine naval spent nuclear fuel handling operations and hypothetical accident conditions. Each individual is evaluated for a 1-year period for routine naval spent nuclear fuel handling operations. For accidents the evaluation period is listed below.

- Worker. The Worker is an adult individual located 100 meters (330 feet) from the radioactive material release point. The release point (for distance from the worker) is the location of the ventilation discharge stack in the naval spent nuclear fuel handling facility or the accident location for hypothetical accident scenarios that occur outside (as noted in Section F.3.3.2, only ground-level releases are modeled). The Worker is an NRF employee walking by or working near the naval spent nuclear fuel handling facility or accident location that is not directly involved in routine naval spent nuclear fuel handling operations or the hypothetical accident scenario (i.e., an uninvolved worker). For hypothetical accidents, the Worker is evaluated for a 20-minute radiation exposure period to account for the evacuation time from the accident location. The impact of hypothetical accident scenarios on workers who are directly involved in an accident or located nearby the accident scene (involved worker) is not calculated numerically but is discussed qualitatively for each accident in Section F.5.4.

- Maximally Exposed Collocated Worker (MCW). The MCW is an adult worker at another independent facility (separate from NRF) within the Idaho National Laboratory (INL) boundary. The intent of the MCW classification is to assess the effect of routine naval spent nuclear fuel handling operations and hypothetical accident scenarios in one facility on workers in another facility on a large DOE site. The MCW is located 8 kilometers (5 miles) away from NRF at the Advanced Test Reactor (ATR) Complex. Based on experience from emergency exercises, emergency response teams would be able to evacuate workers at other INL facilities within 2 hours; therefore, a radiation exposure time of 2 hours is used for accident analysis.

- Maximally Exposed Off-Site Individual (MOI). The MOI is a theoretical individual with the characteristics and habits of an adult member of the public living at the INL property boundary who is evaluated for a 1-year period. Sixteen radial sectors around the accident location are analyzed to confirm that the limiting MOI location would be at the site boundary that is nearest to the facility. The MOI is located 10.5 kilometers (6.5 miles) away from NRF in the west-northwest (WNW) direction.

- Nearest Public Access (NPA). Publically available highways cross the INL. Consequently, these analyses included evaluation of the radiation exposure to an NPA, a theoretical motorist with the characteristics and habits of an adult member of the public who might be stranded on such a public highway within the INL boundary during a hypothetical accident scenario. The closest NPA is located 14 kilometers (8.7 miles) away from NRF in the southwest (SW) direction. Based on experience from emergency exercises, emergency response teams would be able to evacuate such an individual within 2 hours; therefore, a radiation exposure time of 2 hours is used for accident analysis. The NPA is not evaluated for routine naval spent nuclear fuel handling operations due to the short period of time that such an individual would spend on-site while driving on the public access road.

- General Population. The General Population evaluation considers the population distribution (age and location) within an 80.5-kilometer (50-mile) radius of NRF. The General Population is evaluated for a 1-year period. Doses specific to six age groups are calculated (ICRP 1996) and summed to determine the total General Population dose.

Radiation exposure is calculated to result from direct radiation from the facility and exposure to radiological emissions directly to the air and indirectly to the water. The releases to the environment could result in exposure through several pathways. The radiation exposure pathways are shown in Figure F.3-1.

- External direct exposure from immersion in the airborne radioactive plume as it progresses downwind (air immersion).

- External direct exposure to radiation not associated with the airborne plume (direct radiation). This pathway only applies to routine naval spent nuclear fuel handling operations and to hypothetical accident scenarios which involve a loss of or damage to shielding or an inadvertent criticality.

- External direct exposure from radioactive material that is deposited on the ground from the airborne plume as it passes (ground surface).

- Internal exposure from inhalation of radioactive materials for an individual located within the plume (inhalation).

- Inhalation of radioactive materials that are deposited on the ground during passage of the plume (resuspension). Resuspension is calculated for routine naval spent nuclear fuel handling operations. Resuspension is not included in the accident analysis because it is a very small contributor to the overall dose.

- Internal exposure from eating food and drinking water that is contaminated from radioactivity that falls out of the atmosphere (ingestion). Ingestion is applicable for all individuals evaluated for routine naval spent nuclear fuel handling operations. For the hypothetical accident scenarios, ingestion exposure is only applicable to the MOI and General Population exposure groups.

- Ingestion of food and water contaminated by radioactivity in water, and external direct exposure from contaminated water (waterborne). Waterborne exposure is applicable for all individuals for routine naval spent nuclear fuel handling operations. For hypothetical accident scenarios, waterborne contamination exposure is only applicable to the MOI and General Population exposure groups.

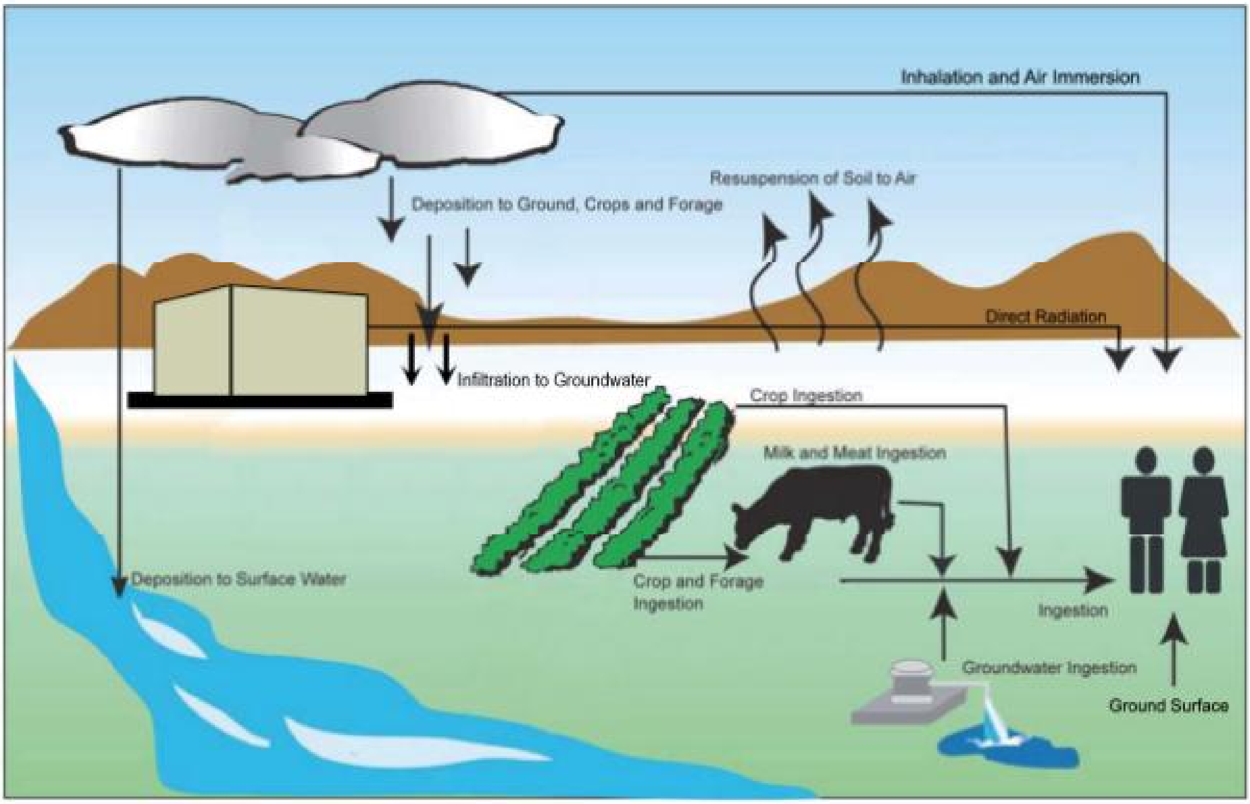


Figure F.3-1: Pathways for Radiation Exposure

The radiation exposure is calculated by the computer programs discussed in Section F.3.2 in a manner recommended by the ICRP. The radiation exposure from ingestion of contaminated food and animal products is calculated assuming a typical annual consumption. However, it is likely that continued consumption of contaminated food products by the public would be suspended in the event of a real accident after a Protective Action Guideline (PAG) is reached. In 1991, the EPA recommended PAGs for response to radiological incidents in the range of 1 to 5 rem whole-body exposure (EPA 1992c). The EPA updated PAGs in 2013 (EPA 2013c). To ensure a consistent analysis basis, no reduction of radiation exposure due to a PAG is accounted for in the analyses. This results in a conservative impact evaluation which may overestimate health effects within an exposed population.

Table F.3-1 presents an example of the results from the detailed radiation exposure calculations. The table shows the possible radiation exposure pathways and individuals analyzed for the hypothetical accident scenario with the highest annual risk (i.e., drained water pool as described in Section F.5.4.4). The TEDs reported in this Appendix include the TED from the airborne pathways (the sum of the inhalation and ingestion CEDs and the ground surface and air immersion EDs from the airborne release), the TED from waterborne contamination (the sum of the ingestion CED and the immersion ED from the waterborne release), and the ED from any direct radiation exposure, where applicable.

The patterns between different dose pathways shown in Table F.3-1 are typical of hypothetical accident scenarios. For the Worker, MCW, and NPA, inhalation is the dominant airborne pathway. Ingestion is the dominant airborne pathway for the MOI and the General Population. The waterborne pathway is a much smaller contributor to dose than the airborne pathway. The direct radiation pathway is significantly less than the airborne pathway and does not contribute noticeably to dose to most exposed individuals or the General Population.

Table F.3-1: Example of Detailed Radiation Exposure Calculation Results for Hypothetical Drained Water Pool Scenario[1]

Exposure Group	Airborne Pathways				Airborne Release TED[2]	Waterborne Release TED	Direct Radiation ED	TED[3]	Fatal Cancer per Individual[4]
	Inhalation CED	Air Immersion ED	Ground Surface ED	Ingestion CED					
	rem								
Worker	8.0	4.5 x 10^{-3}	5.5 x 10^{-3}	N/A	8.0	N/A	1.0	9.0	3.7 x 10^{-3}
MCW	1.3 x 10^{-2}	8.5 x 10^{-5}	3.3 x 10^{-5}	N/A	1.3 x 10^{-2}	N/A	2.0 x 10^{-24}	1.3 x 10^{-2}	5.5 x 10^{-6}
NPA	1.1 x 10^{-2}	4.9 x 10^{-5}	1.6 x 10^{-5}	N/A	1.1 x 10^{-2}	N/A	2.9 x 10^{-30}	1.1 x 10^{-2}	6.3 x 10^{-6}
MOI	9.1 x 10^{-3}	6.5 x 10^{-5}	6.0 x 10^{-2}	1.1 x 10^{-2}	8.0 x 10^{-2}	4.0 x 10^{-3}	1.3 x 10^{-26}	8.4 x 10^{-2}	4.6 x 10^{-5}
General Population within 50 miles[5]	**Inhalation CED**	**Air Immersion ED**	**Ground Surface ED**	**Ingestion CED**	**Airborne Release TED[1]**	**Waterborne Release TED**	**Direct Radiation ED**	**TED[2]**	**Fatal Cancer in the General Population[4]**
	person-rem								
	4.2 x 10^{1}	4.7 x 10^{-1}	2.8 x 10^{2}	5.2 x 10^{1}	3.7 x 10^{2}	1.0	6.9 x 10^{-19}	3.7 x 10^{2}	2.1 x 10^{-1}

[1] Hypothetical accident scenario with the highest annual risk.
[2] The Airborne Release TED equals the sum of all airborne pathways.
[3] The TED equals the sum of the Airborne Release TED, Waterborne Release TED, and Direct Radiation ED.
[4] To convert dose to fatal cancer, a factor of 4.1 x 10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5 x 10^{-4} is multiplied by the dose for the MOI, NPA, and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5.)
[5] 50 miles = 80.5 kilometers

F.3.2 Computer Programs

Two computer programs are used to evaluate the radiation exposures to the specified individuals and General Population.

F.3.2.1 GENII

The Generalized Environmental Radiation Dosimetry Software System – Hanford Dosimetry System (GENII) Version 2 modeling code is used for the environmental transport and radiation exposure calculations for routine naval spent nuclear fuel handling operations and for the calculations of the waterborne components of the total dose for the hypothetical accident scenarios. GENII is designed to model long-term atmospheric and liquid releases of radionuclides and their human health consequences. Pacific Northwest National Laboratory developed and maintains the GENII code (PNNL 2009) and its underlying driver program Framework for Risk Analysis in Multimedia Environmental Systems (FRAMES) Version 1.7. The code incorporates the internal dosimetry model recommended by the ICRP in Publication 72 (ICRP 1996) and the external model recommended by the EPA in Federal Guidance Report (FGR) 12 (EPA 1993).

For this EIS, site-specific data are used including location, meteorology, population, and source terms as discussed in Sections F.3.3 and F.3.4. The chronic model is used in the routine naval spent nuclear fuel handling operations evaluation to reflect long-term average radiation exposure to the radiological emissions. For the chronic evaluations, GENII uses meteorological conditions averaged over each sector to reflect radiation exposure to long-term average concentrations. The acute option is used for the waterborne accident calculations to represent the effects of an accident which occurs over a short period of time.

F.3.2.2 RSAC-7

Radiological Safety Assessment Computer Code (RSAC) Version 7.2 was developed by Westinghouse Idaho Nuclear Company, Inc., for the DOE-Idaho Operations Office and is maintained by INL, currently operated by Battelle Energy Alliance (INL 2010d). The computer program calculates the consequences of the release of radionuclides to the atmosphere during an accident. The code incorporates the internal dosimetry models recommended by the ICRP in Publication 68 (ICRP 1994) and Publication 72 (ICRP 1996) and the external model recommended by the EPA in FGR 12 (EPA 1993).

RSAC is used to evaluate the effects from an airborne plume released during the hypothetical accident scenarios. It allows the amount of each radionuclide from a radiological release to be input individually or to be calculated internally by the code. RSAC calculates potential radiation exposures to individuals via inhalation, ingestion, exposure to radionuclides deposited on the ground surface, and immersion in airborne radioactive material. RSAC meteorological capabilities include Gaussian plume dispersion for Pascal-Gifford conditions. RSAC allows reduction of nuclides by chemical group or element and calculates radioactive decay and buildup during transport through operations, facilities, and the environment. Site-specific data are used including location, meteorology, population, and source terms as discussed in Section F.3.3.

F.3.3 Input Data for Airborne Calculations

Unless stated otherwise, the following conditions are used when performing airborne release calculations with RSAC-7.2 and GENII. In most cases, these conditions are taken directly as defaults from the computer programs.

F.3.3.1 Population Data

A population distribution based on 2010 population projections from the 2000 U.S. Census in 16 compass directions and five equal radial distances from NRF (8 kilometers (5 miles), 24 kilometers (15 miles), 40 kilometers (25 miles), 56 kilometers (35 miles), and 72 kilometers (45 miles)) is used for the evaluations. The population distribution includes a breakdown in estimates for six age groups as defined in ICRP Publication 71 (ICRP 1995):

- Infants:
  - 3 months: from 0 to 12 months of age
  - 1 year: from 12 months to 2 years
- Children:
  - 5 years: more than 2 years to 7 years
  - 10 years: more than 7 years to 12 years
  - 15 years: more than 12 years to 17 years
- Adults: more than 17 years

F.3.3.2 Meteorological Data

Site tower meteorological data for 2005 to 2010 from the National Atmospheric Release Advisory Center tower at NRF is used to determine meteorology. Two different weather conditions (50 percent and 95 percent) are evaluated for hypothetical accident scenarios, based on wind speed and stability class for 16 radial directions. The 50 percent condition represents the average meteorological condition, defined as that condition for which more severe conditions with respect to accident consequences are not exceeded more than 50 percent of the time. The 95 percent condition represents the meteorological conditions which could produce the highest calculated radiation exposures, defined as that condition which is not exceeded more than 5 percent of the time or is the worst combination of weather stability class and wind speed with respect to accident consequences.

Other input assumptions related to meteorological data are:

- The release is calculated as occurring at ground level (0 meters (feet)).

- The effects of plume rise are ignored. Buoyant plume rise can occur with releases of heated gases. Jet plume rise can occur when the gases are released through a stack. Plume rise would result in additional dispersion of the plume.

- Mixing layer height is 400 meters (1320 feet). Airborne materials freely diffuse in the atmosphere near ground level in what is known as the mixing depth. A stable layer exists above the mixing depth which restricts vertical diffusion.

- Wet deposition is zero (no rain occurs to accelerate deposition and reduce the area affected).

- Dry deposition of the cloud is modeled. During movement of the radioactive plume, a fraction of the plume is deposited on the ground due to gravitational forces and becomes available for exposure by ground surface radiation and ingestion.

- The quantity of deposited radioactive material, called the deposition velocity, is proportional to the material size and speed. Deposition velocities are calculated internally by the GENII code, but are specified as inputs in RSAC. The following deposition velocities (meters per second) are used in RSAC:
  - solids = 0.001
  - halogens = 0.01
  - noble gases = 0.0
  - cesium = 0.001
  - ruthenium = 0.001

F.3.3.3 Inhalation Data

The breathing rates used are based upon ICRP 71 (ICRP 1995) methodology summarized in Table F.3-2. The breathing rate has a direct effect on the amount of radioactivity inhaled by an individual and varies with age and work conditions.

Table F.3-2: Breathing Rates

Exposed Individual Group	Breathing Rate cubic meters per second
Worker – Routine operations	4.69×10^{-4}
Worker – Accident	8.33×10^{-4}
MCW	4.69×10^{-4}
NPA	4.69×10^{-4}
MOI	2.57×10^{-4}
Population – Adult	2.57×10^{-4}
Population – 3-month old	3.31×10^{-5}
Population – 1-year old	5.98×10^{-5}
Population – 5-year old	1.01×10^{-4}
Population – 10-year old	1.77×10^{-4}
Population – 15-year old	2.33×10^{-4}

For routine naval spent nuclear fuel handling operations, a 1 micron particle size is used for all analysis. For accident analysis, the particle size for the NPA, MOI, and General Population is 1 micron, and for the Worker and MCW the particle size is 5 microns, consistent with the particle sizes recommended by the ICRP in Publication 60 (ICRP 1991).

The radiation exposure times for each individual type are given in Table F.3-5 and Table F.3-6. The internal radiation exposure period for infants and children is calculated from the time of initial intake until the child reaches 70 years of age. The internal radiation exposure period for adults (including workers) is 50 years.

Inhalation exposure dose conversion factors from ICRP Publication 68 (ICRP 1994) are used for the worker and MCW in RSAC. Inhalation exposure factors from ICRP Publication 72 (ICRP 1996) are used for inhalation modeling of all other individual types. The use of ICRP Publication 68 is consistent with the DOE transition to ICRP 60 series dosimetry for workers and the use of ICRP Publication 72 includes the radiation exposure estimates to multiple age groups.

F.3.3.4 Ground Surface Exposure Data

The radiation exposure times for each individual type are given in Table F.3-5 and Table F.3-6. A representative 8 hour per day exposure is used for routine naval spent nuclear fuel handling operations to represent an average day. A conservative building shielding factor of 0.7 is used for accident analysis exposing the individual to contaminated soil for approximately 16 hours a day. See Section F.6.2 for additional details on time spent outdoors. Ground surface exposure dose conversion factors published in FGR 12 (EPA 1993) are used.

F.3.3.5 Ingestion Data

Annual dietary intake is consistent with the annual average consumption for the U.S. population (SAND 2010). Ten percent of all products are assumed to be grown and consumed locally. Therefore, 10 percent of the annual diet is modeled to be contaminated with the following exceptions:

- 30 percent of the milk is assumed to be contaminated for the 5 years and older age groups (FDA 1998). This increase accounts for the fact that milk is one of the most common agricultural products produced and consumed locally in southeastern Idaho.

- 100 percent of milk is assumed to be contaminated for infants (the 3-month and 1-year age groups) because milk makes up a majority of the infant's diet and because infants often receive all of their milk from a single source (FDA 1998).

- Drinking water is modeled to be 100 percent contaminated because drinking water is often obtained from a single source.

For routine naval spent nuclear fuel handling operations, ingestion for workers including the MCW is adjusted from the adult consumption rates to account for the ingestion of contaminated food and water that occurs while the worker is at work (8 hours per day, 240 days per year).

The consumption parameters for contaminated food, milk, and water used in this analysis, after the above percentage reductions are included, are provided in Table F.3-3.

The RSAC default parameters for ingestion are based on NRC 1977. The only changes from the defaults are the annual dietary consumption rates shown in Table F.3-3. The consumption rates are modified as discussed above to represent the portion of contaminated (local) food ingested annually. The ingestion periods for each individual type are given in Table F.3-5 and Table F.3-6. Ingestion exposure dose conversion factors from ICRP Publication 72 (ICRP 1996) are used (Table F.3-4). Ingestion exposure is modeled with the individual consuming contaminated food for a 1-year period. The internal radiation exposure period for infants and children is calculated from the time of initial intake until the child reaches 70 years of age. The internal radiation exposure period for adults (including workers) is 50 years.

Table F.3-3: Annual Consumption Inputs for Ingestion of Contaminated Food, Milk, and Water

Annual Consumption Inputs for RSAC (kilograms per year unless otherwise noted)							
	3 Months	**1 Year**	**5 Years**	**10 Years**	**15 Years**	**Adult**	**Worker/ MCW[1]**
Milk (liters per year)	208	179	50.4	54.8	52.6	31.8	N/A
Meat	1.82	2.96	4.67	5.77	7.01	7.99	
Leafy Vegetables	0.12	0.23	0.55	0.84	1.06	1.53	
Stored Vegetables	7.63	9.64	13.4	16.5	17.6	16.4	
Annual Consumption Inputs for GENII (kilograms per year unless otherwise noted)							
	3 Months	**1 Year**	**5 Years**	**10 Years**	**15 Years**	**Adult**	**Worker/ MCW[1]**
Milk (liters per year)	208	179	50.4	54.8	52.6	31.8	10.4
Eggs	0.18	0.44	0.66	0.66	0.80	1.06	0.35
Meat	0.96	1.81	3.25	4.27	5.26	5.69	1.87
Poultry	0.66	0.69	0.80	0.99	1.17	1.20	0.4
Fish	0.02	0.13	0.30	0.40	0.47	0.58	0.19
Mollusk	0.005	0.005	0.011	0.020	0.031	0.055	0.018
Crustacea	0.005	0.005	0.011	0.020	0.031	0.055	0.018
Leafy Vegetables	0.12	0.23	0.55	0.84	1.06	1.53	0.5
Root Vegetables	2.81	3.21	4.24	5.39	5.74	5.71	1.88
Fruit	2.77	2.41	2.26	2.66	2.70	3.03	1
Grain	2.04	4.02	6.94	8.40	9.13	7.67	2.52
Dinking Water	113	190	292	343	402	548	180

[1] No ingestion is modeled for the Worker or MCW accident analysis because only a 20-minute radiation exposure period is evaluated.
1 kilogram = 2.2 pounds
1 liter = 0.26 gallons

F.3.3.6 Summary of Airborne Inputs

The source documents for the radiation exposure dose conversion factors used in the radiological analysis are shown in Table F.3-4.

Table F.3-4: Radiation Exposure Factors

Analysis	Pathway	Worker	MCW	NPA	MOI	General Population
Routine Naval Spent Nuclear Fuel Handling Operations	Inhalation	ICRP 72	ICRP 72	N/A	ICRP 72	ICRP 72
	Ingestion	ICRP 72	ICRP 72	N/A	ICRP 72	ICRP 72
	External	FGR 12	FGR 12	N/A	FGR 12	FGR 12
Hypothetical Accidents	Inhalation	ICRP 68	ICRP 68	ICRP 72	ICRP 72	ICRP 72
	Ingestion	N/A	N/A	N/A	ICRP 72	ICRP 72
	External	FGR 12	FGR 12	FGR 12	FGR 12	FGR 12

FGR 12 = EPA 1993
ICRP 68 = ICRP 1994
ICRP 72 = ICRP 1996

The radiation exposure times for routine naval spent nuclear fuel handling operations and hypothetical accident analysis are shown in Table F.3-5 and Table F.3-6, respectively.

Table F.3-5: Exposure Times for Routine Naval Spent Nuclear Fuel Handling Operations

Exposed Individual	Time for Plume Exposure and Inhalation		Time for Ground Surface Exposure		Time for Direct Radiation Exposure		Ingestion Period
	hours per day	days per year	hours per day	days per year	hours per day	days per year	years
Worker and MCW	8	240	8	240	8	240	1
MOI and General Population	24	365	8	365	24	365	1

Table F.3-6: Exposure Times for Hypothetical Accident Analysis

Exposed Individual	Time for Plume Exposure		Time for Ground Surface and Direct Radiation Exposure	Ingestion Period
	Inhalation	Air Immersion		
Worker	5 minutes		20 minutes	N/A
MCW and NPA	15 minutes		2 hours	N/A
MOI and General Population	15 minutes		1 year	1 year

F.3.4 Input Data for Waterborne Calculations

GENII is used to calculate the waterborne contribution to dose. Where relevant, identical input information discussed above for airborne calculations is used in the waterborne analysis. In most cases, these conditions are taken directly as defaults from the computer program.

All radionuclides that are introduced into the water are modeled to be distributed uniformly in the water immediately following a hypothetical accident. There are two processes by which radionuclides might enter the water:

- For liquid discharges (i.e., drained water pool scenario), a fraction of the released radionuclides can enter the water accessed by humans by infiltrating through the ground to the groundwater in the aquifer. Based on water infiltration rates discussed in Section 3.4.2.1, it is conservatively modeled that it would take 2 years for the radionuclides to infiltrate through the ground to reach the aquifer. The flow of the aquifer from north to south (Figure 3.4-5) is ignored, and it is conservatively modeled that the contaminated water flows directly towards the MOI and General Population. It is also assumed that the radionuclides are carried by the aquifer to the wells or surface water located beside the MOI and General Population locations at a flow rate of 3.8 meters per day (12.5 feet per day).

- For airborne discharges, it is conservatively modeled that the entire release of radionuclides is deposited either onto bodies of surface water or directly onto the ground based on the fraction of land covered by surface water near the INL area. The radionuclides deposited on the ground are carried through the soil and reach the aquifer in the same manner described above for liquid discharges.

Radioactive decay and removal by sedimentation occurs during the infiltration time through the soil and the subsequent travel time in the aquifer. Radioactive decay also occurs during the time period when the radionuclides have left the water environment and are being transported through the pathways to humans. During this time they would be subjected to both concentration and removal mechanisms which further modify their effect upon humans. These mechanisms are modeled in GENII and include concentration in the surface deposit, animal, and crop pathways; radioactive decay during periods between harvesting a crop and its ingestion by humans; and removal of activity due to harvesting, handling, and cleaning of foodstuff. Dilution in larger volumes of water is accounted for when the radionuclide concentration in the aquifer is calculated.

The water radiation exposure pathways considered in this analysis are the direct radiation from the external pathways (swimming, shoreline exposure, and boating exposure) and the ingestion pathways (drinking water and food that contacted contaminated water).

F.4 Analysis of Routine Naval Spent Nuclear Fuel Handling Operations

This section describes the public and occupational health effects on individuals and the General Population outside the naval spent nuclear fuel handling facility (i.e., ECF or New Facility) due to routine naval spent nuclear fuel handling operations associated with the proposed action. Naval spent nuclear fuel handling facilities are designed to reduce radiation levels outside radiation areas to less than 0.06 millirem per hour. Analyses considered airborne, waterborne, and direct radiation pathways in the determination of health effects (i.e., cancer).

Section 4.13.2.1 describes radiological exposures for the time periods associated with each alternative. These radiation exposures are split into radiation exposures to workers inside the naval spent nuclear fuel handling facilities (i.e., ECF or the new facility) and radiation exposures to individuals outside the naval spent nuclear fuel handling facilities. The radiation exposures to workers inside the naval spent nuclear fuel handling facilities are fully evaluated in Section 4.13.2.1; therefore, no additional discussion of radiation exposures to workers inside the facilities is provided in this Appendix. This Appendix focuses on the radiation exposures to individuals outside the naval spent nuclear fuel handling facilities for the post-refurbishment operational period of the

Overhaul Alternative, the transition period of the New Facility Alternative, and the new facility operational period. These are the time periods for which there would be increases to the baseline radiation exposures described in Section 3.13.2.

The nature of naval spent nuclear fuel handling operations would be the same for the post-refurbishment operational period of the Overhaul Alternative, the transition period of the New Facility Alternative, and the new facility operational period. During these time periods, ECF or the new facility are modeled to operate at maximum capacity for unloading M-140 shipping containers, unloading M-290 shipping containers, and loading naval spent nuclear fuel canisters to meet the needs of the naval nuclear fleet and the obligations under the Idaho Settlement Agreement (SA 1995) and its 2008 Addendum (SAA 2008). Different shipping containers (i.e., M-140 and M-290) are needed to transport different types of naval spent nuclear fuel. During the transition period, the new facility and ECF would operate in parallel. The production rates during the transition period would be bounded by the maximum capacity for unloading M-140 shipping containers, unloading M-290 shipping containers, and loading naval spent nuclear fuel canisters in either ECF (post-refurbishment operational period) or the new facility (new facility operational period). Therefore, the discussion provided in this Appendix regarding routine naval spent fuel handling operations applies to operations at maximum capacity for the three time periods. A maximum capacity year assumption for the above time periods is conservative because ECF or the new facility would not operate at maximum capacity for the entire operational period. The 2009 baseline emissions and radiation exposures from ECF and NRF provided in Section 3.6.6 and Section 3.13.2 are also discussed to support impact comparisons in Section 4.6.2 and 4.13.2.1.

F.4.1 Radiological Emissions from Routine Naval Spent Nuclear Fuel Operations

Radiological emissions for routine naval spent nuclear fuel handling operations for the time-frames of the proposed action described above are estimated based on routine 2009 annual releases from ECF that are scaled to future activities. The radiological emissions are related to the operational tempo of shipping container unloading and naval spent nuclear fuel canister loading. The operational tempo is set by the need to support the naval nuclear fleet and operate in accordance with SA 1995 and SAA 2008. The baseline 2009 ECF emissions are scaled to represent the capacity of future naval spent nuclear fuel handling operations based on the expected tempo of these operations.

The 2009 emissions from NRF include emissions from ECF (naval spent nuclear fuel handling and examination operations), and non-ECF operations (e.g., the prototype buildings that continue to be monitored). The 2009 NRF emissions rates are presented in Table F.4-1.

Table F.4-1: 2009 Radiological Air Emissions from NRF

Radionuclide[1]	ECF Naval Spent Nuclear Fuel Handling	ECF Examinations	Total ECF Operational Emissions	Non-ECF Emissions from NRF Operations	Total NRF Operational Emissions
	Curies per year				
C-14	8.0×10^{-1}	0.0	8.0×10^{-1}	0.0	8.0×10^{-1}
H-3	1.8×10^{-2}	5.9×10^{-3}	2.4×10^{-2}	0.0	2.4×10^{-2}
I-129	3.8×10^{-5}	0.0	3.8×10^{-5}	0.0	3.8×10^{-5}
I-131	1.1×10^{-6}	4.0×10^{-6}	5.1×10^{-6}	0.0	5.1×10^{-6}
Kr-85	1.7×10^{-2}	1.1×10^{-1}	1.3×10^{-1}	0.0	1.3×10^{-1}
Pu-239[2]	5.1×10^{-7}	1.6×10^{-7}	6.7×10^{-7}	1.1×10^{-6}	1.8×10^{-6}
Sr-90[3]	1.6×10^{-5}	5.8×10^{-6}	2.2×10^{-5}	4.3×10^{-5}	6.5×10^{-5}
Total	**8.3×10^{-1}**	**1.2×10^{-1}**	**9.4×10^{-1}**	**4.4×10^{-5}**	**9.5×10^{-1}**

[1] Radionuclides released in 2009 that are not typical are not included.
[2] Gross alpha activity is modeled as Pu-239.
[3] Gross beta activity is modeled as Sr-90.

The total ECF emissions from naval spent nuclear fuel handling and examination operations and total NRF emissions from Table F.4-1 are evaluated as the 2009 baseline for ECF and NRF. In 2009, the naval spent nuclear fuel handling operations at ECF included the unloading of eight M-140 shipping containers and the loading of sixteen naval spent nuclear fuel canisters. The impacts from the ECF and NRF baseline emissions are discussed in Section 3.6.6.

ECF currently processes M-130 and M-140 shipping containers. Under the proposed action, M-290 shipping containers would also be processed. The source of emissions from the unloading of shipping containers and loading of naval spent nuclear fuel canisters is primarily corrosion products that were activated by radiation. Although the corrosion products tightly adhere to the outside surface of the naval spent nuclear fuel, some corrosion products become dislodged from the naval spent nuclear fuel during shipment or handling and become airborne when the shipping container is opened or the naval spent nuclear fuel canister is loaded. Gaseous radionuclides (e.g., carbon-14 (C-14) and tritium (H-3)) are emitted when the shipping containers are vented. The particulate airborne contamination from shipping container unloading and naval spent nuclear fuel canister loading is controlled at the source through High-Efficiency Particulate Air (HEPA)-filtered ventilation systems at the shipping container unloading stations and naval spent nuclear fuel canister loading stations. A scaling factor for the amount of corrosion products in each type of shipping container is developed to account for the length of the aircraft carrier naval spent nuclear fuel assemblies without prior disassembly transported to NRF in an M-290 shipping container compared to the naval spent nuclear fuel assemblies transported in an M-140 shipping container. To support the operational tempo of the naval nuclear fleet, ECF or the new facility would process fourteen M-140 shipping containers and ten M-290 shipping containers per year at full capacity. Therefore, the 2009 ECF emissions generated from processing eight M-140 shipping containers (no M-130 shipping containers were processed in 2009) are scaled based on the capacity of M-140 and M-290 shipping containers that could be processed in ECF or the new facility for time-frames of the proposed action.

To support the NNPP's obligations under the SA 1995 and SAA 2008, future loading rates of naval spent nuclear fuel canisters are expected to be less than the current loading rates. The expected loading rate at full capacity would peak at 15 naval spent nuclear fuel canisters per year.

Therefore, the 2009 ECF emissions generated from loading 16 naval spent nuclear fuel canisters are scaled based on the future capacity to load 15 naval spent nuclear fuel canisters per year. The scaled emissions from shipping container unloading and naval spent nuclear fuel canister loading are added together to obtain the routine naval spent nuclear fuel handling operations emissions for a full capacity naval spent nuclear fuel handling facility in the time-frames of the proposed action. The estimated emissions from a full capacity naval spent nuclear fuel handling facility are presented in Table F.4-2. For conservatism, additional features that would be incorporated into the design of a new facility (e.g., additional HEPA ventilation) are not accounted for in the development of the emission source term. Since examination operations would continue at ECF during the post-refurbishment operational period, the transition period, and the new facility operational period, the 2009 emissions from ECF examination activities are added to the naval spent nuclear fuel handling operation emissions. Table F.4-2 also provides the naval spent nuclear fuel handling operations emissions combined with the 2009 ECF examination operations emissions for comparison to the total ECF 2009 emissions.

Table F.4-2: Estimated Future Radiological Emissions for Routine Naval Spent Nuclear Fuel Handling Operations

Radionuclide	Full Capacity Naval Spent Nuclear Fuel Handling Operations Emissions	2009 ECF Examination Emissions	Total Naval Spent Nuclear Fuel Handling and Examination Emissions
	Curies per year		
C-14	1.8	0.0	1.8
H-3	5.2×10^{-2}	5.9×10^{-3}	5.8×10^{-2}
I-129	3.6×10^{-5}	0.0	3.6×10^{-5}
I-131	3.6×10^{-6}	4.0×10^{-6}	7.6×10^{-6}
Kr-85	1.6×10^{-2}	1.1×10^{-1}	1.3×10^{-1}
Pu-239[1]	1.6×10^{-6}	1.6×10^{-7}	1.8×10^{-6}
Sr-90[2]	5.1×10^{-5}	5.8×10^{-6}	5.7×10^{-5}
Total	**1.8**	**1.2×10^{-1}**	**1.9**

[1] Gross alpha activity is modeled as Pu-239.
[2] Gross beta activity is modeled as Sr-90.

The total naval spent nuclear fuel handling and ECF 2009 examination emissions are evaluated for a full capacity naval spent nuclear fuel handling facility. The emissions from a full capacity naval spent nuclear fuel handling facility with 2009 ECF emissions are higher than the 2009 baseline emissions for ECF. The increase from the 2009 ECF baseline is due entirely to the assumption that the facility would operate at maximum capacity. The impacts from a full capacity naval spent nuclear fuel handling facility emissions are discussed in Section 4.6.2.

F.4.2 Radiation Exposure from Routine Naval Spent Nuclear Fuel Operations

The radiation exposure calculations include the radioactive particles or gases released into the atmosphere or into the aquifer from routine naval spent nuclear fuel handling operations via three pathways: airborne, waterborne, and direct radiation. Airborne contributions to dose are determined using an air dispersion modeling software (GENII) to calculate the doses attributable to air immersion, inhalation, ingestion, and ground shine (radiation from radionuclides deposited on the ground). Waterborne contributions to dose are determined using the GENII modeling software to calculate the doses attributable to water immersion and ingestion (of both water and contaminated foods). Direct radiation contributions are determined from a facility design requirement for radiation levels outside a radiological facility attenuated by distance.

Table F.4-3 presents the estimated radiation exposure and fatal cancer from the 2009 ECF and NRF emissions for members of the public (MOI and General Population). The emissions evaluated are presented in the total ECF emissions and the total NRF emissions columns of Table F.4-1.

Table F.4-3: Annual Health Effects for 2009 Routine Naval Spent Nuclear Fuel Handling Operations at NRF

<table>
<tr><th colspan="2" rowspan="2">Individual</th><th>TED</th><th rowspan="2">Fatal Cancer Per Individual[1]</th></tr>
<tr><th>rem</th></tr>
<tr><td colspan="2">2009 ECF MOI</td><td>2.7×10^{-7}</td><td>1.5×10^{-10}</td></tr>
<tr><td colspan="2">2009 NRF MOI</td><td>2.7×10^{-7}</td><td>1.5×10^{-10}</td></tr>
<tr><th colspan="3">Exposure to the General Population within an 80.5-kilometer (50-mile) Radius of NRF</th><th rowspan="2">Fatal Cancer in the General Population[1]</th></tr>
<tr><td rowspan="3">General Population of approximately 151,000</td><td></td><td>person-rem</td></tr>
<tr><td>ECF</td><td>9.0×10^{-3}</td><td>5.0×10^{-6}</td></tr>
<tr><td>NRF</td><td>9.0×10^{-3}</td><td>5.0×10^{-6}</td></tr>
<tr><td colspan="4">1 To convert dose to fatal cancer, a factor of 5.5×10^{-4} is multiplied by the dose for the MOI and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factor which includes both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factor overstates the likelihood of fatal cancer in a population and the use of this factor to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5.)</td></tr>
</table>

Only MOI and General Population radiation exposures are evaluated for the 2009 ECF and NRF baseline because these are the only individuals available for comparison to the INL baseline discussed in Section 3.13.2. The ECF emissions from C-14 contribute approximately 98 percent of the radiation exposure to the MOI and General Population. The radiation exposure contribution from the Pu-239 and Sr-90 not related to ECF emissions contribute approximately 2 percent or less of the radiation exposure. Therefore, the radiation exposures from NRF are essentially the same as the radiation exposures from ECF.

Table F.4-4 presents the estimated radiation exposures and fatal cancer for 1 year of routine naval spent nuclear fuel handling and examination operations of a full capacity naval spent nuclear fuel handling facility associated with the proposed action. The emissions evaluated are presented in the full capacity column of Table F.4-2.

Table F.4-4: Estimated Annual Health Effects for Routine Naval Spent Nuclear Fuel Handling Operations

Individual	TED	Fatal Cancer Per Individual[1]
	rem	
Worker	1.0×10^{-3}	4.1×10^{-7}
MCW	6.9×10^{-8}	2.8×10^{-11}
MOI	6.0×10^{-7}	3.3×10^{-10}
Exposure to the General Population within an 80.5-kilometer (50-mile) Radius of NRF		**Fatal Cancer in the General Population[1]**
General Population of approximately 151,000	person-rem	
	2.0×10^{-2}	1.1×10^{-5}

[1] To convert dose to fatal cancer, a factor of 4.1×10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5×10^{-4} is multiplied by the dose for the MOI and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

The 2.0×10^{-2} person-rem from naval spent nuclear fuel handling and examination operations is higher than the 2009 ECF baseline radiation exposure of 9.0×10^{-3} person-rem. The increase is due entirely to the assumption that the facility would operate at maximum capacity.

The estimated likelihood of fatal cancer to the General Population living within an 80.5-kilometers (50-mile) radius of NRF due to radiological releases from 1 year of naval spent nuclear fuel handling operations at full capacity associated with the proposed action is 1.1×10^{-5} (1 in 91,000). The estimate is calculated using the methods described in Section F.3. The fatal cancer that could be developed from routine naval spent nuclear fuel handling operations under the proposed action is very low in comparison to the 2.3×10^{4} (22,650) individuals living within an 80.5-kilometers (50-mile) radius of NRF that would be expected to die from cancer from a lifetime of normal activity unrelated to NRF emissions (Section F.2.6).

F.5 Hypothetical Accident Scenario Analysis

F.5.1 Introduction

Hypothetical accident scenarios were considered for inclusion in detailed analyses if they are expected to contribute substantially to risk (defined as the product of the probability of occurrence of the accident times the consequence of the accident). The hypothetical accident scenarios chosen for evaluation represent a range of both consequence and probability. The range of hypothetical accident scenarios evaluated includes external events (e.g., earthquakes and windborne missiles (i.e., airborne projectiles)), and accidents due to human error or equipment failures (e.g., mechanical damage from naval spent nuclear fuel processing operations, inadvertent criticality, naval spent nuclear fuel assembly drop, or naval spent nuclear fuel basket tip-over). For hypothetical accidents, consequences (i.e., dose) are presented for both the 50 percent and the 95 percent meteorological conditions; annual risk calculations are presented to allow comparisons between hypothetical accident scenarios.

In addition to hypothetical accident scenarios, IDAs are also considered. These IDAs are not considered “accidents” because the event would be intentional. Although any hypothetical accident scenario evaluated could possibly be caused by an IDA, the IDAs discussed specifically in this Appendix are unlikely to result from anything other than intentional intervention. For IDAs, consequences (i.e., dose) are presented for 50 percent and 95 percent meteorological conditions. Annual risk calculations are not completed for these scenarios because the probability of the event is considered “unknowable” (DOE 2004b). For simplicity, the descriptions of methodology for hypothetical accident scenarios are applicable to IDAs. Methodology for preventing and mitigating IDAs is discussed in Section F.6.2.

Significant releases of radioactive material to the environment or significant increases in radiation levels can only occur if an accident produces severe conditions. Some types of accidents, such as procedure violations, spills of small volumes of water containing radioactive particles, or most other types of common human error, may occur more frequently than the hypothetical accidents analyzed. However, they do not involve enough radioactive material or radiation to result in a significant release to the environment or a meaningful increase in radiation levels. The very low consequences associated with these events produce smaller risks than those for the hypothetical accidents analyzed. This is true even when the consequences of the events are combined with higher probability of occurrence. Consequently, they are not explicitly analyzed in this EIS.

The radiological impacts to the individuals and General Population described in Section F.3.1 are calculated quantitatively for each scenario. Radiological impacts to involved workers who are located at or nearby the accident scene are discussed qualitatively for each scenario.

F.5.2 Accident Selection

Various accident scenarios representing a spectrum of hypothetical events are developed for naval spent nuclear fuel handling operations. As described in Section F.5.1, initiating events were considered including natural phenomena (earthquakes, volcanic activity, tornadoes, hurricanes and other natural events) and human initiated events (human error, equipment failures, fires, explosions, plane crashes, transportation accidents, and sabotage). Guiding principles were established for the scenario development including: the radioactive materials involved must be available in a dispersible form; there must be a mechanism available for release of such materials from the facility; and, there must be a mechanism available for off-site dispersion of the released materials. Recognizing these fundamental processes, accidents involving the following basic phenomena are identified:

- Release of radioactive products to the environment due to overheating of naval spent nuclear fuel
- Release of radioactive products to the environment due to mechanical shock, damage, or inadvertent breaching of naval spent nuclear fuel cladding or containment

Accidents are selected to be representative of naval spent nuclear fuel handling operations discussed in Section 1.2.

Twelve hypothetical accident scenarios and IDAs are evaluated for naval spent nuclear fuel handling operations. These hypothetical accident scenarios include a HEPA filter fire, a shielded transfer container (STC) drop or tip-over, an airplane crash into the water pool, a drained water pool, a hydrogen detonation in the water pool, mechanical damage to naval spent nuclear fuel in the water pool, an inter-facility transport accident, an inadvertent fuel cutting in the water pool, an inadvertent criticality in the water pool, a shielded basket transfer container (SBTC) drop or tip-over, a windborne projectile into an SBTC, and a minor water pool leak into the environment. The minor water pool leak is predominantly evaluated qualitatively because of the many variables and associated uncertainties in the scenario and the low consequences expected if a minor water pool leak were to occur.

The inter-facility transport accident scenario and the airplane crash into the water pool scenario have been treated as IDAs only, and no probability of occurrence or resultant annual risk is calculated. Based on the slow travel speeds, short travel distance across NRF property, and infrequent naval spent nuclear fuel assembly transfers, the inter-facility transport accident scenario is not considered reasonably foreseeable without intentional human intervention. Similarly, because of the low level of commercial air traffic across NRF, distance from airports, and relatively small target footprint for a naval spent nuclear fuel handling facility, the airplane crash into the water pool is not considered reasonably foreseeable without intentional human intervention.

F.5.3 Radiological Accident Source Term Development

In analyzing the potential consequences of postulated scenarios, the source term as defined in this Appendix is the amount of radioactive material (in Curies) released to the environment. The airborne source term is estimated by the following equation (DOE 1994):

Source Term = MAR * DR * ARF * RF * LPF

Where:

Source Term (Curies) = the amount of radioactive material released to the environment

MAR = Material-At-Risk (Curies), the maximum amount and type of material present that may be acted upon in the scenario evaluated

DR = Damage Ratio, the fraction of the MAR impacted by the actual accident-generated conditions under evaluation

ARF = Airborne Release Fraction, the fraction of radioactive material actually affected by the accident condition that is suspended in air

RF = Respirable Fraction, the fraction of the airborne radioactive particles that are in the respirable size range (i.e., less than 10 microns)

LPF = Leak Path Factor, the cumulative fraction of materials from the postulated accident that escape to the atmosphere through containment, confinement, water, or filtration

For this EIS it is conservatively assumed that all released material is in the breathable range and the RF is set equal to 1.0. The ARF is combined with the LPF and is not calculated separately. These modifications simplify the source term calculation commonly used in DOE analysis.

For many hypothetical accident scenarios, the MAR is one or more naval spent nuclear fuel assemblies. To account for the fact that there are many different types of naval spent nuclear fuel (e.g., carrier and submarine), a representative equivalent naval spent nuclear fuel type is modeled in the analysis. The representative naval spent nuclear fuel type has the characteristics of a typical naval spent nuclear fuel assembly that would be handled at NRF during the time-frame of the proposed action. The maximum number of representative naval spent nuclear fuel assemblies that would be stored in the water pool during the time-frame of the proposed action is 400 equivalent naval spent nuclear fuel assemblies. The number of representative naval spent nuclear fuel assemblies differs from the 550 storage ports in the water pool to account for the different characteristics of the different types of naval spent nuclear fuel located in the storage ports.

Multiple LPFs are used in this EIS. Naval spent nuclear fuel overheating LPFs apply to scenarios that involve overheating naval spent nuclear fuel (e.g., in a fire) and to energetic releases (e.g., in a criticality). The release fractions are determined for various nuclide groups based on chemical property similarities and the results of NNPP and commercial testing of overheated fuels.

Water scrubbing LPFs apply to underwater releases. For hypothetical accident scenarios in which the MAR is submerged in a water pool, the water above the MAR acts as a filter for certain materials and reduces the overall release to the environment. For a non-energetic, unheated release, materials retained within the water include all particulate fission products and corrosion products. Since none of these materials reach the environment, their LPF is equal to zero. For accidents involving an energetic or heated release beneath an overlaying volume of water (e.g., an underwater criticality or hydrogen detonation), the particulates and elemental iodine are reduced by a water scrubbing factor of 10 (LPF = 0.1). With the exception of elemental iodine, water scrubbing is ineffective in reducing the release of gaseous products. These gaseous products are assumed to bubble up through the water pool water and are released to the building with an LPF of 1.0.

Filtration LPFs apply to all hypothetical accident scenarios that occur within an undamaged building. Filtered ventilation significantly reduces the overall release of all but gaseous constituents to the environment. Naval spent nuclear fuel handling facilities utilize HEPA filters to capture radioactive materials before they are released into the environment. HEPA filtration units are modeled to capture 99.9 percent of the particulates (LPF = 0.001). This represents the filtration efficiency of a single HEPA filter. Multiple HEPA filter units in series are conservatively modeled as single units. The LPF assumption is conservative because systems containing HEPA filtration are tested to ensure they are at least 99.95 percent efficient for capturing 0.7 micron particles. HEPA filtration has no effect on gaseous materials, as they are not captured by the filters (LPF = 1.0).

All noble gases and a fraction of the iodines are modeled as gaseous fission products. The noble gas release, as well as the release of gaseous iodine in the form of organic iodines, is not reduced by either HEPA filtration or water scrubbing. The release of gaseous iodine in elemental form is not reduced by HEPA filtration but, as described earlier, is reduced by water scrubbing if the release is underwater. The release of particulate iodine is reduced by both HEPA filtration and water scrubbing. For an underwater release, particulate iodine is assumed to re-evolve, in the low pH water pools, as elemental iodine.

The mechanical LPFs used in this EIS are determined individually for each scenario dependent upon the path of material release. Mechanical LPFs are associated with passage through a mechanical boundary, such as a cracked container seal. Separate LPFs are frequently used for corrosion products and fission products because the material is released by different pathways. The mechanical LPFs only apply to the particulates in the MAR because the gaseous materials are not trapped by the container or release mechanisms involved in the accident.

Table F.5-1 summarizes the factors used in source term development.

Table F.5-1: Factors in Source Term Development

Scenario	MAR	LPF	Type of Release
HEPA Filter Fire	Four Local HEPA Filter Inventories	Downstream HEPA filtration	Filtered release
Shielded Transfer Container Drop or Tip-Over	One Fuel Assembly	HEPA filtration Mechanical (0.001 for fission products; 0.005 for corrosion products)	Filtered release of fission products and corrosion products
Airplane Crash into Water Pool	Entire Water Pool Inventory of Approximately 400 Equivalent Fuel Assemblies	Water scrubbing	Underwater gaseous release of fission products
Drained Water Pool	Entire Water Pool Inventory of Approximately 400 Equivalent Fuel Assemblies	None	Release of corrosion products
Hydrogen Detonation in the Water Pool	Fuel in Storage Container	HEPA filtration Energetic water scrubbing, Mechanical (0.1)	Filtered, energetic underwater release of fission products and corrosion products
Mechanical Damage to Fuel in the Water Pool	Fuel in a Fuel Discharge Stand	Water scrubbing	Underwater gaseous release of fission product
Inter-Facility Transport Accident	One Fuel Assembly	Fuel overheating Mechanical (0.1)	Release of corrosion products and heated release of fission products
Inadvertent Fuel Cutting in the Water Pool	One Fuel Assembly	Water Scrubbing	Underwater gaseous release of fission products
Inadvertent Criticality in the Water Pool	Two Fuel Assemblies and Criticality Products	Fuel overheating Energetic water scrubbing HEPA filtration	Filtered, energetic underwater release of fission products
Shielded Basket Transfer Container Drop or Tip-Over	Fuel in SBTC	HEPA filtration Mechanical (0.001 for fission products; 0.005 for corrosion products)	Filtered release of fission products and corrosion products
Windborne Projectile into Shielded Basket Transfer Container	Fuel in SBTC	Mechanical (0.005 for corrosion products)	Release of corrosion products
Minor Water Pool Leak	This scenario is evaluated qualitatively.		

F.5.4 Hypothetical Accident Scenarios and Results

The hypothetical accident scenarios evaluated in this Appendix are discussed below.

The scenarios are discussed in operational order as discussed in Section 1.2. A description of the conditions is given to explain plausible causes of the accidents, the source of the release, and the pathways by which radioactivity is released to the environment. All of the radionuclides potentially released from an accident are used in the analyses of the accident consequences. For simplicity, tables showing the source terms include only the nuclides that result in at least 99 percent of the radiation exposure. Factors used in developing the source term are detailed in Table F.5-1 and described in Section F.5.3.

The airborne release to the environment is modeled to occur at a constant rate over a 15-minute period. In general, the estimated annual probability of each accident occurring is discussed. The radiation exposure results, health effects from radiation exposure (fatal cancer), and annual risk to the General Population that could result from each accident are summarized. 'Risk' is defined as the cancer in the General Population times the probability of occurrence of the accident. Annual risk is calculated by multiplying the annual probability of an accident and the health effect. The lifetime risk of developing fatal cancer is determined by multiplying the annual risk of developing fatal cancer by the expected time-frame of the alternative (Section 2.3).

The impact to workers involved in naval spent nuclear fuel handling (involved workers) due to the hypothetical accident scenarios is also discussed qualitatively. This evaluation focuses on the radiological consequences of the accident. A limited number of fatalities may occur due to the non-radiological physical effects of the accident (i.e., a worker who happened to be in the facility may be killed due to a plane crash, seismic event, crane failure, etc.). These non-radiological accident effects are not discussed.

F.5.4.1 HEPA Filter Fire

Description of Conditions

In this hypothetical accident scenario, a fire develops in one of the local ventilation systems used during naval spent nuclear fuel handling operations. Local filtered ventilation systems are utilized during operations with risk of airborne contamination (e.g., shipping container unloading or naval spent nuclear fuel canister loading). This scenario is assumed to occur during the unloading of a shipping container. The local ventilation systems are not run continuously and are only operated while the specific operation is in progress. This accident could be initiated by the ignition of a flammable mixture released upstream of the system or by an external, unrelated fire that spreads to the local HEPA ventilation system. Additionally, shock impact damage to a HEPA filter is assumed to ensure that damage to the HEPA filter is conservatively addressed. It is assumed that the radioactivity released from the local HEPA filters is drawn into the downstream building HEPA filtration system before being released to the environment.

Source Term

The source term used for this scenario is shown in Table F.5-2.

Table F.5-2: Source Term for the HEPA Filter Fire Scenario

Radionuclide[1]	Activity
	Curies
Co-58	1.97×10^{-6}
Co-60	5.18×10^{-6}
Fe-55	9.53×10^{-6}
Mn-54	3.25×10^{-7}
Zn-65	1.40×10^{-7}

[1]The radionuclides shown in the table contribute at least 99 percent of the radiation exposure from the scenario.

Probability

The probability of a fire in a HEPA filter is estimated based on the probability of a fire in the facility spreading to the local HEPA filter system. Fires in industrial nuclear facilities have been estimated to range from 2×10^{-3} to 5×10^{-3} per year (WSRC 1995). The probability of a fire in a HEPA filter is considered to be lower because HEPA filters are not inherently volatile or explosive. In addition, local HEPA filter systems are located nearby operations where the risks for airborne contamination release are high. Since chemicals and flammable liquids are not stored near these areas, it is estimated that the probability of a nuclear facility fire spreading to a HEPA filter is less than 1×10^{-1}. This results in a range of probabilities of 2×10^{-4} to 5×10^{-4} for a HEPA filter fire. An annual probability of 5×10^{-4} is conservatively used to develop the annual risks in Table F.5-3 (Section F.7.1).

Results

The radiation exposure results, fatal cancer from radiation exposure, and annual risk to the General Population (i.e. product of fatal cancer and probability of accident occurrence) that would result from this hypothetical accident scenario, are shown in Table F.5-3.

Table F.5-3: Health Effects From the HEPA Filter Fire Scenario

Weather Condition	Exposed Individual	TED rem	Fatal Cancer Per Individual[1]	
50 Percent Meteorology	Worker	5.5×10^{-7}	2.3×10^{-10}	**Annual Risk of Developing Fatal Cancer to the General Population[2]**
	MCW	3.6×10^{-10}	1.5×10^{-13}	
	NPA	2.8×10^{-10}	1.5×10^{-13}	
	MOI	2.1×10^{-9}	1.2×10^{-12}	
	Exposure to the General Population person-rem		**Fatal Cancer in the General Population[1]**	
	2.1×10^{-5}		1.1×10^{-8}	5.7×10^{-12}
95 Percent Meteorology	**Exposed Individual**	**TED** rem	**Fatal Cancer Per Individual[1]**	
	Worker	3.3×10^{-6}	1.4×10^{-9}	**Annual Risk of Developing Fatal Cancer to the General Population[2]**
	MCW	5.6×10^{-9}	2.3×10^{-12}	
	NPA	4.8×10^{-9}	2.6×10^{-12}	
	MOI	3.5×10^{-8}	1.9×10^{-11}	
	Exposure to the General Population person-rem		**Fatal Cancer in the General Population[1]**	
	1.6×10^{-4}		8.5×10^{-8}	4.3×10^{-11}

[1] To convert dose to fatal cancer, a factor of 4.1×10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5×10^{-4} is multiplied by the dose for the NPA, MOI, and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

[2] Probability of scenario occurrence equals 5×10^{-4} events per year. The probability of the accident is conservative (Section F.7.1).

Impact on Involved Workers

No fatalities would be expected among nearby workers from the radiological consequences of a fire in a local HEPA filter; the release of radioactivity from a HEPA filter fire would be small. The fire could result in release of airborne radioactivity. Fire alarms and radiation alarms would sound requiring evacuation of nearby workers. At most, two or three nearby workers may receive some additional radiation exposure from the released radioactivity. However, evacuation following the radiation alarms would prevent substantial radiation exposure.

F.5.4.2 STC Drop or Tip-Over

Description of Conditions

In this hypothetical accident scenario, mechanical damage to naval spent nuclear fuel occurs while the fuel is being removed from the shipping container and transferred into the fuel discharge station during a shipping container unloading operation. Mechanical damage to the naval spent nuclear fuel can occur as the result of inadvertent dropping of the transfer container or collapse of the transfer crane. It is assumed that seals on the STC are breached resulting in a mechanical leak path factor (0.001 for fission products and 0.005 for corrosion products). The building structure would not be damaged during this scenario, and the existing HEPA filter ventilation systems would continue to operate as normal. The radioactivity release is assumed to be drawn into the filtration system without mixing or dilution in the building.

Source Term

The source term used for this scenario is shown in Table F.5-4.

Table F.5-4: Source Term for the STC Drop or Tip-Over Scenario

Radionuclide[1]	Activity	Radionuclide[1]	Activity
	Curies		Curies
Am-241	1.92×10^{-6}	Kr-85	4.93×10^{1}
Ba-137m	5.69×10^{-3}	Nb-95	2.59×10^{-3}
Ce-144	8.33×10^{-3}	Pm-147	3.51×10^{-3}
Cm-242	2.11×10^{-5}	Pr-144	8.33×10^{-3}
Cm-244	6.75×10^{-6}	Pu-238	1.83×10^{-4}
Cs-134	2.98×10^{-3}	Pu-241	1.98×10^{-4}
Cs-137	6.03×10^{-3}	Ru-106	7.00×10^{-4}
Eu-154	1.70×10^{-4}	Sr-90	5.91×10^{-3}
H-3	2.29	Y-90	5.92×10^{-3}
I-129	5.51×10^{-6}	Zr-95	1.25×10^{-3}

[1] The radionuclides shown in the table contribute at least 99 percent of the radiation exposure from the scenario.

Probability

The STC drop causing mechanical damage to naval spent nuclear fuel is postulated to occur due to crane failure. The DOE performed evaluations of crane failure accidents in analyses for the Initial Handling Facility at Yucca Mountain (DOE 2008b) and developed a probability of 3.2×10^{-5} drops of heavy lifts per demand. The NNPP uses standards that would ensure similar or lower probability of a drop accident. Based on the number of shipping containers unloaded in a typical year, there would be 85 STC crane lifts. Although the rugged construction and design of the STC and naval spent nuclear fuel would reduce the likelihood of a drop resulting in a release to the environment, no additional factors are applied. The probability of an STC drop accident from crane failure would therefore be 2.7×10^{-3} per year. An annual probability of 2.7×10^{-3} is conservatively used to develop the annual risks in Table F.5-5 (Section F.7.1).

Results

The radiation exposure results, fatal cancer from radiation exposure, and annual risk to the General Population (i.e., product of fatal cancer and probability of accident occurrence) that would result from this hypothetical accident scenario are shown in Table F.5-5.

Table F.5-5: Health Effects From the STC Drop or Tip-Over Scenario

Weather Condition	Exposed Individual	TED (rem)	Fatal Cancer Per Individual[1]	Annual Risk of Developing Fatal Cancer to the General Population[2]
50 Percent Meteorology	Worker	1.6×10^{-2}	6.6×10^{-6}	
	MCW	1.1×10^{-5}	4.3×10^{-9}	
	NPA	6.5×10^{-6}	3.6×10^{-9}	
	MOI	1.0×10^{-5}	5.6×10^{-9}	
	Exposure to the General Population (person-rem)		**Fatal Cancer in the General Population[1]**	
	9.7×10^{-2}		5.3×10^{-5}	1.4×10^{-7}
95 Percent Meteorology	**Exposed Individual**	**TED (rem)**	**Fatal Cancer Per Individual[1]**	**Annual Risk of Developing Fatal Cancer to the General Population[2]**
	Worker	9.7×10^{-2}	4.0×10^{-5}	
	MCW	1.6×10^{-4}	6.7×10^{-8}	
	NPA	1.1×10^{-4}	6.2×10^{-8}	
	MOI	1.7×10^{-4}	9.1×10^{-8}	
	Exposure to the General Population (person-rem)		**Fatal Cancer in the General Population[1]**	
	7.3×10^{-1}		4.0×10^{-4}	1.1×10^{-6}

[1] To convert dose to fatal cancer, a factor of 4.1×10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5×10^{-4} is multiplied by the dose for the NPA, MOI, and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

[2] Probability of scenario occurrence equals 2.7×10^{-3} events per year. The probability of the accident is conservative (Section F.7.1).

Impact on Involved Workers

No fatalities would be expected among nearby workers from radiological consequences from an STC drop or tip-over scenario. The breach in the container seal could result in release of airborne radioactivity, and radiation alarms would sound requiring evacuation of nearby workers. At most, two or three nearby workers may receive some additional radiation exposure from the released radioactivity. However, evacuation following the radiation alarms would prevent substantial radiation exposure.

F.5.4.3 Airplane Crash into the Water Pool

Description of Conditions

Impact into water pools by aircraft with resulting damage to the naval spent nuclear fuel assemblies stored inside the water pool is evaluated for the temporary wet storage operation. The resultant debris from the airplane crash into the facility falls into the water pool causing mechanical damage to the naval spent nuclear fuel assemblies. The building structure would be damaged as a result of the airplane crash and all existing filtered ventilation systems would be non-functional. In addition, it is unlikely that an airplane would impact the water pool at an angle steep enough to expose the floor of the pool or the walls of the pool below the water level to the direct impact. It is assumed that the water pools remain intact because the walls of the water pool are constructed of thick, reinforced concrete with earth surrounding them, making them very strong; any fires that would result do not impact the submerged naval spent nuclear fuel. Fission products and corrosion products are released from the naval spent nuclear fuel assemblies into the water pool; however, the water pool water is not released to the environment because the water pool remains intact. The presence of water pool water results in only a release of gaseous fission products to the atmosphere. The scenario conservatively includes damage to the entire water pool inventory of approximately 400 equivalent fuel assemblies.

Source Term

The source term used for this scenario is shown in Table F.5-6.

Table F.5-6. Source Term for the Airplane Crash Into the Water Pool Scenario

Radionuclide[1]	**Activity**
	Curies
H-3	9.22×10^{2}
I-129	4.59×10^{-3}
Kr-85	1.98×10^{4}

[1] The radionuclides shown in the table contribute at least 99 percent of the radiation exposure from the scenario.

Probability

This accident was considered for inclusion in the analysis of risk; however, because of the low-level of commercial air traffic across NRF, distance from airports, and relatively small target footprint for a naval spent nuclear fuel handling facility, this scenario is not considered reasonably foreseeable without intentional human intervention. The consequences of this scenario are analyzed, but the probability for an IDA is considered to be unknowable (DOE 2004b) and no annual risks are developed in Table F.5-7.

Results

The radiation exposure results and fatal cancer from radiation exposure that would result from this IDA are shown in Table F.5-7.

Table F.5-7: Health Effects From the Airplane Crash Into the Water Pool Scenario

Weather Condition	Exposed Individual	TED (rem)	Fatal Cancer Per Individual[1]
50 Percent Meteorology	Worker	9.7×10^{-2}	4.0×10^{-5}
	MCW	8.0×10^{-5}	3.3×10^{-8}
	NPA	3.6×10^{-5}	2.0×10^{-8}
	MOI	2.6×10^{-4}	1.5×10^{-7}
	Exposure to the General Population (person-rem)		**Fatal Cancer in the General Population**[1]
	3.3		1.8×10^{-3}
95 Percent Meteorology	**Exposed Individual**	**TED** (rem)	**Fatal Cancer Per Individual**[1]
	Worker	6.0×10^{-1}	2.5×10^{-4}
	MCW	1.1×10^{-3}	4.7×10^{-7}
	NPA	5.7×10^{-4}	3.1×10^{-7}
	MOI	4.3×10^{-3}	2.3×10^{-6}
	Exposure to the General Population (person-rem)		**Fatal Cancer in the General Population**[1]
	2.5×10^{1}		1.4×10^{-2}

[1] To convert dose to fatal cancer, a factor of 4.1×10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5×10^{-4} is multiplied by the dose for the NPA, MOI, and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

Impact on Involved Workers

No fatalities to workers would be expected from radiological consequences. The source term would be released underwater. Attenuation by the water would occur for most radioactive products, but release of noble gases would cause radiation exposure to workers in the area. NRF Employees are trained to evacuate during radiological emergencies including the potential release of radioactive material. Evacuation following the airplane crash would prevent substantial radiation exposure.

F.5.4.4 Drained Water Pool

Description of Conditions

In this hypothetical accident scenario, an earthquake causes damage to the structure of the water pool, resulting in a complete loss of water pool water. The building structure would also be affected such that filtered ventilation systems would not be functional. For the No Action Alternative, thermal analysis of naval spent nuclear fuel that would be stored in the racks currently installed in the water pool shows that heat dissipation, largely from air circulation, is sufficient to prevent cladding failure for the time necessary to restore cooling. Similarly, for the Overhaul and New Facility Alternatives, thermal analysis for a new naval spent nuclear fuel rack design will show that heat dissipation, largely from air circulation, is sufficient to prevent cladding failure for the time necessary to restore cooling.

However, some of the corrosion products from the approximately 400 equivalent naval spent nuclear fuel assemblies stored in the water pool could be released. This release consists of corrosion products on naval spent nuclear fuel in the drained water pool that go airborne with thermal drafts generated as part of the natural circulation that prevents the naval spent nuclear fuel from overheating. In addition, corrosion products may become dislodged from the outside surface of the naval spent nuclear fuel during the earthquake and be entrained with the water that drains from the water pool. These corrosion products are modeled to be released directly into the ground.

The loss of water could result in increased direct radiation because the shielding properties of the water are removed. The impacts from the airborne release, the release of water pool water directly to the ground, and direct radiation are explicitly calculated.

Source Term

The airborne and waterborne source terms used for this scenario are shown in Table F.5-8.

Table F.5-8: Source Term for the Drained Water Pool Scenario

Radionuclide	Activity Released - Air	Activity Released - Water
	Curies	
Co-58	4.43	4.43×10^{1}
Co-60	1.25×10^{1}	1.25×10^{2}
Fe-55	2.23×10^{1}	2.23×10^{2}
Mn-54	7.36×10^{-1}	7.36
Nb-95	1.88×10^{-1}	1.88
Zn-65	3.14×10^{-1}	3.14

Probability

<u>No Action Alternative</u>

An updated seismic analysis of the ECF water pool structures concluded that the reinforced concrete portion of the pools and adjacent building superstructure meet the seismic strength requirements of DOE 2002b for a Performance Category (PC)-3 structure. The analysis verified that the ECF reinforced concrete pools would not collapse in a design basis earthquake with an annual probability of 4×10^{-4}. Since a seismic strength analysis does not confirm that the water pool would not leak subsequent to a seismic event, an annual probability of 1.0×10^{-3} is conservatively used to develop the annual risks for the No Action Alternative in Table F.5-9 (Section F.7.1).

<u>Overhaul Alternative</u>

The drained water pool is postulated to be caused by a beyond design basis earthquake. The probability evaluation is based on the design of the water pool structures, systems, and components (SSCs) alone and does not take credit for any further reductions from mitigation features in water pool design, emergency response actions, or emergency response systems that may be functional after the seismic event. Seismic strength requirements are discussed in Section 4.3.

To the extent practicable, SSCs for the overhauled facility would be designed in accordance with DOE 2008a, DOE 2012b, and ANS 2004 considering the consequences of unmitigated accidents.

The design basis is the combination of Seismic Design Category (SDC), Limit State, and other applicable criteria (specification of codes and standards, load combinations, quality provisions, etc.) that assure that the SSC maintains its safety function. For simplification in this discussion, emphasis is placed on the SDC and Limit State. The analysis of unmitigated accidents would indicate that the seismic design basis for the overhauled facility water pool would be SDC-5 Limit State D. However, for the purposes of determining a probability of a drained water pool for the Overhaul Alternative, it is assumed that the overhauled facility will have an SSC that meets at least SDC-3 Limit State D seismic standards to prevent the water pool from draining. This assumption is conservative and reflects the uncertainty surrounding the effort and resources necessary to design and construct an SDC-5 SSC given the fact that the existing facility has only been analyzed to the seismic strength requirements of DOE 2002b for a PC-3 structure. An updated seismic analysis of the ECF water pool concluded that the reinforced concrete portion of the pools and adjacent building superstructure meet the seismic strength requirements of DOE 2002b for a PC-3 structure. The analysis verified that the ECF reinforced concrete pools would not collapse in a design basis earthquake. A water pool system designed to SDC-3 Limit State D seismic standards would prevent leaks that could lead to draining following an earthquake with an annual probability of failure of 1.0×10^{-4} or less for this hypothetical accident scenario (ANS 2004). An annual probability of 1.0×10^{-4} is conservatively used to develop the annual risks for the Overhaul Alternative in Table F.5-9 (Section F.7.1).

<u>New Facility Alternative</u>

The new facility water pool would be designed to higher seismic standards than the current ECF water pool. DOE 2008a, DOE 2012b, and ANS 2004 would be evaluated to determine the appropriate design requirement for SSCs in a new facility considering the consequences of unmitigated accidents. The design basis is the combination of SDC, Limit State, and other applicable criteria (specification of codes and standards, load combinations, quality provisions, etc.) that assure that the SSC maintains its safety function. For simplification in this discussion, emphasis is placed on the SDC and Limit State. Based on the analysis of unmitigated accidents, the seismic design basis for the new facility water pool would be SDC-5 Limit State D. With this seismic design basis, the reinforced concrete walls of the water pool would not collapse and the water pool liner would prevent leaks that could lead to draining following an earthquake with an annual probability of failure of 1.0×10^{-5} or less for this hypothetical accident scenario (ANS 2004). An annual probability of 1.0×10^{-5} is conservatively used to develop the annual risks for the New Facility Alternative in Table F.5-9 (Section F.7.1).

Results

The radiation exposure results, fatal cancer from radiation exposure, and annual risk to the General Population (i.e. product of fatal cancer and probability of accident occurrence) that would result from this hypothetical accident scenario are shown in Table F.5-9. The annual risk to the General Population for the New Facility Alternative would be smaller than the annual risk for the Overhaul Alternative due to the higher seismic standard to which the new facility water pool SCCs would be designed.

Table F.5-9: Health Effects From the Drained Water Pool Scenario

Weather Condition	Exposed Individual	TED rem	Fatal Cancer Per Individual[1]	
50 Percent Meteorology	Worker	2.3	9.6×10^{-4}	Annual Risk of Developing Fatal Cancer to the General Population[2]
	MCW	8.7×10^{-4}	3.6×10^{-7}	
	NPA	6.6×10^{-4}	3.6×10^{-7}	
	MOI	5.1×10^{-3}	2.8×10^{-6}	
	Exposure to the General Population person-rem		**Fatal Cancer in the General Population[1]**	
	No Action Alternative	5.0×10^{1}	2.8×10^{-2}	2.8×10^{-5}
	Overhaul Alternative	5.0×10^{1}	2.8×10^{-2}	2.8×10^{-6}
	New Facility Alternative	5.0×10^{1}	2.8×10^{-2}	2.8×10^{-7}
95 Percent Meteorology	**Exposed Individual**	**TED** rem	**Fatal Cancer Per Individual[1]**	**Annual Risk of Developing Fatal Cancer to the General Population[2]**
	Worker	9.0	3.7×10^{-3}	
	MCW	1.3×10^{-2}	5.5×10^{-6}	
	NPA	1.1×10^{-2}	6.3×10^{-6}	
	MOI	8.4×10^{-2}	4.6×10^{-5}	
	Exposure to the General Population person-rem		**Fatal Cancer in the General Population[1]**	
	No Action Alternative	3.7×10^{2}	2.1×10^{-1}	2.1×10^{-4}
	Overhaul Alternative	3.7×10^{2}	2.1×10^{-1}	2.1×10^{-5}
	New Facility Alternative	3.7×10^{2}	2.1×10^{-1}	2.1×10^{-6}

[1] To convert dose to fatal cancer, a factor of 4.1×10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5×10^{-4} is multiplied by the dose for the NPA, MOI, and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5.)

[2] Probability of scenario occurrence equals 1.0×10^{-3} events per year for the No Action Alternative. Probability of scenario occurrence equals 1.0×10^{-4} events per year for the Overhaul Alternative. Probability of scenario occurrence equals 1.0×10^{-5} events per year for the New Facility Alternative. The probabilities are conservative (Section F.7.1).

Impact on Involved Workers

No fatalities to workers would be expected due to radiological consequences from a drained water pool. Complete drainage of the large amount of water in a water pool would take several hours to several days providing ample time for workers to leave the facility. Any attempts to restore water to the water pool would be done with consideration of the dose to the workers involved.

F.5.4.5 Hydrogen Detonation in the Water Pool

Description of Conditions

This hypothetical accident scenario evaluates a hydrogen detonation in a naval spent nuclear fuel storage container during the temporary wet storage operation. This scenario would not result in any damage to the water pool structure, the building structure, or any filtered ventilation systems. This scenario models a mechanical leak path factor of 0.1 for the material released from the storage container. This event is modeled to be an energetic release because of the force of the detonation. This event would occur underwater where the containers are located during temporary wet storage. It is assumed that any radioactivity released is drawn into the HEPA filtration system without mixing or dilution in the building.

Source Term

The source term used for this scenario is shown in Table F.5-10.

Table F.5-10: Source Term for the Hydrogen Detonation in the Water Pool Scenario

Radionuclide[1]	Activity Curies	Radionuclide[1]	Activity Curies
Ba-137m	7.43×10^{-4}	Pu-238	3.89×10^{-6}
C-14	2.09×10^{-3}	Rh-106	8.89×10^{-4}
Ce-144	1.34×10^{-2}	Ru-103	9.65×10^{-4}
Cs-134	4.70×10^{-4}	Ru-106	8.89×10^{-4}
Cs-137	7.88×10^{-4}	Sb-125	9.75×10^{-4}
Hf-175	3.87×10^{-3}	Sn-119m	4.37×10^{-3}
Hf-181	1.12×10^{-1}	Sr-89	3.24×10^{-3}
Kr-85	8.15×10^{-1}	Sr-90	7.88×10^{-4}
Nb-95	2.98×10^{-2}	Ta-182	2.19×10^{-2}
Nb-95m	1.77×10^{-4}	Y-91	5.55×10^{-3}
Pm-147	1.78×10^{-3}	Zn-65	7.40×10^{-5}
Pr-144	1.34×10^{-2}	Zr-95	1.51×10^{-2}

[1] The radionuclides shown in the table contribute at least 99 percent of the radiation exposure from the scenario.

Probability

The hydrogen detonation in a naval spent nuclear fuel storage container scenario would result from leakage of water into a sealed container stored in the water pool. Naval spent nuclear fuel storage containers are loaded dry and sealed to be water-tight after loading. It is modeled that the container seal degrades and is no longer water-tight. The water could disassociate due to high radiation fields into hydrogen and oxygen gas and a spark could cause a detonation. The probability for this scenario is estimated based on ECF operational experience, the materials expected to be stored, and the design of the storage container. The probability of the container having water present and developing an explosive mixture is based on NRF operational experience and the design of the container and container seal. The probability for an ignition is based on the materials being stored in the container and their potential for building up sufficient static charge to generate a spark that would ignite the mixture. The occurrence of a detonation is assumed to cause a failure in the container seal. The probability of a container rupturing is estimated as 1.6 x 10^{-6} per container. Based on work projections, 40 containers are estimated to be present in the water pool during a typical year. This results in an annual probability of 6.4 x 10^{-5} failures for this scenario. An annual probability of 6.4 x 10^{-5} is conservatively used to develop the annual risks in Table F.5-11 (Section F.7.1).

Results

The radiation exposure results, fatal cancer from radiation exposure, and annual risk to the General Population (i.e. product of fatal cancer and probability of accident occurrence) that would result from this hypothetical accident scenario are shown in Table F.5-11.

Table F.5-11: Health Effects From the Hydrogen Detonation in the Water Pool Scenario

Weather Condition	Exposed Individual	TED rem	Fatal Cancer Per Individual[1]	Annual Risk of Developing Fatal Cancer to the General Population[2]
50 Percent Meteorology	Worker	7.1 x 10^{-3}	2.9 x 10^{-6}	
	MCW	4.7 x 10^{-6}	1.9 x 10^{-9}	
	NPA	2.9 x 10^{-6}	1.6 x 10^{-9}	
	MOI	8.0 x 10^{-6}	4.4 x 10^{-9}	
	Exposure to the General Population person-rem		**Fatal Cancer in the General Population[1]**	
	7.8 x 10^{-2}		4.3 x 10^{-5}	2.7 x 10^{-9}
	Exposed Individual	**TED** rem	**Fatal Cancer Per Individual[1]**	**Annual Risk of Developing Fatal Cancer to the General Population[2]**
95 Percent Meteorology	Worker	4.3 x 10^{-2}	1.8 x 10^{-5}	
	MCW	7.2 x 10^{-5}	3.0 x 10^{-8}	
	NPA	5.0 x 10^{-5}	2.7 x 10^{-8}	
	MOI	1.3 x 10^{-4}	7.3 x 10^{-8}	
	Exposure to the General Population person-rem		**Fatal Cancer in the General Population[1]**	
	5.8 x 10^{-1}		3.2 x 10^{-4}	2.0 x 10^{-8}

1 To convert dose to fatal cancer, a factor of 4.1 x 10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5 x 10^{-4} is multiplied by the dose for the NPA, MOI, and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

2 Probability of scenario occurrence equals 6.4 x 10^{-5} events per year. The probability of the accident is conservative (Section F.7.1).

Impact on Involved Workers

No fatalities to workers would be expected from radiological consequences. The source term is released underwater. Attenuation by the water would occur for most radioactive products, but release of noble gases, some fission products, and some corrosion products would cause radiation exposure to workers in the area. Upon release from the surface of the water pool, radiation alarms would sound requiring evacuation of nearby workers. Evacuation following the radiation alarms would prevent substantial radiation exposure.

F.5.4.6 Mechanical Damage to Naval Spent Nuclear Fuel in the Water Pool

Description of Conditions

Accidental mechanical damage to naval spent nuclear fuel is evaluated from impact that could occur to the naval spent nuclear fuel in the water pool. It is postulated that a crane failure and an uncontrolled lowering of an STC occurs. The hypothetical accident includes damage to naval spent nuclear fuel assemblies in the fuel discharge stand, allowing fission products to escape. Gaseous and particulate nuclides are calculated to be released to the water pool. Due to the presence of the water pool water, no particulates are released into the air inside the facility. The initiating event would not impact the building or its systems, therefore the existing filtered ventilation systems would continue to operate in their normal manner. The radioactivity release is assumed to be drawn into the filtration system without mixing or dilution in the building. However, since only gases are released into the environment, the HEPA filtration has no effect on the source term.

Source Term

The source term used for this scenario is shown in Table F.5-12.

Table F.5-12: Source Term for the Mechanical Damage in the Water Pool Scenario

Radionuclide[1]	Activity
	Curies
H-3	2.30
I-129	$1.12\text{x } 10^{-5}$
Kr-85	$4.93 \text{ x } 10^{1}$

[1] The radionuclides shown in the table contribute at least 99 percent of the radiation exposure from the scenario.

Probability

At ECF and the new facility, an STC is used to bring naval spent nuclear fuel assemblies from the shipping container to the water pool. An STC is brought above an empty receiving port in a fuel discharge stand that can hold several naval spent nuclear fuel assemblies. The STC must accidentally fall from the overhead crane or the crane must fail, which damages the fuel discharge stand resulting in damage to the naval spent nuclear fuel assemblies in the stand.

As described in Section F.5.4.2, the probability of failure associated with crane failure is $3.2 \text{ x } 10^{-5}$ per demand (DOE 2008b). Using an average 85 STC crane lifts per year gives a probability of $2.7 \text{ x } 10^{-3}$ per year. Further, the crane failure must occur in the right location and the drop must be high enough to have sufficient energy to damage both the discharge station and the naval spent nuclear fuel inside. An additional factor of 10^{-1} is taken for this event based on the design margin of the fuel discharge stand giving a total probability of $2.7 \text{ x } 10^{-4}$ for the drop of the cask in the right location to cause damage to the naval spent nuclear fuel assemblies. The probability of an STC drop on naval spent nuclear fuel is $2.7 \text{ x } 10^{-4}$ events per year.

An annual probability of $2.7 \text{ x } 10^{-4}$ is conservatively used to develop the annual risks in Table F.5-13 (Section F.7.1).

Results

The radiation exposure results, fatal cancer from radiation exposure, and annual risk to the General Population (i.e., product of fatal cancer and probability of accident occurrence) that would result from this hypothetical accident scenario are shown in Table F.5-13.

Table F.5-13: Health Effects From the Mechanical Damage in the Water Pool Scenario

Weather Conditions	**Exposed Individual**	**TED**	**Fatal Cancer Per Individual**[1]	
		rem		
50 Percent Meteorology	Worker	2.4×10^{-4}	1.0×10^{-7}	**Annual Risk of Developing Fatal Cancer to the General Population**[2]
	MCW	2.0×10^{-7}	8.2×10^{-11}	
	NPA	9.0×10^{-8}	5.0×10^{-11}	
	MOI	6.5×10^{-7}	3.6×10^{-10}	
	Exposure to the General Population		**Fatal Cancer in the General Population**[1]	
	person-rem			
	8.1×10^{-3}		4.4×10^{-6}	1.2×10^{-9}
	Exposed Individual	**TED**	**Fatal Cancer Per Individual**[1]	
		rem		
95 Percent Meteorology	Worker	1.5×10^{-3}	6.2×10^{-7}	**Annual Risk of Developing Fatal Cancer to the General Population**[2]
	MCW	2.8×10^{-6}	1.2×10^{-9}	
	NPA	1.4×10^{-6}	7.8×10^{-10}	
	MOI	1.1×10^{-5}	5.8×10^{-9}	
	Exposure to the General Population		**Fatal Cancer in the General Population**[1]	
	person-rem			
	6.1×10^{-2}		3.3×10^{-5}	9.0×10^{-9}

[1] To convert dose to fatal cancer, a factor of 4.1×10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5×10^{-4} is multiplied by the dose for the NPA, MOI, and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

[2] Probability of scenario occurrence equals 2.7×10^{-4} events per year. The probability of the accident is conservative (Section F.7.1).

Impact on Involved Workers

No fatalities to workers would be expected from radiological consequences. The release of the source term is underwater. Attenuation by the water would occur for most radioactive products, but release of noble gases would cause radiation exposure to workers in the area. Upon releases from the surface of the water pool, radiation alarms would sound requiring evacuation of nearby workers. Evacuation following the radiation alarms would prevent substantial radiation exposure.

F.5.4.7 Inter-Facility Transport Accident

Description of Conditions

In this scenario an STC with naval spent nuclear fuel from the core examination library (being transferred from ECF to a new facility on NRF property) or examination specimens (being transferred back and forth between ECF and the new facility on NRF property) is involved in a vehicular accident. Therefore, this scenario is only applicable to the New Facility Alternative. The scenario is postulated to occur after the initial visual examination while the naval spent nuclear fuel assembly is transferred to a geographically separate core examination facility. The accident results in a mechanical impact with the transport container containing one naval spent nuclear fuel assembly, resulting in a breach of the container seals (a mechanical leak path factor of 0.1) releasing corrosion products and fission products with a subsequent fire associated with the accident vehicles. A heated release is modeled because of the vehicle fire. No filtration by HEPA filters is assumed because this event occurs outside with the transport container exposed to the environment.

Source Term

The source term used for this scenario is shown in Table F.5-14.

Table F.5-14: Source Term for the Inter-Facility Transport Accident Scenario

Radionuclide[1]	Activity
	Curies
Ba-137m	1.04×10^{1}
Cs-134	8.14×10^{1}
Cs-137	1.65×10^{2}
Sr-90	1.08×10^{1}

[1] The radionuclides shown in the table contribute at least 99 percent of the radiation exposure from the scenario.

Probability

This accident was considered for inclusion in the analysis of risk; however, because of the slow travel speeds, short travel distance across NRF property, ability to restrict access to the roadway, and infrequent naval spent nuclear fuel assembly transfers, this accident is not considered reasonably foreseeable without intentional human intervention. The consequences of this accident are analyzed, but the probability for an IDA is considered to be unknowable (DOE 2004b) and no annual risks are developed in Table F.5-15.

Results

The radiation exposure results and fatal cancer from radiation exposure that would result from this IDA are shown in Table F.5-15.

Table F.5-15: Health Effects From the Inter-Facility Transport Accident Scenario

Weather Condition	Exposed Individual	TED rem	Fatal Cancer Per Individual[1]
50 Percent Meteorology	Worker	1.3×10^{1}	5.3×10^{-3}
	MCW	8.5×10^{-3}	3.5×10^{-6}
	NPA	2.8×10^{-3}	1.5×10^{-6}
	MOI	1.0×10^{-1}	5.5×10^{-5}
	Exposure to the General Population person-rem		**Fatal Cancer in the General Population**[1]
	9.4×10^{2}		5.2×10^{-1}
95 Percent Meteorology	**Exposed Individual**	**TED (rem)** rem	**Fatal Cancer Per Individual**[1]
	Worker	7.9×10^{1}	3.2×10^{-2}
	MCW	1.3×10^{-1}	5.4×10^{-5}
	NPA	4.8×10^{-2}	2.6×10^{-5}
	MOI	1.6	9.0×10^{-4}
	Exposure to the General Population person-rem		**Fatal Cancer in the General Population**[1]
	7.0×10^{3}		3.8

[1] To convert dose to fatal cancer, a factor of 4.1×10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5×10^{-4} is multiplied by the dose for the NPA, MOI, and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

Impact on Involved Workers

It is likely no fatalities would occur from radiological consequences. The container seal could be breached and some airborne radioactivity could be dispersed in the vehicle fire. Workers involved in the accident could be exposed to significant levels of radioactivity from the inhalation of the radioactivity released by the fire if they remain downwind of the fire.

F.5.4.8 Inadvertent Fuel Cutting in the Water Pool

Description of Conditions

This hypothetical scenario evaluates inadvertent cutting across the fuel region when removing structural material from the ends of a naval spent nuclear fuel assembly during resizing, inadvertent cutting into the fuel region when milling the naval spent nuclear fuel assembly for examination, or inadvertent drilling through the fuel region when preparing to attach neutron poison. To develop the source term, the milling operation is used for conservatism. All of these processing operations are performed underwater, resulting in the release of only gaseous products from one naval spent nuclear fuel assembly into the atmosphere. This initiating event would not impact the building or its systems; therefore, the existing filtered ventilation systems continue to operate in their normal manner. However, since only gases are released into the environment, the HEPA filtration has no effect on this scenario.

Source Term

The source term used for this scenario is shown in Table F.5-16.

Table F.5-16: Source Term for the Inadvertent Fuel Cutting in the Water Pool Scenario

Radionuclide[1]	Activity
	Curies
H-3	4.59
I-129	2.23×10^{-5}
Kr-85	9.87×10^{1}

[1] The radionuclides shown in the table contribute at least 99 percent of the radiation exposure from the scenario.

Probability

The probability of damage to naval spent nuclear fuel during resizing, securing, or milling operations is small. Since the milling operation forms the basis for the source term, it is also used to develop the scenario probability. To cut into the naval spent nuclear fuel during milling, there must be operator error in positioning the naval spent nuclear fuel in the cutting apparatus and a second error in selecting the saw cut depth. In addition, an independent inspector would need to err in checking the proper positioning of the cutting position. The combined operator errors and independent checker error probabilities for cutting into the naval spent nuclear fuel is evaluated to be less than 1.0×10^{-5} per cut; however, a conservative value of 1×10^{-5} total human error probability is used for the analysis (NRC 1983 and NRC 2005). Using an estimate of 40 milling cuts per year on naval spent nuclear fuel assemblies during milling operations results in an annual probability of cutting into the fuel region of less than 4.0×10^{-4}. An annual probability of 4.0×10^{-4} is conservatively used to develop the annual risks in Table F.5-17 (Section F.7.1).

Results

The radiation exposure results, fatal cancer from radiation exposure, and annual risk to the General Population (i.e., product of fatal cancer and probability of accident occurrence) that would result from this hypothetical accident scenario are shown in Table F.5-17.

Table F.5-17: Health Effects From the Inadvertent Fuel Cutting In the Water Pool Scenario

Weather Condition	Exposed Individual	TED (rem)	Fatal Cancer Per Individual[1]	
50 Percent Meteorology	Worker	4.9×10^{-4}	2.0×10^{-7}	**Annual Risk of Developing Fatal Cancer to the General Population**[2]
	MCW	4.0×10^{-7}	1.6×10^{-10}	
	NPA	1.8×10^{-7}	9.9×10^{-11}	
	MOI	1.3×10^{-6}	7.2×10^{-10}	
	Exposure to the General Population (person-rem)		**Fatal Cancer in the General Population**[1]	
	1.6×10^{-2}		8.9×10^{-6}	3.5×10^{-9}
95 Percent Meteorology	**Exposed Individual**	**TED** (rem)	**Fatal Cancer Per Individual**[1]	**Annual Risk of Developing Fatal Cancer to the General Population**[2]
	Worker	3.0×10^{-3}	1.2×10^{-6}	
	MCW	5.7×10^{-6}	2.3×10^{-9}	
	NPA	2.8×10^{-6}	1.6×10^{-9}	
	MOI	2.1×10^{-5}	1.2×10^{-8}	
	Exposure to the General Population (person-rem)		**Fatal Cancer in the General Population**[1]	
	1.2×10^{-1}		6.7×10^{-5}	2.7×10^{-8}

[1] To convert dose to fatal cancer, a factor of 4.1×10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5×10^{-4} is multiplied by the dose for the NPA, MOI, and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

[2] Probability of scenario occurrence equals 4.0×10^{-4} events per year. The probability of the accident is conservative (Section F.7.1).

Impact on Involved Workers

No fatalities to workers would be expected from radiological consequences. The release of the source term is underwater. Attenuation by the water would occur for most radioactive products, but release of noble gases would cause radiation exposure to workers in the area. Upon release from the surface of the water pool, radiation alarms would sound requiring evacuation of nearby workers. Evacuation following the radiation alarms would prevent substantial radiation exposure.

F.5.4.9 Inadvertent Criticality in the Water Pool

Description of Conditions

In this hypothetical accident scenario, two naval spent nuclear fuel assemblies come together and form a critical mass within the water pool during the loading of a naval spent fuel canister. This scenario assumes a drop of a naval spent nuclear fuel basket such that the basket rearranges and fuel separation is lost. An uncontrolled chain reaction producing 2×10^{19} fissions is postulated to occur between two of the dropped naval spent nuclear fuel assemblies; the integrity of the water pool would not be jeopardized by this hypothetical accident scenario because the walls of the water pool are constructed of thick, reinforced concrete with earth surrounding them, making them very strong. Since the initiating event would have no impact on the building or its systems, it is modeled that the existing HEPA-filtered ventilation systems continue to operate in their normal manner. The radioactivity release is assumed to be drawn into the filtration system without mixing or dilution in the building. An energetic release with fuel overheating is modeled because of the energy involved in a criticality event. Some removal of fission products by the water pool water due to an energetic underwater release is also included. The increase in direct radiation from the criticality event is explicitly calculated.

Source Term

The source term used for this scenario is shown in Table F.5-18.

Table F.5-18: Source Term for the Inadvertent Criticality in the Water Pool Scenario

Radionuclide[1]	Activity
	Curies
Ba-137m	2.28
Cs-134	1.79×10^{1}
Cs-137	3.62×10^{1}
Sr-90	2.37

[1] The radionuclides shown in the table contribute at least 99 percent of the radiation exposure from the scenario.

Probability

An inadvertent criticality during naval spent nuclear fuel handling operations is extremely unlikely. No events of this type have occurred during handling of naval spent nuclear fuel. Prevention of inadvertent, uncontrolled nuclear chain reactions is assured by the design of equipment for the naval spent nuclear fuel, primarily by diminishing the chances for a chain reaction by spacing the naval spent nuclear fuel components far enough apart to eliminate nuclear interaction. Special attention is given to the risk of inadvertent criticality which might be experienced during naval spent nuclear fuel transport and handling operations. Prevention of an inadvertent criticality is provided by designing the reactor servicing system such that criticality would not occur even in the event of unforeseen equipment failures and personnel errors. This criterion specifies that the naval spent nuclear fuel would not attain a critical condition even if any two unlikely and independent accidents occur at the same time. This scenario involves the failure of a crane causing a loaded naval spent nuclear fuel basket holding several naval spent nuclear fuel assemblies to fall. The crane failure is assumed to lead to dropping and toppling of the basket leading to the ejection of the naval spent nuclear fuel assemblies. A sufficient number of naval spent nuclear fuel assemblies are postulated to be ejected into an arrangement that would result in a criticality in two naval spent nuclear fuel assemblies. It is also postulated that the drop and subsequent criticality damages the naval spent nuclear fuel assemblies sufficiently to cause a release of the fission products.

The drop of the basket due to a failure of a crane would be similar to the shielded basket drop accident and would have a probability of less than 3.5×10^{-4} drop per year. (Section F.5.4.10.) Due to equipment designs and facility constraints, the drop of the basket would have less than a 4.2×10^{-2} probability of ejecting naval spent nuclear fuel assemblies from the basket as a result of a drop. There would be a less than a 1×10^{-1} probability that the ejected naval spent nuclear fuel assemblies would achieve a critical arrangement. Additional equipment features would reduce these probabilities by preventing toppling of the basket; however, no additional factors are applied resulting in a conservative calculation of risk. Since all of these events must occur to result in a criticality, these probabilities are multiplied, and the overall probability of an accidental criticality is less than 1.5 x 10^{-6} per year. An annual probability of 1.5 x 10^{-6} is conservatively used to develop the annual risks in Table F.5-19 (Section F.7.1).

Results

The radiation exposure results, fatal cancer from radiation exposure, and annual risk to the General Population (i.e., product of fatal cancer and probability of accident occurrence) that would result from this hypothetical accident scenario are shown in Table F.5-19.

Table F.5-19: Health Effects From the Inadvertent Criticality in the Water Pool Scenario

Weather Condition	Exposed Individual	TED rem	Fatal Cancer Per Individual[1]	Annual Risk of Developing Fatal Cancer to the General Population[2]
50 Percent Meteorology	Worker	4.8	2.0 x 10^{-3}	
	MCW	6.2 x 10^{-3}	2.6 x 10^{-6}	
	NPA	1.8 x 10^{-3}	9.7 x 10^{-7}	
	MOI	2.4 x 10^{-2}	1.3 x 10^{-5}	
	Exposure to the General Population person-rem		**Fatal Cancer in the General Population[1]**	
	2.1 x 10^{2}		1.1 x 10^{-1}	1.7 x 10^{-7}
95 Percent Meteorology	**Exposed Individual**	**TED** rem	**Fatal Cancer Per Individual[1]**	**Annual Risk of Developing Fatal Cancer to the General Population[2]**
	Worker	2.8 x 10^{1}	1.1 x 10^{-2}	
	MCW	4.2 x 10^{-2}	1.7 x 10^{-5}	
	NPA	1.4 x 10^{-2}	7.5 x 10^{-6}	
	MOI	3.6 x 10^{-1}	2.0 x 10^{-4}	
	Exposure to the General Population person-rem		**Fatal Cancer in the General Population[1]**	
	1.6 x 10^{3}		8.5 x 10^{-1}	1.3 x 10^{-6}

[1] To convert dose to fatal cancer, a factor of 4.1 x 10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5 x 10^{-4} is multiplied by the dose for the NPA, MOI, and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

[2] Probability of scenario occurrence equals 1.5 x 10^{-6} events per year. The probability of the accident is conservative (Section F.7.1).

Impact on Involved Workers

It is likely no fatalities would occur from radiological consequences. Shielding by the water would be sufficient to prevent substantial radiation exposure of other nearby workers. Expulsion of a cone of water above the criticality could lead to significant radiation exposure to any workers who might be directly above the location of the criticality.

F.5.4.10 SBTC Drop or Tip-Over

Description of Conditions

In this hypothetical accident scenario, mechanical damage to naval spent nuclear fuel occurs while the naval spent nuclear fuel is inside of the SBTC during the loading of a naval spent fuel canister. Mechanical damage to the naval spent nuclear fuel could occur as the result of inadvertent dropping of the transfer container or the transfer container tipping over due to operator error. It is assumed that seals on the SBTC are breached resulting in a mechanical leak path factor of 0.001 for fission products and 0.005 for corrosion products. The facility structure would not be damaged during this scenario, and all existing filtered ventilation systems would continue to operate as normal. The radioactivity release is assumed to be drawn into the HEPA filtration system without mixing or dilution in the building.

Source Term

The source term used for this scenario is shown in Table F.5-20.

Table F.5-20: Source Term for the SBTC Drop or Tip-Over Scenario

Radionuclide[1]	Activity	Radionuclide[1]	Activity
	Curies		Curies
Am-241	1.92×10^{-5}	H-3	1.37×10^{1}
Ba-137m	3.73×10^{-2}	I-129	3.85×10^{-5}
Ce-144	4.79×10^{-3}	Kr-85	2.88×10^{2}
Cm-244	4.24×10^{-5}	Pu-238	1.25×10^{-3}
Cs-134	8.10×10^{-3}	Pu-241	1.21×10^{-3}
Cs-137	3.95×10^{-2}	Sr-90	3.86×10^{-2}
Eu-154	9.47×10^{-4}	Y-90	3.86×10^{-2}

[1] The radionuclides shown in the table contribute at least 99 percent of the radiation exposure from the scenario.

Probability

The SBTC drop causing mechanical damage to naval spent nuclear fuel is postulated to occur due to a lifting failure. The DOE performed detailed evaluations of crane failure accidents in analyses for the Initial Handling Facility at Yucca Mountain (DOE 2008b) and developed a probability of 3.2×10^{-5} drops of heavy lifts per demand. The NNPP uses standards that would ensure similar or lower probability of a drop accident. Based on the number of shielded baskets loaded in a typical year, there would be 11 SBTC lifting demands. Although the rugged construction and design of the SBTC and naval spent nuclear fuel would reduce the likelihood of a drop resulting in a release to the environment, no additional factors are applied. The annual probability of an SBTC drop accident would therefore be 3.5×10^{-4}. An annual probability of 3.5×10^{-4} is conservatively used to develop the annual risks in Table F.5-21 (Section F.7.1).

Results

The radiation exposure results, fatal cancer from radiation exposure, and annual risk to the General Population (i.e., product of fatal cancer and probability of accident occurrence) that would result from this hypothetical accident scenario are shown in Table F.5-21.

Table F.5-21: Health Effects From the SBTC Drop or Tip-Over Scenario

Weather Condition	Exposed Individual	TED rem	Fatal Cancer Per Individual[1]	Annual Risk of Developing Fatal Cancer to the General Population[2]
50 Percent Meteorology	Worker	9.6×10^{-2}	3.9×10^{-5}	
	MCW	6.3×10^{-5}	2.6×10^{-8}	
	NPA	3.8×10^{-5}	2.1×10^{-8}	
	MOI	5.5×10^{-5}	3.0×10^{-8}	
	Exposure to the General Population person-rem		**Fatal Cancer in the General Population[1]**	
	5.3×10^{-1}		2.9×10^{-4}	1.0×10^{-7}
95 Percent Meteorology	**Exposed Individual**	**TED** rem	**Fatal Cancer Per Individual[1]**	**Annual Risk of Developing Fatal Cancer to the General Population[2]**
	Worker	5.8×10^{-1}	2.4×10^{-4}	
	MCW	9.7×10^{-4}	4.0×10^{-7}	
	NPA	6.6×10^{-4}	3.6×10^{-7}	
	MOI	9.1×10^{-4}	5.0×10^{-7}	
	Exposure to the General Population person-rem		**Fatal Cancer in the General Population[1]**	
	4.0		2.2×10^{-3}	7.7×10^{-7}

[1] To convert dose to fatal cancer, a factor of 4.1×10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5×10^{-4} is multiplied by the dose for the NPA, MOI, and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

[2] Probability of scenario occurrence equals 3.5×10^{-4} events per year. The probability of the accident is conservative (Section F.7.1).

Impact on Involved Workers

It is likely no fatalities would occur among nearby workers from radiological consequences from an SBTC drop or tip-over accident. The breach in the container seal could result in release of airborne radioactivity, and radiation alarms would sound requiring evacuation of nearby workers. Nearby workers may receive significant radiation exposure from the released radioactivity due to loss of container shielding.

F.5.4.11 Windborne Projectile into the SBTC

Description of Conditions

In this hypothetical accident scenario, a tornado propels a large object (e.g., a pipe) into ECF or the new facility structures during the naval spent nuclear fuel canister loading operation. It is assumed that the propelled object impacts the SBTC causing the container seal to be breached resulting in a mechanical leak path factor of 0.005 for corrosion products. Since the wind-propelled object must first pass through the building's structural wall and then impact a robust SBTC, it is modeled that no mechanical damage of the naval spent nuclear fuel within the SBTC occurs. However, some corrosion products would be dislodged from the outside surface of the naval spent nuclear fuel and released from the container. The damage to the building structure is assumed to be extensive enough that filtered ventilation systems are not considered functional. Any radioactivity is assumed to be released directly to the atmosphere without mixing or dilution in the building.

Source Term

The source term used for this scenario is shown in Table F.5-22.

Table F.5-22: Source Term for the Windborne Projectile Into SBTC Scenario

Radionuclide[1]	Activity
	Curies
Fe-55	1.50×10^{-2}
Co-60	1.15×10^{-2}
Ni-63	5.32×10^{-3}

[1] The radionuclides shown in the table contribute at least 99 percent of the radiation exposure from the scenario.

Probability

The probability of a windborne projectile striking an SBTC is based upon DOE 2002b. DOE 2002b establishes a wind speed design criteria capable of generating windborne projectiles at an annual probability of 1×10^{-3} for the region in which NRF is located. Hurricanes are not considered plausible in this region, and tornado probabilities are significantly lower than straight-line winds; they are not used in this analysis. The probability of a windborne projectile striking an SBTC is estimated as 3.3×10^{-2} strikes per incident. It is assumed that a windborne projectile strike would cause a loss of the SBTC seals even though the SBTC is a very large and heavily shielded container; therefore, the annual probability of a windborne projectile strike causing a failure in the SBTC seals would be 3.3×10^{-5}. An annual probability of 3.3×10^{-5} is conservatively used to develop the annual risks in Table F.5-23 (Section F.7.1).

Results

The radiation exposure results, fatal cancer from radiation exposure, and annual risk to the General Population (i.e., product of fatal cancer and probability of accident occurrence) that would result from this hypothetical accident scenario are shown in Table F.5-23.

Table F.5-23: Health Effects From the Windborne Projectile Into SBTC Scenario

Weather Conditions	Exposed Individual	TED (rem)	Fatal Cancer Per Individual[1]	Annual Risk of Developing Fatal Cancer to the General Population[2]
50 Percent Meteorology	Worker	1.2×10^{-3}	4.7×10^{-7}	
	MCW	7.6×10^{-7}	3.1×10^{-10}	
	NPA	5.9×10^{-7}	3.3×10^{-10}	
	MOI	4.5×10^{-6}	2.5×10^{-9}	
	Exposure to the General Population (person-rem)		**Fatal Cancer in the General Population[1]**	
	4.3×10^{-2}		2.4×10^{-5}	7.9×10^{-10}
95 Percent Meteorology	**Exposed Individual**	**TED** (rem)	**Fatal Cancer Per Individual[1]**	**Annual Risk of Developing Fatal Cancer to the General Population[2]**
	Worker	7.0×10^{-3}	2.9×10^{-6}	
	MCW	1.2×10^{-5}	4.8×10^{-9}	
	NPA	1.0×10^{-5}	5.6×10^{-9}	
	MOI	7.3×10^{-5}	4.0×10^{-8}	
	Exposure to the General Population (person-rem)		**Fatal Cancer in the General Population[1]**	
	3.2×10^{-1}		1.8×10^{-4}	5.8×10^{-9}

[1] To convert dose to fatal cancer, a factor of 4.1×10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5×10^{-4} is multiplied by the dose for the NPA, MOI, and General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

[2] Probability of scenario occurrence equals 3.3×10^{-5} events per year. The probability of the accident is conservative (Section F.7.1).

Impact on Involved Workers

No fatalities would be expected among nearby workers from radiological consequences from a windborne projectile into an SBTC. The container seal could be breached and some airborne corrosion products could be released. However, no damage occurs to the naval spent nuclear fuel inside the container; therefore, no fission products are released into the facility. Nearby workers may receive some radiation exposure from the released corrosion products.

F.5.4.12 Minor Water Pool Leak

According to NRC 2013, water pool leaks have been detected at 13 commercial nuclear power plant sites; of these, nine have resulted in inadvertent liquid radioactive releases to the environment. Lessons learned from studies of water pool leaks would be considered in the designs for the new facility water pool or refurbishment. This hypothetical accident scenario qualitatively evaluates the impact of a leak that develops in the water pool resulting in a discharge of water pool water to the environment.

Unlike other hypothetical accident scenarios which involve events that are acute and self-evident, a minor water pool leak might persist for some time before discovery (NRC 2006). Significant short-term water loss from the water pool is likely to be identified due to monitoring of water pool water levels. Additions of water to the water pool would be carefully tracked for unexpected trends. To go undetected, a leak rate would need to be less than the rate of make-up water added to maintain a constant water level in the pool, replacing water lost to evaporation.

Combinations of factors minimize the likelihood that a water pool leak will result in noticeable off-site environmental impacts.

- The radiological contaminants in the water pools are primarily activated corrosion products, not fission products from naval spent nuclear fuel. Additionally, the tritium in the water pool is a minor contaminant from historical operations. The contaminant levels in the water pool are minimized through the use of water pool filtration systems.

- The structural concrete walls of the pool remain formidable impediments to a release to the environment because of the very low permeability of concrete. In addition, as radionuclides migrate through the concrete structure, their concentrations in the leaked water would be reduced by sorption onto the concrete material. Sorption, a process by which a substance in solution attaches onto a solid material, can retard the movement of radionuclides and thus reduce radionuclide concentrations in the leaked water.

- Various hydrologic and chemical processes would reduce the environmental impacts of radionuclides associated with leaked water pool water. The radionuclide concentrations would continue to decrease due to mixing, dilution, and radioactive decay. In addition, adsorption of radionuclides onto subsurface materials may significantly delay the transport of radionuclides in the subsurface environment and keep radionuclide concentrations at low levels in groundwater. Further, adsorption would retard the movement of radionuclides because radionuclide mass is adsorbed on solid surfaces and becomes unavailable for transport by water. Although desorption of radionuclides from the subsurface material back into the groundwater may eventually occur, concentrations would be much less than if no sorption occurred. Different radionuclides have different degrees of adsorptive interaction with geologic media due to the geologic materials and water chemistry. Some radionuclides (e.g., tritium) do not adsorb onto soil and bedrock and, therefore, move generally at the same rate and direction as groundwater. Other radionuclides (e.g., Sr-90 and Cs-137) strongly adsorb onto geologic media and, thus, move much slower than the groundwater velocity and at reduced concentrations compared to the source of a leak. The degree of radionuclide adsorption and retardation depends on the properties of the geologic media (e.g., mineralogy, reactive surface area, and presence of organic matter) and groundwater chemistry (e.g., pH, oxidation-reduction potential, and complexing ion concentration).

- Groundwater monitoring is performed at NRF making it unlikely that leakage from the water pool would remain undetected for an extended period of time.

Based on these factors, the potential for a minor water pool leak to significantly impact the environment would be small. Nonetheless, the impact of a water pool leak three times larger than the leak assumed in the commercial industry (NRC 2013) is assessed and compared to natural background radiation.

No Action Alternative and Overhaul Alternative (Refurbishment Period)

The ECF water pool surfaces are covered with a fiberglass or epoxy coating which serves as an extra barrier to water leakage. Over the next 40 years, preventative and corrective maintenance may not be sufficient to keep the ECF infrastructure and water pools in safe working order. Maintenance and repairs without significant upgrades and refurbishments may not be sufficient to sustain the proper functioning of structures, systems, and components. Additionally, the ECF water pool does not have a liner, creating the potential for water infiltration into the reinforced concrete structure and the potential for corrosion damage of the reinforcing bar within the structure. The capability to detect and collect small leaks, a common feature in modern water pools, is not present for the ECF water pool. However, groundwater monitoring is performed at NRF making it unlikely that leakage from the water pool would remain undetected for an extended period of time.

For purpose of the No Action Alternative assessment, it is assumed that the leak persists for a 40-year duration. The 40-year leak period is applied to conservatively account for a leak that is located in an area of the water pool that cannot be repaired or a small leak that goes undetected as the pool continues to deteriorate. The rate (in gallons per day) of a leak that might develop in the future as the facility continues to degrade is uncertain. Based on current water inventory information tracked to compensate for evaporation, a bounding leak rate from the current ECF water pool would be 150 gallons per day. For conservatism, a rate of 300 gallons per day is assumed for the 40-year period.

The radionuclide inventory of the water pool water is based on analysis of the water in the ECF water pool. Assuming a leak were to occur, it is estimated that the MOI peak annual dose would be 7.6×10^{-3} millirem (7.6×10^{-6} rem), which is less than 0.0025 percent of the annual dose from natural background radiation. (An individual member of the public receives approximately 310 millirem (3.1×10^{-1} rem) per year from natural background radiation alone (Section F.2.2)). Additionally, the concentration of radionuclides in the water at the location of an individual member of the public would be much lower than the EPA Maximum Contaminant Levels (MCLs) for drinking water (Section 3.4). Therefore, the resulting impact on public health and safety from a minor water pool leak would be negligible in comparison to the amount of natural background radiation received by individuals annually.

Overhaul Alternative (Post-Refurbishment Operational Period) and New Facility Alternative

The water pool for both the Overhaul Alternative and the New Facility Alternative would be lined to form a water-tight barrier between the water in the pool and the concrete walls of the water pool. In addition, a groundwater monitoring system would actively monitor the site for leaks. It is expected that the combination of the water pool liner, concrete walls, and groundwater monitoring would prevent water pool water from leaking, undetected, into the environment. Further, the integrity of the water pool liner and structure would be ensured by maintaining a low-corrosive environment in the water pool water through proper water chemistry control.

Relatively small cracks could occur in the water pool liner due to stress-corrosion cracking and crevice corrosion of the water pool liner, seam or plug weld defects, or damage to the liner, resulting in leakage from the water pool (NRC 2012). Water that bypasses the water pool liner could migrate through construction joints and cracks in the concrete due to shrinkage, creep, or alkali-silica reaction, resulting in a release of contaminated water outside the water pool.

For purpose of the Overhaul Alternative and New Facility Alternative assessments, it is assumed that the leak persists for 5 years without detection at a rate of 300 gallons per day. The radionuclide inventory of the water pool water is based on analysis of the water in the ECF water pool. Assuming a leak were to occur, it is estimated that the MOI peak annual dose from a leak would be 2.4 x 10^{-3} millirem (2.4 x 10^{-6} rem) which is less than 0.00077 percent of the annual dose from natural background radiation. (An individual member of the public receives approximately 310 millirem (3.1 x 10^{-1} rem) per year from natural background radiation alone (Section F.2.2)). Additionally, the concentration of radionuclides in the water at the location of an individual member of the public would be much lower than the EPA Maximum Contaminant Levels (MCLs) for drinking water (Section 3.4). Therefore, the resulting impact on public health and safety from a minor water pool leak would be negligible in comparison to the amount of natural background radiation received by individuals annually.

F.5.5 Hypothetical Accident Evaluations Summary

For the hypothetical accident scenarios and IDAs evaluated, the impacts to the Worker, MCW, NPA, MOI, and General Population all result in a small likelihood of developing fatal cancer from radiation exposure. The cancer would be expected to occur over the lifetime of an individual if the accident were to occur. The hypothetical accident scenario that results in the highest annual risk is the drained water pool, and the IDA that results in the highest consequence is the inter-facility transport accident. If these hypothetical scenarios were to occur, the likelihood of fatal cancer for the Worker, MCW, NPA, MOI, and the annual risk of developing fatal cancer in the General Population is small.

For perspective, the average American's risk of dying from cancer from normal activity is 0.15, or 1 chance in 6.7, over his or her lifetime. Using this probability of 1 chance in 6.7, approximately 22,650 cancer fatalities would be expected in the General Population in the 80.5-kilometer (50-mile) radius surrounding NRF (approximately 151,000 people) during a lifetime of normal activity unrelated to NRF emissions (Section F.2.6).

For accident scenarios, the dose and likelihood of fatal cancer for the Worker, MCW, NPA, and MOI is presented (Table F.5-24 and Table F.5-25), and the dose and annual risk of developing fatal cancer is presented for the General Population (Table F.5-26 and Table F.5-27). The annual risk of developing fatal cancer with the 50 percent weather condition in the General Population (fatal cancer in the General Population multiplied by the annual probability of the accident) from a drained water pool is 1 chance in 36,000 (No Action Alternative), 1 chance in 360,000 (Overhaul Alternative), or 1 chance in 3.6 million (New Facility Alternative). The increased likelihood of fatal cancer from the accident is negligible compared to the risk of developing fatal cancer from a lifetime of normal activities.

For IDAs, annual risk calculations are not completed because the probability of the event is considered “unknowable” (DOE 2004b). However, dose and consequences (likelihood of cancer) are presented for the Worker, MCW, NPA, and MOI (Table F.5-24 and Table F.5-25) and General Population (Table F.5-26 and Table F.5-27). The number of fatal cancers in the General Population with the 50 percent weather condition from an inter-facility transport accident scenario would increase by 0.52 (less than one instance of developing fatal cancer in 151,000 people). This increase in fatal cancer, if the IDA were to occur, would be added to the 22,650 fatal cancers expected in the General Population from lifetimes of normal activity. The increased likelihood of fatal cancer if this IDA were to occur is negligible compared to the risk of developing fatal cancer from a lifetime of normal activities.

Table F.5-24: Dose Impacts to Individuals From Radiological Accident Scenarios with 50 Percent Meteorology

Accident Scenario Description	Exposed Individual							
	Worker		MCW		NPA		MOI	
	Dose rem	Fatal Cancer[1]	Dose rem	Fatal Cancer[1]	Dose rem	Fatal Cancer[1]	Dose rem	Fatal Cancer[1]
HEPA Filter Fire	5.5×10^{-7}	2.3×10^{-10}	3.6×10^{-10}	1.5×10^{-13}	2.8×10^{-10}	1.5×10^{-13}	2.1×10^{-9}	1.2×10^{-12}
Shielded Transfer Container Drop or Tip-Over	1.6×10^{-2}	6.6×10^{-6}	1.1×10^{-5}	4.3×10^{-9}	6.5×10^{-6}	3.6×10^{-9}	1.0×10^{-5}	5.6×10^{-9}
Airplane Crash into Water Pool	9.7×10^{-2}	4.0×10^{-5}	8.0×10^{-5}	3.3×10^{-8}	3.6×10^{-5}	2.0×10^{-8}	2.6×10^{-4}	1.5×10^{-7}
Drained Water Pool	2.3	9.6×10^{-4}	8.7×10^{-4}	3.6×10^{-7}	6.6×10^{-4}	3.6×10^{-7}	5.1×10^{-3}	2.8×10^{-6}
Hydrogen Detonation in Storage Container in the Water Pool	7.1×10^{-3}	2.9×10^{-6}	4.7×10^{-6}	1.9×10^{-9}	2.9×10^{-6}	1.6×10^{-9}	8.0×10^{-6}	4.4×10^{-9}
Mechanical Damage to Fuel in the Water Pool	2.4×10^{-4}	1.0×10^{-7}	2.0×10^{-7}	8.2×10^{-11}	9.0×10^{-8}	5.0×10^{-11}	6.5×10^{-7}	3.6×10^{-10}
Inter-Facility Transport Accident	1.3×10^{1}	5.3×10^{-3}	8.5×10^{-3}	3.5×10^{-6}	2.8×10^{-3}	1.5×10^{-6}	1.0×10^{-1}	5.5×10^{-5}
Inadvertent Fuel Cutting in the Water Pool	4.9×10^{-4}	2.0×10^{-7}	4.0×10^{-7}	1.6×10^{-10}	1.8×10^{-7}	9.9×10^{-11}	1.3×10^{-6}	7.2×10^{-10}
Inadvertent Criticality in the Water Pool	4.8	2.0×10^{-3}	6.2×10^{-3}	2.6×10^{-6}	1.8×10^{-3}	9.7×10^{-7}	2.4×10^{-2}	1.3×10^{-5}
Shielded Basket Transfer Container Drop or Tip-Over	9.6×10^{-2}	3.9×10^{-5}	6.3×10^{-5}	2.6×10^{-8}	3.8×10^{-5}	2.1×10^{-8}	5.5×10^{-5}	3.0×10^{-8}
Windborne Projectile into Shielded Basket Transfer Container	1.2×10^{-3}	4.7×10^{-7}	7.6×10^{-7}	3.1×10^{-10}	5.9×10^{-7}	3.3×10^{-10}	4.5×10^{-6}	2.5×10^{-9}
Minor Water Pool Leak	This scenario is evaluated qualitatively in Section F.5.4.12.							

[1] To convert dose to fatal cancer, a factor of 4.1×10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5×10^{-4} is multiplied by the dose for the NPA and MOI. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

Table F.5-25: Dose Impacts to Individuals From Radiological Accident Scenarios with 95 Percent Meteorology

Accident Scenario Description	Exposed Individual							
	Worker		MCW		NPA		MOI	
	Dose rem	Fatal Cancer[1]	Dose rem	Fatal Cancer[1]	Dose rem	Fatal Cancer[1]	Dose rem	Fatal Cancer[1]
HEPA Filter Fire	3.3×10^{-6}	1.4×10^{-9}	5.6×10^{-9}	2.3×10^{-12}	4.8×10^{-9}	2.6×10^{-12}	3.5×10^{-8}	1.9×10^{-11}
Shielded Transfer Container Drop or Tip-Over	9.7×10^{-2}	4.0×10^{-5}	1.6×10^{-4}	6.7×10^{-8}	1.1×10^{-4}	6.2×10^{-8}	1.7×10^{-4}	9.1×10^{-8}
Airplane Crash into Water Pool	6.0×10^{-1}	2.5×10^{-4}	1.1×10^{-3}	4.7×10^{-7}	5.7×10^{-4}	3.1×10^{-7}	4.3×10^{-3}	2.3×10^{-6}
Drained Water Pool	9.0	3.7×10^{-3}	1.3×10^{-2}	5.5×10^{-6}	1.1×10^{-2}	6.3×10^{-6}	8.4×10^{-2}	4.6×10^{-5}
Hydrogen Detonation in Storage Container in the Water Pool	4.3×10^{-2}	1.8×10^{-5}	7.2×10^{-5}	3.0×10^{-8}	5.0×10^{-5}	2.7×10^{-8}	1.3×10^{-4}	7.3×10^{-8}
Mechanical Damage to Fuel in the Water Pool	1.5×10^{-3}	6.2×10^{-7}	2.8×10^{-6}	1.2×10^{-9}	1.4×10^{-6}	7.8×10^{-10}	1.1×10^{-5}	5.8×10^{-9}
Inter-Facility Transport Accident	7.9×10^{1}	3.2×10^{-2}	1.3×10^{-1}	5.4×10^{-5}	4.8×10^{-2}	2.6×10^{-5}	1.6	9.0×10^{-4}
Inadvertent Fuel Cutting in the Water Pool	3.0×10^{-3}	1.2×10^{-6}	5.7×10^{-6}	2.3×10^{-9}	2.8×10^{-6}	1.6×10^{-9}	2.1×10^{-5}	1.2×10^{-8}
Inadvertent Criticality in the Water Pool	2.8×10^{1}	1.1×10^{-2}	4.2×10^{-2}	1.7×10^{-5}	1.4×10^{-2}	7.5×10^{-6}	3.6×10^{-1}	2.0×10^{-4}
Shielded Basket Transfer Container Drop or Tip-Over	5.8×10^{-1}	2.4×10^{-4}	9.7×10^{-4}	4.0×10^{-7}	6.6×10^{-4}	3.6×10^{-7}	9.1×10^{-4}	5.0×10^{-7}
Windborne Projectile into Shielded Basket Transfer Container	7.0×10^{-3}	2.9×10^{-6}	1.2×10^{-5}	4.8×10^{-9}	1.0×10^{-5}	5.6×10^{-9}	7.3×10^{-5}	4.0×10^{-8}
Minor Water Pool Leak	This scenario is evaluated qualitatively in Section F.5.4.12.							

[1] To convert dose to fatal cancer, a factor of 4.1×10^{-4} is multiplied by the dose for the Worker and MCW and a factor of 5.5×10^{-4} is multiplied by the dose for the NPAI and MOI. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factors which include both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factors overstate the likelihood of fatal cancer in a population and the use of these factors to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)

Table F.5-26: Dose Impacts and Annual Risk to the General Population From Radiological Accident Scenarios with 50 Percent Meteorology

Accident Scenario Description	General Population Dose	Fatal Cancer Per Accident Occurrence[1]	Annual Probability of Accident[2]	Annual Risk of Developing Fatal Cancer to the General Population[3]
	person-rem			
HEPA Filter Fire	2.1×10^{-5}	1.1×10^{-8}	5.0×10^{-4}	5.7×10^{-12}
Shielded Transfer Container Drop or Tip-Over	9.7×10^{-2}	5.3×10^{-5}	2.7×10^{-3}	1.4×10^{-7}
Airplane Crash into Water Pool[4]	3.3	1.8×10^{-3}	NA	NA
Drained Water Pool – No Action Alternative	5.0×10^{1}	2.8×10^{-2}	1.0×10^{-3}	2.8×10^{-5}
Drained Water Pool – Overhaul Alternative	5.0×10^{1}	2.8×10^{-2}	1.0×10^{-4}	2.8×10^{-6}
Drained Water Pool – New Facility Alternative	5.0×10^{1}	2.8×10^{-2}	1.0×10^{-5}	2.8×10^{-7}
Hydrogen Detonation in the Water Pool	7.8×10^{-2}	4.3×10^{-5}	6.4×10^{-5}	2.7×10^{-9}
Mechanical Damage to Fuel in the Water Pool	8.1×10^{-3}	4.4×10^{-6}	2.7×10^{-4}	1.2×10^{-9}
Inter-Facility Transport Accident[4]	9.4×10^{2}	5.2×10^{-1}	NA	NA
Inadvertent Fuel Cutting in the Water Pool	1.6×10^{-2}	8.9×10^{-6}	4.0×10^{-4}	3.5×10^{-9}
Inadvertent Criticality in the Water Pool	2.1×10^{2}	1.1×10^{-1}	1.5×10^{-6}	1.7×10^{-7}
Shielded Basket Transfer Container Drop or Tip-Over	5.3×10^{-1}	2.9×10^{-4}	3.5×10^{-4}	1.0×10^{-7}
Windborne Projectile into Shielded Basket Transfer Container	4.3×10^{-2}	2.4×10^{-5}	3.3×10^{-5}	7.9×10^{-10}
Minor Water Pool Leak	This scenario is evaluated qualitatively in Section F.5.4.12.			

[1] To convert dose to fatal cancer, a factor of 5.5×10^{-4} is multiplied by the dose for the General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factor which includes both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factor overstates the likelihood of fatal cancer in a population and the use of this factor to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)
[2] The probability of the accident is conservative (Section F.7.1).
[3] The lifetime risk of developing fatal cancer is determined by multiplying the annual risk of developing fatal cancer by the expected time-frame of the alternative (Section 2.3).
[4] No probability or annual risk is calculated for IDAs because the probability of the event is considered “unknowable” (DOE 2004b).

Table F.5-27: Dose Impacts and Annual Risk to the General Population From Radiological Accident Scenarios with 95 Percent Meteorology

Accident Scenario Description	General Population Dose (person-rem)	Fatal Cancer Per Accident Occurrence[1]	Annual Probability of Accident[2]	Annual Risk of Developing Fatal Cancer to the General Population[3]
HEPA Filter Fire	1.6×10^{-4}	8.5×10^{-8}	5.0×10^{-4}	4.3×10^{-11}
Shielded Transfer Container Drop or Tip-Over	7.3×10^{-1}	4.0×10^{-4}	2.7×10^{-3}	1.1×10^{-6}
Airplane Crash into Water Pool[4]	2.5×10^{1}	1.4×10^{-2}	NA	NA
Drained Water Pool – No Action Alternative	3.7×10^{2}	2.1×10^{-1}	1.0×10^{-3}	2.1×10^{-4}
Drained Water Pool – Overhaul Alternative	3.7×10^{2}	2.1×10^{-1}	1.0×10^{-4}	2.1×10^{-5}
Drained Water Pool – New Facility Alternative	3.7×10^{2}	2.1×10^{-1}	1.0×10^{-5}	2.1×10^{-6}
Hydrogen Detonation in the Water Pool	5.8×10^{-1}	3.2×10^{-4}	6.4×10^{-5}	2.0×10^{-8}
Mechanical Damage to Fuel in the Water Pool	6.1×10^{-2}	3.3×10^{-5}	2.7×10^{-4}	9.0×10^{-9}
Inter-Facility Transport Accident[4]	7.0×10^{3}	3.8	NA	NA
Inadvertent Fuel Cutting in the Water Pool	1.2×10^{-1}	6.7×10^{-5}	4.0×10^{-4}	2.7×10^{-8}
Inadvertent Criticality in the Water Pool	1.6×10^{3}	8.5×10^{-1}	1.5×10^{-6}	1.3×10^{-6}
Shielded Basket Transfer Container Drop or Tip-Over	4.0	2.2×10^{-3}	3.5×10^{-4}	7.7×10^{-7}
Windborne Projectile into Shielded Basket Transfer Container	3.2×10^{-1}	1.8×10^{-4}	3.3×10^{-5}	5.8×10^{-9}
Minor Water Pool Leak	This scenario is evaluated qualitatively in Section F.5.4.12.			

[1] To convert dose to fatal cancer, a factor of 5.5×10^{-4} is multiplied by the dose for the General Population. In determining a means of assessing health effects from radiation exposure, the ICRP has developed the above factor which includes both fatal and non-fatal cancers. The ICRP adjusts the incidence of fatal cancers upward to account for the total harm experienced as a consequence of developing non-fatal cancer. The factor overstates the likelihood of fatal cancer in a population and the use of this factor to estimate the likelihood of fatal cancer is conservative for comparison purposes. (Section F.2.5)
[2] The probability of the accident is conservative (Section F.7.1).
[3] The lifetime risk of developing fatal cancer is determined by multiplying the annual risk of developing fatal cancer by the expected time-frame of the alternative (Section 2.3).
[4] No probability or annual risk is calculated for IDAs because the probability of the event is considered "unknowable" (DOE 2004b).

F.5.6 Evaluation of Impacted Area

The area of land that could be contaminated following the hypothetical accident scenarios is evaluated. The impacted area surrounding a facility following an accident is determined for each scenario evaluated. The impacted area is defined as that area in which radioactive material deposits to such a degree that an individual standing on the boundary of the area would receive approximately 0.01 millirem per hour of radiation exposure. If this individual spends 24 hours a day at this location, that person would receive about 88 millirem per year from the ground shine. This is within the 100 millirem per year limit of 10 C.F.R. § 20. See Section F.2.4 for a discussion on radiation exposure limits.

To best characterize the affected areas for each hypothetical accident scenario, 50 percent meteorology is used. The results for ground surface dose are used to determine the distance downwind where the centerline dose drops to approximately 88 millirem per year based on 24 hours per day of radiation exposure. Once the footprint length is determined, the area of the contaminated footprint is calculated by integrating the area within the plume. Many of the scenarios do not have a footprint plume because they are gas-only releases, or the total activity released from the accident is small and does not contribute measurable dose from external ground contamination. These scenarios are reported with a footprint length of less than 0.1 kilometer (0.06 miles). Table F.5-28 lists each hypothetical accident scenario analyzed and the contaminated footprint associated with the scenario.

Table F.5-28: Footprint Estimates for Accidents at NRF

Accident Scenario	Footprint Length	Footprint Length	Footprint Area[1]	Footprint Beyond INL Boundary
	kilometers	miles	acres	
HEPA Filter Fire	< 0.1	< 0.06	< 0.5	No
Shielded Transfer Container Drop or Tip-Over	< 0.1	< 0.06	< 0.5	No
Airplane Crash into Water Pool	< 0.1	< 0.06	< 0.5	No
Drained Water Pool	1.7	1.0	60	No
Hydrogen Detonation in the Water Pool	< 0.1	< 0.06	< 0.5	No
Mechanical Damage to Fuel in the Water Pool	< 0.1	< 0.06	< 0.5	No
Inter-Facility Transport Accident	5.7	3.5	600	No
Inadvertent Fuel Cutting in the Water Pool	< .01	< 0.06	< 0.5	No
Inadvertent Criticality in the Water Pool	2.2	1.4	100	No
Shielded Basket Transfer Container Drop or Tip-Over	< .01	< 0.06	< 0.5	No
Windborne Projectile into Shielded Basket Transfer Container	< .01	< 0.06	< 0.5	No
Minor Water Pool Leak[2]	N/A			

[1] 1 acre = 0.4 hectares
[2] There is no airborne release from the minor water pool leak. Therefore, there would be no surface land contamination.

Although the plume would be contained within a single sector, the direction of the wind is unknown. Therefore, NRF is examined for impacts in all directions out to a distance equal to the footprint length. Since the accidents occur over a short duration of time, the acreage of the sector quoted is still an accurate indication of the total contaminated area. The extent of contaminated land is expected to remain on the INL and would not be expected to extend beyond 5.7 kilometers (3.5 miles) from NRF. The extent of contamination would not be expected to reach the ATR Complex, the nearest INL facility. The impact of this contamination would be temporary while the area is isolated and remediation efforts completed. Identification of the potential secondary impacts is contained in Table F.5-29.

Table F.5-29: Secondary Impacts of Accidents at NRF

Secondary Impact	Description
Biota	Plants and animals on-site and around INL would experience no long-term impacts. See Section 4.5 for more details on effects on biota.
Surface Water and Ground Water	The water used for drinking and industrial purposes is monitored and use may be temporarily suspended during cleanup operations.
Economy	A small number of individuals may experience temporary job loss due to temporary restrictions on support activities near INL during cleanup operations. The job losses are expected to be minimal because many employees could be temporarily reassigned to support cleanup operations. No enduring impacts are expected.
National Defense	In the event of an accident at NRF, there could be a significant impact on the NNPP's ability to meet fleet demands. This could result in negative impacts to the U.S. Navy.
Cost of Decontamination	Contamination sufficient to exceed the 100 millirem per year limit from 10 C.F.R. § 20 is expected to remain within the INL boundaries and is expected to extend approximately 5.7 kilometers (3.5 miles) from NRF. Although some cleanup of contaminated land would be expected, providing a cost estimate for the effort is too speculative given the uncertainty associated with cleanup level, methods, and timeline.
Endangered and Protected Species	The facility accident would not affect the long-term potential for survival of any species. Section 3.5 states that no potential endangered species are present on INL, and Section 4.5 discusses candidate species and other wildlife on INL.
Land Use	Access to some areas of INL may be temporarily restricted until cleanup is completed.
Treaty Rights	Some temporary restrictions on access may be required until cleanup is completed. No enduring impacts are expected.
Transportation	No impacts are expected because no U.S. highways are within 10,000 meters (6.2 miles) of NRF.

F.6 Emergency Preparedness and Mitigative Measures

F.6.1 Emergency Preparedness

Emergency plans are in effect at NRF to ensure that workers and the public would be properly protected in the event of an accident. These response plans include the activation of emergency response teams provided by NRF or INL and an NRF emergency control center, as well as activation of a command and control network with NNPP Headquarters and supporting laboratories. The long-standing emergency planning program that exists within the NNPP includes the ability to utilize the comprehensive and extensive emergency response resources of each

NNPP site and provides for coordination with appropriate civil authorities. In addition to the NNPP resources, extensive federal emergency response resources are available, as needed, to support state or local response.

Emergency response measures include provisions for immediate response to radiological emergencies at the facility location, identification of the accident conditions, communications with those providing radiological data, and recommendations for any appropriate protective actions. NRF employees are trained to respond to radiological emergencies including evacuation from areas that involve a potential release of radioactive material. In the event of an accident involving radioactive materials, workers in the vicinity of the accident would promptly leave the immediate area, typically within minutes of the accident.

Planning for emergencies is based on NNPP technical analysis as well as recommendations and guidance provided by numerous agencies experienced in emergency planning including the Department of Homeland Security (Federal Emergency Management Agency), the U.S. Navy, DOE, NRC, EPA, National Council on Radiation Protection and Measurements, and the International Atomic Energy Agency. Emergency planning for the public is based on the above-mentioned guidance as well as the specific planning requirements of local civil authorities. NNPP maintains close relationships with civil authorities to ensure that communications and emergency responses are coordinated if ever needed. (NNPP 2013)

Regularly scheduled exercises are conducted to test NRF's ability to respond to accidents. These exercises include realistic tests of people, equipment, and communications involved in all aspects of the plans; the plans are regularly reviewed and modified to incorporate experience gained from the exercises. These exercises also periodically include steps to verify the adequacy of interactions with local hospitals, emergency personnel, and state officials.

F.6.2 Mitigative Measures

For members of the general public residing at the site boundary or beyond, no credit is taken in the results presented for any preventive or mitigative actions that would limit their radiation exposure. These individuals are calculated as being exposed to the entire contaminated plume as it travels downwind from the accident site. Similarly, the models do not account for any action that could be taken to prevent individuals from continuing their routine ingestion of terrestrial food and animal products. As discussed in Section F.3.1, in the event of a real emergency, action would be taken to prevent the public from exceeding a PAG. No reduction of radiation exposure due to PAGs is accounted for in this analysis. For hypothetical accident scenarios, the public is assumed to spend approximately 30 percent of the day indoors. For routine naval spent nuclear fuel handling operations, the public is assumed to spend 66 percent of the day indoors. The exposure to ground surface radiation is therefore reduced appropriately on a yearly basis.

Individuals that work on the INL (MCW) or those that may be traversing the site in a vehicle (NPA) would be evacuated from the affected area within 2 hours. This is based on the availability of security personnel at INL and NRF to oversee the removal of collocated workers and travelers in a safe and efficient manner. Periodic training and evaluation of the security personnel is conducted to ensure that correct actions are taken during an actual casualty. Therefore, collocated workers and travelers would be exposed to the entire contaminated plume from the 15-minute accident release as it travels downwind for a period not to exceed 2 hours. Similarly, the radiation from ground surface deposited radioactive materials would be limited to a 2-hour period. No ingestion of contamination is calculated for these individuals for accident analysis because only a 2-hour radiation exposure period is evaluated.

NRF workers undergo training to take quick, decisive action in the event of an accident. These individuals quickly evacuate the area and move to previously defined areas at NRF. Workers could be exposed to 5 minutes of the radioactive plume as they move to these areas. Once the immediate threat of the plume has moved off-site and downwind, the workers would be instructed to walk to vehicles waiting to evacuate them from the site. An additional 15 minutes would be required to evacuate the workers from the contaminated area; therefore, the workers are assumed to receive a total of 20 minutes of ground surface exposure. No ingestion of contamination is calculated for these individuals for accident analysis because only a 20 minute radiation exposure period is evaluated.

Table F.3-6 provides the individual radiation exposure times utilized in the accident analyses presented in Section F.5.4.

NRF integrates safety and security safeguards to deter, detect, delay, assess, and respond to security threats which could lead to an IDA. Although IDAs cannot be categorically ruled out, appropriate security measures would be taken to lessen the chance of occurrence. These measures include security clearances for personnel, restricted access to areas containing radioactive material, and physical barriers to the facility. If an IDA were to occur at NRF, having additional measures in place (e.g., HEPA-filtered ventilation systems, fire protection systems, emergency response capabilities, and the remote location of NRF) would lessen the consequences.

F.7 Analysis of Uncertainties

The analyses of the impacts of routine naval spent nuclear fuel handling operations and hypothetical accidents associated with naval spent nuclear fuel handling presented in this Appendix are based on conservative calculations. This is necessary because virtually all of the events analyzed have a low probability of occurrence and most of the impacts of routine naval spent nuclear fuel handling operations are so small that they cannot be measured. The use of calculations introduces the possibility that the actual impacts may differ from those calculated due to uncertainties, such as differences between actual behavior and the theoretical models or equations and the variability of the values of factors used in the calculations. To portray the effects of such variability and uncertainty, the analyses performed for this Appendix are divided into four components: (1) the probability that an event, such as an accident, could occur; (2) the amount of radioactive material or radiation that might be released to the environment by the event; (3) the calculation of the potential for radiation exposure to human beings from the release; and (4) the conversion of the radiation exposure to detrimental health effects. Each of these components is discussed separately in the following sections.

The discussion in the following sections focuses on accident analyses, but it should be understood that the analysis of uncertainties for routine naval spent nuclear fuel handling operations is the same, with a few exceptions. First, routine naval spent nuclear fuel handling operations are certain to occur, so the probability of such events is effectively 1.0. Second, the source terms used for the analyses of routine naval spent nuclear fuel handling operations are based on monitoring of current operations at NRF scaled to estimate emissions based on future operations. The estimates of the amount of radiation or radioactivity involved in routine naval spent nuclear fuel handling operations would be conservative for the New Facility Alternative based on the design of the facility. It is possible that there would be some variations, and that future efforts to keep radiation exposures ALARA might reduce the source terms further. The effects of routine naval spent nuclear fuel handling operations and accidents are calculated using similar analytical methods and models for determination of radionuclide movement in the environment, pathways to humans, and conversion of radiation exposure to health effects. Therefore, the discussion of uncertainties in Sections F.7.3

and F.7.4 applies to the results of analyses of both routine naval spent nuclear fuel handling operations and hypothetical accidents.

F.7.1 Event Probabilities

The probability that an accident might occur is determined for the hypothetical accident scenarios. These probabilities are used in this Appendix to calculate the annual risk, defined as the product of the probability times the consequences, for each hypothetical accident.

The hypothetical accident scenario analysis is performed for a range of reasonably foreseeable accidents, with relative probabilities ranging from fairly probable (roughly 1 in 1000 years or smaller probability) to extremely unlikely (up to roughly 1 in 1,000,000 years). Accidents due to external events, human error, and equipment failures are considered. The set of accident scenarios considered inform the decision maker and the public of accident risks associated with the proposed action and alternatives by covering a spectrum from high consequence to lesser consequence. The probabilities of a range of accidents which might be caused by human error are also included. Such events include incorrectly performing machining procedures. For human error, a probability of one error in eight hundred operations (a frequency of 1.25×10^{-3} mean events per year) is used for operations performed by a single trained operator following a written procedure. If the procedure requires verification of the action by a second trained operator this frequency is lowered to 2.0×10^{-4}. If an additional error is also necessary for the accident to occur the calculated error frequency would be well below 1×10^{-5}; however, the minimum human error probability is conservatively set at 1×10^{-5}. These probabilities are derived from the methodology used by the NRC for assessment of human reliability (NRC 1983 and NRC 2005).

In many instances, the probabilities assigned to the events reflect the likelihood that a particular event, such as an earthquake, might occur. However, for the purpose of the analyses, the resulting accident is assumed to have quite severe consequences. The probability of such severe consequences is smaller than the probability that the initiating event might occur, with consequences as severe as used in the analyses possibly occurring only one time in 10 or 100 occurrences of the initiating event. The probabilities for most of the analyses in this Appendix use only the probability of the initiating event and do not include further reduction in the probability for the severity of consequences assumed. This is done, in part, because the severe consequences assumed, and in some cases the initiating events themselves, occur very infrequently, or have never occurred, so little data on their frequency is available.

The NNPP requirements for design and operation of naval spent nuclear fuel handling and processing systems ensure that the probability of such accidents are lower, sometimes orders of magnitude lower (on the order of 1×10^{-7}), than the probabilities assumed for accident analyses. For the purposes of analyses, the event is assumed to result in an accident with severe consequences and various features that would reduce the likelihood of the accident are conservatively omitted. Features such as the ruggedness of naval spent nuclear fuel and fuel containers, passive restraints to prevent tipping, and NNPP material controls, engineering controls and inspections, testing, and operator training and oversight would reduce the probability the initiating event would occur. As a result, the risks stated are believed to be larger than the risks that would be associated with actual accidents.

For example, one hypothetical accident analyzed is the impact on an SBTC of a projectile (e.g., a pipe) produced by high winds. The sequence of events analyzed include breaching the container seal to release radioactive material. In reality, the projectile would have to be large enough and traveling at high enough speed to cause the postulated damage. Similarly, it would have to contact the container at the correct location and at the correct angle to damage the seal. The probability assigned to this accident is 3.3 x 10^{-5} per year, the probability that a windborne projectile might strike a container, and does not include any factor to account for other elements in the sequence required to actually damage the seal. Therefore, the probability of the consequences calculated for this accident is much smaller than the probability of 3.3 x 10^{-5} per year used in the analysis.

A second example is provided by the hypothetical accidents involving damage to the naval spent nuclear fuel assemblies as a result of drop accidents. Naval fuel is designed to withstand combat shock loads and is very rugged. However, for the accidents analyzed that involved damage to naval spent nuclear fuel assemblies, no probability is assigned to the likelihood that an accident would cause impacts sufficient to result in a loss of fuel integrity. Therefore, the probability that the naval spent nuclear fuel could be damaged, and that fission products might be released, is less than the drop accident probability alone, which is the probability assigned to the consequences in this Appendix. In addition, NNPP practices include significant amounts of design conservatism, material controls, engineering controls, and inspections to reduce the probability of crane accidents below those that are assumed. Therefore, the risks for accidents resulting from drops are much smaller than stated in the analyses.

A third example is the probability of a hypothetical accident resulting in an inadvertent criticality. Equipment designs include features that are specifically designed to reduce the likelihood of a criticality in the event of an accident, such as passive feature to prevent tipping and ejection of naval spent nuclear fuel assemblies. These additional features would further reduce the probability of an inadvertent criticality; therefore, the risks presented for criticality would be smaller than presented in this analysis.

As can be seen from these examples, the actual probability of the consequences resulting from the analyses are smaller than the values presented in this Appendix, at least in part because these probabilities do not include any additional factors to reflect the accident severity used in the analyses. As a result, the risks stated in this Appendix for most hypothetical accidents are believed to be greater than the risks associated with actual accidents. However, the same probabilities have been used in the evaluation of all of the alternatives considered and all of the risks are small; so, the approach used is adequate for the comparative purposes of this EIS.

F.7.2 Release of Radioactive Material or Radiation (Source Term)

Since the source terms used in the hypothetical accident analyses are typically for scenarios which have never occurred, there is great room for uncertainty. The range of scenarios analyzed in this EIS is intended to encompass accidents which produce consequences unlikely to be exceeded by any reasonably foreseeable accident. As a result, the accidents themselves, and the sequences of events during the accidents, are chosen to maximize the source term. For example, systems such as HEPA filters are considered to be inoperative in all cases where the accident might have an opportunity to disable them, and the water pool inventory is assumed to be at peak capacity for scenarios which affect all of the naval spent nuclear fuel in the water pool (e.g., airplane crash into the water pool).

The source terms for the hypothetical accident analyses are dependent upon five factors as described in Section F.5.3. The five factors for developing the source term are chosen to ensure that the release to the environment is conservative for the hypothetical accident scenarios. For example, the MAR for the accident scenarios is always conservative and it is assumed that all released material is in the breathable range as represented by an RF set equal to 1.0. In general, for there to be an accidental release of radioactivity to the environment, there must be damage to the facility or containment. When the containment is not provided by the fuel structure (i.e., external containment) this damage is represented by leak path factors (LPFs). Furthermore, naval spent nuclear fuel must also be damaged for any release of fission products since all fission products are fully contained within naval spent nuclear fuel cladding. The amount of damage to the external containment or the naval spent nuclear fuel is dependent upon the severity and the nature of the accident. This damage is represented by damage ratios (DRs) and airborne release fractions (ARFs). In the hypothetical accidents analyzed, the assumptions concerning the containment (LPFs) or the extent of damage to the naval spent nuclear fuel assemblies (DRs and ARFs) provide a conservative evaluation whose results would not be exceeded by reasonably foreseeable accidents of a similar type.

One example of this is the evaluation of the inadvertent cutting into the fuel region of a naval spent nuclear fuel assembly. The saw blade is assumed to be parallel to the naval spent nuclear fuel assembly during the accident because this configuration has the potential to disturb the maximum amount of naval spent nuclear fuel. The parallel configuration of the saw blade demonstrates the selection of a conservative MAR and DR by maximizing the amount of fuel available for release from the naval spent nuclear fuel assembly. The actual magnitude of the release from this event would be somewhere between the value assigned in this EIS and zero.

Another example is the HEPA filter fire scenario. The inventory from four HEPA filters is the assumed MAR which is the maximum possible amount of activity that could be involved in an accident of this type based on ECF operations. The accident represents two in-parallel HEPA filter assemblies which catch on fire. The entire inventory of two HEPA filters and two pre-filters are involved in the fire. For conservatism in selecting the MAR, it is modeled that each filter contains the maximum inventory of a filter even though the downstream HEPA filter in series would contain much less inventory than the leading pre-filter. The actual magnitude of the release from this event would be somewhere between the value assigned in this EIS and zero.

All of the source terms used for the evaluation of the hypothetical accidents are developed in a similar fashion. The source term released to the environment is judged to be conservative for the hypothetical accident scenarios. Thus, the expected outcome for all of the accidents is that a smaller release to the environment is expected than is used in the analysis.

For routine naval spent nuclear fuel handling operation emissions there is also uncertainty because the exact tempo of future operations is unknown. It is conservatively assumed that the emissions are at peak capacity to represent a fully operational facility. This assumption is conservative because facilities only operate at peak capacity for short periods of time.

F.7.3 Radiation Exposure to Humans

Radiation exposure to the individual groups is evaluated with multiple computer programs. The computer programs model the movement of airborne and water contamination resulting from the postulated release using four types of pathways to the population groups. These pathways include exposure directly to the radiation from the material in the plume, direct exposure to radiation from contaminated soil or water, inhalation of air containing gases or particles, and ingestion of contaminated water or food. The analyses in this Appendix use parameter values which are conservative or based on the best information available.

The Gaussian plume model used in these analyses to represent airborne movement of radioactive material is the standard used in many evaluations of environmental effects. To ensure that calculated radiation exposures are as high as could occur under any set of conditions, a ground level release is used and no reduction in the airborne concentrations is included for either turbulence caused by buildings or the effect of plume meander which occurs naturally at the low wind speeds accompanying the 95 percent meteorological conditions (Section F.3.3.2).

The results for both the 50 percent and the 95 percent meteorological conditions are provided in detailed tables in this Appendix and show that the 95 percent meteorological conditions produce radiation exposure estimates which are 3 to 20 times higher than those for the 50 percent conditions (depending upon the specific nuclides released in the source term, and the individual group).

External radiation from contamination which results from particles from the plume deposited on the ground surface depends upon the deposition parameters which are input as best-estimate values. Faster deposition results in more material on the ground and increased ground surface exposure to those closer to the accident location but less material on the ground and decreased ground surface exposure for those farther from the accident site. External ground surface dose is a less significant pathway than the inhalation and ingestion pathways. With higher deposition velocities, fewer particles are suspended in the plume for downwind inhalation. The ingestion pathway has the same trend as the ground surface pathway because the food is contaminated at the same level as the ground surface. The effects of uncertainty in this parameter depend upon the distance at which each individual group is evaluated, the radiation exposure pathways evaluated, and the population distribution around NRF.

The possible exposure to direct radiation from material in surface water and associated sediments as a result of accidental release directly to the water or fallout from an airborne release is estimated for people involved in activities such as swimming and boating. The calculations assumed a stagnant pond and therefore take no credit for dilution by river currents. The concentrations in the air are not reduced by the amount of material deposited in the water and vice versa. Due to the conservative concentrations used in the calculations and an assumption that every member of the public in the area would be exposed to direct radiation from surface waters, radiation exposure from this pathway is very likely overestimated.

The inhalation pathway evaluation is based on average breathing rates and uptake consistent with the recommendations by the ICRP (ICRP 1995) for each age group. Higher values for these parameters would increase the estimated radiation exposures and lower values would decrease the estimates.

The ingestion pathway includes meat, seafood, dairy, food crops, and drinking water. Best-estimate parameters are used to evaluate the contamination levels in food and water when ready for consumption. Consumption rates for individuals are based on expected eating habits. The analysis also includes the assumption that 10 percent of the entire diet of the affected population group consists of contaminated products with exceptions for milk and drinking water. For milk consumption, 30 percent of the diet is assumed to be contaminated based on the amount of local milk available near NRF. (100 percent of the milk intake is assumed to be contaminated for infants because infants often receive all of their milk from a single source). Drinking water is assumed to be 100 percent contaminated because it is often obtained from a single source. Uncertainties associated with these pathways could affect the estimated impacts in either the positive or negative direction.

The drinking water contribution to the ingestion pathway is calculated by assuming that a portion of the radioactive material would become dissolved in the drinking water supply. The drinking water supply would become contaminated either through deposition of radioactive material from the plume directly onto bodies of surface water, or by the deposition of radioactive material onto the ground and its subsequent infiltration through the soil into the aquifer. The flow of the aquifer from north to south (Figure 3.4-5) is ignored, and it is conservatively modeled that the contaminated water flows directly towards the MOI and General Population. Where fresh surface water provides drinking water, any contamination of the water is assumed to occur promptly, and no decreases due to radioactive decay are used. Where aquifers are a source of drinking water, consumption of water from the aquifer is delayed for the time required for the contamination to reach the aquifer and then to reach the nearest drinking water source. Water infiltration rates are discussed in Section 3.4.2.1. To determine water ingestion doses it is conservatively assumed that the contaminated water is ingested during the radiation exposure period, and the delay time for the water contamination to occur is not considered in the radiation exposure period. It is assumed that 9.5 years would pass before water carrying the radioactive material would reach a well drawing from the aquifer. (This includes 2 years for the radioactive material to pass through the soil and reach the aquifer, and an additional 7.5 years for the aquifer flow to carry the radioactive material to the well). While the consumption rate is adjusted to correspond to each age group evaluated, the MOI is conservatively assumed to drink only water from the contaminated source and to drink 1.5 liters (0.4 gallons) of water per day during the 1-year radiation exposure period. The concentrations in these calculations are considered to be higher than expected because no reduction of the concentration by dilution is included and the fraction of each population group exposed to the affected drinking water is conservatively high.

The contamination of food crops, livestock, and local game is analyzed. The same concentration of radioactive material as in drinking water is used in the irrigation water from either surface water or ground water. Affected crops, livestock, and game are assumed to receive all water from the contaminated water source and applicable biological accumulation factors are used. Human consumption rates for the crops, livestock, and game are used to calculate the radiation exposure from this source. The uncertainty from this source is associated with the concentration of contaminants in the irrigation water, the amount of such foods consumed, and the fraction of the individual groups which ingests the affected food.

The General Population used to determine the effects of routine naval spent nuclear fuel handling operation in this Appendix is the entire population of 151,000 people within 80.5 kilometers (50 miles) downwind of the accident. The General Population used to determine the effects of hypothetical accidents in this Appendix is the entire population of 88,500 people within the worst 22.5-degree sector within 80.5 kilometers (50 miles) downwind of the accident. Actual population growth or decreases in a region could introduce small variations in impacts. Additionally, the spread of the plume for the hypothetical accident analysis does not cover the entire sector, introducing conservatism in the application of the calculations to the evaluation of the dose to the General Population.

F.7.4 Conversion of Radiation Exposure to Health Effects

The conversion of amounts of radiation or radioactive material transmitted to an individual or to population groups into health effects requires the calculation of the radiation exposure or dose received by humans caused by inhaling or ingesting radioactive material or by exposure to a radiation field. Such calculations are based on a number of factors. The factors include the nature and rate of human metabolic processes such as respiration or excretion, the type of radiation involved, the sensitivity of various organs, and the age of the individuals involved. The rates of human metabolic processes are well characterized at this time; the energies, half-lives, and similar properties of radioactive material or radiation have been measured extensively and introduce little uncertainty into the calculations in this EIS.

The numerical estimates of fatal cancer and other health effects are obtained by the practice of modeling a linear-non-threshold (LNT) dose-response relationship for the induction of fatal cancer.

The LNT model assumes that the health effects from radiation increase proportionally with dose, that the effects from high doses can be extrapolated to determine the effects at low doses, and that a threshold does not exist below which no health effects occur.

However, the number of detrimental health effects which might result from exposure of a large group of people to low levels of radiation has been the subject of debate for many years and no scientific knowledge exists to confirm a quantitative model. The ICRP stated in its 2007 recommendations (ICRP 2007):

> "Although there are recognised [sic] exceptions, for the purposes of radiological protection the Commission judges that the weight of evidence on fundamental cellular processes coupled with dose-response data supports the view that, in the low dose range, below about 100 mSv [10 rem], it is scientifically plausible to assume that the incidence of cancer or heritable effects will rise in direct proportion to an increase in the equivalent dose in the relevant organs and tissues…However, the Commission emphasises [sic] that whilst the LNT model remains a scientifically plausible element in its practical system of radiological protection, biological/epidemiological information that would unambiguously verify the hypothesis that underpins the model is unlikely to be forthcoming."

There is much uncertainty in the understanding of dose to health effects because the data are inconclusive at small doses, and other methods of extrapolation to the low-dose region could yield higher or lower numerical estimates of cancer. Studies of human populations exposed at low doses have not shown consistent or conclusive evidence upon which to determine the incidence of cancer from radiation exposure. Attempts to observe increased cancer in human populations exposed to low doses of radiation have been difficult. There is scientific uncertainty about cancer incidence in the low-dose region below the range of epidemiologic observation (observations having to do with the branch of medicine that studies events that affect many people throughout an area at the same time), and the possibility of no incidence cannot be excluded. The reason low-dose studies cannot be conclusive is that the incidence rate, if it exists at these low levels, is too small to be seen in the presence of all the other risks of life (NNPP 2011b). However, the NNPP has always assumed that radiation exposure, no matter how small, may involve some consequence (e.g., cancer). For this Appendix, the recommendations from the ICRP (ICRP 2007) based on the LNT model are used to evaluate health effects.

The calculations of health effects performed in this EIS use the relation recommended by the ICRP because it is well documented and kept up to date by the ICRP. It is also consistent with the preferred model identified by the National Academy of Sciences in the BEIR VII report (NRC-NAS 2006), the United Nations Scientific Committee (UNSCEAR 2000) and the National Council on Radiation Protection (NCRP 2001) and is widely accepted by the scientific community as representing a method which produces estimates of health effects which would not be exceeded. However, a number of researchers believe that the ICRP relation overestimates the number of detrimental health effects produced by low levels of radiation and, in fact, the possibility of no effect cannot be excluded. Conversely, there are some who believe that exposure to low levels of radiation can produce more health effects than would be estimated using the ICRP relations.

Clearly, using a relationship developed by one or the other of these groups would produce a larger or smaller estimate of the number of health effects than the values presented in this EIS, but a factor of two change in the small risks calculated for all of the alternatives would still leave them as small risks. All of the results of analyses of routine naval spent nuclear fuel handling operations and hypothetical accidents in this Appendix include the calculated radiation exposure in addition to the number of health effects to enable independent calculations using any relation between radiation exposure and health effects judged appropriate.

The radiation exposures reported in this EIS are chronic radiation exposures based on the committed dose (50 or more years of internal dose delivery) from an accident or annual dose from routine naval spent nuclear fuel handling operations. Exposures to high levels of radiation at high dose rates over a short period (less than 24 hours) can result in acute radiation effects. Minor changes in blood characteristics might be noted at doses in the range of 25 to 50 rad. The external symptoms of radiation sickness begin to appear following acute radiation exposures of about 50 to 100 rad and can include fatigue, anorexia, nausea, and vomiting. More severe symptoms occur at higher doses and can include death at doses higher than 200 to 300 rad of total body irradiation, depending on the level of medical treatment received. Information on the effects of acute radiation exposures on humans was obtained from studies of the survivors of the Hiroshima and Nagasaki bombings and from studies following a multitude of acute accidental radiation exposures. Factors to relate the level of acute radiation exposure to health effects exist but are not applied in this EIS because acute radiation exposures (direct radiation exposure not including inhalation and ingestion) during a hypothetical accident would be well below 20 rem.

F.7.5 Summary of Uncertainties

As discussed in the preceding portions of this section, the calculations in this EIS are generally been performed in such a way that the estimates of annual risk provided are unlikely to be exceeded during either routine naval spent nuclear fuel handling operations or in the event of an accident. For routine naval spent nuclear fuel handling operations, monitoring of actual operations combined with projections for future operations provide realistic but conservative source terms, which, when combined with conservative estimates of the effects of radiation, produce estimates of risk which are very unlikely to be exceeded. The effects for all alternatives have been calculated using the same source terms and other factors, so this EIS provides an appropriate means of comparing potential impacts on human health and the environment.

The analyses of hypothetical accidents provide more opportunities for uncertainty, primarily because the calculations must be based on sequences of events and models of effects which have not occurred. In this Appendix, the goal in selecting the hypothetical accidents analyzed is to evaluate events which would produce effects which would be as severe as or more severe than any other accidents which might be reasonably foreseeable. The models provide estimates of the probabilities, source terms, pathways for dispersion and radiation exposure, and the effects on human health and the environment which are as realistic as possible. In summary, it is judged that the annual risks presented in this Appendix are believed to be greater than what would actually occur.

The use of conservative analyses is not a problem or disadvantage in this EIS since all of the alternatives are evaluated using the same methods and data, allowing a fair comparison of all of the alternatives on the same basis. Furthermore, even using these conservative analytical methods, the annual risks for all of the alternatives are small, which greatly reduces the significance of any uncertainty analysis parameters.

F.8 Updated Modeling Methodology

Many of the accident scenarios included in this EIS were also covered in DOE 1995. In general, differences between the analysis assumptions used in DOE 1995 and the analysis assumptions used for this EIS are due primarily to improved knowledge and improved modeling methodology.

A discussion of these differences is included here to allow a comparison of the results from the separate documents to the greatest extent possible. The methodology changes include:

- The projected amount of naval spent nuclear fuel assemblies stored in the naval spent nuclear fuel handling water pools has changed since 1995. The most up-to-date estimates of water pool inventory are used in this analysis.
- The types of naval spent nuclear fuel stored in the water pools have changed since 1995. A more representative naval spent nuclear fuel type is used in this analysis based on the type of naval spent nuclear fuel that would be handled at NRF during the time period of the proposed action.
- The ICRP recommendations for health effects and radiation effects have been updated based on more recent scientific and technical knowledge than was available in 1995.
    - Conversion factors for health effects based on ICRP Publication 103 (ICRP 2007) guidance replace the ICRP Publication 60 (ICRP 1991) values for cancer fatalities used in 1995. The fatal cancer effects calculated in this EIS are a conservative estimate of cancer fatalities, and the use of this factor to estimate the incidence of fatal cancer is different from the methodology used in 1995.
    - Internal dose conversion factors for inhalation and ingestion of radioactive products from ICRP Publication 72 (ICRP 1996) and ICRP Publication 68 (ICRP 1994) replace the ICRP Publication 30 (ICRP 1979) based FGR 11 (EPA 1988) factors used in 1995.
- Doses for six age groups based on ICRP Publication 72 (ICRP 1996) are used to evaluate the effects to the General Population in this analysis. The ability to calculate dose specific to different age group for the General Population was unavailable in 1995.
- The population of the General Population increased from approximately 116,000 to approximately 151,000.
- The speciation of iodine is adjusted based on more recent experimental and technical knowledge.
- The release mechanism and fraction of corrosion and fission products are adjusted based on more recent experimental and technical knowledge.
- The hypothetical criticality yield is adjusted based on more recent experimental and technical knowledge.
- A revised version of the downwind airborne dose code (RSAC) is used for the airborne accident analysis. The revised code incorporates the updated ICRP ingestion and inhalation parameters and contains modifications to the dispersion model.
- A revised version of the GENII code is used for routine naval spent nuclear fuel handling operations analysis. GENII is used for the waterborne accident analysis instead of the proprietary computer program (WATER RELEASE) used in 1995. The revised GENII code incorporates the updated ICRP ingestion and inhalation parameters, modification to the dispersion model, and many expanded modeling capabilities.

- A more realistic method is used for direct radiation calculations using computer capabilities that were not available in 1995.
- The range of accidents presented was revised to focus on the types of operations conducted at a naval spent nuclear fuel handling facility. DOE 1995 had a broader scope.
- Accident probabilities have been revised for consistency with expected production rates.
- Accident probability calculations are based on more recent information and calculation methodology.

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