April 30, 2008 CCN 213522

Mr. Trevor L. Cook
NGNP Project Manager
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U.S. Department of Energy
19901 Germantown Road
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SUBJECT: Contract No. DE-AC07-05ID14517 – Completion of Milestone G-IN07NG08 "Prepare a Draft Template to Develop an Environmental Compliance Plan Including the Federal and State Environmental Compliance Requirements Pertinent to the Next Generation Nuclear Plant Project Facilities"

Dear Mr. Cook:

This letter formally documents completion of the Idaho National Laboratory (INL) FY 2008 Level 2 milestone identified as Work Package G-IN07NG08. The milestone description is:

> "*Prepare a Draft Template to Develop an Environmental Compliance Plan Including the Federal and State Environmental Compliance Requirements Pertinent to the Next Generation Nuclear Plant (NGNP)Project Facilities*" due April 30, 2008.

The enclosed document "Draft Template to Develop the Environmental Compliance Plan for the Next Generation Nuclear Plant Project," provides objective evidence of completion of the above milestone. This template has been enhanced with examples of information expected to be found under each section. As additional clarification of the specific requirements becomes available, revisions to this template will be issued.

If you have any questions, please contact me at (208) 526-6063 or Mark Holbrook, NGNP, NRC Licensing (208) 526-4362.

Sincerely,

Greg Gibbs, Project Director
Next Generation Nuclear Plant Project

MH:CN

Enclosure:

1. Draft Template to Develop the Environmental Compliance Plan for the Next Generation Nuclear Plant Project

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INL/EXT-08-XXXX

Draft Template To Develop NGNP Environmental Compliance Plan

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April 2008

Idaho National Laboratory
Next Generation Nuclear Plant (NGNP) Project
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Prepared for the
U.S. Department of Energy
Office of Nuclear Energy
Under DOE Idaho Operations Office
Contract DE-AC07-05ID14517

CONTENTS

ACRONYMS

AGR	Advanced Gas-Cooled Reactor
ANL	Argonne National Laboratory
ANSI	American National Standards Institute
ASCE	American Society of Chemical Engineers
ASLB	Atomic Safety and Licensing Board
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
ATR	Advanced Test Reactor
AVR	Arbeitsgemeinschaft Versuchsreaktor (Germany)
BACT	Best Available Control Technology
BEA	Battelle Energy Alliance
BOR	Bureau of Reclamation
CD	Critical Decision
CEQ	Council of Environmental Quality
CFA	Central Facilities Area
CFD	Computational fluid dynamics
CFR	Code of Federal Regulations
CFS	Cubic Feet per Second
COL	Combined Operating License
COSMOS	Consortium of Organizations for Strong Motion Observation Systems
CZMA	Coastal Zone Management Act
DBE	Design Basis Earthquake
DD&D	Deactivation, Decontamination, and Decommissioning
DEM	High Resolution Digital Elevation Model
DOE	U.S. Department of Energy
DOE-ID	U.S. Department of Energy Idaho Operations Office
DOE-NE	U.S. Department of Energy Office of Nuclear Energy, Science, and Technology
DOT	U.S. Department of Transportation
DRL	Design Readiness Level
EDE	Effective Dose Equivalent
EIS	Environmental Impact Statement
EDW	Environmental Data Warehouse
ELs	Emission Levels
EPA	Environmental Protection Agency
EPAct	Energy Policy Act of 2005
EPZ	Emergency Planning Zone
ER	DOE Environmental Restoration
ESP	Early Site Permit
F&Ors	Functional and Operational Requirements
FIMA	Fissions per Initial Metal Atom
FOAK	First of a Kind
FPPA	Farmland Protection Policy Act
FRD	Field Research Division
FSAR	Final Safety Analysis Report
GEn&SIS	Geographical, Environmental, & Siting Information System
GIF	Generation IV International Forum

GIS	Geographical Information System
GMT	Generic Mapping Tool
GPS	Global Positioning System
GT-MHR	Gas Turbine-Modular Helium Reactor
HTR	High Temperature Reactor (China)
HTS	Heat Transfer / Transport System
ICP	Idaho Chemical Processing Plant
IDAPA	Idaho Administrative Procedures Act
IHX	Intermediate Heat Exchanger
INEL	Idaho National Engineering Laboratory
INEEL	Idaho National Engineering and Environmental Laboratory
INL	Idaho National Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
IPR	Independent Project Review
ISMS	Integrated Safety Management System
ITAAC	Inspections, Tests, Analyses, and Acceptance Criteria
ITRG	Independent Technology Review Group
IWTU	Integrated Waste Treatment Unit
LEU	Low Enriched Uranium
LOCA	Loss of Coolant Accident
LPZ	Low Population Zone
LWR	Light Water Reactor
M	Magnitude
MHTGR	Modular High Temperature Gas-Cooled Reactor
MWt	Megawatt Thermal
M&O	Management and Operations
NEPA	National Environmental Policy Act
NERAC	Nuclear Energy Research Advisory Committee
NESHAPS	National Emissions Standards for Hazardous Air Pollutants
NGA	Next Generation Attenuation
NGNP	Next Generation Nuclear Plant
NHI	Nuclear Hydrogen Initiative
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NOAK	Nth of a Kind
NPR	New Production Reactor
NQA	National Quality Assurance
NRC	Nuclear Regulatory Commission
NRHP	National Registry of Historic Places
NRO	Office of New Reactors
NUREG	Nuclear Regulation
NWS	National Weather Service
ORNL	Oak Ridge National Laboratory
ORR	Operational Readiness Review
P2	Pollution Prevention
PBMR	Pebble Bed Modular Reactor
PCD	Pre-conceptual Design
PCS	Power Conversion System
PCU	Power Conversion Unit
PEER	Pacific Earthquake Engineering Research Center
PEP	Project Execution Plan

PIE	Post-irradiation Examination
PIRT	Phenomena Identification and Ranking Tables
PM-10	Particulates with a diameter less than 10 μ
PMB	Project Management Board
PMF	Probable Maximum Flood
PPMP	Preliminary Project Management Plan
PRA	Probabilistic Risk Assessment
PSAR	Preliminary Safety Analysis Report
PTC	Permit to Construct
PVHA	Probabilistic Volcanic Hazards Assessment
QAP	Quality Assurance Program
QAPP	Quality Assurance Program Plan
R&D	Research and Development
RCCS	Reactor Cavity Cooldown System
RG	Regulatory Guide
ROD	Record of Decision
RPV	Reactor Pressure Vessel
RTC	Reactor Technology Complex (formerly TRA)
RWMC	Radioactive Waste Management Complex
S-I	Sulfur-Iodine (process)
SAR	Safety Analysis Report
SDWA	Safe Drinking Water Act
SOW	Statement of Work
SRM	Safety Research Modification
SSA	Sole Source Aquifer
SSC	Structures, Systems, and Components
STAR	Stability Array
TAN	Test Area North
TAPs	Toxic Air Pollutants
TEDE	Total Effective Dose Equivalent
THTR	Thorium Hochtemperatur Reaktor (Germany)
TMI	Three Mile Island
TRL	Technology Readiness Level
UIC	Underground Injection Control
USC	United States Code
USGS	United States Geological Survey
V&V	Verification and Validation
VHTR	Very High Temperature Reactor
Vp	Compressional (P) Wave Velocities
Vs	Shear (S) Wave Velocities
WAG	Waste Area Group
WBS	Work Breakdown Structure

EXECUTIVE SUMMARY

Reserved for future development.

1.0 INTRODUCTION

The *Energy Policy Act of 2005* (Title VI, Subtitle C, Section 644) states that the "Nuclear Regulatory Commission shall have licensing and Regulatory authority for any reactor authorized under this subtitle." This stipulates that the Nuclear Regulatory Commission (NRC) will license the Next Generation Nuclear Plant (NGNP) for operation, which is consistent with the Energy Reorganization Act of 1974 that assigns the responsibility for licensing new Department of Energy (DOE) reactors to the NRC if they are used to generate power for an electric utility system or operated in any manner to demonstrate the suitability for subsequent use by the commercial power industry. NRC licensing of the NGNP will demonstrate the efficacy of licensing future advanced gas-cooled reactor concepts for commercial applications.

An environmental review is performed by the NRC staff in accordance with the National Environmental Policy Act (NEPA) to evaluate the potential environmental impacts and benefits of the proposed plant. After completing this review, the NRC issues a Draft Environmental Impact Statement (EIS) for comment by the appropriate Federal, State, and local agencies as well as by the public. Afterwards, the agency issues a Final Environmental Impact Statement that addresses all comments received.

Much Idaho National Laboratory (INL) site characterization data exist from the efforts that took place in the late 1980's to construct the New Production Reactor (NPR) at the INL. NPR Site E was chosen as the primary location and considerable resources were expended in characterizing the site. Because of this, NPR Site E is the initial site location that will be used for pre-conceptual and conceptual design studies. In addition, further analysis will be necessary to determine if Site E will remain the preferred site for the NGNP facility. The data contained in this report will assist in this effort.

1.1 Overview

The Next Generation Nuclear Plant (NGNP) will be a demonstration of the technical, licensing, operational, and commercial viability of High-Temperature Gas-Cooled Reactor (HTGR) technology for the production of process heat, electricity, and hydrogen. This nuclear based technology can provide high-temperature process heat (up to 950°C) that can be used as a substitute for the burning of fossil fuels for a wide range of commercial applications. The substitution of the HTGR for burning fossil fuels conserves those hydrocarbon resources for other uses, reduces uncertainty in the cost and supply of natural gas and oil, and eliminates the emissions of greenhouse gases attendant with the burning of these fuels. The HTGR is a passively[1] safe nuclear reactor concept with an easily understood safety basis that permits substantially reduced emergency planning requirements and improved siting flexibility compared to current and advanced light water reactors (LWRs).

In the *Energy Policy Act of 2005* (EPAct), the Department of Energy (DOE) was tasked with providing a demonstration of this HTGR technology to economically and reliably produce electricity and hydrogen by the year 2021. As the lead nuclear technology development laboratory of the DOE, the Idaho National Laboratory (INL) has initiated the work necessary to complete this task.

In FY-07, Pre-Conceptual Design (PCD) work was completed with the objective of developing a framework in which the design and technology development of the NGNP could progress and to begin to develop bases for selection of the specific design and operational characteristics of NGNP. This work was completed by three contractor teams with extensive experience in HTGR technology, nuclear power applications, and hydrogen production. The scope of work included completion of special studies to

[1] "Passive," as used here, means that the performance of engineered systems (e.g., the reactor cavity cooling system) are relied upon in the safety analyses, but without requiring any component in those systems to maintain or change state to satisfy the safety functions.

address key aspects of the NGNP (e.g., reactor type, power levels, power conversion system [PCS] and heat transfer/transport system [HTS] designs, licensing, and end product disposition). The results of these special studies were applied to the development by each contractor of a recommended design for NGNP and a commercial version of the HTGR. These were then used to estimate costs and schedule for design; construction; licensing; startup and testing; operation; and deactivation, decontamination, and decommissioning (DD&D) of the NGNP and an economic assessment for an Nth of a kind (NOAK) commercial plant. A primary objective of this work is to identify research and development (R&D), data needs, and future studies required to support selection of key characteristics of and to support the design and licensing processes for the NGNP.

1.2 Purpose and Scope

This document is a draft template for an NGNP Environmental Compliance Plan, as described in the Work Package Plan, Oracle Project Number 1011462. This template has been enhanced with examples of information that is expected to be found under each section. The objective of the work scope covered in this work package is to develop a strategy for complying with the environmental requirements of NRC and DOE, including NEPA, for siting and licensing NGNP facilities at the INL and documenting that process in an Environmental Compliance Plan. This draft template for an NGNP Environmental Compliance Plan provides details of the environmental compliance requirements pertinent to the NGNP project facilities and activities. Resource estimates are preliminary and may be subject to revision prior to development of the final plan.

This Plan is divided into 7 Sections: 1) Introduction; 2) Federal Statues, Regulations, Executive Orders, and DOE Orders; 3) State of Idaho Regulations and Permits; 4) NRC Reactor Siting and Licensing Guidelines and Requirements; 5) Outreach and Stakeholder Involvement; 6) Conclusions and Recommendations, and 7) Compliance Schedules. The applicability of this template guidance for satisfying regulatory requirements is a pre-design judgment and therefore conservative.

1.3 Key Assumptions

The purpose of this section is to identify the key assumptions that drive the applicability and determine the specific requirements of the various laws and regulations. These key assumptions for the facilities as well as assumptions about the common infrastructure will be listed here.

1.3.1 NGNP Facility

- The plant will be a very high temperature gas reactor (outlet temp 800-950 C).
- It will not be a “significant source” for air emissions.
- The power level will be 500-600 MWt.
- The core design will be pebble bed or prismatic.
- It will be licensed by the NRC.
- For the purposes of this report, the NGNP will pursue the Combined License (COL) process.
- It will be designed for at least five years of on-site fuel storage.
- It will be operational in approximately ten years and operate for forty years.
- For the purposes of this report, it will use natural draft cooling towers.
- For the purposes of this report, NPR Site E (located at INL) is the initial site location.

1.3.2 Existing INL Infrastructure

- INL electrical distribution system will be used but major modifications may be necessary.
- Access to the site will include truck and rail.
- Availability of industrial landfills.
- Availability of radioactive waste disposal/storage facilities.

1.4 Validation of Existing Site Information

Site characterization data were developed in the 1980s and 1990s to support the regulatory needs of the New Production Reactor (NPR) project and subsequent nuclear facility EISs, Safety Analysis Reports (SARs), and results of routine monitoring and special studies. Those data can support development of the Environmental Report (ER) for the NGNP project and the subsequent Environmental Impact Statement (EIS) that will be needed for licensing the NGNP with the Nuclear Regulatory Commission (NRC), and preparation of the required safety analysis reports for design, construction, and operation of the reactor and associated support facilities.

Current NRC requirements are focused on licensing light water reactors (LWRs) and do not include specific guidance that accounts for the passive safety features of high-temperature gas reactors. Therefore, applicability analysis will be needed once this report is completed to ensure that LWR-specific requirements are not inadvertently applied to the NGNP design. Those LWR-specific aspects will be identified and discussed with the NRC staff during pre-application review meetings.

2.0 FEDERAL STATUTES, REGULATIONS, EXECUTIVE ORDERS, & DOE ORDERS

This section will summarize the various federal laws, orders, and other requirements that are relevant to the NGNP project. Pertinent federal law and regulations are listed below.

2.1 Energy Policy Act of 2005

The *Energy Policy Act of 2005* (Title VI, Subtitle C, Section 644) states that the "Nuclear Regulatory Commission shall have licensing and Regulatory authority for any reactor authorized under this subtitle." That stipulates that the NRC will license the NGNP for operation, which is consistent with the Energy Reorganization Act of 1974 that assigns the responsibility for licensing new DOE reactors to the NRC if they are used to generate power for an electric utility system or operated in any manner to demonstrate the suitability for subsequent use by the commercial power industry. NRC licensing of the NGNP will demonstrate the efficacy of licensing future advanced gas-cooled reactor concepts for commercial applications.

2.2 40 CFR 61 Subpart H, National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities

EPA has delegated to the State of Idaho administrative authority for all Clean Air Act and air quality control programs except that for the National Emissions Standards for Hazardous Air Pollutants (NESHAPs). The majority of the air quality program requirements are therefore addressed under State of Idaho requirements.

This regulation applies to any facility owned or operated by the DOE. The EPA requires a NESHAPs document for all new and modified sources of radionuclide emissions to the atmosphere that would produce or exceed a facility-wide dose of 0.1 mrem per year effective dose equivalent (EDE) to the maximally exposed offsite individual. The total estimated time for data collection, preparation, review, and EPA approval of a NESHAPs document is 18 months (reference: INEL-NPR Environmental Compliance Plan and Schedule, NPRD-90-018, Rev. 1, July 1990).

The meteorological data needed for the NESHAPs report consist of a "WIND" (.wnd) file necessary to run the CAP88 air dispersion and dose assessment model specified for use by 40 CFR 61.92. The wind files are converted from Stability Array (STAR) files (.STR) using the GETWIND preprocessor supplied with the CAP-88 package. STAR files are formatted joint frequency data of hourly wind direction, stability class, and wind speed. These files are produced on an annual basis (most recent is for 2007) for each of the major facilities at the INL by the National Oceanic and Atmospheric Administration (NOAA) Air Resources Laboratory (ARL) for use in the CAP-88 modeling required for the INL annual EPA NESHAPs report. In addition, cumulative 10-year (1994-2003) STAR and WIND files are currently available for each facility which could be used for the CAP-88 modeling required for the NGNP NESHAPs document.

Additional meteorological and air dispersion inputs needed for the CAP-88 model include annual-average temperature, annual precipitation, absolute humidity, and stack parameters, including stack height, diameter, flow-rate, exit velocity, and exit temperature.

Existing Data:

All required meteorological input data and model input files have been developed for the annual INL NESHAPs analysis. The most recent data files are for the year 2007. In addition, there are

10-year average files available for the years 1994-2003, which are considered to be adequate long-term averages at the INL. Those files are available at: Fserob1\Projects2\Reporting\Verdoorn\NESHAP MET\Wndfiles.

Data Needs:

NGNP stack parameters listed above.

Schedule:

Time required to obtain data and conduct analysis: 18 Months

2.3 Atomic Energy Act of 1954

The Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.), as amended, and the Energy Reorganization Act of 1974 gives the NRC the responsibility for the licensing and regulation of private nuclear facilities related to public health and safety.

2.4 National Environmental Policy Act

The NGNP Project will structure a methodology for informing and consulting with stakeholders statewide that focuses on identifying a full range of community interests, questions, and concerns about locating NGNP facilities in eastern and Idaho. The methodology will be documented in an Outreach Plan and will strive to reach people and organizations at all levels, from the general public to community leadership, and will include business, education, local government, environmental, conservation organizations, and the Shoshone-Bannock Native American Tribes. It will use a variety of techniques to inform and engage stakeholders.

2.5 DOE 450.1 Preoperational Monitoring Requirements

DOE Order 450.1 requires the contractor to conduct environmental monitoring, to support the site's Integrated Safety Management System, to detect, characterize, and respond to releases from DOE activities; assess impacts; estimate dispersal patterns in the environment; characterize the pathways of exposure to members of the public; characterize the exposures and doses to individuals, to the population; and to evaluate the potential impacts to the biota in the vicinity of the DOE activity.

2.6 Clean Air Act

See Section 3.1

EPA has delegated to the State of Idaho administrative authority for all Clean Air Act and air quality control programs except that for the National Emissions Standards for Hazardous Air Pollutants (NESHAPs). The majority of the air quality program requirements are therefore addressed under State of Idaho requirements.

- 40 CFR 50, National Primary and Secondary Ambient Air Quality Standards.
- 40 CFR 51, Requirements for Preparation, Adoption, and Submittal of Implementations Plans.
- 40 CFR 51.166, Prevention of Significant Deterioration of Air Quality.
- 40 CFR 51, Subpart P, Protection of Visibility.
- 40 CFR 61, National Emission Standards for Hazardous Air Pollutants.

2.7 Noise Control Act of 1972

The Noise Control Act of 1972, as amended, directs all federal agencies to carry out to the fullest extent within their authority in a manner that furthers a national policy of promoting an environment free from noise that jeopardizes health or welfare. A document on the effects of noise from the proposed NGNP project will be prepared.

2.8 Archaeological and Historic Preservation Act

See Section 4.4

2.9 Endangered Species Act

See Section 4.3

2.10 Migratory Bird Treaty Act

See Section 4.3

2.11 Bald and Golden Eagle Protection Act

See Section 4.3

2.12 The Clean Water Act

See Section 4.7

2.13 Safe Drinking Water Act

See Section 4.7

2.14 Executive Orders 11988 and 11990

See Section 4.3

2.15 Resource Conservation and Recovery Act

It is assumed that the NGNP will generate, treat, and/or store solid wastes that are regulated under RCRA. Consequently a facility-specific RCRA Treatment, Storage and Disposal Facility Permit will be required. It cannot be determined at this time whether the facility would be permitted under the existing EPA Identification Number for the INL or would require a new EPA Identification Number. Typically, in Idaho, the DEQ requires submittal of the RCRA Permit application 24 months in advance of the start of construction. Generally, preliminary design information is adequate for the initial application submittal. Submittal and DEQ review of the detailed design information as it becomes available can be negotiated with the DEQ. Permit approval in Idaho may take up to 40 months.

2.16 Radioactive Waste Management

To be determined.

2.17 Land Disposal of Solid Waste

To be determined.

2.18 Comprehensive Environmental Response, Compensation and Liability Act

To be determined.

2.19 Emergency Planning and Community Right-to-Know Act of 1986

To be determined.

2.20 10 CFR 72, Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste

Because there will be a need for temporary storage of both spent nuclear fuel and high-level radioactive waste, the NGNP must be licensed in accordance with 10 CFR 72. That license will allow the DOE to receive, transfer, and possess reactor spent fuel, power reactor-related Greater than Class C (GTCC) waste, and other radioactive materials at a temporary facility. As needed, the NGNP will meet the requirements of 10 CFR 72 for obtaining Certificates of Compliance for spent fuel storage cask designs.

2.21 Transportation and Packaging – 10 CFR 71, 49 CFR 171, et al

The NGNP will require the packaging and transport of spent nuclear fuel and high-level radioactive waste; therefore, it must comply with 10 CFR 71, which defines the DOT requirements for packaging and transporting spent nuclear fuel and high-level radioactive waste.

2.22 LLW Disposal – 10 CFR 61 Licensing Requirements for Land Disposal of Radioactive Waste

If required for the disposal of LLW radioactive waste, the NGNP will apply for a license in accordance with 10 CFR 61. This will allow the NGNP to operate a land disposal facility for disposal of low-level radioactive waste.

2.23 10 CFR 110 Export and Import of Nuclear Equipment and Material

The NGNP will need to be licensed in accordance with 10 CFR 110.

3.0 STATE OF IDAHO REGULATIONS & PERMITS

This section will summarize the various Idaho state regulations and permits and other requirements that are relevant to the NGNP project.

3.1 IDAPA 58.01.01, Rules for the Control of Air Pollution in Idaho (Department of Environmental Quality)

These regulations define requirements for assessing any criteria air pollutants, toxic air pollutants, or radionuclides that may be released from the facility including support systems such as combustion sources (boilers, diesel generators), vented storage tanks, and gas pumping stations.

- Section 101 – "Significant emissions increase" from the source is that which would exceed the amounts listed for carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO2), particulate matter and PM-10, volatile organic compounds (ozone precursors), lead, fluorides, sulfuric acid mist, hydrogen sulfide, total reduced sulfur, reduced sulfur compounds. Radionuclide emissions are considered "significant" if the emissions from the single new facility would cause any member of the public to receive an annual EDE of at least 0.1 mrem/year, if total "facility-wide" (i.e., all INL site emission sources) contribute an EDE of less than 3 mrem/year, or any radionuclide emissions, if total facility-wide emissions contribute to greater than or equal to 3 mrem/year. If toxic air pollutants (TAPs), as defined in Sections 585 or 586, are emitted by the facility, preconstruction compliance must be demonstrated by comparing the uncontrolled TAP emission rates to the screening Emission Levels (ELs) given in Sections 585 or 586.
- Section 220 – General Exemption Criteria for permit to construction (PTC). No PTC is required for a source that satisfies the following criteria: (1) would not under maximum capacity equal or exceed 100 tons/year of any regulated pollutant, (2) would not cause an increase in emissions that equals or exceed the significant emission rate, above, or (3) the source is not part of a proposed new major facility or part of a proposed major modification.
- Section 221.02 – No PTC is required if the source has potential emissions that result in less than 1% of the 10 mrem/year EDE 40 CFR Part 61, Subpart H (NESHAPs) standard.

For any new or modified stationary source, the following information is needed for the PTC:

1. Site information, plans, descriptions, specifications, drawings, the nature and amount of emissions (including secondary emissions), and the manner in which it will be controlled and operated.
2. Construction schedule.

For any new major facility or modification, the following information is needed for the PTC:

1. A description of the emission control system, emission estimates, and other information to determine if a best available control technology (BACT) is applied.
2. An analysis of air quality impacts from the new source(s) including meteorological and topographical data necessary for the analysis.
3. An analysis of the secondary air quality impacts as a result of commercial, residential, industrial growth associated with the new facility.

4. A description of the nature, extent, and air quality effects of any or all general commercial, residential, industrial growth which has occurred since August 7, 1977 in the area affected by the major new facility.
5. An analysis of the impairment to visibility, soils, and vegetation from impacts associated with the new facility and secondary growth associated with the new facility. This analysis is only required for vegetation/soils that have significant commercial or recreational value.
6. An analysis of the impairment to visibility in any Federal Class I area that the new major facility would affect.
7. An analysis of the existing ambient air quality in the area affected by the major facility for each pollutant that the facility would emit in significant amounts (see [1], above). No analysis is needed if the modeled maximum ambient air impacts are less than the "significant contribution" amounts listed in Section 102. For any pollutant that has an ambient air quality standard (PM-10, SO2, ozone, NO2, CO, fluorides, lead – see Section 577), the analysis shall include continuous air monitoring data, gathered over the year preceding the submittal of the PTC application (Section 202). Monitoring for other pollutants that do not have an ambient air quality standard may be required by the DEQ if it determines it is necessary.
8. The DEQ may request monitoring of visibility in any Class I area that the facility may affect.
9. Operation of monitoring stations shall meet the requirements of Appendix B to 40 CFR 58 or other equivalent requirements as specified by DEQ.

- All estimates of ambient air concentrations (for non-radiological pollutants) shall be based on applicable air quality models, databases, and other requirements specified in 40 CFR 51, Appendix W, "Guideline on Air Quality Models." The following data are generally required for these modeling analyses:

  1. Maximum hourly and total annual emission rates (both with and without offgas emission controls) for each pollutant and radionuclide.
  2. For all emission points: release location (coordinates), release height, stack/vent diameter, effluent flow rate or velocity, effluent temperature, stack orientation (horizontal or vertical), and whether there is a rain cap or not.
  3. Coordinates and dimensions of all buildings with release points (stacks, vents, etc.) and all surrounding buildings that are within 5L of the release point, where L = the lesser of the building height or width.
  4. Five (5) years of sequential hourly meteorological data including wind direction, speed, ambient temperature, stability class, and mixing height.

  Existing Data:

  A 5-year (1997-2001) sequential hourly meteorological file is currently available for running the ISCST3 refined air dispersion model. However, the ISCST3 model has been replaced by AERMOD as the new preferred model.

  Data Needs:

  1.) All facility (source) modeling input parameters specified above need to be developed, including stack parameters and coordinates of NGNP facility buildings. 2.) A 5-year meteorological file input file for AERMOD needs to be developed by NOAA FRD using on-site (INL Mesonet) meteorological data.

Schedule:

To be determined.

3.2 Title V (Tier I) Air Operating Permit IDAPA 58.01.01.300-399

INL has an existing Title V Air Operating Permit, which will require amendment to incorporate all Federal and State requirements for the NGNP. The Title V Air Operating Permit incorporates all enforceable Air Quality requirements into a State approved and administered permit.

The State of Idaho has taken the position that all activities within the boundary of the INL site should be covered by a single Title V Air Operating Permit, irrespective of ownership of the various facilities.

The Title V permit must be amended to incorporate requirements for the new facility within one year of the start of operation of that facility. The amendment of the Title V permit may be requested as part of the PTC application process.

3.3 Idaho Water Quality Standards and Wastewater Treatment Requirements

3.3.1 Production Water Wells

See Section 4.7

3.3.2 Water Rights for Water Withdrawal

See Section 4.7

3.3.3 Idaho Regulations for Public Drinking Water Systems

See Section 4.7

3.3.4 Oil/Water Separators

See Section 4.7

3.3.5 Sanitary Wastewater treatment and Collection System

It is assumed that the facility will need to construct a sanitary wastewater collection and treatment system. Although no permit is required, the DEQ must review and approve plans and specifications prior to the construction, alteration or expansion of such a facility. Facilities must be designed according to the requirements specified in IDAPA 58.01.16. Plans and specifications must be prepared by or under the supervision of an Idaho registered professional engineer and construction must be observed by a registered professional engineer. It is conservatively assumed that one year will be required to obtain DEQ review and approval of facility plans and specifications.

3.3.6 Wastewater Land Application Permit IDAPA 58.01.16.600, 58.01.17

The application of either clean industrial waste water or sanitary waste water to the land surface would require a Land Application Permit from the State of Idaho. Waters applied to the land surface must be restricted to the premises of the application site. Provision must be made for monitoring the quality of the ground water in proximity to the application site. The ground water monitoring program is subject to approval by the DEQ. Depending on the nature and amount of the radioactive constituents, an air permit

might be required for such a discharge. The State of Idaho requires operator licensing for the operation of evaporative wastewater treatment systems. DOE Order 5400.5 prohibits new discharges to the soil column. Review and approval of a Wastewater Land Application Permit is conservatively estimated to take one year.

3.3.7 Industrial Wastewater Treatment IDAPA 58.01.16

The facility may require an industrial wastewater treatment facility to treat radioactive and/or non-radioactive waste water. Although no wastewater permit is required for an industrial wastewater treatment facility, the DEQ must review and approve plans and specifications prior to the construction, alteration or expansion of such a facility. No deviations from approved plans may be made without prior approval of the DEQ. If actual construction deviates from the approved plans and specifications, complete and accurate plans and specifications must be submitted for review and approval within thirty days of completion of construction. The DEQ does not review or approve industrial in-plant processes. Based on lack of recent data, it is conservatively assumed that one year will be required to obtain DEQ review and approval of facility plans and specifications.

3.4 Idaho Solid Waste Management

To be determined.

3.5 Idaho Hazardous Waste Management

To be determined.

3.6 Underground Storage Tanks

To be determined.

3.7 Tri-party Agreements

The Idaho Settlement Agreement was negotiated and signed in 1995. It documented agreement by the State of Idaho, the Department of Energy, and the Department of the Navy on the management of wastes and spent nuclear fuel at what was then the Idaho National Engineering Laboratory, now known as the Idaho National Laboratory.

In 1992, as a result of a DOE decision to cease reprocessing of spent nuclear fuel at the INEL, coupled with concern over the receipt of spent nuclear fuel from the Fort St. Vrain Nuclear Generating Station, the Idaho Governor initiated negotiations with DOE and the Department of the Navy because of his concern that Idaho would become a permanent disposal site for DOE spent nuclear fuel and waste. (The negotiated settlement resolved two lawsuits: Public Service Co. of Colorado v. Batt, No. CV 91-0035-S-EJL (D. Id.) and United States v. Batt, No. CV-91-0065-S-EJL (D. Id.))

The Settlement Agreement states as follows (section numbering is from the agreement):

D. Shipments of Spent Fuel to INEL

2. Shipments of DOE spent fuel to INEL shall take place as follows:

e. Except as set forth in Section D.2.d. above, DOE will make no shipments of spent fuel from commercial nuclear power plants to INEL. (Section D.2.d refers specifically to Fort St. Vrain spent fuel.)

In recognition of the need for a future mission for INL, the agreement provided that the INL would be designated the Department of Energy's lead laboratory for spent nuclear fuel, and it was further agreed that INL would direct the research, development and testing of treatment, shipment and disposal technology for DOE spent nuclear fuel.

This section also allows INL to bring spent nuclear fuel into Idaho for research and development purposes:

F. Spent Fuel Program

1. Establishment of INEL as DOE Spent Fuel Lead Laboratory. DOE shall, within thirty days of entry of this Agreement as a court order, designate INEL as the Department's lead laboratory for spent fuel. DOE shall direct the research, development and testing of treatment, shipment and disposal technologies for all DOE spent fuel, and all such DOE activities shall be coordinated and integrated under the direction of the Manager, DOE-Idaho Operations Office. Such designation shall not permit the shipment to INEL of any spent fuel beyond that permitted by this Agreement with the exception that quantities of spent fuel brought to INEL for testing in excess of those permitted by this Agreement shall leave the State of Idaho within five years of the date of receipt at INEL.

The agreement also contemplated the need for modification of the agreement, or for exceptions to the agreement, and provided a pathway for doing so:

J. Good Faith Compliance and Affirmative Support

1. The federal parties and Idaho agree that the activities to be performed under this Agreement and the subsequent Consent Order are in the public interest. The federal parties and Idaho acknowledge the complexity of this Agreement and have agreed to act in good faith to effectuate its fulfillment. The federal parties and Idaho shall affirmatively support this Agreement and its terms, conditions, rights and obligations in any administrative or judicial proceeding. The federal parties and Idaho intend to seek a sense of the Congress resolution expressing support for the terms, conditions, rights and obligations contained in this Agreement and the subsequent Consent Order and recommending to future Congresses that funds requested by the President to carry out this Agreement be appropriated. In any administrative or judicial proceeding, Idaho shall support the adequacy of the EIS and ROD against any challenges by third parties. Idaho shall have the ability, in its sole discretion, to waive performance by the federal parties of any terms, conditions and obligations contained in this Agreement.

On March 15, 2007 the current Governor of Idaho signed Senate Bill NO. 1148, which, in part, assigns to the Director of the Department of Environmental Quality the requirement to monitor the implementation of agreements between the United States and the State of Idaho related to the operation and environmental protection obligations of the INL and provide periodic information to the governor, the attorney general, the legislature and the people of Idaho concerning compliance with such agreements and obligations. The bill also gives the Director the power to enter into agreements with the United States Department of Energy in order to carry out the duties and authorities provided in Section 29-104 of the Idaho Code.

3.8 Idaho Adjudication: Water Rights

See Section 4.7.2, Water Availability.

3.9 Summary of Permits Required

Table 3-1 Example Permit Summary

Applicable Permit	Duration	Permit Requirements	Schedule	Regulatory Authority
Permit to Construct	8 – 12 months	Specific emissions controls and process equipment	Prior to the start of construction	
Title V Permit	8 – 12 months	Specific emissions controls and process equipment	For existing Title V Permit, within one year after start of operations	
Industrial Waste Water Treatment System	12 months	Final Plans and Specifications	Prior to the start of treatment system construction	
Sanitary Waste Water Treatment System	12 months	Final Plans and Specifications	Prior to the start of treatment system construction	
Wastewater Land Application Permit	12 months	Final Plans and Specifications	Prior to the start of WWLAP facility construction	
Potable Water System	12 months	Final Plans and Specifications, Demonstration of adequate technical, financial, and managerial capacity	Prior to the start of water system construction	
Potable Water Well	12 months	Well coordinates, construction specifications	Prior to the start of well construction	
Process Water Well	12 months	Well coordinates, construction specifications	Prior to the start of well construction	
Waste Management Plan	N/A	Identification of radioactive waste streams and disposition paths	Prior to the generation of wastes	
RCRA Permit	Up to 40 months	Preliminary Design information	Prior to the start of facility construction	

Applicable Permit	Duration	Permit Requirements	Schedule	Regulatory Authority
P2 and waste Min Plan	N/A	P2 and Waste Minimization Program	Prior to the generation of waste	
Industrial Landfill	12 months	Site-specific information and Operations Plan	Prior to construction of the landfill	

4.0 NRC SITING AND LICENSING GUIDELINES & REQUIREMENTS

The Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.), as amended, and the Energy Reorganization Act of 1974 gives the NRC the responsibility for the licensing and regulation of private nuclear facilities from the standpoint of public health and safety.

The NRC maintains oversight of the construction and operation of a facility throughout its lifetime to assure compliance with the Commission's regulations for the protection of public health and safety, the common defense and security, and the environment. To implement this process, all nuclear power plant applications must undergo a safety review, an environmental review, and antitrust review by the NRC.

4.1 NGNP Licensing Strategy

In the past, nuclear power plants required two licenses; a construction permit, which allowed the facility to be built, and an operating license, which permitted operation of the facility once it was completed (10 CFR Part 50). However, in 1989, the NRC adopted a streamlined licensing process (10 CFR Part 52) that encourages the use of standardized and pre-approved designs for any future plant proposals and provides for the issuance of a combined construction permit and operating license, also known as a Combined License (COL). Another feature of the streamlined process is possible early approval of sites for nuclear plants. This combined licensing process provides for the early resolution of virtually all issues before construction begins. This combined license also incorporates a program of tests, inspections, and related acceptance criteria (ITAAC) that are necessary and sufficient to show that the plant has been properly built. These criteria must be met before plant operation can begin.

After extensive review of vendor recommendations, the project has decided that a 10 CFR Part 52 COL application should be the foundation of the NGNP licensing strategy. It is the most expedient means of obtaining regulatory approval based on gas reactor technology as applied to the specific site for the NGNP project. This approach addresses both the acceptability of the design and its application to a specific site in one process step, including both Federal and State approvals of site issues. The Early Site Permit (ESP) and Limited Work Authorization (LWA) licensing options are considered in this licensing strategy to enable further management of licensing schedule risk.

4.1.1 Early Site Permit (ESP)

An ESP is a new alternative licensing process for NRC approval of a site for one or more nuclear power facilities. Certain siting issues are resolved, but it does not authorize construction of a nuclear power facility. It is a major Federal action. The action requires the preparation of a full and complete environmental impact statement (EIS) considering the impacts of construction, operation and decommissioning, but it does not require the benefits assessment; alternative site assessment is required. There is a mandatory hearing for an ESP.

4.1.2 Combined License (COL)

The COL is a type of license issued by the NRC that authorizes the construction and operation of a nuclear power facility. The COL application may reference an ESP or DC or both or neither. It is a major Federal action, but it is not a connected action; that said, the NRC rules establish a relationship between an ESP and COL that permits tiering and referencing. The action requires the preparation of an EIS; however, if the COL application references an ESP or a Design Certification (DC), then certain issues are treated as resolved in the absence of new and significant information. There is a mandatory hearing for a COL.

4.1.3 Design Certification (DC)

A Design Certification (DC) is an approval of a design sufficiently detailed and complete that can be referenced repeatedly without reopening or repeating the review. It is not a major Federal action. The design is certified in an NRC rule.

4.2 ESP Review and Documentation Requirements

4.2.1 Site Technical Review

The NRC staff reviews the application to determine whether the plant design meets all applicable regulations (10 CFR Parts 20, 50, 73, and 100). The review includes, in part:

- Characteristics of the site, including surrounding population, seismology, meteorology, geology and hydrology,
- Design of the nuclear plant,
- Anticipated response of the plant to hypothetical accidents,
- Plant operations including the applicant's technical qualifications to operate the plant,
- Discharges from the plant into the environment (i.e., radiological effluents), and
- Emergency plans.

When the NRC completes its review, it prepares a Safety Evaluation Report (SER) summarizing the anticipated effect of the proposed facility on public health and safety.

4.2.2 NEPA Review

The NRC NEPA Regulations, at 10 CFR Part 51, require that the NRC prepare an Environmental Impact Statement (EIS) for a permit to construct a nuclear power reactor. The permit applicant is required to submit an ER to aid the NRC in complying with NEPA, and the NRC is responsible for evaluating the reliability of any of the information that it uses to prepare the EIS. After completing this review, the NRC issues a Draft Environmental Impact Statement (EIS) for comment by the appropriate Federal, State, and local agencies as well as by the public. Afterwards, the agency issues a Final EIS that addresses all comments received.

Prior to issuing an operating license for a nuclear power facility, the NRC must assess the potential impacts that the facility may have on the environment. This is to ensure that the following NEPA goals and requirements are met:

- Fulfill the responsibilities of each generation as trustee of the environment for succeeding generations;
- Assure for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings;
- Attain the widest range of beneficial uses of the environment without degradation, risk to health or safety, or other undesirable and unintended consequences;
- Preserve important historic, cultural, and natural aspects of national heritage, and maintain, wherever possible, an environment which supports diversity and variety of individual choice;
- Achieve a balance between population and resource use which will permit high standards of living and wide sharing of life’s amenities; and
- Enhance the quality of renewable resources and approach the maximum attainable recycling of depletable resources.

4.2.3 NRC Environmental Report (ER)

To obtain information that is needed for this assessment, the NRC requires an applicant to develop an ER that delineates the potential impacts that the proposed facility may have on the environment.

The contents for an ER are specified in 10 CFR 51.30. The ER contains a description of the proposed action, a statement of its purposes, and a description of the environment affected, and discusses the following considerations:

- The impact of the proposed action on the environment, discussed in proportion to their significance.
- Any adverse environmental effects that cannot be avoided should the proposal be implemented.
- Alternatives to the proposed action. The discussion of alternatives must be sufficiently complete to aid the NRC in developing and exploring, pursuant to section 102(2)(E) of NEPA, "appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." To the extent possible, the environmental impacts of the proposal and the alternatives should be presented in comparative form.
- The relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity.
- Any irreversible and irretrievable commitments of resources that would be involved in the proposed action should it be implemented.

The ER organization and content, including a description of the various types of environmental data that must be gathered in advance to support development of the ER, is found in NRC Regulatory Guide 4.2, Rev 2, "Preparation of Environmental Reports for Nuclear Power Stations." Appendix 1 of this report discusses the available data and data gaps associated with those requirements.

4.3 Other Required Licenses and Permits

4.3.1 10 CFR 72 Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste

Because there will be a need for temporary storage of both spent nuclear fuel and high-level radioactive waste, the NGNP must be licensed in accordance with 10 CFR 72. That license will allow the DOE to receive, transfer, and possess reactor spent fuel, power reactor-related Greater than Class C (GTCC) waste, and other radioactive materials at a temporary facility. As needed, the NGNP will meet the requirements of 10 CFR 72 for obtaining Certificates of Compliance for spent fuel storage cask designs.

4.3.2 Transportation and Packaging – 10 CFR 71, 49 CFR 171 et al

The NGNP will require the packaging and transport of spent nuclear fuel and high-level radioactive waste; therefore, it must comply with 10 CFR 71, which defines the DOT requirements for packaging and transporting spent nuclear fuel and high-level radioactive waste.

4.3.3 LLW Disposal – 10 CFR 61 Licensing Requirements for Land Disposal of Radioactive Waste

If required for the disposal of LLW radioactive waste, the NGNP will apply for a license in accordance with 10 CFR 61. This will allow the NGNP to operate a land disposal facility for disposal of low-level radioactive waste.

4.3.4 10 CFR 110 Export and Import of Nuclear Equipment and Material

The NGNP will be involved with the possible export and import of special nuclear material and as such will need to be licensed in accordance with 10 CFR 110.

4.4 Air Modeling, Dose Assessment, and Meteorology

4.4.1 Reg. Guide 1.3, Rev. 2, June 1974

This regulatory guide provides procedures and assumptions to be used in evaluating the potential radiological consequences of a loss of coolant accident (LOCA) for boiling water reactors. Those analyses are required by 10 CFR 50.34 for a construction permit or operating license.

Guidance is given for the following: 1.) radionuclide release fractions, leakage rates, release heights, etc. for the iodine and noble gas inventories, 2.) methods and input parameters for calculating atmospheric dispersion, and 3.) methods for calculating external whole body doses.

Existing Data:

None

Data Needs:

Facility and reactor design parameters: 1.) reactor containment stack release height, 2.) fuel and containment radionuclide inventories, 3.) containment leakage rate, 4.) exclusion zone (receptor) distance from facility (needed to determine appropriate dispersion factor), and 5.) accident (worst-case) dispersion factors (X/Qs) developed for 0-8 hour, 1-4 day, and 4-30 day averaging times.

4.4.2 Safety Guide 1.5, March 1971

This safety guide provides methods and assumptions used for evaluating the potential radiological consequences of a steam line break accident for boiling water reactors. This analysis is required by 10 CFR 50.34 for a construction permit or operating license. This is very similar guidance to Reg. Guide 1.3 except even more basic and antiquated.

Existing Data:

None

Data Needs:

Coolant maximum radionuclide inventory.

4.4.3 Reg. Guide 1.23, Rev. 1, March 2007

Describes criteria for an onsite meteorological measurements program needed for estimating public impacts from routine or accidental radiological and non-radiological emissions. This includes assessment of dose to the public and control room as a result of hypothetical design-basis reactor accidents. The met data specified in this regulatory guide are required for NRC construction permit, operating permit, and early site permit.

Other related regulatory guides: Reg. Guide 1.145 provides specific guidance on atmospheric dispersion modeling to determine offsite radiological consequences from design-basis reactor accidents. Reg. Guide 1.111 provides specific guidance on atmospheric dispersion modeling to determine offsite radiological consequences from routine releases from power reactors. Reg. Guide 1.194 provides guidance on atmospheric dispersion modeling of design-basis accidents to determine reactor control room habitability. Reg. Guide 1.78 provides guidance to assess control room habitability during and after a postulated

chemical release. Reg. Guide 1.97 provides criteria for accident monitoring instrumentation for nuclear power plants.

Minimum amount of onsite data needed: (1) for a construction permit is a representative consecutive 12-month period, (2) for an operating license is a representative consecutive 24-month including the most recent 1-year period, (3) for an early site permit is a consecutive 24-month period of data that is defendable, representative, and complete, but not older than 10 years from the date of application. However, 3 or more years of data are "preferable and, if available, should be submitted with the application."

Meteorological Parameters:

1. Wind speed and direction measured at heights of 10 m and 60 m above ground level (AGL).
2. Vertical temperature difference measured at the same two heights as winds. Pasquill stability categories should be determined using ambient temperature change with height (°C/100m).
3. Ambient temperature should be measured at 10 m AGL.
4. Precipitation should be measured near ground level near the base of the tower.
5. If a cooling tower, lake, pond, or spray pond is planned for the plant's heat sink, ambient temperature and moisture measurements (e.g., dew point temperature, wet-bulb temperature, or relative humidity) should be measured at the highest measurement level on the tower.

Instrument accuracy and resolution criteria are given in Table 2. Instrument maintenance schedule should be performed at an interval that ensures at least 90% data recovery. Channel checks should be performed daily. Channel calibrations should be performed semiannually. Guyed tower wires should be inspected annually, and anchors should be inspected once every 3 years. Digital data sampling should be done at least once every 5 seconds, compiled as 15-min average values for real-time display in emergency response facilities, and compiled and archived as hourly values (format in Appendix A).

Existing Data:

The Idaho Falls NOAA Field Research Division (FRD) currently manages a 33-station, advanced Meteorological Monitoring Network (Mesonet) on the INL and surrounding Region (see http://www.noaa.inel.gov/projects/INLMet/INLMet.htm). One of these stations is the Grid 3 (GRI) 64 m (200-ft) tower sited 1.6 miles north of the Idaho Nuclear Technology Center (INTEC), which provides continuous wind data at 10 m and 61 m heights, air temperatures at 6-ft and 50-ft, atmospheric moisture measurements (relative humidity and dew point temperatures), barometric pressure, and solar radiation. The network includes a 915-MHz radar wind profiler which provides upper air data, including wind speed, wind direction, and temperature. According to the INEEL TMI-2 Safety Analysis Report (Revision 3, 2/15/03), the equipment specifications, maintenance standards, and data analysis procedures for the INL Mesonet conform to the requirements in Regulatory Guide 1.23, National Weather Service (NWS) protocols, and EPA quality requirements.

Data Needs:

None, until a site location is determined for the NGNP. After a site is determined, an assessment by NOAA should be made to determine whether the existing Mesonet stations will provide adequate data coverage or whether a new station near the NGNP facility location should be considered.

4.4.4 Reg. Guide 1.145, Rev. 1, November 1982

This guide provides an acceptable methodology for determining site-specific relative concentrations (X/Q) and should be used in determining X/Q values for the evaluations discussed in Regulatory Guide 1.3, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Boiling Water Reactors," and Regulatory Guide 1.4, Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors." These analyses are required for reactor early site review applications, construction permit applications, and operating license applications.

Meteorological data required are: 1-hour averaged wind speed, wind direction, and stability class, classed into the sixteen 22.5-degree compass direction sectors centered on true north. These data are obtained using the procedures in Reg. Guide 1.23 (above). Calms should be assigned a wind speed equal to the vane or anemometer starting speed, whichever is higher. Wind directions during calms should be assigned in proportion to the directional distribution of non-calm winds with speeds less than 1.5 m/s.

Air modeling required:

1. X/Q values are calculated for each sector at the exclusion area boundary distance and outer low population zone (LPZ) boundary distance. For stack releases, X/Q values should also be calculated at various distances beyond the exclusion area boundary distance to confirm the maximum value is obtained.
2. 2-hour averaged X/Q values are calculated separately using specified equations/procedures for: (1) releases that are lower than 2.5 times the height of adjacent solid structures (vents or other building penetrations) and (2) releases greater than 2.5 times the height of adjacent solid structures (stack releases). For stack releases, both nonfumigation and fumigation equations/procedures are specified.
3. An annual-average X/Q value is calculated for each sector at the outer LPZ boundary distance using the method described in Reg.. Guide 1.111. The 2-hour and annual X/Q values are then used to determine sector X/Q values at outer LPZ distances for various intermediate time periods (section 2.2).
4. A "0.5 Percent Maximum Sector X/Qs" is calculated for each sector by constructing cumulative probability distributions of 1-hour X/Q values, and selecting the X/Q value that is exceeded 0.5 percent of the total hours in the data set. The highest of the 16 sector values is defined as the maximum sector X/Q.
5. A "5 Percent Overall Site X/Q" value is also calculated using prescribed methods. The maximum of the 0.5% sector X/Q or the 5% overall site X/Q is selected as the exclusion area or outer LPZ boundary X/Q.

Existing Data:

All meteorological data required for this modeling (1-hour wind speed, direction, and stability class) are available through NOAA FRD.

Data Needs:

The above modeling data (X/Q values) need to be calculated using recent INL meteorological data in the vicinity of the NGNP site. This will require some knowledge of the site location. Also, the LPZ distance will need to be defined.

4.4.5 Reg. Guide 1.70, Revision 3, November 1978

This regulatory guide provides guidance on the "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)." A Preliminary Safety Analysis Report (PSAR) is required by 10 CFR 50.34 for a construction permit application. Section 2.3 gives the meteorological requirements.

Data required are:

1. Regional climatology (2.3.1) , including:
   - general climate description (2.3.1.1), and
   - Regional meteorological conditions for design and operating bases (2.3.1.2) – seasonal and annual frequencies of severe weather phenomena, annual frequency of freezing rain and dust storms, weights of the 100-year return period snowpack and 48-hour Probably Maximum Winter Precipitation, data for evaluating heat sink performance with respect to maximum evaporation and drift loss and minimum water cooling (Reg. Guide 1.27), design basis tornado parameters, and 100-year return period of the "fastest mile of wind," including vertical distribution of velocity and gust factor.
2. Local meteorology (2.3.2), including monthly and annual summaries of normal and extreme values for the following:
   - Wind roses (see Reg. Guide 1.23) at appropriate heights, air temperature and dew point temperature averages, extremes and diurnal range.
   - Air temperatures and dew point temperatures (averages, extremes, and diurnal range).
   - Atmospheric water vapor (absolute and relative).
   - Precipitation, including extremes, number of hours, rates, maximum hourly (1 – 24 hours), monthly precipitation wind roses with precipitation rate classes.
   - Fog (and smog), expected, extremes of frequency and duration.
   - Atmospheric stability (by vertical temperature gradient method).Monthly mixing height and frequency/duration of inversion conditions.
   - Hourly average wind speed/direction at surface and appropriate elevated height and hourly stability class (sequential hourly data and/or joint frequency distribution).
   - Potential influence of the plant facilities on local meteorology (2.3.2.2) – potential modification of above meteorological parameters, detailed topographic features (as modified by the plant) within a 5-mile radius of the plant, map showing topography with a 50-mile radius, plot of maximum elevation versus distance from the center of the plant in each 22.5-degree sector.
   - List of all local meteorological and air quality conditions used for design and operating bases considerations.
3. Short-term diffusion estimates at the minimum site boundary distance (exclusion area) and LPZ:
   - Use one-year onsite meteorological data.
   - Hourly cumulative frequency distributions (CFDs) of 5% and 50% X/Qs.
   - For the LPZ, provide CFDs for: (1) 0 – 8 hours, (2) 8 – 24 hours, (3) 1 – 4 days (3-day period), 4 – 30 days (26-day period).

- Report worst condition and 5%, 50% probability level conditions.
- Use diffusion models specified in Reg. Guide 1.3 and 1.4.

4. Long-term diffusion estimates – "realistic" annual-average X/Qs:
   - For each routine venting location.
   - For each of the sixteen 22.5-degree sectors at 50-miles.

Existing Data:

INL climate data (1, above) is well characterized and provided in Climatography of the Idaho National Engineering Laboratory, DOE/ID-121118, December 1989 and updated in http://niwc.noaa.inel.gov/climate.htm. INL climate data is also summarized in the following recent document: Safety Analysis Report, Idaho Spent Fuel Facility, Volume 1, ISF-FW-RPT-0033.

Data Needs:

Local meteorological data (2) needs to be compiled/developed by NOAA FRD after identification of a general site location (e.g., central INL near NPR site). NOAA will also need to determine monthly mixing height and inversion information (2 [g], above) by analyzing radar sounder data. Short-term (3) and long-term (4) diffusion estimates (X/Qs) are also site-specific and will need to be developed after identification of a site location using recent meteorological data from the INL Mesonet.

4.4.6 Reg. Guide 4.2, Revision 2, July 1976

This regulatory guide provides guidance on preparation of environmental reports for nuclear power stations, as required by 10 CFR 51.20-21. Requires applicant to submit two ERs: (1) Construction Permit Stage, (2) Operating License Stage. Interaction of existing [INL] sources with the proposed nuclear unit should be taken into account.

Chapter 2 – "To the extent possible, the information presented should reflect observations and measurements made over a period of years."

Chapter 2.3 Meteorology:

1. Meteorological description of site and surrounding area using at least one annual cycle from the onsite met program for the construction permit and at least two years for the operating license application.
2. Discussion on climatology, existing levels of air pollution, impact of local terrain and water bodies on the met conditions in the area.
3. On-site (in the area of the proposed new plant) data needed:
   - Diurnal (daily) and monthly averages/extremes of temperature, dew point, and humidity,
   - Joint frequency distributions (JFDs) of monthly and annual wind speed and direction by stability class at heights relative to proposed new source effluent height(s),
   - Total precipitation by month, number of hours with precipitation, rainfall rate distributions, and monthly precipitation wind roses.

     - Frequency of occurrence of winds > 50 knots by storm type.

- Acceptable measurements and format is presented in RG 1.23, "Onsite Meteorological Programs."
- Additional met information should be provided to adequately characterize atmospheric transport processes out to 50 miles from the proposed new station. This includes data from the on-site station and one or two additional stations within 50 miles of the proposed new plant. Data for all stations should be concurrent and presented by hour. Topographic maps with 5-mile and 50-mile radii, 22.5-degree sector lines should be presented. The following data are specified:
  - Wind speed and direction at appropriate release heights
  - Atmospheric stability as defined by vertical temperature gradient or other acceptable method
  - Monthly mixing height data
  - Total precipitation by month, number of hours with precipitation, rainfall rate distributions, and monthly precipitation wind roses.
- Data summaries (e.g., moisture deficit, visibility, solar radiation) are needed to assess the extent of fogging and icing conditions and other impacts on the environment due to station presence and operation. If a wet, dry, or wet-dry cooling tower is being proposed, summaries of joint humidity data with joint wind speed, stability category, and wind direction frequencies at the appropriate cooling tower height should be supplied. On-site data is preferable, but Regional National Weather Service data may also be used.

Effects of Heat Dissipation Facilities (5.1.4):

Where cooling towers are considered, the discussion should include estimates of the dimensions of the visible plume under various stability classes (Pasquill) and the probability distribution of wind directions, air temperature, and humidity expected at the site. Discuss shadowing effects and esthetic considerations caused by cooling tower plumes. If fog clouds or icing may occur, the estimated hours per year, distances, and directions should be presented. Consider possible synergistic effects that might result from mixing of fog or drift with other effluents discharged into the atmosphere from nearby fossil-fueled or industrial facilities (e.g., ATR cooling tower plume).

Existing Data:

The meteorological and climatological data specified in this Regulatory Guide should be developed from 1 – 2 years of "on-site" measurements at the facility site location. Although the NGNP site location is currently unknown, these data could be developed for a general location on the INL (e.g., near INTEC) using existing data from one of the existing NOAA FRD Mesonet towers on the INL http://www.noaa.inel.gov/capabilities/mesonet/mesonet.htm).

INL climate data is well characterized and provided in Climatography of the Idaho National Engineering Laboratory, DOE/ID-121118, December 1989 and updated in http://niwc.noaa.inel.gov/climate.htm. INL climate data is also summarized in the following recent document: Safety Analysis Report, Idaho Spent Fuel Facility, Volume 1, ISF-FW-RPT-0033.

Existing air pollution levels on the INL are monitored for (1) iodine-131, (2) gross alpha, (3) gross beta, (4) specific radionuclides, (5) tritium in atmospheric moisture and precipitation, (6) total suspended particulates and particulate matter less than 10 μm in diameter (PM10). These

data are available in the Idaho National Laboratory Site Environmental Report (http://www.stoller-eser.com/Annuals/2006/index.htm). Existing levels of other criteria pollutants (e.g., NO2, SO2, CO) are not currently measured on the INL, although estimates of the levels can be obtained through the Air Quality Division, Idaho Department of Environmental Quality (Mary Anderson, 208-373-0202).

The "on-site" data specified in (3) above is readily available for tower locations in the existing INL NOAA Mesonet (http://www.noaa.inel.gov/projects/INLMet/INLMet.htm), although it is not clear that these tower locations will suffice for characterization of the final NGNP site location (to be determined).

Data Needs:

Site-specific measurements (1 – 2 years) of existing criteria air pollutant concentrations in the vicinity of the NGNP site will likely be required. This primarily includes carbon monoxide (CO), nitrogen dioxide (NO2), and sulfur dioxide (SO2), as PM-10 levels are currently being measured on the INL site (see Existing Data, above). If the NGNP site will not be located in the vicinity of an existing INL Mesonet tower, a new tower will need to be installed and the data specified in (3) above will need to be developed over a 1 – 2 year period. Finally, the affect of heat dissipation facilities (e.g. cooling tower analysis) specified above should be performed by NOAA FRD after the initial site location is determined.

4.4.7 Supplement 1 to Reg. Guide 4.2, September 2000

An assessment of vehicle exhaust emissions is required if the plant location is in an NAAWS nonattainment or maintenance area. EPA has determined that the INL air quality is in attainment by a wide margin (reference: INEEL TMI-2 SAR, Rev. 3, 2/15/03, Section 2.3). Therefore, the vehicle exhaust emissions assessment is not required for NGNP siting at the INL.

Existing Data:

None

Data Needs:

None

4.4.8 10 CFR Part 20

Subpart D—Radiation Dose Limits for Individual Members of the Public. Section 20.1301 Dose limits for individual members of the public will not exceed: (1) 0.1 rem (100 mrem) total effective dose equivalent (TEDE) in a year, and (2) an external source dose rate of 2 mrem/hour in any unrestricted area. These dose limits include both gaseous and liquid effluents.

Section 20.1302 Compliance with dose limits for individual members of the public is shown by: (1) measurement or "calculation" or (2) demonstrating that the annual concentrations of radioactive material released in gaseous and liquid effluents at the boundary of the unrestricted area do not exceed the concentrations specified in table 2 of Appendix B to Part 20.

Existing Data:

None

Data Needs:

An emissions inventory for annual radionuclide releases during normal operations will need to be developed and compared to the screening concentrations specified in table 2 of Appendix B. This will require development of fuel inventories, design parameters, and leakage rates from all processes and off gas streams associated with the reactor facility.

4.5 Biological Resources

4.5.1 NRC Regulations

NRC regulations implementing NEPA require analysis of potential consequences of project alternatives to the environment, including biota (10 CFR 51, Appendix A [7]). A comprehensive understanding is required not only of the plant and animal species present in the project area, but also of how the various species interact within an ecological framework. A comprehensive characterization of the aquatic and terrestrial biota (and biotic systems) that may be impacted by the project is therefore required.

NRC also requires compliance with regulations pursuant to other laws applicable to biota and biotic systems, including the following:

- Bald and Golden Eagle Protection Act;
- Endangered Species Act;
- Sustainable Fisheries Act;
- Fish and Wildlife Coordination Act;
- Marine Mammal Protection Act; and
- Migratory Bird Treaty Act.

NRC requirements for Biota are summarized in Regulatory Guide 4.7 and NUREG 1555.

- 10 CFR 51, Subpart A, "National Environmental Policy Act—Regulations Implementing Section 102(2)."
- 10 CFR 51.45, "Environmental Report."
- 10 CFR 51.75, "Draft environmental impact statements—production and utilization facilities: draft environmental impact statement—construction permit."
- 10 CFR 51.95, "Final environmental impact statements—production and utilization facilities: supplement to final environmental impact statement."
- 10 CFR 52, Subpart A, "Early Site Permits."
- 10 CFR 52.79, "Contents of application; technical information."
- 50 CFR 10, General provisions for taking, possession, etc. of wildlife and plants
- 50 CFR 13, Fish and Wildlife Service General Permit Procedures
- 50 CFR 17.11, "Fish and wildlife."
- 50 CFR 17.12, "Plants."
- 50 CFR 18, Marine Mammals
- 50 CFR 21, Migratory bird permits
- 50 CFR 22, Eagle permits
- 50 CFR 216, NMFS regulations on taking and importing of marine mammals
- 50 CFR 402, Interagency cooperation – endangered species
- 50 CFR 450-453, endangered species exemption process

- 50 CFR 600, Magnuson-Stevens Fishery Conservation and Management regulations
- Executive Order 11988, "Floodplain Management."
- Executive Order 11990, "Protection of Wetlands."

Additional regulatory positions, guidelines, and specific criteria necessary to meet the regulations as identified above are as follows:

- Regulatory Guide 4.11, Rev. 1, *Terrestrial Environmental Studies for Nuclear Power Stations* (NRC 1977), contains technical information for the design and execution of terrestrial environmental studies, the results of which may be appropriate for inclusion in the applicant's ER.
- U.S. Nuclear Regulatory Commission (NRC). 1977. *Terrestrial Environmental Studies for Nuclear Power Stations*. Regulatory Guide 4.11, Rev. 1, Washington, D.C.
- U.S. Nuclear Regulatory Commission (NRC). 1998. *General Site Suitability for Nuclear Power Stations.* Regulatory Guide 4.7, Rev. 2, Washington, D.C.

4.5.2 Regulatory Guide 4.7, General Site Suitability Criteria for Nuclear Power Stations. April, 1998

- Provides guidance for characterizing the ecological systems and biota at potential sites and assessing the potential impacts to important species or ecological systems from the construction or operation of a nuclear power station at the site.
- If critical or exceptionally complex ecological systems are identified, they will have to be studied in detail to determine the appropriate plant designs before decisions to move forward are finalized, unless sites with less complex characteristics are not available.
- Presence of any important species inhabit or use the proposed site or its environs, and their relative abundance and distribution of their populations should be considered.
- It should be determined whether there are any important ecological systems at a site or in its environs. If so, determination should be made as to whether the ecological systems are especially vulnerable to change or if they contain important species habitats, such as breeding areas (e.g., nesting and spawning areas), nursery, feeding, resting, and wintering areas, or other areas of seasonally high concentrations of individuals of important species.

4.5.3 NUREG-1555 – Environmental Standard Review Plan – Section 2.5 (Biota)

Terrestrial Ecology

- Requires a detailed description of the terrestrial environment and biota of the site, transmission corridors, and offsite areas likely to be impacted by the construction, maintenance, or operation of the proposed project.
- Description should be capable for assessing potential impacts of the project on terrestrial ecosystems.
- Include identification and description of species composition, spatial and temporal distribution, abundance, and other structural and functional attributes of biotic assemblages that could be impacted by the proposed action. a map that identifies "important" terrestrial habitats on and in the vicinity of the site.

- Provide a map of the area occupied by each habitat type.
- List and description of "important" species, their spatial and temporal distributions including relative abundance, critical habitat, and life histories (critical life stages, biologically significant activities, seasonal habitat requirements, etc.).
- Assessment of habitat for threatened, endangered, and other "important" species.

Table 4.5-1. Important Species and Habitats (from NUREG 1555)

SPECIES	HABITAT
Rare species: Listed as threatened or endangered at 50 CFR 17.11 (Fish and wildlife) or 50 CFR 17.12 (Plants). This information may also be found via the Internet at the U.S. Fish and Wildlife Homepage in GEn&SIS. Proposed for listing as threatened or endangered, or is a candidate for listing in the most current list of such species as published in the *Federal Register*. This information may also be found via the Internet at the U.S. Fish and Wildlife Homepage in GEn&SIS. Listed as a threatened, endangered, or other species of concern by the State or States in which the proposed facilities are located **Commercially or recreationally valuable species:** Species that are essential to the maintenance and survival of species that are rare and commercially or recreationally valuable (as defined previously) Species that are critical to the structure and function of the local terrestrial ecosystem Species that may serve as biological indicators to monitor the effects of the facilities on the terrestrial environment	Wildlife sanctuaries, refuges, or preserves, if they may be adversely affected by plant or transmission line construction or operation Habitats identified by State or Federal agencies as unique, rare, or of priority for protection, if these areas may be adversely affected by plant or transmission line operation and maintenance Wetlands (Executive Order 11990), floodplains (Executive Order 11988), or other resources specifically protected by Federal regulations or Executive Orders, or by State regulations Land areas identified as "critical habitat" for species listed as threatened or endangered by the U.S. Fish and Wildlife Service

Aquatic Ecology:

- Requires a description of the aquatic environment and biota at and in the vicinity of the site and other areas likely to be impacted.

- Characterization of the aquatic environment of the water body and onsite streams, including biological, hydrological, and physiochemical.
- Maps showing "important" aquatic habitats.
- Distribution and abundance of "important" aquatic species. , especially in the discharge area and receiving water body.
- Endangered and threatened aquatic species that are known to be present or could potentially occur onsite, and an identification of their other locations and critical habitats within the region.

Numerous documents exist that describe the biotic resources of the proposed NPR site and/or of the INL site in general. Among these are the following:

- USDOE 1991. Draft Environmental Impact Statement for the Siting, Construction, and Operation of New Production Reactor Capacity. Volume 4, Appendix G. DOE/EIS-0144D.
- USDOE, 1992. Environmental and Other Evaluations of Alternatives for Siting, Constructing, and Operating New Production Reactor Capacity. Vol. 2 Appendix G. DOE/NP-0014. September, 1992.
- Irving, J.S. 1993. Environmental Resource Document for the Idaho National Engineering Laboratory (Volume 1). Idaho National Engineering Laboratory Report EGG-WMO-10279. July 1993.
- USDOE 1982. Idaho National Engineering Laboratory Resources and Environment for New Production Reactor. Volume 2 - Detailed Report. USDOE Idaho Operations Office IDO-101008.
- Anderson, J.E., K.T. Ruppel, J.M. Glennon, K.E. Holte, and R.C. Rope. 1996. Plant Communities, Enthnoecology, and Flora of the Idaho National Engineering Laboratory. Environmental Science and Research Foundation Report ESRF-005.
- Anderson, J.E. 1991. Vegetation studies to support the NPR Environmental Impact Statement. Report submitted to EG&G Idaho Inc. May 1991.

Additional information is available from a variety of sources, including INL reports, NEPA documentation for numerous projects, and the open literature.

4.5.4 Regulatory Guide 4.11, Terrestrial Environmental Studies for Nuclear Power Stations, August 1977:

This regulatory guide provides technical information for the design and execution of terrestrial environmental studies for nuclear power stations. The information resulting form the studies as they relate to ecological aspects of site selection, assessment of terrestrial effects of station construction and operation, and formulation of related monitoring activities may be appropriate for inclusion in the applicant's environmental report.

- Relates to environmental studies for five phases: Site Selection, Regional land use analysis; Ecological analysis, Local land use analysis; and Ecological analysis.
- Baseline Studies: Needed to fully describe the site and to establish a basis for predicting the impact of construction or operation. Used for comparison with later construction or operational studies as well as during decommissioning.
- Decommissioning studies: Consider potential for reclamation of the site upon decommissioning.

- Construction monitoring: Biological monitoring of important species may be necessary during construction to document the impact and develop possible corrective actions (e.g. ESA).
- Operational monitoring: To determine whether there are adverse biological effects attributable to operation. Related to operating license, and designed to determine the degree of direct linkage between the proposed station and the terrestrial ecosystem.

4.5.5 50 CFR Part 402; Interagency Cooperation - Endangered Species Act

- Interprets and implements the primary requirements of the Endangered Species Act.
- Imposes requirements on federal agencies regarding endangered or threatened species of fish, wildlife, or plants (‘‘listed species’’) and habitat of such species that has been designated as critical (‘‘critical habitat’’).
- Directs federal agencies to carry out conservation programs for listed species.
- Requires every Federal agency to insure that their actions are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat.

Existing Data:

Terrestrial vegetation and habitat (general): A comprehensive vegetation survey of the NPR site was conducted during the original NPR siting work. This survey is now almost 20 years out of date. A summary report was published (Anderson et al., 1991), but the raw data are not available and the detailed methods applied are not fully known. Some of the 50+ year long-term vegetation (LTV) study plots established by Jay Anderson at Idaho State University are either within or very near the NPR site. This data set can provide some limited information on vegetation changes over time at or near the NPR site. An updated INL-wide vegetation map is currently being produced by the S.M. Stoller Corp.

Rare plants/habitat: No comprehensive rare plant or habitat surveys have been conducted for the INL in general, nor for the NPR site. However, Anderson et al. (1991) reported the presence of two rare plant species at the NPR site. The U.S. Forest Service and the Bureau of Land Management maintain federal “watch list” for rare plants in the area, but other federal agencies (including DOE) do not recognize the list.

Terrestrial fauna (general): Numerous studies have been conducted on terrestrial fauna on the INL, and comprehensive species lists have been compiled for mammals, birds, reptiles, amphibians, and other faunal groups found on the INL. These lists are generally at least 20 years old, and typically report species as either being (a) present in the region; (b) present on the INL, or (c) possibly present on the INL. Many of the earlier studies on terrestrial fauna were conducted for operational or compliance purposes (i.e. NEPA), but many more were produced as part of graduate research programs at various universities. The first compilation of insects found at the INL was recently published (Hampton, 2005), although this was not a comprehensive survey of the site. Although a comprehensive fauna survey has not been conducted for the NPR site, it is not unreasonable to apply earlier lists of fauna that could be present.

1. Breeding Bird Surveys: Breeding bird surveys have been conducted routinely at the INL for the past 25 years. Locations surveyed include some that are near the proposed NPR site. The breeding bird database is maintained by the S.M. Stoller Corporation.

2. Migratory Birds: Surveys for migratory birds are required two weeks prior to any activity that could impact these birds. Surveys are conducted and data is maintained by the S.M. Stoller Corp.
3. Bald and Golden Eagle: A nest survey is required before any activity such as construction. If nests are present, they must be avoided or removed. A permit is required to move the nests.
4. Aquatic ecology and habitat (general): There are not aquatic systems on the NPR site. However, aquatic habitat will have to be evaluated wherever any access road or power lines cross the Big Lost River channel. This assessment must occur during periods of water flow, which do not occur every year.
5. Threatened and Endangered Species and Critical Habitats: The NPR site was evaluated for T&E species according to the listings at the time. At present, there are no listed T&E species for the INL. However, this could change with listing of sage grouse and/or pygmy rabbit. There is also no (or very little) data available for "important ecological systems" or critical habitats at the NPR site, although ongoing work by the S.M. Stoller Corp. may be useful.
6. Wetlands
7. Floodplain Management

Data Needs:

It is anticipated that upcoming work on the Conservation Management Plan will begin to resolve some of these data gaps provided the NPR site is included in the sampling design.

Terrestrial vegetation and habitat (general): Since the original NPR site vegetation survey was conducted, factors such as ecological succession, introduction and expansion of invasive species, and fire. An updated, comprehensive vegetation survey of the NPR site is therefore necessary to assess changes in plant species and vegetation community structure since the original survey was conducted over 20 years ago. At a minimum, a survey should be conducted to determine whether the information in Anderson et al. (1991) is still representative. If not, a comprehensive survey should be conducted. An updated INL-wide vegetation map is currently being produced by the S.M. Stoller Corp. As part of the INL Conservation Management Plan, the S.M. Stoller Corporation has been conducting a vegetation survey of the INL that is based on aerial imagery collected in 2007. A vegetation community map will be generated this year (2008), and ground truth data will be collected. Accuracy assessment of the vegetation community map is scheduled for 2009. This vegetation mapping will be useful to NPR especially if ground truth and accuracy assessment uses the NPR site.

Rare plants/habitat: Surveys of rare plants and unique vegetative habitats should be done in conjunction with the general terrestrial vegetation and habitat survey.

1. Terrestrial fauna (general): A list of terrestrial fauna that could occur on the NPR site could be compiled from existing sources.
2. Breeding Bird Surveys: The S.M. Stoller Corporation should be consulted to determine the effectiveness of applying their existing breeding bird survey data to the NPR site. If existing survey sites are deemed not representative of the NPR, additional NPR survey locations should be added to their routine survey.
3. Migratory Birds: Surveys for migratory birds must be conducted two weeks prior to any activity that could impact these birds. These surveys are relatively short duration, but can be

quite manpower intensive. Scheduling major activities for late summer/fall (i.e. generally after September 1) can avoid the need for these surveys.

4. Bald and Golden Eagles: A nest survey required before any activity such as construction to determine if any nests need to be moved.
5. Aquatic ecology and habitat (general): Aquatic habitat will have to be evaluated wherever any access road or power lines cross the Big Lost River channel. This assessment must occur during periods of water flow, which do not occur every year.
6. Threatened and Endangered Species and Critical Habitats: At present, there are no listed T&E species for the INL, and therefore there is no requirement for assessing T&E species. However, this could change with listing of sage grouse and/or, pygmy rabbit (or any other sagebrush obligate species) in the future. Little (if any) data exists for these species at the NPR site. If one or more species that is potentially present at the NPR site becomes listed by either the state or federal government, it may take several years to develop a data set extensive enough to allow for predictions or assessments of impacts to be made. Federal and State lists of threatened and endangered species and species of special concern that are or could be found at the INL are maintained by the S.M. Stoller Corporation. These lists are updated periodically by the U.S. Fish and Wildlife Service and the Idaho Fish and Game Department. Radiotelemetry studies on sage grouse at the INL is being initiated in 2008 by the S.M. Stoller Corporation, who will maintain the database. Stoller has also recently begun a limited survey of sage grouse leks in selected areas of the INL (but not the NPR site). This effort is expanding in 2008 to include the National Security Test Range. Most existing lek data for the INL is at least 30 years out of date. Pygmy rabbit surveys for the INL will be completed in 2009 by the S.M. Stoller Corporation. Similarly, no data is available on "important ecological systems" or critical habitat at the INL. Activities currently being conducted or planned through the INL Conservation Management Plan could be expanded or altered in such a way as to provide information on T&E species and critical habitats for the NPR site.
7. Wetlands: Surveys of wetlands are not currently required because there are no regulated wetlands in the area.
8. Floodplain management: Access roads need assessment.

Hampton, N.L. 2005. Insects of the Idaho National Laboratory: A Compilation and Review. In: N.L. Shaw, M. Pellant, S.B. Monson (eds.), Sage-grouse habitat restoration symposium proceedings, June, 2001, Boise, ID. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO., Proceedings RMRS-P-38, pp 116-130.

Time and Resource Requirements:

Terrestrial vegetation and habitat (general): A comprehensive vegetation survey of the NPR site would require a single field season, including site visits throughout the growing season (spring to fall) to account for phenological differences between plant species. This work will be more cost effective if done in coordination with scheduled activities associated with the INL Conservation Management Plan.

Rare plant/habitat: If done in conjunction with surveys for general terrestrial vegetation and habitat, rare plants and unique vegetative habitat surveys would ideally require one growing season, with surveys conducted at different times of the year depending on the phenology of the species of concern. However – weather conditions during a particular field season may be such

that additional surveys would be needed during other years. Some plants, for example, only flower during wet periods, and may not be apparent during a dry growing season.

Terrestrial fauna (general): A comprehensive survey of terrestrial fauna for the NPR site is not likely to be required, as a list of terrestrial fauna that could occur on the NPR site could be compiled from existing sources.

Breeding Bird Surveys: Minor expansion of existing routine breeding bird surveys to include the NPR site would require little if any additional resources.

Migratory Birds: Surveys for migratory birds prior to construction (or other major) activity will be of short duration. If the activity is late in the year (after September 1), migratory bird surveys will not likely be required.

Bald and Golden Eagles: A nest survey required before any activity such as construction to determine if any nests need to be moved.

Aquatic ecology and habitat (general): Aquatic habitat will have to be evaluated wherever any access road or power lines cross the Big Lost River channel. This assessment must occur during periods of water flow, which do not occur every year, but would likely be a single site visit.

Threatened and Endangered Species and Critical Habitats: The best approach to T&E issues would be to be proactive, especially with respect to pygmy rabbit and sage grouse. Current INL activities should be expanded to include the NPR site. At a minimum, this should include pygmy rabbit surveys during the winter and sage grouse lek surveys in the spring. Both should be continued annually.

Wetlands: Surveys of wetlands are not currently required because there are no regulated wetlands in the area.

Floodplain management: Access roads need assessment.

4.6 Cultural Resources

Guidance for considering historic properties/cultural resources is located in various NRC sources. NUREG-0099 (Regulatory Guide 4.2) specifically addresses siting studies and new construction. However, this guide has not been updated since 1976. The primary legal drivers for consideration of cultural resources (i.e. National Historic Preservation Act, 36 CFR Part 800, Native American Graves Protection and Repatriation Act, etc.) have been modified/passed since this time. Summaries of NRC requirements for cultural resources during re-licensing and also internal guidance for NRC environmental review staff, especially NUREG-1555 and LIC-203, provide an indication of NRC expectations with regard to compliance with the cultural resource requirements that post-date 1976.

4.6.1 NUREG-0099, Regulatory Guide 4.2, Rev. 2, July 1976

- Provides standard format and content guidelines for preparing Environmental Reports that assess the potential environmental effects of a proposed nuclear facility. These analyses are required by the National Environmental Policy Act, as implemented by 10 CFR Part 51.
- Guidance is given in Section 2-6 for Regional Historic, Archeological, Architectural, Scenic, Cultural, and Natural Features. Data required are: discussion of significant historic, scenic, archeological, architectural, cultural, and natural sites with special attention to those listed as National Natural Landmarks and/or those listed on the National Register of Historic Places, assessment of effect (adverse, beneficial) that construction and operation of the new facility and all associated developments (e.g. transmission lines, rights-of-way, access roads) will have on these resources, discussion of consultation with State Historic Preservation Officer, discussion of any steps taken to recover historical and archeological data affected by construction, discussion of the visual effects of the facility and associated developments on nearby valued cultural, scenic, historic, park, and recreation areas.

4.6.2 NUREG-0099, Regulatory Guide 4.2, Supplement 1, September 2000

- Provides guidance on the format and content of Environmental Reports to be submitted as part of an application for the renewal of a nuclear power plant operating license.
- Generally, plant refurbishment and continued operation are expected to have no more than small adverse impacts on historic and archaeological resources. However, the National Historic Preservation Act (16 U.S.C. 470-470w-6) requires Federal agencies to take into account the effects of undertakings (including issuance of a license) on properties included in or eligible for inclusion in the National Register of Historic Places and prior to approval, to afford the Advisory Council on Historic Preservation a reasonable opportunity to comment. Reference is made to procedures for meeting these requirements located in 36 CFR Part 800. This section also references NEPA requirements to consider the potential effect of the proposed undertaking on resources not necessarily eligible for nomination to the National Register in consultation with the State Historic Preservation Office and other interested parties.
- Specific guidance is given in Section 4.19 to identify resources that might be impacted, particularly by ground disturbing activity, increases in traffic, and audio and visual intrusions. Data required are: maps and descriptions of historic properties on or off-site in areas of potential effects for the project along with reference to National Register eligibility per 36 CFR Part 60, an assessment of the effects that the project will have on these resources per 36 CFR Part 800 (no effect, no adverse effect, adverse effect), measures identified to reduce or mitigate adverse effects in consultation with the State Historic Preservation Office or other interested parties.

4.6.3 Regulatory Guide 4.7, Rev. 2, April 1998

- Provides guidance to assist applicants in the initial stage of selecting potential sites for a nuclear power station. Discussion is focused on the major site characteristics related to public health and safety and environmental issues that the NRC staff considers in determining the suitability of sites for light-water-cooled (LWR) nuclear power stations during initial stages of the site selection process.
- Sections on Land Use and Aesthetics discuss scenic, historical, and archaeological resources and the need to consult with Federal, State, and Tribal offices in the identification and assessment of these resources.

4.6.4 NUREG-1437, Generic EIS for License Renewal of Nuclear Plants

- Assesses 92 environmental issues, documenting that 69 have been adequately addressed for all plants for which the issue is relevant. These issues are identified as Category 1 issues, and additional analysis is not required in a plant-specific review. Of the remaining 23 issues, there are 21 Category 2 issues, which require additional plant-specific analyses. Appendix H of Volume 2 summarizes the major Federal statutes that may relate to license renewal applications.
- Sections 3.7.7 and 4.7.7 address historic and archaeological resources, categorizing impacts resulting from activities associated with license renewal as "small, moderate, and/or large". Several important points are made: 1) any new construction activity has the potential to impact resources so specific project plans must be available early in the evaluation, 2) historic and archaeological resources vary widely from site to site; there is no generic way of determining their existence or significance, 3) historical significance can change from year-to-year, 4) conclusions with respect to significance and potential impacts can be drawn only through consultation with the State Historic Preservation Officer. Because the site-specific and activity-specific information is needed to assess the significance of impacts and appropriate mitigation measures can not be determined generically, NRC classifies this as a Category 2 issue.

4.6.5 NUREG-1555, Environmental Standard Review Plan, October 1999

- Series of instructions developed for NRC staff to use when conducting environmental reviews of applications related to nuclear power plants used in conjunction with regulatory guides that address siting and environmental issues.
- Section 2.5.3 specifically addresses identification and description of historic, archaeological, and traditional cultural resources. The Environmental Report should provide:
    - A detailed description of any archaeological or historical surveys of the proposed project (physical extent of the survey, description of survey techniques, qualifications of the surveyors, findings of the survey).
    - Comments of any organizations contacted to locate and assess archaeological and historic resources on or near the proposed project.
    - Description of properties within the proposed project (including offsite areas) that are eligible to the National Register or considered to be significant as determined through consultation with Federal, State, regional, local, and affected Native American tribal agencies.

- Description of historic properties within 16 km (10mi) of the proposed project or within 2 km (1.2 mi) of proposed transmission lines, access corridors, and other offsite areas and assessment of visual or noise impacts.

- Section 4.1.3 and 5.1.3 specifically address assessment of the potential impacts of construction and operation of the proposed project, including offsite developments (e.g. transmission lines, access roads), on historic properties including districts, sites buildings, structures, or objects of historical, archaeological, architectural, or traditional cultural significance as well as methods to mitigate any adverse impacts. The following tasks must be completed:
  - In consultation with the SHPO, consider the historic properties that are listed in or are eligible for inclusion in the National Register and that may be affected by construction of the proposed project.
  - Identify the construction activities that could result in potential impacts.
  - Assess the potential impacts on these resources with reference to 36 CFR Part 800, recognizing that there are generally two types of impacts on a resource: direct impacts (e.g., destruction during excavation) and indirect impacts (e.g., visual impact, denial of access).
  - Evaluate each identified impact and determine if the impact is small (no mitigation required), adverse (can be mitigated by specific practical design or procedure modifications), or adverse (can not be successfully mitigated and is of such magnitude that is should be avoided through selection of another alternative).
  - Although historic properties that are neither listed in nor eligible for inclusion in the National Register are not protected by the provisions of the NHPA, as amended, or 36 CFR 800, consider the potential impacts on these resources and measures and controls to avoid adverse impacts in consultation with the SHPO or other qualified individuals, as needed, under NEPA.
  - Consider alternatives to reduce the impact on the cultural and historic resources, making a determination of the cost of each alternative versus the benefit derived per the requirements of the Historic and Archaeological Preservation Act of 1974, and include the cost of the recovery required in the consideration of alternatives.
  - When the evaluation does not justify preservation of the resource, design strategies to recover archaeological, historic, architectural, and cultural data related to the resource before its destruction, including recording by photographs or measured drawings, archaeological excavations, removal of structures, salvage of architectural features, and/or other steps that will ensure full knowledge of the lost resource.
  - Deposit artifacts and materials collected during data recovery where they are of public and educational benefit.

4.6.6 Nuclear Reactor Regulation Office Instruction LIC-203, Rev. 1, Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues, June 2001

- Provides guidance on the NRR procedural requirements for demonstrating compliance with environmental statutes and regulations in accordance with NEPA and 10 CFR Part 51.

- Section 5.2.5 addresses responsibilities under the National Historic Preservation Act and Appendix G includes a flowchart of the compliance process as implemented through the overall NEPA compliance process.

All of the NRC sources require compliance with two primary laws that address cultural resources: NEPA and the National Historic Preservation Act, as well as implementing regulations (10 CFR Part 51, 36 CFR Part 800). Under these directives, the Environmental Report and Environmental Impact Statement must include an identification of historic properties and cultural resources in the area of potential effects for project construction, including any offsite developments (e.g. transmission corridors, access roads), as well as an evaluation of potential impacts to them. Then, in consultation with the State Historic Preservation Office, American Indian tribes, other stakeholders and the public, the applicant must assess effects (direct, indirect, cumulative) resulting from the project and consider methods of resolving any that are adverse (avoid, minimize, mitigate). The national Advisory Council on Historic Preservation must also be provided with a reasonable opportunity to participate in this process. Resources can include districts, sites, buildings, structures, or objects of historical, archaeological, architectural, or traditional cultural significance. Information gathered as part of ecological, water, and visual/scenic reviews may also contribute to the analysis. Potential for human remains to occur in the project area and plans for complying with Native American Graves Protection and Repatriation Act regulations in the event of an inadvertent discovery must also be addressed.

Information on the aesthetic and scenic quality of the project site must also be collected and potential impacts evaluated according to standards established by the Bureau of Land Management Visual Resource Inventory and Evaluation System.

Existing Data:

Archives maintained by the INL Cultural Resource Management Office include documentation of nearly three decades of cultural resource investigations on and around the INL, including a number of records valuable for use in NGNP siting:

- Documentation of over 2250 archaeological sites.
- Documentation of over 200 historic buildings.
- Documentation of archaeological surveys ranging from one to hundreds of acres and encompassing over 6% of INL lands.
- Documentation of consultation with the Idaho State Historic Preservation Office and Shoshone-Bannock Tribes for hundreds of proposed projects at INL.
- Knowledge obtained during successful consultations with the Idaho State Historic Preservation Office and Shoshone-Bannock Tribes, valuable in anticipating concerns for future projects.

Electronic databases and geographical information systems files enhance access and ongoing use of much of these data and form the foundation for a simple predictive model for prehistoric archaeological sites. With this model and the underlying specific data, reliable estimates of cultural resource density and potential compliance issues can be produced for any INL location.

Larger surveys completed to support siting studies for various previous projects on the INL should be of value in the current NGNP effort. One large siting study completed for the New Production Reactor project is of particular interest. Intensive archaeological surveys documented 152 archaeological resources in Area E, a 2.25 square mile area east of INTEC. Archaeological test excavations were completed to assess the National Register eligibility of most of the

resources in Area E that exhibited potential for listing. Today, these data could comprise the bulk of the identification phase of cultural resource compliance for any new project proposed for the same area, as long as steps are taken to bring the existing information up to current standards and consultation is initiated with the Shoshone-Bannock Tribes and Idaho State Historic preservation Officer.

Data Needs:

At a minimum, the following information must be presented in the Environmental Report:

- Extent of historic property and cultural resource analyses.
- Known historic properties and cultural resources in the area, including significance evaluations, and a general overview of cultural setting.
- Surveys of the proposed site (physical extent and relationship to area of potential effects, survey techniques used, qualifications of surveyors, results).
- List of historic properties and cultural resources within the area of potential effects and assessment of effects.
- Results of consultation (State, tribal, local).
- Inadvertent Discovery Plan, as appropriate.

INL cultural resource management archives include a significant archive of information useful for NGNP efforts. A predictive model developed for the INL site can be useful for overall siting studies, enabling broad comparisons at early stages in project planning. Once project plans are finalized, and a location is selected for construction, the archives will again prove valuable in providing site-specific information on cultural resources identified during previous cultural surveys of the area. If an area like New Production Reactor Area Site E is chosen, the majority of the effort needed to "identify" cultural resources has already been completed and data will only need to be collated and re-evaluated in light of current cultural resource requirements and project plans. Consultation will also need to be initiated with the Shoshone-Bannock Tribes, Idaho State Historic Preservation Office, and other interested parties.

The following tasks will be necessary to utilize NPR Area E cultural resource data for an NGNP Environmental Report:

1. Collate existing data, quality assessment, conversion/entry into suitable electronic formats.
2. Develop up-to-date National Register evaluations for all known resources.
3. Obtain global positioning system field data for all known resources, complete statements of current condition and visual effects, and assess changes at the project site since surveys were initially completed.
4. Complete surveys of additional offsite developments (e.g. transmission corridors, roads, ~ 2 for each to connect to existing infrastructure).
5. Initiate consultation with the Shoshone-Bannock Tribes and Idaho State Historic preservation Officer, including meetings and tours as necessary.
6. Develop methods of avoiding adverse effects acceptable to all consulting parties.
7. Develop Inadvertent Discovery Plan.
8. Complete Comprehensive Report.

Assumptions:

All of the estimates included in this section assume that NPR Area E will be the preferred site for construction and that the entire 2.25 square mile area will be developed. The figures will be reduced if a smaller area within NPR Area E is utilized. New estimates will be necessary if another location is preferred.

Estimated Time:

The time required to obtain data and conduct analysis is dependent on the location selected for construction. If NPR Area E is chosen, data to support the Environmental Report could be assembled in approximately 3-4 months. Data manipulation and some reporting tasks could be completed concurrently with fieldwork. Subcontractors could also be employed to facilitate concurrent completion of some tasks and possibly complete the work in a shorter time.

- Number of Weeks/Months: 4 Weeks — Data manipulation (Tasks 1, 2, 6)
  6 Weeks — Fieldwork (Tasks 3, 4, part of 5)
  3 Weeks — Reporting/Consultation (Tasks 5, 7, 8)

Seasonal Considerations:

Archaeological fieldwork can not be completed when snow is covering the ground, typically November – March. Consulting parties (Idaho State Historic Preservation Officer, Shoshone-Bannock Tribes) are legally provided with 30 calendar days to respond to requests for meetings or information. This clock restarts at 30 days every time a consulting party requests additional information. When schedules are tight, it is beneficial to have all of the necessary information on hand in a comprehensive report before consultation is initiated.

Estimated Costs:

The estimated costs required to obtain data and conduct analysis is dependent on the location selected for construction. If NPR Area E is chosen, the tasks enumerated above will require the following labor hours:

1. 270 hrs — Collate, QA, and convert existing data
2. 70 hrs — Update National Register evaluations
3. 450 hrs — Fieldwork – GPS locations, condition statements
4. 120 hrs — Fieldwork – one transmission corridor and one access road
5. 80 hrs — Consultation, including two tours
6. 70 hrs — Avoidance/mitigation methods
7. 40 hrs — Inadvertent Discovery Plan
8. 80 hrs — Comprehensive Report

If a smaller area within the 2.25 square mile NPR Area E site is utilized, it is likely that Tasks 2, 3, and 6 will be reduced by roughly the same percentage as the reduction in land area.

Material Costs:

- $ 400 – field supplies (pin flags, flagging tape, forms)
- $2,250 – short term vehicle lease ($500/month for 2 moths, plus gas $1750)

4.7 Geology

4.7.1 Regulatory Requirements

NRC 10 CFR 100.23, 10 CFR Part 50 Appendix A, 10 CFR Part 52.17, NUREG-0800 Section 2.5.1; 2.5.2; 2.5.3, NUREG-5503, NRC RG 1.132, 1.165, 1.198, 1.208, 4.7, DOE Standard 1022, ANS 2.27

Geologic, seismic, and geophysical data are used in assessments to satisfy CFR and RG acceptance criteria, and SRP, DOE, and ANS guidance that support the determination of surface deformation due to faulting at the proposed site. Sufficient data and information are needed to assess the regional tectonic setting, characterize tectonic sources, determine relationships of tectonic structures at the site relative to regional tectonic sources, and identify zones of Quaternary deformation.

Data and information related to regional tectonic sources include:

- Compilation of regional geologic, seismic, and geophysical data and investigations within 320 km (200 mi) of the proposed site.
- Identification of regional tectonic deformation (e.g., faulting and volcanism).
- Characterization and relationships of capable tectonic sources.
- Assessment of Quaternary deformation zones.

4.7.2 Existing Data: Regional Geologic, Seismic, and Geophysical Data and Investigations

The physiographic provinces include: Snake River Plain, Centennial Tectonic Belt, Yellowstone Plateau, Intermountain Seismic Belt, and Idaho Batholith. Each province has a different seismogenic potential that is determined by the nature of its intrinsic tectonic processes. This framework forms the basis for constructing a physiographic province map. Enough published information exists (with exception of finding references on the Idaho Batholith) to define major physiographic provinces and assess earthquake source zones. Data are contained on maps in figures of INL documents.

Data Needs:

Compile geographic data from publications to develop ESRI compatible files of tectonic provinces in the desired map projection.

Resources Required:

Number of Weeks/Months: 2 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 80 hours

Materials:

None

Estimate Assumptions: An existing data compilation is updated. Hours include data compilation and development of ESRI compatible files.

4.7.3 Existing Data: Gravity Data

Gravity data have been acquired on a regional and local basis at and near the INL. Gravity data have been used to assess the subsurface extent of faults, boundaries of tectonic provinces such the Basin and Range relative to the volcanic province of the Snake River Plain, and properties of rocks and sediments. Regional gravity maps have been combined with other data (geology, DEMs, magnetics) to evaluate anomalies and their relevance to earthquake sources (such as segmentation of Basin and Range normal faults).

There are several sources of gravity data that include digital data for processing and published results shown in maps. The sources of data include: PACES Database at University of Texas at El Paso (http://paces.geo.utep.edu/) for the United States; Hadley and Cavit (1984) for gravity values that are not in the PACES database; and Mankinen et al. (2004) for regional gravity data that cover Idaho, Montana, Washington, Oregon, and Wyoming. INL personnel have the capability to process, evaluate, and plot maps (compatible with ESRI) of gravity data using Geosoft, a geophysical processing software package (the license is shared by S. Payne, G. Heath, and C. Scott).

Data Needs:

Compile gravity data for regions of interest, process the gravity data to produce gravity anomaly maps, and generate ESRI compatible files using Geosoft software.

Resources Required:

Number of Weeks/Months: 4 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 120 hours

Materials:

None

Estimate Assumptions: Estimate assumes no new gravity data are collected.

4.7.4 Existing Data: Regional Magnetic Maps

Data and published studies of regional magnetic maps have been compiled to assess anomalies within the volcanic rocks of the Snake River Plain. Magnetic data have been used to delineate boundaries of tectonic provinces such the Basin and Range relative to the Snake River Plain, assess the extent of volcanic rift zones, and determine properties of rock and sediments.

There are several sources of magnetic data that include digital data for processing and published results shown in maps. The sources of data include: PACES Database at University of Texas at El Paso (http://paces.geo.utep.edu/) for the United States; McCafferty et al. (1999) for the state of Idaho; and Mankinen et al. (2004) for regional magnetic data that cover Idaho, Montana, Washington, Oregon, and Wyoming. INL personnel have the capability to process, evaluate, and plot maps (compatible with ESRI) of magnetic data using Geosoft, a geophysical processing software package (the license is shared by S. Payne, G. Heath, and C. Scott).

Data Needs:

Compile magnetic data for regions of interest, process the magnetic data to produce anomaly maps, and generate ESRI compatible files using Geosoft software.

Resources Required:

Number of Weeks/Months: 4 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 120 hours

Materials:

None

Estimate Assumptions: Estimate assumes no new magnetic data are collected.

4.7.5 Existing Data: Crustal Structure

Published results of seismic refraction surveys have been used to assess the crustal structure of the Snake River Plain and surrounding Basin and Range. Published results of other seismic methods such as teleseismic tomography have also been used to assess the crustal and upper mantle structure. Additionally, EARTHSCOPE has broadband seismic stations in Idaho from 2007-2009 and researchers are being funded to evaluate this data. There is sufficient existing information for refraction data within the Snake River Plain to evaluate the crustal structure when combined with other geophysical data such as results of the new studies using the EARTHSCOPE data.

Additionally, published seismic refraction surveys have been used to assess locations of possible subsurface faults, particularly along the northwest edge of the Snake River Plain. These data have been summarized in INL documents.

Data Needs:

Compile new data and information from published seismic tomography studies of the Snake River Plain and Yellowstone hotspot. Integrate new with existing data to develop a model of the crustal structure. Assess relevance to understanding the crustal structure of the Snake River Plain, selecting attenuation relationships of ground motions, and identifying possible fault sources.

Resources Required:

Number of Weeks/Months: 2 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 40 hrs

Materials:

None

Estimate Assumptions: Assumes EARTHSCOPE data and results have been published.

4.7.6 Existing Data: Quaternary Faults and Folds

Quaternary faults have been compiled for a 320-km radius of INL using published geologic maps. The U.S. Geological Survey now has a database of Quaternary faults that covers the United States. Digital fault data can be downloaded for geographic regions of interest. The Quaternary fault and fold database for the United States can be accessed at web site: http://earthquake.usgs.gov/Regional/qfaults/.

Data Needs:

Compile Quaternary faults and folds for a 320-km radius of INL from the U.S. Geological Survey's database. Develop ESRI compatible files that can be used to plot maps for other area radii from the proposed site.

Resources Required:

Number of Weeks/Months: 1 Week

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 40 hrs

Materials:

None

Estimate Assumptions: Assumes database is available. Estimate does not include addition of any local (<40 km radius) Quaternary structural features discovered at the proposed site.

4.7.7 Existing Data: Regional Geological Maps

Maps of the regional geology within a 320-km radius of INL have been used to assess the tectonic history, determine ages of rocks and sediments, identify locations of tectonic deformation such as faults, and to characterize potential volcanic sources. Data are available as individual paper maps and some maps are in digital format. There is not one map that covers the Basin and Range faults closest to INL and the volcanic features of the Snake River Plain in sufficient detail. The state geologic map lacks sufficient detail within local geologic maps for the NPR site and has poor spatial correlation with 10 m DEMs. A BYU-Idaho professor is currently mapping the southern region of the Beaverhead fault. Mel Kuntz (retired US Geological Survey) has unpublished data for the Spencer-High Point volcanic rift zone.

Data Needs:

Compile new and existing information from geologic maps and studies to develop one geologic map that includes the three capable Basin and Range faults (Lost River, Lemhi, and Beaverhead), the volcanic rift zones of the eastern Snake River Plain (extending from Yellowstone to Craters of the Moon), and detailed geologic mapping of the NPR Site or other proposed sites at INL. Develop ESRI compatible files of the geology in the desired map projection that can be used to plot maps for other area radii from the proposed site.

Resources Required:

Number of Weeks/Months: 6 months

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 300 hours

Materials:

Subcontract to Mel Kuntz for geology of the Spence-High Point volcanic rift zone - $30 K.

Estimate Assumptions: The larger recommended map area will provide geologic data for an area that has the radius of 40 km from any proposed site location at INL.

4.7.8 Existing Data: Fault Trenching Studies

Detailed fault trenching studies have been completed on the closest normal fault segments of the Lost River and Lemhi faults. The data include fault lengths, fault displacements, age dates, estimated slip rates, estimated recurrence rates. Additionally, structural geologic studies have been completed for the southern Lost River and Lemhi faults. The data include estimates of fault termination positions into the Snake River Plain, structural aspects between fault segments, fault segmentation options, estimates of fault dip, and some insight into fault kinematics. There is sufficient existing data for the southern segments of the Lost River and Lemhi faults. These data have been used to characterize fault-specific earthquake sources in the 1996 and 2000 INL PSHA. While the studies were performed under INL QA requirements, minimal oversight occurred for implementation. The reports were technically reviewed.

There is limited data to characterize the earthquake potential of the Beaverhead normal fault. There are no paleoseismic data to defend the age of the most recent earthquake or fault movement (inferred to be > 30,000 yrs), termination position of the southernmost segment into the Snake River Plain, or the estimated magnitude distributions. The Beaverhead fault could contribute to the dominant distances and earthquake magnitudes at the 10,000 yr return period for the NPR site and sites further north on INL, depending on its recurrence and fault termination point in the Snake River Plain.

Data Needs:

Perform a complete paleoseismic investigation of the southern two segments of the Beaverhead fault. This includes detailed structural geologic mapping to understand fault geometry, up to four fault trenches across the fault, digital images of the trench walls, samples to assess date of fault offset, interpretation of faulting history, and documentation.

Resources Required:

Number of Weeks/Months: 24 Months

Seasonal Considerations:

Award subcontract in February to perform trenching during summer months.

Estimated Costs:

Labor (hours): 450 hours; INL Geologist to interface with and review work of subcontractors, and conduct peer reviews.

Materials:

Trenching subcontract – $350 K; Structural geology subcontract – $50 K; External Peer Reviews – $30 K

Estimate Assumptions: None

4.7.9 Existing Data: Seismic Reflection Data

Seismic reflection data have been acquired and evaluated to assess the location, geometry, and type of faulting within the shallow subsurface near the southern segments of the Lost River and Lemhi faults. The seismic reflection data were used to assess the options for normal fault terminations at the edge of the Snake River Plain. Some seismic reflection data were acquired for the NPR site characterization program, and all seismic reflection data were reprocessed under NPR quality program. S. Payne has paper copies of all reprocessed reflection seismic lines. Digital copies of the seismic data may be in the NPR files on magnetic tapes. Also, it may be possible to obtain additional industry seismic reflection lines that can help delineate normal fault geometry near the Beaverhead fault.

Data Needs:

Determine disposition of digital seismic data and how these data can be qualified for use in an NRC licensing effort. Assess availability and cost of acquiring industry seismic reflection data for the three fault segments closest to INL.

Resources Required:

Number of Weeks/Months: 2 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 20 hours

Materials:

None

Estimate Assumptions: None

4.7.10 Existing Data: Dike-Induced Surface Deformation at INL

Published geologic data support characterization of small normal faults, ground cracks, ground fissures, volcanic vents, and recurrence of volcanism related to basalt dike intrusion within volcanic rift zones that cross INL. Additionally, dimensions of dike-induced surface deformational features have been compiled from worldwide active volcanic rift zones for comparison. These data have been compiled in tabular lists in INL documents.

Data Needs:

Compile any new geologic data on eastern Snake River Plain volcanic rift zones (such as unpublished data from Mel Kuntz), combine these data with updated compilations of worldwide analogs, and update the discussions and tables of dike-induced surface deformation in INL documentation.

Resources Required:

Number of Weeks/Months: 2 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 80 hrs

Materials:

None

Estimate Assumptions: Assumes that the updated compilation of worldwide analogs is performed as recommended in the Seismology Section.

4.7.11 Existing Data: Origin of Small Normal Quakes

Existing data for small normal faults within the Arco volcanic rift zone that overlap with the southern termination of the Lost River fault are ambiguous to the origin of these features. Two different interpretations have been made. First, the small normal faults are of tectonic origin and related to earthquakes along the southern segment of the Lost River fault (Kuntz et al. 2002). In this scenario, large magnitude earthquakes (M7+) can occur closer to INL facilities. The second interpretation is that the small normal faults are a result of dike intrusion and have a volcanic in origin. Under this scenario, the faults are capable of moderate size earthquakes (M5.5) and have a volcanic recurrence estimate of 17,000 yrs (Smith et al., 1996). These different scenarios have been included in the 1996 and 2000 INL PSHA. For proposed sites in the southern region of INL, additional investigations may be needed to assess contributions to the dominant distances and earthquake magnitudes of a PSHA.

Data Needs:

Evaluate existing data and make recommendations of studies to perform that can determine the origin of the small normal faults. Studies may include acquiring LIDAR data, soil pits to collect samples for age dates, collecting basalt lava flow samples for age dates, and fault trenching (1-2 trenches) of selected geomorphic features.

Resources Required:

Number of Weeks/Months: 2 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 40 hours

Materials:

None

Estimate Assumptions: The proposed site is located in the southern region of the INL.

4.7.12 Regulatory Requirements

NRC 10 CFR 100.23, 10 CFR Part 50 Appendix A, 10 CFR Part 52.17, NUREG-0800 Section 2.5.1; 2.5.2; 2.5.3, 2.5.4, 2.5.5, NUREG-5503, NRC RG 1.132, 1.165, 1.198, 1.208, 4.7, DOE Standard 1022, ANS 2.27

Sufficient geologic, seismic, and geophysical data and information within 40 and 8 km radii of the proposed site are used in assessments to satisfy CFR and RG acceptance criteria, and SRP, DOE, and ANS guidance that support the determination of surface deformation due to faulting or non-tectonic sources.

2. Data and information related to local (< 40 km radius) surface deformation sources include:

A. Data and detailed information of faults, geomorphic, and structural features.

B. Characterization of capable tectonic sources.

C. Ages of most recent deformations

4.7.13 Existing Data: Use of Aerial Photographs

2A: Aerial photographs of the Snake River Plain and INL define geomorphic, linear, and volcanic features. The aerial photographs provide data on the locations of features that may need additional ground based investigations or that demonstrate features (such as volcanic vents, faults, or slopes) do not exist at the proposed sites of interest. Digital images (such as DOQs or Google earth images) should not be substituted for these high quality photographs, but used to supplement digital images for detailed analyses.

Aerial photographs are complete for INL and much of the eastern Snake River Plain. Sufficient aerial photographs exist for the NPR Site. The photographs are located in the ROB1 building in a two drawers of a filing cabinet outside of Hollie Gilbert's office (near the west door). There is also a box on the cabinet with photos that need to be filed properly with the other photos.

Data Needs:

Review aerial photographs as part of detailed site investigations for NPR or other proposed sites and document findings. Compare findings at NPR site with Golder Associates (1992) report for any gaps of surface deformation features. Document the findings and determine geographic coordinates of tectonic significant features.

Resources Required:

Number of Weeks/Months: 2 Weeks

Seasonal Considerations:

Possibly, some field verification may be needed so this evaluation would need to be performed during summer months.

Estimated Costs:

Labor (hours): 80 hrs

Materials:

None

Estimate Assumptions: Aerial photographs are available for the proposed site of interest and limited field verification is needed.

4.7.14 Existing Data: InSAR and Leveling Data for the Snake River Plain

2A: Published results of InSAR data for the Snake River Plain and Yellowstone Plateau regions have been evaluated to assess vertical crustal movements such as subsidence and uplift. Vertical crustal deformation is related to active volcanism at Yellowstone such and includes periods of inflation and deflation of the Yellowstone caldera. In regions of the Snake River Plain, InSAR data over the last decade have revealed very little regional scale crustal subsidence that may result from cooling and contraction following passage of the Yellowstone hotspot. InSAR data processing and analyses are currently being performed by the U.S. Geological Survey for the Yellowstone Plateau, and by Idaho State University Department of Geosciences (contact Dr. David Rodgers) for the Snake River Plain.

Leveling surveys have been conducted within the Snake River Plain. These data have been evaluated to assess vertical crustal movements due to subsidence of the Snake River Plain and Yellowstone Plateau. There may be sufficient leveling data when evaluated with the InSAR data for the proposed site at INL.

Data Needs:

Review new and existing published results of InSAR and leveling data. Document any impacts to the proposed site for surface deformation such as subsidence or uplift.

Resources Required:

Number of Weeks/Months: 2 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 40 hours

Materials:

None

Estimate Assumptions: Assumes new data and results have been published.

4.7.15 Existing Data: LIDAR Data

2A and 2B: High resolution topographic maps or digital elevation models (DEM) can be used to assess fault, geomorphic, volcanic, tectonic, non-tectonic, and slope features within 1, 8, and 40 km radii of NPR or another proposed site location at INL. The high-resolution elevation data can be combined with geologic, seismic, and geophysical data to characterize capable tectonic features. Existing data include 10 m DEMs in ESRI compatible files of the eastern Snake River Plain and adjacent Basin and Range northwest of the INL.

Airborne LIDAR is an active remote sensing tool that can be used for high-precision altimetry (for INL applications need resolution to 0.5 m). LiDAR data can be processed to virtually deforest a landscape to reveal the forest floor topography in high resolution; this enables recognition of surface faults, fracture patterns that can be used to locate and characterize possible earthquake and volcanic sources. LIDAR at a resolution of 0.5 m for a radius of 40 km around the proposed site could be used to identify the presence or absence of linear and geomorphic features associated with dike intrusion and boundaries of volcanic rift zones.

Data Needs:

Acquire LIDAR data through subcontract at a resolution of 0.5 m for a radius of 40 km around the proposed site. Develop ESRI compatible files of the LIDAR data. Evaluate LIDAR data with existing geologic, seismic, and geophysical data. Characterize capable tectonic and volcanic features. Document the analyses in a report with peer review.

Resources Required:

Number of Weeks/Months: 12 Months

Seasonal Considerations:

LIDAR requires May-August time period for reduced snow cover at lower elevations such as the Snake River Plain.

Estimated Costs:

Labor (hours): 300 hours; INL personnel perform oversight (ties to GPS points), review quality, and process data for ESRI compatible files.

Materials:

Subcontracts: Airborne LIDAR – $700 K; Peer Review – $10 K.

Estimate Assumptions: Area for airborne LIDAR is separate effort and not part of the evaluation of strike-slip earthquakes within the shear zone listed under the Seismology Section.

4.7.16 Existing Data: Geological Cross Sections

2A and 2B: Geologic maps, drill hole data, and well data have been used to construct cross sections of the subsurface layers (basalt lava flows and sedimentary interbeds) and discontinuities (such as faults) at INL. These cross sections have been completed for ground water models that identify tectonic structures within 40 km of the NPR site. Recent assessments have identified a discontinuity that may be interpreted as a subsurface NE-trending fault between RTC and INTEC and the "Big Lost Trough" as associated with recent tectonic activity.

Data Needs:

Compile existing data to construct geologic cross sections within 1, 8, and 40 km radii of the NPR site or other proposed site at INL. Assess the impacts of any unidentified tectonic features (NE-trending fault near INTEC and RTC and Big Lost Trough). Provide recommendations for additional studies.

Resources Required:

Number of Weeks/Months: 4 Months

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 320 hours

Materials:

None

Estimate Assumptions: Drill hole data are easily available from the CWI database.

4.7.17 Existing Data: Development of Detailed Maps

2A, 2B, and 2C: Maps will be developed to show the geologic, seismic, geophysical (such as gravity and magnetic), and high-resolution topographic data within radii of 40, 8, and 1 km of the proposed site. The maps will show the presence or absence of tectonic and non-tectonic features at the site of interest. Detailed maps have not been developed for the NPR site.

Data Needs:

Develop ESRI compatible files of desired data sets that can be used to plot maps radii of 40, 8, and 1 km from the proposed site.

Resources Required:

Number of Weeks/Months: 2 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 40 hours

Materials:

None

Estimate Assumptions: Assumes the geologic, seismic, geophysical, and topographic data are available.

4.8 Hydrology

There are five topical areas related to the hydrology regulatory drivers and data requirements. They are:

- Characterization of surface waters and groundwater,
- Water availability,
- Water quality,
- Baseline and operations monitoring programs related to groundwater, and
- Flooding.

Each topical area is discussed in turn.

4.8.1 Topical Area: Characterization of Surface Waters and Groundwater

Regulatory Requirements

NRC 10 CFR 50 Appendix I, NRC Regulatory Guide 1.70, NRC Regulatory Guide 4.2.

Data and information related to characterization of surface waters and groundwater include:

The applicant must describe in quantitative terms the physical, chemical, biological and hydrological characteristics, the typical seasonal and long-term ranges and averages, and the historical extremes for surface and ground water bodies. For water bodies and systems that may receive radionuclides from the NPS, the data should be supplied out to a radius of 50 miles from the site or an area large enough to reach the nearest downgradient supply wells. Mathematical models may be required to predict the transport of liquid radioactive effluents. General criteria applicable to models include:

- Describe in detail and justify all model inputs and assumptions.
- Provide supporting evidence for model reliability and validity.
- Demonstrate that model results are unlikely to be substantially underestimated with all uncertainties considered.

Existing Data:

Surface water bodies at the INL have been well characterized. They are however, not of concern regarding off site transport. The Mud-Lake-Lost River Basin is a closed basin. Most of the water in the three streams flowing into the basin is diverted for irrigation before it reaches the INL. Flow that reaches the INL infiltrates the ground surface along the stream beds and spreading areas at the southern end. The Big Lost River is the closest surface water feature to the NPR site. Since, it is highly unlikely that any surface water would be withdrawn and no wastewater discharged to natural surface water bodies, there would be no impact to surface waters.

Groundwater at the INL has also been well characterized, especially near major facilities. However, groundwater characterization on a local scale near and downgradient (up to 50 miles or nearest groundwater users) from the NPR site may be deficient depending on the types and quantities of releases, and the level of modeling necessary for a complete groundwater pathway analysis.

Several models of flow in Snake River Plain Aquifer (SRPA) have been developed at the INL sitewide scale and for much larger areas of interest. INL recently developed a subregional three-dimensional groundwater flow and contaminant transport model for the OU 10-08 Baseline Risk Assessment (OU 10-08 RI/BRA, 2008). This report documents the underlying data and assumptions used to create the aquifer transport model. The USGS is also developing a subregional model of flow in the SRPA (Ackerman et al. 2006). It is not clear if the USGS will also model transport. The INL model was developed to examine potential commingling of contaminant plumes from three major facilities on the INL site (RTC, INTEC and RWMC). The model was calibrated to tritium concentrations and is considered generally representative of transport in the area around these facilities.

There are many sources of hydrologic characterization information at the INL. The major sources include the NPR-EIS, the ISF-SAR (2001), the INTEC HLW-EIS (2002), the ATR-SAR (2005), the TMI-2 SAR (2003), and the OU 10-08 RI/BRA (DRAFT) (2008), which contains information on the INL Sitewide Groundwater Model.

Data Needs:

1. Determine types and quantities of radionuclides expected to be released under normal operating and accident scenarios and make a determination of the type and sophistication of modeling necessary for each portion of the groundwater pathway.
2. Evaluate existing groundwater flow and transport models in the area of NPR against criteria regarding conservatism. Determine the schedule for completing the USGS aquifer model.
3. Evaluate existing vadose zone characterization data against the type and level of vadose zone modeling required. At a minimum, this could be determining the cumulative thickness of interbeds in the vicinity of anticipated or accidental liquid releases.
4. Evaluate existing aquifer characterization data and determine additional site specific data needed to validate an aquifer flow and transport model (local flow direction, velocity, porosity, aquifer thickness). Possible methods for obtaining this data include: tracer tests, geochemical evaluations, and borehole flowmeters.
5. Consolidate information on groundwater characteristics obtained since publication of the NPR-EIS, HLW EIS (Section 4.8) and OU 10-08 RI/BRA.

Resources Required:

1. Number of Weeks/Months: Unknown-requires plant design and operating parameters.
2. Number of Weeks/Months: 3 months for INL Sitewide groundwater model.
3. Number of Weeks/Months: Depending on the level of sophistication necessary, it could be 1 week to several months.
4. Number of Weeks/Months: Depending on the level of sophistication necessary, it could be a 1 month to 1 year or more. The extended time period would be necessary to conduct tracer tests, perform geochemical evaluation, or other tests to determine aquifer flow parameters.
5. Number of Weeks/Months: 1 month.

Estimated Costs:

1. Labor (hours): 40 to 240. Material: None
2. Labor (hours): 800. Material: None
3. Labor (hours): 30 to 300. Material: None

4. Labor (hours): 300 to 2400. Material: Variable depending on necessary instrumentation.
5. Labor (hours): 200. Material: None

Estimate Assumptions:

1. The subregional three-dimensional groundwater flow and contaminant transport model for the OU 10-08 Baseline Risk Assessment (OU 10-08 RI/BRA, 2008) will be the basis for any evaluation of the aquifer portion of the groundwater pathway. This model will be found suitable for use under the requirements of a site license application.
2. The USGS would be willing to provide their aquifer transport model for use by the NGNP project.
3. Evaluation of the groundwater pathway will include an evaluation of the vadose zone for any expected and accidental liquid releases.
4. Local-scale NPR-site investigations of groundwater velocities will find results consistent with those Roback et al. (2001) and results from the INL Sitewide Groundwater Model (2008) which both suggest the NPR site is over a "fast-flow" portion of the aquifer.
5. The INL Sitewide Groundwater Model will be found to conservatively predict transport for the aquifer pathway.

Note: The degree to which the new INL Sitewide Groundwater Model conservatively predicts transport at and downgradient from the NPR site has not been evaluated. For the groundwater pathway (vadose zone and aquifer), the level of modeling sophistication and the degree of justification required depends upon several factors (radionuclide mobility and toxicity, quantity released, flow and transport pathway parameters, etc). Simple and conservative models requiring little hydrologic characterization may be appropriate if releases are small enough. If results from the simple and conservative models suggest groundwater quality may be threatened or dose limits are exceeded, it may be necessary to use more sophisticated and representative models. Thus, details regarding estimated releases for normal operating conditions and accident scenarios must be determined before necessary details of the model/modeling can be established.

4.8.2 Topical Area: Water Availability

Regulatory Requirements

10 CFR 100.23, Regulatory Guide 1.27, Regulatory Guide 1.59, and Regulatory Guide 4.7

NRC regulations stipulate that the site should have a highly dependable system of water supply shown to be available under postulated occurrences of natural phenomena and site-related accidental phenomena or a combination thereof to perform their safety functions according to 10 CFR 100.23 and Regulatory Guide 1.59. There must also be sufficient water for normal operation of the facility.

There are also Idaho state regulations that specify the volume of water that can be withdrawn for beneficial use at the INL. These requirements are tied to the allocation of ground water in the State of Idaho

Regulatory Guide 1.27 entitled "Ultimate Heat Sink for Nuclear Power Plants,"2 provides guidance on water supply so there will always be an ultimate heat sink for the reactor in response to any potential conditions. Consumption of water may necessitate an evaluation of existing and future water uses in the area to ensure adequate water supply during droughts for both station operation and other water users (i.e., nuclear power station requirements versus public water supply). Regulatory agencies should be consulted to avoid potential conflicts.

Where required by law, demonstration of a request for certification of the rights to withdraw or consume water and an indication that the request is consistent with appropriate State and Regional programs and policies is to be provided as part of the application for a construction permit or operating license.

The NPS site will obtain its water entirely from groundwater sources, so it will need to ensure that there will be adequate availability both physically as well as administratively through the regulations enforced by the State of Idaho.

Regulatory Guide 1.59 stipulates that a highly dependable system of water supply sources must be shown to be available under postulated occurrences of natural and site-related accidental phenomena or combinations of such phenomena as discussed in this guide.

Regulatory Guide 4.7 states nuclear power stations requires a highly reliable source of water for steam condensation, service water, emergency core cooling system, and other functions. Where water is in short supply, the recirculation of the hot cooling water through cooling towers, artificial ponds, or impoundments has been practiced. This system of water supply must be shown to be available under postulated occurrences of natural and site-related accidental phenomena or combinations of such phenomena as discussed in Regulatory Guide 1.59.

Water requirements for nuclear power plants are that sufficient water be available for cooling during plant operation and normal shutdown, for the ultimate heat sink, and for fire protection. The limitations imposed by existing laws or allocation policies govern the use and consumption of cooling water at potential sites for normal operation. The physical availability of ground water at a proposed INL site will be constrained by the geology and hydrology of the particular location.

To evaluate the suitability of sites, there should be reasonable assurance that permits for consumptive use of water in the quantities needed for a nuclear power plant of the stated approximate capacity and type of cooling system can be obtained by the applicant from the appropriate State, local, or Regional agency.

State of Idaho regulations regarding water availability at the INL are documented in the Water Rights Agreement between the State of Idaho and the United States, for the United States Department of Energy, 1990. There are two potential limitations regarding water availability for the NGNP facility: issuance of a water right to the INL from the State of Idaho and physical water availability from ground water at this site. Surface water is not available at this site.

There must be a reasonable assurance that permits for water use and for water consumption in the quantities needed for operation of NGNP are available or can be obtained by the applicant from the State of Idaho. Surface water is not available at this site.

Existing Data:

The water rights issue was addressed in 1990 by the Department of Energy, Idaho Operations Office and the State of Idaho where the State has granted the INL a volume of ground water that can be used for any purpose that water would normally be used for anywhere within the boundaries of the INL and with a priority date of April 7, 1950. This agreement takes effect and will be confirmed by a water right decree in the Snake River Basis Adjudication. The Adjudication has not been finalized at this time and the "Agreement" between the State and INL has not been tested in court. At present, the INL uses approximately 10- percent of the quantity of water that is available to the site.

As to physical availability of water at this site, numerous aquifer stress tests have been conducted and water supply wells have been operated for extended time frames that suggest that sufficient

water should be able to be physically acquired from the Snake River Aquifer at many locations. However, site specific aquifer stress data is not available from the NPR-site E location and tests would need to be conducted to prove that water would be able to be withdrawn at this location. A long-term aquifer stress test was designed by Maddick and Hubbell in 1991 (draft report) but these tests were not conducted. However, a smaller straddle packer pump test was performed at the NPR site E with the existing wells by T.R. Wood and A. Wylie in approximately 1991 or 1992 that was associated with research conducted for the Subsurface Science Program headed by Frank J. Wobber (DOE). The test was run successfully and a completion report is believed to have been written but it has not been located (personnel communication with Joe Lord). This test information could be useful to give an indication of the localized hydraulic properties of this site; however, this straddle packer test used an approximate 4 inch pump that would have a relatively low capacity pumping rate. Thus the data would not be adequate for determining the large scale aquifer characteristics of this site.

The Howe-east Butte rift zone is located just north of the NPR site and may contain low permeability zones that could limit the volume of water that can be obtained at the facility and influence ground water flow paths in this area. The NPR well is mapped as being at a approximate location of a concealed vent or fissure (Anderson and Leszewski, 1997). However, other data indicates the ground water flow rate at the NPR Test Well is in the range of 14 ft/day (a high rate) based on geochemical age dating (Ackerman et al. 2006) suggesting a highly permeable flow path at this site.

This Eastern Snake River Plain (ERSP) aquifer, being comprised of fracture basalt, typically allows large volumes of water to be withdrawn, only limited by the depth to the water and the size of the well and associated pump. Wells have been drilled that can obtain over 2000 gpm from large diameter wells in portions of the aquifer. This being said, there are areas of the INL (for example south of the RWMC) that have been identified that appear to have lower permabilities than the aquifer as a whole and cannot produce large volumes of water. The NPR site also has a sedimentary interbed below the water table that may impact the volume of water that can be withdrawn. Thus the availability of water at any given location must be verified by in situ hydrologic testing (aquifer stress tests).

The INL has rights to use up to 11.4 billion gallons/year of water from the aquifer (only 10% of this volume is currently being used). As the required quantities are defined there will be a need to determine the impact of this water usage to calculate drawdown around the well field. In addition, the States ground water model (IDWR) will need to be run to determine the impact to spring flows in the different reaches of the Eastern Snake River Plain Aquifer. The impact of withdrawing large volumes of water may become an issue as that water scarcity has become an identified problem on the ERSP.

The water right that has been issued to the INL by the “Agreement” has a date of 1950 is older than most of the ground water users on the Eastern Snake River Plain. If there continues to be calls to the State from down stream users with more senior water rights this water right might have a portion of it curtained, were the INL using the entire water right.

It is not known how large of a well field will be required to produce the volume of water required for this site. This is dependant upon the volume of water required for the facility (volume and rates need to be defined). Additionally, the aquifer must be able to produce the required volume and rate of water from a well or series of wells without causing excessive drawdown in the well field.

The Snake River Basin Adjudication has not been finalized and so the "Agreement" is not in effect. Also, since this is an agreement between the State and the INL this agreement may be subject to testing in court and this has not been done.

Withdrawal of large quantities of water may change natural hydraulic gradients in the aquifer and impact the effectiveness of the ground water monitoring systems at INTEC.

Placing water back into the aquifer using percolation ponds will influence perched water in the vadose zone that may travel laterally for long distances (perhaps miles). It is possible, depending on the location of percolation ponds, the hydrogeology of the site, and quantities of water disposed, that water could move laterally and interact with the contaminated perched water at the INTEC site.

Data Needs:

1. The Snake River Basin Adjudication is still in process, so the INL should stay involved and up-to-date with the adjudication process to ensure that the INL's rights are upheld.
2. The volumes, rates and location of ground water withdrawal, how this water may be modified and subsequent disposal methodology will need to be defined for this facility.
3. The quantities of water that will have to be removed from the ESRP for cooling and other facility uses will require drilling wells and performing hydraulic testing ensure an adequate supply of water will be available for the foreseeable future and to design the supply water well field. These aquifer stress tests will need to be performed to validate the long-term availability of water at the chosen site.
4. Previous aquifer stress tests performed at the INL have had difficulty measuring drawdown at wells located at distances greater than a few hundred feet from the pumping well due to the hydraulic characteristics of the aquifer, well construction and influences of the deep vadose zone related to changes in atmospheric pressure and perhaps even earth tides. A special water level monitoring technique developed at the INL (isobaric well technique) will have to be used to quantify the aquifer response from the monitoring wells. The pump test should be performed and measurements taken to obtain hydraulic characteristics of transmissivity, hydraulic conductivity, storage coefficient as well as location of the base of the aquifer and delineate hydraulic boundaries that may impact physically obtaining the required volume of water from the aquifer.
5. Water levels associated with the aquifer stress test and long term background monitoring should be collected at several INTEC wells (also using the isobaric technique) to determine if the flow patterns in the ground water and vadose zone perched water are influenced by the pumping and waste water disposal practices at this facility.

Resources Required (by task number listed above):

Task 1: Tracking the Adjudication Process

Number of Weeks/Months: This should be a low-level continuing task that is assigned to an appropriate INL hydrologist from present to operation of the plant.

Seasonal considerations, if any: None

Estimated Costs: Labor (hours): 5 to 10 per month.

Materials: None

Estimate Assumptions: That there are no major changes in the adjudication process and the agreement with the State of Idaho for water rights at the INL remain intact as stipulated.

Task 2: Defining NGNP Water Usage and withdrawal location

Number of Weeks/Months: From initiation of design to final operation of the facility. The hydrologist will be needed less than about quarter time.

Seasonal considerations, if any: None

Estimated Costs: Labor (hours): 500.

Materials: $2K (models)

Estimate Assumptions: A ground water hydrologist should be kept involved with the design team, regarding the quantities and rates of water required for this facility. Large volumes of water will be used for cooling at the new reactor and ultimately placed in infiltration ponds to recharge the aquifer. This task will have to be conducted during the planning stages for the facilities' overall design. A ground water hydrologist will need to be consulted to determine the water availability (modeling availability and thermal impacts) and suitable location for infiltration ponds. Modeling will probably be required as a portion of this task to evaluate impacts of the withdrawal and reintroduction of water to the Eastern Snake River Plain Aquifer.

Task 3: Design and Installation of New Wells

Number of Weeks/Months: 6 to 8 months to design, drill and complete the wells.

Seasonal considerations, if any: Installing wells will be much less expensive if performed during summer and early fall.

Estimated Costs: Labor (hours): 2500 hr for preparations and oversite on the drilling and well completion (drilling subcontracted and listed under materials).

Materials: Drilling costs about 500K per well so 1,500K, Monitoring wells about 100K each for 600K. Total about 2,100k.

Estimate Assumptions: The site will need multiple water supply wells to be able to provide about 5000 gpm (~54 bg/yr). There should be a backup water supply system, either a pump or gravity fed water supply so water is always accessible for safety considerations. Assume 3 production wells that will make 2000 gpm and six monitoring wells at the well supply field (using existing wells that are available) and around the infiltration ponds.

Task 4: Aquifer Stress Tests

Number of Weeks/Months: Four months for field testing (pumping and recovery) followed by 6 weeks to analyze and report on results.

Seasonal considerations, if any: Running the pumping portion of the aquifer stress test should be conducted during an above freezing time interval to reduce costs.

Estimated Costs: Labor (hours): 3000

Materials: $100K for data loggers, pressure sensors and cabling.

Estimate Assumptions: Three aquifer stress tests will be performed by sequentially stressing (pumping and recovery) each pumping well individually and monitoring the response at the multiple wells (~10) monitored using the isobaric technique. Wells at INTEC will be modified to permit high precision water level measurements.

Task 5: Influence of ground water withdrawal and replacement to aquifer

Number of Weeks/Months: Lead time of 6 months to choose suitable existing wells, obtain approvals and modify surface completions and then confirm well surface completions are effective. This will be conducted concurrently with the aquifer stress test and infiltration of the byproduct water.

Seasonal considerations, if any: Field costs will be reduced if conducted in warm portion of years.

Estimated Costs: Labor (hours): 1000.

Materials: $70 K for well modification materials, data loggers pressure sensors and cabling.

Estimate Assumptions: Modify existing well surface completions (assume 5 wells) at INTEC to permit high precision water level measurements in perched and aquifer wells. Data from some of the advanced tensiometers may need to be obtained to evaluate impacts from reintroduction of groundwater to the subsurface. This will require monitoring in both the ground water and existing vadose zone monitoring locations (no new wells are assumed at the INTEC facility).

Background on general assumptions for Water Availability:

Information for the exact location for the NGNP facility at the INL has not been specified but is assumed for this discussion that it will be sited at the NPR-E site. If the proposed location changes from this site, but is still within the INL boundaries, most if not all of this information should still be applicable. The total volume of water required for the NGNP facility and support operations (base, peak and emergency pumping rates) and total consumptive use have not been specified at this time; however, most reactors use large volumes of water for cooling purposes, if a wet system and significantly less water should a dry system be used. For the estimates above, a 0.3 m3/s water requirement as assumed (based on 1/4 of total flow rate stipulated for the NPR site in report EGG-NPR-8522).

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4.8.3 Topical Area: Water Quality

Regulatory Requirements

10 CFR 20 and 10 CFR 50, NRC Regulatory Guides 1.7, 4.2 and 4.7.

State of Idaho Regulations IDAPA 37, Title 03, Chapter 09, 37.03.09, IDAPA 37, Title 03, Chapter 03 and IDAPA 58.01.11 – Ground Water Quality Rule, Sole source aquifer and Underground Injection Control

Potential impacts to water quality are specifically addressed in NRC Regulatory Guides 1.7, 4.2 and 4.7. 10 CFR 50 specifies radioactive doses that will not be exceeded by any pathway and requires that this be demonstrated by calculational procedures based upon models and data.

Regulatory Guide 1.7 specifies that information on the hydrosphere of the site including, dispersion, dilution, and travel times of accidental releases of liquid effluents that might impact either surface or ground water will be evaluated.

Regulatory Guide 4.2 provides guidance on preparation of environmental reports for nuclear power stations including the surface and ground water hydrology of the site and the use of surface and ground water models, including transport models. The models will be based on the properties and configuration of the local aquifer, variations (spatial and temporal) in ground water levels, and ground water quality data. The site will be described, in quantitative terms, of the physical, chemical, biological, and hydrological characteristics, the typical seasonal ranges and averages, and the historical extremes for surface and ground water bodies. Data should be supplied out to a radius of 50 miles from the site for water bodies and systems that may receive radionuclides from the station.

Regulatory Guide 4.7 states: The potential impacts of nuclear power stations on water quality are likely to be acceptable if effluent limitations, water quality criteria for receiving waters, and other requirements promulgated pursuant to the Federal Water Pollution Control Act are applicable and satisfied. Further it indicates:

> The criteria in 10 CFR Parts 20 and 50 will be used by the NRC staff for determining permissible concentrations of radioactive materials discharged to surface water or to ground water.

Any proposed waste discharges from the NGNP that may impact surface or ground water quality must be evaluated to ensure they will not result in offsite radiation doses.

Evaluations of the dispersion and dilution capabilities and potential contamination pathways of the ground-water environment under operating and accident conditions with respect to present and future users are required. Potential radiological and nonradiological contaminants of ground water should be evaluated. The suitability of sites for a specific plant design in areas with a complex ground-water hydrology or of sites located over aquifers that are or may be used by large populations for domestic or industrial water supplies or for irrigation water can only be determined after reliable assessments have been made of the potential impacts of the reactor on the ground water. Accordingly, 10 CFR Part 100 requires that site environmental parameters, which include hydrological and meteorological characteristics, be characterized and used in or compared to those used in the plant PRA and environmental analysis.

The following are examples of potential environmental effects of station construction and operation that must be assessed: physical and chemical environmental alterations in habitats of important species, including plant-induced rapid changes in environmental conditions; changes in normal current direction or velocity of the cooling water source and receiving water. Idaho State Regulatory drivers pertain to the following actions that may be conducted at a new nuclear plant, dependent upon the design of the facility. These requirements are tied to preserving the quality of water in the State of Idaho.

- The Idaho Department of Water Resources (IDWR) has statutory responsibility for all water wells, monitoring wells, low temperature geothermal wells, injection wells and other artificial openings and excavations.
- The State of Idaho will require permits for any wells that are deeper than 18 ft deep (Idapa 37, Title 03, Chapter 09, 37.03.09-Well construction standards rules).

- Public Water Supply Wells will require approval by Idaho Department of Environmental Quality. They include minimum construction guidelines and periodic sampling.
- If there are wells used to inject fluids into the subsurface they will be regulated under the Underground injection Control guidelines Idaho Code Title 42 Chapter 39 Waste Disposal and Injection Wells. Injection well construction is covered under Idapa 37, Title 03, Chapter 03.

The INL is located on a designated Sole Source Aquifer (SSA) and those rules may apply to other associated federally funded projects that could be related to the NGNP activities. The U.S. EPA's Sole Source Aquifer Program was established under Section 1424(e) of the U.S. Safe Drinking Water Act (SDWA). Federal financial assistance cannot be used for any project that might contaminate the aquifer. However, federal money can be used to help plan or design a project in such a way that it will not contaminate the aquifer.

The Underground Injection Control (UIC) rules would only apply if waste waters were disposed directly into the aquifer. This program would be applicable to NGNP if process, cooling, or sewage water is recharged back to the aquifer via an injection well (Class I well) or if storm runoff water were routed into an injection well (Class V wells).

Existing Data:

There is an extremely large data base of information on ground water quality from the INL. The reader is referred to publications from the INL and it contractors as well at the USGS web based data base. Site specific water quality data from the NPR Test Well is compiled in the USGS data base that is accessible by way of the web (http://waterdata.usgs.gov/id/nwis/qw).

The INL's ground water hydrology including the water quality has been well characterized as a whole, but specific data from individual potential well fields may vary significantly by location. However, groundwater characterization data at a local scale near and down gradient from the NPR site E is limited. The quantities and location of ground water withdrawals and subsequent waste disposal practice associated with this project may influence the quality of existing ground water over the long term operation of the plant.

Waste disposal activities at the INL have influenced the quality of ground water around five of the facilities. Several of the sites are conducting remediation activities to lower concentrations of contaminants while only monitoring is being done at several others. The ground water plume identified at the Reactor Technology Complex (formerly known as TRA-WAG2) is being monitored for chromium. The Idaho Nuclear Technology and Engineering Center is being monitored for nitrates, technetium and iodine where modeling predicts that active remediation will not be required. The INTEC ROD specifies capping with infiltration controls with continued monitoring will be conducted is to ensure drinking water standards will be met for strontium. Vapor extraction is being conducted at the RWMC and the ROD is in process and being actively developed for this site. The Central Facilities Area conducts monitoring for nitrates and active remediation has not been required. The Test Area North has an active in situ bioremediation system in operation around the former injection well with monitoring of natural attenuation on the distal portion of the plume. The NPR site is not in the path of any of these ground water contamination plumes for the foreseeable future.

Waste discharges (planned or accidental) that may impact ground water from the construction or operation of the NGNP will need to be specified and then this information will be used to evaluate the impacts to the ground water quality. In order to perform this evaluation of impacts,

the site may need additional site characterization data from the point of disposal, through the vadose zone, into ground water, and then down hydraulic gradient from the site.

If there are extensive water withdrawals with consumptive use, or the extracted ground water is routed to a disposal location that is near the INTEC facility, this might impact the local ground water flow patterns and impact existing contamination plumes at this site, located 2.5 miles to the east. Lateral water movement in the vadose zone has been documented to move a mile in response to surface infiltration of water at the spreading areas near the RWMC.

The aquifer characteristics at this site are poorly known. These characteristics will control how any waste water discharges could impact the ground water quality in this area.

Data Needs:

The specific data needs relating to ground water quality at this site are addressed in the other topical hydrology sections, namely: characterization of surface and ground water, water availability, and baseline and operations monitoring programs. These sections address the determination of existing water quality for this site and of types and quantities of radionuclides and other chemical constituents that could be reasonably expected to be released under normal operating and accident scenarios that could impact the ground water at this site.

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Data from the NPR test well (designated as USGS number 433449112523101 and located at 03N 30E 16DDD1 NPR TEST) is located at the web site:

http://nwis.waterdata.usgs.gov/id/nwis/qwdata?agency_cd=USGS&county_cd=16023&format=station_list&sort_key=station_nm&group_key=NONE&sitefile_output_format=html_table&column_name=agency_cd&column_name=site_no&column_name=station_nm&begin_date=&end_date=&TZoutput=0&qw_attributes=0&inventory_output=0&qw_sample_wide=wide&rdb_qw_attributes=0&date_format=YYYY-MM-DD&rdb_compression=file&list_of_search_criteria=county_cd%2Cagency_cd

4.8.4 Topical Area: Baseline and Operations Monitoring Programs Related to Groundwater

Regulatory Requirements

Regulatory Guide 4.2. Section 6.1.2, DOE Order 5400.1

Evaluation criteria related to baseline and operations environmental monitoring programs are found in Regulatory Guide 4.2. Section 6.1.2 describes criteria specific to groundwater. DOE Order 5400.1 specifies requirements applicable to monitoring programs.

In cases where the proposed facility may potentially affect local ground water or in which the ground water environment may serve as a pathway to man, either directly or indirectly, a program leading to assessment of potential effects attributable to site preparation, station construction, and station operation must be established.

A preoperational environmental monitoring and data collection program is required to establish a reference framework or baseline environmental condition from which to assess potential impacts.

According to RG 4.2, Section 6.1, any environmental characteristic or parameter that may be altered by site preparation, station construction or operation should be measured and a baseline condition established. In general, at least one year of environmental data should be collected and evaluated prior to filing the ER unless sufficient justification is provided for the proposed program.

According to RG 4.2, Section 2.4, groundwater data should include physical, chemical, biological and hydrological characteristics including typical seasonal ranges and historical extremes. The source and nature of all background pollutants (e.g. chemical species and characteristics) must be determined including the range of concentrations and time variations in release. Water quality characteristics should include measurements made on or in "close proximity to the site."

NRC regulations regarding monitoring are similar to DOE Order 5400.1 which specifies that prior to startup of a new facility; the preoperational study should begin not less than 1 year, and preferably 2 years before startup. DOE Order 5400.1 specifies preoperational monitoring activities shall serve to: characterize existing physical, chemical, and biological conditions that could be affected; establish background levels of radioactive and chemical components; characterize pertinent environmental and ecologic parameters; and identify potential pathways for human exposure or environmental impact as a basis for determining the nature and extent of the subsequent routine operational and emergency effluent monitoring and environmental surveillance programs

Existing Data:

Groundwater monitoring at the INL is well established. In 1993, the DOE Idaho Operations Office (DOE-ID) initiated a program to integrate all of the various groundwater monitoring programs at the Idaho National Engineering Laboratory (INEL) Site. This resulted in the development of the INEL Groundwater Monitoring Plan, DOE/ID-10441 (1993) and the INEL Groundwater Protection Management Plan, DOE/NE-ID-11176 (2004). The monitoring plan described historical conditions and monitoring programs, and included an implementation plan for each facility. The protection management plan established policy and identified programmatic requirements.

The INEL Groundwater Monitoring Plan was updated in 2003 (INEEL Groundwater Monitoring Plan Update, DOE/ID-11034) to include the monitoring wells, constituent lists, and sampling frequencies of current programs. The updated plan does not replace the 1993 plan but uses it as the basis for the information previously presented regarding operational history, contaminant sources, and monitoring networks for each INL Site facility. The updated plan modifies groundwater monitoring recommendations in accordance with more recent information (i.e., requirements in records of decision), relying on existing multiple groundwater programs rather than a single comprehensive program.

Currently groundwater is monitored on a facility scale or a Waste Area Group (WAG) scale, and on a sitewide scale. The ICP contractor and the INL M&O contractor monitor groundwater at the WAGs based on WAG-specific requirements regarding constituents and frequency. Sitewide or surveillance monitoring is done mostly by the USGS and includes wells across the INL and wells outside the INL. The purpose of the surveillance monitoring is to: 1) provide data to determine the baseline conditions of groundwater prior to impact by operations, 2) provide data to support early detection of groundwater contamination resulting from current or historic DOE operations, 3) provide data to track the extent and migration of known contaminant plumes resulting from DOE operations.

There is currently only one groundwater monitoring well (NPR-Test) located at the NPR site where water samples and water levels are collected/measured regularly. The nearest upgradient

wells monitored regularly are USGS-005, approximately 2.5 miles to the northeast, and USGS-017 nearly 6 miles to the north. Groundwater levels have been monitored at least quarterly in the NPR-Test well since it was drilled in 1984.

Information on INL groundwater monitoring programs can be found in the INEL Groundwater Monitoring Plan (1993), the INEEL Groundwater Monitoring Plan Update (2003), and the INEEL Environmental Monitoring Plan (2004). The INEEL Groundwater Monitoring Plan Update contains information on the management and storage of the data. Groundwater data collected by the ICP and INL M&O contractor are stored electronically in a centralized data management system known as Environmental Data Warehouse (EDW). Data collected by the USGS are stored electronically in the USGS Groundwater Site Inventory and Quality of Water databases.

Data Needs:

1. Prepare a preoperational or baseline monitoring plan for the NPR site. It is not necessary to prepare the operations monitoring plan at this time, but it is necessary to determine analytes that could be released and chemical and biological parameters in groundwater that could be impacted by operations so they can be included in the preoperational monitoring plan.
2. Determine if additional monitoring wells are necessary. It is likely that at least one additional upgradient well and three additional down gradient monitoring wells will be necessary.
3. Assess previous and current monitoring against proposed monitoring plan.
4. Collect baseline monitoring data from current and new upgradient and downgradient monitoring wells.

Resources Required:

1. Two months (estimated)-Preparation of a preoperational or baseline monitoring plan for the NPR site requires knowledge of plant design and operating parameters.
2. One month. It is not anticipated to require substantial time (days to weeks) to get agreement on whether or not additional wells are necessary. If wells are necessary, it will take approximately six months to install well.
3. Two to three months to assess previous and current monitoring against proposed monitoring plan.
4. Two years

Estimated Costs:

1. Labor (hours): 60 to 120. Material: None
2. Labor (hours): 40 to 80 (oversite for wells 500 hr). Material: Four aquifer monitoring wells at a cost of $100K per well.
3. Labor (hours): 200. Material: None.
4. Labor (hours): 800. Material: Analytical laboratory and data validation costs: $40K

Estimate Assumptions:

1. The chemical and contaminant monitoring data at the NPR site will be found inadequate for establishing a baseline condition.
2. The list of parameters and analytes will likely need to be expanded based on potential operational impacts.

3. Four additional aquifer monitoring wells (one upgradient and three downgradient) will be required. Depending on the footprint of the facility, additional aquifer monitoring wells may be necessary. These wells will be sited at different locations than those used for the aquifer stress tests.
4. Two years of preoperational data will be collected, with quarterly monitoring and an estimated cost of $1000 per sample which includes data validation.

4.8.5 Topical Area: Flooding

Regulatory Requirements

10 CFR 50 Appendix A, 10 CFR 100.23, 10 CFR 1022, NRC Regulatory Guide 1.70, NRC Regulatory Guide 1.59, DOE Orders 1020-1024

The site must be evaluated for potential flooding. Regulatory Guide 1.59 contains the most specific requirements related to flooding analysis. According to Regulatory Guide 1.59, the facility must be designed to withstand a design basis flood, or the "worst site-related flood probable at the nuclear power plant." Regulatory Guide 1.59 also requires reasonable combinations of less severe flood conditions be considered if the probability of the combination occurring simultaneously and having significant consequences is at least comparable to that associated with the most hydrometeorological or seismically induced flood.

Existing Data:

Because DOE and RCRA facility siting requirements usually restrict construction of waste management facilities within a floodplain, surface water characteristics at INL, especially those near major facilities, have been well characterized. Flooding studies at the INL have been conducted by several investigators including the U.S. Department of Energy, the U.S. Army Corps of Engineers, the U.S. Geological Survey, and the U.S. Bureau of Reclamation. The studies include an examination of the flooding potential at INL facilities due to the failure of Mackay Dam, 45 miles upstream of the INL from a probable maximum flood (PMF) (Koslow and Van Haaften 1986). Other studies estimate the 100-yr and 500-yr peak flows of the Big Lost River and the associated flood plain for each flow estimate.

The only surface water feature near the NPR site with the potential for flooding is the Big Lost River. The most recent and comprehensive study of Big Lost River flooding potential was performed by the Bureau of Reclamation (BOR) (Ostenaa and O'Connell 2005). This recent study, and another performed by the USGS (Hortness and Rousseau 2003) were conducted to reduce the uncertainty in the 100-yr peak flow estimates due to a discrepancy in results from two earlier studies. In those earlier studies, Kjelstrom and Berenbrock (1996) had conservatively high peak flow estimates at the INL Diversion Dam for the 100-yr flood (7260 cfs) compared to estimates by Ostenaa et al. (1999) (2910 cfs). Peak flow estimates from the two most recent studies are more in line with the estimates of Ostenaa et al. (1999).

In 2006, DOE-ID recommended the BOR study (Ostenaa and O'Connell 2005) be used as the best available information for Big Lost River flood plain delineation and determination purposes on the INL Site, unless specifically authorized by DOE-ID to use an alternative source of Big Lost River flood hazard data [M.L. Adams letter to L.A. Sehlke, (AS-SSD-INL-06-030), January 12, 2006, CCN 203995]. Prior to the BOR study, DOE-ID had directed that all proposed actions at the INL be reviewed to identify their location relative to the elevation of the 100-year flood indicated in Flood Routing Analysis for a Failure of Mackay Dam for purposes of the NEPA compliance (Koslow and VanHaaften 1986).

Peak flow estimates at the INL Diversion Dam for the 100-yr and 500-yr floods from the BOR study are 3072 cfs and 3885 cfs respectively. The BOR study also considered longer return periods beyond 500 years, but none of the flood estimates were coupled with failure of Mackay Dam. As a result, the BOR flow estimates are much smaller than any of the Mackay Dam failure scenarios analyzed by Koslow and Van Haaften (1986). Koslow and Van Haaften (1986) estimated flows at the INL Diversion Dam for Mackay Dam failures ranged from 28,500 cfs (100-yr flood with triangular dam breach due to piping failure) to 71,850 cfs (PMF overtopping and completely failing the dam).

It appears the direction given in the letter from DOE-ID to BEA regarding use of the BOR flood hazard study may be in conflict with NRC Regulatory Guide 1.59 which states the "worst site-related flood probable" must be evaluated. However, if DOE considers the scenarios evaluated by Koslow and Van Haaften (1986) to be "improbable," then there is no conflict. Nevertheless, if it is determined that the Koslow and Van Haaften (1986) PMF represents the worst site-related flood probable and should be used in the NGNP evaluation, then it still may be a moot point because the estimated floods of Koslow and Van Haaften (1986) posed a minimal flood threat to the NPR site (NPR Siting Study, Spry et al., 1989).

References dealing with flooding at the INL include: Lamke 1969; Tullis and Koslow, 1983; Koslow 1984; Van Haaften et al., 1984, McKinney 1985; Bennett, 1986; Koslow and Van Haaften, 1986; U.S. Army Corps of Engineers, 1991; Stone et al., 1992; Kjelstrom and Berenbrock, 1996; Berenbrock and Kjelstrom, 1997; Berenbrock and Kjelstrom, 1998; Ostenna, 1998; Ostenaa et al., 1999; Ostenna et al., 2002; Hortness and Rousseau, 2003; and Ostenna and O'Connell, 2005.

Data Needs:

1. Obtain clarification from DOE-ID and NRC regarding the appropriate design-basis flood to be used for the evaluation; whether it should be the 100-yr or 500-yr flood from the BOR study (Ostenaa and O'Connell 2005), or the Mackay Dam PMF from Koslow and Van Haaften (1986).
2. Depending on the decision associated with Date Need 1, determine if the study by Koslow and Van Haaften (1986) is adequate for the flood analysis, or if it needs to be updated. The Koslow and Van Haaften study is more than 20 years old and relied on relatively simplistic assumptions and data compared to the BOR study. Also, changes to the river channel and local topography may have occurred or been made since the 1986 study was done, which could have bearing on the estimated flows and flood levels.
3. Depending on the decision associated with Date Need 2, update the Koslow and Van Haaften (1986) PMF estimate.

Resources Required:

1. Number of Weeks/Months: up to 1 Month
2. Number of Weeks/Months: up to 1 Month
3. Number of Weeks/Months: 1 to 3 Months

Estimated Costs:

1. Labor (hours): up to 40. Material: None
2. Labor (hours): 40 to 80. Material: None
3. Labor (hours): 80 to 200. Material: None

Estimate Assumptions:

1. The NRC is willing and available to become familiar with the two studies sufficient to make a decision regarding the appropriateness of the studies.
2. The regulations are sufficiently clear that a decision regarding the appropriateness of the Koslow and Van Haaften (1986) study can be made with little or no assistance from NRC.
3. The BOR model is available and can be used with either the original flow estimate from Koslow and Van Haaften (1986) PMF, or an updated flow resulting from a recalculation of the PMF.

4.9 Seismology

4.9.1 Regulatory Requirements

NRC 10 CFR 100.23, 10 CFR Part 50 Appendix A, NUREG-0800 Section 2.5.1; 2.5.2; 2.5.3, NRC RG 1.165, 1.208; 1.60, 4.7, DOE Standard 1022, ANS 2.27

Seismologic data are used in assessments to satisfy CFR and RG acceptance criteria, and SRP, DOE, and ANS guidance that support the determination of a Safe Shutdown Earthquake (SSE). Sufficient data and information are needed to identify and characterize seismic sources, perform a probabilistic seismic hazard analysis (PSHA), and determine a site-specific ground motion response spectrum (GMRS) at the site.

Data and information related to seismic sources include:

A. Seismologic data within four areas defined by circles drawn around the site using radii of 320 km (200 mi), 40 km (25 mi), 8 km (5 mi), and 1 km (0.6 mi).

B. Historical earthquake record (instrumentally recorded and historically documented) of magnitudes 3.0 and greater, with any or all of the following information: origin time, location, depth, magnitude, Modified Mercalli intensity (MMI), seismic moment, source mechanism, source dimensions, distance from the site, and any strong ground motion records.

C. Maps of areas around the site with radii of 320 km, 40 km, and 8 km that show the site relative to earthquake epicenters and tectonic structures and faults with emphasis on Quaternary (or < 1.8 million year old) faults and tectonic structures such as folds.

D. Maps of areas around the site with a radius 320 km that show the site relative to regional stress orientations, strain rates, and remote sensing data (e.g., horizontal and vertical GPS velocities).

E. Correlations of earthquakes with faults and tectonic structures.

4.9.2 Existing Data: Seismic Monitoring Program

1A, 1B, and 1C: Real time monitoring of local earthquakes within 161-km (100-mi) radius of INL using 27 seismic stations. Data are routinely compiled into a database. The INL seismic network has seismic stations with sufficient density to monitor microearthquakes near the magnitude 0 level. The INL earthquake catalog from 1972-2007 indicates only infrequent small magnitude (M<2.0) occur within and near the INL. INL and other investigators have conducted detailed microearthquake studies at the INL and within the Snake River Plain. INL earthquake data include: date and time of origin, location, magnitude, location parameters, and focal mechanisms. Earthquake data and seismic station instrumentation are documented in the INL Seismic Monitoring Program annual report.

1A, 1B, and 1C: A Regional earthquake catalog from 1850 to 1995 for earthquakes of magnitude 2.5 and greater was compiled for a 320-km radius of INL for the 1996 Probabilistic Seismic Hazard Analyses. This catalog includes historic and instrumentally recorded earthquake information (date, time, location, magnitude or intensity, source, and quality of location parameters). Development of the catalog is documented and was peer reviewed. The earthquake data were used to compute recurrence estimates (b-values) of earthquake source zones. Documentation of catalog: Woodward-Clyde Federal Services et al.

(1996; volume II). S. Payne has the digital list of 1850-1995 earthquakes. Earthquake data (1850-1995) were compiled under New Production Reactor (NPR) quality requirements.

Data Needs:

Currently, INL Seismic Monitoring Program personnel are compiling earthquake data from the INL seismic network, surrounding seismic networks, and the National Earthquake Information Center to extend the time period of the earthquake catalog so that it covers 1850 to 2007 for the 320 km radius. This is part of the effort to update the INL PSHA by September 2010. Using the expanded earthquake catalog, develop ESRI compatible files of earthquake epicenters for desired magnitude ranges in the desired map projection for radii of 320 km, 40 km, and 8 km from the site.

Resources Required:

Time Required Number of Weeks/Months: 1 Week

Seasonal Considerations:

None

Estimated Costs Required:

Labor (hours): 36 hours

Materials:

None

Estimate Assumptions: The updated regional earthquake catalog is complete and available when needed.

4.9.3 Existing Data: Modified Mercalli Intensities

1A and 1B: Maps of Modified Mercalli intensities of individual earthquakes have been incorporated into previous NRC licenses for INL. The existing data are separate figures that show individual earthquake intensity maps. To produce these figures, sources of data include: published studies and the National Earthquake Information Center, which has links to reports of intensities based on what local residents feel and what damage is observed. "SHAKE" maps are dynamically linked for recent earthquakes listed by the U.S. Geological Survey. Modified Mercalli intensities can be used as a way to estimate magnitudes of historical earthquakes such as was done for the 1905 Shoshone earthquake that is located in the Snake River Plain (Oaks, 1992).

Data Needs:

Identify recent and historic earthquakes for which intensity maps are needed. Develop ESRI compatible files for intensity maps in the desired map projection.

Resources Required:

Number of Weeks/Months: 2 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 80 hours

Materials:

None

Estimate Assumptions: An existing data compilation is updated. Hours include data compilation and development of ESRI compatible files.

4.9.4 Existing Data: Stress Orientations

1D: Stress orientations indicate the type of faulting for a region. Within the 320-km radius of INL, focal mechanisms, faults, and volcanic features indicate extension with varying orientations. Existing stress orientation data are on maps in figures of INL documents. A compilation of focal mechanisms can be used to plot stress orientations (e.g., T-axes). Another resource is the world stress map project that is compiling stress orientations worldwide. For this region, there are also published studies of stress orientations.

Data Needs:

Compile an updated list of stress orientations (in digital format) within 320-km radius of the INL. Currently, T-axes (double ended arrow at a specified azimuth from North) for stress orientations are plotted using the Generic Mapping Tool (GMT at: http://gmt.soest.hawaii.edu/). Plot maps using GMT or develop ESRI compatible files of the stress orientations in the desired map projection.

Resources Required:

Number of Weeks/Months: 3 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 120 hours

Materials:

None

Estimate Assumptions: An existing data compilation is updated. Hours include data compilation and development of ESRI compatible files.

4.9.5 Existing Data: Strain Rates

1D: Existing data for strain rates based on seismogenic sources are on maps in figures of INL documents. Eddington et al. (1987) estimated strain rates for earthquakes that are within the 320-km radius of INL. A recent paper by Payne et al. (2008) computed strain rates using GPS velocities.

Data Needs:

Compile an updated list of strain rates to present in tabular or map formats. Develop ESRI compatible files for map presentation.

Resources Required:

Number of Weeks/Months: 2 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 80 hours

Materials:

None

Estimate Assumptions: An existing data compilation is updated. Hours include data compilation and development of ESRI compatible files.

4.9.6 Existing Data: Crustal Motion

1D: Crustal motion using Global Positioning System (GPS) receivers are used to assess regions of earthquake and volcanic activity. INL operates 13 GPS receivers that are co-located at INL seismic stations. Additionally, INL has participated in or led campaign GPS surveys in 1995, 2000, 2004, 2006, 2007, and 2008. All GPS phase data are archived at UNAVCO. GPS data processing is not trivial. Hence, INL seismologists have teamed with Dr. R. W. King (at MIT) to have GPS phase data processed. The positions over various time frames are used to produce horizontal velocities. Additional processing puts the horizontal velocities into the North American reference frame. At this time, vertical velocities have not been used due to large uncertainties (at least twice those of the horizontal components). The horizontal GPS velocities can be used to assess crustal deformation indicating regions of higher earthquake potential (high strain rates) relative to regions of lower earthquake potential (low strain rates).

The data consist of horizontal velocities (Longitude, Latitude, East velocity, one-sigma east velocity uncertainty, North velocity, one-sigma north velocity uncertainty, GPS site name) that can be plotted on maps. The horizontal velocity field shows component of rotation and strain relative to faults and volcanic features. S. Payne has the 1994-2007 velocity field in the reference frame of North America for the Northern Basin and Range (> 320-km radius of INL).

Data Needs:

Horizontal GPS velocities (arrow at a specified azimuth from north and an ellipse representing one-sigma uncertainty in both East and North components) are plotted using the Generic Mapping Tool (GMT at: http://gmt.soest.hawaii.edu/). Plot maps using GMT or develop ESRI compatible files of the GPS horizontal velocities in the desired map projection.

Resources Required:

Number of Weeks/Months: 3 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 120 hours

Materials:

None

Estimate Assumptions: Hours include data compilation and development of ESRI compatible files.

4.9.7 Existing Data: Possible New Earthquake Source

1D: The paper by Payne et al. (2008) submitted to Geology has horizontal GPS velocities that show strain rates are different between the basin and range and Snake River Plain. The different strain rates require a NE-trending zone of right-later shear. Strike-slip earthquakes could occur in the zone of right-lateral shear along the northwest boundary of the Snake River Plain (coincides with INL northwest boundary). This is a new earthquake source that has not been characterized in INL Probabilistic Seismic Hazard Analyses, and hence, its contributions to ground motion levels currently in use for design at INL, may or may not be included.

Data Needs:

Compile existing data and perform studies to assess possible strike-slip earthquake sources within the shear zone for a PSHA. Existing data include the 1850-2007 earthquake catalog, focal mechanisms of earthquakes, GPS velocities, geologic maps, and locations of Quaternary faults. New data are needed for this assessment and include: airborne LIDAR over the shear zone and detailed structural geologic mapping and ground based LIDAR in areas of possible strike-slip fault offsets. The assessment will be documented in a report that will undergo external peer reviews.

Resources Required:

Number of Weeks/Months: 24 months

Seasonal Considerations if any: LIDAR requires July-August time period for reduced snow cover at high elevations of the mountains. Fieldwork (geologic mapping or ground based LIDAR) requires May-October time frame. Age dates of samples can be determined during winter months and can take up to 6 months.

Estimated Costs:

Labor (hours): 430 hours (INL personnel)

Materials:

Subcontracts: Airborne LIDAR – $0.9 M; Ground based LIDAR - $420 K.

Estimate Assumptions: Model parameters are needed to characterize this earthquake source for the PSHA at the proposed site. Airborne LIDAR data at a resolution of 0.5 m are acquired first to determine specific geomorphic and fault features for further investigations that will assess the amount and timing of strike-slip fault movements. Subcontractors will provide results of the LIDAR to INL personnel who will compile existing data, perform the assessment, and develop the report.

4.9.8 Existing Data: Earthquake Source Parameters

1E: The 1983 Ms 7.3 Borah Peak earthquake is considered the model normal faulting earthquake for the fault-specific earthquake sources closest to INL facilities. Additionally, published studies on basin and range and normal faulting earthquakes also characterize ranges of possible source parameters of other basin and range earthquakes. Results of Borah Peak earthquake studies and the published studies characterize ranges of possible earthquake source parameters including: faulting style, fault geometry, nucleation depth, stress drop, rupture dimensions, and rupture propagation. Source parameters of the 1983 Ms 7.3 Borah Peak earthquake and other Basin and Range earthquakes have been compiled and incorporated into the INL PSHA completed in 1996 and 2000.

Data Needs:

Compile an updated list of basin and range source parameters (faulting style, fault geometry, nucleation depth, stress drop, rupture dimensions, and rupture propagation) to develop source models for a PSHA at the proposed site.

Resources Required:

Number of Weeks/Months: 1 month

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 160 hours

Materials:

None

Estimate Assumptions: An existing data compilation is updated. This effort is not included as part of a PSHA for the proposed site.

4.9.9 Existing Data: Focal Mechanisms

1E: Focal mechanisms or fault plane solutions of earthquakes within a 320, 40, and 8 km radius of the INL. Some of the well-recorded earthquakes (typically M > 3) have focal mechanisms that provide style of faulting, fault strike, fault dip, fault slip, and stress orientations. Focal mechanism data can be obtained from web site repositories and the INL Seismic Monitoring Program. Other data for focal mechanisms are contained within published studies. S. Payne has a compilation of focal mechanisms for earthquakes within 320-km radius of INL.

Data Needs:

Update the list of focal mechanisms of recent and historic earthquakes. Currently, focal mechanisms (circle with shaded quadrants) are plotted using the Generic Mapping Tool (GMT at: http://gmt.soest.hawaii.edu/). Plot maps using GMT or develop ESRI compatible files of focal mechanisms in the desired map projection.

Resources Required:

Number of Weeks/Months: 2 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 80 hours

Materials:

None

Estimate Assumptions: An existing data compilation is updated. Hours include developing plots using GMT and development of ESRI compatible files.

4.9.10 Existing Data: Earthquakes and Associated Faults Within 320-mi Radius of INL

1E: Published studies have been completed that associate Northern Basin and Range earthquakes with faults. A list of earthquakes and associated faults within a 320-km radius of INL has been compiled for INL documents. These data include earthquake (date and time), magnitude, seismic moment, fault plane solution parameters, rupture kinematics, nucleation depth, and fault rupture dimensions.

Data Needs:

In table format, update the current list of earthquakes and associated faults or tectonic structures. If needed, develop ESRI compatible files of earthquakes related to faults and tectonic structures in the desired map projection for radii of 320 km, 40 km, or 8 km from the site.

Resources Required:

Number of Weeks/Months: 2 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 80 hours

Materials:

None

Estimate Assumptions: Existing data compilations are updated. Hours include data compilation and development of ESRI compatible files.

4.9.11 Existing Data: Volcanic Earth Sources

1E: Volcanic earthquakes may accompany future basalt volcanism at the INL. Volcanic earthquake sources and their recurrence estimates are based on data and an understanding of basalt volcanic processes. Estimates of maximum magnitudes of possible Snake River Plain volcanic earthquakes have been made (Jackson, 1994; Smith et al., 1996). Data of ground fractures and normal fault dimensions have been compiled from worldwide analog volcanic rift zones and for Snake River Plain volcanic rift zones. Observed magnitudes of earthquakes at active volcanic rift zones have also been compiled (Payne et al. 2008a). These data have been incorporated into earthquake source models for volcanic rift zones in the 1996 and 2000 INL PSHA.

Data Needs:

In table format, update the current list of volcanic earthquakes and associated volcanic deformational features. If needed, develop ESRI compatible files of volcanic earthquake and volcanic deformational features structures in the desired map projection for radii of 40 km and 8 km from the site.

Resources Required:

Number of Weeks/Months: 3 Weeks

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 120 hours

Materials:

None

Estimate Assumptions: Existing data compilations are updated. Hours include data compilation and development of ESRI compatible files.

4.10 Socio-Economics

4.10.1 NRC Recommendations and Requirements

NRC regulations implementing NEPA require analysis of potential consequences of project alternatives to the environment, including socioeconomic characteristics (10 CFR 51, Appendix A[7]). This includes statistics relating to employment, income, population, housing, and community services within a predetermined "region of influence" (ROI), and an assessment of how these statistics may change due to the proposed action or alternatives. For the INL, a four-county are comprised of Bannock, Bingham, Bonneville and Jefferson Counties, in which over 90 percent of all employees reside is generally used as an ROI. Information sources range from federal data sources (e.g. U.S. Department of Labor Bureau of Labor Statistics, U.S. Department of Commerce Bureau of Economic Statistics, U.S. Census Bureau statistics) to local school districts.

A special requirement related to socioeconomics pertains to "Environmental Justice". This term is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies" (EPA 2006). The goal of an environmental justice review is to ensure that minority and/or low-income populations not bear a disproportionate share of adverse health and environmental impacts from a federal action.

Socioeconomic data such as population density are also used in risk assessment analyses. For example, dose estimates to the public are dependent on population density data. As stated in 10 CFR 100.21(h), "Reactor sites should be located away from very densely populated centers. Areas of low population density are, generally, preferred. However, in determining the acceptability of a particular site located away from a very densely populated center but not in an area of low density, consideration will be given to safety, environmental, economic, or other factors, which may result in the site being found acceptable."

Projected changes in population within about 5 years after initial site approval should be evaluated for the proposed site and any alternative sites considered. Population growth in the site vicinity after initial site approval is normal and expected and will be periodically factored into the emergency plan for the site.

Regulatory positions and specific criteria necessary to meet the NRC requirements relating to socioeconomic analyses reside primarily in two documents:

- Regulatory Guide 4.7, Rev. 2, General Site Suitability for Nuclear Power Stations (NRC 1998), notes that environmental justice is one of the considerations on which site acceptance is based and provides specific information for making the determinations required.
- NUREG. 1555. Environmental Standard Review Plan

Regulatory positions and specific criteria necessary to meet the Regulations identified above are as follows:

- Regulatory Guide 4.7, Rev. 2, General Site Suitability for Nuclear Power Stations (NRC 1998), notes that environmental justice is one of the considerations on which site acceptance is based and provides specific information for making the determinations required.
- NUREG. 1555. Environmental Standard Review Plan.

4.10.2 NRC Regulatory Position and Requirements

Regulatory Guide 4.7, General Site Suitability Criteria for Nuclear Power Stations. April, 1998:

- Requires consideration of social and economic issues in siting determinations.
- Requires assessment of potential impacts socioeconomic structure of a community, including the local labor supply, transportation facilities, and community services, and may result in changes to the tax basis.
- Requires identification of unusual socioeconomic issues such as a distinctive cultural character, specialized or unusual industries or avocational activities, etc. that markedly distinguished themselves from other communities.
- Requires that siting decisions reflect fair treatment and meaningful involvement of all people, regardless of race, ethnicity, culture, income or educational level to assure equitable consideration and to minimize disproportionate effects on minority and low-income populations.
- Requires assessment of impacts on minority and low-income communities (Executive Order 12898).
- Requires assessment of impacts of construction and operation on community services such as schools, police and fire protection, water and sewage, and health facilities.
- Requires a preliminary investigation to address environmental justice considerations and to identify and analyze problems that may arise from the proximity of a distinctive community to a proposed site.

NUREG.-1555 – Environmental Standard Review Plan (ESRP) – Section 2.5

Requires analysis of demography, community characteristics, historic properties, and environmental justice:

Demography: Requires analyses of population distribution within a 80-km (50-mi) radius of the proposed site, including current population distributions, population distributions predicted at the time of plant startup, and for 10-year increments reaching 40 years from the latest decennial census for both permanent and transient populations.

Community Characteristics: Requires analysis of the community characteristics for the region and other areas likely to be affected by the construction, maintenance, or operation of the proposed plant and related facilities. The following data or information should be obtained:

- Information related to the area's economic base, including:
    - important regional industry by category, including employment and consultation with cognizant State and local officials, such as local labor economists;
    - size and nature of the regional heavy construction industry and construction labor force;
    - total regional labor force
    - regional unemployment levels and future economic outlook.
- information related to the area's political structure, including

- regional political jurisdictions and tax districts;
- local and regional planning and administrative organizations

- social-structure information, including major community structures
- housing information, including the sales and rental market in the region
- information about the local educational system including capacity and present percentage of utilization
- public and private recreational facilities and opportunities;
- regional tax structure and distribution of the present revenues to each jurisdiction and district
- local land use and zoning plans
- social services and public facilities, including
  - present and projected water and sewer/sewage disposal facilities, including, present capacity and projected percentage of utilization
  - present and projected police and fire capabilities, as well as emergency planning responsibilities
  - location of hospitals, number of medical doctors, and specialized health facilities, including present and projected capacity
- information on highways and transportation systems, for example:
  - regional and local highway systems, including carrying capacity and condition of roads and highways
  - availability and type of public transportation
  - modifications that might affect traffic flow to and from the station

Historic Properties: (See Cultural Resources)

Environmental Justice: Requires that low income and minority populations that could be impacted by construction, maintenance, or operation of the proposed project be identified and described. This should involve obtaining and incorporating information on demography and community characteristics for comparison with data on minority and low-income populations.

Existing Data:

Socioeconomic data collected and synthesized for the original NPR program are twenty years out of date. They are summarized in the following documents:

- Hardinger, D. 1990. Socioeconomic Database for Southeastern Idaho. Idaho National Engineering Laboratory Informal Report no. EGG-NPR-8759. April, 1990.
- INEL. 1989. Demographic Data Reflecting New and Changing Work at the INEL. Idaho National Engineering Laboratory, U.S. Department of Energy, Idaho Operations Office Report DOE/ID-10247, September, 1989.

More recently, updated socioeconomic data have been used for NEPA documents relating to other proposed INL projects, including the following:

- DOE/EIS-0287. Final Environmental Impact Statement - Idaho High Level Waste and Facilities Disposition, September 2002.
- DOE/EIS-0373D. Draft Environmental Impact Statement for the Proposed Consolidation of Nuclear Operations Related to Production of Radioisotope Power. June, 2005.
- Draft Programmatic Environmental Impact Statement for the Global Nuclear Energy Partnership. (Not yet issued).

The INL updates much of the socioeconomic data required for NEPA analyses on a regular basis.

Data Needs:

The following data or information should be obtained to meet NRC Environmental Justice requirements:

- Comments from any organizations that locate and assess uniquely vulnerable minority and low-income communities located on or near the proposed station site.
- A general description (with maps) of the location of all minority and low-income populations within the environmental impact area of each alternative site, including offsite areas that can expect significant environmental impact as a result of the proposed project construction or operation. Demographic data would be available from Geographical, Environmental, & Siting Information System (GEn&SIS) or from the Bureau of the Census block data and TIGER files.

A more specific description of any unique minority or low-income communities within each environmental-impact area that are likely to be disproportionately affected by the proposed project construction or operation.

Resources Required:

To be determined.

4.11 Volcanology

4.11.1 Regulatory Drivers/Requirements

NRC 10 CFR 100.23, 10 CFR Part 50 Appendix A, NUREG-5503, NUREG-0800 Section 2.5.1; NRC RG 4.7, DOE Standard 1022

Geologic data are used in assessments to satisfy CFR and RG acceptance criteria, and SRP and DOE guidance that support the evaluation of the suitability of a proposed site and adequacy of the design bases of the proposed site established in consideration of the volcanic hazards.

1. Sufficient data and information are needed to:

A. Identify and characterize volcanic sources.

B. Perform a probabilistic volcanic hazards analysis (PVHA).

C. Determine the volcanic risk at the proposed site (e.g., probability of inundation by a lava flow).

Identify and characterize volcanic sources

4.11.2 Existing Data: Age dates of Tertiary and Quaternary Rhyolites

1A: Tertiary silicic caldera eruptions occurred in the Snake River Plain at the position of the INL 4 to 10 million years ago. Hotspot activity during this time period and at this position is supported by age dates of rhyolite surface samples and core samples from deep drill holes (INEL-1 and WO-2), age dates of basalt volcanism at the surface and within boreholes, geologic mapping of caldera eruptive products along the margins of the Snake River Plain, mineralogy and petrology of the rhyolite eruptive products, tomographic crustal structure of the Snake River Plain and Yellowstone, geologic mapping of eruptive activity at Yellowstone over the last 2 million years, and monitoring of the current volcanic activity at Yellowstone. There is sufficient data to support documentation of the unlikely occurrence of caldera volcanism at INL. Documentation would be included to support this position in an updated PVHA.

Age dates of Tertiary and Quaternary rhyolites include surface and core hole samples. The age dates support the NE progression of silicic volcanic activity from southern Idaho in the Snake River Plain to northwest Wyoming in the Yellowstone Plateau. The existing data compilation to plot these features on maps is incomplete and metadata are not included.

Data Needs:

Compile the available age dates for Tertiary and Quaternary rhyolites along with the geographic positions of samples and information of the volcanic unit the sample is associated with. Develop ESRI compatible files in the desired projection to plot maps of the age dates that can be overlain on geologic maps of the volcanic units.

Resources Required:

Number of Weeks/Months: 2 Months

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 60 hours

Materials:

None

Estimate Assumptions:

Update to an existing data compilation. Included as part of the effort to compile existing age dates of other volcanic units in the Snake River Plain. Geologic maps are available in ESRI compatible files.

4.11.3 Existing Data: Quaternary rhyolitic domes

1A: The Quaternary rhyolitic domes postdate the Tertiary caldera-related silicic volcanism by about 3 million years, and the dome compositions are not similar to the caldera rhyolites (Leeman 1982a), suggesting they are volcanic distinct events. The most likely area of future silicic-dome emplacement is along the southeastern boundary of the INL, and hence, the probabilistic risk of impact on southern-INL facilities would be somewhat higher but still < 10-6/yr. Age dates of the rhyolite domes, their volcanic structure and eruptive deposits, emplacement mechanism, and location support the recurrence estimates and associated volcanic hazards. There may be sufficient data to defend the long recurrence intervals of silicic dome eruptions. The existing data compilation to plot these features on maps is incomplete and metadata are not included.

Data Needs:

Compile available age dates of the silicic domes in the Snake River Plain along with the geographic positions of samples and information of the volcanic unit the sample is associated with. Develop ESRI compatible files in the desired projection to plot maps of the age dates that can be overlain on geologic maps of the volcanic units.

Resources Required:

Number of Weeks/Months: 2 Months

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 60 hours

Materials:

None

Estimate Assumptions:

Update to an existing data compilation. Included as part of the effort to compile existing ages dates of other volcanic units in the Snake River Plain. Geologic maps are available in ESRI compatible files.

4.11.4 Existing Data: Age dates of basalt rocks and lava flows

1A: Age dates of basalt rocks and lava flows have been made for surface and subsurface rocks. The age dates have been measured using a variety of techniques: Carbon 14, paleomagnetism, Argon-Argon, Potassium-Argon, thermoluminescence (of baked sediments), and stratigraphic positions in relationship to other dated rock or soil layers. Age dates are used to assess recurrence estimates for basalt eruptions, volcanic related surface deformation, and volcanic earthquakes. These data have been incorporated in the 1996 and 2000 PSHA for volcanic earthquake sources and in the risk assessments of lava flow inundation at some INL facilities. The most recent recurrence estimates and the data used to make these estimates are in Hackett et al. (2002). The existing data compilation to plot these features on maps is incomplete and metadata are not included.

Data Needs:

Compile available age dates of the basalt lava flows in the Snake River Plain along with the geographic positions of samples and information of the volcanic unit the sample is associated with. Develop ESRI compatible files in the desired projection to plot maps of the age dates that can be overlain on geologic maps of the volcanic units.

Resources Required:

Number of Weeks/Months: 2 Months

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 60 hrs

Materials:

None

Estimate Assumptions:

Update to an existing data compilation. Included as part of the effort to compile existing age dates of other volcanic units in the Snake River Plain. Geologic maps are available in ESRI compatible files.

4.11.5 Existing Data: Processes associated with basalt volcanism

1A: Processes associated with basalt volcanism have been studied in the Snake River Plain. Data include field observations of: exposures of dikes as the mechanism of emplacement, eruptive source dimensions of vents, cones, rifts, and craters, types and dimensions of eruptive products (ash, lava flows, bombs, and tephra), petrology and geochemistry of eruptive products, and dimensions of ground deformation (small normal faults, ground cracks, fissures, and monoclines). These data support our understanding of ascent processes through the crust, emplacement in the near surface, eruptive processes to produce the observed products, accompanying surface deformation, and associated seismicity. Basalt magma ascends from the base of the crust in a long tabular body or dike. The emplacement processes is a result of the regional extensional stress field. The orientation of dike emplacement is consistent with the direction of extension indicated by normal faulting earthquakes in the basin and range surrounding the Snake River Plain. There is sufficient data to describe basalt eruptions on the Snake River Plain.

Concentration of NW-aligned volcanic vents suggests concentration of volcanic activity in three recognized basalt volcanic rift zones and the axial volcanic zone, which all overlap with the boundaries of the INL. These volcanic zones have been characterized as source zones for future volcanism, volcanic-related surface deformation, and volcanic earthquakes. Detailed geologic mapping of these features have been completed for the NPR site. Volcanic features and boundaries of these zones are contained on maps in figures of INL documents. The existing data compilation to plot these features on maps is incomplete and metadata are not included.

Data Needs:

Compile the locations of volcanic features and boundaries of volcanic rift zones. Develop ESRI compatible files to plot maps and overlay on geologic maps.

Resources Required:

Number of Weeks/Months: 1 Month

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 60 hrs

Materials:

None

Estimate Assumptions:

Update to an existing data compilation. Geologic maps are available in ESRI compatible files.

4.11.6 Existing Data: Ash Falls

1A: Ash falls from distant volcanic sources. The source locations include Yellowstone, Cascade volcanoes, and other western U.S. volcanic centers (e.g., Long Valley Caldera). Data to support hazard analysis of ash fall include: distance of the volcano to INL, ash accumulations found at field locations at and near INL (such as fault trench or soil pit), prevailing wind direction, and estimates from recent volcanoes (such as Mt St. Helens). There are some recent references on estimating ash fall thicknesses from distant volcanic sources. These were considered in the Yucca Mountain PVHA.

Data Needs:

Compile existing data for measured ash fall thicknesses at INL. Develop ESRI compatible files for the geographic locations. Compile recent literature for methods to assess ash fall thicknesses from distant volcanoes. Document in a short report.

Resources Required:

Number of Weeks/Months: 2 Months

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 100 hrs

Materials:

None

4.11.7 Volcanic hazard assessments

Not included as part of an updated INL probabilistic volcanic hazards assessment.

1B: Volcanic hazard assessments evaluate the potential for local volcanic eruptions (such as basaltic eruptions) and ash falls from local (Yellowstone) and western US (Cascade volcanoes) sources. With regard to local sources, basaltic and rhyolitic volcanic eruptions have affected the Snake River Plain for about the past 10 Ma, and have continued into geologically recent time. No historical eruptions have occurred on the Snake River Plain, but basalt lava flows issued as recently as 2,100 years ago from the Great Rift, about 25 km southwest of the INL. Other Holocene basaltic lava fields near the southern INL boundary are nearly as young, and range from about 5,000 and 13,000 years in age. Many basaltic and three rhyolitic vents located within the present INL boundary erupted between about 200,000 and 1.2 million years ago. Caldera eruptions at the INL are considered unlikely since the hotspot is now located at Yellowstone, 120 km to the northeast.

The first comprehensive volcanic hazards assessment was completed for the NPR site (Volcanism Working Group, 1990). Follow-on work since 1990 has expanded different aspects of this study to make risk assessments primarily to related hazards of basalt volcanism at other INL facility areas. The Volcanism Working Group (1990) work was performed under NPR quality program requirements. New data are available on ages of basalt flows, volcanic rift zones, and lava flow dynamics, and methods to perform a PVHA are available. New sources have not been characterized such as the recurrence of a random volcanic source within 1 km radius of the NPR site. The volcanic hazards assessment for NPR site and other INL sites needs to be updated. The results of an updated PVHA provide input data to the updated INL PSHA.

Data Needs:

Conduct an updated PVHA for the INL with emphasis on the NPR site or another proposed INL site. Produce a peer-reviewed report that can be submitted to the NRC for their assessment since they evaluate volcanic hazards on a case-by-case basis.

Resources Required:

Number of Weeks/Months: 24 Months

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 400 hrs (INL oversight)

Materials:

Subcontract of PVHA – $1.3 M; Peer reviews – $200 K.

Estimate Assumptions:

Assumes INL provides existing data and reports to the subcontractor, minimal data collection and sample analyses by the subcontractor, and other recommended studies have been completed such as characterization of random volcanic source and development of one geologic map listed under the Geology Section.

4.11.8 Determine the volcanic risk

1C: There are several hazards associated with basalt volcanism, which include: gas release, tephra fall (ballistic projectiles), base surge (ground-hugging blast of steam and tephra), and inundation by lava flows. Data to support a risk assessment of volcanic hazards include: location of source vent, type of eruptive products, dimensions of aerial dispersion of eruptive products, dimensions of lava flows, and prevailing wind direction. Based on Hackett et al. (2002), the greatest hazard to INL facilities is inundation by lava flows. Data to assess the risk of lava flow inundation to a facility site of interest include: lava flow structure (type, petrology, and lava tubes), location of source vent, thickness, flow length, extent of aerial coverage, eruptive volume estimates, indicators of flow direction, and high-resolution DEM within 40 km radius of the NPR site. Some of these data have been used in previous risk assessments are available in electronic files. Additionally, recent publications assess the dynamics of basalt lava flows, how cooling affects lava flow lengths, and mitigation strategies to possibly divert lava flows.

Data Needs:

Compile existing data that can be used for volcanic risk assessment. Develop ESRI compatible files for plotting maps in the desired projection for radii of 40, 8, and 1 km of the NPR or proposed site. Compile recent publications on lava flow dynamics.

Resources Required:

Number of Weeks/Months: 2 Months

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 100 hours

Materials:

None

Estimate Assumptions:

Update of existing data compilations.

1C: Volcanic risk assessments have been completed for the Advanced Test Reactor (Hackett and Kericha, 1993), CFA (Hackett et al., 2002), and RWMC (Hackett, 1993). For example, the probability of lava flow inundation was calculated for CFA. No volcanic hazards risk assessment was completed for NPR.

Data Needs:

Complete a volcanic risk assessment for the NPR site or other proposed INL site of interest. Document in a report that is externally peer reviewed.

Resources Required:

Number of Weeks/Months: 6 Months

Seasonal Considerations:

None

Estimated Costs:

Labor (hours): 100 hours (INL oversight)

Materials:

Subcontract – $400 K; Peer review – $20 K.

Estimate Assumptions:

Assumes an updated PVHA has been completed to provide data and recurrence estimates of basalt volcanism. Also, other recommended geologic and volcanic studies have been completed.

5.0 OUTREACH & STAKEHOLDER INVOLVEMENT

Early consultations are essential to maintaining the planned schedule for gathering complete information and identifying potentially significant impacts. Some agencies require 30 days or more to respond to consultation requests and may require additional information (e.g., photos, maps, and specialized surveys). Consultations may include a number of agencies (e.g., local, county, State, tribal, Federal) which will have information relevant to the site. At a minimum, the following consultations are typically required:

- NHPA, Section 106 consultation with the State Historic Preservation Office, federally recognized American Indian Tribes, other stakeholders, and the public for actions with the potential to cause/have effects on historic properties or cultural resources.
- Section 7 consultation with the Fish and Wildlife Service for actions that may affect listed species or designated critical habitat.

Public involvement is an integral component to the NEPA process and may require additional data and access that wouldn't be included in the site characterization. An assessment of needed data and access to support this part of NEPA will be included.

The NGNP Project will structure a methodology for informing and consulting with stakeholders statewide that focuses on identifying a full range of community interests, questions, and concerns about locating NGNP facilities in eastern and Idaho. The methodology will be documented in an Outreach Plan and will strive to reach people and organizations at all levels, from the general public to community leadership, and will include business, education, local government, environmental, conservation organizations, and the Shoshone-Bannock Native American Tribes. It will use a variety of techniques to inform and engage stakeholders.

6.0 CONCLUSIONS & RECOMMENDATIONS

This draft template is the first attempt to address the site-related compliance issues related to the NGNP facility. The objective of this plan is to ensure that all relevant requirements are addressed. The conclusions provided below are preliminary and will be revised and augmented as additional requirements are identified.

High-level tasks that will need to be completed in the future include:

1. Identify and/or confirm resources needed for topical areas and develop an integrated resource estimate.
2. Develop Outreach Plan to facilitate stakeholder involvement.
3. Update compliance plan schedules after considering the final results from the "NGNP and Hydrogen Production Conceptual Design Study Report, Licensing Risk Reduction Study."

In addition, several programmatic activities need to be completed in the near term. Many of the characterization studies and long lead-time permitting activities can only be completed if the reactor site is selected. The plant parameter envelope (PPE) and other fairly detailed design information including effluent releases and waste generation data are needed for the long lead-time permitting activities and for the impact analyses require in the ER and safety analyses.

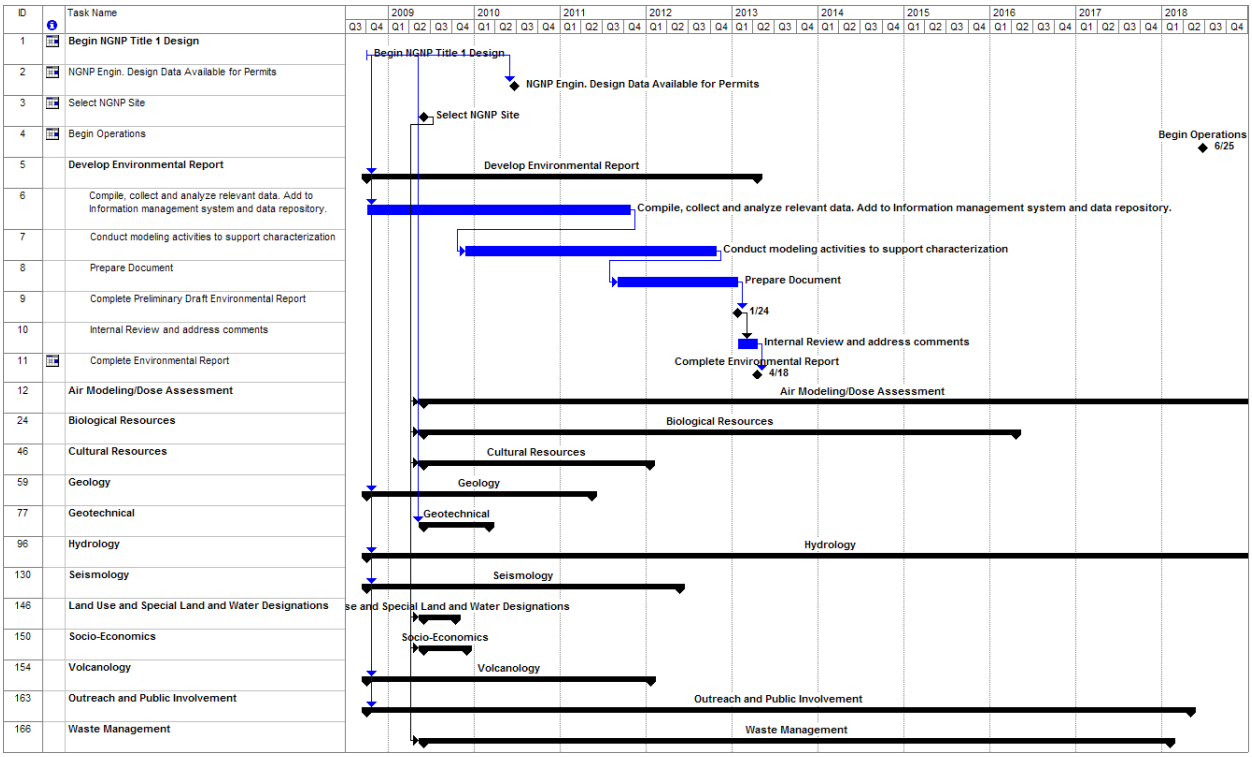
After review of the existing NPR-related site characterization data, the following areas are judged to require additional resources because of long lead-times or are on critical path to compliance with applicable regulations:

- Design and implementation of the preoperational monitoring programs.
- Design and implementation of sensitive wildlife surveys.
- Design and implementation of aquifer test to demonstrate adequate water availability.
- Evaluate existing aquifer characterization data and determine additional site specific data needed to validate an aquifer flow and transport model (local flow direction, velocity, porosity, aquifer thickness).
- Gather sufficient data and information to identify and characterize seismic sources, perform a probabilistic seismic hazard analysis (PSHA), and determine a site-specific ground motion response spectrum (GMRS) at the site.
- Compile the NPR and other seismic velocities for basalt. Assess whether the seismic velocities measured at the NPR site will be acceptable for an NRC license or to external peer reviewers who have appropriate credentials. If needed, make recommendations for measuring additional seismic velocities.
- Compile new and existing information from geologic maps and studies to develop one geologic map that includes the three capable Basin and Range faults (Lost River, Lemhi, and Beaverhead), the volcanic rift zones of the eastern Snake River Plain (extending from Yellowstone to Craters of the Moon), and detailed geologic mapping of the NPR Site or other proposed sites at INL.
- Perform a complete paleoseismic investigation of the southern two segments of the Beaverhead fault.

- Conduct an updated probabilistic volcanic hazards assessment (PVHA) for the INL with emphasis on the NPR site.

7.0 COMPLIANCE SCHEDULE

This section addresses schedules for environmental compliance activities for NGNP. This draft schedule is based on known licensing processes and assumptions that will be reviewed and approved by appropriate management and technical personnel.



Assuming that the site is selected by 06/01/09 and that needed design information is available by 06/23/10, the current schedule indicates that the ER will be completed on 07/12/13.

There are several tasks that impact the time period for ER preparation and completion:

1. Air Modeling/Dose Assessment

   Annual Radiological releases and NESHAPS analyses require external agency review which may require up to 18 months. If this review period is reduced by half, these tasks will not extend the ER preparation period.

2. Biological Resources

   Currently, this component will not extend the ER preparation period. However, one of the uncertainties in this component is what the status of sage grouse and pigmy rabbits will be throughout this process. Should these species be listed significant additional resources may needs to be applied to addressing ESA requirements and satisfying USFWS with appropriate data and mitigation activities.

3. Hydrology

   Groundwater characterization studies are the tasks that extend the ER period out the furthest. They are not scheduled to be completed until 11/07/12. These are the last analyses to be available for the ER. Several of these tasks require that the site location be determined and that certain design information be available prior to beginning work. This is one of the areas that should be investigated further to determine how necessary information can be provided earlier in the process.

   Water availability analyses also extend the ER preparation period by approximately 2 months.

4. Seismology

   Deep borehole drilling efforts to support the seismic investigations, the PSHA and site response analysis will not be completed until 05/25/12. If the site response analysis is not required, these tasks will conclude by 05/27/11.

Assumptions:

The schedule presented here assumes that funding for adequate personnel and material resources will be available when required. It also assumes that site selection and design information will be available when needed to begin and perform the required tasks.