DOE/ID-10474
REVISION 1

IDAHO NATIONAL ENGINEERING LABORATORY (INEL)

Environmental Restoration Program (ERP) Baseline Safety Analysis File (BSAF)

June 20, 1994

Environmental Restoration Division
United States Department of Energy, Idaho Operations Office

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UNITED STATES DEPARTMENT OF ENERGY, IDAHO OPERATIONS OFFICE

IDAHO NATIONAL ENGINEERING LABORATORY (INEL)
ENVIRONMENTAL RESTORATION PROGRAM (ERP)
BASELINE SAFETY ANALYSIS FILE (BSAF)

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REVISION 1

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**IDAHO NATIONAL ENGINEERING LABORATORY ENVIRONMENTAL RESTORATION PROGRAM
BASELINE SAFETY ANALYSIS FILE AND BASELINE TECHNICAL SAFETY REQUIREMENT FILE
SAFETY DOCUMENT EVALUATION**

FORWARD

This document was prepared to take the place of a Safety Evaluation Report since the Baseline Safety Analysis File (BSAF) and associated Baseline Technical Safety Requirements (TSR) File do not meet the requirements of a complete safety analysis documentation that conforms to DOE Order 5480.23 and 5480.22. Its purpose is to present in summary form the background of how the BSAF and Baseline TSR originated and a description of the process by which it was produced and approved for use in the Environmental Restoration Program.

BACKGROUND

The Baseline Safety Analysis File (BSAF) and Baseline Technical Safety Requirement (TSR) File for environmental restoration activities at the Idaho National Engineering Laboratory (INEL) originated as part of the Environmental Restoration Program implementation plans for U.S. Department of Energy (DOE) Order 5480.23, *Nuclear Safety Analysis Reports*, and DOE Order 5480.22, *Technical Safety Requirements*. Initially conceived as a site-wide (i.e., umbrella, aggregate, or blanket) safety analysis report (SAR) and associated TSRs, the concept evolved to a facility reference document for use in developing activity-specific safety analysis documents. The objective of the BSAF and the Baseline TSR File is to reduce both the cost and the time to develop, review, and approve required safety analysis documents for environmental restoration activities.

The BSAF and Baseline TSR File were developed by INEL environmental restoration contractors (i.e., EG&G Idaho, Inc. [EG&G]; MK-Ferguson of Idaho Company [MK-FIC]; and Westinghouse Idaho Nuclear Company, Inc. [WINCO]) in cooperation with the DOE Idaho Operations Office (DOE-ID) Environmental Restoration Program Office. This integrated, multi-contractor effort was managed, and the BSAF and Baseline TSR File were prepared, reviewed, and approved in accordance with a formal project plan and implementing procedure.

BSAF AND BASELINE TSR FILE DESCRIPTION

The BSAF is a facility safety reference document for INEL environmental restoration activities including environmental remediation of inactive waste sites and decontamination and decommissioning (D&D) of surplus facilities. The BSAF is organized into 21 chapters that parallel the 21 required safety analysis topics of DOE Order 5480.23. The BSAF contains safety bases common to environmental restoration activities and guidelines for performing and documenting safety analysis. The common safety bases can be incorporated by reference into the safety analysis documentation prepared for individual environmental restoration activities with justification and any necessary revisions. The safety analysis guidelines in BSAF provide an accepted method for hazard analysis; analysis of normal, abnormal, and accident conditions; human factors analysis; and derivation of TSRs. The BSAF safety bases and guidelines are graded for environmental restoration activities that are Hazard Category 3 or are below the Hazard Category 3 threshold as defined in DOE Order 5480.23 and DOE-STD-1027-92, *Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*.

The Baseline TSR File is a template and starting point for developing TSRs required for individual Hazard Category 3 environmental restoration activities. The Baseline TSR File consists of administrative control TSRs derived from the common safety bases of the BSAF in a format consistent with the guidance in DOE Order 5480.22.

DEVELOPMENT AND REVIEW PROCESS

Guidance for the BSAF, including the graded approach for Hazard Category 3 activities and activities below the Hazard Category 3 threshold criteria, was developed and documented by a committee of senior EG&G, MK-FIC, WINCO, and DOE-ID safety analysis staff from December 1992 to July 1993. Using the resulting "Idaho National Engineering Laboratory Environmental Restoration Program Baseline Safety Analysis File Format and Content Guide," dated July 1993, each of the 21 BSAF chapters were developed by a team composed of an experienced safety analyst from EG&G, MK-FIC, WINCO, and two technical support contractors. Although one of the five team members was assigned the lead for each chapter, all team members were required to review and approve the initial draft chapter and subsequent revisions necessary to resolve review comments. The Baseline TSR File was developed by a similarly composed team.

After consolidation of the initial draft chapters of the BSAF and Baseline TSR File, a Line Management Review was conducted by EG&G, MK-FIC, and WINCO. The line management reviewers from each contractor included those technical and management staff normally responsible for the review and approval of activity-specific safety analysis reports or auditable safety analyses for environmental restoration activities. In addition, John Miller, safety analysis consultant for EM-441, performed a review of the BSAF and the Baseline TSR File as part of the Line Management Review. Approximately 550 comments were received. The comments and their resolutions are documented on Comment/Resolution Forms in the project records as required by the implementing procedure that established the BSAF and Baseline TSR File preparation, review, and approval process.

Following the Line Management Review, a Safety Review was performed by the independent safety review groups of EG&G, MK-FIC, and WINCO. The almost 100 comments received are documented with their resolutions on Comment/Resolution Forms in the project records. The BSAF and Baseline TSR File were also transmitted to selected DOE-ID technical staff and to EM-23 for review. No comments were received from the DOE-ID staff. EM-23 requested a two or three month extension of the review period. Considering that this document is a contractors tool, delaying the completion of the initial BSAF and Baseline TSR File this long was judged by DOE-ID to be unacceptable. Any subsequent DOE-ID and EM-23 comments can be incorporated into the required annual updates of the BSAF and Baseline TSR File.

REVIEW SUMMARY AND CONCLUSION

The BSAF and Baseline TSR File are facility safety documents, not SARs and TSRs, and, therefore, this is not a Safety Evaluation Report (SER). The BSAF and Baseline TSR File are for use in the development of activity-specific safety analysis documents (SARs/TSRs or auditable safety analyses) and this safety evaluation only summarizes the review of the BSAF and the Baseline TSR File and conclusions on their intended use.

All technical comments received on the BSAF and the Baseline TSR File have been satisfactorily resolved. This included comments on the common safety bases provided in the BSAF (Chapters/SAR Topics 2, 3, 4, 6, 7, 9, 10, 12, 13, 15, 17, 18, 19, 20, 21), on analysis and documentation guidelines provided in the BSAF (Chapters/SAR Topics 1, 5, 8, 11, 14, 16), and on the Baseline TSR File template developed from the BSAF. The contractor Line Management and Safety Reviews described above ensure the general adequacy and acceptability of the BSAF and the Baseline TSR File for use in meeting the requirements of DOE Orders 5480.22 and 5480.23. An important caution, however, is that use of the BSAF and the Baseline TSR File for activity-specific safety documentation still requires the judgement of an experienced safety analyst. That is, the safety analyst must still justify the applicability of the BSAF common safety bases, the associated baseline administrative control TSRs, and the BSAF analysis guidelines for the specific activity and provide any necessary activity-specific deletions, revisions, or additions. Training of safety analysts and reviewers in the correct use of the BSAF and Baseline TSR File will be important to their successful application.

While the BSAF and Baseline TSR File represent a significant effort to help standardize and facilitate the more efficient performance, documentation, review, and approval of safety analysis required by DOE, experience in their application and the continuing development of safety analysis guidance by DOE Headquarters will require their updating and upgrading. Particular areas where improvements are expected are in further distinguishing the gradation of requirements for Hazard Category 3 activities versus those that fall below the Hazard Category 3 threshold criteria of DOE-STD-1027-92. New DOE guidelines, if and when approved, and experience will also permit even clearer definition of the acceptable level of hazard analysis; analysis of normal, abnormal, and accident conditions; and human factors analysis needed for Hazard Category 3 and lower hazard activities. The BSAF and Baseline TSR File must be reviewed at least annually against the latest approved DOE guidance and DOE Complex and INEL experience and make necessary revisions and improvements.

It is expected by DOE-ID that Rust-Geotech will continue as custodian and will be the integrating contractor for the BSAF and Baseline TSR file until the consolidated contractor determines that it will formally take responsibility for its use and maintenance when the contract becomes effective October 1, 1994. In the event of a delay in the effective date of the new contract then Geotech will continue in its role until the contract effective date.

June 29, 1994

PREFACE

The Baseline Safety Analysis File (BSAF) provides approved safety bases and guidelines to standardize and to more efficiently perform, document, and obtain review and approval of the safety analyses required by the United States Department of Energy (DOE) for environmental restoration activities at the Idaho National Engineering Laboratory (INEL). The BSAF was developed by contractors responsible for INEL environmental restoration activities in cooperation with the DOE Idaho Operations Office (DOE-ID) Environmental Restoration Division.

Following the issuance of DOE Order 5480.23, *Nuclear Safety Analysis Reports* in April 1992, DOE-ID and its contractors responsible for the INEL Environmental Restoration Program recognized the need to establish the following:

- A consistent format and content for safety analysis documentation (safety analysis reports, auditable safety analyses)
- A consistent interpretation of the "graded approach," especially for environmental remediation and decontamination and decommissioning (D&D) activities that pose little or no risk to co-located workers, the public, or the environment
- Standardized documentation of those safety analysis topics that are common to environmental restoration activities to enhance the efficiency of safety analysis documentation development, review, and approval.

Beginning in early December 1992, an integrated team of safety analysts led by senior safety analysis staff from EG&G Idaho, Inc., MK-Ferguson Company of Idaho, and Westinghouse Idaho Nuclear Company, Inc. conceived, evolved, and developed the BSAF.

The BSAF is not a safety analysis report (SAR), but contains safety bases and/or guidelines covering the 21 safety analysis topics listed in DOE 5480.23. Where possible, the BSAF contains safety bases for topics common to environmental restoration activities. These common safety bases can be incorporated by reference into safety analysis documentation for specific environmental restoration activities with appropriate justification and, as necessary, deletions, revisions, or additions by the responsible safety analyst. For topics including hazard analysis; analysis of normal, abnormal, and accident conditions; human factors analysis; and derivation of technical safety requirements (TSRs), the BSAF provides guidelines for the safety analyst. Both the safety bases and guidelines incorporate a graded approach for environmental restoration activities that are classified as Hazard Category 3 or less than the Hazard Category 3 radionuclide threshold criteria established in DOE Standard (DOE-STD)-1027-92. Further information on use and limitations of the BSAF are described in BSAF Chapter 1.

During the development of the BSAF, the only DOE-approved guidance on implementing the requirements of DOE 5480.23 were the Attachment to the Order and DOE-STD-1027-92, *Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*. The BSAF follows and is consistent with this guidance. In the latter stage of BSAF development, additional draft guidance on implementing DOE 5480.23 began to appear. Principal documents among this new draft guidance are DOE-STD-3005-YR, *Evaluation Guidelines for Accident Analysis and Safety Structures, Systems, and Components*, and DOE-STD-3009-YR, *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*. The position of the BSAF developers, which is consistent with DOE-ID direction, is that until approved, draft standards are not referenced. It is recognized, however, that if and when approved, these standards and other approved DOE guidelines should be included in the BSAF. This revision and inclusion should be accomplished during the required annual review and update of the BSAF, or in a special update or BSAF supplement if considered appropriate by the responsible INEL environmental restoration contractors.

Beneficial comments (recommendations, additions, deletions) and any pertinent data that may be of use in improving this document should be addressed to the following:

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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS

ACGIH	American Conference of Governmental Industrial Hygienists
ACI	American Concrete Institute
AEA	Atomic Energy Act
AEC	Atomic Energy Commission
AIHA	American Industrial Hygiene Association
ATR	Advanced Test Reactor
AISC	American Institute of Steel Construction
ALARA	As Low As Reasonably Achievable
ALI	Annual Limit of Intake
Am	Americium
ANL-W	Argonne National Laboratory-West
ANS	American Nuclear Society
ANSI	American National Standards Institute
AOC	Area of Contamination
APR	Air Purifying Respirator
ARA	Auxiliary Reactor Area
ARAR	Applicable or Relevant and Appropriate Requirement
ARCHIE	Automated Response for Chemical Hazard Incident Evaluation
ARF	Airborne Release Fraction
ARVF	Army Re-entry Vehicle Facility
ARVFS	Army Re-entry Vehicle Facility Site
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigeration, and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
AST	Accident Source Term
Ba	Barium
BAT	Best Available Technology
BDAT	Best Demonstrated Available Technology
BDS	Bureau of Disaster Services (Idaho)
BORAX	Boiling Water Reactor Experiment
BR	Breathing Rate
BSAF	Baseline Safety Analysis File
BWR	Boiling Water Reactor
CAA	Clean Air Act (of 1987)
CAIRS	Computerized Accident/Incident Reporting System
CAM	Continuous Air Monitor
CDE	Committed Dose Equivalent
CDP	Census Designated Place
Ce	Cerium
CEDE	Committed Effective Dose Equivalent
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CF	Concentration Factor
CFA	Central Facilities Area
CFR	Code of Federal Regulations
Ci	Curie
Cm	Curium
CMSM	Construction Management Services Manual

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (CONTINUED)

Co	Cobalt
CO ₂	Carbon Dioxide
COCA	Consent Order and Compliance Agreement
Cs	Cesium
CTB	Centennial Tectonic Belt
CTF	Containment Test Facility
CWA	Clean Water Act
D&D	Decontamination and Decommissioning
DAC	Derived Air Concentration
DBA	Design Basis Accident
dBA	Decibels on A-Weighted Scale
DBFL	Design Basis Flood
DCF	Dose Conversion Factor
DCG	Derived Concentration Guide
DoD	United States Department of Defense
DOE	United States Department of Energy
DOE-HQ	United States Department of Energy Headquarters
DOE-ID	United States Department of Energy, Idaho Operations Office
DOE-STD	DOE Standard
DOELAP	DOE Laboratory Accreditation Program
DOL	United States Department of Labor
DOT	United States Department of Transportation
DR	Damage Ratio
DRCF	Dose-Rate Conversion Factor
EA	Environmental Assessment
EAL	Emergency Action Level
EAM	Emergency Action Manager
EBR	Experimental Breeder Reactor
ECC	Emergency Control Center
ED	Emergency Director
ED	Exposure Duration
EDE	Effective Dose Equivalent
EH-1	Assistant Secretary for Environment, Safety and Health (DOE-HQ)
EIS	Environmental Impact Statement
EM	Office of Environmental Restoration and Waste Management (DOE-HQ)
EMS	Emergency Management System
EOC	Energy Operations Center
EPA	United States Environmental Protection Agency
EPB	Environmental Programs Branch
EPCC	Emergency Planning Coordinating Committee
EQ	Equipment
ERO	Emergency Response Organization
ERP	Environmental Restoration Program
ERPG	Emergency Response Planning Guideline
ERWM	Environmental Restoration/Waste Management
ES&H	Environment, Safety, and Health
ESF	Engineered Safety Features
ETR	Engineering Test Reactor
Eu	Europium

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (CONTINUED)

f/cm ³	Fibers Per Cubic Centimeter (asbestos)
FEMA	Federal Emergency Management Agency
FFA/CO	Federal Facility Agreement and Consent Order
FID	Flame Ionization Detector
FMEA	Failure Mode and Effects Analysis
FR	Federal Register
FS	Field Supervisor
FY	Fiscal Year
GAC	Granular-Activated Carbon
GOCO	Government-Owned, Contractor-Operated
H-G	Hilsmeier-Gifford
HAZOP	Hazards and Operability (Studies)
HAZWOPER	Hazardous Waste Operations (40-hour Training-OSHA Mandated)
HCRWSF	Hazardous Chemical and Radioactive Waste Storage Facility
HEP	Human Error Probability
HEPA	High Efficiency Particulate Air (filter)
HFS	Human Factors Society
Hg	Mercury
HPP	Headend Processing Plant
HSWA	Hazardous and Solid Waste Amendments (of 1984)
HTRE	Heat Transfer Reactor Experiment
HVAC	Heating, Ventilation, and Air Conditioning
HWMA	Hazardous Waste Management Act (Idaho)
IAEA	International Atomic Energy Agency
IAG	Interagency Agreement
IARC	International Agency for Research on Cancer
ICPP	Idaho Chemical Processing Plant
ICRP	International Commission on Radiological Protection
ICS	Incident Command System
IDHW	Idaho Department of Health and Welfare
IDLH	Immediately Dangerous to Life and Health
IEEE	Institute of Electrical and Electronics Engineers
IET	Initial Engine Test (Facility)
IFGD	Idaho Fish and Game Department
INEL	Idaho National Engineering Laboratory
INPO	Institute of Nuclear Power Operations
IPDS	Integrated Plant Document System (WINCO)
ISB	Intermountain Seismic Belt
ISP	Idaho State Police
ITEPP	INEL Transportation Emergency Preparedness Program
JFD	Joint Frequency Distribution
KI	Potassium Iodide
KV	Kilovolt
LCCDA	Liquid Corrosive Chemical Disposal Area

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (CONTINUED)

LDRs	Land Disposal Restrictions
Li	Lithium
LLW	Low Level (Radioactive) Waste
LOFT	Loss-of-Fluid Test (Facility)
LWR	Light Water Reactor
MAR	Material at Risk
M&O	Management and Operations
Mgr. OPE	Manager, Office of Program Execution
Mgr. SWP	Manager, Sitewide Programs
Mgr. MS	Manager, Matrix Support
MK-FIC	MK-Ferguson of Idaho Company
MOU	Memorandum of Understanding
mph	Miles Per Hour
MSA	Major System Acquisition
MTR	Materials Test Reactor
MVA	Megavolt Amperes
Na	Sodium
NaK	Sodium Potassium
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection
NE	United States Department of Energy, Office of Nuclear Energy
NEPA	National Environmental Policy Act
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NFPA	National Fire Protection Association
NIIMS	National Inter-Agency Incident Management System
NIST	National Institute of Standards and Technology
NOAA	National Oceanic and Atmospheric Administration
NO _x	Nitrous Oxide
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NQA	Nuclear Quality Assurance
NRC	United States Nuclear Regulatory Commission
NRF	Naval Reactors Facility
NRTS	National Reactor Testing Station
NSC	National Safety Council
NTP	National Toxicology Program
NWCF	New Waste Calcining Facility
OMRE	Organic Moderated Reactor Experiment
ORPS	Occurrence Reporting and Processing System
ORR	Operational Readiness Review
OSH	Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OSR	Operational Safety Requirement
OSSB	Occupational Safety Support Branch
OU	Operable Unit
P-G	Pasquill-Gifford
PAG	Protective Action Guide
PASS	Personnel/Area Sampling System
PBF	Power Burst Facility
PCBs	Polychlorinated Biphenyls

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (CONTINUED)

PEL	Permissible Exposure Limits
PHA	Preliminary Hazard Analysis
PIC	Public Information Center
PID	Photoionization Detector
PM	Project Manager
PMF	Probable Maximum Flood
PPE	Personal Protective Equipment
ppm	Parts Per Million
PRA	Probabilistic Risk Assessment
psi	Pounds Per Square Inch
PSO	Program Secretarial Officer
PWTU	Portable Water Treatment Unit
QA	Quality Assurance
QAP	Quality Assurance Program
QAPjP	Quality Assurance Project Plan
QAPM	Quality Assurance Program Manual (WINCO)
QMP	Quality Methods and Procedures
QPP	Quality Project Plan
RA	Readiness Assessment
RAL	Radiological Analytical Laboratory
RaLa	Radioactive Lanthanum
RAM	Remote Area Monitor
RC	Radionuclide Concentration
RCM	Radiological Control Manual
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RF	Respirable Fraction
RFA	Resource Conservation and Recovery Act, Facility Assessment
RFI	Resource Conservation and Recovery Act, Facility Investigation
RI/FS	Remedial Investigation/Feasibility Study
RMWSF	Radioactive Mixed Waste Staging Facility
ROD	Record of Decision
RPSSA	Radioactive Parts Service Storage Area
RSAC	Radiological Safety Analysis Computer (Program)
RWMC	Radioactive Waste Management Complex
RWMIS	Radioactive Waste Management Information System
RWP	Radiation Work Permit
SA	Supplied Air (Respirator)
SAR	Safety Analysis Report
SARA	Superfund Amendments and Reauthorization Act
SCBA	Self-Contained Breathing Apparatus
SD	Supplemental Directive
SDA	Subsurface Disposal Area
SDWA	Safe Drinking Water Act
SEN	Secretary of Energy Notice
SHARP	Systematic Human Reliability Procedure (Electric Power Research Institute)
SL	Safety Limit

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (CONTINUED)

SMC	Specific Manufacturing Capabilities (Facility)
SPERT	Special Power Excursion Reactor Tests
SPMS	Safety Performance Measurement System
Sr	Strontium
SR	Surveillance Requirement
SRPA	Snake River Plain Aquifer
SSC	Structures, Systems, and Components
SSDC	System Safety Development Center
SSFI	Scaffolding, Shoring, and Framing Institute
STEL	Short Term Exposure Limit
SWEPP	Stored Waste Examination Pilot Plant
TAN	Test Area North
TCL	Target Compounds List
TCLP	Toxicity Characteristic Leaching Procedures
TEDE	Total Effective Dose Equivalent
TEEM	Team-Enhanced Evaluation Method (Brookhaven National Laboratory)
TLD	Thermoluminescent Dosimeters
TLV	Threshold Limit Value
TRA	Test Reactor Area
TRAIN	Training Records and Information Network (EG&G)
TRU	Transuranic
TSA	Transuranic Storage Area
TSCA	Toxic Substances Control Act (of 1976)
TSD	Treatment, Storage, and Disposal
TSDF	Treatment, Storage, and Disposal Facility
TSF	Technical Support Facility
TSR	Technical Safety Requirement
TAAF	Test Train Assembly Facility
TWA	Time-Weighted Average
UBC	Uniform Building Code
UCRL	University of California Research Laboratory
UL	Underwriters' Laboratory
UOR	Unusual Occurrence Report
USQ	Unreviewed Safety Question
UST	Underground Storage Tank
UV	Ultraviolet (light)
VOC	Volatile Organic Compound
VRZ	Volcanic Rift Zone
WAG	Waste Area Group
WCB	Willow Creek Building
WCC	Warning Communications Center
WCDE	Weighted Committed Dose Equivalent
WECED	Worker Exposure Committed Effective Dose Equivalent
WERF	Waste Experimental Reduction Facility
WINCO	Westinghouse Idaho Nuclear Company, Inc.
WIPP	Waste Isolation Pilot Plant
WMIP	Waste Minimization Implementation Plan
WMP	Waste Minimization Program
WMPP	Waste Minimization Policy and Program

LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (CONCLUDED)

WROC	Waste Reduction Operations Complex
WRRTF	Water Reactor Research Test Facility
WSB	Waste Storage Building
WSOP	WINCO Standard Operating Procedure
WVDP	West Valley Demonstration Project

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GLOSSARY

Administrative Controls: Provisions relating to organization and management, procedures, recordkeeping, assessment, and reporting necessary to ensure safe operation of a facility.

Applicable or Relevant and Appropriate Requirement (ARAR): Requirements, including cleanup standards, standards of control, and other substantive environmental protection requirements and criteria for hazardous substances as specified under Federal and State law and regulations, that must be met when complying with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (from the Superfund Amendments and Reauthorization Act (SARA)).

Aquifer: A geologic formation or structure capable of yielding water in usable quantities.

As Low As Reasonably Achievable (ALARA): A radiation protection principle applied to radiation exposures, with costs and benefits taken into account.

Atomic Energy Act (AEA): The Act (1954) that placed production and control of nuclear materials within a civilian agency, originally the Atomic Energy Commission.

Baseline Safety Analysis File (BSAF): Document designed to provide the safety bases common to Idaho National Engineering Laboratory (INEL) environmental remediation and decontamination and decommissioning (D&D) activities. Common safety bases provided in the BSAF will be incorporated by reference into the safety analysis documentation prepared for individual environmental remediation and D&D activities with appropriate justification and, as needed, revisions and additions. Use of the BSAF's common safety bases and safety analysis guidelines standardizes safety analysis documentation for INEL Environmental Restoration Program (ERP) activities. Additionally, the BSAF provides guidelines for activity-specific hazard analysis; for analysis of normal, abnormal, and accident conditions; for human factors analysis; and for derivation of technical safety requirements.

Below Regulatory Concern: A level of radioactivity in waste, which is considered to be safe for human exposure and, therefore, does not require monitoring or control.

Best Available Technology (BAT) or Best Demonstrated Available Technology (BDAT): Treatment technologies that have been shown through actual use to yield the greatest environmental benefit among competing technologies that are practically available.

Calcining: The process of making unconsolidated powder or granules by thermal evaporation and partial decomposition of high-level waste.

GLOSSARY (CONTINUED)

Characterization: Facility or site sampling, monitoring, and analysis activities to determine the extent and nature of the release. Characterization provides the basis for acquiring necessary technical information to develop, screen, analyze, and select appropriate cleanup techniques.

Clean Air Act (CAA): Federal statute designed to "protect and enhance the quality of the Nation's air resources." Its primary application is through Prevention of Significant Deterioration permits to regulate new potentially polluting facilities. Of increasing importance are the National Emissions Standards for Hazardous Air Pollutants (NESHAPs). The CAA was passed in 1970 as an amendment to 42 USC 7401.

Clean Water Act of 1977 (CWA): Amended the Federal Water Pollution Control Act first passed in 1956. Its objective is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The Act's major enforcement tool is the National Pollution Discharge Elimination System (NPDES) permit.

Commitment in a Baseline Safety Analysis File (BSAF): Any statement in the BSAF that presents an assumption or requires that something be accomplished, transformed, produced, or provided. A BSAF commitment "establishes guidelines for operation, reliability, availability, or maintainability of any system or subsystem that is required for safe operation of a facility within the risk accepted by DOE; limits the risk accepted by DOE; establishes (directly or indirectly by reference) a parametric value that if changed in any arbitrary manner could increase the risk relative to the safety or protection of workers, the public, or the environment.

Compliance Agreements: Legally binding agreements between regulators and regulated entities that set standards and schedules for compliance with environmental statutes. Includes Consent Order and Compliance Agreements, Federal Facilities Agreements, and Federal Facility Compliance Agreements.

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): Federal Statute (also known as Superfund), enacted in 1980 and reauthorized in 1986, that provides the statutory authority for cleanup of hazardous substances that could endanger public health, welfare, or the environment.

Consent Order and Compliance Agreement (COCA): See Compliance Agreements.

Decommissioning: Actions taken to reduce the potential health and safety impacts of DOE contaminated facilities, including activities to stabilize, reduce, or remove radioactive materials or to demolish the facilities.

Decontamination: The removal of unwanted material (either radioactive or hazardous materials) from facilities, soils, or equipment by washing, chemical action, mechanical cleaning, or other techniques.

GLOSSARY (CONTINUED)

Design Basis: Set of requirements that bound the design of systems, structures, and components within the facility. These design requirements include consideration of safety, plant availability, efficiency, reliability, and maintainability. Some aspects of the design basis are important to safety, although others are not.

Design Basis Accidents (DBAs): Accidents that are postulated for the purpose of establishing functional requirements for safety significant structures, systems, components, and equipment.

Disposal: Waste emplacement designed to ensure isolation of waste from the biosphere, with no intention of retrieval for the foreseeable future, and requiring deliberate action to regain access to the waste.

DOE Directives: Internal requirements that establish DOE policy for compliance with applicable laws and regulations.

Drinking Water Standard: Concentration limits for certain elements and pollutants that may occur in drinking water; established by the Safe Drinking Water Act.

Engineered Safety Features: Systems, components, or structures that prevent and/or mitigate the consequences of all potential accidents including the bounding design basis accidents.

Environmental Restoration: Cleanup and restoration of sites contaminated with hazardous substances during past production or disposal activities.

Feasibility Study: A step in the environmental restoration process specified by CERCLA. The objectives of the feasibility study are to identify the alternatives for remediation and to select and describe a remedial action that satisfies the applicable or relevant and appropriate requirements for mitigating confirmed environmental contamination. Successful completion of the feasibility study should result in unimpeded subsequent development of a remedial design for implementation of the selected remedial actions.

Federal Facilities Agreement (model FFA): See Compliance Agreements.

Federal Facility Compliance Agreement: See Compliance Agreements.

Groundwater: Liquid water occurring beneath the earth's surface, in the interstices between soil grains, in fractures, or in porous formations.

Groundwater Remediation: Treatment of groundwater to remove pollutants.

Hazard: Source of danger (for example, material, energy source, or operation) with the potential to cause illness, injury, or death to personnel or damage to a facility or to the environment (without regard for the likelihood or credibility of accident scenarios or consequence mitigation).

GLOSSARY (CONTINUED)

Hazard Classification Categories: Hazard classification categories are defined in DOE Order 5480.23, *Nuclear Safety Analysis Reports* as follows:

The consequences of unmitigated releases of radioactive and/or hazardous material shall be evaluated and classified by the following hazard categories:

- Category 1 Hazard. The hazard analysis shows the potential for significant offsite consequences.
- Category 2 Hazard. The hazard analysis shows the potential for significant onsite consequences.
- Category 3 Hazard. The hazard analysis shows the potential for only significant localized consequences.

Hazardous Materials: Any solid, liquid, or gaseous material that is toxic, explosive, flammable, corrosive, or otherwise physically or biologically threatening to health. Oil is excluded from this definition.

Hazardous Waste: As defined in the Resource Conservation and Recovery Act (RCRA), a solid waste or combination of solid wastes that, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may cause or significantly contribute to an increase in mortality or an increase in serious, irreversible, or incapacitating reversible illness or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed. Hazardous wastes may be listed or characteristic.

High-Level Waste: The highly radioactive waste material that results from the reprocessing of spent nuclear fuel, including liquid waste produced directly in reprocessing and any solid waste derived from the liquid, that contains a combination of transuranic waste and fission products in concentrations requiring permanent isolation.

Inactive Waste Site: Sites formerly used for the treatment, storage, or disposal of wastes.

Incineration: A treatment technology using combustion to destroy organic constituents and reduce the volume of wastes.

Interagency Agreement (IAG): A formal document in which two or more Federal agencies agree to cooperate.

Land Disposal Restrictions (LDRs): Provisions of the Hazardous and Solid Waste Amendments (HSWAs) requiring phased-in treatment of hazardous wastes before disposal.

Low-Level Waste: Radioactive waste not classified as high-level waste, transuranic waste, spent nuclear fuel, or byproduct material.

GLOSSARY (CONTINUED)

Mixed Waste: Mixed waste contains both radioactive and hazardous components, as defined by the Atomic Energy Act and RCRA, respectively.

National Emission Standards for Hazardous Air Pollutants (NESHAPs): Clean Air Act limits for release of hazardous pollutants for which no ambient air quality standard is applicable.

National Environmental Policy Act (NEPA) of 1969: Act that established the requirement for conducting environmental reviews of Federal actions that have the potential for significant impact on the human environment.

National Pollutant Discharge Elimination System (NPDES): Section 402 of the Federal Water Pollution Control Act (Clean Water Act) that establishes a permit for discharges to water and provides standards by which such permits may be granted.

National Priorities List: Formal listing of the Nation's worst hazardous waste sites, as established by CERCLA.

Nonreactor Nuclear Facility: Those activities or operations that involve radioactive and/or fissionable materials in such form and quantity that a nuclear hazard potentially exists to the employees or the general public. Included are the following activities or operations:

- Produce, process, or store radioactive liquid or solid waste, fissionable materials, or tritium
- Conduct separations operations
- Conduct irradiated materials inspection, fuel fabrication, decontamination, or recovery operations
- Conduct fuel enrichment operation
- Perform environmental remediation or waste management activities involving radioactive materials.

Incidental use and generating of radioactive materials in a facility operation (for example, check and calibration sources; use of radioactive sources in research, experimental, and analytical laboratory activities; electron microscopes; and X-ray machines) would not ordinarily require the facility to be included in this definition. Accelerators and reactors and their operations are not included.

GLOSSARY (CONTINUED)

Operable Unit (OU): A discrete portion of a site consisting of one to many release sites considered together for assessment and cleanup activities. The primary criteria for placement of release sites into an operable unit include geographic proximity, similarity of waste characteristics and site type, and the possibilities for economy of scale.

Radioactive Waste: A solid, liquid, or gaseous material of negligible economic value that contains radionuclides in excess of threshold quantities. Does not include material contaminated by radionuclides from nuclear weapons testing.

RCRA Part A Permit: The first part of a RCRA permit application that identifies treatment, storage, and disposal units within a to-be-permitted facility.

RCRA Part B Permit: The detailed second part of a RCRA permit application that describes wastes managed, quantities, and facilities.

Record of Decision (ROD): The CERCLA document used to select the method of remedial action to be implemented at a site after the Feasibility Study/Proposed Plan process has been completed.

Remedial Investigation (RI): The CERCLA process of determining the extent of hazardous substance contamination and, as appropriate, conducting treatability investigations. The RI provides the site-specific information for the feasibility study.

Reprocessing: The dissolution of spent reactor fuel and separation of uranium, transuranic elements, and fission products.

Risk: The quantitative expression of possible loss that considers both the probability that a hazard will cause harm and the consequences of that event.

Safety Analysis: Documented processes to provide systematic identification of hazards within a given DOE operation; to analyze the adequacy of the measures taken to eliminate, control, or mitigate identified hazards; and to analyze and evaluate potential accidents and associated risks.

Safety Analysis Report (SAR): The report which documents the adequacy of safety analyses for a nuclear facility to ensure that the facility can be constructed, operated, maintained, shut down, and decommissioned safely and in compliance with applicable laws and regulations.

Safety Basis: The combination of information relating to the control of hazards at a nuclear facility (including design, engineering analyses, and administrative controls) upon which DOE depends for its conclusion that activities at the facility can be conducted safely.

GLOSSARY (CONTINUED)

Sanitary Waste: Wastes, such as garbage, that are generated by normal housekeeping activities and that are not hazardous or radioactive.

Spent Fuel: Irradiated nuclear reactor fuel before reprocessing. Contains uranium, fission products, and transuranic elements.

Storage: Retention and monitoring of waste in a retrievable manner pending final disposal.

Superfund Amendments and Reauthorization Act (SARA): The 1986 Act amending and reauthorizing CERCLA.

Surplus Facility: Any facility or site (including equipment) that has no identified programmatic use and may or may not be radioactively contaminated to levels that require controlled access.

Technical Safety Requirements (TSRs): Those requirements that define the conditions, safe boundaries, and the management or administrative controls necessary to ensure the safe operation of a nuclear facility and to reduce the potential risk to the public and facility workers from uncontrolled releases of radioactive materials or from radiation exposures due to inadvertent criticality. A TSR consists of operating limits, surveillance requirements, and administrative controls, use, and application instructions, and the basis thereof.

Toxic Substances Control Act (TSCA): TSCA was enacted in 1976 to protect human health and the environment from unreasonable risk due to exposure to, manufacture, distribution, use, or disposal of substances containing toxic chemicals. Under TSCA, any hazardous wastes that contain more than 50 parts per million of polychlorinated biphenyls are subject to regulation.

Treatment: Any activity that alters the chemical or physical nature of a hazardous waste to reduce its toxicity, volume, mobility, or render it amenable for transport, storage, or disposal.

Transuranic (TRU) Waste: Waste that is contaminated with alpha-emitting transuranium nuclides with half-lives greater than 20 years and concentrations greater than 100 nanocuries per gram of waste.

Tri-Party Agreement: An agreement signed by DOE, EPA, and individual states that identifies milestones for key waste management actions.

Underground Storage Tank (UST): Any tank or associated piping below ground level containing hazardous materials as defined by the Hazardous and Solid Waste Amendments (Subtitle C or Subtitle I).

GLOSSARY (CONCLUDED)

Unreviewed Safety Questions: A determination made by examining the following circumstances:

- (1) Temporary or permanent changes in the facility as described in existing safety analyses
- (2) Temporary or permanent changes in the procedures as derived from existing safety analyses
- (3) Tests or experiments not described in existing safety analyses.

On identification of any of the above circumstances, an Unreviewed Safety Question exists if one or more of the following conditions result:

- The probability of occurrence or the consequences of an accident or malfunction of equipment important to safety as previously evaluated in the facility safety analyses could be increased
- Possibility for an accident or malfunction of a different type than any evaluated previously in the facility safety analyses could be created
- Any margin of safety as defined in the bases of the Technical Safety Requirements (TSRs) could be reduced.

Vitrification: The process of immobilizing waste that produces a glass-like solid that permanently captures the radioactive materials.

Waste Area Group (WAG): A grouping of facilities and/or release sites with areawide soil and/or groundwater contamination. Generally, a WAG would be limited to a geographically contiguous and hydrologically defined area.

Waste Isolation Pilot Plant (WIPP): Research and demonstration facility located at Carlsbad, New Mexico, intended to demonstrate safe disposal of radioactive waste in a deep geologic environment. A decision on whether to convert WIPP to a disposal facility for transuranic waste will be made after successful testing is demonstrated.

Waste Minimization: Reduction, to the extent feasible, of hazardous waste that is generated prior to treatment, storage, or disposal of the waste. Waste minimization includes any source reduction or recycling activity that results in either reduction of total volume of hazardous waste; reduction of toxicity of hazardous waste; or both.

Wastestream: Terminology used to refer to waste leaving a facility or operation.

CHAPTER 1.0

EXECUTIVE SUMMARY

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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1.0 EXECUTIVE SUMMARY

This chapter of the Baseline Safety Analysis File (BSAF) in Section 1.4 contains guidelines for the format and content of the Executive Summary (Chapter 1) of Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP) activity-specific safety analysis documentation. In addition, this chapter contains the following:

- Introduction and background information for this BSAF (Section 1.1)
- Discussion of the use and limitations of the BSAF (Section 1.2)
- Overview of the INEL ERP (Section 1.3).

1.1 Introduction and Background

United States Department of Energy (DOE) Order 5480.23, *Nuclear Safety Analysis Reports* (DOE, 1992a), requires development of safety analyses that establish and evaluate the adequacy of the safety bases of DOE nuclear facilities and operations. DOE 5480.23 requires that results of the safety analyses be documented in safety analysis reports (SARs) for nuclear facilities or in a form that is auditable by DOE for nonfacility nuclear operations. DOE Order 5481.1B, *Safety Analysis and Review System* (DOE, 1986), and DOE-Idaho Operations Office (DOE-ID) Supplemental Directive 5481.1B (DOE-ID, 1991) establish requirements for the preparation and review of safety analyses on DOE nonnuclear facilities and operations.^a

To more efficiently develop and review DOE-required safety analyses and safety analysis documentation, the INEL ERP developed this BSAF. The BSAF provides the safety bases common to ERP activities at the INEL. Additionally, the BSAF provides guidelines for activity-specific hazard analysis; for analysis of normal, abnormal, and accident conditions; for human factors analysis; and for derivation of technical safety requirements (TSRs). To the extent possible, the BSAF's common safety bases and safety analysis guidelines standardize safety analysis development and documentation for the INEL ERP activities.

The BSAF encompasses environmental remediation and decontamination and decommissioning (D&D) activities with the potential for only significant localized consequences. That is, the BSAF specifically covers activities classified as Hazard Category 3 and activities below the Hazard Category 3

^a DOE facilities and operations classified as Hazard Category 1, 2, or 3 in accordance with guidance in DOE Standard "Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, *Nuclear Safety Analysis Reports*" (DOE-STD-1027-92) (nuclear facilities and operations) are required to meet DOE 5480.23 requirements. DOE facilities and operations that do not exceed the radioactive material, inventory-based, Hazard Category 3 threshold criteria in DOE-STD-1027-92 are exempt from DOE 5480.23 requirements, but are subject to the safety analysis requirements of DOE 5481.1B. See the "Interim Guidelines for Compliance with Safety Analysis Requirements on Environmental Remediation and D&D Activities at the INEL," Revision 0, April, 1993 (Williams, 1993), for additional information on INEL ERP safety analysis documentation and review requirements.

threshold.^b Although developed specifically for environmental remediation and D&D activities with the potential for only localized consequences, many of the safety bases and safety analysis guidelines in the BSAF may be also applicable for activities that include Category 1 or 2 hazards.

The BSAF covers work to remediate those inactive sites and facilities contaminated with radioactive and/or hazardous material included in the INEL Federal Facility Agreement and Consent Order (FFA/CO) Action Plan (INEL, 1991b) and in the INEL D&D Long Range Plan (EG&G, 1993) for which DOE-ID is responsible. The Naval Reactors Facility (NRF) and Argonne National Laboratory - West (ANL-W) are not included in the INEL ERP. ERP activities covered include the following:

- Environmental remediation - removal, interim, and final cleanup actions
- D&D - facility surveillance and maintenance, and facility D&D.

Safety analysis and safety analysis documentation of facility characterization activities (for example, sampling and monitoring) required to support the FFA/CO and the D&D program are covered independently and are not included in the BSAF.

The BSAF contains 21 chapters that parallel the 21 requirements topics prescribed by DOE 5480.23, Paragraph 8.b.(3). The BSAF is a controlled document and is annually reviewed and updated, as necessary, to ensure that the safety bases and safety analysis guidelines remain current.

1.2 Use and Limitations of the Baseline Safety Analysis File

1.2.1 Use of the BSAF

The BSAF is a sitewide safety document for the INEL. The BSAF safety bases and safety analysis guidelines should be used by the responsible INEL contractor for environmental remediation and D&D activities to meet the requirements of DOE 5480.23 and DOE 5481.1B; related DOE Orders, Directives; and associated DOE standards and guidelines. The common safety bases provided in the BSAF should be incorporated by reference into the safety analysis documentation prepared for individual environmental remediation and D&D activities with appropriate justification and, as necessary, revisions and additions. The safety analysis guidelines in the BSAF provide a recommended approach for the performance of hazards analysis; analysis of normal, abnormal, and accident conditions; human factors analysis; and derivation of TSRs that should be used to meet DOE requirements, standards, and guidelines. The safety analysis guidelines are graded for environmental remediation and D&D activities that are Hazard Category 3 or below the threshold.

^b Hazard Categories 1, 2, and 3 are defined in DOE 5480.23. Guidelines for classification are provided in DOE Standard "Hazard Categorization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports" (DOE-STD-1027-92) dated 1992.

1.2.2 Limitations of the BSAF

The BSAF provides safety bases and safety analysis guidelines to be used in the development of activity-specific safety analysis documentation (that is, SARs and auditable safety analyses) for environmental remediation and D&D activities at the INEL. The BSAF is *not* a safety analysis report (SAR).

The scope of the BSAF covers Hazard Category 3 activities or activities below the Hazard Category 3 threshold. For these activities, the BSAF should provide the safety bases or safety analysis guidelines generally needed for the development of activity-specific safety analysis documents. However, the BSAF safety bases and safety analysis guidelines may not be sufficient to address activities where there is a potential for significant offsite (Hazard Category 1) or onsite (Hazard Category 2) consequences. Additionally, the BSAF may not provide all of the necessary and sufficient safety bases and safety analysis guidelines for unique or unusual environmental remediation and D&D activities.

1.3 Overview of the INEL Environmental Restoration Program

1.3.1 Purpose and Mission

The mission of the ERP is to remediate inactive sites and facilities contaminated with radioactive, hazardous, and mixed wastes at the INEL. The INEL ERP encompasses the following activities:

- Remedial investigations to identify and, where necessary, remedial actions to clean up existing and potential releases from inactive waste sites
- D&D of surplus facilities.

An overview of INEL environmental remediation and D&D activities is provided in Section 1.3.2 and 1.3.3, respectively.

1.3.2 Environmental Remediation Program

In 1989 under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the INEL was added to the United States Environmental Protection Agency's (EPA's) National Priorities List (NPL) of "Superfund" sites. CERCLA is a law that regulates the cleanup of inactive waste sites containing hazardous substances, including radioactive substances. In addition, the INEL must comply with the Resource Conservation and Recovery Act (RCRA), which is administered by the state of Idaho under the authority of the Idaho Hazardous Waste Management Act (HWMA). RCRA is a law regulating generation, transportation, treatment, storage, and disposal of hazardous wastes and corrective action for releases to the environment of hazardous wastes.

In compliance with CERCLA, DOE entered into a FFA/CO for the INEL on December 9, 1991, with the EPA and the State of Idaho (INEL, 1991a). This agreement has the common goals of ensuring that releases or threatened

releases of hazardous substances at the INEL are thoroughly investigated in accordance with CERCLA's implementing regulation, the National Contingency Plan (NCP); and ensuring that appropriate response actions are undertaken and completed as necessary to protect human health and the environment.

Since the INEL is too extensive to be cleaned as a single site, it was divided in the FFA/CO into ten Waste Area Groups (WAGs) upon which to focus environmental remediation efforts. WAGs 1 through 9 generally correspond to the surface and subsurface concerns of specific operational facilities at the INEL. WAG 10 corresponds to overall concerns associated with the Snake River Plain Aquifer and those areas outside the boundaries of facility-specific WAGs. Table 1-1 provides descriptive highlights of the ten WAGs. Figure 1-1 is a map showing the INEL WAGs. Although the NRF (WAG 8) and ANL-W (WAG 9) are included in the FFA/CO, DOE-ID is not responsible for these WAGs. Therefore, WAGs 8 and 9 are not part of the INEL ERP.

The FFA/CO process is CERCLA-based and described in the FFA/CO Action Plan which is part of the agreement (INEL, 1991b). Activities typically follow a phased approach: initial investigation; characterization and assessment; evaluation of remedial action alternatives; issuance of a proposed plan; a Record of Decision (ROD); remedial design; and remedial action. For site characterization and remedial actions required by the FFA/CO, the FFA/CO process incorporates requirements to ensure the health and safety of workers and the public and to protect the environment. These FFA/CO health and safety requirements include compliance with the following Occupational Safety and Health Administration (OSHA) regulations:

- 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response*, that specifies the requirements for preparation of a Health and Safety Plan. A Health and Safety Plan addresses the measures taken by the contractor to ensure that the activity will be conducted in a manner safe for workers and the surrounding community. The plan is written to identify potential site-specific hazards.
- 29 CFR 1910.119, *Process Safety Management of Highly Hazardous Chemicals*, that specifies requirements for performance of a process hazard analysis. A process hazard analysis may be required for a remedial action that involves chemicals at or above the threshold quantities specified in Appendix A of the standard. Section 2.2 provides additional description of process safety management requirements.

1.3.3 D&D Program

The D&D program at the INEL addresses the following:

- Surveillance and maintenance of surplus radioactively contaminated facilities awaiting decommissioning to protect the public and worker health and safety and to reduce potential environmental hazards

TABLE 1-1. DESCRIPTIVE HIGHLIGHTS OF THE INEL WASTE AREA GROUPS (WAGs)

WAG 1 - Test Area North (TAN) is subdivided into 10 operable units (OUs). Potential release sites include tanks, spills, disposal sites, wastewater disposal systems.
WAG 2 - Test Reactor Area (TRA) is subdivided into 13 OUs. Sites investigated include pits, trenches, rubble piles, ponds, cooling towers, wells, French drains, spills.
WAG 3 - Idaho Chemical Processing Plant (ICPP) is subdivided into 13 OUs. Cleanup sites include potential releases from hazardous materials stored in a tank farm and items associated with wastewater disposal systems such as sumps, ponds, injection wells.
WAG 4 - Central Facilities Area (CFA) is subdivided into 13 OUs. Cleanup sites include spill sites, tanks, landfills, ponds, leach field, pits.
WAG 5 - Power Burst Facility/Auxiliary Reactor Area (PBF/ARA) is subdivided into 13 OUs. Currently, PBF is in standby mode; all ARA reactors are removed. Some underwent partial or complete decontamination.
WAG 6 - Experimental Breeder Reactor/Boiling Water Reactor Experiment (BORAX) contains five OUs. Sites include old tanks, small spill, several liquid and solid waste disposal sites.
WAG 7 - Radioactive Waste Management Complex (RWMC) has 14 OUs primarily in subsurface disposal area (SDA). Sites include numerous pits, trenches, and vaults where radioactive and organic wastes were placed. Large asphalt pad stores waste aboveground.
WAG 8* - Naval Reactors Facility (NRF) is divided into eight OUs.
WAG 9* - Argonne National Laboratory - West (ANL-W) is subdivided into four OUs. Sites include industrial waste pond, leach pits, ditch associated with cooling tower.
WAG 10 - Five OUs were identified to assess the Snake River Plain Aquifer and miscellaneous waste sites on an INEL-wide basis.

*These units are part of the FFA/CO, but are not part of the INEL ERP.

Figure 1-1. Map Showing INEL Waste Area Groups (WAGs)

- Appropriate disposition of surplus radioactively contaminated facilities in compliance with the National Environmental Policy Act (NEPA), RCRA, CERCLA, and other applicable Federal and state requirements.

A facility is declared "surplus" if the programmatic sponsor so designates it and no future programs are identified for the facility.

D&D projects must meet the requirements of DOE Order 5820.2A, *Radioactive Waste Management* (DOE, 1988), Chapter V, "Decommissioning of Radioactively Contaminated Facilities," which establishes DOE policies and guidelines for the management, decontamination, and decommissioning of radioactively contaminated facilities. Table 1-2 is a list of current D&D projects at the INEL.

TABLE 1-2. INEL D&D PROJECTS

- Auxiliary Reactor Area I (ARA-I)
- ARA-II
- ARA-III
- Army Reentry Vehicle Facility Site (ARVFS) - NaK
- Boiling Water Reactor Experiment-V (BORAX-V) Reactor Building
- Central Facilities Area Hot Laundry (CFA-669)
- Engineering Test Reactor (ETR) Complex
- Loss-of-Fluid Test (LOFT) Facility - Ancillaries
- Materials Test Reactor (MTR) Facility
- Test Area North 607 (TAN-607) Decontamination Shop
- Test Train Assembly Facility (TTAF)
- Test Area North Technical Support Facility (TAN/TSF)
- Idaho Chemical Processing Plant (ICPP) Facilities
 - Uranium Separation Plant (CPP-601)
 - Fuel Receiving and Storage Facility (CPP-603)
 - Radioactive Lanthanum (RaLa) Recovery System (CPP-631)
 - Waste Calcining Facility (CPP-633)
 - Headend Processing Plant (CPP-640)
 - East Side Service Waste Monitoring Station (CPP-709)
 - West Side Service Waste Monitoring Station (CPP-734)
 - Horizontal Settling Basin (CPP-740)
 - Hot Waste Tank (SFE-20)
 - High Level Waste Tank Farm

INEL D&D activities are performed in a documented and structured manner consistent with DOE 5820.2A, Chapter V. The management approach includes a facility characterization, a decision analysis aided by a cost-risk-benefit assessment, a D&D plan, generation of a project data file, a post-D&D characterization, and a final report. Key D&D safety documentation prepared for D&D activities includes the DOE-required safety analysis documentation covering both the inactive status of a facility awaiting D&D and actual D&D activities, and a Health and Safety Plan required by 29 CFR 1910.120 (DOL, 1993b).

1.3.4 Management and Organization

The DOE-ID Environmental Restoration Division has responsibility for the INEL ERP. Management and oversight of FFA/CO activities is provided under provisions outlined in the FFA/CO by members of a team with representatives from DOE-ID, the State of Idaho Department of Health and Welfare (IDHW), and EPA Region 10.

Implementation of the INEL ERP currently is accomplished by three contractors: EG&G Idaho, Inc.; Westinghouse Idaho Nuclear Company, Inc. (WINCO); and MK-Ferguson Company of Idaho (MK-FIC). EG&G and WINCO are responsible for the investigation, characterization, and assessment phase of the FFA/CO process up to the ROD. MK-FIC is responsible for the remedial design and remedial action phase of the FFA/CO process after the ROD is signed. WINCO is responsible for D&D at the Idaho Chemical Processing Plant (ICPP). EG&G has D&D responsibility for the rest of the INEL, except for NRF and ANL-W. The contractors' work scopes include safety analysis responsibility for their respective environmental remediation and D&D activities. DOE-ID may award ERP work to other contractors.

1.4 Executive Summary Guidelines

This section provides the recommended format and content for the Executive Summary (Chapter 1) of environmental remediation and D&D activity-specific safety analysis documentation (for example, SARs or auditable safety analyses).

1.0 Executive Summary

This chapter should provide an overview of the environmental remediation or D&D activity and summarize the key aspects of the safety analysis presented in the SAR or auditable safety analysis that define the safety basis; document the logic of safety basis derivation; demonstrate safety basis adherence; and justify safety basis adequacy. The use of the BSAF in development of the activity-specific safety analysis documentation should be described.

1.1 Facility Overview

This section should provide a summary description of the environmental remediation or D&D activity, including its purpose, mission, and the life-cycle addressed (inherent for D&D activities; and usually the entire life-cycle for environmental remediation activities). The location of the activity on the INEL and proximity of the activity to nearby facilities should be described. Contractors responsible for design, construction, and operation, as well as overall management and safety of the activity, should be identified. External functions necessary to support activity safety should be stated. The overview should identify the hazard classification of the activity.

1.2 Consequences of Normal Operations

This section should provide a summary of the normal operation hazards and estimated exposures from radioactive and hazardous materials to ERP workers, co-located workers within the INEL site boundary, and the general public beyond the INEL site boundary, and how the hazards and exposures are controlled. (Summary of Section 11.1 of the safety analysis documentation.)

1.3 Consequences of Abnormal Operations

This section should provide a summary of hazards resulting from abnormal operations and the design, operation, and administrative measures and controls that prevent occurrences or mitigate consequences. (Summary of Section 11.2 of the safety analysis documentation.)

1.4 Consequences of Postulated Accidents

This section should provide a summary of the controlling accidents postulated and the potential exposures to ERP workers, co-located workers within the INEL site boundary, and the general public beyond the INEL site boundary. Potential contamination of the environment should be summarized. (Summary of Section 11.3 of the safety analysis documentation.)

1.5 Conclusions

The major conclusions of the safety analysis should be presented in this section. The conclusions presented in this section should provide a basis for the reviewer to determine whether or not the environmental remediation or D&D activity can be conducted without either endangering the safety of ERP workers, co-located workers within the INEL site boundary, or the general public beyond the INEL site boundary; or adversely affecting the environment.

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1.0 REFERENCES

- Department of Energy (DOE, 1986), *Safety Analysis and Review System*, DOE, Washington, D.C., Change 001 (5/19/87), DOE 5481.1B.
- Department of Energy (DOE, 1988), *Radioactive Waste Management*, DOE, Washington, D.C., DOE 5820.2A.
- Department of Energy (DOE, 1992a), *Nuclear Safety Analysis Reports*, DOE, Washington, D.C., DOE 5480.23.
- Department of Energy (DOE, 1992b) *Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, DOE, Washington, D.C., DOE-STD-1027-92.
- Department of Energy, Idaho Operations Office (DOE-ID, 1991), *Safety Analysis and Review System*, DOE-ID, Idaho Falls, ID, DOE-ID Supplemental Directive 5481.1B.
- Department of Labor (DOL, 1993a), *Process Safety Management of Highly Hazardous Chemicals*, U.S. Government Printing Office, Washington, D.C., 29 CFR 1910.119.
- Department of Labor (DOL, 1993b), *Hazardous Waste Operations and Emergency Response*, U.S. Government Printing Office, Washington, D.C., 29 CFR 1910.120.
- EG&G Idaho, Inc. (EG&G, 1993), *INEL D&D Long-Range Plan*, October 1993, EG&G, Idaho Falls, ID, EGG-WM-10924, Rev. 9.
- Idaho National Engineering Laboratory (INEL, 1991a), *Federal Facility Agreement and Consent Order*, December 4, 1991, INEL, Idaho Falls, ID.
- Idaho National Engineering Laboratory (INEL, 1991b), *Action Plan for Implementation of the Federal Facility Agreement and Consent Order*, December 4, 1991, INEL, Idaho Falls, ID [Part of the FFA/CO (INEL, 1991a)].
- Williams, A. C. (1993), *Interim Guidelines for Compliance with Safety Analysis Requirements on Environmental Remediation and D&D Activities at the INEL*, Revision 0, letter to Distribution, ERWM-RPO-419-93.

CHAPTER 2.0

APPLICABLE STATUTES, RULES, REGULATIONS, AND DEPARTMENTAL ORDERS

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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2.0 APPLICABLE STATUTES, RULES, REGULATIONS, AND DEPARTMENTAL ORDERS

Chapter 2 identifies applicable statutes, rules, regulations, and United States Department of Energy (DOE) Directives binding on the safety basis of Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP) activities. These encompass Federal, state, and local statutes, regulations, and other requirements that establish safety constraints on the ERP activities at the INEL. DOE Directives include DOE Orders and DOE-Idaho Operations Office (DOE-ID) Supplemental Directives. Section 2.1 lists applicable statutes, rules, regulations, and DOE Directives. Sections 2.2 and 2.3 describe Occupational Safety and Health Administration (OSHA) regulations for process safety management programs and safety and health programs. These OSHA regulations are presented separately because of the special relationship of these regulations to DOE safety analysis requirements. The applicable statutes, rules, regulations, and DOE Directives identified in this chapter are discussed in subsequent chapters in the Baseline Safety Analysis File (BSAF).

INEL ERP activities are required to meet new and revised statutes, rules, regulations, and DOE Directives that are applicable, to the activity safety basis. This includes statutes, rules, regulations, and DOE Directives that may not be included in this chapter or elsewhere in the BSAF. The BSAF will be annually updated, including the tables in Chapter 2, to reflect an updated list of applicable statutes, rules, regulations, and DOE Directives.

2.1 Applicable Statutes, Rules, Regulations, and DOE Directives

This section identifies statutes, rules, regulations, and DOE Directives applicable to safety of INEL ERP activities. These documents address engineering, operations management, program management, and safety oversight requirements. Applicable Federal and State of Idaho statutes and regulations are listed in Table 2-1 (All tables are grouped together at the end of this chapter). There are no applicable local requirements. Applicable DOE Directives are listed in Table 2-2. Tables 2-1 and 2-2 provide cross-references to Baseline Safety Analysis File (BSAF) chapters in which compliance with identified Federal and State of Idaho statutes and regulations and DOE Directives are discussed.

The DOE Directives may reference additional technical standards or mandate development of DOE contractor internal safety policies and procedures. Upon adoption, these subsidiary documents may be binding on ERP activities. INEL ERP activities implement the applicable requirements through documents such as project plans, the Health and Safety Plans, and detailed operating procedures. These implementing documents are discussed in the subsequent chapters of this BSAF.

2.2 OSHA Process Safety Management Program Regulations

Title 29, *Code of Federal Regulations* (CFR) 1910.119 (DOL, 1993a), specifies that a process safety management program must be implemented for activities that either use hazardous chemicals in excess of the threshold quantities listed in Appendix A of the regulation or use pressurized

flammables in excess of 10,000 pounds. Fuels consumed on the worksite; flammables stored or transferred at atmospheric conditions and below boiling point; oil and gas drilling facilities; and normally unoccupied remote facilities are exempted from process safety management requirements. DOE-STD-1027-92 (DOE, 1992) states that process safety management provisions also may apply if an assessment of chemical hazards shows the potential for significant offsite consequences, regardless of the type or quantity of chemical involved. The process safety management program emphasizes prevention of catastrophic releases of such materials and mitigation of consequences if such releases occur.

The process safety management program shall include provisions for worker participation and for review of information developed in accordance with program requisites. The required information will include chemical safety information, process technical descriptions and specifications, process hazard analyses, operating procedures (including steps for each operating phase, operating limits, safety and health considerations, and safety systems and functions), training programs, and pre-startup safety reviews.

The process safety management program shall include provisions to assure the continuing safety of critical process components. These program provisions include maintenance procedures, maintenance training, inspection and testing requirements, methods to document and correct deficiencies, and quality assurance.

The process safety management program shall contain provisions to prevent accidents during operation or to mitigate accidents should they occur. Provisions shall be made for hot work permitting, process change control, investigation of incidents, emergency planning and response, and compliance audits.

Table 2-3 presents the major elements of 29 CFR 1910.119 (DOL, 1993a) and appropriate cross-references to the BSAF chapter where the elements are discussed.

2.3 OSHA Safety and Health Program Regulations

Title 29 CFR 1910.120 (DOL, 1993b) specifies that certain hazardous waste management activities shall be covered by a safety and health program. This regulation is applicable to ERP activities at the INEL.

Title 29 CFR 1910.120(b) (DOL, 1993b) specifies the contents of safety and health programs. The program must include identification of safety and health hazards; evaluation of hazard magnitude; provisions for control of hazards; and plans for emergency response for hazardous waste operations. 29 CFR 1910.120(b)(4) (DOL, 1993b) requires development of a Health and Safety Plan. Table 2-4 lists the elements of a Health and Safety Plan and provides cross-references to the BSAF chapter where the elements are discussed.

The *INEL Federal Facility Agreement and Consent Order* (FFA/CO) (INEL, 1991) specifies that DOE must submit Health and Safety Plans to the United States Environmental Protection Agency (EPA) and the Idaho Department of Health and Welfare (IDHW) for environmental remediation activities specified in the FFA/CO. Comments from EPA and IDHW are incorporated into the final Health and Safety Plans. Unresolved Health and Safety Plan issues among the involved agencies are addressed through the dispute resolution provisions of the FFA/CO.

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TABLE 2-1. APPLICABLE FEDERAL AND STATE STATUTES AND REGULATIONS.

STATUTE/ REGULATION	TITLE	DESCRIPTION	APPLICABLE BSAF CHAPTER
10 CFR 820	Procedural Rules for DOE Nuclear Activities	Establishes rules for DOE contractor compliance with DOE nuclear safety requirements.	Chapter 12: Management, Organization, and Institutional Safety Provisions. Chapter 17: Operational Safety
10 CFR 830	Nuclear Safety Management	Establishes quality assurance requirements for nuclear facilities.	Chapter 18: Quality Assurance
10 CFR 835	Radiation Protection for Occupational Workers	Establishes personnel radiation protection requirements for DOE activities.	Chapter 9: Radiation Protection
29 CFR 1910, 1926	Occupational Safety and Health Administration (OSHA) Standards	Establishes worker safety provisions. All industrial and construction operations shall comply with the applicable OSHA requirements.	Chapter 6: Principal Health and Safety Criteria
40 CFR 191	Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High Level and Transuranic Wastes	Establishes dose standards for management and storage of subject wastes.	Chapter 7: Radioactive and Hazardous Material Waste Management
40 CFR 260	Hazardous Waste Management System: General	Provides general standards and overview information applicable to the Resource Conservation and Recovery Act (RCRA).	Chapter 7: Radioactive and Hazardous Material Waste Management
40 CFR 261	Identification and Listing of Hazardous Waste	Identifies solid wastes subject to regulation as hazardous wastes.	Chapter 7: Radioactive and Hazardous Material Waste Management
40 CFR 262	Standards Applicable to Generators of Hazardous Waste	Establishes standards for generators of hazardous waste including manifesting, recordkeeping, reporting, exporting, importing, and pre-transportation requirements.	Chapter 7: Radioactive and Hazardous Material Waste Management
40 CFR 263	Standards Applicable to Transporters of Hazardous Waste	Establishes standards applicable to persons transporting hazardous waste within United States if transportation requires manifest under 40 CFR Part 262. Regulations do not apply to onsite transportation of hazardous waste by owners or operators of permitted hazardous waste management facilities.	Chapter 7: Radioactive and Hazardous Material Waste Management
40 CFR 264	Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Establishes minimum national standards that define acceptable management of hazardous waste.	Chapter 7: Radioactive and Hazardous Material Waste Management

TABLE 2-1. APPLICABLE FEDERAL AND STATE STATUTES AND REGULATIONS (CONTINUED).

STATUTE/ REGULATION	TITLE	DESCRIPTION	APPLICABLE BSAF CHAPTER
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	Establishes minimum national standards that define acceptable management of hazardous waste during periods of interim status and until certification of final closure or, if facility is subject to postclosure requirements, until postclosure responsibilities are fulfilled.	Chapter 7: Radioactive and Hazardous Material Waste Management
40 CFR 268	Land Disposal Restriction	Identifies hazardous wastes restricted from land disposal and defines limited circumstances under which an otherwise prohibited waste may continue to be land disposed. Requirements apply to persons who generate or transport hazardous waste and owners and operators of hazardous waste treatment, storage, and disposal facilities.	Chapter 7: Radioactive and Hazardous Material Waste Management
40 CFR 280	Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks	Establishes requirements for underground storage tank remediation.	Chapter 21: Applicable Facility Design Codes and Standards
40 CFR 300	Oil and Hazardous Substances Pollution National Contingency Plan (NCP)	Establishes NCP guidelines to prepare for and respond to discharges of oil and hazardous substances.	Chapter 4: Facility Description and Operation Chapter 19: Emergency Preparedness
40 CFR 302	Designation, Reportable Quantities, and Notification	Identifies reportable quantities for substances designated under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980; sets forth notification requirements for releases of these substances.	Chapter 19: Emergency Preparedness
40 CFR 355	Emergency Planning and Notification	Establishes activity notification responsibilities.	Chapter 19: Emergency Preparedness
40 CFR 370, 372	Community Right-to-Know	Establishes disclosure requirements for hazardous material inventories and releases.	Chapter 10: Hazardous Material Protection
49 CFR 100-181	Department of Transportation (DOT) Hazardous Material Transportation Act Regulations	Regulates packaging and transportation of oil and hazardous materials.	Chapter 7: Radioactive and Hazardous Material Waste Management

TABLE 2-1. APPLICABLE FEDERAL AND STATE STATUTES AND REGULATIONS (CONTINUED).

STATUTE/ REGULATION	TITLE	DESCRIPTION	APPLICABLE BSAF CHAPTER
49 CFR 172	Hazardous Materials Tables, Special Provisions, Hazardous Material Communications Requirements, and Emergency Response Information Requirements	Classifies materials which DOT has designated as hazardous for purpose of transportation and prescribes requirements for shipping papers, package marking, labeling, and transport vehicle placarding applicable to shipment and transportation of those hazardous materials; includes requirements for emergency response and training.	Chapter 7: Radioactive and Hazardous Material Waste Management
IDAPA S16.01.1000 to 16.01.1999	Rules and Regulations for Control of Air Pollution in Idaho	Establishes rules and regulations as part of Federally-authorized program under Clean Air Act.	Chapter 7: Radioactive and Hazardous Material Waste Management
IDAPA S16.01.2050	Idaho State Administrative Policy on Protection of Waters of the State	Regulates protection of surface and groundwater.	Chapter 4: Facility Description and Operation
IDAPA S16.01.2600, 02 ET SEQ.	Idaho Water Quality Standards and Wastewater Treatment Requirements; Land Application of Wastewater or Recharge Waters	Establishes requirements for permits and monitoring for the land application of wastewater.	Chapter 7: Radioactive and Hazardous Material Waste Management
IDAPA S16.01.2800	Hazardous and Deleterious Material Storage	Establishes guidelines that dictate hazardous and deleterious materials must not be stored, disposed, or accumulated adjacent to (in immediate vicinity of) state waters unless adequate measures and controls are provided to ensure materials do not enter state waters as a result of high water, precipitation, runoff, wind, storage facility failure, accidents and operation, or unauthorized third party activities.	Chapter 7: Radioactive and Hazardous Material Waste Management
IDAPA S16.01.5004	Idaho State Hazardous Waste Management System	Provides definition of terms, general standards, and overview information.	Chapter 7: Radioactive and Hazardous Material Waste Management
IDAPA S16.01.5005	Idaho State Identification and Listing of Hazardous Waste	Identifies solid wastes subject to regulation as hazardous.	Chapter 7: Radioactive and Hazardous Material Waste Management
IDAPA S16.01.5006	Idaho State Standards Applicable to Generators of Hazardous Waste	Establishes standards for generators of hazardous wastes.	Chapter 7: Radioactive and Hazardous Material Waste Management
IDAPA S16.01.5009	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities	40 CFR 265 and all subparts, with the exception of Subpart R and 40 CFR Parts 265.149 and 265.150, are incorporated by reference.	Chapter 7: Radioactive and Hazardous Material Waste Management

TABLE 2-1. APPLICABLE FEDERAL AND STATE STATUTES AND REGULATIONS (CONCLUDED).

STATUTE/ REGULATION	TITLE	DESCRIPTION	APPLICABLE BSAF CHAPTER
IDAPA S16.01.5011	Idaho State Land Disposal Restrictions	Identifies hazardous wastes restricted from land disposal.	Chapter 7: Radioactive and Hazardous Material Waste Management
FFA/CO for INEL	Federal Facility Agreement (FFA) and Consent Order (CO)	Agreement between State of Idaho, Department of Health and Welfare, the EPA Region 10, and DOE-Idaho Operations Office, addressing investigations and cleanup of releases at INEL.	Chapter 4: Facility Description and Operation

TABLE 2-2. APPLICABLE DOE DIRECTIVES.

DIRECTIVE	TITLE	DESCRIPTION	APPLICABLE BSAF SECTION
DOE 1324.2A	Records Disposition	Assigns responsibilities and prescribes policies, procedures, standards, and guidelines for orderly disposition of records of DOE and of operating contractors.	Chapter 18: Quality Assurance
DOE 4330.4B	Maintenance Management Program	Provides general policy/objectives for establishment of programs for management and performance of cost-effective maintenance and repair of DOE facilities.	Chapter 15: Initial Testing, Inservice Surveillance, and Maintenance
DOE 5000.3B ID 5000.3B	Occurrence Reporting and Processing of Operations Information	Establishes reporting of unusual occurrences with programmatic significance for DOE operation.	Chapter 12: Management, Organization, and Institutional Safety Provisions Chapter 19: Emergency Preparedness
DOE 5400.5	Radiation Protection of the Public and the Environment	Establishes standards and requirements for DOE and contractor operations related to protection of members of public and environment against undue risk from radiation.	Chapter 6: Principal Health and Safety Criteria Chapter 9: Radiation Protection
DOE 5480.1B ID 5480.1B	Environment, Safety, and Health (ES&H) Program for DOE Operations	Establishes ES&H Program for DOE operations.	Chapter 17: Operational Safety
DOE 5480.3 ID 5480.3	Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes	Establishes hazardous material packaging and transportation requirements.	Chapter 7: Radioactive and Hazardous Material Waste Management
DOE 5480.4 ID 5480.4A	Environmental Protection, Safety, and Health Protection Standards	Specifies environmental protection, safety, and health standards broadly applicable to DOE and contractors, with partial applicability to environmental remediation and decontamination and decommissioning (D&D).	Chapter 6: Principal Health and Safety Criteria
DOE 5480.5 ID 5480.5A	Safety of Nuclear Facilities	Establishes nuclear facility safety program requirements.	Chapter 17: Operational Safety
DOE N 5480.6 ID 5480.6A	Radiological Control Manual	Implements DOE Radiological Control Manual.	Chapter 9: Radiation Protection
DOE 5480.7A ID 5480.7A	Fire Protection	Establishes requirements for "improved risk" level of fire protection sufficient to attain DOE objectives.	Chapter 6: Principal Health and Safety Criteria Chapter 17: Operational Safety
DOE 5480.8A ID 5480.8	Contractor Occupational Medical Program	Establishes minimal Occupational Medical Program requirements for the DOE.	Chapter 10: Hazardous Material Protection

TABLE 2-2. APPLICABLE DOE DIRECTIVES (CONTINUED).

DIRECTIVE	TITLE	DESCRIPTION	APPLICABLE BSAF SECTION
DOE 5480.9 ID 5480.9	Construction Safety and Health	Protection of workers, public, and property during construction.	Chapter 10: Hazardous Material Protection
DOE 5480.10 ID 5480.10	Contractor Industrial Hygiene Program	Establishes requirements and guidelines applicable to DOE contractor operations for maintaining an effective industrial hygiene program.	Chapter 6: Principal Health and Safety Criteria Chapter 10: Hazardous Material Protection
DOE 5480.18A	Accreditation of Performance-Based Training for Category A Reactors and Nuclear Facilities	Establishes performance-based training process for DOE reactor and non-reactor nuclear facilities.	Chapter 13: Procedures and Training
DOE 5480.19	Conduct of Operations Requirements for DOE Facilities	Provides requirements and guidelines for developing directives, plans, and/or procedures relating to conduct of operations at DOE facilities.	Chapter 17: Operational Safety
DOE 5480.20	Personnel Selection, Qualification, Training, and Staffing Requirements at DOE Reactor and Non-Reactor Nuclear Facilities	Establishes selection, qualification, training, and staffing requirements for personnel involved in operation, maintenance, and technical support of DOE-owned, non-reactor nuclear facilities.	Chapter 12: Management, Organization, and Institutional Safety Provisions Chapter 13: Procedures and Training
DOE 5480.21 ID 5480.21	Unreviewed Safety Questions	Requires review of conditions potentially outside of facility safety bases and TSR.	Chapter 12: Management, Organization, and Institutional Safety Provisions
DOE 5480.22 ID 5480.22	Technical Safety Requirements (TSRs)	Establishes requirements for preparation of TSRs for DOE nuclear facilities and delineation of criteria, content, scope, format, approval process, revision, and reporting requirements of TSR documents.	Chapter 16: Derivation of Technical Safety Requirements
DOE 5480.23 ID 5480.23	Nuclear Safety Analysis Reports	Establishes requirements for contractors responsible for design, construction, operation, and D&D of nuclear facilities to develop safety analyses that establish and evaluate adequacy of safety bases of facilities. The nuclear Safety Analysis Report (SAR) required by this Order documents results of safety analyses.	Chapter 1: Executive Summary
DOE 5480.28	Natural Phenomena Hazards Mitigation	Establishes performance criteria and evaluation methods for natural phenomena hazards.	Chapter 6: Principal Health and Safety Criteria Chapter 21: Applicable Facility Design Codes/Standards

TABLE 2-2. APPLICABLE DOE DIRECTIVES (CONTINUED).

DIRECTIVE	TITLE	DESCRIPTION	APPLICABLE BSAF SECTION
DOE 5480.31	Startup and Restart of Nuclear Facilities	Establishes requirements for safe conduct of startup and restart of nuclear facilities.	Chapter 15: Initial Testing, Inservice Surveillance, and Maintenance
DOE 5481.1B ID 5481.1B	Safety Analysis and Review System	Provides uniform requirements for preparation and review of non-nuclear safety analyses for DOE operations.	Chapter 1: Executive Summary
DOE 5482.1B ID 5482.1B	Environment, Safety, and Health Appraisal Program	Establishes ES&H Appraisal Program for DOE.	Chapter 12: Management, Organization, and Institutional Safety Provisions
DOE 5484.1 ID 5484.1B	Environmental Protection, Safety, and Health Protection Information Reporting Requirements	Establishes requirements and procedures for reporting information of ES&H significance for DOE operations.	Chapter 6: Principal Health and Safety Criteria Chapter 9: Radiation Protection Chapter 10: Hazardous Material Protection
DOE 5500.1B	Emergency Management System	Establishes overall policy and requirements for DOE Emergency Management System (EMS). EMS provides framework for development, coordination, and direction of planning, preparedness, and readiness assurance activities.	Chapter 19: Emergency Preparedness
DOE 5500.2B	Emergency Categories, Classes, and Notification and Reporting Requirements	Establishes DOE emergency categories, classes, and notification and reporting requirements to facilitate communication and reporting of emergency events.	Chapter 19: Emergency Preparedness
DOE 5500.3A	Planning and Preparedness for Operational Emergencies	Establishes requirements for planning and preparedness for operational emergencies involving DOE or requiring DOE assistance.	Chapter 19: Emergency Preparedness
DOE 5500.4A ID 5500.4A	Public Affairs Policy and Planning Requirements for Emergencies	Establishes requirements for DOE public affairs actions for emergency situations; provides guidelines to develop public information plan to ensure necessary public affairs actions are planned, coordinated, and taken as integral part of total emergency response effort.	Chapter 19: Emergency Preparedness
DOE 5500.10	Emergency Readiness Assurance Program	Establishes requirements for assuring continued readiness of Emergency Management System for response to an emergency.	Chapter 19: Emergency Preparedness
DOE 5700.6C ID 5700.6E	Quality Assurance	Establishes quality assurance requirements for DOE.	Chapter 18: Quality Assurance

TABLE 2-2. APPLICABLE DOE DIRECTIVES (CONCLUDED).

DIRECTIVE	TITLE	DESCRIPTION	APPLICABLE BSAF SECTION
DOE 5820.2A	Radioactive Waste Management	Establishes requirements for DOE management of D&D radioactive and mixed waste, including ERP/D&D.	Chapter 4: Facility Description and Operation Chapter 7: Radioactive and Hazardous Material Waste Management
DOE 6430.1A	General Design Criteria	Provides general design criteria and establishes responsibilities and authorities for development and maintenance of criteria.	Chapter 6: Principal Health and Safety Criteria Chapter 21: Applicable Facility Design Codes and Standards
DOE-ID	DOE-ID Architectural Engineering Standards Manual	Establishes criteria for architectural engineering activities at INEL.	Chapter 6: Principal Health and Safety Criteria Chapter 21: Applicable Facility Design Codes and Standards
DOE-ID 10074	INEL Transuranic Waste Acceptance Criteria	Establishes criteria for disposal of transuranic waste at the INEL.	Chapter 7: Radioactive and Hazardous Waste Management
DOE-ID 10112	INEL Low-Level Radioactive Waste Acceptance Criteria	Establishes criteria for disposal of low-level radioactive waste at Radioactive Waste Management Complex (RWMC) and governs acceptance of low-level radioactive waste for processing at Waste Experimental Reduction Facility (WERF).	Chapter 7: Radioactive and Hazardous Material Waste Management
DOE-ID 12044	DOE-ID Operational Safety Design Criteria Manual	Establishes operation design criteria for INEL projects.	Chapter 21: Facility Design Codes and Standards

TABLE 2-3. OSHA PROCESS SAFETY MANAGEMENT PROGRAM REGULATIONS (DOL, 1993a).

REFERENCE	TITLE	DESCRIPTION	APPLICABLE BSAF CHAPTERS
29 CFR 1910.119(a)	Application	Explains types and quantities of materials and processes when program is required.	Chapter 5
20 CFR 1910.119(c)	Employee Participation	Requires plans for employee involvement in process safety management program.	Chapter 10
29 CFR 1910.119(d)	Process Safety Information	Requires compilation of significant properties of hazardous materials in process, design parameters of process, and equipment therein.	Chapters 4, 5
29 CFR 1910.119(e)	Process Hazard Analysis	Requires analysis of process hazards using approved method; identification of incidents involving process; hazard controls; consequences of failures; siting; and human factors.	Chapters 5, 11, 14
29 CFR 1910.119(f)	Operating Procedures	Requires operating procedures with instructions for safely operating the process.	Chapter 13
29 CFR 1910.119(i)	Pre-Startup Safety Review	Requires confirmation that construction and equipment are in accordance with design specifications; review of adequacy of procedures; confirmation of implementation of hazards analysis recommendations; verification of training.	Chapters 15
29 CFR 1910.119(j)	Mechanical Integrity	Requires provision for maintenance of integrity of process system.	Chapters 15
29 CFR 1910.119(k)	Training	Requires initial training, refresher training, training documentation.	Chapter 13
29 CFR 1910.119(l)	Management of Change	Requires documented procedure for safety review of changes other than replacements-in-kind.	Chapters 12, 17
29 CFR 1910.119(m)	Incident Investigation	Requires investigation of releases or potential releases of hazardous materials.	Chapters 12, 17
29 CFR 1910.119(n)	Emergency Planning and Response	Requires emergency action plan in accordance with 29 CFR 1910.38, including plans for small releases.	Chapter 19
29 CFR 1910.119(o)	Compliance Audits	Requires triennial audits of compliance with process safety management standards.	Chapter 18

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TABLE 2-4. OSHA HEALTH AND SAFETY PLAN PROGRAM REGULATIONS (DOL, 1993b).

REFERENCE	TITLE	DESCRIPTION	APPLICABLE BSAF CHAPTER
29 CFR 1910.120(b)(4)(ii)(A)	Element A	Requires hazard/risk analysis for all operations in workplan.	5, 11
29 CFR 1910.120(b)(4)(ii)(B)	Element B	Requires employee training consistent with 29 CFR 1910.120(e).	13
29 CFR 1910.120(b)(4)(ii)(C)	Element C	Requires provisions for personal protective equipment per 29 CFR 1910.120(g).	9, 10
29 CFR 1910.120(b)(4)(ii)(D)	Element D	Requires provisions for medical surveillance per 29 CFR 1910.120(f).	9, 10
29 CFR 1910.120(b)(4)(ii)(E)	Element E	Requires description of workplace and environmental monitoring program, including maintenance and calibration.	9, 10
29 CFR 1910.120(b)(4)(ii)(F)	Element F	Requires provisions for site control per 29 CFR 1910.120(d).	9, 10, 17
29 CFR 1910.120(b)(4)(ii)(G)	Element G	Requires provisions for decontamination per 29 CFR 1910.120(g).	9, 10, 20
29 CFR 1910.120(b)(4)(ii)(H)	Element H	Requires emergency response plan per 29 CFR 1910.120(l).	19
29 CFR 1910.120(b)(4)(ii)(I)	Element I	Requires description of confined space entry procedures.	10
29 CFR 1910.120(b)(4)(ii)(J)	Element J	Requires provisions for spill containment program per 29 CFR 1910.120(j).	19
29 CFR 1910.120(b)(4)(iii)	Pre-Entry Briefing	Requires briefing of workers immediately prior to site activity to assure safety and health plan provisions are followed. Provides for updating of plan.	13
29 CFR 1910.120(b)(4)(iv)	Effectiveness of the Site Safety and Health Plan	Requires inspections by safety and health supervisor to determine effectiveness of the plan and remedy deficiencies.	12, 17

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2.0 REFERENCES

Department of Energy (DOE, 1992), *Hazard Characterization and Accident Analysis Techniques for Compliance with DOE 5480.23, Nuclear Safety Analysis Reports*, DOE, Washington, D.C., DOE-STD-1027-92.

Department of Labor (DOL, 1993a), *Process Safety Management of Highly Hazardous Chemicals*, United States Government Printing Office, Washington, D.C., 29 CFR 1910.119.

Department of Labor (DOL, 1993b), *Hazardous Waste Operations and Emergency Response*, United States Government Printing Office, Washington, D.C., 29 CFR 1910.120.

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CHAPTER 3.0

SITE CHARACTERISTICS

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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3.0 SITE CHARACTERISTICS

The Idaho National Engineering Laboratory (INEL) was established in 1949 as the National Reactor Testing Station (NRTS) on land formerly used as a United States Navy weapons proving ground. The NRTS was named a national laboratory by congressional action in 1974, at which time the name was changed to the Idaho National Engineering Laboratory (WINCO, 1993). The INEL's original mission was to build, test, and operate various nuclear reactors and associated facilities. The isolated location assured maximum public safety in the then unfamiliar field of nuclear research. Today, the INEL is a United States Department of Energy (DOE) multi-program laboratory; its primary mission is to provide the nation with innovations in nuclear technologies and unique scientific and engineering capabilities in nonnuclear programs that provide commercialization potential or enhance the quality of the environment.

The INEL occupies about 890 square miles in Southeastern Idaho (Figure 3-1). The site is 132 miles southwest of Yellowstone National Park; 234 miles north of Salt Lake City, Utah; and 198 miles east of Boise, Idaho. The eastern boundary is 29 miles west of Idaho Falls, Idaho. The INEL is on a high desert plain with an elevation of approximately 5,000 feet above sea level. The site is irregularly shaped, with its longest dimension measuring 39 miles north-to-south and 36 miles east-to-west and encompasses portions of five Idaho counties: Bingham, Bonneville, Butte, Clark, and Jefferson (Figure 3-2). The INEL site boundary is the effective exclusion boundary and all activities within are controlled by DOE. Although public roads do traverse the site, arrangements in effect close roads and control access during emergencies.

This chapter was developed with existing information from current Safety Analysis Reports (SARs), site plans, INEL environmental documents, and technical literature. Additional information for sections in this chapter can be found in the referenced materials used to develop the section.

3.1 Site Location and Description

As shown in Figure 3-2, the INEL has the following nine major facility areas: Test Area North (TAN); Test Reactor Area (TRA); Idaho Chemical Processing Plant (ICPP); Central Facilities Area (CFA); Power Burst Facility/Auxiliary Reactor Area (PBF/ARA); Experimental Breeder Reactor-I/ Boiling Water Reactor Experiment (EBR-I/BORAX); Radioactive Waste Management Complex (RWMC); Argonne National Laboratory-West (ANL-W); and Naval Reactors Facility (NRF). To focus environmental restoration efforts, each of these facilities is designated as a Waste Area Group (WAG). The tenth WAG includes the groundwater system underlying the INEL and the dispersed minor facilities and areas that represent actual and potential contaminant release sites not included in the other nine WAGs (EG&G, 1993).

All WAGs are included in the INEL Environmental Restoration Program (ERP) with the exception of the NRF (WAG-8) and ANL-W (WAG-9). In addition, underground storage tanks (USTs) and decontamination and decommissioning (D&D) activities are part of the ERP. The following is a brief description of each WAG included in the ERP and facilities scheduled for D&D. More comprehensive information is provided in Chapter 4.

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Figure 3-1

Figure 3-1. Location Map for Idaho National Engineering Laboratory.

Figure 3-2. Idaho National Engineering Laboratory Site.

3.1.1 Test Area North (TAN) - Waste Area Group (WAG)-1

TAN is located in the north-central portion of the INEL, near the west boundary of Jefferson County, along State Highway 33. TAN was originally established to house a project to develop nuclear-powered aircraft (Aircraft Nuclear Propulsion Project) which was operated from 1951 to 1961. The area later was used in reactor accident testing (Loss-of-Fluid Test [LOFT] Facility). Currently, TAN facilities are used to handle and evaluate irradiated material; to support energy research and defense programs; and to perform flow tests to support reactor safety studies.

TAN (WAG-1) is about 2,121 acres in size. The facility area encompasses the following four subareas: the Initial Engine Test (IET) Facility; the Technical Support Facility (TSF); the Water Reactor Research Test Facility (WRRTF); and the Containment Test Facility (CTF). TAN (WAG-1) is approximately 6.1 miles from the northwestern INEL boundary.

3.1.2 Test Reactor Area (TRA) - Waste Area Group (WAG)-2

The TRA is located in the southern portion of the INEL in Butte County west of the ICPP and north of the CFA. TRA (WAG-2) is about 747 acres in size. TRA (WAG-2) is approximately 6.6 miles from the northwestern INEL boundary.

TRA houses extensive facilities for studying effects of radiation on materials and fuels. When the area was established in the early 1950s, three reactors were built: the Materials Test Reactor (shut down in 1970); the Engineering Test Reactor (completed in 1957 and inactive since 1981); and the Advanced Test Reactor (completed in 1965 and operated since 1967). The Materials Test Reactor and the Engineering Test Reactor are identified for D&D. The Advanced Test Reactor is used for materials testing under reactor conditions and for producing radioisotopes used in medicine, research, and industry. Numerous laboratory facilities dedicated to chemical science and physics programs are located at the TRA. For research and testing, a hot cell operation is maintained in support of these and other facilities.

3.1.3 Idaho Chemical Processing Plant (ICPP) - Waste Area Group (WAG)-3

The ICPP is located in the south-central portion of the INEL in Butte County between TRA (WAG-2) and PBF/ARA (WAG-5), and just south of the Big Lost River. The ICPP (WAG-3) is about 510 acres in size. ICPP (WAG-3) is approximately 8.5 miles from the southern INEL boundary.

The ICPP was a one-of-a-kind facility built in the early 1950s for reprocessing government-owned nuclear fuels from research and defense (primarily Naval) reactors. The ICPP recovered uranium from the spent nuclear fuels for reuse. The ICPP mission now includes the following:

- Developing advanced technologies to process spent nuclear fuel for permanent offsite disposition and to achieve waste minimization
- Receiving, storing, and processing Navy and other DOE-spent nuclear fuels.

3.1.4 Central Facilities Area (CFA) - Waste Area Group (WAG)-4

The CFA is located in the south central region of the INEL, south of the ICPP, near United States Highways 20 and 26 in Butte County. CFA (WAG-4) is about 1,372 acres in size and is approximately 5.6 miles from the southern INEL boundary. The original facilities at CFA were built in the 1940s and 1950s. Many technical and support services for the entire site are provided from CFA including solid waste disposal, environmental monitoring and calibration laboratories, communication systems, security, fire protection, medical services, warehouse, cafeteria, vehicle and equipment pools, and bus operations. Waste operations facilities include the Hazardous Waste Storage Facility and the Solid Waste Landfill. The Hazardous Waste Storage Facility temporarily houses hazardous wastes pending shipment to a commercial, offsite, United States Environmental Protection Agency (EPA)-permitted disposal site.

3.1.5 Power Burst Facility (PBF)/Auxiliary Reactor Area (ARA) - Waste Area Group (WAG)-5

The PBF/ARA is located in the south portion of the INEL in Butte and Bingham Counties. PBF/ARA (WAG-5) is about 1,388 acres in size. PBF/ARA (WAG-5) is approximately 6.4 miles from the southern INEL boundary.

Originally, the PBF area was built for Special Power Excursion Reactor Tests (SPERT) which began in the late 1950s and concluded in 1970. Following the end of SPERT, PBF operations were initiated in 1972. For approximately 10 years, PBF served as the severe-damage testing facility for nuclear fuels and materials used in commercial reactors. The reactor support facilities were converted to waste management-related uses, including the development of radioactive waste volume reduction techniques and waste immobilization research. One former reactor building houses the Waste Experimental Reduction Facility (WERF), where low-level waste and mixed waste are treated for volume reduction and removal of hazardous components. Other facilities in the area include the Mixed Waste Storage Facility, WERF Waste Storage Building, and the Waste Engineering Development Facility.

The ARA was constructed in 1957 to conduct tests of portable power reactors for the United States Army. The program was discontinued and all reactors were removed and dismantled. ARA I (hot cell), ARA II (site of the stationary Low Power Reactor No. 1 [SL-1] accident in 1961), and ARA III (reactor test pit) are identified for D&D. ARA IV presently is used to perform explosive-initiated, powered-metal, manufacturing experiments.

3.1.6 Experimental Breeder Reactor-I (EBR-I)/Boiling Water Reactor Experiment (BORAX) - Waste Area Group (WAG)-6

The EBR-I and BORAX compose WAG-6. WAG-6 is located south of United States Highway 20 in Butte County. It is about 36 acres in size. EBR-I/BORAX (WAG-6) is approximately 4.5 miles from the southern INEL boundary.

EBR-I was the first reactor in the world to generate usable amounts of electricity in 1961. Today, this site is a National Historic Landmark, usually open to the general public daily from Memorial Day through Labor Day each year.

BORAX is near EBR-I. This area originally included five separate experimental reactors that operated between 1953 and 1964. The facilities were not used after 1964. D&D is completed or scheduled for BORAX facilities.

3.1.7 Radioactive Waste Management Complex (RWMC) - Waste Area Group (WAG)-7

The RWMC is located at the far southwest corner of the INEL, southwest of WAG-6 (EBR-I/BORAX) and east of the Big Lost River. RWMC (WAG-7) is about 815 acres in size and is approximately 3.5 miles from the southern INEL boundary.

Various strategies for waste storage, processing, and disposal are investigated at the RWMC. The complex was established in 1952 as a controlled area for the disposal of solid radioactive wastes generated at the INEL. The area was used to store defense wastes after 1970. Currently, the facility provides for interim storage of transuranic (TRU) waste and disposal of low-level radioactive waste. RWMC supports research and development projects to improve treatment and TRU waste interim storage; low-level radioactive waste disposal; buried waste remediation technologies; and environmental restoration.

There are two main operating areas within the complex: the TRU waste storage area and the subsurface disposal area. In the storage area, TRU waste is managed, including interim storage operations, certification, technology development, and preparation for future shipment to the Waste Isolation Pilot Plant (WIPP) in New Mexico. A new engineered storage area that meets Resource Conservation and Recovery Act (RCRA) requirements is under construction for waste stored on two asphalt pads currently covered by air-support structures. The subsurface disposal area is dedicated to permanent disposal of low-level radioactive waste generated at the INEL. Related research and development projects support buried waste, remediation technologies, and contaminant migration studies.

3.1.8 Waste Area Group 10 (WAG-10)

The Snake River Plain Aquifer (SRPA) and five OUs representing a variety of small sites and facilities not encompassed in other WAGs are identified collectively as WAG-10 (EG&G, 1993). Facilities identified as part of WAG-10 include the Liquid Corrosive Chemical Disposal Area (LCCDA); Old Disposal Pit; LCCDA Limestone Treatment and Disposal Pit; Organic Moderated Reactor Experiment Leach Pond; and a former bombing range. The majority of the sites are centrally located on the INEL site with the bombing range representing approximately 30% of the INEL surface area. WAG-10 is about 170,880 acres in size.

3.1.9 Facilities Scheduled for Decontamination and Decommissioning (D&D)

The INEL ERP includes the D&D of surplus radioactively contaminated facilities. The facilities currently scheduled for D&D are listed in Table 3-1 (EG&G, 1993).

TABLE 3-1. INEL FACILITIES SCHEDULED FOR DECONTAMINATION AND DECOMMISSIONING (D&D).

LOCATION	FACILITY
Test Area North (TAN)	Loss-of-Fluid Test Facility (LOFT) Ancillaries
	Decontamination Shop (TAN-607)
	Technical Support Facility
Test Reactor Area (TRA)	Engineering Test Reactor
	Materials Test Reactor
	Test Train Assembly
Army Re-entry Vehicle Facility Site (ARVFS)	Army Re-entry Vehicle Facility Site
Idaho Chemical Processing Plant (ICPP)	Radioactive Lanthanum Recovery System (CPP-631)
	Fuel Receiving and Storage Facility (CPP-603)
	Headend Processing Plant (CPP-640)
	Waste Calcining Facility (CPP-633)
	East Side Service Waste Monitoring Station (CPP-709)
	Uranium Separation Plant (CPP-601)
	High Level Waste Tank Farm
	West Side Service Waste Monitoring Station (CPP-734)
	Horizontal Settling Basin (CPP-740)
Central Facilities Area (CFA)	Hot Waste Tank (SFE-20)
	Hot Laundry (CFA-669)
Power Burst Facility/Auxiliary Reactor Area (ARA)	ARA I, II, III
Experimental Breeder Reactor-I/ Boiling Water Reactor Experiment (BORAX)	BORAX-V

3.2 Demography

3.2.1 Offsite

All or part of 16 counties are within 50 miles of a border of the INEL. This 16-county region has a low population density and includes 15 Idaho counties and one Montana county (Figure 3-3). The total 1990 population for the region was 240,098 (Bureau of the Census, 1992). Nearly 63% of the population in the 16-county region in 1990 resided in the two most populous counties, Bonneville and Bannock (Table 3-2). Only six cities in the 16-county region had more than 5,000 residents in 1990. As of 1993, the largest cities

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Figure 3-3

Figure 3-3. Incorporated Cities Within 50 Miles of the INEL.

were Idaho Falls (located in Bonneville County) with nearly 47,300 residents and Pocatello (located in Bannock County) with just over 46,117 residents (Holland, Personal Communication, 1994) (Table 3-2).

TABLE 3-2. POPULATION CENTERS WITHIN 50 MILES OF THE INEL BOUNDARY FROM 1990 CENSUS.

COUNTY	PLACE	POPULATION
Bannock, ID	Total	<u>60,387</u>
	Chubbuck	7,791
	Fort Hall	1,370
	Inkom	769
	Pocatello	46,117 ¹
Beaverhead, MT	Total	<u>490¹</u>
	Dell	N/A
	Lima	257 ¹
	Monida	N/A
Bingham, ID	Total	<u>37,583</u>
	Aberdeen	1,406
	Atomic City	25
	Basalt	407
	Blackfoot	9,646
	Firth	429
	Fort Hall	1,311
	Moreland	8,141
	Pingree	N/A
	Riverside	N/A
	Shelley	3,536
	Springfield	N/A
	Sterling	N/A
	Tabor	N/A
Blaine, ID	Total	<u>765</u>
Bonneville, ID	Total	<u>73,631</u>
	Ammon	5,002
	Bone	N/A
	Idaho Falls	47,300 ¹
	Iona	1,049
	Lincoln	N/A
	Ucon	895
Butte, ID	Total	<u>2,918</u>
	Arco	1,016
	Butte City	59
	Darlington	N/A
	Howe	N/A
	Moore	190

TABLE 3-2. POPULATION CENTERS WITHIN 50 MILES OF THE INEL
BOUNDARY FROM 1990 CENSUS (CONTINUED).

COUNTY	PLACE	POPULATION
Caribou, ID	Total	1N/A ²
Clark, ID	Total	<u>762</u>
	Dubois	420
	Humphrey	N/A
	Small	N/A
	Spencer	11
Custer, ID	Total	<u>2,590</u>
	Leslie	N/A
	Lost River	29
	Mackay	574
Fremont, ID	Total	<u>10,118</u>
	Ashton	1,114
	Chester	N/A
	Newdale	377
	Parker	288
	St. Anthony	3,010
	Teton	570
Jefferson, ID	Total	<u>16,543</u>
	Hamer	79
	Heise	N/A
	Lewisville	471
	Menan	601
	Montevieu	N/A
	Mud Lake	179
	Rigby	2,681
	Ririe	596
	Roberts	557
	Terreton	N/A
Lemhi, ID	Total	<u>981</u>
	Leadore	74
	Patterson	N/A
Lincoln, ID	Total	<u>989</u>
	Richfield	383
Madison, ID	Total	<u>23,674</u>
	Archer	N/A
	Hibbard	N/A
	Lorenzo	N/A
	Rexburg	14,302
	Sugar City	1,275
	Thornton	N/A
Minidoka, ID	Total	<u>1,379</u>
	Minidoka	67

TABLE 3-2. POPULATION CENTERS WITHIN 50 MILES OF THE INEL BOUNDARY FROM 1990 CENSUS (CONCLUDED).

COUNTY	PLACE	POPULATION
Power, ID	Total	<u>6,893</u>
	American Falls	3,757
	Rockland	595
Total		<u>240,098</u>

N/A = Population estimate not available

¹1993 Estimates

²Area within the 50-mile radius is unpopulated

NOTE: The Census Bureau defines a census designated place (CDP) or an incorporated place. CDPs comprise densely settled concentrations of population identifiable by name, but not legally incorporated. State and local census statistical committees identified and delineated boundaries for CDPs. Other small population concentrations with identified map names located within 50 miles from the INEL boundary, may exist but not be recognizable as a place by the Census Bureau. These areas are included in total county population only. Total county population is noted, but only portions of some counties fall within a 50-mile radius from the INEL boundary.

These two cities represent approximately 45% of the regional population. Incorporated cities within 50 miles of the INEL are shown on Figure 3-3. Population distribution within 50 miles of each WAG is indicated on Figures 3-4 through 3-9.

3.2.2 Onsite

The size of the work force at the INEL varies with current activities, but is stable between 10,400 to 12,400 employees. The total INEL work force is expected to decrease by about 1,000 workers over the next 10 years. The current breakdown of the staff employed at each facility area included in the INEL ERP is identified in Table 3-3.

TABLE 3-3. NUMBER OF EMPLOYEES LOCATED AT EACH INEL FACILITY AREA.

FACILITY AREA	NUMBER OF EMPLOYEES
TAN	550
TRA	681
ICPP	1,794
CFA	1,319
PBF/ARA	167
EBR-I/BORAX	0
RWMC	156

POPULATION WITHIN 50 MILES OF TAN

TOTAL POPULATION = 145,752

Figure 3-4. Population Within 50 Miles of TAN (WAG-1).

POPULATION WITHIN 50 MILES OF TRA

TOTAL POPULATION = 104,167

Figure 3-5. Population Within 50 Miles of TRA (WAG-2).

POPULATION WITHIN 50 MILES OF ICPP

TOTAL POPULATION = 120,003

Figure 3-6. Population Within 50 Miles of ICPP (WAG-3).

TOTAL POPULATION = 132,398

POPULATION WITHIN 50 MILES OF PBF/ARA

TOTAL POPULATION = 151,205

Figure 3-8. Population Within 50 Miles of PBF/ARA (WAG-5).

POPULATION WITHIN 50 MILES OF RWMC

TOTAL POPULATION = 74,620

Figure 3-9. Population Within 50 Miles of EBR-I/BORAX and RWMC (WAGs 6, 7).

3.3 Regional and Local Land Use

The dominant land uses in the area surrounding the INEL are agricultural and open land, each type accounting for 45% of the area with the remaining 10% occupied by urban/built land (EG&G, 1990). On the INEL site, only about 2% or 11,400 acres are used for facilities and operations.

3.3.1 Urban/Suburban

Regional

The region adjacent to the INEL boundary is primarily public or private land for agricultural use and ranching. Therefore, population densities are low and urban and suburban land uses are spatially distant.

3.3.2 Agriculture, Ranching, and Forestry

Regional

In the seven-county area surrounding the INEL, there are 1,100,000 acres of cropland in use each year. Additionally, this area produces annually about 115,000 head of livestock, mostly beef cattle (EG&G, 1990).

Local

A significant portion of the INEL is grazed by permit. However, grazing is not permitted within 2 miles of any nuclear facility, and dairy cattle are not permitted. The number of acres of the INEL land used for grazing usually varies between 300,000 and 350,000 acres (Berain, 1992). These grazing areas are shown on Figure 3-10.

The United States Sheep Experiment Station, located northeast of the INEL site, uses 900 acres of the INEL for a winter feed lot for approximately 6,500 breeding sheep. The Mud Lake feed lot located at the junction of Idaho Highways 28 and 33, is used primarily between mid-October and mid-May, although the facilities are maintained year round. The feed lot and other grazing areas are shown in Figure 3-10.

3.3.3 Natural Resources

Regional

The INEL is bordered on the north and west by the Bitterroot, Lemhi, and Lost River mountain ranges and on the south by the Big Southern, Middle, and East Buttes. Significant portions of these largely federally-owned lands are used for recreational purposes: hunting, fishing, boating, hiking, cross-county skiing, and camping. Specific recreational and tourism sites are nearby at the Craters of the Moon National Monument, Hell's Half Acre, Camas National Wildlife Refuge, Market Lake State Wildlife Management Area, and the Birch Creek Camping Area. In addition, there are two National Forests, Challis and Targhee, within 50 miles of the north and west INEL boundaries, respectively.

LEGEND	
	BLM or Private Land
	Grazing Area
	State Land
ANL-W	- Argonne National Laboratory-West
ARA	- Auxiliary Reactor Area
BORAX	- Boiling Water Reactor Experiment
CFA	- Central Facilities Area
EBR-I	- Experimental Breeder Reactor - I
ICPP	- Idaho Chemical Processing Plant
NRF	- Naval Reactors Facility
PBF	- Power Burst Facility
RWMC	- Radioactive Waste Management Complex
TAN	- Test Area North
TRA	- Test Reactor Area
WERF	- Waste Experimental Reduction Facility
Map Not Drawn to Scale	

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Figure 3-10

Figure 3-10. Grazing Permit Areas Within the INEL (WINCO, 1993).

Local

Public tours are conducted at the INEL. Tours are held throughout the year for the general public and special interest groups. Most general facility areas are visited; however, some facilities such as EBR-I currently are closed to the public.

Controlled hunts conducted by the Idaho Fish and Game Department (IFGD) have been permitted on the INEL (DOE, 1989). In 1992, pronghorn hunting was permitted to within 0.5 miles of the INEL boundaries (Naderman, 1992).

3.3.4 Transportation, Utilities, and Services

Transportation

The INEL and commercial transportation systems include road and highway systems; railroad systems; and airports. Approximately 5% of INEL land, about 28,450 acres, is devoted to public road and utility right-of-ways crossing the site.

The INEL site has 87 miles of paved roads within its boundaries; about 18 miles are considered service roads. Road use is restricted to employees and visitors on official business. An additional 90 miles of paved highway runs through the INEL and is used by the general public: United States Highways 20 and 26 cross the southern portion and Idaho State Highways 22, 28, and 33 cross the northern portion of the site. Figure 3-11 illustrates the network of highways and roads on the INEL site. Over 100 miles of unpaved roads and trails provide additional access for emergency, security, and service vehicles.

The Union Pacific Railroad's Mackay Branch Line services the southern portion of the INEL through the Scoville Spur. Freight services are received from the Union Pacific Railroad's main lines from Butte, Montana, on the north and Pocatello, Idaho, and Salt Lake City, Utah, on the south. Interconnections are made from these locations throughout the United States. The INEL freight comes through Blackfoot, Idaho, from the Union Pacific's north-south track over the Mackay Branch Line. There are 14 miles of Mackay Branch Line traversing the southern part of the INEL site (Figure 3-11).

A DOE-owned railroad track passes north at the Scoville Siding from the Mackay Branch through CFA, past the east side of the ICPP, and terminates within the NRF. A spur line runs westerly to connect this trackage through the south end of ICPP's Fuel Storage Facility (CPP-603) to the coal-fired plant; a portion of this line is presently out of service.

A separate rail system services the TAN/Containment Test Facility (CTF) and TAN/Technical Support Facility (TSF). This system is a four-rail, standard-gauge railroad system used primarily to move large, radioactive waste material transport casks to and from the TAN-607 Hot Shop Complex. The track enters the Containment and Service Building (TAN-650) in the CTF area and the Hot Shop (TAN-607), the Warm Shop (TAN-607), and the Dolly Storage Building (TAN-647) in the TSF area. A 90-foot diameter turntable is located to the west of TAN-607.

Figure 3-11. Highways, Railroads, Roads, and Trails on the INEL.

The cities of Idaho Falls and Pocatello both have airports which receive jet and turboprop air passengers and cargo service from two major carriers, and commuter service from two other carriers. There is a helicopter landing pad at each of the major facilities and the main helicopter pad is located at the CFA-608 security checkpoint.

Utilities

Commercial electric power and power generated onsite are delivered to the operating areas at the INEL by an extensive power transmission system (Figure 3-12). The system is a loop configuration with 56.5 miles of 138-kilovolt (kV) transmission line, more miles of secondary voltage feeder lines, and seven major substations with a cumulative transformer capacity of 122.6 megavolt amperes (MVA).

There are no gas or oil lines that distribute fuels throughout the INEL. Each facility may have propane or diesel tanks for fuel storage.

3.4 Nearby Facilities

No industrial or military facilities are located closer to the INEL boundary than Idaho Falls, approximately 29 miles away (WINCO, 1993).

Within the INEL boundaries, Environmental Restoration Program (ERP) activities will be located throughout, primarily at the major facility areas. Table 3-4 provides distances between INEL facilities. Postulated accidents at INEL facilities could result in a release of radioactive and/or non-radioactive (hazardous) materials requiring evacuation of environmental remediation and D&D sites. Evacuation procedures are covered by the INEL emergency management program as discussed in Chapter 19.

3.5 Meteorology

3.5.1 Regional Climatology

The INEL is in a semi-arid region with limited rainfall and a predominantly southwest wind. The relatively dry air and infrequent low clouds permit intense solar heating of the surface during the day and rapid radiational cooling at night. These factors combine to produce a large diurnal temperature range near the ground. The Centennial and Bitterroot Mountain ranges keep most of the intensely cold, Canadian winter air masses from intruding into the Eastern Snake River Plain where the INEL is located. Occasionally, cold air spills over the mountains, producing low temperatures at the INEL for periods lasting a week or longer (EG&G, 1990). Relative humidity at the INEL averages 50% annually, with an average maximum of 89% in February and December and an average minimum of 15% in August. Large variations in relative humidity occur predominantly from late fall through spring because of regional storms.

Figure 3-12. Electric Power Lines Within the INEL.

TABLE 3-4. DISTANCES BETWEEN INEL FACILITIES (IN MILES).

MAJOR INEL FACILITIES	ERP WAGs													
	TAN/TSF (WAG-1)	TAN/IET (WAG-1)	TAN/LOFT (WAG-1)	TRA (WAG-2)	ICPP (WAG-3)	CFA (WAG-4)	PBF CONTROL (WAG-5)	PBF REACTOR (WAG-5)	ARA I & II (WAG-5)	ARA III (WAG-5)	ARA IV (WAG-5)	EBR I (WAG-6)	BORAX-V (WAG-6)	RWML (WAG-7)
TAN/TSF (WAG-1)	X	1.4	1.8	25.3	24.4	27.0	32.5	33.1	34.2	34.1	34.0	30.2	31.1	33.0
TAN/IET (WAG-1)	1.4	X	3.2	26.7	25.8	28.4	33.9	34.5	35.6	35.5	35.9	32.2	32.5	34.4
TAN/LOFT (WAG-1)	1.8	3.2	X	26.1	26.2	28.8	34.3	34.9	36.0	35.8	36.3	32.6	32.9	34.3
TRA (WAG-2)	25.3	26.7	26.1	X	2.3	4.9	10.4	11.0	12.1	12.0	12.4	7.7	9.0	10.9
ICPP (WAG-3)	24.4	25.8	26.2	2.3	X	3.4	8.9	9.5	10.6	7.4	10.9	7.2	7.5	9.4
CFA (WAG-4)	27.0	28.4	28.8	4.9	3.4	X	5.8	6.4	7.5	7.4	7.8	4.8	5.1	6.0
PBF CONTROL (WAG-5)	32.5	33.9	34.3	10.0	8.9	5.8	X	0.6	4.3	3.3	3.5	10.3	10.6	11.8
PBF REACTOR (WAG-5)	33.1	34.5	34.9	10.4	9.5	6.4	0.6	X	4.9	3.9	4.1	10.9	11.2	12.4
ARA I & II (WAG-5)	34.2	35.6	36.0	11.0	10.6	7.5	4.3	4.9	X	1.0	1.5	11.8	12.8	13.5
ARA III (WAG-5)	34.1	35.5	35.8	12.0	7.4	7.4	3.3	3.9	1.0	X	0.6	12.7	13.0	15.5
ARA IV (WAG-5)	34.0	35.9	36.3	12.4	10.9	7.8	3.5	4.1	1.5	0.6	X	13.3	12.3	13.6
EBR I (WAG-6)	30.2	32.2	32.6	7.7	7.2	4.8	10.3	10.9	11.8	12.7	13.3	X	0.5	1.5
BORAX-V (WAG-6)	31.1	32.5	32.9	9.0	7.5	5.1	10.6	11.2	12.8	13.0	12.3	0.5	X	0.9
RWML (WAG-7)	33.0	34.4	34.3	10.9	9.4	6.0	11.8	12.4	13.5	15.5	13.6	1.5	0.9	X
HRF (WAG-8)	20.7	22.1	22.5	7.0	6.1	8.7	14.2	14.8	15.9	15.8	16.2	11.5	12.8	14.7
ANL W (WAG-9)	46.9	48.3	48.7	24.8	23.3	20.2	20.8	21.4	14.0	14.9	15.5	24.4	24.7	26.2

3.5.2 Local Weather

The INEL is characterized as a cool high desert. During the summer, days are warm and nights are cool; in winter, days and nights are cold. The following temperature averages were calculated using data collected over a 39-year period (1950 to 1988) at the CFA (Clawson et al., 1989). The annual average temperature is 42.1°F, with recorded extremes of -49°F in January and 103°F in July. The average maximum temperature in winter is 27°F with an average minimum temperature of -3°F. Summer data show an average maximum temperature of 87°F and average minimum of 50°F (Clawson et al., 1989).

The INEL is in a belt of prevailing westerly winds normally channeled by the crescent shape of the Eastern Snake River Plain to produce a prevailing southwest wind at the INEL. The greatest frequency of wind is in the spring (Clawson et al., 1989). During the summer months, a sharp reversal in wind direction can occur. The record of average wind ranges between 5 miles per hour (mph) in December and 9 mph in April and May. The highest recorded wind speed, based on a maximum hourly average, is 51 mph, which was measured at approximately the 20-foot level from the west-southwest (Clawson et al., 1989).

The highest instantaneous wind speed (one of a series of hourly readings) recorded at the INEL was approximately 78 mph (Clawson et al., 1989); the maximum recorded gust (measured from a continuous reading) was 87 mph at the 250-foot level (WINCO, 1993). Calm conditions (in which wind speed is below the detection threshold) prevail 11% of the time (Clawson, et al., 1989). The INEL is designated an "extreme" wind area. On the average, windspeeds at the INEL exceed 15 mph for about five to six hours per day. Peak gusts at these average speeds were 21 to 22 mph, which are sufficient to pick up and transport dust and snow. Although the INEL is situated in a desert region, there is very little fine sand (such as would be found in a sand dune) and much of the ground is covered with grasses and brush which form a natural wind break for the soil and bind the soil to the ground. Duststorms or sandstorms, which would have the potential for damaging facilities and systems at the INEL, are not considered possible and are not analyzed.

Tornadoes have not been confirmed at the INEL during 34-years of monitoring, as the atmospheric aspects of tornadoes are not consistent with meteorological conditions in the Pacific Northwest. However, five funnel clouds have been sighted within the boundaries of the INEL (Clawson et al., 1989).

The Wind Hazard Curve for the INEL indicates that the probability of exceeding the threshold tornado wind speed for any given year is less than 1.0 E-06 per year (Coats and Murray, 1985). Therefore, it is considered incredible that tornadoes will impact INEL operations.

Average annual precipitation (rain and snow) at the INEL is 8.5 inches. Maximum precipitation typically occurs during May and June, and declines to a minimum in July. Since 1950, 13 occurrences are recorded of more than 1 inch of rain in a 24-hour period. The greatest amount recorded was 1.7 inches in June 1954. Only once has more than 0.5 inch of rain fallen in one hour; that amount was 1.2 inches on June 10, 1969. Snowfall ranges from a low of about 12

inches per year to a high of about 45 inches per year. The maximum, average, and minimum yearly snowfall recorded at the INEL is 40.9, 26, and 11.3 inches per year, respectively. The maximum snowfall amounts in any 24-hour period were 8.5 and 8.6 inches, recorded during January and March, and the maximum snow depth observed on the ground was 25 inches. The ground is normally free of snow accumulations from mid-April to mid-November (Clawson *et al.*, 1989).

The INEL may experience an average of two or three thunderstorm days (a day on which thunder is heard at a given observing station) from June through August (Clawson *et al.*, 1989). Although small hail stones (usually smaller than 0.25 inch) frequently accompany thunderstorms, significant damage from hail has not occurred at the INEL. Occasional blowing dust, sand, or snow reduce visibility and impede transportation.

Klassy (1993) estimates the frequency of lightning strikes at the INEL to be once per square mile per year. In the last 8 years, lightning detection field instruments at the INEL have recorded 14 strikes in a surrounding area of approximately 1.83 square miles (Hartigan, 1993).

3.5.3 Meteorology Measurement Programs

The National Oceanic and Atmospheric Administration (NOAA) has operated a meteorological observation program at the INEL since 1949. In addition to recording day-to-day weather data and providing daily operational forecasts for the INEL, the NOAA staff maintains an intensive research and development program. The program's purpose is to improve the reliability of prediction and measurement of meteorological parameters that influence safe conduct of operations at the INEL. The meteorological observation program researches transport, diffusion, and deposition of airborne effluents at the INEL (Bonney, 1992).

Continuous measurements are made from 30 stations in and around the INEL (DOE-ID, 1992). Figure 3-13 (Ackerman and Johnson, 1989) shows the locations of measuring stations in the new observation network (DOE-ID, 1992). The weather stations at the CFA appear on National Climate Center records as "Idaho Falls 46 W" and "Idaho Falls 42 NW," respectively. The meteorological stations simultaneously measure the spatial variation of several meteorological parameters, such as temperature, wind speed, and wind direction up to a height of 250 feet. Telemetered wind measurements, usually at 50 feet above ground, are collected at those stations.

3.5.4 Atmospheric Dispersion Estimates

Atmospheric dispersion estimates predict distribution and concentrations of emissions from release sources. Different parameter values are used for radiological and non-radiological emissions for normal operations and for accidents. The following sections discuss data requirements, parameter values, and limitations of the estimates used at the INEL for atmospheric dispersion.

Figure 3-13. Locations and Extent of the INEL Meteorological Monitoring Network (map area, 115 miles east to west; 105 miles, north to south) (Ackerman and Johnson, 1989).

Radiological Emissions - Normal Operations

For radiological assessments of normal operations, atmospheric data collected by the INEL meteorological network is used to calculate long term dispersion estimates, such as annual average, sector-averaged atmospheric dispersion factors (X/Q_s), at the locations of interest. Data collected at the seven INEL facility complexes from 1987 to 1991 are documented in Leonard (1991a; 1991b). Atmospheric data are issued by NOAA.

Radiological Emissions - Accidents

For radiological accident assessments, the atmospheric conditions Class F stability and 2 meters per second wind speed traditionally are used at the INEL as a conservative means to model short-term ground-level releases at distances greater than 2 kilometers (km) from the source location. At distances less than 2 km, Class F stability and 0.5 meters per second wind speed are applied to conservatively model short-term ground-level releases. These stability classes and wind speeds represent generic 95% meteorological conditions (Start, 1989). Different atmospheric conditions may be used if they represent conservative 95% meteorology, based on site-specific meteorological data. Because inversion conditions often exist at the INEL, the impact of fumigation conditions should be considered when a release from a stack is postulated.

Diffusion parameters (σ_y and σ_z) are selected that correspond to the duration of the postulated release. For example, the curves for σ_y and σ_z developed by Hilsmeier and Gifford represent releases from a few minutes to 15 minutes in duration (Clawson et al., 1989). The curves developed by Markee represent release of about 15 minutes to 60 minutes in duration (Clawson et al., 1989). The main difference between the two sets of curves occurs during stable conditions. For the longer releases, plume meander in the crosswind direction becomes significant and σ_y may increase by a factor of four. For releases on the order of 3 to 15 minutes, the Hilsmeier and Gifford curves should be used. For releases on the order of 15 to 60 minutes, the Markee curves should be used (Clawson et al., 1989). For releases longer than 60 minutes, a meteorological evaluation similar to that described in the United States Nuclear Regulatory Commission's (NRC's) "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants" is completed (NRC, 1983). This type of assessment typically involves developing atmospheric dispersion estimates for different release durations, such as 0-2 hours, 2-8 hours, 8-24 hours, 1-4 days, and 4-30 days.

Non-radiological Emissions - Normal Operations

For pollutants with an annual time-averaged exposure standard (such as nitrogen dioxide), the required meteorological data is a long-term (for example, 5-year) joint frequency distribution (JFD) of wind direction, wind speed, and atmospheric stability class. These data are developed from the same NOAA hourly statistics used for radiological modeling. In addition to the JFD, an annual average mixing (lid) height and ambient air temperature are required. Mixing height currently is estimated to be 800 meters feet at the INEL although accurate onsite measurements from a recently installed radar sounder will be available. Ambient air temperature is required for stack releases to calculate the amount of buoyant plume rise.

For pollutants with hourly time-averaged exposure standards (for example, 8-hour for carbon monoxide), sequential hourly meteorological data are required for wind direction, wind speed, stability class, and mixing height. If available, at least 5 years of this hourly data should be used in the assessment to ensure that worst-case dispersion conditions are considered. In all cases, the meteorological data should be taken from the tower height closest to the release height. For releases near ground level, wind data from a 10-meter height should be used.

Non-radiological Emissions - Accidents

For scenarios involving particulate or passive gas (density similar to air) releases, dispersion conditions should be the same as in radiological analyses (that is, Stability Class F and 2 meters per second wind speed). Although NOAA suggested a 0.5 meter per second wind speed for receptors within 2 kilometers, this may produce unrealistically high downwind concentrations because of limitations in the Gaussian plume model. Modeling guidance from the EPA recommends that wind speeds less than 1 meter per second should be entered as 1 meter per second. Therefore, for general assessments, worst-case diffusive transport should be modeled using F and 1 meter per second. This same guidance is given in the *DOE Guidance for Hazards Assessment* (DOE, 1992). Different atmospheric conditions may be used if demonstrated to be conservative based on site-specific meteorological data or on accident specific conditions.

For scenarios involving non-passive (dense) gas dispersion, worst-case diffusive conditions may be different than those for passive gas dispersion. Although higher wind speeds generally increase the dispersion, significant increase in the emission rate may result. In addition, near-field dense gas dispersion is not as sensitive to the stability class parameter. For these cases, a number of refined model simulations should be made using various stability class and wind speed combinations to determine the highest downwind concentration. These simulations can be accomplished with the United States Environmental Protection Agency (EPA) TSCREEN model (EPA, 1990) which has a built-in range of wind speeds with associated stability categories.

For liquid pool spills, the EPA recommends using Stability Class F and 2 meters per second wind speed for initial screening. For dense gas dispersion modeling, ambient air temperature, atmospheric pressure, and absolute humidity may be required (depending on the simulation model selected) to calculate gas and liquid release rates and aerosol vaporization rates.

3.6 Hydrology

3.6.1 Surface Hydrology

Except for artificial ponds, surface water at the INEL is almost nonexistent except during years of heavy runoff or when rainfall occurs on frozen soil and snow. Surface water at the INEL includes water from three sources; water from direct rainfall and snowmelt, artificial infiltration, and evaporation ponds (Bennett, 1990). Most of the INEL is located in the Pioneer basin which is topographically closed with no outlet. The three surface waters in the vicinity of the INEL include the Big Lost River, the Little Lost River, and Birch Creek. These waterways drain mountain watersheds to the

north and northwest of the INEL. These drainages and their relationship to the INEL are shown in Figure 3-14.

The Big Lost River is the major surface water feature at the INEL. The Big Lost River bed follows a southeasterly direction between the Lost River Range and Pioneer Mountains, draining an area of approximately 1,450 square miles upstream from the INEL. Mackay Dam, located about 30 miles upstream of Arco, impounds and regulates the Big Lost River flow for irrigation purposes. After being discharged from Mackay Dam, water flows southeastward past Arco. The Big Lost River generally flows perennially to a point located a few miles southeast of Arco. The flowrate and infiltration capacity of the river channel determine the point at which surface flow ceases. The river bed meanders onto the INEL at the southern part of its western boundary, curves to the northeast past the RWMC (WAG-7) and the ICPP (WAG-3), and then northeast to four terminal playas called the Big Lost River Sinks. The TAN (WAG-1) is located on the eastern edge of Big Lost River Sinks' Playa 4. Although it is uncommon for surface water from the Big Lost River to reach the western boundary of the INEL, flow can continue as far downstream as Playa 4.

The Birch Creek Basin is comprised of an elongated, southeast trending valley located between the Lemhi and Beaverhead Mountain Ranges with a basin drainage area of about 750 square miles (Figure 3-14). The water in the creek is diverted northeast of the INEL for irrigation and hydropower during the summer months. In the winter months, water is returned to an artificial channel on the INEL, 4 miles north of TAN, where it infiltrates into channel gravels, recharging the Snake River Plain Aquifer.

The Little Lost River drains the slopes of the Lemhi and Lost River Ranges (Figure 3-14). The drainage area for the basin northwest of Howe is 705 square miles. Little Lost River streamflow is diverted for irrigation north of Howe and does not flow onto the INEL.

The INEL flood diversion system, a low earthen structure, was built in 1958 (and analyzed in 1984) to divert high flows from the Big Lost River that might create flood hazards to the INEL facilities. This system consists of a small dam usable for diversion of flow from the river channel into four spreading areas (A, B, C, and D in Figure 3-14). The dam is located 6.5 miles downstream from the INEL boundary. Nearly all flow is diverted during winter months to avoid ice jams in the river channel (Bennett, 1986; 1990).

Flooding conditions at the INEL can occur with coincident melting snow and heavy spring rains. Frozen ground reduces the soil's infiltration capacity which can, if accompanied by rapid snowmelt, result in extensive flooding. Local runoff from rapid spring thaws has resulted in flooding of the RWMC at least three times (1962, 1969, and 1982). Similar local snowmelt flooding occurred at TAN in 1969 (Koslow and Van Haaften, 1986). Ice jams in the Big Lost River and its diversion channel have threatened to flood areas at the INEL in the past (McKinney, 1985). The largest flood of the Big Lost River occurred in 1965, when spreading areas A and B and part of C were filled.

Figure 3-14. Location of Surface Water Features on or near the INEL and Inundation Map for the PMF-Induced Overtopping Failure of Mackay Dam (Koslow and Van Haaften, 1986).

Because the INEL surface water flow is intermittent and controlled, high water is contained within the channel of the Big Lost River and the diversion area. Flood plains in existence prior to construction of the flood diversion system are now inactive. Based on extrapolation of previous storm events, if flow is diverted to the diversion areas, the 100- and 500-year flood events will not result in flooding outside the banks of the existing Big Lost River channel. Flooding of the Big Lost River on the INEL might result from coincident high water and failure of the Mackay Dam (Bennett, 1986; 1990). Stormwater runoff is controlled by site systems and grading to prevent localized flooding.

Koslow and Van Haaften (1986) assessed the hydrologic consequences of a potential failure of Mackay Dam and the resulting flooding of the Big Lost River. Potential failure scenarios included failure due to a seismic event; two types of structural failures; and failure caused by a probable maximum flood (PMF), providing sufficient water to top the dam. The PMF/Mackay Dam failure scenario produced significantly higher flows and a greater extent of flooding than the other scenarios. The assessment indicated that considerable spreading of floodwaters would occur on the INEL where the plain is wide and flat, subjecting some INEL facilities to encroaching floodwaters. The water depths associated with this PMF/Mackay Dam failure flood scenario near these facilities would be from 2 to 4 feet, and the flow velocities would be low, less than 3.0 feet per second. Although flood waters could be expected in the buildings, the slow-moving water would not be expected to cause structural damage. The area inundated by the probable maximum flood is shown in Figure 3-14.

3.6.2 Subsurface Hydrogeology

The INEL overlies 890 square miles of the Snake River Plain Aquifer (Figure 3-15). The active portion of the aquifer is located primarily in the Quaternary basalts. However, since the lower boundary is largely undefined, parts of the aquifer may extend into the Tertiary basalts and rhyolites. The upper boundary is the water table, and lateral boundaries correspond to surface physical features. Depths to the water table from the INEL land surface range from about 200 feet in the northern site to more than 900 feet in the south (Pittman *et al.*, 1988).

The Snake River Plain Aquifer is recharged by return of irrigation water, stream channel and canal leakage, tributary valley underflow, and direct infiltration from precipitation (Pittman, *et al.*, 1988). The watershed area recharging the Snake River Plain Aquifer is approximately 35,000 square miles. Recharge to the Snake River Plain aquifer is primarily in the form of infiltration from the rivers and streams draining the areas to the north, northwest, and northeast of the Eastern Snake River Plain.

The primary source of stream channel infiltration is the Big Lost River, which flows perennially in a southeasterly direction towards Arco, where the stream then enters the Snake River Plain and infiltrates to the Snake River Plain Aquifer. During particularly wet years, significant recharge from high flows in the Big Lost River cause a regional rise in the groundwater table over much of the INEL. Water levels in some wells rise as much as 6 feet within a few months following very high sustained flows in the river. Most of the water from the aquifer is discharged through springs near

Figure 3-15. Water Table Elevations of the Snake River Plain Aquifer and General Direction of Groundwater Flow, Spring 1980 (Lindholm, et al., 1987).

American Falls Reservoir (southwest of Pocatello) and along the Snake River from Milner Dam to King Hill (near Twin Falls). About two-thirds of the groundwater discharged from the aquifer is discharged through the Thousand Springs areas between Milner and King Hill, approximately 110 miles from the INEL. Additional water is discharged from the aquifer through pumping for irrigation.

The Snake River Plain Aquifer's transmissivity and storativity are highly variable across the INEL. In general, the aquifer is very productive and production wells in any location can be expected to yield several thousand gallons per minute. Groundwater travel time from the INEL to Thousand Springs (near Twin Falls) is estimated at between 80 and 200 years.

The thickness of the aquifer is poorly defined. Based on hydrologic and geologic data, the effective aquifer base is considered to coincide with the top of a thick, widespread sequence of clay, silt, sand, and basalt that occurs at depths ranging from 800 to 1,500 feet below land surface (Anderson, 1991; Mann, 1986).

Perched water bodies have been detected at the ICPP, TRA, TAN, and RWMC facilities. They are generally related to the presence of disposal ponds or other surface water sources.

The natural groundwater chemistry of the Snake River Plain Aquifer beneath the INEL is influenced by the chemical composition of groundwater originating outside of the INEL; precipitation, streams, rivers, and runoff; and the weathering reactions that occur as water interacts with the minerals composing the aquifer (Wood and Low, 1986; 1988). These processes result in water containing relatively high concentrations of calcium and bicarbonate as well as other components. However, the chemical composition of natural groundwater beneath the INEL does not exceed the EPA maximum contaminant level for any component.

Groundwater use on the Snake River Plain is dominated by irrigation. Total water use for the upper Snake River drainage basin and the Snake River Plain Aquifer was 36,500 acre-feet per day during 1985, which was over half the water used in Idaho. Other uses include industrial applications such as food processing and aquaculture as well as domestic, rural, public, and livestock supply. The INEL withdraws an average 8.8 cubic feet per second (Pittman et al., 1988). Therefore, groundwater use at the INEL is about 0.05% of the total water consumed from the aquifer.

Water levels in wells have decreased since the 1950s because of annual increases in groundwater pumpage. Based on a modeled aquifer, if 1980 conditions of recharge and discharge are extended to the year 2010, aquifer declines of 2 to 8 feet could be expected. However, if withdrawals were increased by 2,400 cubic feet per second to irrigate another 1 million acres, wellhead water level declines of 10 to 50 feet might be expected within 30 years (Garabedian, 1986).

3.7 Geology and Seismology

3.7.1 Geologic Evaluation

Soil parent materials on the INEL are composed of four bedrock units and surficial deposits. The four bedrock units covering the INEL include Quaternary basalts, Quaternary rhyolites, Tertiary volcanics, and Paleozoic carbonates (Figure 3-16). Quaternary basalts cover most of the INEL with lava flows ranging in age from about 15,000 to 730,000 years. Inclusions of Quaternary rhyolites form the buttes in the southeast corner and the mountains to the north end of the site. Tertiary volcanics are limited to the buttes and Paleozoic carbonates are found only in a small portion on the northwest edge of the INEL.

Quaternary surficial deposits cover the INEL along the Big Lost River drainage and the northern portion of the INEL (Figure 3-16). Mainstream alluvium extends along the course at the Big Lost River from the southwestern corner of the INEL to the Lost River Sinks area. In addition, the northern portion of the site is dominated by mainstream alluvium. Alluvial fan material is found along the extreme western edge of the site and near Birch Creek. Lacustrine (lake) deposits are found in the northwest portion of the site. Those deposits of alkaline clay and sand were part of Lake Terreton (which encompassed the area where the city of Howe and TAN currently are located). Eolian (wind-blown) deposits forming large dune fields are found in the east-central portion of the site. These beach sands were deposited at the high stand at Lake Terreton and were redeposited by winds in the late Pleistocene and Holocene times.

TAN (WAG-1) is located on the lacustrine deposits of the Quaternary surficial deposits. TRA (WAG-2) and ICPP (WAG-3) are located on the mainstream alluvium of the Quaternary surficial deposits. CFA (WAG-4), BORAX (WAG-6), and RWMC (WAG-7) are located on Quaternary basalts from approximately 15,000 to 200,000 years ago. PBF/ARA (WAG-5) is located on Quaternary basalts from approximately 200,000 to 400,000 years ago.

3.7.2 Seismic Evaluation

Earthquakes

The distribution of major earthquake epicenters in Figure 3-17 indicates that the Eastern Snake River Plain, including the INEL, has not experienced earthquakes over an M_L (local magnitude) of 2.5 (Anders et al., 1989). However, the Eastern Snake River Plain is surrounded by the seismically active Intermountain Seismic and Centennial Tectonic belts as defined by Smith and Arabasz (1991) and Stickney and Bartholomew (1987) (Figure 3-17). The Intermountain Seismic Belt (ISB) is a zone of concentrated seismicity that extends from northwestern Montana through eastern Idaho and central Utah into southern Nevada and northern Arizona (Smith and Sbar, 1974; Arabasz and Smith, 1981; Smith and Arabasz, 1991). In Idaho, the ISB trends north-south from the Utah-Idaho border along the Idaho-Wyoming border to the Yellowstone Plateau. The Centennial Tectonic Belt (CTB) (formerly called Idaho Seismic Zone) is a seismically active zone that extends from Hebgen Lake, Montana, westward into central Idaho just north of the INEL.

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Figure 3-10

Figure 3-16. Geologic Map of the INEL and Adjacent Area (Adapted from Scott, 1982; Kuntz et al., 1992).

Figure 3-17. Earthquake Activity Greater than M_L 2.0 from 1884 - 1989
(Woodward-Clyde Consultants, 1992a and WINCO, 1993).

Earthquake activity greater than M_L 2.0 for the period 1884 to 1989, shown in Figure 3-17 was compiled by Woodward-Clyde Consultants, (1992a) using earthquake catalogs from the INEL, United States Geological Survey, Montana Bureau of Mines and Geology, United States Bureau of Reclamation, University of Utah Seismograph Stations, and Engdahl and Rinehart (1988; 1991). Localized seismic networks were installed in the ISB beginning in 1960 and within the Eastern Snake River Plain in 1970. Earthquakes occurring prior to 1970 have location errors of 12 miles to more than 62 miles and, after 1970, less than about 12 miles.

From 1972-1990, approximately 19 microearthquakes ($M_L \leq 1.5$) occurred within or near the boundary of the Eastern Snake River Plain suggesting that infrequently occurring small-magnitude earthquakes may be characteristic of the Eastern Snake River Plain seismicity (Jackson *et al.*, 1990; Pelton *et al.*, 1990; Jackson *et al.*, in press). Although 13 of these microearthquakes have occurred near or within the INEL site boundaries, Jackson *et al.* in press, indicate that the INEL area is not more microseismically active than other areas of the Eastern Snake River Plain, but rather that the INEL seismic network has an adequate detection threshold ($M_L = 0$) to record these small events.

The largest earthquake in the CTB occurred on October 28, 1983, with an M_L of 7.3 (Doser and Smith, 1985). The earthquake resulted from northwest rupture (or slippage) with relative vertical movement downward to the west along the Lost River fault. The epicenter for this event was located in the Thousands Springs Valley near the western flank of Borah Peak, approximately 56-68 miles from the INEL facilities (Figure 3-17). Substantial damage occurred to masonry structures in the local communities of Mackay and Challis, Idaho, near the epicentral area. Although the earthquake ground motions were felt at the INEL site, only minor nonnuclear building damage occurred in the form of hairline cracks or settlement.

The largest earthquake within the ISB occurred on August 17, 1959, at Hebgen Lake, Montana, located 116 miles northeast of the INEL (Figure 3-17). The event had an M_L of 7.1 and was felt at the INEL, but caused no damage. In addition to the Borah Peak and Hebgen Lake earthquakes, 26 earthquakes exceeding magnitude 5.5 have occurred within 200 miles of the INEL since 1884.

The most recent earthquake over an M_L of 5.0 occurred on August 22, 1984, at Challis, Idaho, located 79 miles northwest of the INEL site (Figure 3-17) with a magnitude of 5.8. Four earthquakes were within 100 miles of the INEL site with magnitudes varying from 5.8 to 7.3. Twenty-two earthquakes were within a distance of 100 to 200 miles of the INEL site and had magnitudes ranging from 5.5 to 6.7.

Active Local Faults

Patterns of seismicity and locations of mapped faults have been used to assess potential sources of future earthquakes for estimating ground shaking at the INEL. In addition, faulting occurs almost always along preexisting faults. Therefore, future faulting may be expected along existing major fault zones. The sources and maximum magnitudes of earthquakes that could produce the maximum levels of ground motions at the INEL include the Lemhi Fault, the

Lost River Fault, the Eastern Snake River Plain Volcanic Zones, and the Eastern Snake River Plain Region ("Random Earthquake").

The Howe and Fallert Springs segments are located at the southern end of the Lemhi Fault. The INEL facilities are located at distances of 6 to 18 miles from the closest point of rupture on the fault along the Howe segment (Woodward-Clyde Consultants, 1990). From recent paleoseismic investigations (four trenches excavated across the faults), the most recent event, 15,000-24,000 years ago, had an estimated maximum magnitude of 7.0 (Woodward-Clyde Consultants, 1992a; 1992b).

The Arco segment is located at the southern-most end of the Lost River fault and is closest to the INEL. The INEL facilities are approximately 15 to 43 miles from the closest point on the fault along the Arco segment. Reconnaissance paleoseismic studies conducted by Malde (1987) and Pierce (1985; 1988) along the Arco fault indicate that the most recent event occurred about 30,000 years ago. By analogy to results of paleoseismic investigations of the Howe and Fallert Springs segments of the Lemhi fault, the maximum magnitude estimated for the most recent event is 7.0 since no detailed studies were performed along the southern Lost River Fault (Woodward-Clyde Consultants, 1992a).

The INEL facilities are approximately 1 to 28 miles from the Arco or Lava Ridge-Hell's Half Acre (Volcanic Rift Zone) boundaries and the Axial Volcanic Zone. Small normal faults and fissure sets are located within the volcanic rift zones and result from basaltic dike injection (Smith *et al.*, 1989; Rodgers *et al.*, 1990; Kuntz *et al.*, 1992; Hackett and Smith, 1992). Since a dike-injection event was not observed within the Eastern Snake River Plain, earthquake data from worldwide active volcanic rift zones were evaluated. A maximum M_L of 5.5 is assumed possible for future dike-injection events within the Eastern Snake River Plain volcanic rift zones, based on this compilation (Woodward-Clyde Consultants, 1992a). For comparison, magnitudes of 5.2 and 5.5 were estimated using the fault rupture area for the small normal faults located in the Arco and Lava Ridge-Hell's Half Acre rift zones, respectively (Woodward-Clyde Consultants, 1992a).

Determination of Maximum Credible Earthquake. A probabilistic procedure to define maximum credible earthquakes developed by WINCO (1993) is similar to seismic hazard models developed by Coats and Murray (1984).

The probability calculations for the attenuation relationship are expressed in terms of Mercalli Intensity (MI) and Richter Magnitude (M) where the local epicentral intensity (M_L) or the surface wave magnitude (M_S), is converted to body wave magnitude (M_b). For example, an M_L of 7.5 to 8.0 would be equivalent to an M_b of 7.2 to 7.5, as assigned in previous deterministic studies. The model assumes a source area in which the fault directions and lengths are unknown. This model was used because earthquake epicenters are not always clearly associated with known faults, and all source areas have numerous capable faults. Based on empirical data, a focal depth of 5 miles was used in the calculations.

As shown in Figure 3-18, to determine the maximum probable earthquake the area surrounding the INEL site was divided into the three Source Areas, A, B, and C, for which historic data were available.

Figure 3-18. Location of Earthquake Epicenters with Magnitudes Greater than 7.0 in NOAA Record Search Areas A, B, and C, Relative to the INEL

In Area A, the largest earthquake occurred at Hebgen Lake, Montana, on August 17, 1959, with an M_L of 7.1 and an MI IX-X (Figure 3-18). An $M_L \geq 8$ is rare and would probably never be exceeded in this area. Therefore, a maximum epicentral intensity of X and an M_b of 7.2 - 7.5 was assigned to Source Area A.

In Area B, the largest earthquake occurred at Borah Peak, Idaho, on October 28, 1983 with an M_L of 7.3 and an MI of X (Figure 3-18). Earthquakes in this area are associated with the Idaho Batholith Province and not the basin and range structure northwest of the INEL. However, to be conservative, a MI of IX and an M_b of 6.6 - 7.1 was assigned to Source Area B. This earthquake has a recurrence interval of 250 years.

In Area C, the largest earthquake occurred at Pocatello Valley on March 27, 1975, with an M_s of 6.1 and an MI of VIII (Figure 3-18). Faults in this area are of significant length. It is assumed that this area has the same magnitude potential as Area A, but a longer recurrence interval. A maximum epicentral intensity X or an M_b of 7.2 - 7.5 and a recurrence interval of 400 years was assigned to Source Area C.

Maximum earthquakes are customarily assigned postulated fault lengths. However, for the INEL there is insufficient geologic information and many uncertainties associated with correlations between fault length and earthquake magnitude. Additionally, epicenters of past earthquakes are not associated clearly with previously existing capable faults. Therefore, completely deterministic procedures for specifying maximum earthquakes are probably inadequate.

Seismic design criteria for the INEL are contained in the DOE-ID *Architectural and Engineering Standards* (DOE-ID, 1992b) and are discussed in Section 6.1.7.

3.7.3 Volcanic Evaluation

According to Kuntz *et al.* (1992) and Pierce and Morgan (1992), the Western Snake River Plain has experienced sporadic volcanic activity during the last 10-12 million years. Volcanic vents on the Eastern Snake River Plain are concentrated in several linear belts that trend northwest and an axial rift that trends northeast (Figure 3-19). The northwest-trending belts have associated northeast-trending fissures which characterize them as volcanic rift zones (VRZs). Three VRZs occur in the INEL region of the Eastern Snake River Plain: the Great Rift VRZ; the Arco VRZ; and the Lava Ridge-Hell's Half Acre VRZ (Figure 3-19).

Unlike the VRZs, the northeast-trending Axial Volcanic Zone (AVZ) (Figure 3-19) has northwest-trending fissures, atypical of the VRZs. This fissure orientation causes the seismic-energy transmission properties and hydraulic properties to vary considerably throughout the Eastern Snake River Plain and the INEL. This orientation also indicates that the volcanic vents in the AVZ are fed by northwest-trending dikes and that seismicity can be associated with volcanism (Hackett and Smith, 1992).

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Figure 3-13

- Eastern Snake River Plain
- BSB = Big Southern Butte
- CB = Cedar Butte
- Volcanic Rift Zones
- L = Lava Ridge-Hells Half Acre
- A = Arco
- G = Great Rift
- Holocene Lava Fields
- COM = Craters of the Moon
- CG = Cerro Grande
- HHA = Hells Half Acre
- R = North and South Robbers
- W = Wapi

Figure 3-19. Volcanic Rift Zones and Holocene Lava Fields in the INEL Area
(Adapted from Kuntz et al., 1992; Pierce and Morgan, 1992).

Although no volcanism occurred in the INEL area during recorded history, eruptions occurred as recently as 2,100 years ago along the Great Rift about 15 miles southwest of the INEL. Basaltic lava eruptions occurred near the southern INEL boundary between 5,000 and 13,000 years ago.

Precursor events that typically precede basaltic eruptions are the following:

- Vertical and horizontal ground displacement above or near the site of the future volcanic vents
- Seismic activity
- New or increased fuming near the site of the future vents
- Changes in the composition and temperatures of hot springs or fumaroles near the volcano.

Seismic instruments now in operation on and near the INEL are capable of detecting such activity, which would foretell a return of volcanism to the site. This would allow sufficient time to assess the current operational situation and to initiate an appropriate action to mitigate potential consequences of any volcanic activity. Therefore, volcanic activity is not considered.

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CHAPTER 4.0

FACILITY DESCRIPTION AND OPERATION

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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4.0 FACILITY DESCRIPTION AND OPERATION

The Environmental Restoration Program (ERP) is a top-priority United States Department of Energy (DOE) mission at the Idaho National Engineering Laboratory (INEL). The goal of ERP activities is to undertake as necessary remedial actions at potential release sites at the INEL to protect the health of INEL personnel, the public, and the environment. Historically, research and development projects at the INEL have generated radioactive and chemical wastes. Some of these wastes have migrated into the environment and caused contamination at different sites around the INEL.

The INEL ERP activities include two major elements: environmental remediation and decontamination and decommissioning (D&D). The environmental remediation program follows requirements set forth in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the INEL Federal Facility Agreement and Consent Order (FFA/CO). Environmental remediation activities are designed to assess and clean up potential release sites at the INEL. The D&D program is responsible for managing radiologically contaminated surplus facilities to ensure that releases and exposures are acceptably controlled and to ultimately allow other use of the facilities or occupation of the land. The D&D process follows the requirements of DOE Order 5820.2A (DOE, 1988), Chapter V.

This chapter provides a general description of the environmental remediation program and INEL Waste Area Groups (WAGs) and Operating Units (OUs); the D&D program and current D&D projects; and environmental remediation and D&D techniques that may be used. Included is the identification of structures, systems, and components that may be important to safety and potential supporting facilities, services, and utilities for INEL ERP activities. Activity-specific safety analysis documentation will provide the necessary detailed description of the activity facilities and operation to support the activity-specific safety analysis.

4.1 Environmental Remediation

Since 1986, over 368 suspected release sites have been identified for investigation at the INEL. Initial investigation of potential release sites was conducted under the Resource Conservation and Recovery Act (RCRA)-based Consent Order and Compliance Agreement (COCA) (INEL, 1987) which was later superseded by the CERCLA-based FFA/CO (INEL, 1991a) described in Section 4.1.1. Potential release sites are grouped together for assessment and cleanup activities to provide greater management and cleanup efficiency. These groupings are called "operable units" (OUs). OUs are further grouped into ten location areas, called WAGs, which generally correspond to the INEL functional areas. For each WAG, environmental remediation activities include an assessment phase to characterize the nature and extent of contamination and a cleanup/remediation phase (including implementation of interim and final remedial actions). When the extent and nature of contamination constitutes a potential threat to human health and safety or the environment, the latter cleanup or remediation phase is implemented. Sources of contamination include spills, abandoned tanks, septic systems, percolation ponds, landfills, and injection wells. Release sites range in size from large facilities such as

the Subsurface Disposal Area (pits and trenches) at the Radioactive Waste Management Complex to areas with no physical evidence of a release. Section 4.1.2 provides a summary description of each of the OUs contained within each WAG.

4.1.1 Federal Facility Agreement and Consent Order (FFA/CO)

The INEL environmental remediation process, conducted under the CERCLA-based FFA/CO, focuses on early determination of what should be done with each OU. The goal of the environmental remediation process is to ensure that releases or threatened releases of hazardous substances at the INEL are thoroughly investigated and that appropriate response actions are undertaken and completed as necessary to protect human health and the environment. One of the purposes of the FFA/CO is to establish a procedural framework and schedule for developing, prioritizing, implementing, and monitoring appropriate response actions at the INEL in accordance with CERCLA, the Resource Conservation and Recovery Act (RCRA), and the Idaho Hazardous Waste Management Act (HWMA).

Implementation of the FFA/CO is accomplished by the *Action Plan For Implementation of the Federal Facility Agreement And Consent Order* (INEL, 1991b). The Action Plan describes how the environmental remediation program will proceed to ensure compliance with CERCLA and other applicable statutes. The Action Plan describes the application of the CERCLA process, as defined in the National Contingency Plan (NCP), to the remedial effort at the INEL. To ensure that actions are taken as soon as possible, OUs are addressed on two "tracks": OUs on Track 1 can be evaluated using existing data, while OUs on Track 2 require that additional field data be collected before a sound evaluation can be made. The determination may be that no further action is necessary.

The CERCLA process involves an initial investigation to determine the extent of contamination and available remediation alternatives, usually referred to as a Remedial Investigation/Feasibility Study (RI/FS). The RI/FS process could include preparation of a risk assessment to determine the level of risk associated with the characteristics of the site and the type, concentration, and amount of contamination. Following the RI/FS is the decision and agreement on the selection of a remediation alternative formalized by a Record of Decision (ROD), and then the Remedial Design/Remedial Action phase in which the site is remediated. The Remedial Design encompasses plans and specifications for remedial action including design analysis, an operation and maintenance plan, a Quality Assurance Project Plan, a Health and Safety Plan, and the results of additional studies such as a safety analyses.

4.1.2 Waste Area Group (WAG) and Operable Unit (OU) Descriptions

The following sections summarize WAG and OU descriptions at the INEL (DOE-ID, 1993). The summaries are presented by WAG and by OUs within each WAG. General information on the contamination for each OU is provided when available from site characterization work already completed. WAGs 8 and 9 are not within the scope of the Baseline Safety Analysis File (BSAF) and, therefore, are not included.

The location of each WAG is described in Chapter 3. A detailed site remediation layout is required in the Health and Safety Plan and is discussed in Chapters 9 and 10. Estimated inventories of radioactive and hazardous materials are contained in the referenced documents WINCO (1993) for WAG 3 and EG&G (1993c) for the other WAGs. Estimated quantities of radioactive and hazardous waste generated from remediation activities are contained in EG&G (1993a).

WAG 1 - Test Area North (TAN)

WAG 1 includes sites associated with the following facilities at Test Area North (TAN): the Technical Support Facility (TSF), Water Reactor Research Test Facility (WRRTF), Cask Testing Project, Loss-of-Fluid Test (LOFT), Initial Engine Test (IET) Facility, and Specific Manufacturing Capabilities (SMC) Facility. WAG 1 is divided into 10 OUs, including underground storage tanks (USTs), pits, ponds, contaminated groundwater, components from a radioactive waste processing system, and a railroad turntable. Hazardous, radioactive, and mixed wastes exist at WAG 1. Possible contaminants include asbestos, petroleum products, acids and bases, radioactive soils and rubble, organic chemicals, laboratory bottles, and sanitary wastes.

- OU 1-01

OU 1-01 includes 13 sites. The sites and the types of waste associated with each site are described in Table 4-1. These sites currently are designated as no action sites.

- OU 1-02

OU 1-02 includes 15 petroleum fuel or waste storage tanks. Nine of the tanks have been removed under the UST program. Three tanks cannot be found and are assumed to have been removed. The sites and the types of waste associated with each site are described in Table 4-2.

- OU 1-03

OU 1-03 consists of four sites. The TSF laboratory bottle site includes a disposal site in the desert where approximately 300 to 400 bottles were dumped. The TSF Burn Pit is a pit used for open burning in the mid 1950s. The WRRTF burn pit is an open pit where garbage was burned from the late 1950s through the mid 1960s. Both of these sites are covered with soil. Table 4-3 summarizes this OU.

- OU 1-04

OU 1-04 consists of seven sites that resulted from storage and disposal of caustics at LOFT and TSF. However, TSF-29 may have received radioactively contaminated soil from other sites at TAN. The sites and the types of waste associated with each site are described in Table 4-4.

TABLE 4-1. SUMMARY OF OU 1-01.

DESCRIPTION	COMMENTS/CONTAMINANTS
LOFT. Asbestos Piping	Asbestos
LOFT. Buried Asbestos Pit	Asbestos
TSF. Transite Contamination	Asbestos
TAN 607-A Room 161. Contaminated Pipe	N/A
Radioactive Parts Service Storage Area (RPSSA) Buildings 647/648 and Pads	N/A
IET-05. IET Foam Stabilizer Tank (TAN-317)	Tank removed
IET-06. IET Injection Well (TAN-332)	No contaminants present
LOFT-03. LOFT Rubble Pit S of LOFT Disposal Pond	No contaminants present
LOFT-07. LOFT Foam Solution Tank (TAN-119)	No contaminants present
LOFT-11. LOFT Cryogen Pits (3) E of TAN 629	No contaminants present
TSF-01. TSF Diesel Tank (3000 gal) W of TAN-607	Tank removed; soil contaminated with diesel fuel removed
TSF-04. Gravel Pit/Acid Pit	No contaminants present
TSAF-11. Three Clarifier Pits E of TAN-604	(To be transferred to OU 1-08)

N/A = not available

TABLE 4-2. SUMMARY OF OU 1-02.

DESCRIPTION	COMMENTS/CONTAMINANTS
IET-01. IET Gasoline Storage Tank (TAN-318)	Tank removed
LOFT-09. IET Lube Oil Tank (TAN-316)	Tank removed
LOFT-05. LOFT Fuel Tanks (2) (TAN-109 A & B)	Soil contaminated with petroleum hydrocarbons
LOFT-06. LOFT Slop Tank E of TAN-631	Tank not located; believed to have been removed previously
LOFT-08. LOFT Tank in Borrow Pits (TAN-110)	Tank removed
TSF-13. TSF Gasoline Tank N of TAN-610	Tank not located; believed to have been removed previously
TSF-14. TSF Fuel Oil Tank W of TAN-603	Tank removed
TSF-15. TSF Oil Tank W of TAN-603	Tank removed
TSF-24. TSF Oil Sumps (TAN-609)	Tank removed
TSF-25. TSF Fuel Tank Under SW Corner of TAN-607	N/A
TSF-32. TSF Oil Tank S of TAN-601	Tank not located; believed to have been removed previously
TSF-33. TSF T-11 Fuel Tank E of TAN-602	Tank removed
WRRTF-09. WRRTF Diesel Fuel Tank (TAN-103)	Tank removed
WRRTF-10. WRRTF Gasoline Tank (TAN-644)	Tank removed

N/A = not available

TABLE 4-3. SUMMARY OF OU 1-03.

DESCRIPTION	COMMENTS/CONTAMINANTS
TSF. Bottle Site	Metals
TSF-02. TSF Service Station Spill (TAN-664)	No contamination found
TSF-03. TSF Burn Pit	Solvents; hydrocarbons; metals
WRRTF-01. WRRTF Burn Pit	Solvents; hydrocarbons; metals

TABLE 4-4. SUMMARY OF OU 1-04.

DESCRIPTION	COMMENTS/CONTAMINANTS
LOFT-02. LOFT Disposal Pond (TAN-750)	Low-level radionuclides
TSF-12. TSF Acid Neutralization Sump	No known contamination
TSF-17. Two TSF Neutralization Pits N of TAN-649	Low-level radionuclides; metals inside of tank
TSF-19. TSF Caustics Tank V-4	Tank removed; no contamination present
TSF-20. TSF Neutralization Pits (2)	No known contamination
TSF-29. TSF Acid Pond (TAN-735)	Low-level radionuclides; metals
TSF-31. TSF Acid Pit	No known contamination

● OU 1-05

OU 1-05 consists of nine subunits and the contaminants are primarily low-level radioactive wastes. Mixed, radioactive, and hazardous waste may require treatment and disposal. The bulk of the material requiring disposal may come from low levels of surface contamination in TSF-06. The TAN TSF-1 soil area (TSF-06) was, and still is, used as a common storage site for radioactively contaminated equipment. Radiological contamination remains even in those open field areas where equipment is no longer stored. This area was a dumping ground for small quantities of waste materials. The sites and the types of waste associated with each site are described in Table 4-5.

TABLE 4-5. SUMMARY OF OU 1-05.

DESCRIPTION	COMMENTS/CONTAMINANTS
IET-04. IET Stack and Rubble Site	No contamination present
IET-07. IET Hot Waste tank (TAN-319)	No contamination present
TSF-06. TSF TAN/TSF-1 Area (soil area)	Radionuclides; metals; organics in soils, sludges, and liquids
TSF-09. TSF Intermediate Level (Radioactive) Waste Disposal System	N/A
TSF-10. TSF Drainage Pond (TAN 782)	Unknown
TSF-18. TSF Contaminated Tank SE of Tank V-3	Radionuclides; metals; organics in soils, sludges, and liquids
TSF-21. TSF IET Valve Pit	Radioactive sludges
TSF-26. TSF PM-2A Tanks (TAN-710 A&B)	Radionuclides; metals; organics in soil
WRRTF-04. WRRTF Radioactive Liquid Waste Tank (TAN-735)	Radionuclides; metals in soils, sludge, and liquids

N/A = not available

- OU 1-06

OU 1-06 consists of three spill areas and 1 disposal pond. The sites and the types of waste associated with each site are described in Table 4-6. The quantities of contaminated material are large; however, the diesel spill may be remediated by *in situ* biodegradation. The TSF-07 disposal pond may not pose a sufficiently high risk to require removal of all sediments.

TABLE 4-6. SUMMARY OF OU 1-06.

DESCRIPTION	COMMENTS/CONTAMINANTS
LOFT-01. LOFT Diesel Fuel Spill (TAN-629)	Soil contaminated hydrocarbons (diesel)
LOFT-10. LOFT Sulfuric Acid Spill (TAN-771)	No known contamination
TSF-07. TSF Disposal Pond	Pond sediment containing low-level radionuclides, inorganics, organics, metals
TSF-08. TSF HTRE III Mercury Spill Area	Soil contaminated with mercury

- OU 1-07

OU 1-07 includes the TSF injection well at TAN-330 and groundwater contamination caused by the injection of wastewaters into the Snake River Plain Aquifer. The injection well was drilled in 1953 to a depth of 310 feet to dispose of liquid effluents generated at TSF. The well has a 12-inch diameter casing with openings from 180 to 244 feet and from 269 to 305 feet below the land surface. Depth to groundwater is 206 feet. The well was last used as a primary disposal site in September, 1972, when wastewaters were diverted to the TSF disposal pond. Until the early 1980s, the well may have been used for overflow from the sump at TAN-655 in the event a power failure, equipment failure, or equipment maintenance precluded discharge to the pond. Releases to TAN groundwater were first detected in September, 1987, when low levels of trichloroethylene and tetrachloroethylene were found in the two nearby wells that supply drinking water to TAN. Subsequent sampling of the drinking water wells and other TAN area wells confirmed contamination and identified lead and strontium as contaminants that exceeded drinking water standards.

The chosen treatment alternative for the TAN groundwater involves groundwater extraction (pumping), filtration, air stripping with vapor phase granular-activated carbon (GAC), and ion exchange. The pumped water will be treated using a filter to remove sediment; an air stripper to remove organic contaminants; and an ion exchange column to remove strontium. The ion exchange resin will be disposed as low level radioactive waste. An *Auditable Safety Analysis for Test Area North (TAN) Interim Action Groundwater Treatment Facility Operable Unit 1-07A*, (MK-FIC, 1993a) was prepared for this remediation activity.

- OU 1-08

This OU includes three diverse sites. The surface soils around the TSF railroad turntable are suspected of mercury contamination. The source of the contamination is spills that occurred when the Heat Transfer Reactor Experiment (HTRE) engines were tested. The TSF sewage treatment plant contamination and the WRRTF injection well contamination, if any, currently are unknown. These sites are summarized in Table 4-7.

TABLE 4-7. SUMMARY OF OU 1-08.

DESCRIPTION	COMMENTS/CONTAMINANTS
TSF-22. TSF Railroad Turntable	Metals (Hg)
TSF-28. TSF Sewage Treatment Plant (TAN-623); and Sludge Dry Beds	Metals; low-level radionuclides
WRRTF-05. WRRTF Injection Well (TAN-331)	Low-level radionuclides; metals; various chemicals

- OU 1-09

OU 1-09 includes five sites with suspected soil contamination. Currently, one site is estimated to have contamination requiring removal. These sites are summarized in Table 4-8.

TABLE 4-8. SUMMARY OF OU 1-09.

DESCRIPTION	COMMENTS/CONTAMINANTS
TSF-37. Contaminated Water Spill	No contaminants present
TSF-36. TAN-603 French Drain	Diesel fuel; low levels of radioactive contamination
WRRTF-02. WRRTF Two-Phased Pond (TAN-763)	No contaminants present
WRRTF-03. WRRTF Evaporation Pond (TAN-762)	No contaminants present
WRRTF-06. WRRTF Sewage Lagoon	No contaminants present

- OU 1-10

OU 1-10 is the comprehensive RI/FS area for WAG 1.

WAG 2 - Test Reactor Area

The Test Reactor Area (TRA) includes three high-neutron flux test reactors: the Materials Test Reactor, the Engineering Test Reactor, and the Advanced Test Reactor (ATR). Only ATR currently is operational. WAG-2 is divided into 13 OUs, including pits, trenches, rubble piles, ponds, cooling towers, wells, french drains, and spills. Hazardous, radioactive, and mixed wastes exist at WAG-2. Possible contaminants include acids, petroleum products, polychlorinated biphenyls (PCBs), and radionuclides.

- OU 2-01

OU 2-01 consists of one site, the TRA Paint Shop ditch. This unit is designated a "no action site" approved by the State of Idaho and the United States Environmental Protection Agency (EPA).

- OU 2-02

OU 2-02 consists of five inactive UST sites. The USTs addressed in this OU were removed, and Track 1 documents were submitted and approved. Soil around two of the tanks was found to be slightly contaminated when the tanks were removed. Contaminated soil was removed and disposed at the CFA landfill. The sites all were approved as "no action sites" by the State of Idaho and EPA.

- OU 2-03

OU 2-03 consists of six sites, four of which are sulfuric acid spills, and two of which are potential spills or past storage locations of petroleum distillates. None of the six sites are recommended for further action because of the absence of a significant contaminant source.

- OU 2-04

OU 2-04 consists of eight confirmed or potential spill sites which are associated with storage and transfer of petroleum products and leakage from electric transformers.

Bulk fuel usage at TRA is basically limited to No. 5 Fuel Oil (burned in the boilers) and diesel fuel (used in standby power generators). In both instances, the product is delivered to TRA in tank trucks and pumped to aboveground storage tanks by the fuel oil pumphouse (TRA-627). Stains on the ground around the piping manifold at the fuel oil pumphouse indicate minor spillage during filling operations. New stock of oils, lubricants, and small amounts of solvents brought into TRA in 55-gallon drums often were stored on an open loading dock (TRA-722). The area around the loading dock may have been contaminated with these materials.

Information on the remaining OU 2-04 sites is limited, but in general these sites are related to the transfer and storage of petroleum products. There are spills associated with leakage of PCB-contaminated oils from individual electric transformers. This OU will be evaluated through fiscal year 1994.

- OU 2-05

OU 2-05 consists of 4 sites associated with the hot waste storage system at TRA. One of the tanks at site TRA-15 leaked. Table 4-9 summarizes these sites.

TABLE 4-9. SUMMARY OF OU 2-05.

DESCRIPTION	COMMENTS/CONTAMINANTS
TRA-603/605. Tank	Piping, tunnel, and tank contaminated with beta/gamma radioactive contamination
TRA-15. TRA Hot Waste Tanks 2, 3, 4, at TRA-613	USTs and soil contaminated with radionuclides
TRA-16. TRA Inactive Radioactively Contaminated Tank at TRA-614	Tank containing metals; organics; radionuclides
TRA-19. TRA Radioactive Tanks 1 and 4 at TRA-630, replaced by Tanks 1, 2, 3, and 4	No contamination identified

- OU 2-06

OU 2-06 consists of three rubble sites. These sites were evaluated and determined to be "no action sites." Documentation is still in draft format and not yet approved by the State of Idaho and EPA.

- OU 2-07

OU 4-07 consists of four sites initially thought to be contaminated from cooling water. These sites were evaluated and determined to be "no action sites." Documentation is still in draft format and not yet approved by the State of Idaho and EPA.

- OU 2-08

The TRA reactor, OU 2-08, is divided into a reactor area and a utility area. The reactor area contains the inactive MTR and ETR and the operating ATR. All three test reactors have canals for adding or removing reactor fuel and core hardware. The canals are filled with water that acts as a radiation shield. The OU 2-08 MTR canal leaked. The bottom is approximately 60 feet below ground surface in building TRA-603. The canal was partitioned and the leaks fixed in the section currently used. The upgraded section is for storage of fuel rods from the PBF reactor. The waste type from the MTR canal is unknown, but is probably mixed fission products.

- OU 2-09

OU 2-09 encompasses the TRA Sewage Treatment and Sludge Pit (TRA-07), the Final Sewage Leach Pond (TRA-13), and the Cold Waste Disposal Pond (TRA-08). The Sewage Treatment Plant, Sludge Pit, and Leach Ponds make up the Sewage Treatment Area. The Cold Waste Pond is recommended for "no action."

The Sewage Treatment Area is located 150 feet east of the TRA security fence and is comprised of an Imhoff tank, trickling filter, chlorination basin, sludge pit, and leach pond containing two cells into which effluent is discharged. The dimensions of the northern cell, constructed in 1965 (65 cell), are 250 x 50 x 14 feet; and the dimensions of the southern cell, constructed in 1950 (50 cell), are approximately 250 x 80 x 18 feet. After 1952, the system was used continuously, receiving effluent from sanitary sewer drains throughout TRA at average discharges of 20 to 30 gallons per minute. The system is in use and will be upgraded in 1994.

Samples were collected from the Sewage Treatment Area during the summer of 1992. A Track 2 summary report demonstrated that the risks resulting from this area are dominated by external exposure to ionizing radiation. After completion of the new treatment system, an action to reduce the external exposure risk from this site should be considered. This recommendation will be addressed in the WAG-2 comprehensive RI/FS.

A multitude of organics, inorganics, and radionuclides were found at low levels in the sediments of the two sewage leach ponds. A risk assessment was conducted that identified cobalt (^{60}Co) and cesium (^{137}Cs) as contaminants posing the most significant risk for occupational and residential scenarios.

The extent of contamination in the Final Sewage Leach Ponds is concentrated in the upper sediments.

- OU 2-10

OU 2-10 is the TRA Warm Waste Pond. The Warm Waste Pond consists of three wastewater infiltration cells, used for the disposal of reactor cooling water, radioactive wastewater, and regenerative solutions from ion exchange. From 1952 until 1962, all liquid wastes from TRA, except sanitary sewage, were discharged to the Warm Waste Pond. Wastewater from the demineralization plant went into the pond until 1962. Other non-radioactive wastewater, including water from the cooling towers, was disposed in the Pond until 1964. Since 1964, the Warm Waste Pond received only radioactive wastewater. The volume of wastewater discharged to the Warm Waste Pond ranged from over 200 million gallons per year during the periods 1958-1963 and 1969-1976 to less than 20 million gallons per year from 1987 to the present. Contaminant levels in wastewater discharged to the Pond decreased significantly in the past 12 years because of installation of water treatment and cessation of use of hexavalent chromium in cooling towers. However, these past disposal practices resulted in the contamination of pond sediments.

In a ROD for pond sediments, the proposed remedial action involved soil washing, using physical separation and chemical extraction. Treatability studies, performed after the ROD,

proved unsuccessful. Therefore, sediments from the 3 cells will be consolidated into 1 or 2 cells, followed by containment by capping. With this alternative, no significant waste volumes requiring disposal will be produced. An *Auditable Safety Analysis for Test Reactor Area Warm Waste Pond Interim Action Operable Unit 2-10* (MK-FIC, 1993b), has been prepared for this remediation activity.

- OU 2-11

OU 2-11 consists of three sites suspected of containing low-levels of radionuclides or wastewater contamination. These sites were evaluated and determined to be "no action sites." Documentation is in draft and not yet approved by the State of Idaho and EPA.

- OU 2-12

OU 2-12 consisted of a remedial investigation of perched water under the TRA Warm Waste Pond. This perched water was thoroughly evaluated, a "no action" decision was made, and a ROD issued.

- OU 2-13

OU 2-13 consisted of TRA-06, TRA Chemical Waste Pond (TRA-701), and is the comprehensive RI/FS area for WAG-2.

WAG 3 - Idaho Chemical Processing Plant (ICPP)

WAG 3 is the Idaho Chemical Processing Plant (ICPP). Since 1950, the ICPP mission was the processing of spent nuclear fuel to recover reusable uranium and the management of high-level radioactive wastes. Byproducts of the processes were radioactive, hazardous, and mixed wastes including mixed fission products, heavy metals, and various solvents. Part of the current ICPP mission includes management of wastes and site environmental remediation. WAG-3 is divided into 13 OUs. Cleanup sites include potential releases from hazardous materials stored in a tank farm and items associated with wastewater disposal systems, such as sumps, ponds, and an injection well. Possible contaminants include polychlorinated biphenyls (PCBs), solvents, metals, hydrocarbons, asbestos, acids, and radionuclides.

- OU 3-01

OU 3-01 consists of four sites of suspected PCB contamination. Less than one gallon of liquid was estimated to have leaked from the CPP-705 and CPP-731 transformers. The sites and types of waste associated with each site are described in Table 4-10.

TABLE 4-10. SUMMARY OF OU 3-01.

DESCRIPTION	COMMENTS/CONTAMINANTS
CPP-49. PCB Transformer Yard (CPP-705)	Soil contaminated with PCBs and oils
CPP-50. PCB Transformer Yard (CPP-731)	Soil contaminated with PCBs and oils
CPP-51. PCB Staging Area West of CPP-660	Soil contaminated with PCBs and oils
CPP-61. PCB Spill in CPP-718 Transformer Yard	Soil contaminated with PCBs and oils

● OU 3-02

OU 3-02 consists of sites possibly contaminated from hexane and kerosene spills; mercury from paint and paint solvent discharges; contaminated paint chips and associated pads; an ICPP injection well which received wastes until 1984; ICPP Gravel Pits #1 and #2; a gas storage building; fire training pits; a solid waste storage bin; a drum storage area; soil contamination associated with a sulfuric acid spill; sewage treatment plant lagoons; a fly ash pit; and an abandoned gasoline tank. The sites and types of waste associated with each site are described in Table 4-11.

TABLE 4-11. SUMMARY OF OU 3-02.

DESCRIPTION	COMMENTS/CONTAMINANTS
CPP-07. Soil Contamination NW of CPP-642	No contamination*
CPP-12. Contaminated Paint Chips and Pad S of CPP-603	No contamination*
CPP-18. Gas Storage Building (currently location of CPP-668)	No contamination*
CPP-21. Solid Waste Storage Bin S of CPP-601	Site remediated
CPP-23. CPP Injection Well (MAH-FE-304)	Soil contaminated with low-level radionuclides; metals
CPP-37. CPP Gravel Pits #1 and #2	No contamination*
CPP-41. Fire Training Pits Between CPP-602 and CPP-603	No contamination*
CPP-53. Paint and Paint Solvent Area S of CPP-697	No contamination*
CPP-54. Drum Storage Area W of CPP-660	Soil contaminated with organic solvents and/or soils
CPP-55. Mercury Contaminated Area S of CPP T-15	Soil contaminated with solvents; mercury
CPP-57. Sulfuric Acid Spills E of CPP-606	No contamination*
CPP-59. Kerosene Tank Overflow W of CPP-633	Soil contaminated with hydrocarbons
CPP-60. Paint Shop (currently site of CPP-645)	Soil contaminated with metals; solvents
CPP-62. Mercury Contaminated Area Near CPP TB-4	No contamination*
CPP-63. Hexone Spill by CPP-710	Soil contaminated with hexone
CPP-64. Hexone Spill W of CPP-660	Soil contaminated with hexone
CPP-65. CPP Sewage Treatment Plant Lagoons	Low-levels of radionuclides
CPP-66. CPP Coal-Fired Steam Generation Facility Fly Ash Pit	Soil and fly ash contaminated with hydrocarbons and metals
CPP-68. Abandoned Gasoline Tank CPP VES-UTI-652	No known contamination

*Subsequent evaluation determined that there was no contamination.

- OU 3-03

OU 3-03 consists of percolation ponds for the discharge of ICPP service wastewater. The site is summarized in Table 4-12.

TABLE 4-12. SUMMARY OF OU 3-03.

DESCRIPTION	COMMENTS/CONTAMINANTS
CPP-67. CPP Percolation Ponds	Metals; radioactive contamination

- OU 3-04

OU 3-04 consists of the outside walls and roofs of nine CPP buildings with transite (containing asbestos) that has become partially friable. The site is summarized in Table 4-13.

TABLE 4-13. SUMMARY OF OU 3-04.

DESCRIPTION	COMMENTS/CONTAMINANTS
CPP-38. CPP Buildings with Friable Transite	Asbestos

- OU 3-05

OU 3-05 is the old sewage treatment plant. The site is summarized in Table 4-14.

TABLE 4-14. SUMMARY OF OU 3-05.

DESCRIPTION	COMMENTS/CONTAMINANTS
CPP-14. CPP Old Sewage Treatment Plant	Low-level radioactive and chemical

- OU 3-06

OU 3-06 consists of four sites where contamination is known to have occurred. The sites are summarized in Table 4-15.

TABLE 4-15. SUMMARY OF OU 3-06.

DESCRIPTION	COMMENTS/CONTAMINANTS
CPP-33. Contaminated Soil in Tank Farm Area Near WL-102, NE of CPP-604	Soil contaminated with radionuclides
CPP-34. Soil Storage Area in the NE Corner of the ICPP	Soil contaminated with radionuclides
CPP-40. Lime Pit at the Base of the CPP-601 Berm and French Drain	No contamination
CPP-47. Pilot Plant Storage Area West of CPP-620	No contamination

- OU 3-07

OU 3-7 includes eleven sites at the Tank Farm Area I. The sites are summarized in Table 4-16.

[Table 4-16 on following page.]

TABLE 4-16. SUMMARY OF OU 3-07.

DESCRIPTION	COMMENTS/ CONTAMINANTS
CPP-16. Contaminated Soil from Leak in Line from CPP WM-181	No contamination*
CPP-20. CPP-604 Radioactive Waste Unloading Area	Soil contaminated with radionuclides; metals
CPP-24. CPP Tank Farm Area Bucket Spill	No contamination*
CPP-25. Contaminated Soil in Tank Farm Area N of CPP-604	No contamination*
CPP-26. Contaminated Soil in Tank Farm Area from Steam Flushing	Soil contaminated with radionuclides; mercury
CPP-28. Contaminated Soil in Tank Farm Area S of WM-181 by Valve Box A-2	Soil contaminated with radionuclides; mercury
CPP-30. Contaminated Soil in Tank Farm Area Near Valve Box B-9	No contamination*
CPP-31. Contaminated Soil in Tank Farm Area S of Tank WM-183	Soil contaminated with radionuclides; mercury
CPP-32. Contaminated Soil in Tank Farm Area SW and NW of Valve Box B-4	Soil contaminated with radionuclides; mercury
CPP-79. Tank Farm Release Near Valve Box A-2	Soil contaminated with radionuclides
CPP-83. Well 55-06 (perched water)	Contaminated water

*Subsequent evaluation determined that there was no contamination.

- OU 3-08

OU 3-8 consists of six sites associated with the tank farm. The sites are summarized in Table 4-17.

TABLE 4-17. SUMMARY OF OU 3-08.

DESCRIPTION	COMMENTS/CONTAMINANTS
CPP-13. Pressurization of Solid Storage Cyclone NE of CPP-633	Soil contaminated with radionuclides; mercury
CPP-15. Solvent Burner East of CPP-605	No contamination
CPP-27. Contaminated Soil in Tank Farm East of CPP-604	Soil contaminated with radionuclides; mercury
CPP-29. Contaminated Soil North and West of Main Stack (CPP-708)	No contamination
CPP-35. CPP-633 Decontamination Spill	Soil contaminated with radionuclides; mercury
CPP-36. Transfer Line Lead from CPP-633 to WL-102	Soil contaminated with radionuclides; mercury

- OU 3-09

OU 3-09 consists of fifteen sites, thirteen of which are located in the ICPP-603 area. The site is summarized in Table 4-18.

[Table 4-18 on following page.]

TABLE 4-18. SUMMARY OF OU 3-09.

DESCRIPTION	COMMENTS/CONTAMINANTS
CPP-01. Concrete Settling Basin, Vault and Dry Well E of CPP-603	Radionuclide-contaminated soils
CPP-092. French Drain W of CPP-603	Radionuclide-contaminated soils
CPP-03. Temporary Storage Area SE of CPP 603	Radionuclide-contaminated soils
CPP-04. Contaminated Soil Area Around CPP-603 Settling Tank	Radionuclide-contaminated soils, previously remediated
CPP-05. Contaminated Soil Area Around CPP-603 Settling Basin	Radionuclide-contaminated soils, previously remediated
CPP-06. Trench E of CPP-603 Fuel Storage Basin	Radionuclide-contaminated soils
CPP-08. CPP-603 Basin Filter System Line Failure	Radionuclide-contaminated soils
CPP-09. Soil Contamination Near NE Corner of CPP-603 South Basin	Radionuclide-contaminated soils
CPP-10. CPP-603 Plastic Pipeline Break	Radionuclide-contaminated soils, previously remediated
CPP-11. CPP-603 Sludge and Water Release	Radionuclide-contaminated soils, previously remediated
CPP-17. Soil Storage Area S of CPP Peach Bottom Fuel Storage Area	Radionuclide-contaminated soils
CPP-19. CPP-603 to CPP-604 Line Leak	Radionuclide-contaminated soils, previously remediated
CPP-22. Particulate Air Release S of CPP-603	Radionuclide-contaminated soils, previously remediated
CPP-69. Abandoned Liquid Radioactive Waste Storage Tank CPP VES-SFE-20	Tank containing low-level radioactive waste; possible soil contamination
CPP-78. Contaminated Soil W of CPP-693, E of Dry Fuel Storage Area	Radionuclide-contaminated soils

- OU 3-10

OU 3-10 consists of four suspected chemical disposal sites. The sites are summarized in Table 4-19.

TABLE 4-19. SUMMARY OF OU 3-10.

DESCRIPTION	COMMENTS/CONTAMINANTS
CPP-42. Drainage Ditch W of CPP-637	No contamination
CPP-44. Grease Pit S of CPP-608	No contamination
CPP-46. CPP-637 Courtyard Pilot Plant Release	No contamination
CPP-56. Nitric Acid Contamination S of CPP-734	No contamination

- OU 3-11

OU 3-11 consists of two sites, the Chemical Storage Area and the Evaporator Overhead Pipeline. The sites are summarized in Table 4-20.

TABLE 4-20. SUMMARY OF OU 3-11.

DESCRIPTION	COMMENTS/CONTAMINANTS
CPP-45. CPP-621 Chemical Storage Area Spills	No contamination
CPP-58. CPP PEW Evaporator Overhead Pipeline Spills	Soil contaminated with radionuclides and acid

- OU 3-12

OU 3-12 consists of sites recently added to this WAG. These sites have soils contaminated with suspected radionuclide and hazardous chemicals. The sites are summarized in Table 4-21.

TABLE 4-21. SUMMARY OF OU 3-12.

DESCRIPTION	COMMENTS/CONTAMINANTS
CPP-80. CPP-601 Vent Tunnel Drain Leak	Soil contaminated with radionuclides and hazardous chemicals
CPP-81. Abandoned CPP-637/CPP-601 VOG Line	No contamination
CPP-82. Abandoned Line (1-1/2") PLA-776, W of Beach Street	No contamination

- OU 3-13

OU 3-13 is the overall OU for the comprehensive RI/FS, perched water zones at the ICPP, and other miscellaneous units requiring investigation. The site is summarized in Table 4-22.

TABLE 4-22. SUMMARY OF OU 3-13.

DESCRIPTION	COMMENTS/CONTAMINANTS
CPP-39. CPP HF Storage Tank (YDB-105) and Dry Well	No contamination
CPP-48. French Drain South of CPP-633	No contamination
Comprehensive RI/FS	Soils contaminated with radionuclides; chemicals

WAG 4 - Central Facilities Area (CFA)

This WAG consists of thirteen OUs within the CFA. Services for the entire INEL are located at CFA including the DOE Radiological and Environmental Services Laboratory; the United States Geological Survey; security; fire protection; medical facilities; communications systems; warehouses; a cafeteria; vehicle and equipment pools; a bus system; and laundry facilities. The CFA sites investigated under the FFA/CO include historical spills, tanks, landfills, ponds, leach fields, and leach pits.

- OU 4-01

OU 4-01 consists of two sites containing unexploded ordnance. This OU was transferred to OU 10-05 and included in an "Interim Action" in 1993. The sites and the types of associated waste are described in Table 4-23.

TABLE 4-23. SUMMARY OF OU 4-01.

DESCRIPTION	COMMENTS/CONTAMINANTS
CFA-09. CFA Central Gravel Pit	Unexploded ordnance
CFA-11. CFA French Drain N of CFA-633	Unexploded ordnance

- OU 4-02

OU 4-02 consists of five dry wells with no records indicating receipt of hazardous constituents. Consequently, the sites are listed as "no action" sites. The sites and types of associated waste are described in Table 4-24.

TABLE 4-24. SUMMARY OF OU 4-02.

DESCRIPTION	COMMENTS/CONTAMINANTS
CFA-13. CFA Dry Well (S of CFA-640)	No contaminants
CFA-14. CFA Two Dry Wells (CFA-665)	No contaminants
CFA-15. CFA Dry Well (CFA-674)	No contaminants
CFA-16. CFA Dry Well (S of CFA-682 Pumphouse)	No contaminants

- OU 4-03

OU 4-03 consists of UST sites used for petroleum products. One of the tanks contained sulfuric acid. Potential soil contaminants include total petroleum hydrocarbons and BETX. Protection of groundwater from these contaminants will result in a completion of Track 1 investigations probably resulting in a "no action" determination for all of the sites. The sites and types of associated waste are described in Table 4-25.

TABLE 4-25. SUMMARY OF OU 4-03.

DESCRIPTION	COMMENTS/CONTAMINANTS
CFA-18. CFA Fire Department Training Area, Oil Storage Tanks	Hydrocarbons
CFA-19. CFA Gasoline Tanks (2) E of CFA-606	No contaminants
CFA-20. CFA Fuel Oil Tank at CFA-609 (CFA-732)	Tank removed; other wastes unknown
CFA-21. CFA Fuel Tank at Nevada Circle 1 (S by CFA-629)	Tank removed; soil contaminated with diesel fuel
CFA-22. CFA Fuel Oil Tank at CFA-640	Tank removed; other wastes unknown
CFA-23. CFA Fuel Oil Tank at CFA-641	Tank removed; no contaminants
CFA-24. CFA Fuel Tank at Nevada Circle 2 (S by CFA-629)	Tank removed; no contaminants
CFA-25. CFA Fuel Oil Tank at CFA-656 (N side)	Tank removed; no contaminants
CFA-27. CFA Fuel Oil Tank at CFA-669 (CFA-740)	No contaminants
CFA-28. CFA Fuel Oil Tank at CFA-674 (W)	Hydrocarbons
CFA-29. CFA Waste Oil Tank at CFA-664, Active	Tank removed; no contaminants
CFA-30. CFA Waste Oil Tank at CFA-665, Active	Tank removed; no contaminants
CFA-31. CFA Waste Oil Tank at CFA-754, Active	Hydrocarbons
CFA-32. CFA Fuel Oil Tank at CFA-667 (N side)	Tank removed; no contaminants
CFA-33. CFA Fuel Oil Tank at CFA-667 (S side)	Tank removed; no contaminants
CFA-34. CFA Diesel Tank at CFA-674 (S)	Tank removed; no contaminants
CFA-35. CFA Sulfuric Acid Tank at CFA-674 (W side)	Tank removed; no contaminants
CFA-36. CFA Gasoline Tank at CFA-680	Tank removed; no contaminants
CFA-37. CFA Diesel Tank at CFA-681 (S side)	Tank removed; no contaminants
CFA-38. CFA Fuel Oil Tank, CFA-683	Hydrocarbons

- OU 4-04

OU 4-04 consists of the CFA drum storage area. Suspected contaminants are chemicals such as solvents and oils. The sites and types of associated waste are described in Table 4-26.

- OU 4-05

OU 4-05 consists of two sites, the CFA Pond and the Fire Department Training Area. The sites and types of associated waste are described in Table 4-27. A Track 2 investigation will be conducted for CFA-04 and a Track 1 investigation for CFA-17 was prepared.

TABLE 4-26. SUMMARY OF OU 4-04.

DESCRIPTION	COMMENTS/CONTAMINANTS
CFA-39. CFA "Drum Dock" (CFA-771)	Possible soil contamination with oils; solvents
CFA-40. CFA Returnable Drum Storage S of CFA-601	Possible soil contamination with oils; solvents
CFA-41. CFA Excess Drum Storage S of CFA-674	Possible soil contamination with oils; solvents

TABLE 4-27. SUMMARY OF OU 4-05.

DESCRIPTION	COMMENTS/CONTAMINANTS
CFA-04. CFA Pond (CFA-674)	Soil contaminated with hazardous chemicals; low-level radionuclides; and metals
CFA-17. CFA Fire Department Training Area, Bermed	Soil contaminated with petroleum hydrocarbons

- OU 4-06

OU 4-06 consists of three sites with possible paint and lead contamination. The sites and types of associated waste are described in Table 4-28.

TABLE 4-28. SUMMARY OF OU 4-06.

DESCRIPTION	COMMENTS/CONTAMINANTS
CFA-44. CFA Spray Paint Booth Drain (CFA-654)	Soil contaminated with lead-based paints and solvents
CFA-06. CFA Lead Shop (Outside Areas)	Soil contaminated with lead and solvents
CFA-43. CFA Lead Storage Area	Soil contaminated with lead and solvents

- OU 4-07

OU 4-07 consists of the CFA french drains and associated contaminants. Disposed wastes to the french drains included solvents, oily waste, pesticides, organic chemicals, inorganic

chemicals, acids, bases, heavy metals, and low-level radioactive waste. The sites and types of associated waste are described in Table 4-29.

TABLE 4-29. SUMMARY OF OU 4-07.

DESCRIPTION	COMMENTS/CONTAMINANTS
CFA-07. CFA French Drain E/S of (CFA-633)	Solvents; oily waste; pesticides; organic chemicals; inorganic chemicals; acids; bases; heavy metals; low-level radioactive waste
CFA-12. CFA French Drains (2) (CFA-690)	Solvents; oily waste; pesticides; organic chemicals; inorganic chemicals; acids; bases; heavy metals; low-level radioactive waste

- OU 4-08

OU 4-08 consists of the CFA sewage plant, septic tank, and drain field. Wastes from sanitary sewage systems, a laundry that handled radioactively contaminated clothing, and other CFA facilities flowed into the system. The site and types of associated waste are described in Table 4-30.

TABLE 4-30. SUMMARY OF OU 4-08.

DESCRIPTION	COMMENTS/CONTAMINANTS
CFA-08. CFA Sewage Plant (CFA-691), Septic Tank (CFA-716), and Drain Field	Soil potentially contaminated with radionuclides and metals

- OU 4-09

OU 4-09 consists of CFA transformer spill sites with suspected PCB and petroleum hydrocarbon soil contamination. The sites and types of associated waste are described in Table 4-31.

TABLE 4-31. SUMMARY OF OU 4-09.

DESCRIPTION	COMMENTS/CONTAMINANTS
CFA-10. CFA Transformer Yard Oil Spills	Soil contaminated with PCBs and petroleum hydrocarbons
CFA-26. CFA 760 Pump Station Fuel Spill	Soil contaminated with petroleum hydrocarbons
CFA-42. CFA Tank Farm Pump Station Spills	Soil contaminated with petroleum hydrocarbons

- OU 4-10

OU 4-10 is the CFA Landfill I, which was the primary landfill for all facilities at the INEL from 1951 to 1970. The site and the types of associated waste are described in Table 4-32.

TABLE 4-32. SUMMARY OF OU 4-10.

DESCRIPTION	COMMENTS/CONTAMINANTS
CFA-01. CFA Landfill I	Asbestos; metals; organics; acids; waste paints and thinners; solvents and pesticides; sanitary wastes

- OU 4-11

The CFA Motor Pool Pond received wastes from two sumps located at the CFA Service Station. One sump is located in the bus wash bay and collected wastes from bus washes and from floor drains in the adjacent service bay. In the service bay, routine servicing of fleet vehicles was performed. The second sump is located outside the station and collected wastes from the steam cleaning bay and roof downspouts. The motor pool pond received wastes from the two sumps from 1951 until 1985. After 1985, wastes were diverted through an oil/water separator to a sanitary sewer line connected to the sewage treatment plant.

During the 35-year service life of the motor pool pond, the wastestream mainly consisted of wastewater from washing vehicles. According to service station personnel, the waste volumes were highest from 1978 until 1985, when automatic washing systems were in place at the service station. The automatic systems permitted washing 30 buses and 10 cars and trucks per day. These washes are estimated to have generated up to 4,200 gallons of wastewater per day that was discharged to the pond.

Wastes from vehicle washes can be assumed to have contained metals and organic compounds associated with road dust, oil, and grease. On several occasions, vehicles and equipment with small amounts of radioactive contamination were washed at the station. Because the CFA is not a controlled area where radioactive materials are handled in large amounts, highly contaminated vehicles were not decontaminated at the service station.

A "no further action" ROD for this OU was signed in January, 1993.

- OU 4-12

OU 4-12 consists of CFA Landfills II and III. Both were municipal-type landfills and are no longer in use. The sites and types of associated waste are described in Table 4-33.

TABLE 4-33. SUMMARY OF OU 4-12.

DESCRIPTION	COMMENTS/CONTAMINANTS
CFA-02. CFA Landfill II	Sanitary wastes; construction debris; paint thinners; solvents; asbestos; chemicals
CFA-03. CFA Landfill III	Sanitary wastes; construction debris; paint thinners; solvents; asbestos; chemicals

- OU 4-13

OU 4-13 is the comprehensive RI/FS for WAG-4.

WAG 5 - Power Burst Facility (PBF) and Auxiliary Reactor Area (ARA)

WAG 5 consists of the Power Burst Facility (PBF) and Auxiliary Reactor Area (ARA). PBF is located in an area originally constructed for the Special Power Excursion Reactor Tests (SPERT). Four SPERT reactors were built beginning in the late 1950s in a radial array around what is now the PBF control and personnel building complex. All of the SPERT reactors were removed, and SPERT facilities have undergone partial or complete D&D. The PBF reactor is still operational, but in a standby mode.

The ARA consists of four separate groupings of buildings in which various activities have occurred, including the operation of test reactors. All of the ARA reactors were removed and the facilities have undergone partial or complete D&D.

PBF and ARA sites investigated include tanks and components of wastewater disposal systems (such as evaporation and percolation ponds, leach

fields, pits, and dry wells). The boundary of WAG 5 encompasses the facility locations presently or historically used within the PBF and ARA areas and those immediately adjacent areas where waste activities may have taken place. The WAG is divided into thirteen OUs and includes all surface and subsurface areas, except those designated as part of WAG 10.

- OU 5-01

OU 5-01 consists of six subunits suspected of low-level radioactive or mixed waste contamination. Tanks in ARA-15, 18, and 19 are scheduled for removal by the INEL D&D program. The sites and types of associated waste are described in Table 4-34.

TABLE 4-34. SUMMARY OF OU 5-01.

DESCRIPTION	COMMENTS/CONTAMINANTS
ARA-05. ARA I Evaporation Pond to NE (ARA 744)	No action site; surface contamination transferred to SL-1 surface cleanup project
ARA-15. ARA III Radionuclide Tank (ARA 735)	Radioactive contamination in tank
ARA-16. ARA I Radionuclide Tank (ARA 729)	Radioactive contamination in tank
ARA-17. ARA I Boiler Blowdown Drainage Area (ARA 626)	No contamination
ARA-18. ARA III Radionuclide Tank (ARA 736)	Radioactive contamination in tank
ARA-19. ARA II Detention Tank for Fuel Oil and Radionuclides (ARA 719)	Tank containing radioactively contaminated fuel oil from SL-1 cleanup

- OU 5-02

OU 5-02 consists of three leach ponds suspected of containing low-levels of radionuclides. The sites and types of associated waste are described in Table 4-35.

TABLE 4-35. SUMMARY OF OU 5-02.

DESCRIPTION	COMMENTS/CONTAMINANTS
PBF-12. PBF SPERT I Leach Pond	Radionuclides in soil; Track 1 document proposed Track 2 investigation
PBF-21. PBF SPERT III Large Leach Pond	Radionuclides in soil; site covered with clean backfill in 1982
PBF-26. SPERT IV SPERT Lake (Adjacent to PBF 758)	Heavy metals at outlet pipe; one soil sample with low levels of PCB contamination; Track 1 document proposed at a Track 2 investigation

- OU 5-03

OU 5-03 consists of five subunits, which are documented in draft Track 1 documents. These sites all were recommended for "no action." Table 4-36 summarizes sites within this OU.

TABLE 4-36. SUMMARY OF OU 5-03.

DESCRIPTION	COMMENTS/CONTAMINANTS
PBF-ZY. PBF Cooling Tower Area and Drainage Ditch	No action site
PBF-06. PBF Reactor Area Blowdown Pit for Reactor Boiler by PBF 621	No action site
PBF-07. PBF Reactor Area Oil Drum Storage (PER T13)	No action site
PBF-13. PBF Reactor Area Rubble Pit	No action site
PBF-24. PBF SPERT IV Blowdown Pit (Adjacent to PBF 716)	No action site

- OU 5-04

OU 5-04 consists of three petroleum USTs. Two were removed, and one currently is in service. One of the removed tanks leaked (PBF-04). As much contaminated soil as possible was removed. However, residual contamination exists under building PBF-608. The sites and types of associated waste are described in Table 4-37.

TABLE 4-37. SUMMARY OF OU 5-04.

DESCRIPTION	COMMENTS/CONTAMINANTS
PBF-04. PBF Control Area Oil Tank at PBF 608 Substation	Soil contaminated with petroleum hydrocarbons (recommended for no action until buildings on top of site are removed)
PBF-14. SPERT II Inactive Fuel Oil Tank (Front of PBF 612)	Tank in use
PBF-19. SPERT III Inactive Fuel Oil Tank at PBF 609 (W Side of WERF)	Tank was removed; proposed no action site

● OU 5-05

OU 5-05 is the ARA burial ground known to contain low-level radioactive materials from the cleanup of the SL-1 reactor accident. The SL-1 burial ground was created to store and dispose of contaminated material not sent to the Radioactive Waste Management Complex (RWMC). The site consists of 2 trenches and 1 pit. The burial ground is considered to be two separate areas of contamination; the buried waste and the surface contamination. Surface contamination represents a direct exposure risk plus an airborne dispersion pathway for radionuclides. Buried waste presents a potential groundwater threat because of the high amount of activity stored within the waste. Surface contamination is not from the migration of buried material, but the result of the initial waste-handling process. Other differences between the two contamination areas are apparent. Surface contamination is relatively well characterized, and, if necessary, further characterization should be relatively straight forward. Buried waste is not well characterized, and any further characterization is likely to be difficult and time consuming. In addition, remediation methods for each area are different.

The draft Track 1 document considers this site to warrant further RI/FS investigation. The site is planned for Track 2 investigation in accordance with the Action Plan. Table 4-38 summarizes this unit.

TABLE 4-38. SUMMARY OF OU 5-05.

DESCRIPTION	COMMENTS/CONTAMINANTS
ARA-06. ARA II SL-1 Burial Ground	Buried waste contaminated with various radionuclides; contaminated soil

- OU 5-06

OU 5-06 consists of a leach pond and a leach pit, suspected sites of radiological contamination. These sites were last used in the late 1950s and early 1960s. The sites and types of associated waste are described in Table 4-39.

TABLE 4-39. SUMMARY OF OU 5-06.

DESCRIPTION	COMMENTS/CONTAMINANTS
ARA-12. ARA III Radioactive Waste Leach Pond	Potential for radioactively contaminated soil
ARA-20. ARA IV Test Area Contaminated Leach Pit #1	Radioactively contaminated soil; organic and metal contamination

- OU 5-07

OU 5-07 consists of two subunits with possible radioactive contamination. These sites are part of a FY-93 Track 2 investigation. The sites and types of associated waste are described in Table 4-40.

TABLE 4-40. SUMMARY OF OU 5-07.

DESCRIPTION	COMMENTS/CONTAMINANTS
ARA-02 ARA I Sanitary Waste Leach Field and Seepage Pit (ARA 746)	Soil contaminated with radioactive materials
ARA-03 ARA I Pad Near ARA 627 (Lead sheeting)	Soil contaminated with radioactive materials

- OU 5-08

OU 5-08 consists of 2 injection wells and 1 seepage pit. None of the sites have been investigated. Track 2 investigations are scheduled. The sites and types of associated waste are described in Table 4-41.

TABLE 4-41. SUMMARY OF OU 5-08.

DESCRIPTION	COMMENTS/CONTAMINANTS
PBF-05. PBF Reactor Area Warm Waste Injection Well (PBF 301)	Soil contaminated with low-levels of radioactivity
PBF-11. SPERT I Seepage Pit (PBF 750)	Soil contaminated with salts, acids and caustics
PBF-15. PBF Reactor Area Corrosive Waste Injection Well (PBF 302)	Soil contaminated with salts, acids and caustics

- OU 5-09

OU 5-09 consists of three leach ponds. Radioactive material surveys did not detect any radiological contamination. These ponds were used to dispose ion exchange regeneration solutions. The sites are summarized in Table 4-42.

TABLE 4-42. SUMMARY OF OU 5-09.

DESCRIPTION	COMMENTS/CONTAMINANTS
PBF-16. SPERT II Leach Pond	No contamination above regulatory limits found
PBF-20. SPERT III Small Leach Pond	Soil contaminated with acids and caustics
PBF-22. SPERT IV Leach Pond (PBF 758)	Soil contaminated with low-levels of radioactivity and metals

- OU 5-10

The ARA I Chemical Evaporation Pond (ARA 745) is designated site ARA-01. This pond (known as the ARA I Chemical Waste Pond) was installed in 1970 as an unlined surface impoundment of ARA 627. This building was a print shop, materials research facility, and radiochemistry laboratory. The pond received waste discharges from this building from 1970 to 1988. The only current flow into

the pond is from natural runoff. The ponded area is about 66 feet in diameter. The 1990 site characterization covered an area of 130 feet by 460 feet, completely encompassing the pond and surrounding landscape.

The 1990 site characterization study demonstrated that several metals were present above background levels, as was the radio-isotope cesium (^{137}Cs). Several volatile organic compounds (VOCs) were present in parts per million (ppm) quantities; and isotopes of Cs, Cobalt (Co), uranium (U), and plutonium (Pu) were detectable in pCi/g quantities. The background concentrations for these isotopes were not determined. An RI was conducted to determine risks associated with ARA-01. In a ROD dated December 1992, DOE, with EPA and IDHW concurrence, determined that no further remedial action is necessary for this site.

- OU 5-11

OU 5-11 consists of the ARA-III sanitary sewer tank and leach field. The sites and types of associated waste are described in Table 4-43.

TABLE 4-43. SUMMARY OF OU 5-11.

DESCRIPTION	COMMENTS/CONTAMINANTS
ARA-13. ARA-III Sanitary Sewer Leach Field and Septic Tank (ARA 740)	Unknown

- OU 5-12

OU 5-12 is the comprehensive RI/FS for WAG 5.

- OU 5-13

OU 5-13 consists of the PBF corrosive waste sump (PBF-08) and the PBF evaporation pond (PBF-10). PBF-08 is a PBF reactor building unlined concrete structure (PBF-620) used during the neutralization of spent reactor secondary coolant water, prior to discharge to the evaporation pond. The evaporation pond (PBF-10) is a lined surface impoundment of the PBF reactor building. The pond receives secondary coolant from the reactor following neutralization and mixing in the corrosive waste sump. A ROD was issued for both sites requiring remediation because of the immediate human health risk posed by chromium contamination. Table 4-44 provides a summary of OU 5-13 sites.

TABLE 4-44. SUMMARY OF OU 5-13.

DESCRIPTION	COMMENTS/CONTAMINANTS
PBF-08. PBF Reactor Area Corrosive Waste Disposal Sump Brine Tank	Tank contaminated with hazardous materials including metals
PBF-10. PBF Reactor Area Evaporation Pond (PBF 733)	Soil contaminated with hazardous materials including metals

WAG 6 - Experimental Breeder Reactor No. I and Boiling Water Reactor Experiment Areas

WAG 6 consists of the Experimental Breeder Reactor No. I (EBR-I) and Boiling Water Reactor Experiment (BORAX) areas. Both areas were originally constructed to house test reactors and have since been decommissioned. EBR-I currently is designated as a National Historical Landmark. The BORAX area was the site of five different reactors, but many of the facilities were removed and no operations are occurring. BORAX-I was intentionally destroyed in 1954 and a new site, northeast of BORAX-I was selected for BORAX-II through BORAX-V. The BORAX-V facility currently is undergoing D&D. WAG-6 is divided into 5 OUs, including old tanks, a small spill, and several liquid and solid waste disposal sites. Possible contaminants include heavy metals, petroleum products, and radionuclides.

- OU 6-01

OU 6-01 consists of the BORAX-I burial site, the site of an intentionally destroyed reactor. The site and types of associated waste are described in Table 4-45.

TABLE 4-45. SUMMARY OF OU 6-01.

DESCRIPTION	COMMENTS/CONTAMINANTS
BORAX-02. BORAX-I Burial Site	Radioactively contaminated debris (metal and concrete) and soil

- OU 6-02

OU 6-02 consists of three subunits including a leach pond, septic tank, and trash dump. The trash dump was remediated during D&D operations and is a "no action site." The leach pond and septic tank are scheduled to be assessed by Track 1 investigations. The sites and types of associated waste are described in Table 4-46.

TABLE 4-46. SUMMARY OF OU 6-02.

DESCRIPTION	COMMENTS/CONTAMINANTS
BORAX-01. BORAX II-V Leach Pond	Soil contaminated with radionuclides
BORAX-03. BORAX AEF Septic Tank (AEF-703)	Soil and tank with heavy metals; hazardous contaminants
BORAX-04. BORAX Trash Dump	No action site

- OU 6-03

OU 6-03 consists of ten petroleum USTs. The sites and types of associated waste are described in Table 4-47.

[Table 4-47 on following page.]

TABLE 4-47. SUMMARY OF OU 6-03.

DESCRIPTION	COMMENTS/CONTAMINANTS
BORAX-05. BORAX Fuel Oil Tanks, SW of AEF-602	5,500 and 300 gal tank; stored heating oil; removed 1990; tank had visible holes; some soil contamination; maximum TPH of 6,600 ppm; no action site
BORAX-07. BORAX Inactive Fuel Oil Tank by AEF-601	500 gal tank; stored heating oil, removed 1990; tank had visible holes, some soil contamination
EBR-07. EBR-I (AEF-704) Fuel Oil Tank, Soon Inactive	Heating oil tank; size unknown; removed and delisted
EBR-08. EBR-I (WMO-703)	4,250-gal tank; stored gasoline; removed 1990; residual VOC contamination; removed
EBR-09. EBR-I (WMO-704) Fuel Oil Tank at WMO-601	200 gal heating oil tank; still in place; delisted
EBR-10. EBR-I (WMO-705) Gasoline Tank	50 gal tank; stored gasoline; removed 1990; residual VOC contamination; action unknown
EBR-11. EBR-I Fuel Oil Tank	4,500 gal tank; stored heating oil; removed 1990 and delisted
EBR-12. EBR-I Diesel Tank (EBR-707)	1,000 gal tank; stored diesel fuel; removed 1990 and delisted
EBR-13. EBR-I Gasoline Tank (EBR-708)	550 gal tank; stored gasoline; removed 1990 and delisted; residual soil contamination removed to CFA landfill
EBR-14. EBR-I Gasoline Tank (EBR-717)	500 gal tank; stored gasoline; still in place and delisted

● OU 6-04

OU 6-04 consists of radioactive soil contamination from a spill involving activities at EBR-I and is designated with site code EBR-15. EBR-15 consists of two areas in the vicinity of EBR-I contaminated with ¹³⁷Cs. When first detected in 1988, Area 1 was approximately 9,900 square feet and Area 2 was approximately 6,800 square feet. Risk assessments performed found the risk from ¹³⁷Cs and strontium (⁹⁰Sr) in Areas 1 and 2 and americium (²⁴¹Am) and europium (¹⁵⁴Eu) in Area 1 to be above acceptable risk levels. Non-radioactive contaminants were shown to pose no risk above acceptable risk levels. Current recommendations for the site are for further site characterization under the Track 1 protocol, with likely Track 2 investigations. Table 4-48 summarizes this unit.

TABLE 4-48. SUMMARY OF OU 6-04.

DESCRIPTION	COMMENTS/CONTAMINANTS
EBR-15. Radioactive Soil Contamination (EBR-1)	Soil contaminated with radionuclides and hazardous constituents

- OU 6-05

OU 6-05 is the comprehensive RI/FS for WAG-6.

WAG 7 - Radioactive Waste Management Complex (RWMC)

The RWMC was established in 1952 as a controlled area for the disposal of solid radioactive wastes. The primary RWMC site being investigated under the FFA/CO is the Subsurface Disposal Area (SDA). Located on the west side of the RWMC, the SDA includes numerous pits, trenches, and vaults where radioactive and organic wastes were placed, and a large aboveground pad where waste containers were stacked and covered. To the east of the SDA is the Transuranic Storage Area (TSA), an aboveground facility for storage of transuranic (TRU) waste, and associated support facilities. The TSA complex includes the Stored Waste Examination Pilot Plant (SWEPP) Project, which is not part of the WAG 7 activities. WAG-7 is divided into 14 OUs.

- OU 7-01

OU 7-01 is all SDA soil vaults containing waste stored before October 1, 1990. Vaults are designated by site code RWMC-04. Soil vaults are cylindrical holes drilled into the ground for disposal of waste with radiation levels in excess of 500 mR/hr at 3 feet from the container surface. If a vault's floor was basalt rock, soil was placed over the basalt. Each vault is separated from any previously buried waste by a minimum of 2 feet. When filled, each vault is covered with a soil layer. Suspected contaminants include radioactive and nonradioactive hazardous materials. Table 4-49 summarizes this unit.

TABLE 4-49. SUMMARY OF OU 7-01.

DESCRIPTION	COMMENTS/CONTAMINANTS
RWMC-04. SDA Soil Vaults	Types of materials disposed in vaults is known; extent of contamination around or beneath vaults is unknown and will be the subject of a Track 2 investigation.

- OU 7-02

OU 7-02 consists of the SDA acid pit located near the center of the SDA, and designated by site code RWMC-04. The pit was in use from 1954 to 1961. It extends down to the top of the first basalt layer. Geophysical surveys indicate metal objects in the pit. Suspected contaminants include radioactive and nonradioactive hazardous materials. This OU is scheduled for Track 2 scoping investigations.

Reports indicate that as acids were placed in the pit, lime was periodically added to neutralize the acids. A soil cover was added on a daily or weekly basis. The pit received both liquid organic and inorganic wastes, some containing radionuclides. Informational searches indicate that disposed wastes include carbon tetrachloride, organic solvents (trichloroethylene, trichloroethane, and tetrachloroethylene), radioactively contaminated acids, and cleaning solutions. Radioactive contaminants are believed to be low-level wastes, primarily U, with some ⁹⁰Sr, ¹³⁷Cs, ⁶⁰Co, and TRU radionuclides. The acids include nitric, sulfuric, hydrofluoric, and aluminum acids. Quantities added varied considerably, with the largest additions in the range of 40,000 gallons. This unit is summarized in Table 4-50.

TABLE 4-50. SUMMARY OF OU 7-02.

DESCRIPTION	COMMENTS/CONTAMINANTS
RWMC-04. SDA Acid Pit	Contaminants include liquid organic and inorganic wastes, some containing radionuclides. The full extent of contamination that has migrated from the acid pit will be addressed in an RI/FS

- OU 7-03

OU 7-03 consists of the non-TRU contaminated waste pits and trenches designated by site code RWMC-04. Suspected contaminants include radioactive and nonradioactive hazardous materials. Wastes were generated in a large number of on- and offsite facilities and disposed in these trenches. Material in the trenches is in excess of 75,000 cubic meters. Data indicate that some migration of radionuclides and volatile organics to surface soils occurred. Burials took place in the 1960s and early 1970s. This OU is scheduled for preliminary Track 1 investigations. Table 4-51 summarizes OU 7-03.

TABLE 4-51. SUMMARY OF OU 7-03.

DESCRIPTION	COMMENTS/CONTAMINANTS
RWMC-04. Non TRU-Contaminated Waste Pits and Trenches	Contaminants include organic, inorganic, and radioactive wastes; for example, records indicate that Trench #36 contains the following: boxes=drums; radioactively contaminated paper, metal, wood, graphite, resin, lagging, filters, plastic, zirconium; misc. radioactive waste; core and loop components; hot cell waste; canal trash; a source; depleted ²³⁸ U; irradiated end boxes

- OU 7-04

OU 7-04 consists of the air pathways for the RWMC. Suspected contaminants include radioactive and nonradioactive hazardous materials.

Air monitoring for particulate radionuclides currently is conducted as part of a regular monitoring program at the RWMC. No regular monitoring is conducted for nonradioactive materials. Potential sources for air contaminants include the active pits; TRU waste; TRU mixed waste; low-level mixed waste; hazardous waste buried in the pits and trenches; and liquid wastes poured into selected pits at the RWMC. Soil gas surveys taken during a screening for 13 compounds identified 1,1,1-trichloroethane, carbon tetrachloride, trichloroethylene, tetrachloroethylene, and chloroform. This OU is scheduled for Track 2 scoping investigations.

- OU 7-05

OU 7-05 consists of the surface, water pathways, and surficial sediments associated with the RWMC. Suspected contaminants include radioactive and nonradioactive hazardous materials. The surface water pathway and surficial sediments were defined as surficial sediments to a depth of 1 foot within the local drainage basin of the RWMC that may have been contaminated with surface water runoff from the RWMC. Track 2 risk assessments indicate that current levels of contamination do not pose a risk above the currently acceptable risk levels (that is, less than 1E-04), using conservative risk calculations. OU 7-05 is recommended for "no further action."

- OU 7-06

OU 7-06 consists of the groundwater pathway associated with the RWMC. Suspected contaminants include radioactive and nonradioactive hazardous materials. These contaminants are associated

with the subsurface soils and groundwater. Further identification of the extent of contamination will be part of the Track 2 scoping investigations and RI/FS work.

- OU 7-07

OU 7-07 consists of the vadose zone associated with the RWMC. The vadose zone is described as the subsurface region, beginning at the surface, down to the top of the Snake River Plain Aquifer. For this OU, the contaminants under study in the vadose zone are limited to radionuclides and metals. Organic contamination in this zone is addressed in OU 7-08. Radionuclides found in vadose zone samples in the past include hydrogen (^3H), ^{60}Co , ^{137}Cs , ^{154}Eu , ^{238}Pu , ^{239}Pu , ^{240}Pu , and ^{241}Am . Inorganic compounds were detected in the vadose zone. A reference for the radionuclides and organics is *RI/FS Work Plan of the Subsurface Disposal Area, Radioactive Waste Management Complex at the INEL*, EGG-WM-8776 (EG&G, 1989). The specific types and concentrations of contaminants will be determined as part of the Track 2 investigations.

- OU 7-08

OU 7-08 consists of the RI/FS for the vadose zone associated with the RWMC. For this OU, investigation and potential remediation of contaminants are limited to VOCs. Radionuclides and metal contamination are addressed in OU 7-07. Primary sources of VOC contamination and release mechanisms were identified as inactive pits and trenches. Contaminants could be released from these areas to the air through volatilization or through leaching to the groundwater by infiltration of surface water.

Vapor vacuum extraction was investigated as a potential remediation technology for VOC contamination. The system was tested for periods of two weeks and four months. During these tests 1,116 pounds of carbon tetrachloride and 427 pounds of trichloroethylene were removed. The test system used vapor phase granular-activated carbon (GAC) to capture organic vapors. A full scale system will probably use a catalytic oxidation offgas treatment system that will destroy the organic contaminants.

- OU 7-09

OU 7-09 consists of the contaminant releases from the Transuranic Storage Area, and is designated by site code RWMC-05. The TSA is a 56-acre area consisting of four aboveground storage pads and soil vaults. The TSA and waste stored in the TSA are regulated by RCRA and are not part of WAG 7. The TSA was established in 1970 for retrievable storage of waste with contamination levels of TRU greater than 10 nCi/g. Waste is stored aboveground on asphalt pads. After a section of a pad was filled with waste containers, successive layers of plywood, nylon-reinforced polyvinyl sheeting, and approximately 3 feet of soil were placed over the containers. The wastes were generated by operations

conducted in support of DOE (and formerly Atomic Energy Commission (AEC)) programs at numerous locations.

The total volume of waste placed at TSA between 1970 and 1980 was approximately 1,500,000 cubic feet. This OU encompasses any past releases from the wastes at TSA. Previous sampling programs have not identified any contamination in excess of regulatory limits near TSA pads. This site is scheduled for preliminary Track 1 investigation. A finding of "no action" will probably result from these investigations.

- OU 7-10

OU 7-10 consists of the Pit 9 demonstration project and is designated by site code RWMC-04. Pit 9 is located in the northeast corner of the SDA, and cannot be easily distinguished from the surface since soil was placed over the pit. The inventory of wastes buried in the pit was estimated from available shipping records and the Radioactive Waste Management Information System (RWMIS). Wastes include drums of sludge, drums of assorted solid waste, cardboard boxes containing empty drums, an inactive reactor vessel, and other large, contaminated metal objects. This site is scheduled for interim action.

The dimensions of Pit 9 are approximately 127 x 379 feet, with a depth from ground surface to bedrock of approximately 17.5 feet. The pit contains approximately 150,000 cubic feet of buried waste, primarily TRU (according to the 1969 definition), and hazardous wastes. Approximately 75% of the waste was generated at the Rocky Flats Plant, with additional waste from generators at the INEL. Pit 9 contains about 4,000 drums of sludges and solid waste and about 2,500 cardboard boxes of solid wastes. About 80 unspecified containers of waste are buried in the pit. The boxes were disposed, in general, at the north end of the pit, and the drums were dumped at the south end. Some intermixing of containers in the pit did occur.

The alternative interim actions chosen for the cleanup of Pit 9 are physical separation, chemical extraction, or stabilization. One contractor is using vitrification as the stabilization step and one contractor is applying a proprietary cement mixture.

- OU 7-11

OU 7-11 encompasses three sites designated as "no action" sites. The RWMC drainage and septic tank for WMF-613 was designated site code RWMC-01. The tank has a volume of 1,250 gallons, is assumed to be made of concrete, and includes a drain field constructed of 4-inch perforated plastic drain tile. The system was put into operation in 1986. Site RWMC-02 is a 2,000 gallon concrete septic tank servicing WMF-601, WMF-604, and WMF-620, with a drain field constructed of 4-inch perforated plastic drain tile. The system was put into operation in 1976 when WMF-601 was built.

The drain field for RWMC-02 failed and was replaced in 1986. The new drain field was installed in the same location. Site RWMC-03 is a 2,000 gallon tank with an associated drain field constructed of 4-inch perforated polyvinyl chloride pipe. These sites received a decision of determination of "no action" dated January 7, 1993.

- OU 7-12

OU 7-12 consists of the RI/FS for Pad A, which is identified by site code RWMC-04. Pad A is a 2 to 3 inch thick asphalt surface laid over a gravel base and measuring 240 x 335 feet. The pad was built in 1972 for the aboveground disposal of mixed wastes that did not meet the TRU definition (waste with >10 nCi/gm TRU). Wastes stored on Pad A are contaminated with relatively small amounts of depleted uranium, plutonium, and other TRU nuclides, along with other materials, such as sodium and potassium salts (mostly nitrates) and sewer sludges. Wastes were disposed in about 2,000 plywood boxes (4 x 4 x 7 feet) and about 18,000 55-gallon drums. Drums were stacked horizontally in staggered layers up to 11 high. Boxes were stacked a maximum of five high. When the pad was closed for operation in 1979, waste containers occupied about half the pad (about 32,000 square feet). Closure involved placing plywood, polyethylene, or both over the containers and covering with a minimum of 3 feet of soil. The soil overburden was seeded with crested wheat grass.

Extent of contamination is under investigation as part of the RI/FS process. No measurable levels of contaminants from Pad A were detected in the soil adjacent to the pad, groundwater, surface water, or offsite.

- OU 7-13

OU 7-13 consists of the RI/FS for the TRU pits and trenches, which are identified with site code RWMC-04. Wastes disposed in these pits and trenches included TRU, low-level, and mixed wastes in solid and liquid form. Disposal of TRU-contaminated wastes at SDA ceased in 1970. There are 14 pits and 27 trenches containing TRU-contamination. Soils around or beneath these pits and trenches contaminated by TRU or hazardous materials are part of this investigation.

- OU 7-14

OU 7-14 consists of the WAG 7 Comprehensive RI/FS.

WAG 10 - Miscellaneous

WAG 10 includes the regional Snake River Plain Aquifer, other areas and sites related to the INEL that cannot be addressed on a WAG-specific basis, and surface disposal sites and ponds identified at the INEL that are not included in other WAGs. The WAG consists of 12 specifically identified

and 2 generally identified sites, divided into 5 OUs. These OUs include pits, a pond, ordnance areas, miscellaneous surface sites, and liquid disposal areas. Possible contaminants include waste oils, solvents, ordnance, and radionuclides.

- OU 10-01

OU 10-01 consists of two disposal pits associated with the Liquid Corrosive Chemical Disposal Area (LCCDA). The sites and types of associated waste are described in Table 4-52.

TABLE 4-52. SUMMARY OF OU 10-01.

DESCRIPTION	COMMENTS/CONTAMINANTS
LCCDA-01. LCCDA Old Disposal Pit (W end)	Soil contaminated with waste oils, solvents, radionuclides
LCCDA-02. LCCDA Limestone Treatment and Disposal Pit (E end)	Soil contaminated with waste oils, solvents, radionuclides

- OU 10-02

OU 10-02 consists of a single site associated with the Organic Moderated Reactor Experiment (OMRE), with suspected solvent and radionuclide contamination. The site and types of associated waste are described in Table 4-53.

TABLE 4-53. SUMMARY OF OU 10-02.

DESCRIPTION	COMMENTS/CONTAMINANTS
OMRE-01. OMRE Leach Pond	Soil contaminated with radionuclides and xylene

- OU 10-03

OU 10-03 consists of numerous ordnance areas associated with aerial bombing practice and artillery testing. The sites and types of associated waste are described in Table 4-54. A ROD calling for interim action was issued for this OU.

TABLE 4-54. SUMMARY OF OU 10-03.

DESCRIPTION	COMMENTS/CONTAMINANTS
Ordnance areas (including NODA)	Unexploded ordnance

- OU 10-04

OU 10-04 is the WAG 10 Comprehensive/Snake River Aquifer RI/FS and includes all miscellaneous surface sites and liquid disposal areas throughout the INEL not included in other WAGs. The regional Snake River Plain Aquifer, defined by the INEL boundary, will be studied, and extent of the contamination will be determined accordingly.

- OU 10-05

OU 10-05 consists of Ordnance Interim Action for numerous sites including those listed in OU 4-01 and excluding those listed in 10-03. The sites and types of associated waste are described in Table 4-55. Four interim action alternatives were presented in the ROD for this OU. An *Auditable Safety Analysis for Interim Action to Clean Up Unexploded Ordnance Locations at the Idaho National Engineering Laboratory*, (MK-FIC, 1993c) was prepared for this remediation activity.

TABLE 4-55. SUMMARY OF OU 10-05.

DESCRIPTION	COMMENTS/CONTAMINANTS
Ordnance interim action	Unexploded ordnance

4.2 Decontamination and Decommissioning

4.2.1 D&D Program

D&D activities address the management of surplus radioactively contaminated facilities to permit other uses of those facilities or the occupied land. D&D activities will be performed to ensure that releases and exposure to radioactively contaminated and other hazardous materials are in compliance with Federal and state standards. D&D projects will meet the requirements of DOE 5820.2A, Chapter V - "Decommissioning of Radioactively Contaminated Facilities" (DOE, 1988).

D&D activities at the INEL are driven by DOE-ID schedules for cleaning up contaminated surplus or excess facilities. A facility is declared "excess" if the programmatic sponsor so designates and no future programs are identified for the facility. Facilities may be added or removed from scheduled D&D activities in response to programmatic INEL mission and funding changes.

Through fiscal year (FY) 1993, 24 facilities were decontaminated and decommissioned (EG&G, 1993d). Some facilities were dismantled and all evidence of existence removed; others had contamination removed and useful parts of the facilities reused.

D&D activities may generate all types of waste, including industrial municipal, hazardous, and radioactive wastes, depending on the type of facility. Table 4-56 summarizes wastes anticipated from facilities currently scheduled for D&D. The volumes of waste are expected to greatly impact the necessity for various treatment, storage, and disposal facilities for waste-handling. Exact volumes of waste are difficult to predict because overall remedial goals affect types and volumes of secondary wastestreams produced. Technology development would be required for some activities.

D&D planning for each excess facility includes assignment of a priority; radiological, chemical, and physical characterization; decision analysis to select preferred D&D alternative; and preparation of a D&D plan. Facilities awaiting D&D are maintained to limit exposure of workers, the public, and the environment to potential hazards.

4.2.2 D&D Projects

Planned or proposed D&D projects are described in this section. For more detailed descriptions and layouts, see the *INEL D&D Long Range Plan* (EG&G, 1993d). As D&D projects for the Naval Reactors Facility (NRF) and Argonne National Laboratory-West (ANL-W) are not within the scope of this BSAF, they are not included in the following descriptions.

General site description and location information is provided in Chapter 3. Detailed facility layouts are required in the Health and Safety Plan and are discussed in Chapters 9 and 10. Estimated inventories of radioactive and hazardous materials are contained in the *INEL D&D Long Range Plan* (EG&G 1993d). Estimated quantities of radioactive and hazardous waste generated from D&D activities are contained in *INEL Technical Site Information* (EG&G 1993c).

Loss-of-Fluid Test Facility Ancillaries

The Loss-of-Fluid Test (LOFT) Facility was used to perform loss-of-coolant experiments that simulated reactor accidents. These tests were performed during the 1970s. The Mobile Test Assembly (MTA), mounted on a railroad flatcar, was part of the LOFT reactor shielding assembly. This D&D activity will dispose MTA equipment remaining from the LOFT program. The 1991 safety analysis report, *TAN Hot Cell Complex Final Safety Analysis Report* (INEL, 1991c), was prepared for surveillance and maintenance of the facility including LOFT ancillary equipment awaiting D&D. D&D of the LOFT ancillary equipment will be accomplished within the TAN-607 Hot Shop which is part of

TABLE 4-56. FACILITIES TO BE DECONTAMINATED AND DECOMMISSIONED AND THE TYPES OF WASTE EXPECTED TO BE GENERATED.

LOCATION	FACILITY	TYPES OF WASTE
Test Area North (TAN)	Loss of Fluid Test Facility (LOFT) Ancillaries	Low Level; Mixed; Industrial Municipal
	Decontamination Shop (TAN-607)	Low Level; Industrial Municipal
	Technical Support Facility	Low Level; Industrial Municipal
Test Reactor Area (TRA)	Engineering Test Reactor	Low Level; Mixed; Industrial Municipal
	Materials Test Reactor	Low Level; Mixed; Industrial Municipal
	Test Train Assembly	Low Level; Industrial Municipal
Army Re-entry Vehicle Facility Site (ARVFS)	Army Re-Entry Vehicle Facility Site	Hazardous; Low Level; Mixed; Industrial Municipal
Idaho Chemical Processing Plant (ICPP)	Radioactive Lanthanum Recovery System (CPP-631)	Low Level; Industrial Municipal
	Fuel Receiving and Storage Facility (CPP-603)	Low Level; Industrial Municipal
	Headend Processing Plant (CPP-640)	Low Level; Industrial Municipal
	Waste Calcining Facility (CPP-633)	Low Level; Mixed; Industrial Municipal
	East Side Service Waste Monitoring Station (CPP-709)	Low Level; Industrial Municipal
	Uranium Separation Plant (CPP-601)	Low Level; Mixed; Industrial Municipal
	High Level Waste Tank Farm	High Level; Low Level; Mixed; Industrial Municipal
	West Side Service Waste Monitoring Station (CPP-734)	Low Level; Industrial Municipal
	Horizontal Settling Basin (CPP-740)	Low Level; Industrial Municipal
	Hot Waste Tank (SFE-20)	Low Level; Industrial Municipal
Central Facilities Area (CFA)	Hot Laundry (CFA-669)	Low Level; Industrial Municipal
Power Burst Facility/Auxiliary Reactor Area (ARA)	ARA I, II, III	Low Level; Mixed; Industrial Municipal
Experimental Breeder Reactor-I/Boiling Water Reactor Experiment (BORAX)	BORAX-V	Low Level; Mixed; Industrial Municipal

the TAN Hot Cell Complex. D&D of LOFT MTA would generate low level, mixed, and industrial municipal waste types (Table 4-56).

Test Area North 607 Decontamination Shop

The TAN-607 Decontamination Shop was used for radiological decontamination of tools and small equipment from INEL and non-INEL facilities. Operations began in this facility in 1957 and were shut down in 1987. Recommended D&D for this shop includes the removal of all contaminated equipment, including tanks and piping, and decontamination of the space within TAN-607 to allow reuse of the area. The safety analysis report, *Safety Analysis Report for the TAN-607 Decontamination Facilities* (INEL, 1992a), was prepared for surveillance and maintenance of the facility. D&D of the TAN-607 decontamination shop would generate low level and industrial municipal waste types (Table 4-56).

Test Area North Technical Support Facilities

The Technical Support Facilities consist of buildings, structures, pits, and equipment used to support various INEL programs at TAN. D&D cannot be begun until all use of the Liquid Waste Treatment Facility is discontinued. Recommended D&D for this unit includes partial dismantlement of TAN-616, removal of contaminated tanks and soil, and backfill and seed excavations. This project would generate low level and industrial municipal waste types (Table 4-56).

Engineering Test Reactor

The Engineering Test Reactor (ETR) was a pressurized light water test reactor at the TRA operated between 1957 and 1982. Late in the life of the facility, the Sodium Loop Safety Facility was operated as part of the test program. A significant volume of highly radioactive contaminated material must be removed for D&D. Specific facilities planned for D&D are the reactor compressor; heat exchanger; electrical buildings; exhaust delay tanks; primary stack; and primary and secondary filter pits. D&D of ETR would generate low level, mixed, and industrial municipal waste (Table 4-56).

Materials Test Reactor

The Materials Test Reactor (MTR), located at the TRA complex, was a 40-megawatt light water reactor (LWR) that operated between 1952 and 1970. The MTR area contains more than 15 buildings and structures. A major portion of the facility was decontaminated and is used for other INEL programs. The reactor vessel is still in place and all coolant was drained. Auxiliary portable shielding was placed on the reactor vessel closure to reduce external radiation to acceptable levels. Specific facilities at MTR planned for D&D include the reactor and reactor wing "A" buildings; auxiliary buildings (for example, maintenance and storage buildings TRA-607 and TRA-651); the neutron chopper 20-meter building (TRA-665); the exhaust stack and monitoring building (TRA-710); compressor building; fan house; process water building; plug storage facility; hot waste storage and catch tank pump houses; engineering services building (TRA-635); gamma facilities building (TRA-641); and a

retention basin (MTR-712). Waste types that would be generated from this project include low level, mixed, and industrial municipal (Table 4-56).

Test Train Assembly Facility

The Test Train Assembly Facility in the MTR basement at the TRA, was used in support of the Thermal Fuels Behavior Program to build and disassemble nuclear fuel tested at the Power Burst Facility reactor. D&D operations will remove stored nuclear fuel; remove radioactively contaminated water; and clean up residual radioactive contamination from the canal walls, floor, and equipment. The facility will be repaired to a stable condition when dismantlement efforts are completed. Waste types generated during this project would be low level and industrial municipal (Table 4-56).

Army Re-Entry Vehicle Facility Site

The Army Re-Entry Vehicle Facility Site (ARVFS) consisted of an earth-covered bunker, a test pit, and a lean-to shed covering the test pit. The test pit was contaminated with low-level beta-gamma radioactivity. D&D operations removed the test pit and lean-to shed in 1989. The bunker contains four drums of RCRA-regulated mixed waste with radioactively contaminated sodium-potassium liquid metal, considered hazardous because it is reactive. This liquid metal is the primary coolant removed from the Experimental Breeder Reactor (EBR-I). Treatment options for the contaminated liquid metal include private sector transport and treatment at an existing facility; a private sector mobile treatment process operated at the INEL; and treatment at other DOE facilities using an existing process. D&D on contaminated process equipment and the bunker will be performed to return the bunker and area to a reusable condition.

Radioactive Lanthanum Recovery System

CPP-631, the Radioactive Lanthanum Recovery System, is an inactive part of the Fuel Processing Complex. The system was taken out of service in 1981 and the process equipment removed in 1985. Low level and municipal industrial wastes would be waste types generated from the remaining D&D of this room (Table 4-56).

Fuel Receiving and Storage Building

The Fuel Receiving and Storage Building, CPP-603, was the primary fuel storage facility for the ICPP from the early 1950s until completion of the Fluorinel and Storage Facility, CPP-666 in 1985. While some fuel currently remains in the basins, this facility is being phased out. D&D of this facility is expected to generate low level and industrial municipal waste types (Table 4-56).

Headend Processing Plant

CPP-640, the Headend Processing Plant (HPP), previously housed stainless steel and graphite fuel processing headend facilities. These processing facilities no longer are needed. Low level and industrial

municipal wastes are the waste types that would be generated from this project (Table 4-56).

Waste Calcining Facility

The Waste Calcining Facility, CPP-633, was originally constructed as a technology demonstration facility and was used to calcine high-level liquid waste until the New Waste Calcining Facility was constructed. Use of the calcination equipment in this facility was discontinued in 1981. Low level, mixed, and industrial municipal wastes are the waste types that would be generated during this D&D project (Table 4-56).

East Side Service Waste Monitoring Station

The East Side Service Waste Monitoring Station was used for many years to monitor the service wastestream discharged to the injection well and later the percolation ponds. This facility was replaced with updated facilities and equipment and is scheduled for D&D activities. Waste types that would be generated from this project include low level and industrial municipal (Table 4-56).

Uranium Separation Plant

The Uranium Separation Plant (CPP-601) facility contains all the equipment necessary to accept dissolved fuel feed, separate wastes from uranium, and convert liquid product to solid product. The facility transfers liquid wastes to other facilities for solidification and handling. An activity to phase out the facility prior to D&D was initiated in 1992. Waste types that would be generated from D&D of this facility include low level, mixed, and industrial municipal (Table 4-56).

High Level Waste Tank Farm

The High Level Waste Tank Farm currently is in use, but is scheduled for D&D. D&D of this tank farm would generate high level, low level, mixed, and industrial municipal (Table 4-56).

West Side Service Waste Monitoring Station

The West Side Service Waste Monitoring Station (CPP-734) was used for many years to monitor the service wastestream discharged to the injection well and later the percolation ponds. This facility was replaced with updated facilities and equipment and is scheduled for D&D activities. Waste types that would be generated from this project include low level and industrial municipal (Table 4-56).

Horizontal Settling Basin

The Horizontal Settling Basin (CPP-740) accepted backwash from the CPP-603 basin diatomaceous earth filter system which was cleaned and put on standby in 1983. In the settling basin, the slurry was washed over a series of weirs where the diatomaceous earth was separated from the stream. Water was drained to an open drywell and the filter aid material was retained in

CPP-740. Waste types generated from D&D of the CPP-740 facility include low level and industrial municipal (Table 4-56).

Hot Waste Tank

The Hot Waste Tank (SFE-20) system was used to collect low-level radioactive liquid wastes from the south basin area of CPP-603. These wastes flowed by gravity through underground lines to the SFE-20 tank. Wastes were pumped to the Process Equipment Waste Evaporator. Waste types that would be generated from D&D of this facility include low level and industrial municipal (Table 4-56).

Central Facilities Area Hot Laundry

Building CFA-669 formerly was used as a laundry facility for both radioactively and non-radioactively contaminated clothing. It was built in 1950 and was last used in 1983. D&D currently is being conducted which includes dismantling CFA-669 and disposing all waste generated. The safety analysis report, *Safety Analysis Report for the D&D of the Hot Laundry Facility* (INEL, 1992b), was prepared for the surveillance, maintenance, characterization, and decommissioning of the facility. This project would generate low level, mixed, and industrial municipal waste (Table 4-56).

Auxiliary Reactor Area I

Auxiliary Reactor Area I (ARA-I) was constructed in the late 1950s as a support facility for the other ARA facilities. The facilities were used to support INEL programs and facilities until the spring of 1988. D&D includes dismantling Building ARA-626, the hot cells, Building ARA-627, the septic systems, and all other structures. ARA-I would generate low level, mixed, and industrial municipal (Table 4-56). The safety analysis report, *Safety Analysis Report for the Auxiliary Reactor Area I* (INEL, 1992c), was prepared and covers surveillance and maintenance of the facility prior to D&D.

Auxiliary Reactor Areas II and III

Auxiliary Reactor Area II (ARA-II) housed the Stationary Low Power Reactor No. 1 (SL-1), operated by the Army between August 1958 and December 1961. The reactor was destroyed in a reactor accident that occurred during maintenance operations on January 3, 1961. A thorough evaluation of the subsequent contamination was performed shortly after the accident and a full cleanup effort was initiated. After cleanup of the area was completed, the three main buildings were converted into offices and welding shops. Since the removal of the welding qualification shop in 1987, the facilities were not used. D&D of this facility includes total dismantling of existing buildings and structures at the ARA II facility and removing all area utilities. In addition, contaminated soil areas that exist inside the security fences will be cleaned or covered with clean soil, using the guidelines presented in DOE 5400.5 (DOE, 1990a), Chapter 4, "Residual Radioactive Material." The safety analysis report, *Safety Analysis Report for the Auxiliary Reactor Area (ARA-II) at the INEL* (INEL, 1992d), was prepared for surveillance and maintenance of the facility prior to D&D, with an addendum covering the actual D&D.

The ARA-III facility was used between 1960 and 1965 to test gas-cooled reactors for the Army. After 1956, the facility served as a laboratory for component and instrument testing. The facility was not used after 1987. The reactor previously was removed. D&D of the ARA-III facility includes removing the exhaust stack, associated piping, the hot-waste tank and pipelines, concrete, and miscellaneous items in the reactor buildings. Once complete, the facility will be released for unrestricted use. All the buildings may be completely demolished. The safety analysis report, *Safety Analysis Report for the Auxiliary Reactor Area (ARA-III) at the INEL* (INEL, 1992e), was prepared for surveillance and maintenance of the facility prior to D&D, with an addendum covering the actual D&D. Both ARA-II and ARA-III would generate low level, mixed, and industrial municipal waste (Table 4-56).

Boiling Water Reactor (BWR) Experiment-V

The BORAX-V building housed two separate experimental reactors which operated between 1953 and 1964. The facilities were used after 1964. D&D activities were conducted in FYs 1979, 1984-1987, and 1989-1992. BORAX-V currently is undergoing D&D. D&D activities include total dismantlement, removal, and disposal of the equipment and buildings. The foundations of the Turbine Building were decontaminated, demolished to below grade, and left in place. The three USTs were removed and disposed under the Underground Storage Tank Program. The raw water system, electrical substation, and security fence will be removed and disposed when D&D of the reactor building is completed. The site will be restored and seeded with native grasses and will be available for reuse. The safety analysis report, *Safety Analysis Report for the D&D of the BORAX-V Facility* (INEL, 1992f), was prepared for D&D of the facility. D&D of BORAX-V would generate low level, mixed, and industrial municipal waste (Table 4-56).

4.3 Environmental Remediation and D&D Techniques

4.3.1 Remedial Action Techniques

Contaminated sites at the INEL contain a variety of waste types. Different types of remedial action techniques will be employed to clean the sites to acceptable levels as part of the CERCLA-based FFA/CO process. For each particular site, one or more of the treatment options may need to be employed, depending on the type of contamination present.

This section discusses different techniques in use, or planned, at the INEL to remediate soil and groundwater contaminated with a variety of materials including diesel fuel, metals, acids, solvents, radioactive isotopes, and PCBs. Table 4-57 presents a summary of methods currently in use or planned at the INEL for environmental remediation activities. This table is from the *Environmental Restoration Program Major System Acquisition Baseline*, DOE/ID-0000, April 1993 (EG&G, 1993b). The remainder of this section contains brief descriptions of each of the remedial action or cleanup techniques listed in the table. Following this discussion are brief descriptions of selected treatment technologies not currently planned for use, but with potential for implementation in the future after further investigation into the treatment technologies, demonstrations, and evaluation of effectiveness and cost efficiency for specific INEL sites.

TABLE 4-57. ANTICIPATED REMEDIATION MATRIX.

CONTAMINATION	REMEDATION	DISPOSAL
Mixed Waste Contaminated Soil and Sediments	Physical/Chemical Extraction Process	RWMC and RCRA Subtitle D Facility
TCE Radioactive Contaminants in Groundwater	Air Stripping/Carbon Absorption, Ion Exchange	Offsite Disposal and RWMC
Hazardous Waste Contaminated Soil	a. Offsite Incineration b. Physical/Chemical Extraction Process	a. Offsite Disposal b. RWMC and RCRA Subtitle D Facility
Contaminated Soils and Debris-Heavy Metal	a. Physical/Chemical Extraction Process b. Multi-Layered Capping	a. RCRA Subtitle D Facility b. Onsite In Place
Radiologically Contaminated Concrete/Soils	a. Hot Box (waste container for radioactive material) b. Multi-Layered Capping c. Physical/Chemical Extraction Process d. Stabilization	a. RWMC b. In Place c. RCRA Subtitle D Facility d. Onsite
Pb Contaminated Soil, Pb Scrap	Encapsulation (Proposed Best Demonstrated Available Technology)	Offsite
Solvent/Paint Contaminated Soils	RCRA incineration	Offsite
PCB Contaminated Soil	Toxic Substances Control Act Incineration	Offsite
Municipal Landfill Wastes	Multi-Layered Capping	In Place
Petro Contaminated Soils	Bioremediation	Onsite
Nitroaromatic Contaminated Soils	RCRA Incineration	Offsite
VOCs in Vadose Zone	Vapor Vacuum Extraction	Onsite

Source: Table taken from 5.3.11, Anticipated Cleanup Matrix (EG&G, 1993b)

Description of Planned Remedial Action Techniques. The following are the remedial action methods and techniques currently used, or planned, for environmental remediation of INEL sites. The technologies described here are limited to the types of remediation technologies listed in the *Environmental Restoration Program Major System Acquisition Baseline* (EG&G, 1993b).

Containment

Containment technologies are designed to reduce mobility of contaminants by creating a barrier to prevent waste outflow from the site or creating a subsurface or surface diversion to prevent water from flowing through or over a site.

- Capping

For closure in place of a trench or pit landfill, a low-permeability cap of native soil, asphalt, or concrete is used to cover the landfill to minimize migration of liquids into waste materials. RCRA recommends a multi-layered cap composed of three layers: a top layer of native soil and vegetation; a drainage layer of sand or other granular material; and a low permeability layer of compacted soil.

A cap must be constructed to meet specified design and performance standards, and requires 30 years of post closure maintenance, which can be considered a major drawback. Since a landfill is considered a permanent structure, the future use of the site is limited.

Immobilization

Immobilization technologies are treatments applied to wastes to prevent migration of contaminants to the surrounding environment. In general, these technologies consist of agents mixed with waste materials to prevent migration, without destroying the hazardous constituents. By comparison, high heat vitrification thermal treatment technologies will destroy organic material while immobilizing inorganics and radionuclides.

- Solidification/stabilization

Stabilization is the process of converting liquid wastes into a form which contains as little freestanding and noncorrosive liquid as is reasonably achievable. This process stabilizes the waste, essentially immobilizing the contaminants and improving the stability of any radioactive component. Stabilization process materials include Portland cement and pozzolanic materials such as fly ash. For large areas, such as surface impoundments, materials are introduced directly into liquid waste, creating a solidified mass. The mass is covered with a multi-layered cap to provide long-term minimization of precipitation and run-off into the closed impoundment. Small amounts of hazardous or radioactive liquid waste are immobilized by waste transfer to a disposable container, addition of stabilizers, and solidification of the mass. The container is disposed as a solid waste.

Though the stabilization process is an effective means of immobilizing contaminants in liquid wastes, side products generated by the process may increase the final volume of waste materials. During *in situ* solidification/stabilization, problems may occur if the final cover settles differentially over the unit, creating channels through which liquids can enter the unit.

Physical Treatment

Physical treatment processes separate hazardous constituents from contaminated material, usually followed by treatment for the removed hazardous components. Physical treatment methods involve the use of newly constructed, temporary, or portable process equipment and related structures. The INEL currently has a portable water treatment unit (PWTU) in use, or available for use, accompanied by completed safety analyses, *Waste Reduction Operations Complex Portable Water Treatment Unit Auditable Safety Analysis* (INEL, 1993a) and *Waste Reduction Operations Complex Portable Water Treatment Unit Operational/Technical Safety Requirements* (INEL, 1993b).

- Physical separation process
 - Screening: Involves use of a mesh of determined size openings to allow material to pass through below a certain size while retaining larger particles
 - Clarification: Permits settling of suspended solids out of water. Involves use of a clarifier tank and support equipment to circulate water and remove settled solids
 - Flotation: Allows removal of floating material from water. Can be done in a tank, such as an oil-water separator, or in an extraction well by skimming floating material off the groundwater layer.

- Air stripping

Air stripping is effective in the treatment of water with low levels of volatile organic compounds (VOCs). This method relies on exposure of contaminated water to a fresh air supply. As air is introduced into the water, VOCs in the water are driven out of the solution and into the vapor state. The most common type of air stripping is packed tower aeration, in which air and water are run counter-current through a randomly-structured media, which exposes a large amount of liquid surface area to the air. The air carries the contaminants out of the stripper and into the atmosphere where VOCs are either dissipated by wind currents or broken down by natural ultraviolet (UV) degradation. The treated water passes out of the column for use, discharge, or further treatment. Packed towers are typically composed of a cylindrical tower shell, tower internals (including a mist eliminator and a water distributor), packing, air delivery systems (including a forced draft blower at the base of the tower or vacuum blower off the top of the tower), and water delivery systems (including extraction wells, pumps, and holding tanks). Drawbacks to the air stripping process are restricted mainly to maintenance problems resulting from iron, calcium, and/or microbial bacteria buildup in the packing materials, which can lead to a deterioration of system performance.

Potential environmental impacts caused by air stripping include the emission of VOCs into the atmosphere. These emissions can be treated with either activated carbon or by incineration. Activated carbon is typically used to polish the discharge water (that is, to remove any trace contaminants) from the air stripper before being released to the sewer.

- Soil washing/soil flushing

Soil washing or flushing is a method that uses water and detergent, solvent, or other chemicals to separate fine particles from the soil. Water, or other liquid, and the soil is slurried and fine particles are separated for further treatment and disposal. This process involves use of soil and liquid-handling equipment, and requires additional treatment and/or disposal of the removed particles.

- Vacuum extraction

Vacuum extraction, or soil vapor extraction, is a process that uses negative pressure to remove VOCs from groundwater and soil. Vacuum extraction systems typically consist of extraction wells, a vacuum blower, or reciprocating engine, and effluent-handling equipment. This process requires additional treatment of the removed material. The INEL currently has a vacuum extraction system in use, or available for use, with a completed safety analysis, *Vapor Vacuum Extraction Safety Analysis Report* (INEL, undated).

- Activated carbon adsorption

Activated carbon, because of its unique ability to absorb a variety of compounds, is used for air and wastewater treatment. In an operating carbon adsorption system, water is usually pumped through one or a series of units (columns or 55-gallon drums) containing activated carbon. Liquid enters through the top of the unit and exits through the bottom. Operating flow rates for liquids are highly dependent on the amount of suspended solids, but are usually in the range of 2 gallons per minute per square foot.

Carbon adsorption is a relatively expensive process. Units must be recharged periodically with either thermally reactivated or virgin carbon, so supply of activated carbon to the adsorption system may be significant.

- Filtration

Filtration is one method of removing suspended solids from contaminated groundwater. The simplest form of filtration is to pass the groundwater through a bed of sand. The suspended solids adhere to the sand particles, and the water continues through the bed. As the filter bed becomes clogged, it must be backwashed by

rapid pumping of clean water through the sand bed, opposite the flow of the wastewater. As the sand bed is fluidized, the turbulence breaks off particles attached to the sand, allowing the water to flush suspended solids out of the filter.

Other types of filter technology include bag, cartridge, and cloth filters, which strain the suspended solids from the water. Once the pressure drop is too high, the filter is removed and cleaned or replaced. These types of filters provide a way of economically removing suspended solids. This method requires additional treatment and disposal of removed contaminants.

- Ion exchange

Ion exchange is a process in which ions held by electrostatic forces to the surface of a solid are exchanged for ions of similar charge in a solution in which the solid is immersed. A typical ion exchange would be the replacement of a sodium ion with a calcium ion, the basis for water softening. Sodium ions can be entirely removed by hydrogen ions, which combine with hydroxide ions to form water.

The disadvantage of remediation by ion exchange is the expense. This method requires additional treatment and disposal of removed contaminants.

Thermal Treatment

Thermal treatment uses high temperature as the principal means of destroying or detoxifying hazardous waste. Thermal treatment methods involve use of newly constructed, temporary, or portable process equipment and related structures.

- Incineration

An incinerator is defined in 40 CFR 260.10 (EPA, 1990) as any closed device using controlled flame combustion that neither meets the criteria for classification as a boiler nor is listed as an industrial furnace. Incineration raises both water (or soil) and contaminants to high temperatures in the presence of oxygen, resulting in carbon dioxide, water, and other side products of combustion. A flame incinerator requires temperatures in the range of 1,500° to 2,000°F to be effective. When waters contain approximately 20% organics, contaminated water has a self sustaining burn. At concentrations below this level, auxiliary fuel is required.

Incinerators, while effective, require an intensive trial burn and permitting process. Groundwater typically contains too small a volume of highly contaminated water, making incineration very expensive. Onsite incineration can be performed when contaminated soil is too dangerous to transport over public roads, or when the nearest landfill is too far away.

- Catalyzed thermal oxidation

Catalyzed thermal oxidation is the most widely applied thermal method of air treatment. This method is applied to air treatment from vapor extraction systems or offgas treatment from air strippers, using either metals or inorganic acid as the catalyst. Preheated air is passed through the catalyst which, in the presence of oxygen, effects combustion reactions between 500° and 1,000°F. The catalyst surface lowers the activation energy required to cause oxygen to react with contaminant hydrocarbons, resulting in water and carbon dioxide.

The advantage of catalytic thermal oxidation is that it does not require supplemental fuel to oxidize influent streams with low concentrations of organics. Lower nitrous oxide (NO_x) and carbon dioxide (CO₂) emissions are a benefit.

- *In situ* vitrification

During *in situ* vitrification large areas of soil are solidified by heating the soil to a very high temperature, approximately 1,800°C. This technology uses electrical energy to heat the sand in soil which effectively turns the soil into a monolith of glass. The INEL has completed a safety analysis for *in situ* vitrification, *Safety Analysis for the Intermediate Scale Testing of In situ Vitrification* (INEL, 1991d).

Chemical Treatment

Chemical treatment technologies alter the chemical structure of constituents to produce a waste residue less hazardous than the original waste. Altered constituents may be easier to remove from the wastestream. These methods will involve the use of newly constructed, temporary, or portable process equipment and related structures.

- Chemical oxidation/reduction

Chemical oxidation processes in the detoxification of contaminated groundwater involves the exchange of electrons (redox reactions) between chemical constituents and effects a change in the oxidation state of the constituents. This exchange of electrons destroys organic compounds by breaking carbon bonds and creating new compounds. The three most commonly used chemical oxidants are chlorine, ozone, and hydrogen peroxide. Chemical oxidants are used in the treatment of groundwater to break down carbonaceous compounds into CO₂ and water. An adequate amount of oxidant is required to effect a complete reaction. To economically facilitate a desired reaction, many reactions require the input of energy in the form of heat or UV light, or the presence of a catalyst. This technique is typically used in series with an air stripper and/or activated carbon for groundwater treatment.

Limitations of the chemical oxidation/reduction process include the effect of temperature on reaction rates and the long-term effectiveness of the catalysts or energy sources used to stimulate the reactions.

- Precipitation/Flocculation

Chemical precipitation, in conjunction with other treatment methods, is used to adjust the pH and to reduce the concentration of solids in the waste. Precipitation produces a sludge which must be further treated.

Particles suspended in water that are not large enough to settle by gravity, must be collected by flocculation. The first step in flocculation is to neutralize the charge on all of the particles by adding acid or caustic. Once the charge is neutralized, the particles must be agglomerated by gentle mixing, forming floc. Improvement of the efficiency of flocculation can be achieved by introducing a coagulant such as lime. However, while coagulants improve flocculation, they can be ineffective in water with low concentrations of suspended solids.

Biological Treatment

Biological treatment technologies involve the addition of bacteria, fungi, or other microorganisms to alter or destroy hazardous wastes. These processes are highly sensitive to environmental conditions. Biological treatment can be accomplished *in situ*, or contaminated soil or groundwater can be removed and treated in holding tanks or surface treatment cells. These methods will involve the use of newly constructed, temporary, or portable process equipment and related structures.

- Land farming

For soil contaminated with degradable materials such as diesel fuel, land farming can be used to accelerate the volatilization and biodegradation of the contaminants. In this method, the soil is spread in a thin layer to maximize exposure to air, and nutrients are added. Soil typically is placed on plastic to collect any water, and tilled to mix in nutrients and air.

- Bioreactors

Aerobic reactors magnify the effectiveness of a biological reaction by maximizing the ability of bacteria to produce requisite enzymes which use a specific contaminant as a food and energy source. These reactions are aided by the presence of oxygen supplied to the reactor. One of the easiest units of operation to implement for a groundwater treatment system is an aerated lagoon or basin. An existing pond or tank can be used for the reactor. Contaminated water enters the aerated vessel where bacteria degrade the organics and create new bacteria.

Oxygen is supplied to the vessel with a surface aerator or air diffusers.

Additional treatment may be required for air emissions or constituents that are not biodegradable.

Description of Potential Remedial Action Techniques. The following are remedial action methods and technologies not currently being used, or planned, for environmental remediation of INEL sites. The technologies described here include methods proven effective, and some promising, unproven methods.

Containment

- Surface Impoundment

A surface impoundment is a man-made depression or excavation designed to contain an accumulation of liquid wastes or sludges. A surface impoundment is installed with a double liner system to minimize potential for soil and groundwater contamination.

Though a surface impoundment can be "clean closed" by removing and treating all waste and containment system components, the same requirements defined for landfills require compliance.

- Vertical barriers

- Slurry walls: Vertical barrier placed underground in the path of a contaminated groundwater plume. Slurry walls can be constructed from cement grout or bentonite to retard groundwater flow. Alternately, a wall of limestone acts as a neutralizing agent to effectively adjust the pH of an acidic plume. Cost to construct a wall is relatively high. If heavy metals are present in water, the precipitation clogs the slurry wall. Furthermore, with very little mixing in an aquifer, only the leading edge of the plume comes in contact with the wall.

- Subsurface horizontal barriers

- Grout injection: Cementitious grout is forced under pressure below and/or above the contaminated region of soil to prevent migration of contaminants in a vertical direction.
- Cryogenic barrier: A liquid nitrogen solution is chilled, then pumped to a location under the soil surface where it freezes in place. This frozen boundary acts as a barrier to any movement by the contaminants.

Immobilization

- Surface encapsulation

For friable materials such as asbestos, encapsulation prevents fibers or dust from becoming airborne by effectively sealing the material *in situ*. The most common encapsulates are thermoplastics and organic polymers, which are applied to the material with a sprayer.

Encapsulation is an inexpensive and effective short-term solution to treating friable materials and does not generate additional waste. However, since it is only a temporary solution, long term risks must be considered.

Physical Treatment

- Diffusion membrane separation

Diffusion membrane separation involves the diffusion of water through a semi-porous membrane of selective permeability. The system operates with a low pressure gradient of approximately 35 pounds per square inch (psi). The impermeability to halogenated and nonhalogenated hydrocarbons causes these compounds to be retained by the membrane.

Advantages to this technology are low operating pressure and effectiveness in treating oily substances. Additional treatment and disposal of the removed contaminants is required.

- Pervaporation membrane separation

Like diffusion membrane separation, pervaporation membrane separation is a permeability-selective technology. Contaminated water contacts the membrane on one side and is removed as vapor on the other. This phase change is accomplished by maintaining a vapor pressure on the permeate side which is less than that of the liquid influent side. The effluents of this system are purified groundwater and vapor phase-condensed, concentrated permeate liquid.

Although pervaporation does not require additional air phase offgas treatment as does air stripping, management of the concentrated permeate stream is necessary.

Chemical Treatment

- Chemical (liquid phase) oxidation

In chemical (liquid phase) oxidation, a contaminated liquid stream is mixed with an inorganic acid solution such as phosphoric acid, and heated to temperatures in the range of 250° to 500°F. Byproducts of this reaction mechanism are nitrogen,

oxygen, carbon monoxide, carbon dioxide, hydrogen, and water. This technology has proven effective in the reduction of pesticides and herbicides.

Biological Treatment

- Composting

Composting, an established technology for the treatment of solid hazardous wastes, reduces the biological content of wastes prior to stabilization. Biodegradation of organic compounds occurs within a compost matrix consisting of contaminated soils and/or sludges mixed with organic carbon sources and bulking agents such as straw, bark, or wood chips. The matrix is divided into piles and placed on lined treatment beds. Microbial degradation of contaminants is maximized by aeration and maintenance of optimum temperature, moisture content, and nutrient levels within the piles. An advantage of composting is that bulking agents can be screened out after completion of the composting process and added to a subsequent batch of contaminated soil to be composted. However, composting is time consuming and may extend the closure process.

4.3.2 D&D Techniques

Techniques used for D&D of equipment and buildings are presented in Table 4-58. The decontamination techniques are separated into two groups: the decontamination techniques being used or planned to be used for existing projects; and some techniques under investigation or development, but potentially available at a later date. Decontamination techniques commonly used involve some method to clean the surface of the equipment and to collect the cleaning agent (typically water) for treatment and disposal. Listed in Table 4-58 are the four common modes used for decommissioning facilities: safe storage; in-place stabilization; decontamination for reuse; and dismantlement. D&D techniques presently in use typically use standard or modified construction-type equipment, and do not require the installation of new process equipment or structures.

TABLE 4-58. DECONTAMINATION AND DECOMMISSIONING TECHNIQUES.

TECHNIQUE	DESCRIPTION
DECONTAMINATION TECHNIQUES IN-USE OR PLANNED:	
Water/chemical flushes	Large amounts of water used, with or without chemicals being added, to remove any surface contamination.
Steam jet cleaning	Involves use of high pressure steam to clean the surface with or without chemicals being added.
Manual cleaning	Water used, with or without chemical additives, and stiff bristle brushes to manually scrub the surface of the contaminated material.
Carbon dioxide blasting	An abrasive method using carbon dioxide pellets as abrasive media.
Scabbling and spalling	Machinery used that mechanically removes top layer of material such as concrete, along with surface contaminants.
Sandblasting	Sand used as abrasive to remove surface layers.
DECONTAMINATION TECHNIQUES UNDER INVESTIGATION/DEVELOPMENT:	
Strippable coating	Coating system, applied before facility becomes contaminated, and easily removed along with surface contaminants.
Vibratory	Vibratory action used to dislodge particles from surface.
Hydroblasting	Extremely high pressure water used to remove surface layer contaminants.
Abrasion	Abrasive material (sand, CO ₂ pellets, glass beads), propelled against contaminated surface at high velocity to remove contaminants and some of substrate.
Electropolishing	Object being decontaminated serves as anode in electrochemical process which dissolves surface material, including contaminants.
Light ablation	High energy light source (UV, laser) used to volatilize surface layer contaminants.
Foams and gels	Specially formulated foams and gels used as cleaning agents.
DECOMMISSIONING MODES	
Safe storage	Contaminated material stored in location designated as safe for storage of contaminated material. Used when contaminated material cannot be safely decontaminated, but can be moved to safe location. Method involves volume reduction, if possible.
In-place stabilization	Immobilization or encapsulation of contaminants to eliminate dispersion of contaminants. Method used when contaminated material cannot be decontaminated or moved to safe storage location.
Decontamination for reuse	Removal of contamination to "clean" condition suitable for reuse.
Dismantlement	Dismantlement of structure and separate disposal of contaminated and non-contaminated material. Method involves volume reduction, if possible.

4.3.3 Facility Surveillance and Maintenance Techniques

A surveillance and maintenance program is required by DOE 5820.2A, Chapter V (DOE, 1988). This program activity manages the inspection and maintenance of surplus facilities identified for D&D and assures compliance with all applicable safety, environmental, and procedural standards while these facilities are under D&D program control. The purposes of the surveillance and maintenance function for surplus facilities awaiting D&D are to ensure adequate containment of contamination; and to provide physical safety and security controls and regulated surveillance to maintain the facilities in a manner that will minimize potential hazards to the public, workers, and the environment. Elements of the D&D surveillance and maintenance program follow:

- Surveillance and maintenance planning to accomplish the appropriate integration of facility conditions, surveillance frequencies, security requirements, routine maintenance, and major facility repair
- Performance and documentation of periodic inspections at each surplus facility
- Deficiency control system that provides for the prioritization, tracking, resolution, and documentation of identified deficiencies
- Performance of maintenance, repair, and cleanup tasks required to correct deficiencies and complete routine scheduled maintenance.

Hazards to workers, the public, and the environment may be present at a surplus facility awaiting D&D. The hazards depend on factors including type and amount of contaminant present; medium in which contaminant is present; condition of facility; present use of facility; and location of workers engaged in day-to-day or periodic activities. Health hazards will be identified in the activity-specific safety analysis documentation but can include the presence of ionizing radiation; airborne particulates of toxic materials such as heavy metals; VOCs in the atmosphere; flammable substances; PCBs; and physical hazards such as open excavations and equipment or buildings in disrepair. Environmental hazards can include the presence of toxic contaminants in liquids or airborne contaminated soil or debris. Table 4-59 provides some examples of standard surveillance techniques.

TABLE 4-59. EXAMPLES OF SURVEILLANCE TECHNIQUES FOR SURPLUS FACILITIES.

HAZARD	SURVEILLANCE TECHNIQUE
<ul style="list-style-type: none"> • Radioactivity 	<ul style="list-style-type: none"> - Surface contamination swipes/swabs - Handheld radiation detector - Continuous area monitors (CAMs) - Remote area monitors (RAMs)
<ul style="list-style-type: none"> • Chemical 	<ul style="list-style-type: none"> - Organic vapor detectors (photoionization, flame ionization) - Laboratory analysis of samples - Personal air sampling pumps (for example, lead, silica dust) - Combination gas detector (oxygen percentage, lower explosive limit (LEL)) - Draeger tubes and hand pump
<ul style="list-style-type: none"> • Industrial 	<ul style="list-style-type: none"> - Noise: noise dosimeter/sound level monitor - Heat/cold: field measurements and observations - Visual inspection of work site and equipment before and during work activities

4.4 Structures, Systems, and Components Important to Safety

Engineered safety features (ESFs) and safety class structures, systems, and components (SSC) are not expected to be required for environmental remediation and D&D activities that are classified as Hazard Category 3 or below. For these environmental remediation and D&D activities within the scope of the BSAF, the unmitigated release of the available inventory of radioactive and/or hazardous material has the potential for only significant localized consequences (Section 5.3).

Structures, systems, and components important to worker safety may be required for environmental remediation and D&D activities. Table 4-60 lists design features important to environmental remediation and D&D activities at the INEL, that may be required dependent on the hazards to which workers may be exposed. Standard industrial controls apply for areas such as electrical and fire safety. Design, operation, maintenance, and surveillance of SSC important to worker safety are described in Chapters 9 and 10. A listing of codes and standards that may be applicable is provided in Chapter 21, which includes DOE 6430.1A (DOE, 1989) and the DOE-ID Architectural Engineering Standards (DOE-ID, 1992).

TABLE 4-60. EXAMPLES OF DESIGN FEATURES IMPORTANT TO WORKER PROTECTION.

HAZARD	DESIGN FEATURE
	ITEM
Radioactivity	Shielding
	Containment/confinement
	Monitors
Chemical	Ventilation
	Containment/confinement
	Monitors

4.5 Supporting Facilities, Services, and Utilities

Environmental remediation and D&D activities require the support of INEL facilities, services, and utilities. Supporting facilities necessary for environmental remediation and D&D activities include waste storage, treatment, and disposal facilities (onsite and offsite), including WERF and RWMC; and personnel support facilities for sanitation, staging areas, and offices. Services required in support of environmental remediation and D&D activities include transportation of radioactive, hazardous, and solid waste; fire protection; security; and emergency response personnel and equipment. Facilities, services, and utilities potentially necessary to support environmental remediation and D&D activities include the following:

- Telephone service
- Water service/supply
- Electrical generators/emergency electrical power
- Decontamination unit (trailer)
- Radio communications
- Fire Brigade
- Respirable air supply
- Emergency egress considerations
- Confined space testing services
- Underground utility locating services.

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CHAPTER 5.0

HAZARD ANALYSIS AND CLASSIFICATION OF THE FACILITY

June 20, 1994

ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY

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5.0 HAZARD ANALYSIS AND CLASSIFICATION OF THE FACILITY

Hazard analysis and classification of hazards is required by United States Department of Energy (DOE) Order 5480.23, *Nuclear Safety Analysis Reports* (DOE, 1992a), for nuclear facilities and operations. DOE Standard (DOE-STD)-1027-92, *Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports* (DOE, 1992b), provides guidance on performing hazard analyses and classifying hazards to satisfy DOE 5480.23 requirements. This chapter of the Baseline Safety Analysis File (BSAF) provides guidelines for the following: identifying the inventory of radioactive and hazardous materials for Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP) activities, including environmental remediation and decontamination and decommissioning (D&D) (Section 5.1); assessing hazards associated with ERP activities (Section 5.2); and determining the hazard classification of ERP activities (Section 5.3) to meet DOE 5480.23 requirements and DOE-STD-1027-92 guidelines.

5.1 Inventory of Radioactive and Hazardous Materials

Section 5.1 of ERP activity-specific safety analysis documentation should provide estimates of the existing inventory of radioactive and hazardous materials at the Waste Area Group (WAG)/Operable Unit (OU) site or at the surplus facility scheduled for D&D, based on best available information. In addition, the inventory of hazardous materials required by remedial action or D&D techniques should be included in the hazardous material inventory. The quantity, form, and location of the radioactive and hazardous materials for the WAG/OU site or D&D project should be identified and presented in a table. The table should include the following:

- Environmental remediation or D&D site
- Radioactive/hazardous material
- Maximum quantity
- Form (for example, powder, metal, sludge, gas)
- Location
- Additional information (for example, passive barriers to release).

The basis for the estimated quantity of material should be provided. The basis may include historical data on contamination levels and releases; soil sampling; well drilling; water sampling from wells, ponds, or tanks; direct radiation surveys; and/or scraping and wipe sampling.

5.2 Hazard Analysis

As defined in DOE 5480.23 (DOE, 1992a), "a hazard is a source of danger (that is, a material, energy source, or operation) with the potential to cause illness, injury, or death to personnel or damage to a facility or to the environment, without regard for the likelihood or credibility of accident scenarios or consequence mitigation." In this section, the recommended methodology for hazard analysis of ERP activities is presented. The methodology consists of hazard identification and hazard assessment and is consistent with the guidelines in DOE-STD-1027-92 (DOE, 1992b). Based on the hazard analysis, hazards not clearly addressed by DOE-required occupational safety and health programs are identified for further analysis in Chapter 11.

5.2.1 Hazard Identification

After identifying the inventory of radioactive and hazardous materials for the specific ERP activity (Section 5.1), potential hazards to workers, the public, and the associated environment are identified. Hazard identification is facilitated by use of standard checklists to ensure the hazard review is comprehensive. Tables 5-1 and 5-2 are checklists that identify occupational hazards, material hazards, and energy sources that may pose hazards from ERP activities. The hazard analysis for each ERP activity should systematically determine whether the hazards in Tables 5-1 and 5-2 are applicable to the activity. Documentation of the potential hazards identified for an ERP activity can be as simple as reproducing the BSAF Tables 5-1 and 5-2 in the safety analysis documentation and marking either "yes" or "no" that the hazard is or is not applicable.

To ensure that the identified hazards include relevant DOE experience, two primary databases should be searched: the Safety Performance Measurement System (SPMS) (DOE, 1990) and the Occurrence Reporting and Processing System (ORPS) (DOE-ID, 1991). These systems are maintained by the System Safety Development Center (SSDC), located at the INEL, under guidance of DOE's Office of Nuclear Energy (NE). The SPMS consists of several modules including the Computerized Accident/ Incident Reporting System (CAIRS) module and the Unusual Occurrence Report (UOR) module. The CAIRS is an automated system for retrieving DOE-wide accident data. The UOR module is a database consisting of unusual occurrence reports generated between January 1981 and September 1990. After 1990, the UORs were categorized as Occurrence Reports and recorded and tracked by the ORPS.

The databases can be searched using key words. Potential applicable events can be printed. Searching with key words is useful in determining whether other DOE sites have performed similar activities and have had reportable problems. An example list is provided in Table 5-3.

The events identified in Table 5-3 are representative of types of events in DOE databases potentially applicable to ERP activities. Based on Table 5-3, the most common hazards for environmental remediation and D&D workers are industrial safety hazards. Some worker contaminations and some releases of radioactive and nonradioactive hazardous materials are identified. However, none of these releases resulted in significant environmental damage or significant localized exposures.

TABLE 5-1. OCCUPATIONAL HAZARD ANALYSIS CHECKLIST

HAZARD	APPLICABLE	EXPLANATION	DOE-PREScribed OSH STANDARDS
High voltage ($\geq$ 600 V)	Yes/No	Power supply lines or electrical equipment at the environmental remediation or D&D site.	29 CFR 1910, Subpart S
Low voltage (< 600 V)	Yes/No	Power supply lines or electrical equipment at the environmental remediation or D&D site.	29 CFR 1910, Subpart S
Flammable gases, liquids, dusts	Yes/No	Contained in vessels, piping, or used in decontamination or at site.	29 CFR 1910.106, .107, .108, .110, .111, .120, .144, .1200; 29 CFR 1926.152; DOE-ID Appendix 0550, Part IV-B.
Explosive materials	Yes/No	Explosives used at site.	29 CFR 1910.109; DOE <u>Explosive Safety Manual</u> (DOE, 1991); 40 CFR Subchapter C
Cryogenic systems	Yes/No	Used in decontamination or at site.	None of DOE-prescribed standards clearly address cryogenics.
High temperature ($\geq 125^{\circ}\text{F}$ at contact or 203°F)/ pressures (≥ 25 psig for gas or vapor or ≥ 200 psig for liquids)	Yes/No	Used in decontamination or at site.	American Society of Mechanical Engineers (ASME) <u>Boiler and Unfired Pressure Vessel Code</u>
Inert and low-oxygen atmospheres	Yes/No	At vessel entry and in excavations.	29 CFR 1910.120, .252, .1200; 29 CFR 1926.651; DOE-ID Appendix 0550, Part III, Subpart O.
Toxic substances	Yes/No	Identified in material inventory; used in decontamination or at site.	29 CFR 1910.120, .1200, Subpart Z; 29 CFR 1926.353; American Conference of Governmental Industrial Hygienists (ACGIH) <u>Threshold Limit Values (TLVs)</u> ; DOE-ID Appendix 0550, Part III, Subpart J, and Part V.
Nonionizing radiation	Yes/No	Use of lasers, infrared heaters, or radiofrequency equipment in decontamination or at site.	29 CFR 1910.97; ACGIH TLVs
High intensity magnetic fields	Yes/No	Used in decontamination or at site.	ACGIH TLVs
High noise levels	Yes/No	Generated around operating equipment or during gas or liquid releases during decontamination or at site.	29 CFR 1910.95, .1200; 29 CFR 1926.52; ACGIH TLVs; DOE-ID Appendix 0550, Part V.

TABLE 5-1. OCCUPATIONAL HAZARD ANALYSIS CHECKLIST (CONCLUDED)

HAZARD	APPLICABLE	EXPLANATION	DOE-PRESCRIBED OSH STANDARDS
Mechanical and moving equipment dangers	Yes/No	Exposure around equipment and vehicles used in decontamination or at site.	29 CFR 1910.147, .211 - .222; 29 CFR 1926, Subpart W; DOE-ID Appendix 0550 Part III, Subparts D and F.
Working at heights	Yes/No	Exposure on structures or high working surfaces at site.	29 CFR 1910.25, .28; 29 CFR 1926.951, .451; DOE-ID Appendix 0550, Part III, Subpart C.
Excavation	Yes/No	Exposure around excavations at site.	29 CFR 1926, Subpart P; DOE-ID Appendix 0550, Part III, Subpart C.
Material handling dangers	Yes/No	Exposure at site.	29 CFR 1910.120, .176, .178 - .182; 29 CFR 1926.953; DOE <u>Hoisting and Rigging Manual</u> ; DOE-ID Appendix 0550, Part III, Subparts G and H.
Pesticide use	Yes/No	Used at site.	29 CFR 1910.1200; DOE-ID Appendix 0550, Part V.
Temperature extremes (for example, high and low temperatures during activities)	Yes/No	Exposure from environmental temperature extremes at site. Exposure from personal protective equipment layers.	29 CFR 1910.120, .1200; ACGIH TLVs; DOE-ID Appendix 0550, Part V.
Inadequate illumination	Yes/No	Activities within enclosed structures or if little daylight at site.	29 CFR 1910.37, .68, .110, .120, .177 - .179, .219, .303; 29 CFR 1926.26; DOE-ID Appendix 0550, Part V.
Construction	Yes/No	Exposure at site.	29 CFR 1926; DOE-ID Appendix 0550, Part III, Subpart C.

TABLE 5-2. MATERIAL AND ENERGY SOURCE HAZARD ANALYSIS CHECKLIST

HAZARD	APPLICABLE	EXPLANATION
Radioactive	Yes/No	Identified in material inventory and exposure at activity site.
Fissionable or Fissile	Yes/No	Identified material inventory greater than DOE-STD-1027-92 minimum critical fissile mass limits.
Alkali Metal	Yes/No	Identified in material inventory and exposure at activity site; incompatible mixtures at site (for example, sodium (Na), sodium potassium (NaK), lithium (Li)).
Corrosive	Yes/No	Identified in material inventory and exposure at activity site; incompatible mixtures at site (for example, acids, caustics, organic solvents).
Natural Phenomena	Yes/No	Exposure at site; contributes to release of radioactive or hazardous materials.
Fire	Yes/No	Exposure at site; contributes to release of radioactive or hazardous materials.
Interfaces	Yes/No	Equipment used to transport material from place to place; exposure at site.
Waste Disposal	Yes/No	Incompatible wastes and container materials.
Maintenance	Yes/No	Maintenance requirements outside of as low as reasonably achievable (ALARA) philosophy.
Security	Yes/No	Accidental discharge of weapons during inspection or surveillance contributing to release of radioactive or hazardous materials.

TABLE 5-3. EXAMPLE OF DATABASE EVENTS

DATABASE	REPORT NUMBER	EVENT DESCRIPTION	SAFETY SIGNIFICANCE
ORPS	RL-WHC-TPLANT-1992-0018	Pinhole failure in lower area of 55-gallon steel drum, resulted in release of potentially hazardous waste exceeding state-specified quantities.	Environmental release
	ORO-MMES-PORTSTEMG-1992-0001	Five individuals contaminated with beta contamination during radioactive solid waste transfer activities.	Personnel contamination
UOR	1953	Eight subcontractor employees contaminated after handling contaminated tools.	Personnel contamination
	5524	Asbestos accidentally released during removal of insulated pipe. Asbestos spread over 40-square foot area of facility; approximately 5 additional people possibly exposed to unknown concentrations of asbestos fibers.	Personnel exposure to hazardous materials
	5026	Small quantity of mixed hazardous material released when drum fell during transport with forklift.	Environmental release
	869	Chemical reaction occurred in treatment facility when operator accidentally transferred chemical precipitate to tank containing acid. Chemical reaction resulted in foam released through vent line and through high energy particulate air (HEPA) filter contaminating side of building with U, Pu, and Am.	Environmental release and contamination
CAIRS	87005	During D&D activities, employee killed after falling through unguarded hole in mezzanine.	Personnel injury
	92008	Large polyethylene tank being installed in bermed area when lifting strap broke and tank fell on employee. Employee died five days later.	Personnel injury
	87005	Approximately 300 gallons of nitric acid spilled through failed pipe nipple and pump suction flange. Acid was contained in bermed area. Pipe nipple failed due to incompatibility with nitric acid.	Hazardous material release

5.2.2 Hazard Assessment

The hazard assessment defines the specific hazards posed by the ERP activity. Hazard assessment is necessary to identify potential hazards that require further analysis in Chapter 11.

A recommended method for performing and documenting the hazard assessment is providing a table. Table 5-4 illustrates information recommended for this table.

TABLE 5-4. EXAMPLE HAZARD ASSESSMENT TABLE.

HAZARD	OPERATION/EVENT	POTENTIAL IMPACTS	PREVENTIVE OR MITIGATIVE FEATURES		METHOD OF DETECTION
			DESIGN	ADMINISTRATIVE	
Radioactive materials	Failure to use equipment properly; not following procedures; natural phenomena	Worker exposure to radioactive material	HEPA filter system	Limitation of worker exposure time	Monitoring
Hazardous materials	Failure to use equipment properly; not following procedures; natural phenomena	Worker exposure to hazardous material	N/A	Personal protective equipment	Monitoring
Excavation - soil slide	Failure of shoring or slope improper for depth	Equipment damage and personnel injury	Shored sides or 1 to 1 1/2 side slope	Construction safe work permit	Depth of excavation

The column headings in Table 5-4 are defined as follows:

Hazard	Lists potential hazards identified in Section 5.2.1, such as, radioactive material.
Operation / Event	Describes potential effect of hazard on workers, the public, or the environment; addressing both normal operation and off-normal events. For example, workers may be subject to radiation exposure as part of normal activities; or postulated events including equipment failure or human error may result in unplanned release of radioactive material. Possible causes of off-normal events are described.
Potential Impacts	Identifies impacts such as worker radiation exposures above that anticipated for normal operation.
Preventive or Mitigative Features	Identifies and describes design and/or administrative controls provided to prevent or mitigate the hazard. For example, HEPA filter system or emergency plans.
Method of Detection	Identifies and describes the means of detecting the hazard. For example, area radiation monitors or routine surveillance.

The hazard assessment should be performed by experienced safety analysts with ERP project staff knowledgeable about the planned activity. Walk-down of the activity/area by the appropriate personnel should be considered. The hazard assessment should include use of the hazard checklists and DOE experience databases to ensure that the results are comprehensive.

Special guidelines for the hazard assessment of occupational, fire, and natural phenomena hazards are provided in the following discussion.

- Occupational Hazards

Occupational hazards, including common industrial hazards identified in the hazard analysis (Section 5.2.1), that are clearly regulated by DOE-prescribed occupational safety and health (OSH) standards require no specific hazard assessment. However, analyses required by the OSH standards should be referenced and all applicable OSH standards listed in the safety analysis documentation (Table 5-1 and Chapters 9 and 10).

- Fire Hazards

Fire is an expected hazard for ERP activities. The principal concerns from fire hazards relate to the potential for a fire that contributes to a release of radioactive or hazardous material. These potential hazards should be identified in this chapter and analyzed in Chapter 11. Fire hazards and effects

on personnel safety are standard occupational hazards and require no specific hazard analysis. Fire hazard analyses required by fire standards (such as, DOE 5480.7A (DOE, 1993a)) should be referenced and applicable OSH standards listed in safety analysis documentation. Damage to environmental remediation and D&D facilities by fire is not a major concern because of the limited facilities normally required. In DOE 5480.7A (DOE, 1993a), property scheduled for D&D is not considered a loss if destroyed by fire.

- Natural Phenomena Hazards

Hazards posed by natural phenomena that could affect the operation of ERP activities should be summarized (Chapter 3). Natural phenomena hazards may include earthquakes, floods, and high winds.

ERP activities covered by the BSAF are typically of short duration and not complex. This results in minimal risk. Further analysis is required when the natural phenomena can contribute to or initiate a release of radioactive or hazardous material.

The hazard assessment is the basis for the analysis of normal, abnormal, and accident conditions in Chapter 11 as this assessment identifies and describes the hazards that require additional qualitative analysis for the specific ERP activity.

5.3 Hazard Classification

5.3.1 Hazard Classification Guidance

Table 5-5 presents hazard classification standards used for ERP activities. Each major type of hazard is classified as well as the overall activity in accordance with DOE 5480.23 (DOE, 1992a). In accordance with DOE-STD-1027-92 (DOE, 1992b), hazard classification is determined by first identifying the radioactive and hazardous material inventories for an activity (Section 5.1). Inventories are compared to the hazard category threshold values for radioactive materials in Table A-1 of DOE-STD-1027-92 or the threshold values cited for hazardous materials in interim guidance issued by the DOE-Idaho Operations Office (DOE-ID) (Williams, 1993). DOE-STD-1027-92 Table A-1 threshold values assume release fractions for Hazard Category 3 activities and the guideline does not specifically allow their modification. Calculation and analysis of radioactive decay and daughter products is not required to determine the hazard category since site-specific sampling and analysis should provide appropriate inventories. The DOE-ID interim guidance specifies that 29 CFR 1910.119 (DOL, 1992) thresholds should be used as the Hazard Category 3 threshold quantities for hazardous materials. Threshold planning quantities from 40 CFR 355 (EPA, 1993) are specified if the chemical of concern is not listed in 29 CFR 1910.119. These thresholds were chosen based on the fact that the chemical industry is not required to apply any special precautions if quantities on-hand are less than the listed thresholds.

TABLE 5-5. HAZARD CLASSIFICATION STANDARDS

HAZARD CATEGORIES	CLASSIFICATION CRITERIA (DOE STANDARD DOE-STD-1027-92)	CLASSIFICATION CRITERIA (DOE ORDER 5480.23)
Hazard Category 1	Radiological: Hazard Category A Reactors (DOE 5480.6) Chemical: None	Hazard analysis shows potential for significant offsite consequences. DOE 5481.1B addresses requirements for safety analysis of nonnuclear facilities.
Hazard Category 2	Radiological: Table A.1 Cat 2 TQs (DOE-STD-1027-92), Criticality events Chemical: None	Hazard analysis shows potential for significant onsite consequences. DOE 5481.1B addresses requirements for safety analysis of nonnuclear facilities.
Hazard Category 3	Radiological: Table A.1 Cat 3 TQs (DOE-STD-1027) Chemical: None (DOE-ID interim guidance: 29 CFR 1910.119 quantities; threshold planning quantities from 40 CFR 355.)	Hazard analysis shows potential for only localized significant consequences. DOE 5481.1B addresses requirements for safety analysis of nonnuclear facilities.

ERP activities that involve combinations of radioactive materials should be designated as Category 2 or 3 if the sum of the ratios of the quantities of each material to the Category 2 or 3 thresholds exceeds one. The sum of the ratio is given by Equation 5-1 and is described in DOE-STD-1027-92.

$$R = \sum_{j=1}^n \frac{I_j}{I_{tj}} \quad (5-1)$$

where

R = sum of the ratios
n = total number of isotopes present
j = isotope counter
I_j = inventory of isotope j
I_{tj} = threshold value of isotope j.

The ratio, R, must consistently apply the same category threshold list (that is, Category 3 or Category 2 thresholds). For example, if the Category 3 thresholds were used to assess the hazard classification of a particular activity and the sum of the ratios, R, was greater than 1, then the activity would be classified as Hazard Category 3, if, in addition, the ratio, R, recalculated using the Category 2 thresholds is less than one.

The sum of the ratios for radioactive material required by DOE-STD-1027-92 for hazard classification does not apply to hazardous materials. Threshold quantities in 29 CFR 1910.119 and threshold planning quantities in 40 CFR 355 should be compared for individual hazardous materials potentially present. If each individual hazardous material is below the threshold, the activity is not subject to Hazard Category 3 safety analysis requirements. If the sum of the ratios for radioactive materials are below the thresholds in DOE-STD-1027-92 and the hazardous chemical inventory is below the threshold quantities in 29 CFR 1910.119/40 CFR 355 (DOE-ID) guidance indicates the level of safety analysis documentation required.

Bases for hazard classification should be provided in activity-specific safety analysis documentation through tables. Two tables, one for the radiological inventory and one for the hazardous material inventory of the activity, should be provided. Tables 5-6 and 5-7 are example tables. For simplicity, the quantity of 100,000 kilograms of soil is assumed for each case. The hazardous material limits are given in pounds so conversion to the appropriate units may be necessary.

TABLE 5-6. EXAMPLE RADIOACTIVE MATERIAL HAZARD CLASSIFICATION

RADIONUCLIDE	ACTIVITY IN SOIL (pCi/g)	AMOUNT OF SOIL (kg)	INVENTORY (Ci)	HAZ. CAT. 3 THRESHOLD (Ci)	RATIO
²⁴¹ Am	1.1E+01	100,000.0	1.1E-03	5.2E-01	2.1E-03
⁶⁰ Co	1.3E+03	100,000.0	1.3E-01	2.8E+02	4.6E-04
⁵¹ Cr	7.3E+00	100,000.0	7.3E-04	2.2E+04	3.3E-08
¹³⁴ Cs	3.0E+01	100,000.0	3.0E-03	4.2E+01	7.1E-05
¹³⁷ Cs	9.2E+03	100,000.0	9.2E-01	6.0E+01	1.5E-02
¹⁵² Eu	2.0E+01	100,000.0	2.0E-03	2.0E+02	1.0E-05
¹⁵⁴ Eu	1.4E+01	100,000.0	1.4E-03	2.0E+02	7.0E-06
^{239/240} Pu	9.1E+00	100,000.0	9.1E-04	5.2E-01	1.8E-03
²³⁸ Pu	1.9E+00	100,000.0	1.9E-04	6.2E-01	3.1E-04
⁹⁰ Sr	4.2E+02	100,000.0	4.2E-02	1.6E+01	2.6E-03
²³⁴ U	5.1E+00	100,000.0	5.1E-04	4.2E+00	1.2E-04
²³⁵ U	2.0E+01	100,000.0	2.0E-03	4.2E+00	4.8E-04
²³⁸ U	1.9E+00	100,000.0	1.9E-04	4.2E+00	4.5E-05
⁶⁵ Zn	2.9E+00	100,000.0	2.9E-04	2.4E+02	1.2E-06
⁶⁵ Zr	3.1E+00	100,000.0	3.1E-04	7.0E+02	4.4E-07
Ratio < 1 ?					2.3E-02

TABLE 5-7. EXAMPLE HAZARDOUS MATERIAL HAZARD CLASSIFICATION

CHEMICAL	CONCENTRATION IN SOIL (mg/kg)	AMOUNT OF SOIL (kg)	INVENTORY (kgs)	THRESHOLD (kgs)
Cresol	2.2E+02	100,000.0	106.9	2,204
Phenol	2.4E+00	100,000.0	1.1	1,102
Toluene	4.0E-03	100,000.0	19.4E-4	220.4

5.3.2 General Guidance for Hazard Categorization

ERP activities may be subdivided into segments provided passive features preclude bringing material together or causing harmful interaction from a common event or severe phenomena. The overall hazard classification of an ERP activity is the highest hazard category classification of the various segments of the activity. An activity, structure, or facility segment is assigned a hazard category according to the material inventory associated with that segment. However, by segmenting the activity, the necessary and appropriate design and administrative controls will be provided commensurate with the hazard.

As an example, environmental remediation activities such as excavations normally do not expose the entire inventory of radioactive or hazardous material in the ground for release. Typically, only the top surface of the excavation area is available for a release that may affect workers or the public. Therefore, the inventory of radioactive or hazardous material available for release by postulated events (such as high wind or fire) for the purpose of hazard classification, can be segmented to include only the surface quantity to a justifiable depth.

Similarly, an activity may be segmented based on physical separation. For example, a facility undergoing D&D may be segmented if facets of the facility are physically separated so that materials cannot be brought together to total more than the radioactive or hazardous material threshold limits.

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CHAPTER 6.0

PRINCIPAL HEALTH AND SAFETY CRITERIA

June 20, 1994

ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY

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6.0 PRINCIPAL HEALTH AND SAFETY CRITERIA

This chapter presents the principal health and safety criteria applicable to Environmental Restoration Program (ERP) activities at the Idaho National Engineering Laboratory (INEL). Criteria are derived or adopted from generic safety and related environmental requirements contained in statutes, rules, regulations, and United States Department of Energy (DOE) Directives, together with DOE health and safety policies and goals. The criteria are provided in Section 6.1 organized under the areas of nuclear criticality safety, radiation protection, hazardous material protection, industrial hazards protection, fire protection, environmental protection, and structural design. These criteria are used in Section 6.2 to define a hazard grade system for determination of a hazard level for a specific environmental remediation or D&D activity. This hazard grade system for the INEL ERP is intended to assist in the application of the necessary and sufficient design requirements, codes, and standards and administrative controls to environmental remediation and D&D activities.

6.1 Principal Health and Safety Criteria

6.1.1 Nuclear Criticality Safety

ERP activities with a potential for a criticality event are outside the scope of the Baseline Safety Analysis File (BSAF). Chapter 8 provides guidelines for demonstrating that a particular activity does not present a criticality concern.

6.1.2 Radiation Protection

Radiation protection criteria are drawn from requirements including 10 CFR 835 (DOE, 1994) and DOE directives DOE 5480.11 (DOE, 1988a), DOE 5400.5 (DOE, 1990), and DOE Notice 5480.6 (DOE, 1992), which directs the use of the *Radiological Control Manual* (DOE-ID, 1992a). 10 CFR 835 will surplant DOE 5480.11 in accordance with the DOE plan and schedule for compliance with the rule.

Radiation protection criteria include normal operating criteria, limiting operational criteria, and siting and design criteria. Normal operating criteria are intended to maintain radiation dose below operational limits and to assist in optimizing radiation dose at levels as low as reasonably achievable (ALARA). Operational radiation protection criteria are presented in Table 6-1 and establish administrative control levels, action levels requiring monitoring and assessment of normal operational radiation hazards, use of protective equipment, and notification of workers.

Limiting operational criteria are established limits for radioactive protection of workers, the public, and the environment. Dose limits are established during normal operations, abnormal occurrences, and emergencies, including dose limits from radioactive material effluent which may be discharged to the environment and dose limits for emergency response personnel. Table 6-2 presents the limiting operational criteria for radiation protection of workers, the public, and the environment.

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TABLE 6-1. OPERATIONAL RADIATION PROTECTION CRITERIA.

CRITERION	QUANTITY	SAFETY BASIS	REFERENCE
Radiological Performance Indicator Goals	Operation-specific measures of occupational dose, personnel contaminations, waste volume, effluent discharges	Indicator of effectiveness of radiation protection program - may be established by M&O contractor at site level or operation level	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
DOE Administrative Control Dose Level	2,000 mrem/year total effective dose equivalent (TEDE) to personnel at DOE facilities	Assures control of occupational dose; evaluation and approval of DOE Program Secretarial Official required to exceed control level	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Administrative Dose Control Level	$\leq 1,500$ mrem/year TEDE to individual; 200 mrem/yr whole body EDE to DOE-ID personnel	Assures control of occupational dose; evaluation and approval of M&O senior site executive required to exceed control level	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Lifetime Individual Dose Control Level	N rem TEDE, where N is person's age in years	Assures chronic occupational doses approach 1 rem/year for prevention of non-stochastic effects	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Monthly Occupational Dose Guideline - Fetus of Declared Pregnant Worker	50 mrem/month dose equivalent	Prevention of fetal stochastic radiation effects	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Special Dose Control Level for Workers Exceeding Lifetime Control Level	≤ 1 rem/year TEDE	Assures chronic occupational doses approach 1 rem/year for prevention of non-stochastic effects	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Guideline for Occupational Dose Exclusively in Controlled Areas	≤ 0.1 rem/year TEDE	Ensures work in Controlled Areas adequately isolated from Radiological Areas	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Posted "Hot Spot"	> 0.1 rem/hr and five times general area dose rate	Alerts workers to localized external radiation hazard	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Radiological Planning Review of Nonroutine or Complex Activity	Nonroutine or Complex Activity in High Contamination Area or area exceeding 1 rem/hr	Provides for ALARA review, worker indoctrination, and assessment of work to assure worker protection	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Radiation Work Permit Required	Entry to High and Very High Radiation Areas, High Contamination Areas, Airborne Radioactivity Areas	Provides for radiation protection review, worker information to assure worker protection	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Protective Clothing Required	Entry to Surface Contamination and Airborne Radioactive Materials Areas	Protection against personnel contamination	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)

TABLE 6-1. OPERATIONAL RADIATION PROTECTION CRITERIA (CONCLUDED).

CRITERION	QUANTITY	SAFETY BASIS	REFERENCE
Doubled Protective Clothing Required	Entry to High Contamination Areas	Protection against personnel contamination	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Guidelines for Reuse of Protective Clothing	< 10,000 dpm/100 cm ² beta-gamma < 1,000 dpm/100 cm ² alpha	Protection against personnel contamination	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Guideline for Use of Supplemental Dosimeters	Entry to High Radiation Area; potential to exceed 10% of a dose control level in one day	Self-monitoring to prevent exceeding control levels and to meet dose budgeted for work	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Dose Evaluation Due to Personnel Contamination or Inadvertent Airborne Exposure	100 mrem based on site-specific instrumentation factors	Assures monitoring of occupational exposure	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Reproducibility of Radiation Protection Monitoring Instrument Checks	±20% initial mean response checked daily before use	Assures statistical control of monitoring instrument accuracy	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Calibration of Radiation Protection Monitoring Instruments	Within one year	Assures monitoring instrument accuracy	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)

¹Total Effective Dose Equivalent (TEDE) is the sum of the external deep dose equivalent and the internal 50-year committed effective dose equivalent.

TABLE 6-2. LIMITING CRITERIA FOR RADIATION PROTECTION.

CRITERION	QUANTITY	SAFETY BASIS	REFERENCE
Occupational Whole Body Dose	5 rem TEDE	Prevention of stochastic radiation effects	10 CFR 835 (DOE, 1994); DOE 5480.11 (DOE, 1988a); DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Occupational Dose to the Lens of the Eye	15 rem TEDE	Prevention of non-stochastic radiation effects to the eye, principally cataracts	10 CFR 835 (DOE, 1994)*; DOE 5480.11 (DOE, 1988a)
Occupational Dose To Any Individual Organ, Tissue, or Extremity Except The Lens Of the Eye And Skin Exposures Localized to < 10 cm ²	50 rem TEDE	Prevention of non-stochastic radiation effects to individual organs, tissues, and extremities	10 CFR 835 (DOE, 1994); DOE 5480.11 (DOE, 1988a); DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Occupational Dose To The Fetus Of A Declared Pregnant Worker	0.5 rem TEDE in 9 months (conception to birth)	Prevention of fetal non-stochastic and stochastic radiation effects	10 CFR 835 (DOE, 1994); DOE 5480.11 (DOE, 1988a); DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Occupational Dose To Minors And Students	0.1 rem/year TEDE	Prevention of stochastic radiation effects; dose minimization	10 CFR 835 (DOE, 1994); DOE 5480.11 (DOE, 1988a)
Visitors And The Public Within Radiologically Controlled Areas	0.1 rem/year TEDE	Prevention of stochastic radiation effects; dose minimization	10 CFR 835 (DOE, 1994); DOE 5480.11 (DOE, 1988a)
Primary Dosimeter Required	>100 mrem Annual Dose Equivalent or 10% of occupational limits	Assures monitoring of significant occupational exposures	10 CFR 835 (DOE, 1994); DOE 5480.11 (DOE, 1988a)
Internal Dose Evaluation including Bioassay Monitoring	>100 mrem/year CEDE	Assures monitoring of significant occupational exposures	10 CFR 835 (DOE, 1994); DOE 5480.11 (DOE, 1988a)
Air Monitoring Required	Air Sampling: 0.1 Derived Air Concentration (DAC) Continuous Air Monitor: 1 DAC averaged over 8 hours	Assures monitoring of potential internal exposures	10 CFR 835 (DOE, 1994); DOE 5480.11 (DOE, 1988a); DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Posted "Caution Surface Contamination Area, RWP Required for Entry" Required Detection Capabilities for Surface Contamination Survey	Uranium and Decay Products: 1,000/5,000 Removable/Total alpha dpm/100 cm ² Transuranics, ²²⁸ Ra, ²²⁸ Ra, ²³⁰ Th, ²²⁸ Th, ²³¹ Pa, ²²⁷ Ac, ¹²⁵ I, ¹²⁹ I: 20/500 Removable/Total dpm/100 cm ² Th-natural, ²³² Th, ⁹⁰ Sr, ²²³ Ra, ²²⁴ Ra, ²³² U, ¹²⁸ I, ¹³¹ I, ¹³³ I: 200/1,000 Removable/Total dpm/100 cm ²	Ensures detection, worker awareness, surveillance, and control of contaminated areas to prevent contamination spread, personnel contamination, and occupational dose	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)

*10 CFR 835 will supplant DOE 5480.11 in compliance with the DOE plan and schedule for compliance with the rule.

TABLE 6-2. LIMITING CRITERIA FOR RADIATION PROTECTION (CONTINUED).

CRITERION	QUANTITY	SAFETY BASIS	REFERENCE
Posted Surface Contamination and Required Detection Capabilities for Surface Contamination Survey (Cont.)	Beta-Gamma Emitters: 1,000/5,000 Removable/Total beta/gamma dpm/100 cm ² Tritiated Compounds: 10,000 dpm/100 cm ²	N/A	N/A
Posted "Danger High Surface Contamination Area, RWP Required for Entry"	100 times Surface Contamination Area levels from above	Ensures worker awareness, surveillance, control of highly contaminated areas to prevent contamination spread, personnel contamination, occupational dose	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Airborne Radioactive Material Concentration (μCi/cc) for Posted "Caution Airborne Radioactive Materials Area, RWP Required for Entry"	10 % Derived Air Concentration (DAC) (μCi/cc)	Alerts workers to potential internal dose hazard	10 CFR 835 (DOE, 1994)*; DOE 5480.11 (DOE, 1988a) DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Posted "Caution, Radiation Area, TLD, and RWP Required for Entry"	5 - 100 mrem/hr	Alerts workers to external dose hazard	10 CFR 835 (DOE, 1994)*; DOE 5480.11 (DOE, 1988a) DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Posted "Danger, High Radiation Area, TLD, Supplemental Dosimeter, and RWP Required"	100 mrem/hr - 500 RAD/hr	Alerts workers to external dose hazard	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Posted "Grave Danger, Very High Radiation Area, Special Controls Required for Entry"	> 500 RAD/hr	Alerts workers to external dose hazard and imposes added access controls	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Posted "Caution, Soil Contamination Area"	Contaminated soil not releasable in accordance with DOE 5400.5 (DOE, 1990)	Ensures worker awareness and surveillance and control of contaminated soils to prevent contamination spread, personnel contamination, and occupational dose	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a); DOE 5400.5 (DOE, 1990)
Labeled Radioactive Material Posted Radioactive Material Area When Not in Contamination Area or Airborne Area	Internal or external contamination ≥ Posted Contamination Area levels; Sealed sources	Ensures worker awareness and surveillance, and control of radioactive materials to prevent contamination spread, personnel contamination, and occupational dose	DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Planned Special Exposure Limit	10 rem Annual Effective Dose Equivalent	Prevention of stochastic effects to exposed worker where lower-dose alternatives are unavailable or impractical. DOE-ID review and approval required	10 CFR 835 (DOE, 1994)*; DOE 5480.11 (DOE, 1988a) DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)

*10 CFR 835 will supplant DOE 5480.11 in compliance with the DOE plan and schedule for compliance with the rule.

TABLE 6-2. LIMITING CRITERIA FOR RADIATION PROTECTION (CONTINUED).

CRITERION	QUANTITY	SAFETY BASIS	REFERENCE
Emergency Exposure Guideline For Prevention of Major Property Damage, Reduction of Potential for Public Health Hazard, and Recovery of Deceased Victims	10 rem EDE	Prevention of stochastic effects to exposed worker during vital emergency response actions. Approved by emergency response official	10 CFR 835 (DOE, 1994)*; DOE 5480.11 (DOE, 1988a); DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Voluntary Emergency Exposure Guideline For Prevention of Major Property Damage or Reduction of Potential for Public Health Hazard	25 rem EDE	Minimization of non-stochastic effects to volunteer worker during vital emergency response actions. Approved by emergency response official	10 CFR 835 (DOE, 1994)*; DOE 5480.11 (DOE, 1988a); DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Voluntary Emergency Exposure Guideline For Lifesaving and Prevention of Public Health Hazard	> 25 rem EDE	Minimization of non-stochastic effects to volunteer worker during vital emergency response actions. Approved by emergency response official	10 CFR 835 (DOE, 1994)*; DOE 5480.11 (DOE, 1988a); DOE-ID 10399 Radiological Control Manual (DOE-ID, 1992a)
Unrestricted Release of Items From Controlled Areas, Excluding Hazardous Materials	No hazardous material, contamination is ALARA, and meets the following: Uranium and Decay Products, alpha emitters: <1,000/15,000 Removable/Maximum alpha dpm/100 cm ² Th, ²³² Th, ⁹⁰ Sr, ²²³ Ra, ²²⁴ Ra, ²³² U, ¹²⁸ I, ¹³¹ I, ¹³³ I 200/3,000 Removable/Maximum dpm/100 cm ² Beta & Gamma Emitters: 1,000/15,000 Removable/Maximum beta/gamma dpm/100 cm ²	Ensures evaluation of potentially contaminated items prior to release to prevent contamination spread and protect the public	DOE 5400.5 (DOE, 1990)
Contamination Limits on Packages Offered For Offsite Transport	Beta-Gamma Emitters: Uranium, Thorium: <22,000 dpm/100cm removable Alpha emitters: <2,200 dpm/100cm ² removable	Prevents contamination spread in public areas	49 CFR 173.443 (DOT, 1993)
External Radiation Limits For Closed Exclusive-Use Vehicles Transporting Radioactive Materials	200 mrem/hr at any exterior contact point 10 mrem/hr at 2 meters 2 mrem/hr in any space occupied by person not under radiation protection program	Minimizes public exposure during transportation	49 CFR 173.441 (DOT, 1993)

*10 CFR 835 will supplant DOE 5480.11 in compliance with the DOE plan and schedule for compliance with the rule.

TABLE 6-2. LIMITING OPERATIONAL RADIATION PROTECTION CRITERIA (CONCLUDED).

CRITERION	QUANTITY	SAFETY BASIS	REFERENCE
DOE Public Dose Limit- Total	100 mrem/yr TEDE, all pathways	Minimizes public exposure to radiation due to DOE activities	DOE 5400.5 (DOE, 1990)
DOE Public Dose Limit - Air Emissions- Total	10 mrem/yr TEDE	Minimizes public exposure to radiation due to DOE activities	DOE 5400.5 (DOE, 1990)
DOE Public Dose Limit - Disposal of Spent Nuclear Fuel, High Level Waste, Transuranic Wastes	25 mrem/year dose equivalent 75 mrem committed dose equivalent to any organ	Minimizes public exposure to radiation due to DOE activities	DOE 5400.5 (DOE, 1990)
DOE Public Dose Limit - Drinking Water	4 mrem/yr TEDE	Minimizes public exposure to radiation due to DOE activities	DOE 5400.5 (DOE, 1990)

*10 CFR 835 will supplant DOE 5480.11 in compliance with the DOE plan and schedule for compliance with the rule.

Criteria for siting and designing nuclear facilities and nuclear operations are provided in Table 6-3.

TABLE 6-3. SITING AND DESIGN RADIATION PROTECTION CRITERIA.

CRITERION	QUANTITY	SAFETY BASIS	REFERENCE
Design Estimate Occupational Annual Effective Dose Equivalent Limit	500 mrem/year	Maintains occupational dose below operational limits and assists in maintaining dose ALARA	DOE-ID Radiological Control Manual (DOE-ID, 1992a)
Design Value for Neutron Quality Factor	20 (dimensionless)	Introduces conservatism into design calculations	DOE-ID Radiological Control Manual (DOE-ID, 1992a)
Siting Guideline Dose Limits to Maximally Exposed Individual at Site Boundary Following a Credible Unmitigated Accident (1E-6/yr probability) (see Note)	25 rem whole body 300 rem thyroid 300 rem bone 75 rem lung 150 rem any other organ	Reference values for evaluation of Design Basis Accidents for given site	DOE 6430.1A (DOE, 1989)

Note: The use of siting guideline doses is not intended to imply that these doses constitute acceptable limits for emergency doses to the public under accident conditions. Rather, these are reference values useful in the evaluation of facility design in combination with the suitability of the site with respect to accidents having a low probability of occurrence and a low risk of public exposure to radiation.

6.1.3 Hazardous Material Protection

Worker Protection Criteria. Hazardous material protection criteria for workers are based on a chemical's Threshold Limit Value (TLV) (ACGIH, 1992), or Permissible Exposure Limit (PEL), (DOL, 1993c and 1991), whichever provides greater protection.

Actual or anticipated exposures above TLVs or PELs necessitate the use of hazard control measures including ventilation, exposure monitoring, training, and personal protective equipment (PPE) beyond normal work clothing. Table 6-4 contains a listing of general recommended PPE criteria for normal work operations. Protective criteria levels are classified as Levels 1, 2, 3, or 4. The levels are based on whether an environmental remediation or D&D worker may be exposed to chemical concentrations above the chemical's PEL or TLV, or to immediately dangerous to life and health (IDLH) concentrations. Table 6-4 should be used in conjunction with Tables 6-5 and 6-6. Table 6-5 contains exposure limits for chemicals that may be constituents of contaminated soils or other particulates that may be encountered during ERP activities. For each chemical, an estimate is provided of the ground concentration (soil or groundwater concentration) that could cause a dust containing the chemical contaminant to be more hazardous than an inert (nuisance) dust. Estimates of the ground concentrations that may result in requirements for higher levels of protection than Level 3 or 4 are given. Similarly, Table 6-6 provides exposure limits for chemicals that are volatile. Estimates of the saturation (at equilibrium) vapor concentration and the corresponding ground concentrations that may result in requirements for

TABLE 6-4. RECOMMENDED LEVELS OF PERSONAL PROTECTIVE EQUIPMENT.

ACTIVITY OF RESTORATION WORKER	LEVEL OF PROTECTIVE EQUIPMENT
Remediation Work Inside of Building, in Soil, or in Groundwater	
Chemical concentration known to be below TLV or PEL	3
Calculated chemical airborne concentration for dusts are below TLV, PEL, or DOE criteria	3
Calculated chemical airborne concentrations for vapors are below TLV, PEL, or DOE criteria	3
Calculated chemical airborne concentrations for dusts are above TLV, PEL, or DOE criteria	2
Calculated chemical airborne concentrations for vapors are above TLV, PEL, or DOE criteria	2
Exposure to carcinogen regulated by OSHA or ACGIH above Action Level is possible	2
Chemical Container Remediation Work	
Chemical concentration known to be below TLV, PEL, or DOE criteria	2
Calculated chemical airborne concentration for dusts are below TLV, PEL, or DOE criteria	2
Calculated chemical airborne concentrations for vapors are below TLV, PEL, or DOE criteria	2
Calculated chemical airborne concentrations for dusts are above TLV, PEL, or DOE criteria	2
Calculated chemical airborne concentrations for vapors are above TLV, PEL, or DOE criteria	2
Exposure to carcinogen regulated by OSHA or ACGIH above Action Level is possible	2

- 4 - Normal Attire: Exposure $\leq$ PEL or TLV
- 3 - PPE beyond what is normally required on a construction site is not required, but may be worn to keep clean, for example, coveralls & gloves; Exposure $\leq$ PEL or TLV
- 2 - PPE to include gloves, coveralls, and respirators required; Exposure $\geq$ PEL or TLV, but less than IDLH, See Table 6-5
- 1 - PPE to include encapsulating suit and Self-Contained Breathing Apparatus (SCBA); Exposure $\geq$ IDLH

TABLE 6-5. EXPOSURE LIMITS FOR PARTICULATES AND CALCULATED GROUND CONCENTRATIONS THAT MAY REQUIRE PROTECTIVE MEASURES.

CHEMICAL NAME CAS NUMBER	TLV ¹ OR PEL ² (mg/m ³)	EXPOSURE LIMIT RATIO ³	CALCULATED GROUND CONCENTRATION NEEDED TO EQUAL TLV OR PEL AIR CONCENTRATION ⁴ (mg/kg)	MAXIMUM GROUND CONCENTRATION FOR LEVEL 3 OR 4 PPE ⁵ (mg/kg)	MAXIMUM GROUND CONCENTRATION FOR LEVEL 2 PPE		IDLH (mg/m ³)
					APR ⁶ (PF=50) (mg/kg)	SA ⁷ (PF=200) (mg/kg)	
Aluminum 7429-90-5	10 (TLV)	1.0	1,000,000	1,000,000	See Note 9	See Note 9	IDLH not established
Arsenic 7440-38-2	0.01 (PEL, 1910.1018)	1,000	1,000	1,000	50,000	1,000,000 (PF=2,000)	100
Barium 7440-39-3	0.5 (PEL)	20	50,000	50,000	1,000,000	1,000,000	1,100
Cadmium 7440-43-9	0.005 (PEL, 1910.1027)	2,000	500	500	25,000	500,000 (PF=1,000)	50
Copper 7440-50-8	1 (PEL)	10	100,000	100,000	1,000,000	1,000,000	IDLH not established
Cresol ¹¹ 1319-77-3	22 (PEL)	0.45	See Note 10	See Note 10	See Note 10	See Note 10	1,100
Lead 7439-92-1	0.05 (PEL, 1910.1025)	200	5,000	5,000	250,000	1,000,000 (PF=2,000)	700
Mercury ¹¹ 7439-97-6	0.01 (PEL)	1,000	1,000	1,000	50,000	200,000	28
Nickel 7440-02-0	1.0 (PEL)	10	100,000	100,000	1,000,000	1,000,000	IDLH not established
Silver 7440-22-4	0.01 (PEL)	1,000	1,000	1,000	50,000	200,000	IDLH not established
Zinc oxide 1314-13-2	10.0 (TLV)	1.0	1,000,000	1,000,000	1,000,000	1,000,000	IDLH not established

TABLE 6-5. EXPOSURE LIMITS FOR PARTICULATES AND CALCULATED GROUND CONCENTRATIONS THAT MAY REQUIRE PROTECTIVE MEASURES (CONCLUDED).

- ¹ 8-hour time-weighted average TLV (ACGIH, 1992).
- ² PEL (DOL, 1993c) unless the limit published by OSHA in 1989 (DOL, 1991), but stayed by the Federal Court System in 1992, is smaller.
- ³ Ratio of nuisance dust exposure limit, which is 10 mg/m³, to value in column 2, calculated as 10 ÷ (PEL or TLV).
- ⁴ Ground mass concentration equivalent to the reciprocal of the ratio in column 3. It is the mass fraction (chemical mass to total mass) of a chemical in contaminated soil or aerosol that would cause a measured air (airborne particulate) concentration to simultaneously exceed both the nuisance dust exposure limit and the specific chemical exposure limit. Expressing the ground concentration in mg/kg requires multiplying the reciprocal of the ratio in column 3 by 1,000,000.
- ⁵ If value in this column is exceeded, Health and Safety Plan should contain a monitoring plan and specify industrial hygiene evaluation to determine required protective measures. Refer to Table 6-4 for definitions of PPE levels 1, 2, 3, and 4.
- ⁶ Maximum ground concentration for which an air purifying respirator is likely to be adequate, if dust concentrations do not exceed 10 mg/m³. This is based on a protection factor of 50, except where noted otherwise. Values calculated greater than 1,000,000 mg/kg are shown as 1,000,000 mg/kg.
- ⁷ Maximum ground concentration for which a supplied air respirator is likely to be adequate, if dust concentrations do not exceed 10 mg/m³. This is based on a protection factor of 200, except where noted otherwise. Values calculated greater than 1,000,000 mg/kg are shown as 1,000,000 mg/kg.
- ⁸ IDLH concentration, from National Institute for Occupational Safety and Health (NIOSH) pocket guide (NIOSH, 1985). Ground concentrations equivalent to IDLH are not calculated, because all IDLH values exceed 10 mg/m³, the reference air concentration used in these estimates. The potential for exposure conditions to exceed these values must be evaluated in the Health and Safety Plan.
- ⁹ Level 2 needed only if airborne dust concentration may exceed 10 mg/m³.
- ¹⁰ Calculation would be meaningless. Exposure limit for Cresol is greater than 10 mg/m³, indicating it is less harmful than nuisance dust.
- ¹¹ Exists as vapor and/or entrained with particulates. Calculations are for particulate components.

TABLE 6-6. EXPOSURE LIMITS FOR VAPORS AND GASES, WITH ESTIMATED GROUND CONCENTRATIONS CAPABLE OF YIELDING AIR CONCENTRATIONS THAT MAY REQUIRE PROTECTIVE MEASURES.

CHEMICAL NAME CAS NUMBER	PEL ¹ OR TLV ² (ppm)	ODOR THRESHOLD ³ (ppm)	VAPOR PRESSURE ⁴ (mm/Hg)	SATURATION VAPOR CONCENTRATION ⁵ (ppm)	EXPOSURE LIMIT RATIO ⁶	CALCULATED GROUND CONCENTRATION NEEDED TO EQUAL PEL OR TLV ⁷ (mg/kg)	MAXIMUM GROUND CONCENTRATION FOR LEVEL 3 OR 4 PPE ⁸ (mg/kg)	MAXIMUM GROUND CONCENTRATION FOR LEVEL 2 PPE		IDLH ¹¹ ppm	IDLH RATIO ¹²	CALCULATED GROUND CONCENTRA- TION EQUAL IDLH CONCENTRA- TION (mg/kg)
								APR (PF=50) (mg/kg) ⁹	SA ¹⁰ (mg/kg)			
Acetone 67-64-1	750 (TLV)	3.6 - 653	180	240,000	320	3,100	3,100	4,300 (PF=1.33)	83,000	20,000	12	83,000
Carbon tetrachloride ACGIH A2 56-23-5	2 (PEL)	140-584	89.5 NIOSH	120,000	60,000	16	16	See Note 14	2,500	300	400	2,500
Chloroform ACGIH A2 67-66-3	2 (PEL)	133-276	158.4	210,000	105,000	10	10	See Note 14	4,800	1,000	210	4,800
1,1- dichloroethane 75-34-3	100 (PEL)	49-1359	182	240,000	2,400	420	420	4,200 (PF=10)	17,000	4,000	60	17,000
1,2- dichloroethylene 540-59-0	200 (PEL)	0.08-17	180-264	240,000- 350,000	1,750	570	570	2,850 (PF=5)	11,000	4,000	88	11,000
Ethylbenzene 100-41-4	100 (PEL)	0.092-0.60	7.1	9,000	90	11,000	11,000	110,000 (PF=10)	240,000	2,000	4.5	240,000
Methyl ethyl ketone 78-93-3	200 (PEL)	1-30	77.5	100,000	500	2,000	2,000	10,000 (PF=10)	30,000	3,000	33	30,000
Mercury ¹⁸ 7439-97-6	0.001	No odor	0.0018	2	2,000	420	420	See Note 14	1,000,000	3.4	See Note 15	1,000,000
Methylene chloride ACGIH A2 75-09-2	50 (TLV)	160	440	580,000	11,600	86	86	See Note 14	8,600	5,000	116	8,600

TABLE 6-6. EXPOSURE LIMITS FOR VAPORS AND GASES, WITH ESTIMATED GROUND CONCENTRATIONS CAPABLE OF YIELDING AIR CONCENTRATIONS THAT MAY REQUIRE PROTECTIVE MEASURES (CONTINUED).

CHEMICAL NAME CAS NUMBER	PEL ¹ OR TLV ² (ppm)	ODOR THRESHOLD ³ (ppm)	VAPOR PRESSURE ⁴ (mm/Hg)	SATURATION VAPOR CONCENTRATION ⁵ (ppm)	EXPOSURE LIMIT RATIO ⁶	CALCULATED GROUND CONCENTRATION NEEDED TO EQUAL PEL OR TLV ⁷ (mg/kg)	MAXIMUM GROUND CONCENTRATION FOR LEVEL 3 OR 4 PPE ⁸ (mg/kg)	MAXIMUM GROUND CONCENTRATION FOR LEVEL 2 PPE		IDLH ¹¹ ppm	IDLH RATIO ¹²	CALCULATED GROUND CONCENTRA- TION EQUAL IDLH CONCENTRA- TION (mg/kg)
								APR (PF=50) (mg/kg) ⁹	SA ¹⁰ (mg/kg)			
Naphthalene 91-20-3	10 (PEL)	0.038	0.087 (at 25°C)	110	11	91,000	91,000	1,000,000	1,000,000	500	See Note 15	1,000,000
Phenol 108-96-2	6 (PEL)	0.06	0.35 (at 25°C)	460	92	11,000	11,000	540,000 (PF=42)	540,000	250	1.84	540,000
1,1,2,2- tetrachloroethane 79-34-5	1 (TLV)	0.28-7.9	6 (at 25°C)	7,900	7,900	130	130	6,500	19,000	150	53	19,000
Tetrachloro- ethylene 127-18-4	25 (PEL)	47	19 (at 25°C)	25,000	1,000	1,000	1,000	See Note 14	20,000	500	50	20,000
Toluene 108-88-3	50 (TLV)	0.16-37	28 (at 25°C)	37,000	740	1,400	1,400	28,000 (PF=20)	54,000	2,000	18.5	54,000
1,1,1- trichloroethane 71-55-6	350 (PEL)	390	100	130,000	370	2,700	2,700	See Note 14	7,700	1,000	130	7,700
Trichloroethylene 79-01-6	50 (TLV)	82	58	76,000	1,520	660	660	See Note 14	13,000	1,000	76	13,000
Xylenes 1330-20-7	100 (PEL)	20	7-9	9,200 to 12,000	120	8,300	8,300	83,000 (PF=10)	83,000	1,000	12	83,000

¹ PEL (DOL, 1993c), unless the limit published by OSHA in 1989 (DOL, 1991), but stayed by the Federal Court System in 1992, is more restrictive.

² 8-hour time-weighted-average TLV (ACGIH, 1992).

³ Published odor threshold (3M, 1993).

⁴ Published vapor pressure at 20°C unless otherwise noted (ACGIH, 1986).

⁵ Calculated air concentration when equilibrium is reached. Airborne concentration in ppm = (vapor pressure of chemical in mm of mercury/atmospheric vapor pressure which is typically 760 mm of mercury) X (1,000,000).

⁶ This is the ratio of the saturation vapor concentration to the exposure limit, calculated as (saturation vapor concentration)/(exposure limit).

TABLE 6-6. EXPOSURE LIMITS FOR VAPORS AND GASES, WITH ESTIMATED GROUND CONCENTRATIONS CAPABLE OF YIELDING AIR CONCENTRATIONS THAT MAY REQUIRE PROTECTIVE MEASURES (CONCLUDED).

- ⁷ The ground (soil or water) concentration needed to equal the exposure limit concentration (assuming equilibrium is reached and Henry's Law holds) is calculated by taking the reciprocal of the exposure limit ratio. Expressing the ground concentration in mg/kg required multiplying the reciprocal of the exposure limit ratio by 1,000,000.
- ⁸ If the value in this column is exceeded, the Health and Safety Plan should contain an exposure monitoring plan and specify industrial hygiene evaluation to determine required protective measures. Refer to Table 6-4 for definition of PPE levels 1, 2, 3 and 4.
- ⁹ Maximum ground concentration for which an air purifying respirator is likely to be adequate. This is based on a protection factor of 50, except where noted otherwise. A smaller protection factor was used to avoid use of APR in atmospheres with concentrations greater than 1,000 ppm, or the IDLH concentration, whichever is smaller.
- ¹⁰ Maximum ground concentration for which a supplied air respirator is likely to be adequate. This is based on using SA respirators up to the IDLH concentration.
- ¹¹ IDLH, concentration published by NIOSH (NIOSH, 1990).
- ¹² This is the ratio of the saturation vapor concentration to the IDLH concentration calculated as (saturation vapor concentration)/(IDLH concentration) X (1,000,000).
- ¹³ The ground (soil or water) concentration needed to equal the IDLH concentration, assuming equilibrium is reached and Henry's Law holds. It is calculated by taking the reciprocal of the IDLH ratio. Expressing the ground concentration in mg/kg requires multiplying the reciprocal by 1,000,000.
- ¹⁴ APR not recommended. Poor warning properties.
- ¹⁵ IDLH is smaller than the saturation vapor concentration. Therefore, evaporation will not exceed protection capability of an SA respirator.
- ¹⁶ Exists as vapor and entrained with particulates. Calculations are for vapor component.

protective measures are provided in Table 6-6. In Tables 6-5 and 6-6, ground concentrations of chemicals for both full face air-purifying and supplied air respirators are given. These estimates are based on assumptions that chemical contaminants will be uniformly distributed in soil and airborne dusts, and that Henry's Law can be used to predict vapor concentrations; however, soils and groundwater are complex mixtures and may exhibit characteristics not consistent with theoretical predictions.

Estimates in Table 6-5 and 6-6 provide a starting point for characterizing risks to workers. Actual exposure conditions may vary from predicted levels. The toxic hazard depends on additional factors not reflected in the estimates, including temperatures (higher temperatures increase vapor pressures), particle size (dispersion and lung deposition rates vary with particle size), and non-uniform spatial distribution of contaminants. Anticipated risks are characterized in activity-specific Health and Safety Plans (see Chapter 10).

For estimated or monitored airborne concentrations of chemicals, consideration shall be given to chemicals with similar effects on body systems such as the respiratory tract, liver, nervous system, kidneys, and reproductive systems. A chemical by itself may be below its TLV or PEL, but when added to airborne levels of other chemicals with similar effects on the body, the result could be a potential overexposure.

The following formula should be used to calculate additive effects:

- $$\begin{aligned} & (\text{Chemical 1 airborne concentration in ppm} / \text{TLV or PEL of} \\ & \text{Chemical 1}) + (\text{Chemical 2 airborne concentration in ppm} / \text{TLV or} \\ & \text{PEL of Chemical 2}) + (\text{Chemical 3 airborne concentration in ppm} / \\ & \text{TLV or PEL of Chemical 3}) + \text{other chemicals with similar effects} \\ & = X \end{aligned}$$

If X is > 1 , overexposure potential

If X is ≤ 1 , should not result in overexposure

If the additive effects are greater than 1, then an overexposure can be expected. That is, even though the airborne concentration for each individual chemical may be below its respective TLV, the additive effects of the chemicals could create a health concern.

Federal OSHA and the ACGIH identify certain chemicals as being either known human carcinogens or suspected human carcinogens. These are identified in Federal OSHA regulations 29 CFR 1910.1003 through 1050 (DOL, 1993c) and in the ACGIH TLVs with either an A1 or A2 designation. The A1 designation indicates that the chemical is a confirmed human carcinogen while the A2 designation indicates that the chemical is a suspected human carcinogen.

The level of PPE required and the actual type of glove material, coverall material, and respirator will be determined by an industrial hygienist based on the chemicals involved for the specific ERP activity. PPE requirements will be specified in the activity-specific Health and Safety Plan. The industrial hygienist will evaluate the possibilities of higher chemical exposures due to accidents or chemical incidents. If there is a

credible likelihood of accident conditions or chemical incidents occurring, the industrial hygienist may specify in the activity-specific Health and Safety Plan, the requirement for upgraded emergency PPE.

INEL Co-Located Worker and General Public Protection Criteria. The exposure criteria for INEL co-located workers and the general public are based on protection of co-located workers, visitors, or other members of the public from chemical exposures that are likely to be of short duration, such as spills of materials that are usually in closed containers. Consequently, the best available exposure guides are those based on toxicological data representing short duration exposures. The Emergency Response Planning Guides (ERPGs) developed by the American Industrial Hygiene Association (AIHA) have such a basis. There are three levels, ERPG 1, 2, and 3, of which ERPG 1 is the most conservative and therefore offers the highest degree of protection. ERPG-1 is the maximum airborne concentration below which nearly all individuals for any time up to one hour could be exposed to a plume from a credible accident without experiencing other than mild transient adverse health effects (AIHA, 1994). This and lesser concentrations may cause minor, reversible, and nuisance effects, such as lacrimation (eye tearing) or objectionable odor. If an ERPG-1 value has not been issued for a certain chemical, then the TLV (8-hour time weighted average) may be used. If there is not a TLV, then 0.1 of the IDLH level may be used. If chemical airborne concentrations exceed ERPG-1 concentrations, evacuation of INEL co-located workers and possibly the general public should be considered.

6.1.4 Industrial Hazards Protection

DOE 5483.1A (DOE, 1983) requires that DOE contractors develop an active health and safety program that complies with Federal OSHA regulations contained in 29 CFR 1910 (DOL, 1993a) and 29 CFR 1926 (DOL, 1993b). DOE 5480.4 (DOE, 1991) outlines the various non-DOE health and safety standards which must be followed by contractors on DOE facilities. DOE 5480.10 (DOE, 1985) delineates the requirements for industrial hygiene programs at DOE facilities.

The industrial hygiene organization shall identify the health hazards associated with chemical exposures and possible physical exposures including noise, ultraviolet radiation, heat or cold stress, and non-ionizing radiation, as well as situations such as confined spaces. The safety organization shall identify safety hazards associated with construction type activities including, but not limited to, vehicular traffic patterns; machine guarding or moving equipment; fall protection when working at heights; electrical grounding; electrical safety; fire and explosion protection (including storage of flammable materials on a site, and use and storage of explosives); uneven or slippery working or walking surfaces; compressed air or gas use and associated pressure vessels and relief valves; and blocked exit ways in buildings. An industrial hygienist and safety professional shall work with the environmental remediation or D&D project manager to gain an understanding of the scope of the activity along with any chemical and physical hazard data which is available for the site. This chemical data may be obtained from sample analysis or from reviewing the previous use history of the site or facility. Using this information, the industrial hygienist shall prescribe the proper PPE to wear, decontamination procedures, and personal and area air

monitoring to be performed. The industrial hygienist shall include this information in the activity-specific Health and Safety Plan which is required by Federal OSHA regulation 29 CFR 1910.120 (DOL, 1993a).

The industrial hygiene organization shall ensure a training program is in place, implemented, and maintained, which shall include the 40-hour and associated 8-hour annual updates required by 29 CFR 1910.120. Training for the 40-hour and 8-hour courses includes use of monitoring equipment, personal and equipment decontamination, medical surveillance requirements, proper use and limitations of PPE, container handling, emergency response, engineering controls to limit personal chemical exposure, and site hazard identification and assessment. Additionally, training shall be implemented and maintained for hazard communication required by 29 CFR 1910.1200; respiratory protection required by 29 CFR 1910.134 and ANSI Z88.2-1980, update 1992 (ANSI, 1992); hearing conservation required by 29 CFR 1910.94; and necessary training required by chemical statutes found in 29 CFR 1910.1001 through 1050 (DOL, 1993c) and in 29 CFR 1926 (DOL, 1993b). Training requirements are summarized in Chapter 13.

The industrial hygiene and safety organizations shall maintain an adequate number of instruments to properly evaluate chemical and physical exposures on environmental remediation sites and D&D locations. The industrial hygiene organization shall maintain an adequate staffing level to allow industrial hygienists to properly prepare, review, and approve Health and Safety Plans and to personally evaluate the activities occurring at the environmental remediation sites and D&D locations. The safety organization shall maintain an adequate safety staff to allow safety professionals to evaluate activities which are occurring at environmental remediation sites and D&D locations.

6.1.5 Fire Protection

The fire and explosion criteria to be met for fire protection of structures, systems, components, equipment, and processes as well as workers, are derived from the requirements of DOE Order 5480.7A, *Fire Protection* (DOE, 1993a) DOE-ID Supplemental Directive 5480.7A, *Fire Protection* and applicable fire codes and standards. DOE Order 6430.1A, *General Design Criteria Manual* (DOE, 1989), and DOE-ID *Architectural Engineering Standards* (DOE-ID, 1992b), provide general fire protection design requirements.

DOE 5480.7A (DOE, 1993a) states that facilities shall be designed with "improved risk" for fire protection. Improved risk is a sufficiently high level of fire protection to fulfill requirements for insurability by private industrial fire insurance companies that limit underwriting to the best protected class of industrial risks. The improved risk level of protection requires that the "maximum possible fire loss" shall be the basis for determining the need to provide automatic fire suppression systems and for additional fire protection systems and features. This improved risk level of fire protection is required for facilities where large or unusual fire potential exists; where special life-safety hazards exist; where toxic chemicals or biological agents exist; where the consequences of fire include radioactive contamination of the facility, the site, or the public environment; or where national security could be adversely affected by fire.

Environmental remediation and D&D facilities may fall within the requirements for improved risk because of the presence of toxic chemicals and/or radioactive contamination.

DOE 5480.7A and DOE 6430.1A provide definitions of different levels of classification of facilities as Criteria I through V. These Criteria address whether automatic fire suppression systems shall be provided based on the cost of the maximum possible fire loss, and factors relating to the use of the facility and potential risks to the environment and personnel. DOE Order 6430.1A requires that "building structures that house operations that may release energy from rupture of equipment or explosions, either inadvertently or purposely (such as testing), shall be designed to control the resulting internal shock pressure loads per applicable criteria."

These fire protection requirements for facilities apply to new facilities or extensively modified existing facilities built or required for ERP activities. These requirements do not apply to the actual structures subject to D&D or the sites being remediated. For ERP activities involving only construction-type activities, 29 CFR 1926.150 (DOL, 1993b) must be followed which provides requirements concerning fire extinguishers for the job site. As a backup for fire extinguishers, the INEL Fire Department provides onsite fire protection, as well as response capability for explosions, spills, and medical emergencies. Chapter 17 provides additional information on INEL fire protection.

6.1.6 Environmental Protection

The environmental protection criteria are derived from DOE Order 5400.1, *General Environmental Protection Program* (DOE, 1988c); DOE Order 5484.1B, *Environmental Protection, Safety, and Health Protection Information Reporting Requirements* (DOE, 1981); and DOE Order 5820.2A, *Radioactive Waste Management* (DOE, 1988b). These DOE Orders require that environmental protection standards and regulations promulgated by the United States Environmental Protection Agency (EPA) and Idaho Department of Health and Welfare be followed. DOE policy is that all applicable Federal, state, and local environmental laws and regulations and DOE requirements will be followed. Federal laws that affect environmental protection include the Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act (CERCLA/SARA), Clean Water Act (CWA), Clean Air Act (CAA), Safe Drinking Water Act (SDWA), and others.

Toxic and radioactive contamination levels are established by RCRA, CERCLA, National Emission Standards for Hazardous Air Pollutants (NESHAPS), SDWA, and OSHA. The values used define whether a waste is considered hazardous; if a spill is reportable; the maximum contaminant level in drinking water; the maximum allowed toxic air emissions; and the maximum contaminant that can be discharged to surface waters or land disposal. The regulatory levels for each contaminant typically found at the INEL are provided in Table 6-7, "Regulatory Levels for Toxic and Radioactive Contaminants." Table 6-7 contains those hazardous constituents identified as contaminants present at INEL sites requiring environmental remediation or D&D. If new hazardous

TABLE 6-7. REGULATORY LEVELS FOR TOXIC AND RADIOACTIVE CONTAMINANTS

CONTAMINANT	RCRA HAZARDOUS LEVELS 40 CFR 261 SUBPART B	SARA (SPILL) REPORTABLE QUANTITIES (CERCLA STATUTORY LEVELS) 40 CFR 302.4	SDWA (DRINKING WATER) MAXIMUM CONTAMINANT LEVELS 40 CFR 141	CAA (PROCESS AIR) NESHAPS 40 CFR 61	HAZARDOUS CHEMICAL LIST, OSHA, 29 CFA 1910.119
Organics					
Acetone	n/a	5,000 lb	n/a	n/a	n/a
Carbon tetrachloride	0.5 mg/L	10 lb	n/a	n/a	n/a
Chloroform	6.0 mg/L	10 lb	0.10 mg/L	n/a	n/a
1,1-dichloroethane	n/a	1,000 lb	n/a	n/a	n/a
1,2-dichloroethylene	n/a	1,000 lb	n/a	n/a	n/a
Ethylbenzene	n/a	1,000 lb	n/a	n/a	n/a
Methyl ethyl ketone	200.0 mg/L	5,000 lb	n/a	n/a	n/a
Methylene chloride	n/a	1,000 lb	n/a	n/a	n/a
Naphthalene	n/a	100 lb	n/a	n/a	n/a
Pheno	n/a	1,000 lb	n/a	n/a	n/a
1,1,2,2-tetrachloroethane	n/a	100 lb	n/a	n/a	n/a
Toluene	n/a	1,000 lb	n/a	n/a	n/a
1,1,1-trichloroethane	n/a	1,000 lb	n/a	n/a	n/a
Trichloroethylene	0.5 mg/L	100 lb	n/a	n/a	n/a
Xylene	n/a	1,000 lb	n/a	n/a	n/a
Inorganics					
Aluminum	n/a	n/a	n/a	n/a	n/a
Arsenic	5.0 mg/L	1 lb	0.005 mg/L	n/a	n/a
Barium	100.0 mg/L	1,000 lb	1.0 mg/L	n/a	n/a
Cadmium	1.0 mg/L	10 lb	0.010 mg/L	n/a	n/a
Chromium	5.0 mg/L	10 lb	0.05 mg/L	n/a	n/a
Copper	n/a	5,000 lb	n/a	n/a	n/a
Cresol	200.0 mg/L	1,000 lb	n/a	n/a	n/a
Lead	5.0 mg/L	1 lb*	0.05 mg/L	n/a	n/a
Mercury	0.2 mg/L	1 lb	0.002 mg/L	n/a	n/a
Nickel	n/a	100 lb	n/a	n/a	n/a
Silver	5.0 mg/L	1 lb	0.05 mg/L	n/a	n/a
Zinc	n/a	1,000 lb	n/a	n/a	n/a
pH	≤ 2, or ≥ 12.5	n/a	6.5 - 8.5	n/a	n/a

TABLE 6-7. REGULATORY LEVELS FOR TOXIC AND RADIOACTIVE CONTAMINANTS (CONCLUDED)

CONTAMINANT	RCRA HAZARDOUS LEVELS 40 CFR 261 SUBPART B	SARA (SPILL) REPORTABLE QUANTITIES (CERCLA STATUTORY LEVELS) 40 CFR 302.4	SDWA (DRINKING WATER) MAXIMUM CONTAMINANT LEVELS 40 CFR 141	CAA (PROCESS AIR) NESHAPS 40 CFR 61	HAZARDOUS CHEMICAL LIST, OSHA, 29 CFA 1910.119
Radionuclides					
Cobalt-60	n/a	10 Ci	< 4 mrem/yr	**<10 mrem/yr	n/a
Americium-241	N/a	0.01 Ci	≤ 4 mrem/yr	**<10 mrem/yr	n/a
Silver-108	n/a	10 Ci	< 4 mrem/yr	**<10 mrem/yr	n/a
Uranium-234	n/a	0.1 Ci	≤ 4 mrem/yr	**<10 mrem/yr	n/a
Uranium-235	nm/a	0.1 Ci	≤ 4 mrem/yr	**<10 mrem/yr	n/a
Uranium-238	n/a	0.1 Ci	≤ 4 mrem/yr	**<10 mrem/yr	n/a
Curium-244	n/a	0.01	< 4 mrem/yr	**<10 mrem/yr	n/a
Plutonium-238	n/a	0.01	≤ 4 mrem/yr	**<10 mrem/yr	n/a
Plutonium-239/240	n/a	0.01	≤ 4 mrem/yr	**<10 mrem/yr	n/a
Strontium-90	n/a	0.1	≤ 4 mrem/yr	**<10 mrem/yr	n/a
Cesium-134	n/a	1	< 4 mrem/yr	**<10 mrem/yr	n/a
Cesium-137	n/a	1	< 4 mrem/yr	**<10 mrem/yr	n/a
Chromium-51	n/a	1000	< 4 mrem/yr	**<10 mrem/yr	n/a
Europium-152	n/a	10	≤ 4 mrem/yr	**<10 mrem/yr	n/a
Europium-154	n/a	10	< 4 mrem/yr	**<10 mrem/yr	n/a
Niobium-95	n/a	10	< 4 mrem/yr	**<10 mrem/yr	n/a
Zirconium-95	n/a	10	< 4 mrem/yr	**<10 mrem/yr	n/a
Zinc-65	n/a	10	≤ 4 mrem/yr	**<10 mrem/yr	n/a

n/a not available or not applicable

* Final Reportable Quantity for lead may change when risk assessment is completed for carcinogenicity.

** Value of "<10 mrem/yr" is for combined radionuclides present.

constituents are identified through further investigations, they shall be reviewed against the regulations cited in Table 6-7.

Requirements for environmental monitoring are contained in DOE 5400.1 (DOE, 1988c), DOE 5400.5 (DOE, 1990), and DOE 5480.4 (DOE, 1991). There are two elements to environmental monitoring at the INEL: ambient monitoring and effluent monitoring. Monitoring of ambient conditions is performed by taking samples of air, groundwater, surface water, drinking water, and agricultural products at numerous locations on and near the INEL site. Samples are analyzed for radioactive and chemical constituents present at the INEL and a determination is made whether INEL operations have contributed to an increase in contaminants offsite. This environmental monitoring program is administered by the DOE-ID Radiological and Environmental Sciences Laboratory, State of Idaho INEL Oversight, Idaho State University Environmental Surveillance Program, and the United States Geological Survey. Normal activities will be covered by the existing environmental monitoring programs. For environmental remediation and D&D projects potentially involving contaminants other than those currently being monitored or involving unusual circumstances (such as a large amount of contaminants anticipated from cleanup operations), additional environmental ambient monitoring may be required. If so, then the DOE-ID Radiological and Environmental Sciences Laboratory should be contacted to help in defining new or additional monitoring requirements.

Effluent, or process, monitoring is performed for specific ERP activities that generate some type of effluent resulting from processes that could contain some type of hazardous or radioactive constituent, such as air emissions and water discharge from treatment of groundwater. The effluents must be periodically monitored and analyzed to determine if the effluent meets all applicable regulations and standards. The ERP contractor is responsible for administering an effluent monitoring program adequate to demonstrate compliance with applicable environmental regulations and standards.

6.1.7 Structural Design

The structural design of facilities shall conform to applicable sections of DOE Order 6430.1A, *General Design Criteria Manual* (DOE, 1989), and the requirements of the DOE-ID Architectural Engineering Standards (DOE-ID, 1992b). These structural design requirements apply to new facilities or to extensive modification to existing facilities required for ERP activities. These requirements do not apply to facilities subject to D&D or to sites being remediated. DOE 6430.1A and the *DOE-ID Architectural Engineering Standards* require that structural designs comply with current editions of pertinent, nationally recognized codes and standards. They require that design criteria for natural phenomena hazards such as earthquakes, wind, tornados, and floods, be in accordance with UCRL-15910, *Design and Evaluation Guidelines for DOE Facilities Subjected to Natural Phenomena Hazards* (LLNL, 1990), and the guidance presented in DOE Order 5480.28, *Natural Phenomena Hazards Mitigation* (DOE, 1993b). UCRL-15910 provides uniform design and evaluation guidelines for protection against natural phenomena at DOE sites throughout the United States. Different guidelines are provided for four usage categories each with a specified performance goal in terms of hazard exceedance probabilities. Usage categories and performance goals range from general use (normal building code provisions) to highly hazardous use (approaching nuclear power plant

provisions). Facilities used for ERP activities will typically fall into either the General Use category or the Important or Low Hazard category. Note that UCRL-15910 will be replaced by DOE-STD-1020-92, *Natural Phenomena Hazards Design and Evaluation Criteria for Department of Energy Facilities- (Draft)* when it becomes final. DOE Standard 1021-92, *National Phenomena Hazards Performance Categorization Criteria for Structures, Systems, and Components*, is final and mandatory by application of DOE 5480.28. Other draft standards that will become mandatory when final by application of DOE 5480.28 are DOE-STD-1022-92, *Natural Phenomena Hazards Site Characterization Criteria (Draft)*, and DOE-STD-1023-92, *Natural Phenomena Hazards Assessment Criteria (Draft)*.

The definitions of the hazard categories as used in UCRL-15910 are as follows:

High Hazard facilities are facilities for which it is of paramount importance that the contents be confined for the protection of the public and environment (for example, facilities handling substantial quantities of in-process plutonium or fuel reprocessing facilities). Facilities in this category represent hazards with long-term and widespread effects, with a performance goal of occupant safety, continued function, and a very high confidence of hazard confinement. This usage category corresponds to a Performance Category 4 in DOE 5480.28. This Performance Category has a performance goal (or mean annual probability of exceedance of acceptable behavior limits) of 1×10^{-5} .

Moderate Hazard facilities are concerned with the confinement of contents necessary for public or employee protection (for example, uranium enrichment plants; or other facilities involving the handling or storage of significant quantities of radioactive or toxic materials). Occupant safety, continued function, and hazard confinement are the performance goals of a Moderate Hazard facility. This usage category corresponds to a Performance Category 3 in DOE 5480.28. This Performance Category has a performance goal (or mean annual probability of exceedance of acceptable behavior limits) of 1×10^{-4} .

Important or Low Hazard facilities have a mission-dependent use (for example, laboratories, production facilities, and computer centers) and internal emergency handling or hazard recovery facilities. These facilities have a performance goal of occupant safety and continued operation with minimal interruption. This usage category corresponds to a Performance Category 2 in DOE 5480.28. This Performance Category has a performance goal (or mean annual probability of exceedance of acceptable behavior limits) of 5×10^{-4} .

General Use facilities have a non-mission-dependent purpose, such as administrative buildings, cafeterias, storage, maintenance, and repair facilities which are plant- or grounds-oriented. General Use facilities maintain occupant safety as a performance goal. This usage category corresponds to a Performance Category 1 in DOE 5480.28. This Performance Category has a performance goal (or mean annual probability of exceedance of acceptable behavior limits) of 1×10^{-3} .

Wind and Tornado

For General Use and Important or Low Hazard facilities at the INEL, UCRL-15910 specifies that an extreme wind speed of 70 miles per hour be used to determine wind loading. Facilities classified as Moderate Hazard or High Hazard should use wind speeds of 84 and 95 miles per hour, respectively. Procedures according to ANSI A58.1-1982, *Minimum Design Loads for Buildings and Other Structures* (ANSI, 1982), are recommended for determining the wind loads on structures. Due to the low probability of tornadoes at the INEL site, designs and evaluations do not normally require inclusion of criteria for tornado wind loading. Section 0112-3 of DOE-ID *Architectural Engineering Standards* states that "unless otherwise directed in specific project design criteria, buildings and structures shall not be designed for tornado loads. When tornado loading is required, it shall be done in accordance with UCRL-15910."

Earthquake

Earthquake, or seismic, loading shall be considered in the design of all permanent buildings, structures, cranes, and towers. For design purposes, the simultaneous occurrence of an earthquake with any other limiting site-related event, such as high winds, fire, or flood, need not be considered except where the joint occurrence is causally related. Such instances will be identified in specific design criteria. DOE-ID *Architectural Engineering Standards* specifies that for General Use and Important or Low Hazard facilities, the Uniform Building Code (UBC) shall govern and shall be used as the basis for design. For an Important or Low Hazard facility containing radioactive materials not generally accepted by the public, an importance factor "I" of 2.0 shall be used in the UBC seismic design formula along with the seismic zone. DOE-ID *Architectural Engineering Standards* provides the criteria to be used to evaluate Moderate and High Hazard facilities.

Flooding

DOE-ID *Architectural Engineering Standards* requires that protection against flooding shall be considered when required by the project design criteria. The project design criteria must establish the design basis flood (DBFL) based on the location of the facility required to support ERP activities. Whenever possible, the facilities should be located above the DBFL to mitigate any potential flood hazards. If the facilities will be located below the DBFL, the design criteria of DOE 6430.1A will apply, which requires that design loads from flooding shall comply with UCRL-15910. DOE 6430.1A requires that a conservative design approach be taken to ensure that the loads used in the design correspond to greater than the maximum historic levels recorded for the site, and no less than the probable maximum flood.

6.2 Hazard Grade System

6.2.1 Hazard Grade System

The hazard grade system for INEL ERP activities is designed to ensure the proper identification and application of design requirements, codes, standards, and administrative controls to ERP activities. The basis for the

hazard grade system is that the level of acceptable and necessary and sufficient safety basis required to support an ERP activity is dependent on the potential hazards posed by the specific activity. Administrative controls including, but not limited to, management controls; procedures and training; initial testing; inservice surveillance and monitoring; and quality assurance should be instituted commensurate with the hazard level determination for an activity similar to design requirements, codes, and standards. For example, an activity with a low hazard level may not be required to have the same management controls, or the same level of defense in operating procedures, and training programs, as a higher hazard level activity. Each chapter of the BSAF that contains design requirements or administrative controls provides, as applicable and appropriate, the level of controls required, based on the hazard level determined for the specific activity.

The hazard grade system defines hazards levels using the principal health and safety criteria presented in Section 6.1. To support the definition of hazard levels, Table 6-8, "Environmental Hazard Criteria," consolidates factors affecting environmental conditions into a qualitative rating of the severity of environmental contamination from a potential release. Table 6-7, "Regulatory Levels for Toxic and Radioactive Contaminants" provides the regulatory levels of contaminants previously identified as present at the INEL.

TABLE 6-8. ENVIRONMENTAL HAZARD CRITERIA.

ENVIRONMENTAL HAZARD LEVEL	REGULATORY LEVELS				
	>HAZARDOUS WASTE LEVELS	>REPORTABLE QUANTITIES	>MAX. CONTAMINANT LEVELS	>HAZARDOUS CHEMICAL LIST LEVELS	>NESHAPS LEVELS
Severe	Yes	--	--	--	--
Serious	No	Yes	--	--	--
Moderate	No	No	--	Yes	Yes
Minor	No	No	Yes	No	No

Table 6-9 uses fire protection criteria and physical hazards to categorize physical hazards for use in defining hazard levels for ERP activities. Where the potential exists for rupture of equipment or explosions due to failure of pressurized systems or systems involving flammable gases or vapors, the physical hazard category in Table 6-9 should be increased one level. Sections 6.1.5 and 6.1.7 provide discussions regarding the criteria shown in Table 6-9.

6.2.2 Hazard Levels

Hazard levels are defined by the criteria presented in Table 6-10. These criteria are from Section 6.1 and are based on DOE Directives, and Federal or state regulations. There are five hazard levels with the most stringent, Level 1, corresponding to Hazard Category 1 from DOE 5480.23, which

TABLE 6-9. PHYSICAL HAZARD CRITERIA.

PHYSICAL HAZARD CATEGORY	SEISMIC (From 6.1.7.2)	WIND/TORNADO (From 6.1.7.1)	FLOOD (From 6.1.7.3)	FIRE ² (FROM 6.1.5)
1	Moderate and High Hazard Facility Category ¹	Moderate and High Hazard Facility Category ¹	---	Criterion IV
2	Important or Low Hazard Facility Category ¹	Important or Low Hazard Facility Category ¹	---	Criterion I or V
3	General Use Facility Category ¹	General Use Facility Category ¹	Below Design Basis Flood (DBFL) level	Criterion II
4	General Use Facility Category ¹	General Use Facility Category ¹	Above Design Basis Flood (DBFL) level	Criterion III

¹ Facility Categories are in accordance with UCRL-15910, Design and Evaluation Guidelines for DOE

Facilities Subjected to Natural Phenomena Hazards.

² Criterion are in accordance with DOE 5480.7A and DOE 6430.1A.

TABLE 6-10. GRADED HAZARD LEVELS MATRIX.

HAZARD LEVEL ¹	HAZARD TYPE	PUBLIC	CO-LOCATED INEL WORKERS	ERP WORKERS	ENVIRONMENT ⁵	STRUCTURES/SYSTEMS ⁶
1	Radiation ²	DOE finding of potentially significant offsite impact (potential fatalities) (DOE, 1992)	N/A	N/A	DOE finding of potentially significant offsite impact (potential fatalities) (DOE, 1992)	Category A reactor systems and facilities designated Category 1 by DOE Program Secretarial Official (DOE, 1992)
	Chemical ³	N/A	N/A	N/A	N/A	N/A
	Physical ⁴	N/A	N/A	N/A	N/A	N/A
2	Radiation ²	N/A	1 rem CEDE cloud shine and inhalation at 100 m from accidental release (DOE, 1992)	N/A	5 mrad/hr at 1 cm from contaminated surfaces 100 m from accidental release (DOE, 1992)	Containing > Category 2 threshold quantities. (DOE, 1992) Credible potential for nuclear criticality (DOE, 1992)
	Chemical ³	>TLV or PEL	>TLV or PEL	If Level A PPE is required	Severe	N/A
	Physical ⁴	Category 1	Category 1	Category 1	N/A	Category 1
3	Radiation ²	N/A	N/A	10 rem EDE at 30 m from accidental release, 24 hr exposure & inhalation (DOE, 1992)	Soil Contamination Area occurs outside Controlled Area (DOE, 1990)	Containing > Category 3 threshold quantities (DOE, 1992)
	Chemical ³	<TLV or PEL	< TLV or PEL	If Level B PPE is required	Significant	N/A
	Physical ⁴	Category 2	Category 2	Category 2	N/A	Category 2
4	Radiation ²	Untreated effluent releases > Derived Concentration Guide requiring Best Demonstrated Available Technology (BDAT) (DOE, 1990)	N/A	Affected personnel within areas >5 mrem/hr or >10% DAC or Contamination Areas (DOE, 1988a)	Untreated effluent releases > Derived Concentration Guide requiring Best Available Technology (BAT) (DOE, 1990)	Containing < Category 3 threshold quantities (DOE, 1992) Structure or system contains areas >5 mrem/hr or >10% DAC or Contamination Areas (DOE, 1988a)

TABLE 6-10. GRADED HAZARD LEVELS MATRIX (CONTINUED).

HAZARD LEVEL ¹	HAZARD TYPE	PUBLIC	CO-LOCATED INEL WORKERS	ERP WORKERS	ENVIRONMENT ⁵	STRUCTURES/SYSTEMS ⁶
5	Chemical ³	Below Regulatory Concern ⁷	Below Regulatory Concern ⁷	>TLV or PEL	Minor	N/A
	Physical ⁴	Category 3	Category 3	Category 3	N/A	Category 3
	Radiation ²	Less than 100 mrem annual CEDE (DOE, 1990)	N/A	Affected personnel in areas <5 mrem/hr and <10% DAC and non-contaminated (DOE, 1988)	Effluent releases less than Derived Concentration Guide (DOE, 1990)	Containing < Category 3 threshold quantities (DOE, 1992) Structure or system contains areas >5 mrem/hr or >10% DAC or Contamination Areas (DOE, 1988A)
	Chemical ³	Below Regulatory Concern ⁷	Below Regulatory Concern ⁷	Below Regulatory Concern ⁷	Below Regulatory Concern ⁷	N/A
	Physical ⁴	Category 4	Category 4	Category 4	N/A	Category 4

[Notes for Table 6-10 on following page.]

TABLE 6-10. NOTES FOR GRADED HAZARD LEVELS MATRIX (CONCLUDED).

1. Hazard Level Definitions:	
Level 1:	Corresponds to Hazard Category 1 as defined by DOE Order 5480.23. This hazard level is expected to be outside the scope of the BSAF. As applied to ERP work activities, this might correspond to an activity with the potential for severe environmental contamination, extreme health hazards to ERP workers, potential serious health hazards to other INEL workers, and probable offsite impact to the public. An example for ERP activities in this category might include a D&D operation involving a facility containing highly radioactive contamination as well as extremely hazardous material with the potential for fire or explosion.
Level 2:	Corresponds to Hazard Category 2 as defined by DOE Order 5480.23. This hazard level is expected to be outside the scope of the BSAF. As applied to ERP work activities, this might correspond to activities with the potential for serious environmental contamination, potential health hazards to ERP workers, potential hazards to other INEL workers, potential offsite impact to the public. An example for ERP activities in this category might include a remediation operation involving removal and handling of highly radioactive contaminated and/or extremely hazardous materials.
Level 3:	Corresponds to Hazard Category 3 as defined by DOE Order 5480.23 for which only modest reduction of hazard is required. As applied to ERP work activities, this would correspond to conditions with the potential for moderate environmental contamination, elevated hazards to ERP workers, low potential for hazards to other INEL workers, and no potential for offsite impact to the public. An example for ERP activities in this category might include a remediation operation involving removal and handling of radioactive contaminated and/or hazardous materials which require normal controls and procedures to minimize the exposure to ERP workers and prevent exposures to other INEL workers and the public.
Level 4:	Corresponds to activities involving inventories below Hazard Category 3 as defined by DOE Order 5480.23. This level equates to activities involving inventories below the hazard category 3 threshold in DOE-STD-1027-92 for radioactive material and below the 29 CFR 1910.119 threshold for highly hazardous chemicals. An example for ERP activities in this category might include activities such as removal or treatment of material with low levels of contamination, sampling, or surveillance and monitoring where known levels of contaminants require only minimal protection.
Level 5:	Corresponds to activities involving typical industrial hazards subject only to normal industrial standards and practices. As applied to ERP work activities, this would correspond to conditions with no potential for significant environmental contamination or health hazards for ERP workers, no potential hazards to other INEL workers, no potential impact to the public. Examples of ERP activities would include routine monitoring, and maintenance of equipment not providing containment for environmental contaminants.
2. See Section 6.1.2 for the basis of the exposure and quantity levels shown, and also for special exposure limits that may apply (e.g., fetal exposure limits).	
3. See Section 6.1.3 for the TLV and/or PEL values for specific chemicals.	
4. Physical hazards include hazards associated with natural phenomena (wind, earthquakes, flooding), fire, explosion, etc. See Section 6.1.7 and Table 6-8 for a description of hazards and hazard categories.	
5. See Table 6-7 for a description of the different levels of environmental contamination and Section 6.1.6 for the regulatory basis for the levels.	
6. Structures and systems that are part of a remediation system or that support a D&D operation are covered by the BSAF.	
7. The definition of "Below Regulatory Concern" for chemical hazards for personnel, as used in this document, is that exposures are below 10% of the TLV or PEL for any hazardous chemical present, and that no known carcinogenic materials are present over detectable limits.	

covers facilities or operations with the potential for unmitigated releases of radioactive and/or hazardous material with the potential for significant offsite consequences. The least stringent, Level 5, corresponds to facilities and operations only including common industrial hazards. The definitions of each of the hazard levels is provided in Note 1 of Table 6-10. Note that the criteria for Hazard Levels 1 and 2 contained in Table 6-10 are provided only for completeness as these levels are expected to be outside the scope of the BSAF.

Placement of an activity, or a specific aspect of an activity, at a particular hazard level is determined by comparing all criteria in that level (that is, radiation, chemical, and physical criteria for the public, co-located INEL workers, ERP workers, the environment, and structures/systems) to the potential hazards associated with the activity. For an activity to qualify for a particular hazard level, all of the criteria listed for that level must be satisfied. If one or more criteria require a higher hazard level, then that activity must be elevated to that higher hazard level.

For example, for an activity to be considered a Hazard Level 5, there can be the potential for only common industrial-type hazards. An activity only qualifies for Hazard Level 5 if no source of radiation is present above background levels; if no exposures are likely from any chemical; and if risks associated with physical hazards such as fire, earthquake, or wind, do not present a significant hazard to personnel or structures. Another example is an activity that involves a chemical exposure hazard, but only to ERP workers (that is, potential ERP worker exposure greater than TLV or PEL). This activity qualifies as a Hazard Level 4. However, if this same activity involves potentially significant exposures from radioactivity to co-located INEL workers (that is, >10 rem EDE at 30m from accidental release), then the hazard level is Hazard Level 2.

Use of the graded hazard level system ensures that the necessary and sufficient requirements are incorporated into the design and operation to protect the health and safety of the public, INEL workers, and the environment.

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CHAPTER 7.0

RADIOACTIVE AND HAZARDOUS MATERIAL WASTE MANAGEMENT

June 20, 1994

ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY

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7.0 RADIOACTIVE AND HAZARDOUS MATERIAL WASTE MANAGEMENT

The Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP), which includes environmental remediation and decontamination and decommissioning (D&D) activities, will generate radioactive, hazardous, mixed, and nonhazardous wastestreams. Protection of the public, workers, and the environment are integral factors in the management of these wastestreams resulting from ERP activities.

The ERP waste management options include the following activities which may occur in parallel:

- Removal of waste and reuse of all recyclable materials
- Minimization of additional waste generation during cleanup activities by control of emissions to air and water
- Remediation of waste in place
- Treatment, storage, and disposal (TSD) of waste at onsite facility, if possible
- Treatment and disposal of waste at offsite facility, if only alternative.

The following sections describe the framework for radioactive and hazardous material waste management. Detailed discussion of individual waste management practices will be described in the specific safety analysis documentation for each environmental restoration activity.

- Section 7.1 discusses requirements and guidelines for the management of radioactive, hazardous, and mixed waste resulting from ERP activities. This section identifies and describes TSD facilities at the INEL or elsewhere where waste from ERP activities will be disposed. This section includes a discussion of waste acceptance criteria
- Section 7.2 describes the waste minimization policy and program
- Section 7.3 provides a general estimate of the capacity and form of radioactive, hazardous, and mixed wastes generated from ERP activities
- Section 7.4, 7.5, and 7.6 discuss methods for control or mitigation of potential impacts of gaseous, liquid, and solid waste if treatment and storage is accomplished at the ERP site.

7.1 Waste Management Design and Operations Criteria

Radioactive, hazardous, and mixed wastes will be managed in a manner that assures protection of the health and safety of the public, employees, and the environment. The generation, treatment, storage, transportation, and/or

disposal of waste materials will be accomplished in a manner that minimizes such wastes and complies with applicable Federal and state environmental, safety, and health laws and regulations and United States Department of Energy (DOE) requirements. The objectives of the INEL waste management program are to ensure compliance with applicable guidelines and regulatory requirements; conserve resources; and eliminate or generate a minimum of waste and pollution.

The waste management practices at the INEL must comply with the following Federal and state laws and regulations and DOE Directives:

- 40 Code of Federal Regulations (CFR) 191 (EPA, 1993b)
- 40 CFR 260 (EPA, 1993c)
- 40 CFR 261 (EPA, 1993d)
- 40 CFR 262 (EPA, 1993e)
- 40 CFR 263 (EPA, 1993f)
- 40 CFR 264 (EPA, 1993g)
- 40 CFR 265 (EPA, 1993h)
- 49 CFR 171 (DOT, 1993a)
- 49 CFR 173 (DOT, 1993b)
- Resource Conservation and Recovery Act of 1976 (RCRA)
- Hazardous and Solid Waste Amendments of 1984 (HSWA)
- Toxic Substances Control Act of 1976 (TSCA)
- Clean Air Act of 1970 (CAA)
- Federal Water Pollution Control Act (Clean Water Act of 1972)
- Safe Drinking Water Act of 1974
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- DOE 5480.4 (DOE, 1992b), *Environmental, Safety, and Health Protection Standards*
- DOE 5480.3 (DOE, 1985), *Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes.*

Hazardous, radioactive, mixed, and nonhazardous wastes generated by ERP activities will be treated, stored, and disposed in facilities located on the INEL and offsite. Waste acceptance criteria documents for the TSD facilities outline specific acceptable wastestreams (DOE-ID, 1987a and 1987b).

If waste is treated, stored, or disposed at the specific environmental remediation site or D&D facility, all applicable state and Federal regulations will be followed. At some sites or facilities, temporary or interim storage of wastes will be required. Interim storage requirements under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) are under negotiation with applicable Federal and state agencies. Currently, CERCLA interim storage requirements are being established on an as needed, case by case basis. Interim storage for RCRA classified wastes will follow Federal and state regulations. The storage facility must meet RCRA requirements listed in 40 CFR 265.30 to 265.35 and 40 CFR 262.34, if applicable. If RCRA-classified, CERCLA-generated wastes are stored at the CERCLA site, the RCRA permit and 90-day time requirement do not apply.

Industrial or commercial solid waste is waste generated by manufacturing or industrial processes that do not create hazardous wastes. The industrial or commercial solid waste generated at the INEL is disposed onsite at the landfill complex located at the Central Facilities Area. The waste types disposed at the INEL Landfill Complex include the following: asbestos; asphalt; cafeteria garbage; dirt and gravel; masonry and concrete; scrap metal; trash; sweepings of weeds, grass, and trees; and wood and scrap lumber.

Non-hazardous liquid effluents are released from facilities in sewer systems, sanitary systems, and heating boiler blowdown. Non-hazardous liquid effluents are sent onsite to either sewage waste treatment facilities or ponds/sanitary lagoons. These wastestreams are sampled and monitored.

Contamination of stormwater is controlled by implementing best management practices as outlined in the appropriate Stormwater Pollution Prevention plan.

Hazardous waste at the INEL is treated, stored, or disposed at INEL facilities or sent to permitted offsite TSD facilities. Currently, INEL is operating under RCRA interim status. Hazardous waste from ERP activities as defined under RCRA and TSCA will be remediated in place or sent to either the Hazardous Waste Storage Facility or the Hazardous and Radioactive Mixed Waste Staging Area prior to final disposition. Partial treatment may occur at the Waste Experimental Reduction Facility (WERF). INEL currently is evaluating additional onsite storage or use of WERF to treat hazardous waste.

Radioactive wastes are treated, stored, and disposed according to the appropriate waste acceptance criteria documents. Low-level radioactive wastes will be sent either directly to the Radioactive Waste Management Complex (RWMC) or to WERF and then to the RWMC. Liquid radioactive wastes may be handled at the ICPP by evaporation and storage at the High Level Waste Tank Farm and treatment at the New Waste Calcining Facility (NWCF).

Low-level mixed waste will be generated during the cleanup process. Mixed waste has both a hazardous and a radioactive component. These wastes may be stored prior to treatment and/or disposal at a number of facilities including the following: WERF Waste Storage Building, Mixed Waste Storage Facility, Hazardous Chemical Radioactive Waste Facility, or the Radioactive Scrap and Waste Facility. Treatment may occur at WERF or at a commercial facility and includes sodium processing and lead recycling and treatment. In the future, disposal may be conducted at a low-level radioactive waste management complex or at a mixed waste disposal facility onsite or offsite.

The final treatment or disposal method for wastestreams currently under remediation at the INEL is not determined for every wastestream. Under certain circumstances, determination of the anticipated TSD method is impossible, particularly if further characterization activity is required to determine quantities or waste constituents; or if regulatory conditions or technological capabilities prevent TSD method determination. In such instances, anticipated TSD methods are labeled "indeterminate." New treatment techniques are being explored throughout the DOE system and some may be applicable to ERP wastes. Proper interim storage is required for these "indeterminate" wastestreams.

7.2 Waste Minimization Policy and Program

The INEL Waste Minimization Policy and Program (WMPP) is described in two documents prepared in 1991 (INEL, 1991a; 1991b) and in 1990 (DOE-ID, 1991a). This WMPP is applicable for the management of radioactive, hazardous, and mixed wastes from ERP activities. The WMPP conforms to waste minimization requirements mandated under DOE Order 5400.1, *General Environmental Protection Program* (DOE, 1988b); DOE Order 5400.3, *Hazardous and Radioactive Mixed Waste Programs* (DOE, 1989); and DOE Order 5820.2A, *Radioactive Waste Management* (DOE, 1988a). INEL's WMPP meets the requirements of the *National Pollution Prevention Strategy* (FR, 1991). The WMPP includes background information; policy objectives and goals; cost savings and benefits analysis; waste assessments including waste types and waste tracking; waste minimization

methods; training; and management commitment. The INEL WMPP is briefly summarized in the following subsections (Klossner and Gitt, 1990).

Prior to any D&D or environmental remediation site cleanup, specific waste minimization plans are developed. Each waste minimization plan includes the following:

- Operations description
- Process characterization
- Wastestream characterization
- Waste reduction goals
- Pollution prevention strategy

Each waste minimization plan ensures that the results of process waste assessments and applicable waste minimization procedures (source reduction, recycling, treatment, segregation) are integrated into project activities.

7.2.1 Program Administration

At the INEL, the DOE-Idaho Operations Office (DOE-ID) oversees waste minimization activities conducted by all INEL contractors. All contractors are tasked with developing effective waste minimization efforts for waste generated by their operations.

Each facility has a waste minimization program in operation. Programs are audited periodically to ensure a basis in written procedures approved by facility managers. These audits ensure procedures that meet all applicable requirements. Each facility has a waste minimization coordinator reporting directly to the facility manager. The facility manager has ultimate responsibility for minimization of all wastes generated at that facility.

Waste minimization plans are required prior to any INEL ERP cleanup activities. The INEL ERP will identify waste to be recycled (such as metal shielding and other hazardous scrap metals) and will minimize the generation of additional waste during cleanup activities.

7.2.2 Objectives and Goals

Policies and requirements outlined in DOE Orders 5400.1, 5400.3, and 5820.2A require DOE and contractors to conduct operations in a safe and environmentally sound manner and to develop and implement a waste minimization program. The EPA's 40 CFR 262, 40 CFR 264, and 40 CFR 265 call for waste minimization efforts to be reported in the *Biennial RCRA Hazardous Waste Report*.

The objective of the WMPP is to ensure that INEL contractors develop and implement source reduction and recycling activities to relieve the burdens caused by storage, treatment, and disposal of wastes. These burdens include increased risk to human health and the environment; increased legal liability;

high costs of treatment, storage, and disposal of waste; and negative public perception. The program policy includes use of source-reduction techniques to reduce risk to public health, safety, welfare, and the environment and use of environmentally sound recycling methods to achieve these goals.

Waste minimization practices will be a prime consideration in ERP activities. These practices will be considered in planning both remedial actions and D&D activities.

Source reduction is preferable to waste treatment and will be an important aspect of ERP activities. Generated environmental restoration wastes will be evaluated for the applicability of recycling or reclamation activities. Those wastes that cannot be recycled will be treated to reduce volume and/or toxicity. Wastes with no accepted method of treatment or disposal will be stored until a method of treatment or disposal is developed.

The following statements summarize goals and objectives of the DOE-ID Waste Minimization Program (WMP) applicable to the ERP activities. Dashed items are methods applicable to achievement of the goals and objectives for waste generated by ERP activities.

- Meet or exceed applicable policies and requirements
 - Prepare yearly program review and conduct audits upon completion of each ERP activity
- Ensure waste minimization practices are a prime consideration in ERP activities
 - Require all generators to develop waste minimization implementation plans (WMIPs)
 - Provide appropriate training for all employees and additional appropriate training for managers, auditors, and trainers
 - Provide incentives for developing waste minimization ideas
- Ensure consideration of waste management/waste minimization issues before approval of new or existing programs, including the ERP
- Obtain management commitment to waste minimization activities
 - Require special training for managers
 - Require managers to sign statement of commitment.

7.2.3 Waste Minimization Methods

Waste minimization includes activities that reduce or eliminate the generation of wastes and recycling processes that use, reuse, or reclaim a

material from a wastestream. Some activities commonly claimed to be waste minimization techniques are actually waste treatment. The following activities are not considered waste minimization by DOE-ID:

- Transfer of hazardous constituents from one environmental medium to another
- Concentration conducted solely for reducing volume
- Dilution as a means of toxicity reduction, unless later recycling steps are involved.

If the activity makes the material more amenable for disposal (for example, reduction of volume or toxicity before storage or disposal), then the waste is being treated, not minimized.

Waste minimization techniques are employed throughout the environmental restoration process. Often more than one technique is applied to a work process, resulting in maximum waste reduction through integrated waste minimization. The following is a summary of waste minimization techniques for the ERP:

- *Decontamination:* Removal of radioactive, mixed, or hazardous components from a material, resulting in a less toxic or easier-to-handle waste
- *Housekeeping:* Performance of activities that result in reduced material use and reduced material waste through proper operations and spill prevention
- *Reclamation:* Recovery of secondary materials from a wastestream for useful purposes. Form of recycling
- *Recycling:* Reuse of waste with attendant generation of a valuable substance. For purposes of the WMP, recycling refers to all such activities not considered reclamation or reuse
- *Reuse:* Subsequent use of a material within a process or use of a waste material in another process
- *Waste Segregation:* Separation of waste types to reduce or eliminate contamination from other wastes, or to permit selective handling or treatment.

Waste minimization methods applied to waste generation processes throughout the ERP are listed in Table 7-1. Although successful when applied, these methods are not universally employed for all applicable wastestreams.

7.3 Radioactive and Hazardous Material Wastestreams

The quantity and form of radioactive, hazardous, and mixed wastes generated from INEL's ERP activities are summarized in this section. The information and data presented represents an overview of projected

TABLE 7-1. WASTE MINIMIZATION METHODS APPLICABLE TO ENVIRONMENTAL RESTORATION WASTES.

WASTE TYPE	DECONTAMINATION	HOUSEKEEPING	RECLAMATION	RECYCLING	REUSE	WASTE SEGREGATION
Radioactive Waste	X	X			X	X
Mixed Waste	X	X				X
Hazardous Wastes						
Batteries				X	X	
Contaminated soils		X				
Excessed soils		X	X	X		
Excessed paint		X				
Lead	X	X	X	X	X	X
Mercury	X	X	X	X	X	X
Munitions		X				
Oxidizers		X				X
Paint thinners		X		X	X	
Photo chemicals		X	X	X		
Pyrophoric metals		X	X			X
RCRA metal- contaminated wastes	X	X	X			X
Solvent rags	X	X			X	X
Solvents		X		X	X	
Waste hydrofluoric acid		X				
Solid, Nonhazardous Wastes						
Cardboard				X	X	
Glass		X		X	X	
Masonry		X	X			
Metal				X	X	
Old fuel				X	X	
Packing material				X	X	
Used oil				X		
Wood		X			X	

environmental remediation and D&D activity wastestreams. Detailed estimates of wastestream quantity, type, and form, will be provided for specific environmental remediation and D&D activities in their individual safety analysis documentation. The following sections discuss waste types and waste tracking (Section 7.3.1), environmental remediation wastestreams (Section 7.3.2), and D&D wastestreams (Section 7.3.3).

7.3.1 Waste Types and Waste Tracking

Wastestreams are divided into the following four general types: non-hazardous, hazardous, radioactive, and mixed wastes. Non-hazardous wastes include solid industrial/commercial wastes and liquid municipal sanitary wastes. Hazardous wastes are solid wastes as defined in 40 CFR 261. These wastes are either characteristic wastes or listed wastes. Hazardous waste may include TSCA wastes such as polychlorinated biphenyls (PCBs) and asbestos. Radioactive waste consists of solid, liquid, or gaseous material that contains radionuclides regulated under the Atomic Energy Act. Mixed waste contains both radioactive and hazardous components as defined by the Atomic Energy Act and RCRA.

The ERP Waste Stream Tracking System is a centralized database management system that houses an inventory of waste information for all activities described by the ERP Major System Acquisition (MSA) Baseline Summary (DOE-ID, 1993a). The Waste Stream Tracking System is a prototype currently being refined before uploading to the Environmental Restoration Information System.

The Waste Stream Tracking System consists of several interconnected databases that describe and define the following:

- Waste volumes
- Hazardous waste code numbers
- Radionuclides
- Waste already generated
- Forecasts of waste generation
- Anticipated TSD actions
- Anticipated TSD essential technology dates
- Anticipated TSD volume.

Tracking system data are generated from the following sources: waste sites within an Operable Unit (OU); facilities targeted for D&D; abandoned/out-of-service petroleum tanks; and abandoned/out-of-service hazardous and/or radioactive tanks. Data are gathered twice a year from ERP project personnel. The newly gathered information is analyzed for consistency and compared against data currently in the system. Other sources of information (such as, the Technical Baseline section of the MSA Baseline Summary) are used to verify the consistency of the new information. If any information appears inconsistent or questionable, project personnel are contacted for clarification. New information is entered into the system and checked for accuracy. Updated data are returned to project personnel for final verification.

7.3.2 Environmental Remediation Wastestreams

An estimate of the quantity and form of radioactive, hazardous, mixed, and nonhazardous wastes generated from each Waste Area Group (WAG) is summarized in Table 7-2. This information was gathered from the *Waste Stream Projections for Environmental Restoration at INEL* of June, 1993 (DOE-ID, 1993b) (all wastestreams discussed in this report are generated from ERP activities). The waste forms may be liquid, sludge, debris, or soil (DOE-ID, 1993b). A breakdown by WAG and OU of the waste type, form, potential remediation method, and waste volume is provided in DOE-ID, 1993b; this data is revised at least annually.

TABLE 7-2. QUANTITIES AND WASTE TYPES FROM INEL WASTE AREA GROUPS (WAGS).

WAG ^d	LOCATION	WASTE FORM ^b	WASTE TYPE				TOTAL ESTIMATED QUANTITY ^{a,b} YD ³
			RADIOACTIVE ^b	HAZARDOUS ^b	MIXED ^b	NON-HAZARDOUS ^b	
1	Test Area North (TAN)	Debris, liquid, soil, sludge	low-level	metals, organics, petroleum	low-level (metals) (chemicals)	industrial/municipal, scrap metals, asbestos	29,784 yd ³
2	Test Reactor Area (TRA)	Debris, soil	low-level	metals	low-level (metals) (chemicals)	industrial/municipal	0 yd ^{3c}
3	Idaho Chemical Processing Plant (ICPP)	Soil	low-level	corrosives, organics	low-level (corrosives) (metals)	industrial/municipal	3,758 yd ³
4	Central Facilities Area (CFA)	Soil, debris, sludge	low-level	corrosives, organic, metals	low-level (corrosives) (metals) (chemicals)	scrap metals, industrial/municipal	287,510 yd ³
5	Power Burst Facility/Auxiliary Reactor Area (PBF/ARA)	Solid, soil, sludge, liquid	low-level	metals, organics	low-level (chemicals) (metals)	industrial/municipal	5,906 yd ³
6	Experimental Breeder Reactor-I/Boiling Water Reactor Experiment (BORAX)	Soil	low-level	---	low-level (chemicals) (metals)	industrial/municipal	29,930 yd ³
7	Radioactive Waste Management Complex (RWMC)	Soil, debris, liquid, sludge	low-level	organics	Low-level (chemicals) TRU (organics)	---	154,166 yd ³
10	Various	Soil, liquid	low-level	chemical, metals	---	scrap metals	2,040 yd ³

^a Total estimated quantity includes all radioactive, hazardous, mixed, and nonhazardous waste.

^b From DOE-ID-10417 Waste Stream Projections for Environmental Restoration at INEL, June, 1993 (DOE-ID, 1993b).

^c All waste generation projection volumes were changed to 0 yd³ because no further remediation is planned beyond the two cap-in-place actions.

^d Does not include D&D wastes.

7.3.3 Decontamination and Decommissioning (D&D) Wastestreams

Wastes from D&D activities include mixed low-level, hazardous, asbestos, low-level radioactive, and municipal sanitary. Table 7-3 shows the quantities and waste types for D&D activities. This information was gathered from the *Waste Stream Projections for Environmental Restoration at INEL* (DOE-ID, 1993b). Additional data is provided in DOE-ID 1993b; this data is revised at least annually.

7.4 Gaseous Waste Treatment and Ventilation

Gaseous wastes may be a byproduct of some environmental remediation and D&D techniques (Chapter 4). The methods chosen to control or mitigate gaseous waste from these activities will be governed by the following considerations:

- Concentration and characteristics of radioactive, hazardous, or mixed waste
- Exposure pathways and targets
- Probability of release or emission.

The first consideration is relevant primarily because the concentrations and characteristics of radioactive or hazardous waste migrating from the site to the air will determine the appropriate control technology. Different waste forms (for example, liquids, solids, sludges) as well as the volatility of hazardous constituents, permit variable amounts of gaseous release. Technologies will be selected to control potential gaseous releases during ERP activities. These technologies may range from simple techniques such as wetting soil to more complex techniques such as scrubbing, activated carbon filtration, wet scrubbing, or similar offgas treatment methods.

The second consideration - exposure pathways and targets - involves the identification and evaluation of the impact on the surrounding population and the environments. This information is crucial to protecting human life and the environment, especially any sensitive environments. Exposure pathways and targets will be analyzed prior to any ERP activities, as specified under state and Federal regulatory requirements. Worker exposure will be analyzed in activity-specific Health and Safety Plans.

The third consideration is the likelihood of a release of gaseous contaminants resulting from ERP activities. Potential and actual release sources will be identified and controlled through passive and active perimeter gas control systems. Some of these systems confine gases in areas where they can be trapped and treated. The controls for gaseous waste during remediation include thermal destruction and incineration which destroy organic components while trapping inorganics for further treatment by other methods including stabilization. Fugitive emissions may be controlled using dust suppressants, negative pressure air systems, foams, and covered shelters.

TABLE 7-3. QUANTITIES AND WASTE TYPES FROM D&D ACTIVITIES

LOCATION	WASTE FORM ^b	WASTE TYPE			TOTAL ESTIMATED QUANTITY ^{a,b} YD ³
		RADIOACTIVE ^b	MIXED ^b	NON-HAZARDOUS ^b	
Auxiliary Reactor Area I	Debris, solid	low-level		sanitary, wood rubble	1,135.2 yd ³
Auxiliary Reactor Area II	Solid, debris	low-level		asbestos	670 yd ³
Auxiliary Reactor Area III	Debris, solid	low-level		industrial/municipal	1,076 yd ³
Army Reentry Vehicle Facility Site	Solid, debris	low-level		sanitary	58 yd ³
Boiling Water Reactor Experiment V	Solid, debris, soil, liquid	low-level	low-level (metal)	asbestos, wood, metal (scrap)	533 yd ³
Central Facilities Area Hot Laundry	Debris	low-level		industrial/municipal	119 yd ³
ICPP-601 ^c					
ICPP-603	Solid, debris	low-level		municipal/sanitary	0
Special Power Excursion Reactor Test IV	Debris, solid, soil	low-level			0
High-Level Waste Tank Farm ^c					
Engineering Test Reactor	Debris, solid	low-level	low-level (metal)	industrial/municipal	4,934 yd ³
Idaho Chemical Processing Plant (ICPP)-631	Debris	low-level		sanitary, debris	133 yd ³
ICPP-633	Debris	low-level	low-level (hazardous)	industrial/municipal	41 yd ³
ICPP-640	Debris	low-level			105 yd ³
ICPP-740	Debris, soil	low-level	low-level (hazardous)	sanitary, debris	162 yd ³
ICPP-709/734	Debris, soil	low-level	low-level (hazardous)	sanitary, debris	236.4 yd ³
Loss of Fluid Test Facility	Debris, liquid, lead	low-level	low-level (metal)	industrial/municipal	120 yd ³
Material Test Reactor	Debris, solid	low-level	low-level (metal)	industrial/municipal	6,146 yd ³
Test Area North/Technical Support Facility	Debris, solid	low-level		industrial/municipal	70 yd ³
Test Area North/Decontamination Shop	Solid, debris	low-level	low-level (hazardous)	industrial/municipal	15 yd ³
Test Train Assembly Area	Solid, soil, debris	low-level		industrial/municipal	1,894 yd ³

^a Total estimated quantity includes all radioactive, hazardous, mixed, and nonhazardous waste.

^b From DOE-ID-10417 Waste Stream Projections for Environmental Restoration at INEL, June, 1993 (DOE-ID, 1993b).

^c No Data Available

^d No Future Waste will be Generated

The operating philosophy and objectives of gaseous waste treatment are to prevent any regulatory concern releases (emissions) of hazardous gaseous wastes into the environment, using trap and treat technologies.'

7.4.1 Treatment and Disposal Methods for Gaseous Wastestreams

Gaseous wastes generated during ERP activities may include hazardous, radioactive, and mixed wastes. The majority of gaseous wastes will be generated during treatment process. Table 7-4 provides examples of wastestreams and treatment technologies which require the control of gaseous wastes.

TABLE 7-4. GASEOUS WASTE TREATMENT.

WASTESTREAM	TREATMENT
Mixed Low-Level (Chemical) in groundwater	- Air stripping/carbon absorbtion/ion exchange
Hazardous (Organics) in soil	- Soil vapor vacuum extraction

Treatment technologies for gaseous wastes will be determined prior to ERP activities at any given site. Equipment and systems, engineering drawings, and flow paths to show location of equipment, crucial components, and instrumentation will be provided when technologies are selected.

7.5 Liquid Waste Treatment and Retention

Several methods are available for control or mitigation of the potential impacts of liquid radioactive, hazardous, and mixed wastes if treatment or storage activities are conducted at the INEL site during ERP activities. These methods are summarized in Table 7-5 by waste type.

TABLE 7-5. LIQUID WASTE TREATMENT.

LIQUID WASTE TYPE	APPLICABLE CONTROL METHODS
Radioactive Waste	- Evaporation - Dewatering - Packaging and special handling - Shipment to WIPP for disposal
Hazardous Waste	- Conversion of aqueous solution to a solid form for easy storage and disposal - Evaporation - Neutralization and precipitation - Filtration
Mixed Waste	- Solidification/fixation - Storage until new disposal methods are identified

Liquid waste includes purge water, spent solvents, liquid sanitary wastes, petroleum, D&D liquids, and sludge. An estimated 180,000 gallons of liquid waste, primarily from D&D activities, are expected to be treated and disposed during the program (DOE-ID, 1993b). This estimate does not include contaminated groundwater estimates from WAG-10.

The operating philosophy and objectives for the management of liquid radioactive, hazardous, and mixed wastes are to minimize waste generation and to apply best demonstrated available technology (BDAT) to manage any waste generated. Measures to prevent or minimize spills or releases will be implemented to protect human life and the environment.

Treatment technologies for liquid wastes will be determined prior to ERP activities at any given site. Equipment and systems, engineering drawings, and flow paths to show location of equipment, critical components, and instrumentation will be provided when technologies are selected.

7.6 Solid Waste Treatment and Retention

Methods employed to control or mitigate the potential impacts of solid waste if treatment or storage is accomplished at the INEL site or facility include various containment, immobilization technologies, and physical, thermal, chemical, and biological treatment methods described in Chapter 4. Specific technologies (Table 7-6) applicable to solid radioactive, hazardous, and mixed wastes are summarized below.

TABLE 7-6. SOLID WASTE TREATMENT.

SOLID WASTE TYPE	APPLICABLE CONTROL METHODS
Radioactive Waste	<ul style="list-style-type: none">- Stabilization/fixation- Physical compaction
Hazardous Waste	<ul style="list-style-type: none">- Solidification/stabilization- Physical separation- Chemical reduction- Neutralization/precipitation- Biodegradation
Mixed Waste	<ul style="list-style-type: none">- Solidification/stabilization- Storage until promulgation of management guidelines- Physical compaction

The operating philosophy and objectives for management of solid waste are to minimize the amount of solid radioactive, hazardous, and mixed wastes generated. Any wastes generated should be managed using the best technical standards available and in compliance with DOE Directives, and state and Federal laws and regulations.

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CHAPTER 8.0

INADVERTENT CRITICALITY PROTECTION

June 20, 1994

**ENVIRONMENTAL RESTORATION DIVISION
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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8.0 INADVERTENT CRITICALITY PROTECTION

8.1 Guidelines for Criticality Hazard Evaluation

This chapter provides guidance for the development of the specific criticality hazard evaluation for an Environmental Restoration Program (ERP) activity. Chapter 8 of the activity-specific safety analysis shall conservatively demonstrate no potential for a criticality hazard. If a nuclear criticality is possible, based on the fissile material inventory involved with the activity, the activity is classified as Hazard Category 2 in accordance with DOE-STD-1027-92 (DOE, 1992a), requiring a criticality evaluation per DOE 5480.24 (DOE, 1992b), and is outside the scope of this Baseline Safety Analysis File (BSAF).

Chapter 8 of the activity-specific safety analysis shall conservatively estimate the total fissile material involved in the specific ERP, consistent with material inventories in Chapter 5 of the safety analysis documentation. The estimate shall include the total mass of each fissile radionuclide within the defined activity boundary, including bulk contamination, surface contamination, and contaminated systems and components.

The estimates shall employ isotopic analyses and gross activity analyses from available site or facility characterization surveys. Because of the potential uncertainty of such estimates, conservatism is warranted. Gross alpha survey measurements for fissile mass shall be scaled to the most conservative single fissile nuclide or conservative fissile nuclide mixture identified in available isotopic analyses from the site or facility. Nuclides used for gross activity scaling shall be assumed to be in a conservative chemical form, consistent with available radiochemical data. The fissile material quantities shall be compared with the single-parameter fissile mass limits of the following standards:

- DOE-STD-1027-92 (DOE, 1992a)
- ANSI/ANS 8.1-1983 (ANSI, 1983)
- ANSI/ANS 8.15-1981 (ANSI, 1981)
- ANSI/ANS 8.12-1978 (ANSI, 1978).

DOE-STD-1027-92 (DOE, 1992a) cites the fissile mass limits of ANSI/ANS 8.1 (ANSI, 1983). ANSI/ANS 8.12 (ANSI, 1978) and ANSI/ANS 8.15 (ANSI, 1981) provide detailed mass limit guidance for fissile mixtures and actinide elements not addressed in DOE-STD-1027-92.

If the estimates of the total fissile material involved in the ERP activity exceed the fissile mass limits, segmentation as allowed by DOE-STD-1027-92 (DOE, 1992a) may preclude the possibility of a nuclear criticality. Segmentation credit may be taken only if fissile material in one segment is independent from and cannot interact with material in another segment. Credit for segmentation shall not be taken if administrative controls or active systems are relied upon to prevent material interaction between segments.

The hazard evaluation shall demonstrate that the quantities of fissile material involved in any segment do not exceed the single-parameter fissile mass limits stated in the cited standards, with a margin to protect against uncertainties.

8.0 REFERENCES

American National Standards Institute/American Nuclear Society (ANSI, 1978),
*American National Standard for Nuclear Criticality Control and Safety of
Homogenous Plutonium-Uranium Fuel Mixtures Outside Reactors*, ANSI, La
Grange Park, IL., ANSI/ANS 8.12-1978.

American National Standards Institute/American Nuclear Society (ANSI, 1981),
*American National Standard for Nuclear Criticality Control of Special
Actinide Elements*, ANSI, La Grange Park, IL., ANSI/ANS 8.15-1981.

American National Standards Institute/American Nuclear Society (ANSI, 1983),
*American National Standard for Nuclear Criticality Safety in Operations
with Fissionable Material Outside Reactors*, ANSI, La Grange Park, IL.,
ANSI/ANS 8.1-1983.

Department of Energy (DOE, 1992a), *Hazard Characterization and Accident
Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear
Safety Analysis Reports*, DOE, Washington, D.C., DOE-STD-1027-92.

Department of Energy (DOE, 1992b), *Nuclear Criticality Safety*, DOE,
Washington, D.C., DOE 5480.24.

CHAPTER 9.0

RADIATION PROTECTION

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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9.0 RADIATION PROTECTION

The Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP) protects personnel and the public from radiation and radioactive materials through a radiological control program administered by the local Radiological Control Organization, as defined in the United States Department of Energy (DOE) Idaho Operations Office (ID) Radiological Control Manual (RCM) (DOE-ID, 1992a). The local Radiological Control Organization either integrates radiation protection services from several organizations within the INEL, or resides within a facility where ERP activities are conducted. The responsible Radiological Control Organization implements radiological controls for ERP activities by arrangement with the environmental restoration contractor.

Radiation Protection for Occupational Workers, 10 CFR 835 (DOE, 1994), contains the primary requirements for occupational radiation protection throughout the DOE Complex. The DOE RCM (DOE, 1992) requires that a site-specific RCM be developed to implement the primary requirements. The DOE-ID RCM (DOE-ID, 1992a) is the site-specific RCM for the INEL, including ERP activities. INEL contractors in the Radiological Control Organization employ DOE-approved, contractor-specific, and facility-specific RCMs. The content and format of the DOE-ID RCM and contractor RCMs are consistent with the DOE RCM.

The radiological protection program incorporates requirements from 10 CFR 835 (DOE, 1994), DOE 5400.5 (DOE, 1990), DOE 5480.11 (DOE, 1988a), the DOE-ID RCM (DOE-ID, 1992a), and the DOE-approved contractor RCM applicable to the ERP activity. ERP contractor compliance with these requirements forms the radiation protection safety basis. The Radiological Control Organization will comply with revisions to DOE radiation protection requirements. The Baseline Safety Analysis File (BSAF) will be annually updated to reflect ongoing revisions to DOE requirements.

9.1 As Low as Reasonably Achievable (ALARA) Policy and Program

Guidance to Federal agencies directs that there should be no occupational exposure of workers to ionizing radiation without the expectation of an overall benefit from the activity causing the exposure (EPA, 1987). Therefore, radiation exposure of the ERP work force and public is controlled to assure that radiation exposures are below regulatory limits and as low as reasonably achievable (ALARA). This section discusses the INEL ALARA program in which the ERP participates.

9.1.1 ALARA Committee

The INEL ALARA Committee with jurisdiction over ERP activities makes recommendations to management toward minimizing radiation exposure and radiological releases. The Committee evaluates ERP items such as construction and design of new facilities and systems; planned major modifications of work activities; and plans for exposure, waste, and release minimization. The Committee receives the results of all ERP radiation protection reviews and audits, both internal and external.

9.1.2 Radiological Goals

The INEL establishes, approves, and maintains a radiological performance goals program (DOE-ID, 1992a). Performance goals are measurable and auditable. Radiological performance goals are reviewed at least annually and revised as appropriate.

9.1.3 Administrative Control Levels

Administrative control levels are established by the DOE-ID RCM at levels below regulatory limits to administratively control and help reduce individual and collective radiation dose (DOE-ID, 1992a). These control levels are multi-tiered with increasing levels of authority required to approve higher administrative control levels. Chapter 6 presents administrative control levels as part of the principal safety criteria.

9.1.4 ALARA Review and Work Planning

ERP activities with the potential to exceed DOE-ID ALARA review levels undergo an ALARA review (DOE-ID, 1992a). At those operations with routine, recurring processes, special management attention is directed to radiological activities infrequently conducted or representative of first-time operations. Job-specific radiological requirements identified as part of the ALARA review are documented in the activity-specific Health and Safety Plan or workplan.

Pre-job briefings are held prior to work conducted under the formal ALARA review process (DOE-ID, 1992a). Pre-job briefings are typically conducted by the field supervisor. Workers and supervisors directly participating in the job, cognizant radiological control personnel, and representatives from involved support organizations attend the briefing. The summary of topics discussed at the pre-job briefing and attendance are documented.

For routine tasks such as surveillance, tours, and minor nonradiological maintenance, performance of a suitable work planning session and documentation of identified radiological requirements may be conducted as part of the radiation work permit (RWP) process (Section 9.5).

ERP activity-specific Health and Safety Plans are reviewed to identify and incorporate radiological requirements and ALARA techniques such as engineering controls and dose and contamination reduction considerations. These reviews are the responsibility of line management, with support and concurrence from the INEL Radiological Control Organization (DOE-ID, 1992a).

9.2 Radiation Sources

Chapter 5 will identify the inventory of radioactive materials present in activity-specific safety analysis documentation. This information will include types of radioactive materials, maximum quantities, and location. Chapter 7 will identify radioactive wastestream data.

The potential primary sources of radiation during ERP activities at INEL result from the following:

- Source materials (for example, uranium) and processes used in the support of national defense and energy programs
- Wastes generated from these defense and energy programs
- Contaminated equipment
- Past spill cleanup and waste storage, treatment, and disposal activities.

Types of radionuclides at ERP sites include the following:

- Alpha emitters, chiefly transuranic (TRU) materials from reactor operations and chemical separation and recovery, such as americium (^{241}Am)
- Beta-gamma emitters, chiefly fission and activation products due to reactor operations and chemical separation operations, such as cesium (^{137}Cs) and cobalt (^{60}Co)
- Pure beta emitters, primarily the fission product strontium (^{90}Sr).

ERP soil sampling, drilling, treatment, and earthmoving activities result in gamma radiation exposure through exposure to contaminated soils, liquids, and sludges. Decontamination and decommissioning (D&D) activities result in gamma radiation exposure from contaminated surfaces and residual contamination in tanks and systems.

Gamma exposure will be controlled through minimizing time spent in radiation areas; maximizing distance to contaminated materials; and shielding provided by existing structures or soil layers. Additional temporary shielding may be added as appropriate and optimal under the ALARA evaluation process.

ERP earthmoving and drilling activities will generate airborne radioactive materials. Surface decontamination, grinding, cutting, and other D&D activities will generate airborne radioactive material. Inhalation of these materials is the primary source of internal exposure to ERP personnel. Ingestion or injection of radioactive material into the body is not expected to be a significant source of internal exposure. The beta emitter, ^{90}Sr , and alpha emitter, ^{241}Am , are chief concerns for internal exposure from uptakes of contaminated dusts from soils. Contaminated sludges, if suspended in air, may result in additional uptakes of curium (^{244}Cm) and cerium (^{144}Ce).

Radiation protection personnel evaluate each activity for application of engineering controls to reduce airborne contamination at the source. Many ERP activities may involve extensive earthmoving or D&D tasks, which may render engineering control impractical or less effective. In these cases, respiratory protection will reduce or eliminate internal exposure. Internal exposures are expected to be ALARA and well below 100 mrem per year committed effective dose equivalent (CEDE).

ERP personnel will handle materials with removable contamination and enter Contaminated Areas. Beta-gamma emitting radionuclides, ^{137}Cs and ^{60}Co , are of greatest concern for skin contamination. Procedures for control of contamination, and for maintaining, selecting, donning, and removing protective clothing provide protection against contamination of the skin.

9.3 Radiation Protection Design Features

Radiation protection objectives for the design of ERP radiation protection features are prevention of radionuclide contamination and of exposure of INEL personnel, the public, and the environment; and the safe management of radioactive wastes from ERP activities. To meet these objectives, engineering design considerations address identification of radiation hazards, causes, consequences, and likelihood of occurrence. The system for confinement, shielding, ventilation, and monitoring is designed in accordance with the ALARA philosophy. Contingencies eliminate or mitigate the radiological impact of a system failure. Design engineers review proposed designs and offer alternatives as part of the ALARA process. Radiation protection features are selected as required by the State of Idaho, Environmental Protection Agency (EPA), and DOE 5480.11 (DOE, 1988a) and DOE 5400.5 (DOE, 1990).

DOE-ID policy is to design facilities in accordance with DOE-ID 6430.1A (DOE-ID, 1989), which references DOE 6430.1A (DOE, 1989), and in compliance with the codes and standards contained in DOE-ID *Architectural Engineering Standards* (DOE-ID, 1992b). DOE-ID 6430.1A provides that design goals be established below occupational dose limits to incorporate the ALARA concept into facility design. The shielding design basis goal is less than 1 rem effective dose equivalent (EDE) per year to an individual, based on normal conduct of operations (DOE-ID, 1989). Consistent with this goal, the DOE-ID RCM (DOE-ID, 1992a) recommends an overall radiological design goal of less than 500 mrem EDE per year to an individual.

ERP processes are designed to confine radioactive materials and control routine releases so that operating areas of structures do not exceed 10% derived air concentration (DAC) and so that public exposure is less than the limits specified in DOE 5400.5 (DOE, 1990), with all releases ALARA.

Monitoring systems are provided to assess releases from ERP sites, and are tested periodically (DOE-ID, 1989). Equipment is provided as directed by the RCM (DOE-ID, 1992a) to monitor both direct radiation and airborne radioactive material at the ERP site. This equipment may be portable. Alarm functions are provided to alert workers to unexpected changes in radiation levels or airborne concentrations.

Facilities erected for ERP use are designed to limit spread of radionuclide contamination and to allow ease of decontamination. Measures include containment systems separable from structures; waste treatment and ventilation systems localized to the contamination source; prevention of dead-leg piping and inaccessible areas of contamination or accumulation; modular shielding material; and materials selected for ease of decontamination (DOE-ID, 1989).

9.4 Radiation Exposure Assessments

Guidelines for assessing radiation exposure from normal operation of ERP workers, workers at nearby INEL facilities, and the general public beyond the INEL site boundary are summarized in this section. Quantitative radiation exposure assessments will generally not be necessary in the safety analysis of ERP activities covered by the BSAF. However, activity-specific safety analysis documentation must include an assessment of expected occupational radiation dose to workers and radiation dose to nearby facility workers and the public from normal operational releases of radioactive material. The results of the assessment are compared to relevant radiation protection requirements and ALARA guidelines in DOE 5480.11 (DOE, 1988a), DOE 5400.5 (DOE, 1990), and the RCM (DOE-ID, 1992a).

Potential radiation hazards are assessed by determining the consequences to human and environmental targets in various domains as a result of normal ERP activities. Both onsite and offsite effects of normal operation are considered. Mitigation measures that reduce the magnitude of normal operational consequences are considered. These measures include normal functioning of filtration, shielding, containment, and ventilation systems.

Expected worker doses can be estimated based on monitored dose from prior, similar ERP activities. Worker doses can be calculated based on the time workers are expected to spend in areas where they can be exposed to direct radiation, or can receive indirect radiation exposure by inhalation or ingestion of radioactive material. Exposure by direct radiation is estimated from the expected time workers spend in known or projected radiation fields.

Calculation of doses due to airborne radioactive material and liquid effluent, if necessary, begins by establishing average airborne concentrations in the workplace and in air effluent, and liquid concentrations in effluent. DACs from DOE 5480.11 (DOE, 1988a) are compared to workplace measurements as an index of performance. Derived Concentration Guides (DCGs) from DOE 5400.5 (DOE, 1990) are applied for air and liquid effluent performance indicators. For those ERP sites where no drinking water pathway exists, compliance with DOE 5400.5 (DOE, 1990) may be demonstrated by compliance with the liquid DCG.

Using air and liquid concentrations and release rates, computer codes such as AIRDOS and CAP88 can be employed if needed to determine doses to various receptors, including the INEL facility worker; maximally-exposed individual at the site boundary; and 50-mile radius collective population dose.

9.5 Radiological Control Program

ERP activities incorporate site-specific or program-specific radiological control methods. The Health and Safety Plan and RWPs specify controls for all types of ERP activities at the specific site. The Health and Safety Plan is discussed in Section 9.6.

The RWP is an administrative mechanism to establish specific radiological controls for DOE contractor work. The RWP informs workers of

area radiological conditions and entry requirements and provides a mechanism for relating worker exposure to specific work activities.

9.5.1 External Radiation Exposure Controls

External occupational radiation exposure from ERP activities are limited to levels specified in DOE 5480.11 (DOE, 1988a) and DOE-ID RCM (DOE-ID, 1992a). Within these limits, exposure is controlled ALARA using evaluation and control methods described in Section 9.1. Structures, systems, and components are designed so that personnel shall not be expected to receive more than 500 mrem total effective dose equivalent (TEDE) due to routine operations (DOE-ID, 1992a).

External radiation dose control is accomplished by monitoring ERP personnel for external radiation and tracking of doses received; establishing operational dose limits and administrative dose control levels; establishing radiological goals; identifying and controlling radiation sources; controlling access to radiation areas; and incorporating radiation protection design features in ERP facilities and equipment.

External exposure is anticipated by radiological monitoring and surveys (Sections 9.5.7 and 9.5.8) in order to characterize work areas prior to ERP activities. Work control documents, such as the Health and Safety Plan and RWPs (Section 9.5), employ survey data to inform workers of potential hazards so external dose can be minimized through instructions on work time, distance to radiation sources, and shielding. Access control requirements assure that only qualified individuals have access to Controlled Areas and potentially incur exposure for a given ERP activity (Section 9.5.12).

While within the area, workers and radiation protection personnel remain cognizant of, and avoid or shield, external radiation sources identified by surveys and work documents. Primary dosimeters, self-reading dosimeters, and continuing surveys provide data on actual exposure incurred and current radiological conditions. The worker and radiation protection personnel evaluate doses received and ongoing workplace surveys, identifying unnecessary exposure and mitigating such exposures when reasonable.

Challenging radiological goals (Section 9.1.2) and administrative limits are set based on operating experience at the INEL and within the ERP. Dosimeter data is tracked to ascertain external exposure control performance relative to goals and administrative limits.

9.5.2 External Dosimetry

Personnel dosimetry is provided for workers expected to receive an annual external whole body dose greater than 100 mrem or an annual dose to the extremities, lens of the eye, or skin greater than 10 percent of the corresponding limits specified in the RCM (DOE-ID, 1992a). Neutron dosimetry is provided when a person is likely to exceed 100 mrem annually from neutrons.

Primary Dosimeters. DOE 5480.15 (DOE, 1987) specifies requirements for accreditation of personnel external dosimetry monitoring programs by the DOE Laboratory Accreditation Program (DOELAP). Personnel external dosimeters

include, but are not limited to, thermoluminescent dosimeters (TLDs), track etch dosimeters, and neutron sensitive film. INEL personnel dosimeters are accredited through DOELAP.

Exposures of INEL personnel's skin, lens of the eye, and extremities are reported separately when monitored. Multiple dosimeters are issued to personnel to assess whole body exposure in non-uniform radiation fields. Non-uniform radiation fields exist when the dose to a portion of the whole body exceeds the dose to the primary dosimeter by more than 50 percent and the anticipated whole body dose is greater than 100 mrem.

Supplemental Dosimeters. Pocket and electronic dosimeters are supplemental dosimeters that provide real-time indication of exposure to radiation and assist in maintaining personnel doses less than administrative control levels.

Supplemental dosimeters are issued to personnel prior to entry into a High Radiation Area, when a person could exceed 10 percent of an administrative control level for external radiation in 1 workday, or when required by an RWP. Pocket dosimeters are typically selected with the lowest range applicable (typically 0-200 mrem) for anticipated personnel exposures.

Supplemental dosimeters are worn simultaneously with the primary dosimeter, read periodically while in use, and not allowed to exceed 75 percent of full scale.

Routine work on an RWP is stopped when supplemental dosimeter readings indicate total exposure or rate of exposure substantially greater than planned. The Radiological Control Organization is consulted prior to continuation of work.

Use of electronic dosimeters is considered for entry into High Radiation Areas or when planned doses greater than 100 mrem in 1 workday are expected. An electronic dosimeter provides an early warning of elevated exposure through the use of alarm set points at specified dose rates or integrated doses.

When the dose result from a pocket or electronic dosimeter differs by more than 50 percent from the primary dosimeter result and the primary dosimeter result is greater than 100 mrem, an investigation is initiated to explain the difference.

9.5.3 Internal Radiation Exposure Controls

To minimize internal exposures, contamination is controlled at the source. Airborne radioactivity and contamination are reduced where such reductions are ALARA (DOE-ID, 1992a). Work is planned to avoid the routine use of respiratory protection devices.

The minimization and control of internal exposure is conducted in accordance with the following hierarchy of controls (DOE-ID, 1992a):

- Engineering controls, including containment of radioactive material at the source wherever practicable
- Administrative controls, including access restrictions and the use of specific work practices designed to minimize airborne contamination
- Respiratory protection, to limit internal exposures when engineering and administrative controls are applied and the potential for airborne radioactivity still exists. Use of respiratory protection is considered under the following conditions:
 - Entry into posted Airborne Radioactivity Areas
 - Breach of contaminated systems or components
 - Work in areas or on equipment with high contamination levels
 - Work with potential to generate airborne radioactivity from contaminated or activated surfaces or soils.

Potential intakes of radioactive material are indicated when personnel without respiratory protection are exposed to airborne radioactivity or when respiratory protection is compromised. If intakes of radioactive material are indicated which could result in a CEDE greater than 100 mrem, the following actions are taken (DOE-ID, 1992a):

- Identification of personnel potentially exposed to airborne radioactivity
- Obtaining of nasal smears for qualitative indication of intakes, where appropriate
- Analysis of air samples to determine airborne concentrations, where appropriate
- Determination of duration of potential exposure to airborne radioactivity
- Performance of bioassay appropriate for radionuclides involved
- Evaluation of dose prior to permitting worker to return to radiological work.

9.5.4 Internal Dosimetry

DOE 5480.11 (DOE, 1988a) and DOE-ID RCM (DOE-ID, 1992a) provide requirements for monitoring personnel for internal exposures. Individuals working on ERP activities are classified by job tasks to evaluate internal exposure potential. If the potential exposure exceeds RCM trigger levels, the individuals are included in the bioassay program. As a minimum, all employees

scheduled to become Radiation Workers and likely to receive intakes resulting in greater than 100 mrem, undergo initial, periodic, and termination baseline whole body counts or bioassays in accordance with the RCM (DOE-ID, 1992a).

9.5.5 Radiological Protection Instrumentation Program

Radiological instruments are used only to measure radiation for which calibrations are valid. DOE 5480.4 (DOE, 1991b) mandates requirements contained in American National Standards Institute (ANSI) N323 (ANSI, 1983) for radiological instrumentation calibration. Calibration of radiological instruments is accomplished in facilities designed and operated in accordance with the recommendations of ANSI-N323 (ANSI, 1983), employing National Institute of Standards and Technology (NIST) traceable sources.

Supplemental electronic dosimeters, area radiation monitors, and portable instruments are calibrated semi-annually. Radiological instruments undergo calibration prior to use following any preventive or corrective maintenance or any adjustment that voids the previous calibration. A functional check to test all components involved in an alarm or trip function is performed semi-annually (ANSI, 1983).

Instruments with "as found" readings, indicating the instrument may have been used while out of calibration, are reported to the Radiological Control Organization. If underresponse of -20% is identified, the Radiological Control Organization reviews surveys performed with the instrument while it was out of calibration and takes corrective action (ANSI, 1983).

9.5.6 Respiratory Protection Program

Respiratory protection equipment includes respirators with particulate or gas-filtering cartridges, supplied air respirators, self-contained breathing apparatus, and air line supplied-air suits and hoods. Engineering controls and work practices for ERP activities are designed to control radioactive materials at the source, so that respiratory protection can be reduced (DOE-ID, 1992a).

DOE 5480.4 (DOE, 1991b) mandates the requirements contained in ANSI Z88.2 (ANSI, 1980) and 29 CFR 1910.134 (DOL, 1993) for implementation of the Respiratory Protection Program and associated training of personnel. Respirators are issued only to personnel trained, fitted, and medically qualified to wear the specific type of respirator. Training and qualification testing are performed annually. Positive controls are maintained for the issue, use, and return of respirators to ensure that only qualified personnel wear respirators.

Each prospective respirator wearer receives a medical assessment prior to being fit-tested. The medical assessment determines if an employee's medical condition precludes the use of respirators. The ability of an employee to accommodate additional stress placed on the body when working in a respirator is part of this assessment.

The selection of respiratory protection equipment includes consideration of worker safety, comfort, and efficiency. Positive pressure respiratory protection devices are used wherever practicable to alleviate fatigue and increase comfort.

9.5.7 Airborne Radioactive Material Monitoring

Air monitoring equipment is considered in situations where airborne radioactivity levels can fluctuate and early detection of airborne radioactivity can prevent or minimize inhalation of radioactivity by personnel. Air monitoring equipment includes portable and fixed air sampling equipment and continuous air monitors. Air monitoring equipment is routinely calibrated and maintained at least once each year (DOE-ID, 1992a).

Air sampling equipment is used in areas where, under normal operating conditions, a person is likely to receive an annual intake of 2 percent or more of the specified annual limit of intake (ALI) values, or 40 DAC hours. An annual intake of 2 percent of a specified ALI generally represents a CEDE of approximately 100 mrem. Air sampling equipment is positioned to representatively measure air concentrations to which persons are exposed (DOE-ID, 1992a).

Continuous air monitoring (CAM) equipment is installed in occupied areas where a person without respiratory protection is likely to be exposed to a concentration of radioactivity in air exceeding 1 DAC or where there is a need to alert potentially exposed workers to unexpected increases in the airborne radioactivity levels. A person exposed continuously to a concentration of radioactivity in air of 1 DAC for 1 work week would generally receive a CEDE of approximately 100 mrem (DOE-ID, 1992a).

Continuous air monitors are capable of measuring 8 DAC-hours (DOE, 1988a). CAM equipment has alarm capability to alert personnel that immediate action is necessary to minimize or terminate inhalation exposures. The proper operation of CAM equipment is verified daily by performing an operational check (DOE-ID, 1992a).

9.5.8 Radiological Monitoring and Contamination Control

Radiological monitoring of radiation exposure levels, contamination, and airborne radioactivity characterizes workplace conditions and identifies areas requiring postings. Surveys for radiation, contamination, and airborne radioactive materials are performed as specified in the RCM and RWPs (DOE-ID, 1992a).

Monitoring is performed only by trained and qualified personnel, using properly calibrated instruments. Instruments used to perform radiation surveys are response-checked daily or prior to operation. When response checks are not within ± 20 percent of the expected value, the instrument is removed from service (ANSI, 1983).

Area Radiation Monitoring. Radiological control personnel perform area radiation surveys, including dose rate measurements of the general area; dose rates at a distance of 30 centimeters from a source or surface of

interest to evaluate potential whole body exposures; and dose rates on contact with potential sources of radiation where there is a potential for hands-on work (DOE, 1988a).

Radiation area monitors (not including area monitoring dosimeters) are placed in very high radiation areas when such monitoring is necessary for physical access control (DOE-ID, 1992a).

Radiation area monitors are considered for frequently occupied locations with the potential for unexpected increases in dose rates and in remote locations where a local indication of dose rates prior to personnel entering are required. However, radiation area monitors are not substituted for radiation exposure surveys in characterizing a workplace (DOE-ID, 1992a).

Radiation area monitors are tested at least quarterly to verify audible alarm system operability and audibility under ambient working conditions and operability of visual alarms when so equipped. If installed instrumentation is removed from service for maintenance or calibration, a radiation monitoring program providing at least equal detection capability is maintained (DOE-ID, 1992a).

Surface Contamination Monitoring and Control. ERP objectives include mitigation of radiological contamination for ultimate return of the project site for other uses. Control of radioactive contamination is achieved by using engineering controls and worker performance to contain contamination at the source; by reducing existing areas of contamination; and by promptly decontaminating areas that become contaminated.

Routine surface contamination surveys are conducted in accordance with the RCM (DOE-ID, 1992a). Requirements for assessing representative samples of bulk material (such as sand, sweeping compounds, or plate steel), not suitable for normal, loose, and fixed contamination-level assessment techniques, are specified in DOE 5400.5 (DOE, 1990). Contaminated soil not releasable in accordance with DOE 5400.5 (DOE, 1990) is posted as a Soil Contamination Area (DOE-ID, 1992a). Posting typically includes instructions or special warnings to workers such as "Consult With Radiological Control Organization Before Digging" or "Subsurface Contamination Exists." Soil Contamination Areas may be located outside a Radiological Buffer Area.

Personnel Contamination Monitoring and Control. Personnel perform a whole body frisk immediately upon exiting Contamination Areas, High Contamination Areas, and Airborne Radioactivity Areas and as directed by the RWP or the Radiological Control Organization (DOE, 1988a).

ERP personnel exiting a Radiological Buffer Area containing Contamination, High Contamination, or Airborne Radioactivity Areas perform a hand and foot frisk. This frisk is optional if the Radiological Buffer Area exit is immediately adjacent to the location where the exiting worker already has performed a whole body frisk (DOE-ID, 1992a).

Personnel frisking is performed after removal of protective clothing and prior to washing or showering. Personal items such as notebooks, papers, and flashlights are subject to the same frisking requirements as the person

carrying them. Instructions for personnel frisking are posted adjacent to personnel frisking instruments or monitors.

When personnel detect skin contamination, they notify the Radiological Control Organization. The extent of skin contamination is determined prior to initiating decontamination procedures (DOE-ID, 1992a).

Emergency medical care is administered immediately for injuries involving radioactive materials in accordance with National Council on Radiation Protection (NCRP) *Measurements Report Number 65* (NCRP, 1980). Medical treatment of injuries takes precedence over radiological considerations.

Radioactive Material Monitoring and Control. The DOE-ID RCM (DOE-ID, 1992a) defines radioactive material as any material, equipment, or system component determined to be contaminated. Items located in known or suspected Contamination, High Contamination, or Airborne Radioactivity Areas with the potential to become contaminated are considered radioactive material. Radioactive material includes activated material, sealed and unsealed sources, and materials that emit radiation.

Materials in Contamination, High Contamination, or Airborne Radioactivity Areas are considered radioactive material until surveyed and released. Radioactive material within Contamination, High Contamination, or Airborne Radioactivity Areas, that is confirmed or suspected of having removable radioactive contamination levels greater than RCM values, is labeled and packaged prior to release to Controlled Areas (DOE-ID, 1992a).

Radioactive material in Controlled Areas or Radioactive Material Areas is surveyed prior to release to uncontrolled areas. DOE 5400.5 (DOE, 1990) describes criteria for releasing radioactive material to uncontrolled areas. Radioactive material to be released is evaluated for contamination under any coatings or contamination in depth or volume, such as activated material or smelted contaminated material. Labels are removed or defaced prior to release of radioactive material for unrestricted use.

In cases where outdoor storage of ERP radioactive material is necessary, the integrity of containers will prevent degradation from weathering and subsequent release of radioactive material (DOE-ID, 1992a).

DOE N 5400.9 (DOE, 1991a) describes how sealed sources are controlled and maintained. Unsealed sources are controlled and maintained in a similar manner except for integrity testing.

Transportation of Radioactive Materials. 49 CFR 170 through 180 (DOT, 1993) describes requirements for inspecting and surveying packages, containers, and transport conveyances prior to offsite transport. The contamination limits of 49 CFR 173 are used to control any shipment which uses a non-DOE conveyance for any portion of the overall transportation route. RCM contamination values are applied as controlling limits for onsite and offsite transportation when using a DOE conveyance. Receipt surveys of radioactive material shipments are performed by the Radiological Control Organization.

Onsite transfers over nonpublic thoroughfares or between facilities on the same site are performed in accordance with written procedures using pre-approved routes. Onsite transfers over public thoroughfares are performed in accordance with United States Department of Transportation (DOT) shipping requirements (DOT, 1993).

Drivers of DOE and non-DOE motor vehicles have a copy of the emergency response plan, or the emergency response information required by 49 CFR 172.600, during transport onsite or offsite (DOT, 1993).

9.5.9 Radiological Boundaries and Posting

Radiological posting alerts ERP personnel to the presence of radiation and radioactive materials and aids them in minimizing exposures and preventing the spread of contamination. If more than one radiological condition (such as contamination and high radiation) exists in the same area, each condition is identified. Postings at entrance points to Radiological Areas contain basic entry requirements, such as dosimetry, RWP, and respirator required (DOE-ID, 1992a).

Posting Controlled Areas. Controlled Areas within the ERP activity boundary are clearly posted to alert personnel to the presence of radiation and radioactive materials above natural background levels. Activity-specific Controlled Area posting is not required if the ERP boundary is within previously defined and posted INEL Controlled Area boundaries. Personnel entering only the Controlled Area without entering Radiation, Contamination, Airborne Radioactivity, or Radiological Buffer Areas are not expected to receive more than 100 mrem in a year (DOE, 1988a).

Posting Radiological Buffer Areas. A Radiological Buffer Area is established within the Controlled Area to provide a second boundary to minimize the spread of contamination. The Radiological Buffer Area is intended for use if ongoing work activities may create airborne radioactivity or the spread of contamination. At a minimum, the Radiological Buffer Area includes the area adjacent to any exit from and entrance to Contamination, High Contamination, and Airborne Radioactivity Areas (DOE-ID, 1992a).

Posting Radiation Areas. Areas are posted to alert personnel to the presence of external radiation in accordance with the RCM (DOE-ID, 1992a).

Posting Contamination and Airborne Radioactivity Areas. Areas are posted to alert personnel to contamination in accordance with the RCM (DOE-ID, 1992a). DAC values used with RCM airborne area posting criteria are found in DOE 5480.11 (DOE, 1988a).

Posting Radioactive Material Areas. Areas where radioactive materials are used, handled, or stored are posted "Caution, Radioactive Material." Radioactive Material Areas are located within Controlled Areas. Posting for Radioactive Material Areas is not required when the radioactive material is inside a Contamination, High Contamination, or Airborne Radioactivity Area (DOE-ID, 1992a).

Underground Radioactive Material Areas are established to indicate the presence of underground items that contain radioactive materials such as pipelines, radioactive cribs, covered ponds, covered ditches, catch tanks, inactive burial grounds, and sites of known, covered, unplanned releases (spills). Underground Radioactive Material Areas are posted "UNDERGROUND RADIOACTIVE MATERIAL." Underground Radioactive Material Areas may be located inside or outside Controlled Areas and are exempt from entry and exit requirements (DOE-ID, 1992a).

9.5.10 Radiological Protection Recordkeeping

Radiation protection records related to ERP activities are retained to document the effectiveness of the radiation protection program and demonstrate compliance with DOE 1324.2A (DOE, 1988b), DOE 5484.1B (DOE, 1981), DOE 5480.11 (DOE, 1988a), and the RCM (DOE-ID, 1992a).

DOE 1324.2A (DOE, 1988b) provides implementing instructions, records inventory requirements, disposition schedules, and provisions for the transfer of records. The Privacy Act of 1974 contains requirements to protect the privacy of individual records.

A radiological records management program ensures that auditable records and reports are controlled through the stages of creation, distribution, use, arrangement, storage, retrieval, and disposition, consistent with DOE 1324.2A (DOE, 1988b) and the Privacy Act. The records management program includes the following:

- Radiological policy statements
- Radiological control procedures
- Individual radiological doses
- Internal and external dosimetry policies and procedures (including bases documents)
- Personnel training (course records and individual records)
- ALARA records
- Radiological instrumentation test, repair, and calibration records
- Radiological surveys
- Area monitoring dosimetry results
- RWPs
- Radiological performance indicators and assessments
- Radiological safety analysis and evaluation reports

- Quality assurance records
- Radiological incident and occurrence reports (and critique reports, if applicable)
- Accountability records for sealed sources
- Records for release of material to Controlled Areas
- Reports of loss of radioactive material.

Where radiological services (for example, dosimetry and laboratory analyses) are purchased, records of results will reside in the custody of the Radiological Control Organization.

9.5.11 Radiological Protection Training

The ERP contractor radiation safety training program ensures that personnel have the training to work safely in and around radiological areas and to maintain individual radiation exposure and the radiation exposures of other individuals ALARA.

Standardized INEL core course training material is used for General Employee Radiological Training, Radiological Worker I and II training, and Radiological Control Technician training. However, ERP site-specific aspects of radiological training are provided, with emphasis on the activity-specific Health and Safety Plan. Site-specific training for General Employee Radiological Training and Radiological Worker I and II training may be included with other site orientation training (DOE-ID, 1992a).

Written examinations for General Employee Radiological Training, Radiological Worker I and II training, and Radiological Control Technician qualification are used to demonstrate satisfactory completion of theoretical and classroom material (DOE-ID, 1992a).

General Employee Radiological Training is completed every 2 years. In alternate years when full retraining is not offered, the latest course materials are distributed for self-study (DOE-ID, 1992a).

Radiological Worker I and II retraining is completed every 2 years. In alternate years when retraining is not performed, refresher training is completed (DOE-ID, 1992a).

Site-specific training and refresher training includes information regarding changes in requirements and updates of lessons learned from operations and maintenance experience and occurrence reporting for the INEL, ERP, and across the DOE Complex (DOE-ID, 1992a).

9.5.12 Entry and Exit Control Program

Entry and exit controls are implemented at ERP sites to ensure only properly trained and equipped personnel enter Controlled or Radiological Areas to prevent unnecessary radiation dose and contamination spread. Successful

completion of Visitor Orientation or General Employee Radiological Training is required for unescorted entry into Controlled Areas (DOE-ID, 1992a).

Radiological workers from other DOE or DOE-contractor facilities may receive the same occupational exposure as an INEL radiological worker if they have met the following conditions:

- Provision of record of current Radiological Worker I or II standardized core training
- Completion of site-specific Radiological Worker I or II training at facilities where they will work
- Provision of personal radiation dose records for previous years and written estimates for current year.

Access to Radiological Buffer Areas. Minimum requirements for unescorted entry into Radiological Buffer Areas include the following (DOE-ID, 1992a):

- Radiological Worker I training
- Personnel dosimetry, as appropriate.

Personnel who exit a Radiological Buffer Area containing Contamination Areas, High Contamination Areas, or Airborne Radioactivity Areas monitor themselves and personal belongings for contamination.

Access to Radioactive Material Areas. Radiological Worker I training is required for unescorted entry into Radioactive Material Areas containing either of the following (DOE-ID, 1992a):

- Sealed radioactive sources
- Labeled and packaged radioactive material.

Entry into Radioactive Material Areas posted as Radiation or Contamination Areas is in accordance with the requirements in the discussion that follows.

Access to Radiation Areas. Minimum requirements for unescorted entry into Radiation Areas include the following (DOE-ID, 1992a):

- Radiological Worker I training
- Worker's signature on the RWP, as applicable
- Personnel dosimetry.

Access to High Radiation Areas. Physical controls to prevent inadvertent or unauthorized access to High and Very High Radiation Areas are maintained in accordance with the DOE-ID RCM (DOE-ID, 1992a) and DOE 5480.11

(DOE, 1988a). Minimum requirements for unescorted entry into High Radiation Areas include the following (DOE-ID, 1992a):

- Radiological Worker II training
- Worker's signature on the RWP
- Personnel and supplemental dosimeters
- Survey meter or dose rate indicating device available at the work area.

Minimum requirements for unescorted entry into High Radiation Areas where dose rates exist such that a worker could exceed a whole body dose of 1 rem in one hour include requirements for entry to High Radiation Areas and the following (DOE-ID, 1992a):

- Determination of the worker's current exposure, based on primary and supplemental dosimeter readings
- Pre-job briefing, as applicable
- Review and determination by the Radiological Control Organization regarding the required level of Radiological Control Technician coverage.

Access to Very High Radiation Areas. Physical controls to prevent inadvertent or unauthorized access to Very High Radiation Areas are maintained in accordance with the DOE-ID RCM (DOE-ID, 1992a), and DOE 5480.11 (DOE, 1988a). Workers are prevented from entry to Very High Radiation Areas when the radiation source is exposed and very high radiation fields are present. In addition to the controls required for High Radiation Areas, a survey is performed prior to the first entry to the area after the source has been secured or shielded to verify the very high radiation field has been terminated (DOE-ID, 1992a).

Facility operations personnel are notified prior to ERP personnel entry to areas where operational or system changes made by operations personnel could result in significantly increased area dose rates. The number, issue, and use of keys are strictly controlled where locked entryways are used to control access to High and Very High Radiation Areas (DOE-ID, 1992a).

Access to Contamination, High Contamination and Airborne Radioactivity Areas. Minimum requirements for unescorted entry into Contamination Areas include the following (DOE-ID, 1992a):

- Radiological Worker II training
- Worker's signature on the RWP, as applicable
- Protective clothing

- Personnel dosimetry, as appropriate.

Minimum requirements for unescorted entry into High Contamination or Airborne Radioactivity Areas include the following (DOE-ID, 1992a):

- Radiological Worker II training
- Worker's signature on the RWP
- Protective clothing and respiratory protection, as specified by the RWP
- Pre-job briefing for High Contamination or Airborne Radioactivity Areas, as applicable
- Personnel dosimetry, as appropriate.

Requirements for personnel exiting Contamination, High Contamination, or Airborne Radioactivity Areas include the following (DOE-ID, 1992a):

- Removal of protective clothing as specified in the RCM
- Performance of whole body frisking to detect personnel contamination
- Monitoring of tools or equipment removed from the area for release or for retention in a contaminated tool crib.

Exit points from Contamination, High Contamination, or Airborne Radioactivity Areas include the following:

- Step-off pad maintained free of radioactive contamination outside the exit point, contiguous with the area boundary
- Labeled containers inside the area boundary for the collection of protective clothing and equipment
- Contamination monitoring equipment located as close to the step-off pad as background radiation levels permit.

Visitor Access Control. Site procedures and the activity-specific Health and Safety Plan identify area entry requirements and access restrictions for visitors. Visitors with a demonstrated need may be allowed access if such access is controlled with a combination of training and the use of escorts trained for the following areas:

- Radiological Buffer Areas
- Radiation and High Radiation Areas
- Contamination Areas
- Radioactive Material Areas

Visitors are prevented from entering Very High Radiation Areas, High Contamination, and Airborne Radioactivity Areas.

9.6 Radiation Protection in the Health and Safety Plan

The requirements and contents of the Health and Safety Plan for the performance of specific ERP activities are provided in 29 CFR 1910.120 (DOL, 1993). The contents of the Health and Safety Plan include the following:

- Personnel training
- Medical surveillance
- Hazard evaluation
- Levels of protection and personal protective equipment
- Site control measures
- Environmental and personnel monitoring
- Decontamination procedures
- Emergency procedures, equipment, and information
- Confined space entry
- Spill Containment program.

The conduct of all ERP activities must meet the requirements stipulated in the activity-specific Health and Safety Plan.

ERP activities may involve low-levels of radioactivity and may use heavy construction or earth-moving equipment. These activities may require specialized radiological considerations in the Health and Safety Plan. These considerations include the following (DOE-ID, 1992a):

- Radiological goals appropriate to restoration activities
- Use of respiratory protection as normal conduct of operation due to lack of engineering controls and temporary nature of the work
- Use of contamination reduction corridors to accommodate movement of personnel and heavy equipment through a variety of decontamination stations
- Methods to obtain representative samples for release of equipment and material from work areas
- Surveying of materials released from soil contamination areas that exhibit significant contamination transfer properties

- Precedence of state- and federally-mandated soil cleanup criteria over surface contamination criteria that otherwise apply
- Monitoring and survey frequency for inactive facilities or for large infrequently occupied areas
- Outdoor storage of uncontained, bulk radioactive materials such as contaminated soil
- Postings of adjacent property
- Evaluation of outdoor air monitoring methodologies that consider dust loading, environmental factors, and supplemental breathing zone sampling
- Criteria for suspension of operations under inclement conditions, such as wind or rain.

Inclement weather or other environmental conditions may disrupt radiological controls at ERP sites. If this occurs, the following actions are considered (DOE-ID, 1992a):

- Use of covers, wind screens, and runoff collection basins to preclude inadvertent spread of radioactive material
- Provisions for worksite personnel to assemble and be monitored prior to release or reestablishment of work
- Evaluation of work area to determine if a need exists for modified work controls or decontamination.

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CHAPTER 10.0

HAZARDOUS MATERIAL PROTECTION

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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10.0 HAZARDOUS MATERIAL PROTECTION

The Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP) protects personnel and the public from hazardous materials through implementation of industrial hygiene, industrial safety, and construction safety programs. The primary requirements for occupational health and safety programs are found in United States Department of Energy (DOE) Directives, Occupational Safety and Health Administration (OSHA) Standards, and other applicable guidance specified in DOE 5480.4 (DOE, 1991). ERP contractor compliance with these requirements forms the hazardous material protection safety basis. INEL contractors will comply with revisions to DOE hazardous material protection requirements. The Baseline Safety Analysis File (BSAF) will be annually updated to reflect any revisions to DOE requirements.

DOE 5480.4, *Environmental Protection, Safety, and Health Protection Standards*, (DOE, 1991) specifies mandatory environmental protection, safety, and health (ES&H) standards and provides a list of reference ES&H standards. These standards cover the following categories: emergency preparedness, environmental protection, fire protection, occupational health protection, occupational safety, nuclear safety, and transportation safety. DOE 5480.4 requires compliance with OSHA 29 CFR 1910 *Occupational Safety and Health Standards* (DOL, 1993a-f). With respect to Hazardous Material Protection, the OSHA standard provides regulations for exposures to carcinogens and other hazardous chemicals.

OSHA regulation 29 CFR 1910.120(b)(4) (DOL, 1993d) requires that site-specific Health and Safety Plans be written to address safety and health hazards of each phase of the hazardous waste site operation and includes procedures for employee protection. This is the primary OSHA regulation for environmental restoration work. Section 10.5.1 addresses requirements for Health and Safety Plans in more detail.

The DOE-Idaho Operations Office (DOE-ID) imposes DOE Headquarters requirements on environmental remediation and decontamination and decommissioning (D&D) contractors through DOE-ID Supplemental Directives (SD). DOE-ID SD 5480.4A (DOE-ID, 1991a) is used in conjunction with DOE 5480.4 (DOE, 1991) and provides additional environmental protection, safety, and health standards for DOE-ID contractors to follow. DOE-ID SD 5480.10 (DOE-ID, 1991b) emphasizes that DOE-ID contractors shall develop and implement an Industrial Hygiene Program for employees that complies with DOE 5480.10 (DOE, 1985).

The inventory of hazardous materials present will be identified in Chapter 5 of activity-specific safety analysis documentation. Chapter 7 will identify hazardous material wastestream data. Recognition, evaluation, and control of health and safety effects on the public or workers associated with these hazardous materials is the subject of this chapter.

10.1 As Low as Reasonably Achievable (ALARA) Policy and Program

10.1.1 Requirements

DOE 5480.10, *Contractor Industrial Hygiene Program* (DOE, 1985), requires that an industrial hygiene program be designed by each DOE contractor to preserve employee health and well-being. In addition, this DOE Order states that a carcinogen control program shall be implemented to maintain occupational exposure to chemical carcinogens *as low as reasonably achievable* (ALARA). The carcinogen control program covers chemical substances regulated as carcinogens by the OSHA Standard, 29 CFR 1910, Subpart Z "Toxic and Hazardous Substances" (DOL, 1993c), and those listed as carcinogens and suspect carcinogens in Appendix A of the American Conference of Governmental Hygienists (ACGIH) Threshold Limit Value (TLV) document (ACGIH, 1992b). To maintain an ALARA carcinogen exposure in operations with an exposure potential, the carcinogen control program requires written safety plans, standard operating procedures, or experimental protocols; restriction of access to locations where carcinogens are used; preference for engineering methods to minimize exposure; provisions for good industrial hygiene practices; and emergency preparedness.

Some ALARA principles are applied to chemicals which are not carcinogens, and for which exposure levels generally regarded as safe are defined in regulations or other guidance. In these cases, ALARA principles are applied only when exposures exceed acceptable levels. These regulatory exposure levels are described in Chapter 6.

Activity-specific Health and Safety Plans identify the potential for exposure to carcinogens and exposure to other chemicals at levels exceeding applicable limits, so that the extent of applicable ALARA requirements can be determined. A partial list of carcinogens, including only those chemicals for which OSHA has promulgated specific regulations, is provided in Table 10-1 to facilitate the determination of ALARA requirements for a specific ERP activity.

10.1.2 Environmental Restoration ALARA Program for Hazardous Materials

The requirements stated in Section 10.1.1 are generally applied through INEL contractor industrial hygiene programs and specifically addressed in Health and Safety Plans. The general elements of ERP safety and health programs structured to maintain hazardous material exposures to ALARA levels include the following:

- Written plans and procedures including technical review (Chapter 13)
- Training (Chapter 13)
- Good hygiene practices (showers, handwashing, and restriction of food from hazardous material areas)

- Procedures that control purchasing of hazardous materials and require reviews to identify suitable, less hazardous substitute materials
- Job hazard analysis of ERP activities to identify potential exposures to hazardous materials
- Workplace monitoring to verify personnel exposures as ALARA
- Pre-job briefings to appraise employees of Health and Safety Plan requirements. These briefings are required for construction projects and for asbestos projects.

TABLE 10-1. OSHA CARCINOGEN STANDARDS.

REGULATION	SUBSTANCE
1910.1001 and 1926.58	Asbestos
1910.1003	4-Nitrobiphenyl
1910.1004	alpha-Naphthylamine
1910.1006	Methyl chloromethyl ether
1910.1007	3,3-Dichlorobenzidine
1910.1008	bis-Chloromethyl ether
1910.1009	beta-Naphthylamine
1910.1010	Benzidine
1910.1011	4-Aminodiphenyl
1910.1012	Ethyleneimine
1910.1013	beta-Propiolactone
1910.1014	2-Acetylaminofluorene
1910.1015	4-Dimethylaminoazobenzene
1910.1016	N-Nitrosodimethylamine
1910.1017	Vinyl chloride
1910.1018	Inorganic arsenic
1910.1027	Cadmium
1910.1028	Benzene
1910.1029	Coke oven emissions
1910.1044	1,2-Dibromo-3-chloropropane
1910.1045	Acrylonitrile
1910.1047	Ethylene oxide
1910.1048	Formaldehyde

These elements are covered in Morrison Knudsen-Ferguson's (MK-FIC's) *Environment, Safety and Health Plan* (MK-FIC, 1993), Westinghouse Idaho Nuclear Company's (WINCO's) *Industrial Safety Manual* (WINCO, 1993), EG&G's *Safety Manual* (EG&G, 1993b), and EG&G's *Idaho Industrial Hygiene Manual* (EG&G, 1993a). Site specific considerations will be addressed in health and safety plans as required by 29 CFR 1910.120, and described in Section 10.5.1.

10.2 Hazardous Material Sources

This section defines hazardous materials and identifies hazardous materials that may be encountered during ERP activities.

10.2.1 Hazardous Chemical Categories

For hazardous waste operations, OSHA defines a hazardous material to include any substance defined under Section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); listed by the United States Department of Transportation (DOT); capable of causing disease; or defined as a hazardous waste in Environmental Protection Agency (EPA) regulations. The OSHA definition includes the characteristic that exposure to the hazardous material may result in adverse effects on the health or safety of employees.

For the purpose of communicating hazards information to employees, OSHA regulation 29 CFR 1910.1200 "Hazard Communication," Appendix A (DOL, 1993b), defines several types of hazardous materials including carcinogens, corrosives, highly toxic chemicals, irritant chemicals, sensitizer chemicals, and toxic chemicals.

A chemical is considered *carcinogenic* if

- The International Agency for Research on Cancer (IARC) has evaluated and found the chemical to be a carcinogen or potential carcinogen
- The National Toxicology Program (NTP) publishes the chemical in its *Annual Report on Carcinogens* as a carcinogen or a potential carcinogen
- OSHA regulates the chemical as a carcinogen.

A chemical is a *corrosive* if it causes visible destruction or irreversible alterations of living tissue by chemical action at the site of contact.

An *irritant chemical* is not corrosive, but it does cause a reversible inflammatory effect on living tissue by chemical action at the site of contact.

A *sensitizer chemical* causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.

Toxic and highly toxic chemicals are defined by the concentrations that produce lethal effects in animals. Toxicity may be described by naming the *target organ* affected. Hepatotoxins produce liver damage. Nephrotoxins produce kidney damage. Neurotoxins cause primary toxic effects to the nervous system. Reproductive toxins affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogens). Other chemicals can affect the hematopoietic system, the respiratory system, the skin, and the eyes or visual capacity.

10.2.2 Environmental Restoration Sources

Estimated inventories of hazardous material involved in INEL ERP activities are available in the *Draft INEL EIS Environmental Restoration Program Assessment* (DOE-ID, 1993) and the *INEL D&D Long-Range Plan* (EG&G, 1993c). Hazardous and mixed wastestream data for INEL ERP activities are available in *Waste Stream Projections for Environmental Restoration at the Idaho National Engineering Laboratory* (EG&G, 1993d). Examples of chemicals in the inventory that were reported to the State of Idaho in the 1992 *Superfund Amendments and Reauthorization Act (SARA) 312 Report* (DOE-ID, 1992a) include ammonia, ammonium nitrate, cadmium, chlorine, cyclohexylamine, Freon 12, hydrofluoric acid, hydrogen peroxide, lead, lithium hydride, potassium hydroxide, sodium, and sulfuric acid. These or other hazardous materials may be found in underground storage tanks, pits, trenches, waste sumps, ponds, sumps, french drains, landfills, leach fields, septic tanks, and storage pads, and may be encountered during ERP activities.

10.2.3 Potential Exposure Conditions

Typically, environmental remediation and D&D tasks are expected to create little risk of exposures that exceed permissible exposure levels. These risks, however, depend on site-specific conditions. Environmental remediation activities that may create potential exposures include the following:

- Soil sampling, drilling, and earthmoving activities that generate dusts or release volatiles to the air
- Surface decontamination activities, such as grinding and cutting, that generate airborne particulates
- Treatment of contaminated soils involving particle size, screening, conveying, and mixing with stabilization agents
- Treatment of contaminated soils involving thermal processes which may drive off volatiles, or cause chemical reactions
- Treatment of contaminated groundwater that may involve emissions of volatile organic compounds (VOCs) from tank vents or process equipment.

D&D activities may require asbestos removal, structure demolition, and handling transformers containing polychlorinated biphenyls (PCBs), creating hazardous material exposures.

Conditions that contribute to potentially high exposure levels for workers include opening tanks, excavating contaminated soil, and working in confined spaces. Environmental factors, such as high ambient temperatures, may increase likely exposure levels. Consequently, the risk of worker exposure to hazardous materials will be addressed in Health and Safety Plans or other safety analysis documents.

Workers at the INEL could be subjected to short- or long-term exposure to a chemical or combination of chemicals. Exposure may occur by inhalation of airborne dusts or vapors; dermal contact and absorption; accidental ingestion if splashed; or injection if injured by a contaminated object.

Comprehensive ES&H programs are implemented to protect worker health. Exposure monitoring is part of the industrial hygiene component of these programs. Exposures to asbestos, lead, cadmium, beryllium, formaldehyde, benzene, nitric acid, sulfuric acid, hydrogen fluoride, welding by-products, and various solvents have been evaluated at the INEL. Historical industrial hygiene monitoring data will be considered when evaluating the risks associated with planned ERP activities.

10.3 Hazardous Material Protection Design Features

10.3.1 Exposure Criteria

In accordance with DOE 5480.10 (DOE, 1985), contractor industrial hygiene manuals have been developed to define the exposure guidelines applied at the INEL for chemical substances and physical agents regulated by OSHA or subject to limits published by the ACGIH. Sampling and monitoring results obtained during hazard evaluations are compared with these permissible exposure limits (PELs) or published exposure guidelines. Appropriate control measures are recommended when necessary to maintain worker exposures below these levels. Chapter 6 describes OSHA PELs and ACGIH TLVs, adopted by reference in "Hazardous Waste Operations and Emergency Response," 29 CFR 1910.120 (DOL, 1993d).

10.3.2 Design of Engineered Controls

Pursuant to "Toxic and Hazardous Substances - Subpart Z," 29 CFR 1910.1000(e) (DOL, 1993c), to achieve compliance with the designated limits for toxic and hazardous air contaminants, administrative or engineering controls will be implemented whenever feasible. If such controls are not feasible to achieve full compliance, protective equipment or other protective measures will be used to keep within prescribed limits for exposure of employees to air contaminants.

Administrative controls limit employees' exposures by scheduling of reduced work hours in contaminated areas, and/or implementation of other work rules. Although administrative control measures can limit the individual's duration of exposure, this type of control is generally not preferred because of difficulty in implementation and maintenance.

If industrial processes or facilities are designed to support ERP activities, design criteria required by DOE will be applied during design; and

design drawings will be reviewed by a qualified industrial hygienist to ensure correct interpretation of the DOE criteria.

Methods of engineering control include isolation (placing a barrier between the hazard and the individual) and ventilation. Engineering controls may include the use of the following:

- Totally enclosed cabs on excavating equipment
- Exhaust blowers mounted next to bore holes or monitoring wells
- 55-gallon drum grapplers mounted on the ends of forklifts to lift, puncture, and empty drums
- Glove bags for the dismantlement of small, contaminated components or for asbestos abatement operations
- High efficiency particulate air (HEPA)-filtered vacuum cleaners for asbestos work
- Laboratory fume hoods for opening smaller containers and emptying of container contents
- Robots with mounted cameras to survey areas (such as confined spaces) before worker entry
- Remote-sensing monitors designed to sound an alarm when monitored hazardous material concentrations exceed predetermined values.

Ventilation methods include dilution of the concentration of the substance by mixing uncontaminated air; or removing the substance at the source or point of generation (local exhaust ventilation). Local exhaust ventilation generally is the preferred method for effective control.

Guidance for design of ventilation systems is published by the Committee on Industrial Ventilation of the ACGIH (ACGIH, 1992a). The ACGIH ventilation manual addresses general principles of ventilation; hood design; design procedures; recirculated air; fans; and air cleaning devices.

Specifications related to the design of local exhaust systems required by DOE 6430.1A (DOE, 1989) include the following:

- Systems shall be designed to maintain the required capture air velocities for source contaminant control
- Air quantities and transport shall be calculated based on methods prescribed by the American Society for Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) *Systems Handbook*, the *ASHRAE Applications Handbook*, and the ACGIH *Industrial Ventilation Manual*

- Design criteria in DOE 6430.1A, "Section 1550-2.5 for Air Handling and Air Distribution Systems" (DOE, 1989) shall be used.

Supply and exhaust ventilation systems for industrial-type facilities and laboratories shall be provided in the ventilation quantities required to maintain OSHA air quality limits; all the PELs established by 29 CFR 1910; and all ACGIH TLVs. Make-up air shall be provided in the quantities required to maintain positive or negative room static pressure requirements and to offset local exhaust air quantities (DOE, 1989).

Exposures of maintenance personnel during service or replacement of dust collector or filter elements should be considered when designing or selecting ventilation equipment. For example, wet dust collector designs may store material more safely and make contamination less likely.

Equipment designed to control hazardous material may involve monitoring systems or air cleaning devices that serve to limit environmental releases. In these cases, the design will conform to all applicable permit requirements, environmental standards, and DOE requirements related to environmental protection.

10.4 Hazardous Material Exposure Assessments

Guidelines for performing hazardous material exposure assessments to estimate exposure risks for ERP workers, workers at nearby INEL facilities, and the general public beyond the INEL site boundary are summarized in this section. These evaluation guidelines will be applied for normal operations and expected releases of hazardous material to the environment to support development of worker protection measures incorporated in Health and Safety Plans. The requirement for occupational exposure assessment related to ERP activities is contained in OSHA regulation 29 CFR 1910.120 (c) (DOL, 1993d). This regulation requires an evaluation of the potential for activities during hazardous waste operations to result in exposures exceeding exposure limits; concentrations "immediately dangerous to life or health (IDLH)"; potentially explosive or flammable situations; potential skin absorption and irritation; eye irritation; and oxygen deficiency.

Potential hazards are evaluated by comparing estimated exposure concentrations to applicable guidelines and limits. Expected worker exposures are estimated based on site characterization data and industrial hygiene monitoring data. The exposure estimate is an estimate of the probability of occurrence of airborne concentrations of dusts, mists, vapors, or gases that may be harmful if inhaled, and the potential for skin contact with hazardous material that may injure or be absorbed through the skin. Such estimates should be based on exposure monitoring results for similar tasks in similar environments, if possible. These data, however, are not generally available.

Specific chemical substances that represent significant hazards will be identified in Chapters 5 and 11 of activity-specific safety analysis documentation. Identification of specific chemical hazards and probable airborne concentrations is essential to selection of appropriate respirator types, monitoring equipment, and protective clothing materials.

10.4.1 Data Requirements

The hazardous material exposure estimate is established based on the best available information. This information may include industrial hygiene monitoring data developed during normal operations of similar activities or chemical composition analysis of soil, groundwater, surface water, or landfill gas. Inventories or other historical records of chemical use or disposal may be helpful.

Some exposures associated with ERP activities may result from tasks and/or situations not previously measured. For example, non-friable asbestos in floor tiles may be rendered friable by demolition, causing unacceptable levels of asbestos fibers. Similarly, the use of wrecking balls to fracture painted walls may result in high airborne levels of compounds used as paint pigments. Therefore, possible exposures to cadmium, chromium, lead, and mercury or other heavy metals may be of a concern during D&D activities.

The potential for weathering and biological transformation of chemicals in the soil and radioactive decay to alter chemical composition in tanks should be considered in the exposure assessment.

10.4.2 Data Potentially Available

Monitoring and sampling programs established by industrial hygienists at the INEL provide data to characterize exposures to the more common toxic chemicals such as asbestos, beryllium, cadmium, lead, welding fumes, hydrogen fluoride, and strong acids. These data were compiled in occupational exposure databases, such as the Personnel/Area Sampling System (PASS), operated by EG&G, which includes records of approximately 7,000 samples dating back to 1989 (Smith, 1993). The mainframe system on which PASS resides allows industrial hygienists, managers, and medical personnel to obtain information by desktop computers. Queries of the PASS database, or other similar contractor data files, should be made to identify any monitoring data for tasks and operations similar to the planned effort.

If available historical industrial hygiene monitoring data are not suitable to characterize anticipated exposures, then estimates can be developed from other sources of information, together with risk assessment calculations.

The hazardous material inventory in Chapter 5 and the information on wastestreams in Chapter 7 of the activity-specific safety analysis document should be reviewed. Other useful data sources include the Record of Decision (ROD) for the applicable CERCLA Remedial Investigation/Feasibility Study (RI/FS) project, which may contain soil chemistry, groundwater chemistry, and other relevant data. Soil chemistry analyses reporting total concentrations of hazardous materials are preferred to leachate tests, such as the Toxicity Characteristic Leaching Procedure (TCLP) or Target Compounds List (TCL). Calculations to estimate worker exposures to airborne dusts or aerosols are simpler for soil chemistry analyses than for leachate concentrations.

10.4.3 Guidelines for Review of Available Data

Airborne particulates may be dispersed when contaminated soils are disturbed. Soil chemistry data can be used to develop estimates of these potential airborne exposures to determine if exposure limits applicable to normal operation will be exceeded. Soil chemistry data can be used to evaluate the potential for any soil contaminant to be a greater hazard than nuisance dusts, for which the published exposure limit of 10 mg/m^3 can be used as the determinant of hazard potential. Examples of application of this method are provided in Section 6.1.3. This approach is suitable for metals, pesticides, herbicides, and non-volatile organic compounds, such as PCBs. Non-volatile soil constituents can be expected to be carried with dust particles, while volatile soil contaminants will evaporate into the air from exposed surfaces.

For volatile soil contaminants, calculations presented in Section 6.1.3 can be used to make a preliminary estimate of expected exposure conditions and to determine related worker protection requirements. The calculations in Section 6.1.3 are conservative and do not account for non-equilibrium and weather conditions.

If soil chemistry data are not available, but leachate concentrations data are available, the following calculation should be used for estimating airborne concentrations:

$$C_{\text{est}} = C_{\text{TCLP}} + 20 + (1/e) + (10.0 \text{ mg/m}^3) + (10^6 \text{ mg/kg}) \quad (1)$$

where:

C_{est}	is the estimated airborne concentration
C_{TCLP}	is the TCLP soil chemistry value (in mg/kg)
20	is the TCLP dilution factor
e	is the assumed TCLP extraction efficiency (<1)
10.0	is the ACGIH TLV for nuisance dust

The result obtained for each chemical species can be compared to the OSHA PEL (from 29 CFR 1910) or the ACGIH TLV, whichever is lower.

The activity-specific Health and Safety Plan will indicate worker protection measures to be implemented if exposure limits are exceeded, and a monitoring plan to verify calculated exposure estimates (Section 10.5.1). In developing the Health and Safety Plan, consideration is given to the severity of exposure; the numbers of workers involved; the duration of exposure; and the feasibility of reducing exposure levels.

To establish exposures that may result from non-routine events such as spills or other unprotected exposures, additional calculations are necessary. Calculations may be performed to evaluate the potential for worker inhalation exposures approaching IDLH conditions, and for health risks related to ingestion of contaminated water and dermal absorption of contaminated fluids. Precise calculation methods depend on expected exposure conditions. Risk

assessment methods developed by EPA (EPA, 1989) to estimate maximum reasonable exposure conditions can be used to develop the assumptions needed to support these calculations. Examples of assumptions include the following:

- Dermal absorption: assume worker is totally drenched by the contaminated fluid and requires 30 minutes to change to dry, uncontaminated clothing
- Dermal absorption: assume hazardous chemical contamination has the same permeability coefficient as water
- Ingestion: assume worker ingests 15 ml of contaminated water or fluid
- Inhalation: assume worker breathes contaminated air for 30 minutes
- Inhalation: assume contaminated air in a reasonable source volume (tank head space, well head) mixes perfectly into an 8 m³ volume of air surrounding the worker.

Calculations should be made to estimate doses or concentrations and compare to doses associated with a 1E-04 lifetime cancer risk (for carcinogens), EPA reference dose (for non-carcinogens), or IDLH concentrations (for VOCs). Additional guidance for these calculations is found in EPA's publication, *Risk Assessment Guidance for Superfund, Human Health Evaluation Manual Part A* (EPA, 1989).

Computer models for estimating airborne chemical concentrations following spills or sudden releases have been developed. One example is the National Safety Council's (NSC's) *Computer Aided Management of Emergency Operations* (NSC, undated). Use of such models may be helpful, but has limitations and makes inherent assumptions.

10.5 Hazardous Material Control Program

The hazardous material control program incorporates requirements from DOE 5480.4 (DOE, 1991), DOE 5480.7A (DOE, 1993), DOE 5480.8A (DOE, 1992), and DOE 5480.10 (DOE, 1985), and other Federal regulations and standards determined by DOE to be applicable to DOE operations. Compliance with these requirements forms the safety basis for hazardous material control for ERP activities.

DOE, DOE-ID, and all contractors at the INEL have policies and enforce regulatory requirements for ensuring a safe and healthful workplace. Protection for occupational workers is generally part of the contractor's industrial hygiene program. Protection from hazardous materials for the public and the environment is covered under environmental compliance programs.

At the INEL, industrial hygiene sections within the various contractor organizations directly support line organizations in the recognition, evaluation, and control of environmental factors and stresses found in the

workplace. These sections design industrial hygiene programs to comply with DOE and other applicable government regulations.

Health and Safety Plans are developed to identify activity and site-specific hazards and to specify engineering and administrative controls, work practices, and personal protective equipment and clothing to be used to prevent or control exposures to those hazards (Section 10.5.1). ERP activities incorporate standard hazardous material control requirements described in Sections 10.5.2 through 10.5.9.

10.5.1 Health and Safety Plans

OSHA standards cited in DOE 5480.4 (DOE, 1991) include requirements at 29 CFR 1910.120 (DOL, 1993d) for preparation of Health and Safety Plans. These requirements are applicable to ERP activities.

OSHA regulations require planning and communication of hazard assessment information to employees. As part of the Health and Safety Plan, a safety and health hazard analysis is provided for each site, task, and operation identified in the workplan for cleanup of hazardous wastes as required by 29 CFR 1910.120(b)(ii)(a). Health and Safety Plans prepared by INEL contractors include the required topics that follows:

- Task and site description
- Organization structure
- Training requirements for site personnel
- Medical monitoring
- Hazard evaluation
- Air monitoring
- Site access control
- Personal protective clothing and equipment
- Decontamination
- Confined space entry
- Spill prevention and control
- Emergency response
- Recordkeeping.

Additional elements may be added as required to define the activity or site specific hazards and protective measures.

Task and Site Description. The Health and Safety Plan will include a clear statement of the scope of work and a description of site characteristics. This information forms the basis for an evaluation of the nature and extent of the exposure hazards that employees may encounter. The remaining elements of the Health and Safety Plan will be derived from this initial definition of the action.

Organizational Structure. The Health and Safety Plan identifies by name, the individuals in key positions, including the responsible field supervisor and a site safety and health officer. Qualifications of the supervisors and the site safety and health officer should be commensurate with the complexity of the planned effort. The objective is to create an organization with adequate resources to perform the task safely.

Training Requirements for Site Personnel. General requirements for training of ERP workers are contained in Chapter 13. The Health and Safety Plan will note that those general requirements apply to all employees and subcontractors, and augment the general training with activity-specific topics to be covered in briefings or on-the-job training.

Medical Monitoring. OSHA regulations state that medical surveillance requirements will be included in the Health and Safety Plan. Medical examinations are provided for all ERP workers to comply with 29 CFR 1910.120(f). Additional medical surveillance requirements for a specific activity, such as bioassays, and their frequencies, will be stated in the Site Health and Safety Plan. Where appropriate, medical surveillance requirements will be tailored to the activity and based on the potential risks associated with the planned effort.

Hazard Evaluation. Health and Safety Plans will include an evaluation of the potential hazards to be encountered during the planned ERP activity. The anticipated risks become the principal drivers that establish worker health and safety control measures. The hazard and accident analyses in Chapters 5 and 11 of the activity-specific safety documentation contain information relevant to this section of the Health and Safety Plan.

The Health and Safety Plan will name all chemicals identified as potential site contaminants, and describe the potential for exposures exceeding exposure limits, IDLH concentrations, potential skin absorption and irritation, eye irritation, or oxygen deficiency. This list of site contaminants should include chemicals known to have been disposed at the site and chemicals identified in available analyses of soil, groundwater, surface water, and landfill gas.

Once characterized, potential chemical exposures will be compared to appropriate standards or criteria to demonstrate that risks are acceptable (that is, exposures are less than regulated levels) or can be mitigated to acceptable levels. The hazard assessment will be used to develop task-specific controls including engineering and administrative controls, work practices, and personal protective equipment and clothing to be used to prevent or control exposures to identified hazards.

Air Monitoring. As required by 29 CFR 1910.120(b)(4)(ii)(E), the Health and Safety Plan includes a monitoring plan. The frequency and types of air monitoring, radiological monitoring, personnel monitoring, and environmental sampling are spelled out in the monitoring plan. Each monitoring plan will include information on the sampling techniques and instrumentation to be used and the method and frequency for calibration of sampling equipment. The monitoring plan may be summarized in table format, similar to Table 10-2.

TABLE 10-2. MONITORING REQUIREMENTS.

TYPE OF MONITORING	SAMPLE TYPE/ INSTRUMENT USED	LOCATION OF MONITORING	RECOMMENDED FREQUENCY OF MONITORING
Lower Explosive Limit (LEL)	Combustible gas indicator	General area and any sources of flammable gas	To be specified in the Health and Safety Plan
Oxygen	Oxygen indicator	General area and any depressions or excavations	To be specified in the Health and Safety Plan
Metals	Personal total mass sample Bulk soil samples for analyte list	Breathing zone of worker subject to highest levels Soils representative of area where dusts are generated	To be specified in the Health and Safety Plan
Organic Vapors	1. Photoionization detector (PID), flame ionization detector (FID) 2. Various integrated sampling methods	Breathing zone of workers subject to highest levels	To be specified in the Health and Safety Plan
Silica	Personal respirable mass sample/10mm cyclone	Breathing zone of workers subject to highest levels	To be specified in the Health and Safety Plan
Total Dust	Personal total mass sample/Miniram	Sampling representative of the worker breathing zone	To be specified in the Health and Safety Plan

The monitoring plan will include quantitative action levels and specific action to be taken when action levels are reached. Monitoring data may validate or challenge initial assumptions about exposure levels, contaminants present, and effectiveness of engineering controls. Initial assumptions will be reviewed and protective measures revised, if appropriate.

Site Access Controls. Site access control methods will be described in Health and Safety Plans, as indicated in Chapter 17, Section 17.2.2. The hazard evaluation is the basis for defining the control zone boundaries.

Personal Protective Clothing and Equipment. The Health and Safety Plan will specify personal protective equipment to be used by employees for each task and operation to be conducted. The use of respiratory protection is generally described in Chapter 9, Section 9.5. The Health and Safety Plan will state how the general respiratory protection program will be applied to specific tasks. In addition to respiratory protection, protective clothing such as coveralls, chemical resistant suits and boots, eye and face protection, and gloves may be required, depending on the hazard identified. The personal protective clothing specified in the Health and Safety Plan must provide effective protection against the identified hazards, when properly used.

Decontamination. Hazardous contaminants may be encountered during ERP activities. The Health and Safety Plan will describe the processes to be used to remove contaminants from personnel and equipment. Criteria by which personnel and equipment will be judged "clean" will be established. Radiological protection requirements for contamination control, described in Chapter 9, are included in the Health and Safety Plan.

Confined Space Entry. If worker entry to confined spaces is required, the Health and Safety Plan will identify procedures to be used to ensure compliance with requirements of 29 CFR 1910.146 (DOL, 1993g). A confined space has limited or restricted means of entry or exit; is large enough for an employee to enter and perform assigned work; and is not designated for continuous occupancy by the employee. Confined spaces may include, but are not limited to, underground vaults, tanks, trenches, and pits.

Spill Prevention and Control. Many ERP activities will generate hazardous wastes. The Health and Safety Plan will address the methods to be used to minimize the quantities of hazardous wastes generated. Procedures for handling, storing, and disposing of hazardous wastes will be referenced in the Health and Safety Plan. If there is a potential for a spill or environmental release of hazardous material, measures to be taken to prevent or mitigate such spills or releases will be included in the Health and Safety Plan.

Emergency Response. Sitewide emergency preparedness programs are described in Chapter 19. OSHA requirements (29 CFR 1910.120 (l)) for an emergency response plan are met by including the following information in Health and Safety Plans:

- Types of potential emergencies
- Emergency evacuation routes and location of nearest medical facility
- Emergency evacuation signals and procedures
- Emergency decontamination procedures
- Roles and responsibilities of ERP personnel in an emergency.

Recordkeeping. Records related to ERP activities are retained to document the effectiveness of the hazardous materials protection program and to demonstrate compliance with DOE 1324.2A (DOE, 1988b), DOE 5484.1B (DOE, 1981), and DOE 5480.10 (DOE, 1985). DOE 1324.2A provides implementing instructions, records inventory requirements, disposition schedules, and provisions for the transfer of records. The Privacy Act of 1974 contains requirements to protect the privacy of individual records.

Review and Approval of Health and Safety Plans. A safety review committee or other independent review group reviews Health and Safety Plans. The purpose of the safety review committee is to provide independent assurance that operations maintain a high degree of safety, health protection, quality, and environmental compliance.

Standard Operating Procedures Incorporated by Reference. Health and Safety Plans may incorporate by reference standard operating procedures used by contractors to plan and control specific tasks or work elements. Such planning may include a job safety analysis, job hazard analysis, or radiation hazard analysis. When hazards cannot be completely eliminated, control may be achieved with the following requirements:

- Safe work permits
- Confined space entry permits
- Special safe work permits
- Lock and tagout procedures
- Standard practices
- Detailed operating procedures
- Standard operating procedures.

10.5.2 Bioassay or Medical Monitoring

Medical monitoring services are provided to contractor employees to comply with DOE 5480.8A, *Contractor Occupational Medical Program* (DOE, 1992). These services include the following:

- Conduct of preplacement assessments for employees working in areas where respirators are required or where exposures to hazardous agents are likely
- Development of guidelines for medical surveillance for chemical and physical agents without legally specified requirements
- Establishment of biological monitoring protocols, as deemed necessary for specific exposures
- Performance of bioassay appropriate for radionuclides (Section 9.5)

- Maintenance of medical history and employee exposure records of all biological monitoring results.

10.5.3 Air Monitoring

Airborne exposure levels for nonradiological contaminants are determined from area and personnel monitoring. Industrial hygienists (and technicians under their supervision) monitor for exposures resulting from processes or work operations that could produce hazardous air contaminants. Monitoring samples define exposures, the condition of the work environment, and the effectiveness of engineering controls. The monitoring instruments, sampling devices, and procedures used have a known, demonstrated accuracy. Samples that require laboratory analysis are submitted to a laboratory accredited by the American Industrial Hygiene Association (AIHA).

For some chemicals such as asbestos (29 CFR 1910.1001), lead (29 CFR 1910.1025), and benzene (29 CFR 1910.1028), OSHA regulations specify monitoring frequencies and required protective equipment until monitoring data indicate that there is not a potential to expose individuals above allowable PELs. The monitoring of substances identified in the exposure assessment will be conducted in accordance with applicable regulations. As ERP activities involve constantly changing worksites, performance of monitoring for chemicals such as asbestos, benzene, and lead on all jobsites where these chemicals may be suspected to be present may be necessary.

Often, available data will indicate the potential for environmental remediation or D&D work to involve exposure to a mixture of chemicals. These circumstances call for a monitoring strategy that can be used to monitor the mixture of hazardous materials potentially present. Ideally, the monitoring strategy should include easy to detect constituents, present in all or most wastestreams, and possessing relatively high toxicity.

10.5.4 Workplace Monitoring

Workplaces and operations are periodically surveyed to identify both potential and existing health hazards and evaluate them using DOE-approved criteria as required by DOE 5480.10 (DOE, 1985). These surveys identify and quantify potential health hazards and verify the effectiveness of engineering and administrative controls. Categories of hazards surveyed include chemical, physical (excluding ionizing radiation), biological, and ergonomic. Recommendations to correct identified deficiencies or eliminate hazards are made in writing to the responsible manager.

10.5.5 Recordkeeping on Hazardous Material Exposures

Records related to hazardous material exposure associated with ERP activities are retained to document the effectiveness of the hazardous material protection program and demonstrate compliance with applicable DOE Orders. Records and reports are controlled through the stages of creation, distribution, storage, retrieval, and disposition consistent with DOE 1324.2A (DOE, 1988b) and the Privacy Act. Records subject to retention requirements include the following:

- Exposure monitoring results
- Personnel training (individual records)
- Training records (lesson plans, evaluations)
- Instrument test, repair, and calibration records
- Medical examinations and bioassay tests
- Industrial hygiene survey reports
- Hazardous material incident reports
- Hazardous material occurrence reports
- Program appraisal and/or self-assessment reports.

Each contractor maintains custody of records related to their employees and operations. The INEL Occupational Medical Program maintains medical records of biological monitoring results that assess employee exposure to toxic substances; medical and employee exposure records are retained for at least 30 years, as required by 29 CFR 1910.20.

10.5.6 Instrumentation

Industrial hygienists use a variety of instruments to assess exposures to hazardous materials, including direct reading instruments and laboratory instrumentation. Direct reading instruments have the advantage of providing an immediate assessment of the exposure potential, compared to laboratory tests which require days or even weeks to obtain results. Direct reading instruments that measure parameters related to hazardous materials at ERP activity sites include the following:

- Direct reading instruments that measure ionizing radiation
- Combustible gas meters that measure concentrations relative to lower explosion limit or lower flammable limit
- Oxygen sensors that measure oxygen concentrations
- Flame ionization detectors, which detect VOCs that can be ionized in a flame
- Photoionization detectors (PIDs) which detect VOCs that can be ionized by ultraviolet radiation
- Fibrous aerosol monitors that measure airborne concentrations of asbestos or other fibers
- Direct reading dust monitors that measure airborne concentrations of dusts

- Toxic gas monitors; some are selective for specific chemicals such as carbon monoxide, hydrogen sulfide, or hydrogen cyanide.

Monitoring of exposure conditions using instruments is performed only by trained and qualified personnel.

10.5.7 Instrument Calibration

Monitoring of hazardous material exposures is conducted using instruments or sampling devices calibrated and maintained to ensure accurate and reproducible results. Calibration standards are traceable to the National Institute of Standards and Technology (NIST). Records of instrument calibration activities are maintained, and labels are placed on all monitoring equipment indicating the date when calibration is necessary. If feasible, instruments are field calibrated prior to each use. Defective instruments are taken out of service to prevent inadvertent use and segregated until properly disposed, repaired, or calibrated.

10.5.8 Hazard Communication

OSHA regulations [29 CFR 1910.120(c)(8)] require that "any information concerning the chemical, physical, and toxicological properties of each substance known or expected to be present on site that is available to the employer and relevant to the duties an employee is expected to perform shall be made available to the affected employees." This requirement is accomplished in part by providing each employee an opportunity to read the Health and Safety Plan, and in part by training and information provided through existing hazard communication programs.

Each contractor performing ERP activities at the INEL has a written description of a hazard communication program that complies with DOE 5480.10 (DOE, 1985) and OSHA regulation 29 CFR 1910.1200, "Hazard Communication," (DOL, 1993b). These hazard communication programs include provisions to inventory hazardous materials, label containers of hazardous material, acquire a material safety data sheet for each hazardous material, and train employees about hazardous materials in the workplace.

10.5.9 Hazard Evaluation and Elimination

Each contractor responsible for a facility or work location at the INEL has established procedures to evaluate and control occupational health hazards. Generally, industrial hygiene evaluations are provided in written reports to management, with recommendations to eliminate or mitigate identified hazards, as required by DOE 5480.10 (DOE, 1985). Recommendations may include engineering control measures, process changes, substitution of less toxic materials, administrative controls, or personal protective equipment.

Industrial hygienists review applicable work control documents and purchase requisitions for products that contain hazardous materials to evaluate the potential hazard, employee health risk, effectiveness of controls, special regulatory requirements, and employee training requirements. Special attention is given to products that contain carcinogens to eliminate

their use if possible, prevent exposures, and/or require control measures that will reduce exposures to as low as reasonably achievable (ALARA) levels. Health physicists perform a similar review to evaluate potential radiological hazards as described in Chapter 9.

10.6 Mixed Waste

DOE defines mixed waste as waste containing both radioactive and hazardous components as defined by the Atomic Energy Act (AEA) and the Resource Conservation and Recovery Act (RCRA), respectively (DOE, 1988a). Mixed wastes are likely to exist at environmental remediation sites and are possible at D&D sites at the INEL. D&D may involve mixed waste as building structures or components may be contaminated with both chemical and radiological constituents. This section describes how radiation protection and hazardous materials protection requirements (Chapter 9 and 10) will be integrated.

ERP activities are required to have Health and Safety Plans prepared before site operations commence (DOL, 1993d). The Health and Safety Plan will identify and evaluate hazards potentially present on the site. These hazards may be chemical, radiological, biological, and/or physical in nature. The results of this evaluation will determine the types of personnel training, work permits, chemical and radiological monitoring, and required personnel protective equipment. Appropriate requirements of the radiological control program, as defined in the *DOE-ID Radiological Control Manual* (DOE-ID, 1992b), will be included in the Health and Safety Plan.

Depending on the hazards identified, a "hazardous work permit" and/or a "radiation work permit" may be required before work begins on an environmental remediation site. The Health and Safety Plan will state which permit types are required and who will issue them. A "construction safe work permit" must be initiated before work begins. The issuance of these permits allows health physics and industrial hygiene personnel to know when operations will be occurring. This knowledge, in turn, allows for the proper scheduling of Radiological Control Technicians and Industrial Hygienists to monitor the environmental remediation operations.

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CHAPTER 11.0

ANALYSIS OF NORMAL, ABNORMAL, AND ACCIDENT CONDITIONS

June 20, 1994

ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY

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11.0 ANALYSIS OF NORMAL, ABNORMAL, AND ACCIDENT CONDITIONS

This chapter provides guidance on analyzing normal and abnormal operations, potential accidents, and associated risks for hazards identified in Chapter 5. This guidance is provided to support development of Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP) environmental remediation and decontamination and decommissioning (D&D) activity-specific safety analysis documents. The guidance presented is suitable for performing analyses for activities below or at the Hazard Category 3 threshold criteria. For these activities, the guidance is consistent with United States Department of Energy (DOE) 5480.23 (DOE, 1992a), DOE-STD-1027-92 (DOE, 1992b), and DOE 5481.1B (DOE, 1986), as appropriate.

To establish a common basis for the remainder of this chapter, this introduction provides general guidance for the analysis of normal, abnormal, and accident conditions; provides an explanation of the terms normal operations, abnormal operations, and accident conditions for ERP activities; and presents a methodology for assessing the risk to workers, the public, and the environment.

Basic Guidance for the Analysis of Normal, Abnormal, and Accident Conditions

- Results of the Chapter 5 hazard analysis determine hazard classification based on an "unmitigated release" of the available radioactive or hazardous material. The Chapter 5 hazard analysis identifies administrative or design features that serve to prevent or mitigate the consequences of a release in an accident scenario (DOE, 1992b).
- Occupational hazards (including common industrial hazards) identified in the Chapter 5 hazard analysis as regulated by DOE-prescribed occupational safety and health (OSH) standards are not required to be specifically analyzed in the safety analysis documentation. However, analyses required by the OSH standards are referenced, and applicable OSH standards are listed in the safety analysis documentation (Chapters 2, 5, 9, and 10) (DOE, 1992b).
- Expended effort necessary for performing accident analysis is a function of the hazard and the complexity of a particular activity. Accident analysis builds on the hazard analysis presented in Chapter 5; the main objective is to focus on hazards with the potential of presenting significant and non-routine risks to the worker, public, and environment.
- Hazard Category 3 activities, the highest level of hazard covered by the Baseline Safety Analysis File (BSAF), have the potential for only localized significant consequences (DOE, 1992a), and the analysis should focus on significant risks to the worker (DOE, 1992b).

Explanation of the Terms Normal Operations, Abnormal Operations, and Accident Conditions

Explanation of the terms normal operations, abnormal operations, and accident conditions for ERP activity-specific analyses are presented below.

- Normal Operations

Normal operations are activities performed within normal operational limits.

- Abnormal Operations

Abnormal operations are activities outside normal operational limits that do not have significant local, onsite, or offsite consequences.

- Accident Conditions

Accidents are unplanned events with significant adverse consequences locally, onsite, or offsite.

Risk Assessment Methodology

A primary objective of the safety analysis is to identify and assess risks of the ERP activity caused by equipment failure, human error, natural phenomena, or a combination of these factors. Risk, as defined by DOE 5480.23, is "the quantitative or qualitative expression of possible loss that considers both the probability that an event will occur and the consequence of that event." The methodology presented here is provided as guidance in assigning a hazard risk level to potential hazards to determine if the risks are acceptable. For ERP activities that are simple and straightforward and involve material inventories less than Hazard Category 3 threshold criteria, assignment of a hazard risk level may not be warranted.

A hazard risk level should be assigned that accounts for hazard consequences or severity and the annual probability or frequency of occurrence. Numerous methods are available (DOE, 1992b). An example of a hazard risk assessment method is the assignment of a hazard severity level and annual probability or frequency level to each identified activity condition that might result in an unwanted consequence. From this, a hazard risk level is assigned to each condition.

Hazard severity levels are illustrated in Table 11-1. Hazard severity Level 1 is the most severe level and Level 4 is the least severe. Numbers correspond directly to Hazard Categories 1, 2, or 3 in DOE 5480.23 (DOE, 1992a).

TABLE 11-1. HAZARD SEVERITY LEVELS

HAZARD SEVERITY LEVEL (Corresponding to DOE 5480.23 Hazard Category)	OVERALL CONSEQUENCES
1 (1)	Significant offsite consequences
2 (2)	Significant onsite consequences
3 (3)	Only significant localized consequences
4*	No significant consequences

* Less than Hazard Category 3 threshold criteria.

Hazard annual probabilities or frequencies are assigned from the most probable (anticipated) to the least (incredible), as shown in Table 11-2. The descriptive terms are further quantified by assigning numerical ranges of annual probability or frequency.

TABLE 11-2. HAZARD ANNUAL PROBABILITY OR FREQUENCY LEVELS

DESCRIPTIVE TERM	ANNUAL PROBABILITY OR FREQUENCY (PER YEAR)
Anticipated	10^{-2} to 1
Unlikely	10^{-4} to 10^{-2}
Extremely Likely	10^{-6} to 10^{-4}
Incredible	less than 10^{-6}

Table 11-3 is an example hazard risk matrix for hazard evaluation. The hazard risk matrix in Table 11-3 could be further developed to tailor-fit a specific activity. Numerical values (for example, 1 through 16) or qualitative descriptions (for example, no impact, low, moderate, high) could be assigned to the intersecting boxes in Table 11-3 to describe the risk. Table 11-3 illustrates that risk associated with an activity increases with a combined consequence and annual probability or frequency that falls in the upper left quadrant and decreases with those in the lower right quadrant.

The numerical values or the qualitative descriptions assigned to boxes in Table 11-3 can be assigned to a qualitative hazard risk level. An example of this is presented in Table 11-4.

TABLE 11-3. EXAMPLE HAZARD RISK MATRIX

Hazard Severity Level	Hazard Frequency or Annual Probability Level			
	10^{-2} - 1 Anticipated	10^{-4} - 10^{-2} Unlikely	10^{-6} - 10^{-4} Extremely Unlikely	Less than 10^{-6} Incredible
1 Significant Offsite Consequences	1 High			
2 Significant Onsite Consequences				
3 Only Significant Localized Consequences				
4 No Significant Consequences				16 No Impact

Severity of Consequences ↑

Frequency or Annual Probability of Release ←

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TABLE 11-4. EXAMPLE QUALITATIVE HAZARD RISK LEVELS

RISK RATING	RISK EVALUATION
1 - 4 or high	Unacceptable
5 - 8 or moderate	Undesirable
9 - 12 or low	Acceptable with Review
13 - 16 or no impact	Acceptable

Note: The range of numerical values assigned to each qualitative description is subjective and can be varied with each activity being analyzed as needed.

11.1 Normal Operation

This section provides guidance for evaluating normal operations that present some level of routine hazard for workers or some potential for release of radioactive or hazardous materials. Hazards associated with normal ERP operations are identified in Chapter 5. Routine hazards are typically standard industrial hazards adequately covered by DOE-prescribed OSH standards and do not require specific safety analyses. These OSH standards should be listed in applicable chapters of the safety analysis documentation (Chapters 2, 5, 9, and 10). Radioactive or hazardous material exposure to the workers, the public, or the environment is assessed in accordance with the guidance presented in Sections 9.4 and 10.4 of the BSAF. The resulting exposure is then compared to the criteria defined in Chapter 6.

11.2 Abnormal Operation

This section provides guidance for evaluating abnormal operations. From the hazards identified in Chapter 5, abnormal operations are qualitatively discussed in this section of activity-specific safety analysis documentation.

A recommended method to qualitatively assess abnormal operations is to provide a table similar to Table 11-5. Malfunctions of systems, human errors, or external events that could cause abnormal operations are listed under "Possible Causes." Consequences of each abnormal operation are then listed under "Potential Impacts." Design and administrative controls that prevent or mitigate an abnormal operation are listed and methods of detecting an abnormal operation are identified. Each abnormal operation is evaluated qualitatively for severity, frequency, and risk. The table should be explained and augmented by accompanying text as necessary to demonstrate that acceptable protection against possible abnormal operations is provided in the design and planned operation of the ERP activity.

A table to assess abnormal operations is useful for more complex ERP activities where preventive and mitigative features for abnormal operations may not be obvious. Simple, straightforward activities may not warrant use of any structured method to adequately assess abnormal operations.

11.3 Accident Analysis

This section provides guidelines for accident analysis and documentation for INEL ERP activities covered by the BSAF. Section 11.3.1 describes the following four elements of accident analysis presented in DOE-STD-1027-92 (DOE, 1992b):

- Release mechanism analysis
- Sequence selection
- Engineering analysis
- Consequence analysis.

TABLE 11-5. EXAMPLE ASSESSMENT OF ABNORMAL OPERATIONS

ABNORMAL OPERATION	POSSIBLE CAUSES	POTENTIAL IMPACTS	PREVENTIVE OR MITIGATIVE FEATURES		METHOD OF DETECTION	RISK		
			DESIGN	ADMINISTRATIVE		CONS ^a	FREQ ^b	RISK ^c
Worker exposure; release of localized radioactive or hazardous material above normal operating parameter	Failure to use equipment properly; not following procedures; natural phenomena (seismic, high wind)	Worker exposure to radioactive or hazardous material above anticipated for normal operations	High energy particulate air (HEPA) filter system	Limitation of worker exposure time	Monitoring	4	<10 ⁴	13-16 (no impact)

^a CONS - Hazard severity level: for example, 4 = no significant consequence; 3 = significant localized consequence; 2 = significant onsite consequence; 1 = significant offsite consequence

^b FREQ - Hazard annual probability or frequency level: for example, incredible ($\leq 10^{-6}/y$); extremely unlikely ($> 10^{-6}$ to $\leq 10^{-4}/y$); unlikely ($> 10^{-4}$ to $\leq 10^{-2}/y$); anticipated ($> 10^{-2}/y$ to $\leq 1/y$)

^c RISK - Hazard severity level vs. hazard annual probability or frequency level (Table 11-3): for example, 1 - 4 (high) = unacceptable; 5 - 8 (med) = undesirable; 9 - 12 (low) = acceptable with review; 13 - 16 (no impact) = acceptable.

Recommended accident analysis methodologies are described in Section 11.3.2. A standard format for accident analysis documentation and an example are presented in Sections 11.3.3 and 11.3.4, respectively.

11.3.1 Accident Analysis Elements

There are four accident analysis elements presented in DOE-STD-1027-92 (DOE, 1992b). The general criteria of these elements are discussed in this section. The focus is on those elements generally expected to be required for ERP activities classified Hazard Category 3 or activities below Hazard Category 3 threshold criteria.

11.3.1.1 Release Mechanism

The release mechanism analysis identifies vulnerabilities in the structures, systems, and components that create conditions for or cause the releases of radioactive or hazardous materials. The objective is to identify potential release mechanisms that could have adverse effects.

11.3.1.2 Sequence Selection

An accident sequence is the chain of events that begins with an initiating event and includes subsequent events that result in accident consequences. Part of the analysis includes estimating accident frequency. The objective of accident sequence selection is to choose unique accident sequences that could have a major effect and encompass the principal release mechanisms. Selection of accident sequences facilitates reduction of identified release mechanism information to a more manageable form.

A spectrum of accidents is selected based on the hazard analysis (Chapter 5). The spectrum includes accidents that envelop the potential consequences resulting from the ERP activities. Those accidents that result from internal events (system/component failures, human errors) and external events (natural phenomena, nearby facilities, transportation routes), but not from sabotage, are included. Accidents with an annual probability or frequency $\leq 10^{-6}$ /year are not included.

11.3.1.3 Engineering Analysis

Engineering analysis identifies physical relationships among the systems, structures, and components, and release mechanisms for postulated accident sequences. Preventive features prevent the release of radioactive or hazardous materials while mitigative features reduce the consequences of a release of radioactive or hazardous materials. To define the safety basis, only preventive or mitigated features necessary to reduce annual probabilities or frequencies, or consequence rating (or both), to an acceptable level are identified in an engineering analysis.

11.3.1.4 Consequence Analysis

Consequence analysis evaluates potential effects from a postulated accident. Consequence analysis may include source term evaluation and dose calculations. For some activities, this analysis may include health effects

assessments. For Hazard Category 3 or below Hazard Category 3 threshold criteria ERP activities, only qualitative consequence analysis is required (DOE, 1992b). However, quantitative determinations may be presented to emphasize the limited consequences of the event, as further described in Section 11.3.2.4.

11.3.2 Accident Analysis Methodology

Recommended methodologies for ERP accident analysis are presented in this section. In particular, methodologies for accident sequence selection and accident consequence analysis are described.

11.3.2.1 Release Mechanism

The hazard analysis (Chapter 5) should provide sufficient information to identify important release mechanisms for specific ERP activities which meet or are below the Hazard Category 3 threshold criteria.

11.3.2.2 Sequence Selection

The primary objective of the accident sequence selection step is to ensure, to the extent possible, that sequences relevant and important to safety are selected. Descriptions of the accident sequences must be technically accurate, complete, and comprehensible to an audience including analysts, anticipated reviewers, and users of the safety analysis document.

Accidents requiring analysis should be selected from the assessment of abnormal operations as described in Section 11.2. The abnormal operations assessment in Section 11.2 incorporates the range of potential hazards identified in the Chapter 5 hazard analysis that are non-routine (that is, not covered by OSH standards) and that have a potential to result in unexpected exposures to radioactive and hazardous materials. Using the example qualitative hazard risk levels in Table 11-4, the selected accidents will have an undesirable or unacceptable risk. Hazard Category 3 activities covered by the BSAF typically will not fall above the "acceptable with review" risk level. Acceptable activities are usually not analyzed except when deemed necessary on a case by case basis. Accident sequences resulting from natural phenomena hazards identified as significant in the Chapter 5 hazard analysis should be included.

Accident sequences selected for analysis could be presented in table form and annotated to indicate potential initiators, release mechanisms, potential mitigators, and type of consequence (radiological, other hazard, or a combination of hazards). An example accident sequence is shown in Table 11-6. Analysis of a similar sequence is presented in Appendix 11B.

11.3.2.3 Engineering Analysis

Limited quantitative engineering analysis is necessary for Hazard Category 3 level activities to determine the effectiveness of preventive and mitigative features for worker protection. A table similar to Table 11-5, which identifies preventive and mitigative features, is an acceptable method. However, quantitative determination may be used to emphasize control measures.

TABLE 11-6. EXAMPLE ACCIDENT SEQUENCE

ACCIDENT SEQUENCE LISTING	ANNOTATION
Ignition Source	Initiator
Fire	Release Mechanism
Fire Extinguisher	Possible Mitigator
Radiological/Chemical Exposure	Consequence
Inhalation, Ingestion, or Dermal Exposure to Toxic, Radioactive, or Carcinogenic Materials	Consequence

11.3.2.4 Consequence Analysis

Qualitative consequence assessments of postulated accidents are usually sufficient and quantitative assessments will generally not be necessary in the safety analysis of ERP activities covered by the BSAF. For Hazard Category 3 ERP activities, quantitative accident consequence analysis is required only selectively to confirm or emphasize limited consequences of the event. For ERP activities below the threshold criteria for a Category 3 hazard, quantitative consequence analysis is *not* required. A qualitative assessment of consequences (and risk) using the methodology presented in the introduction to Chapter 11 should be acceptable for most ERP activities encompassed by the BSAF.

Although not generally required, the remainder of this section describes quantitative accident consequence analysis methodologies recommended for INEL ERP activities, when necessary. The methodologies presented estimate the amount of radioactive and hazardous material that could be released and dispersed into the atmosphere from postulated accident scenarios and the consequences of the accidents to potential receptors.

The Radiological Safety Analysis Computer Program (RSAC) (Wenzel, 1993) is recommended when determining airborne dispersion of radioactive and nonradioactive hazardous materials (depending on the form) for the INEL. RSAC is used in this section to illustrate the basic methodology used in the accident calculations. However, certain situations may require the use of other computer codes or methodologies. Alternate codes and methodologies, accompanied by justification for selection, should be used as appropriate. Table 11-7 lists various consequence analysis computer codes (including RSAC), code application, general functional description, and basic features.

Guidelines for radiological consequence analysis and for hazardous material consequence analysis are provided in the following discussion.

TABLE 11-7. EXAMPLES OF CONSEQUENCE ANALYSIS COMPUTER CODES

CODE	APPLICATION	DESCRIPTION	FEATURES
RSAC Radiological Safety Analysis Computer Program (Wenzel, 1993)	Radiological dose assessment	Calculates radiological doses to workers/public by inhalation, ingestion, and external exposure pathways resulting from acute or chronic airborne releases of radioactive materials. Atmospheric dispersion factors calculated by RSAC can be used for modeling releases of non-radiological materials.	Developed specifically for INEL; incorporates site specific meteorological conditions such as desert dispersion; can incorporate time-dependent releases.
GENII GENII - The Hanford Environmental Radiation Dosimetry Software System (Napier, 1988)	Radiological impact assessment	Analyzes environmental contamination resulting from chronic or acute releases of radionuclides to/from initial concentration of radionuclides in air, water, soil; calculates radiation doses to individuals/populations.	Documentation available; relatively easy to use; widely known; does not require another code to complete radiological assessment.
SLAB A Denser-Than-Air Atmospheric Dispersion Model (Ermac, 1989)	Environmental transport and diffusion evaluation	Simulates atmospheric dispersion of denser-than-air vapor release; subsequent dispersion is modeled as steady state plume, transient puff, or combination.	Simulates instantaneous and time variable releases, dispersion, entrainment; good performance in validation and verification comparisons.
ARCHIE Automated Resource for Chemical Hazard Incident Evaluation (FEMA, 1989)	Consequence assessment of radioactive/hazardous material releases for tanks or pipelines.	Estimates gas or liquid discharge rate and duration; size of liquid pool; rate at which pool evaporates or boils; downwind hazards; consequences of explosion.	Easy to use.

Radiological Consequence Analysis. Two different methodologies may be required to evaluate the radiological consequences to the various receptors. Consequences to downwind receptors at 100 meters should be estimated by computer code. RSAC is the preferred code for analysis at the INEL because it was developed specifically for releases over desert terrains such as the INEL and subjected to extensive validation and verification. RSAC is limited to determining dispersion at distances of 100 meters or greater. Worker exposures < 100 meters are calculated by hand.

- Receptors Within 100 Meters

Typically, within 100 meters, only the worker inhalation exposures are determined because inhalation exposure is usually the most limiting pathway. The inhalation exposure estimates for the workers (receptors within 100 meters) can be calculated using the following equation:

$$WECED = RC \times BR \times ED \times DCF \quad (11-1)$$

where

WECED=	worker exposure committed effective dose equivalent (CEDE)
RC =	radionuclide concentration in the air inhaled by the worker Ci/m ³
BR =	breathing rate 3.33E-04 m ³ /s
ED =	exposure duration (s)
DCR	= dose conversion factor (rem/Ci)

The curie (Ci) content for each radionuclide is specific to each accident scenario and is the same as that used in calculations for downwind receptors. The radionuclide concentration (RC) in the air inhaled by the worker is dependent on the plume volume assumed to surround the worker or a room/building volume; and the airborne release fraction (ARF), the respirable fraction (RF), and the damage ratio (DR). A more detailed description of these fractional parameters is presented in the subsequent paragraphs for the receptors at greater than 100 meters. The breathing rate is assumed to be 3.33E-04 m³/per second based on the assumption the worker inhales 2,400 m³ of air during a 2,000-hr work year (ICRP, 1975 and DOE, 1988b). The exposure duration is dependent on the specific conditions (typically no more than a 120-second time period is assumed for the workers in the immediate area as evacuation is expected. The DCFs are obtained from DOE/EH-0071 (DOE, 1988a) and the ARFs and RFs from draft DOE-STD-0013-93 (Mishima, 1993).

Direct exposure estimates are determined from the exposure time of the individual worker.

- Receptors at Greater Than 100 Meters

Exposure calculations for receptors at greater than 100 meters typically are performed by codes such as those listed in Table 11-7. RSAC is used in the following discussion for illustrative purposes. Model and input requirements specific to RSAC are found in the RSAC Manual (Wenzel, 1993).

To calculate downwind radiological consequences from a code, an accident source term (AST) must be calculated. An AST is the amount of radioactive material released from an event or facility during a specific accident scenario. ASTs are determined using the following equation:

$$AST = MAR \times CF \times DR \times RF \times ARF \quad (11-2)$$

where

AST	=	accident source term (Ci)
MAR	=	material at risk (m^3)
CF	=	concentration factor (Ci/m^3)
DR	=	damage ratio
RF	=	respirable fraction
ARF	=	airborne release fraction.

Note: Other methods may be used to calculate the source term. The source term calculations will depend on factors such as activity, media, and location.

The AST is the total amount of dispersible radioactive material released. AST is multiplied by the individual fraction of each radionuclide to determine the curie content input for RSAC. For example, if the AST = 1.0 Ci, and the radionuclide fractionation is

<u>Radionuclide Fraction</u>	
⁶⁰ Co	0.50
¹³⁷ Cs	0.25 (include contribution of ^{137m} Ba)
⁹⁰ Sr	0.25

The inventory per individual radionuclides is

<u>Radionuclide Ci Content</u>	
⁶⁰ Co	5.00E-01
¹³⁷ Cs	2.50E-01
^{137m} Ba	2.37E-01
⁹⁰ Sr	2.50E-01

This inventory is input into RSAC.

- *Material at Risk (MAR)*. The MAR is the total inventory of material (such as soil or sludge) available to be impacted for a given accident scenario and is typically expressed in terms of total volume at risk in cubic yards (meters). The MARs for each activity or area that contains radioactive or hazardous materials is provided in Chapter 5 of activity-specific safety analysis documentation.
- *Concentration Factor (CF)*. The CF is the concentration of the radioactive or hazardous material at a given area or activity. Concentrations are provided in Chapter 5 of activity-specific safety analysis documentation. The CF is used to convert from a volume (MAR) measurement to a total curie content of the material (such as soil or sludge) for a particular area or activity. The CF is expressed in terms of curies per cubic meter.
- *Damage Ratio (DR)*. The DR represents the percentage of MAR available for exposure to onsite and offsite receptors from the postulated scenario. The DR includes the leak path factor which accounts for reduction in the MAR caused by the containment inhibiting the total release of the source term. This percentage does not take into account respirable fraction (RF) or airborne release fraction (ARF) of the MAR. Derivation of the DR selections is discussed in Chapter 11 of the activity-specific safety analysis documentation.
- *Respirable Fraction (RF)*. The RF of the released material is that fraction of the MAR with an aerodynamic equivalent diameter less than $3.94\text{E-}04$ inch ($10\text{ }\mu\text{m}$) and a mass associated with airborne particles. Most scenarios will use an RF of 1.0. An exception is fire. Fire scenarios must estimate a percentage of combustible and noncombustible material. The RF for combustible material is 1.0 and $1\text{E-}03$ for noncombustible material (Mishima, 1993).
- *Airborne Release Fraction (ARF)*. The ARF is that fraction of the total radioactive material assumed released in a dispersible form by a postulated accident. The following recommended ARFs are taken from draft DOE-STD-0013-93 (Mishima, 1993):

Combustible Solids

Fires	5.0E-04
Explosions	1.0E-03
Spills, breaches, crush impacts, etc.	1.0E-03

Noncombustible Solids

Fires	1.0E-02
Explosions	1.0E-03
Spills, breaches, crush impacts, etc.	1.0E-03

Liquids

Free-fall spill (aqueous solution)	2.0E-04
Free-fall spill (TRU solutions)	2.0E-05

Note: The above are for aqueous solutions with density near 1 gram per cubic centimeter (g/cc) and for trans-uranic (TRU) solutions with density greater than 1 g/cc. For other specific ARFs for aqueous solutions and/or other types of liquids, refer to draft DOE-STD-0013-93 (Mishima, 1993).

The various assumptions and parameters input into RSAC are discussed in the *RSAC Users Manual* (Wenzel, 1993). Additional information on the bases for the RSAC assumptions, particularly for ingestion and inhalation doses, can be found in the recommendations of the International Commission of Radiological Protection (ICRP, 1977).

Hazardous Material Consequence Analysis. This section presents some recommended methods for determining consequences of a release of nonradiological hazardous materials.

Computer codes should be used if available. Table 11-7 lists some of the computer codes for determining hazardous material consequences. Other available computer codes may be used if applicable to the situation being evaluated.

Air concentrations are estimated at the location of workers (within 100 meters of the release), the co-located worker (100 meter), and if necessary, the offsite public at the nearest public highway or site boundary. All chemical concentrations should be reported in units of milligrams per cubic meter. For asbestos, concentrations are measured in fibers per cubic centimeter.

The consequences may be calculated manually using the following equations:

Concentration affecting onsite workers in

$$(\text{mg}/\text{m}^3) = (Q \times T)/(\text{RD} \times V) \quad (11-3)$$

Concentration affecting downwind receptors in

$$(\text{mg}/\text{m}^3) = (Q \times \text{DC})/\text{RD} \quad (11-4)$$

where:

Q	=	quantity of hazardous material released (milligrams or fibers)
T	=	worker exposure time (seconds)
RD	=	release duration (seconds)

V = plume volume (m^3)
DC = dispersion coefficient (x/Q) for specific downwind receptor

For outside conditions, the worker exposure time (T) is equal to or less than the release duration, the contamination is dispersed into an infinite plume, and workers can move upwind or away from the plume.

Comparison of exposure concentration to a threshold limit value - time weighted average (TLV-TWA) is made by multiplying the exposure concentration by the worker's exposure time divided by 8 hours (T/8 hours). The TLV-TWA is a time-weighted average concentration for a normal eight-hour work day. When comparing the exposure concentration to a threshold limit value - short term exposure limit (TLV-STEL), the concentration is multiplied by T/15 minutes. The TLV-STEL is a maximum average concentration for a 15-minute continuous exposure period. When an exposure concentration is compared to the Immediately Dangerous to Life and Health (IDLH) limit, no fractional time exposure reduction is applied. The IDLH represents a maximum concentration from which one could escape within 30 minutes without impairing symptoms or any irreversible health effects.

RSAC is recommended for use in determining the dispersion coefficient (x/Q). Parameters in Equations 11-3 and 11-4 are based on the same assumptions used for radiological consequences.

The effect of exposure to multiple toxicological substances is assumed to be additive if the biological response is the same and chemicals are not concentration dependent. The concentration of the hazardous constituent at the receptor location is divided by the Emergency Response Planning Guideline (ERPG), as appropriate for that receptor, which yields the fraction of the ERPG. Summing these fractions provides a means of evaluating the additive effects. If the sum of the fractions for a given receptor is less than one, the combined release is assumed to pose no health hazard to that receptor.

11.3.3 Standard Format and Content for Accident Analysis

Standard format and content for presenting an accident analysis in Chapter 11 of a safety analysis document should be in conformance with the latest guidelines. Detailed guidance, reflective of the guidance to date, for the Chapter 11 format is provided in Appendix 11A. The format and content for presentation of a specific accident includes the detail necessary when a quantitative accident analysis is performed. This level of detail can be reduced when only a qualitative assessment of the accident is required.

11.3.4 Example Accident Analysis

An example analysis of an accident is presented in Appendix 11B to illustrate how the accident analysis elements in Section 11.3.1 and the accident analysis methodologies in Section 11.3.2 are applied. The example involves a tank containing radioactive and hazardous materials where a potential inadvertent fire is postulated.

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APPENDIX 11A

FORMAT AND CONTENT FOR CHAPTER 11

June 20, 1994

**ENVIRONMENTAL RESTORATION DIVISION
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

APPENDIX 11A FORMAT AND CONTENT FOR CHAPTER 11

11.0 ANALYSIS OF NORMAL, ABNORMAL, AND ACCIDENT CONDITIONS

This chapter should analyze and evaluate normal and abnormal operations as well as potential accidents and associated risks for those hazards identified in Chapter 5.

11.1 Normal Operation

This section should identify those conditions during normal operations that could result in hazardous conditions for workers or release of radioactive and/or hazardous materials (cross-reference Chapter 5). An analysis of expected worker exposures and effluent releases during normal operation should be performed (cross-reference Sections 9.4 and 10.4). These results should be compared to applicable limits specified in United States Department of Energy (DOE) Directives, Environmental Protection Agency (EPA) requirements, and Occupational Safety and Health Administration (OSHA) requirements.

11.2 Abnormal Operation

Based on the hazard analysis in Chapter 5, this section should summarize (or cross-reference) the significant, non-routine concerns to workers, the public, or the environment that could be expected from the Environmental Restoration Program (ERP) activity. The assessment should be qualitative and should identify the preventive and mitigative design features, operating procedures, and/or administrative controls that demonstrate the following:

- Adequate protection of ERP workers
- Health and safety of co-located workers in nearby Idaho National Engineering Laboratory (INEL) facilities
- Adequate protection of the health and safety of members of the public both on and off the INEL site
- Adequate protection of the environment from accidental contamination.

11.3 Accident Analysis

This section should provide analysis of ERP accidents and analysis documentation. The hazard analysis in Chapter 5 should define the range of accidents required to envelop the potential hazards posed by the ERP activity. The accident analysis should consist of the following:

- Release mechanism analysis
- Sequence selection

- Engineering analysis
- Consequence analysis.

In accordance with the guidelines of DOE-STD-1027-92 for Hazard Category 3 activities, the release mechanisms need only cover those identified in the hazard analysis; sequence selection can be accomplished via checklist adaptation or simple process walkthroughs; minimal engineering analysis is necessary; and consequences may be expressed in restrictive or qualitative terms. DOE-STD-1027-92 provides additional guidance on accident analysis that should be followed.

The accident analysis section should be organized in conformance with the latest guidelines document. The level of detail can be reduced when only a qualitative assessment of the accident is necessary. The following sections are representative of the accident analysis section organization conforming to the latest guidelines.

11.3.1 Selection of Accidents

This section should describe how the spectrum of accidents was selected based on the hazard analysis in Chapter 5. The accident spectrum should include accidents that envelop the potential consequences of the ERP activity. The accident spectrum should include those accidents resulting from internal events (system/component failures, human errors) and external events (natural phenomena, nearby facilities, and transportation routes), but should not include sabotage.

11.3.2 Accident Analysis Methodology

This section should describe the methods used to accomplish the following:

- Qualitative assessment of the consequences
- or
- Quantitative accident consequence analysis, if deemed necessary for confirming or emphasizing limited consequences of an event
 - Transport and deposition within a building and external releases
 - Potential onsite and offsite exposures.

This section should describe criteria used to judge the acceptability of the consequences (radiological and nonradiological) and risk. The risk methodology should be qualitative and based on a matrix of event frequency and consequences.

11.3.X Accident X

11.3.X.1 Scenario Description

This section should provide a complete description of the postulated accident scenario. The scenario description should include the initiating event and preventative or mitigative features and human responses assumed.

11.3.X.2 Estimated Frequency of Occurrence

This section should estimate the frequency of occurrence of the accident. The estimate should be qualitative and consistent with the probability classes of accidents defined in the introduction to Chapter 11.

11.3.X.3 Source Term

This section should give the source term for the accident and its basis. The basis should include and justify the release fractions assumed.

11.3.X.4 Consequences

This section should present the qualitative results of the accident analysis in terms of consequences to the following:

- ERP Workers
- Co-located worker at nearby INEL facilities
- Public located outside the INEL site boundary
- Environment (for example, contamination)

If deemed necessary for confirming or emphasizing the consequences of an event, quantitative results can be presented.

11.3.X.5 Risk

This section should combine the estimated event frequency and the calculated consequences in a risk matrix to determine the acceptability of the preventive and mitigative design features, operational procedures, and administrative controls that protect the health and safety of the workers, the public, and the environment.

11.3.Y Results

This section should summarize the conclusions of the accident analysis.

APPENDIX 11B

EXAMPLE ACCIDENT CALCULATIONS

June 20, 1994

**ENVIRONMENTAL RESTORATION DIVISION
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

APPENDIX 11B EXAMPLE ACCIDENT CALCULATIONS

B.1 Scenario Description

An accident involving cutting torch operations on a 1,000-gallon hot waste tank is postulated to occur during D&D activities. The tank is empty except for a 3-inch layer of sludge in the bottom, about 0.1 cubic meters, which contains radionuclides, cadmium, and acetone. In this scenario, the worker fails to comply with operating procedures or the procedures fail to require checking and monitoring for flammable vapors and/or liquids. During cutting torch or welding operations, the acetone in the sludge is ignited. The fire burns to completion in 30 minutes when the acetone is consumed.

B.2 Estimated Frequency of Occurrence

The likelihood that this accident will be initiated without mitigation, prior to a significant release, a combination of the following human error probabilities (HEPs).

- Initiator - operator causes fire with cutting torch

This HEP will be a generic error probability moderated by the existence and quality of the worker's oversight, training, procedures, and human factors engineering of equipment.
- Mitigator - operator and/or emergency team fail to extinguish the fire

This HEP will be a generic error probability moderated by the worker's and possibly emergency response team's oversight, training, procedures, and human factors engineering of equipment.

The frequency of occurrence is estimated to be 10^4 to 10^2 per year. This frequency can be further reduced by the number of actual days that the work is performed on the tank. For this example, 5 days is used. The frequency is then multiplied by $5/365$ resulting in a frequency of occurrence of 10^6 to 10^4 . This frequency corresponds to a Hazard Frequency of extremely unlikely in Table 11-2 of Chapter 11.

B.3 Source Term

The source term for the accident in this example was determined from sampling and analysis performed on the tank. Other than the radionuclides listed in Table 11B-1, the only other known constituent is cadmium at a concentration of 4.5 mg/kg.

Facilities with combinations of radioactive materials are designated Hazard Category 3 if the sum of the ratios of the quantities of each material divided by the Category 3 thresholds exceeds one. For the example accident,

the sum of the ratios is 0.96 (Table 11B-1), which is below the criterion for Category 3 and corresponds, therefore, to a Hazard Severity Level 4 (no significant consequences) (see Table 11-1).

TABLE 11B-1. RADIONUCLIDE INVENTORY

RADIONUCLIDE	INVENTORY (CURIES)	CATEGORY 3 THRESHOLD QUANTITIES (Ci) DOE-STD-1027-92	RATIO OF INVENTORY OVER THRESHOLD QUANTITY
⁶⁰ Co	4.0E+0	280	1.4E-02
¹³⁷ Cs	1.2E+1	60	2.0E-01
^{137m} Ba	1.1E+01	NA	NA
⁹⁰ Sr	1.2E+1	16	7.5E-01
	Total 39		Ratio Sum 0.96

NA - ^{137m}Ba is not listed in Attachment 1 of DOE-STD-1027-92 (DOE, 1992b). For isotopes not listed, users may contact DOE-Headquarters, Office of Nuclear Safety Policy and Standards (EH-60), for threshold quantities of any isotopes of interest. For the case of ^{137m}Ba, the listed threshold quantity for ¹³⁷Cs has taken the effects of ^{137m}Ba into account. Therefore, a threshold quantity for ^{137m}Ba is not listed and does not need to be included when determining the ratio. Because this methodology is not necessarily true for other isotopes not listed, EH-60 should always be contacted on a case-by-case basis.

B.4 Consequences

This section presents the results of the accident analysis in terms of consequences to the following:

- D&D worker (< 100 meters)
- Downwind receptors ($\geq$ 100 meters).

The accident analysis methodology presented in Chapter 11, Section 11.3.2 is followed for the calculations presented in the following section.

- D&D Worker (< 100 meters)

The exposure estimates from the inhalation of contaminants by the workers from the explosion are calculated using the accident methodology presented in Chapter 11, Section 11.3.2.

$$WECED = RC \times BR \times ED \times DCF \quad (11B-1)$$

where

RC = radionuclide concentration (Ci/m³)
BR = breathing rate 3.33E-04 (m³/second)
ED = exposure duration
DCF = dose conversion factor

In this example, the RC is calculated by multiplying the amount of each radionuclide present in the sludge by 5E-03 and dividing the result by the plume volume (assumed to be 1,200 cubic meters). For this scenario, 5E-03 was assumed because the outdoor fire involved non-volatile radionuclides in an aqueous solution under the fire (Mishima, 1993). The plume volume is a best engineering estimate for the size of a plume that forms, assuming stagnant air conditions. There are no concurring references; but, given that the fire occurs outside at the INEL, it is likely that wind will disperse this plume and reduce its concentration of radionuclides and hazardous materials. The RF and DR are both conservatively assumed to be 100%. Chapter 11, Section 11.3.2, provides airborne release fraction guidance. The breathing rate is assumed to be 3.33E-04 m³/second for a typical worker (DOE, 1988b). The duration of the exposure is assumed to be 2 minutes. The dose conversion factor is from DOE/EH-0071 (DOE, 1988a).

Using the data presented in Table 11B-1 (specifically ⁶⁰Co for illustrative purposes), the worker exposure committed effective dose equivalent (CEDE) is calculated.

$$\begin{aligned} \text{WECED} &= ((5\text{E}-03) (4.0 \text{ Ci})) / (1199.5 \text{ m}^3) \times (3.33\text{E}-04 \text{ m}^3/\text{sec}) \times \\ &\quad (120 \text{ second}) \times (1.5\text{E}+5 \text{ rem/Ci}) \\ &= 1.0\text{E}-01 \text{ rem CEDE} \end{aligned}$$

The exposure estimates for all the radionuclides present are summarized in Table 11B-2.

TABLE 11B-2. WORKER EXPOSURE TO RADIONUCLIDES

RADIONUCLIDE	INVENTORY (CURIES)	CONVERSION FACTOR (REM/CI) *	CEDE (REM)
⁶⁰ Co	4.0E+0	1.5E+5	.1
¹³⁷ Cs	1.2E+1	3.2E+4	6.4E-02
^{137m} Ba	1.1E+01	3.2E+4	5.9E-02
⁹⁰ Sr	1.2E+1	1.3E+6	2.6
Total	39		Total CEDE 2.8 rem

Reference: The rem/Ci conversion factors are from U.S. Department of Energy, Internal Dose Conversion Factors for Calculation of Dose to the Public, DOE/EH-0071, July 1988. The rem/Ci conversion factors taken from the stated reference are applicable for both the worker and the public.

Potential worker exposure to cadmium is determined using the methodology presented in Chapter 11, Section 11.3.2. The release duration is assumed to be 30 minutes, the time for the fire to burn completely. Worker exposure time is conservatively assumed to be 2 minutes. (Procedures call for the workers to evacuate the area and allow trained fire fighters to combat any

fire.) The plume volume is assumed to be 1200 m³, as before. Because the cadmium is a particulate in the sludge, the 5E-03 airborne release fraction applies. As in the radionuclide worker exposure calculation, the respirable fraction and damage ratio are both conservatively assumed to be 100%.

Using the relationship,

$$\text{Concentration affecting onsite workers mg/m}^3 = (Q * T) / (RD * V)$$

where:

Q = quantity of hazardous material released (mg or fibers)
T = worker exposure time (s)
RD = release duration (s)
V = plume volume

and inserting the numerical values, yields

$$2.55\text{E-}9 \text{ mg/m}^3 = 9.2\text{E-}2 \text{ mg/m}^3 \times 0.10 \text{ m}^3 \times 5\text{E-}03 \\ \times 2 \text{ min} / (30 \text{ min} \times 1,199.5 \text{ m}^3)$$

The TLV-TWA for cadmium is 0.002 mg/m³ (respirable fraction of dust). This is an average concentration over an eight-hour time period. To compare the cadmium concentration affecting onsite workers with this TLV-TWA, the time-weighted eight-hour TWA exposure is calculated as follows:

$$5.8\text{E-}07 \text{ mg/m}^3 = 1.4\text{E-}04 \text{ mg/m}^3 \times 2 \text{ min.} / 480 \text{ min.}$$

- Downwind receptors (> 100 m)

To calculate the downwind radiological consequences, an accident source term is determined. The accident analysis methodology of Chapter 11, Section 11.3.2 is used.

Determining accident source term (AST)

$$\text{AST} = \text{MAR} \times \text{CF} \times \text{DR} \times \text{RF} \times \text{ARF}$$

where:

MAR = Material at risk (m³)
CF = Concentration factor (Ci/m³)
DR = Damage ratio
ARF = Airborne release fraction
RF = Respirable fraction
AST = Accident source term (Ci)

For the example presented here, the MAR is (0.1 m³). The total number of curies in the tank is 39 Ci; therefore the CF is 390 Ci/m³. For conservatism in this accident, the DR and RF are

assumed to be 100% and the ARF is 5E-03, as before, for the worker exposure calculations. Therefore,

$$AST = 0.1 \text{ m}^3 \times 390 \text{ Ci/m}^3 \times 5\text{E-}03 = 1.95\text{E-}01 \text{ Ci}$$

The AST is multiplied by the individual fraction of each radionuclide to determine the curie content input for RSAC. This inventory is presented in Table 11B-3. For example, for ^{60}Co

$$\begin{aligned} \text{RSAC input inventory} &= 4.0 \text{ Ci/39 Ci} \times 1.95\text{E-}01 \text{ Ci} \\ &= 2\text{E-}02 \text{ Ci of } ^{60}\text{Co} \end{aligned}$$

TABLE 11B-3. DETERMINATION OF RSAC INVENTORY INPUT

RADIONUCLIDE	INVENTORY (CURIES)	INVENTORY FRACTION	RSAC INVENTORY INPUT (CI)
^{60}Co	4.0E+0	0.1	2E-02
^{137}Cs	1.2E+1	0.3	6E-02
$^{137\text{m}}\text{Ba}$	1.1E+01	0.3	5.5E-02
^{90}Sr	1.2E+1	0.3	6E-02

Using the criteria and input requirements from the *RSAC Manual* (Wenzel, 1993), the data in Table 11B-3 was input into the RSAC code to determine the potential doses at 100 meters, 1,000 meters, and 10,607 meters. These distances were selected to represent the co-located worker and the public at Highway 20/26 and at the nearest INEL site boundary from a fictitious INEL location. The Markee sigmas for releases between 15 and 60 minutes and an air stability Class F were chosen. The conservative wind speed of 0.5 meters/second was used for distances less than 2 kilometers. A wind speed of 2 meters/second was used for distances greater than 2 kilometers. The downwind exposures were calculated based on the time necessary for 100% release. Similar calculations were also performed using stability Class D and the average wind speed of 3.4 meters/second. The results of these calculations are presented in Table 11B-4. Values in parentheses correspond to the stability Class D calculations. The inhalation doses for the onsite worker are presented in Table 11B-4. The actual code input and selected output are presented at the end of this discussion.

Downwind receptors exposure to the cadmium would be less than that calculated previously for the worker. Because the calculated value is well below the TLV-TWA, it is not necessary to perform calculations for downstream receptors. However, the calculations are presented below for illustrative purposes. The more conservative X/Q values from RSAC calculations that used

air stability Class F were employed. The equations are from Chapter 11, Section 11.3.2. The release duration is 30 minutes (1,800 seconds) and the ARF is 5E-03, as used previously for the radionuclide calculations.

TABLE 11B-4. CALCULATED EXPOSURES

PATHWAY	WORKER* (REM)	CO-LOCATED WORKER (REM) (100 m)	HIGHWAY 20/26 (REM) (1,000 m)	NEAREST SITE BOUNDARY (REM) (10,607 m)
Inhalation	2.8	5.18E-02 ^b (6.36E-03) ^c	3.27E-03 (1.73E-04)	4.15E-05 (3.54E-06)
Ingestion	NA	NA	NA	2.25E-04 (1.92E-05)
Ground Surface	NA	2.86E-06 (3.51E-07)	1.81E-07 (9.54E-09)	2.29E-09 (1.96E-10)
Air immersion	NA	1.23E-04 (1.51E-05)	7.76E-06 (4.09E-07)	9.84E-08 (8.40E-09)
Total	2.8	5.19E-02 (6.38E-03)	3.28E-03 (1.73E-04)	2.67E-04 (2.27E-05)

*Independent of Stability Class

^bClass F stability

^cClass D stability

NA Not applicable

Concentration affecting downwind receptors (mg/m³) = ((Q) *
(DC))/RD

where:

Q = quantity of hazardous material released (mg or
fibers)
DC = dispersion coefficient (χ/Q) for specific downwind
receptor. The values are obtained from the RSAC
calculations (end of Appendix 11B)
RD = release duration (s)

At 100 meters,

$$1.16\text{E-}05 \text{ mg/m}^3 = (4.5 \text{ mg/L})(109 \text{ L})(5\text{E-}03)(8.488\text{E-}03 \text{ s/m}^3/1800 \text{ s})$$

At 1,000 meters,

$$7.95\text{E-}07 \text{ mg/m}^3 = (4.5 \text{ mg/L})(109 \text{ L})(5\text{E-}03) \\ (5.838\text{E-}04 \text{ s/m}^3 / 1800 \text{ s})$$

At 10,607 meters,

$$1.28\text{E-}08 \text{ mg/m}^3 = (4.5 \text{ mg/L})(109 \text{ L})(5\text{E-}03) \\ (9.402\text{E-}06 \text{ s/m}^3 / 1800 \text{ s})$$

B.5 Risk

The hazard annual probability or frequency and hazard severity levels for this accident were determined in Chapter 11, Table 11-5, Example Assessment of Abnormal Operations. The annual probability or frequency is no greater than 10^{-4} . As shown in Table 11-2, this corresponds to an extremely unlikely event. This D&D activity is below the Category 3 threshold criteria because the sum of the ratios of each radionuclide present in the inventory, divided by the threshold criteria, is less than one (0.96 from Table 11B-1). There are no significant consequences from this hazard, per Table 11-1, corresponding to Hazard Severity Level 4. Therefore, from Tables 11-3 and 11-4, the risk rating is acceptable (13-16 or no impact).

CHAPTER 12.0

MANAGEMENT, ORGANIZATION, AND INSTITUTIONAL SAFETY PROVISIONS

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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LIST OF ILLUSTRATIONS

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12.0 MANAGEMENT, ORGANIZATION, AND INSTITUTIONAL SAFETY PROVISIONS

The Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP) management and organization is discussed in this chapter. The organizational elements, responsibilities, interfaces, and controls important to ensuring safety are described. In addition, essential staffing and qualifications are summarized.

12.1 Organizational Structure, Responsibilities, and Interfaces

The INEL is administered by the United States Department of Energy (DOE). Policy for operation and management of the INEL is developed at DOE Headquarters (DOE-HQ) in Washington, D.C., and is implemented by the DOE-Idaho Operations Office (DOE-ID). The Naval Reactors Facility (NRF) and Argonne National Laboratory-West (ANL-W) facilities are excluded. DOE establishes contracts with private firms to operate the various facilities and conduct the required environmental remediation and decontamination and decommissioning (D&D) activities at the INEL. The organization of the INEL ERP is illustrated in Figure 12-1.

12.1.1 United States Department of Energy Headquarters

The DOE Headquarters (HQ) Office of Environmental Restoration and Waste Management (EM) manages the program for environmental remediation and D&D at DOE facilities. DOE's goal for all environmental remediation and D&D activities is to ensure that risks to the environment and to health and safety posed by inactive and surplus facilities and sites are either eliminated or reduced to prescribed, safe levels.

12.1.2 United States Department of Energy, Idaho Operations Office

The DOE-ID Manager is responsible for direct communication and promulgation of agreements with responsible Program Secretarial Officers (PSOs) and DOE-ID. The DOE-ID Manager establishes requirements for the INEL ERP and the DOE-ID organizational structure for implementing the program. The Manager provides general direction for program efforts, allocates resources accordingly, and acts in an overview position to ensure INEL ERP goals and reporting requirements are fulfilled.

The DOE-ID Assistant Manager, Office of Program Execution, is responsible for overseeing the development and implementation of the INEL ERP. The Assistant Manager ensures that the program complies with DOE, United States Environmental Protection Agency (EPA), State of Idaho, and DOE-ID requirements. The ERP Manager directs and oversees the specific environmental remediation and D&D activities.

12.1.3 INEL Environmental Restoration Program

The INEL management and operation (M&O) and remedial design/remedial action (RD/RA) ERP organizations have overall responsibility for assuring that

Figure 12-1. Generalized INEL Environmental Restoration Program Organization.

activities are performed safely. These organizations are responsible for developing and implementing the following documentation for each activity:

- Health and Safety Plan
- Environmental Remediation or D&D Plan
- Safety Analysis Report
- Quality Assurance Project Plan.

The INEL contractor is responsible for the development and enforcement of an Environmental, Safety, and Health (ES&H) Program. The source of requirements for the contractor ES&H program is the contract with DOE-ID, which requires that contractors follow the requirements of DOE Directives and the regulations of other Federal agencies and the State of Idaho. ERP Management is responsible for ensuring that the projects are performed in compliance with health and safety program requirements.

12.1.4 Environmental Restoration Program Management

The INEL M&O and RD/RA contractors are responsible for conducting day-to-day management and operation of INEL ERP activities. The Project Management organization includes at a minimum the following elements: Project Manager with overall responsibility for safety and regulatory compliance and interface between the environmental remediation or D&D project and technical support organizations and subcontractors; Field Supervisor with responsibility and authority to direct all field operations; Health and Safety Officer with responsibility and authority to develop and implement the Health and Safety Plan and verify compliance; and all other personnel necessary for activity-specific operations and emergency response.

The Health and Safety Plan establishes the specific chain of command and specifies the overall responsibilities of supervisors and employees.

12.1.5 Environmental Restoration Program Technical Support

Technical support personnel are responsible for supervision and performance of technical support functions for ERP activities. Expertise in areas including mechanical, electrical, instrumentation and control, chemistry, RD/RA technology, waste management, radiation and hazardous material protection, training, safety, quality assurance, document control, and emergency preparedness is normally provided as a technical support function. INEL-wide services and facilities include fire protection and onsite medical services.

12.1.6 Subcontractor Support

Subcontractors may be used to provide services including RD/RA support, technical support, and operations support. Subcontractor personnel are required to comply with the Health and Safety Plan for the ERP activity. It is the responsibility of the Project Manager to assure that subcontractor

personnel receive appropriate health and safety training as required by the Health and Safety Plan.

12.2 Administrative Controls

Administrative controls are established and implemented to ensure the following:

- Safety and health of workers and protection of the environment are first priority
- Operations are conducted in compliance with applicable environmental, safety, health, and quality requirements of DOE, Federal, and state regulatory agencies
- Activities are conducted in a preventive mode that recognizes and controls workplace hazards.

The following sections summarize upper tier administrative controls imposed on ERP activities.

12.2.1 Health and Safety Plan

An approved Health and Safety Plan provides necessary controls for safe and efficient operation. An approved Health and Safety Plan will be in place for each ERP activity. The detailed elements of the Plan, as required by 29 CFR 1910.120 (DOL, 1993), are itemized in Section 2.3, and are discussed in Sections 9.6 and 10.5.1.

All personnel must comply with the requirements of the Health and Safety Plan during ERP activities. A Health and Safety Officer is assigned to each activity to monitor and address issues concerning health and safety.

12.2.2 Personnel Training

Personnel are categorized relative to specific job function and receive training commensurate with this job function. A training program will be established for ERP activities to train personnel on facility and operating requirements and to assure suitable response by personnel to any abnormal occurrence. The training program is designed to stress safety consciousness and is described in Chapter 13.

12.2.3 Design and Procurement Controls

Design and procurement control is required to ensure that quality and safety requirements are satisfied. Controls provide for the following, as appropriate: source evaluation and selection; evaluation of objective evidence of quality furnished by the supplier; inspection and in-process audit at the source; audit and examination of items or services upon delivery or completion; or evaluation of item performance after installation. The INEL ERP configuration and documentation management system is outlined in Section 12.4.

12.3 Occurrence Reporting

Procedures for occurrence reporting are established by DOE 5000.3A (DOE, 1990) and DOE-ID Supplemental Directive 5000.3B (DOE-ID, 1991a) to notify contractor management and DOE-ID of safety-related occurrences at ERP sites and facilities. The Project Manager is designated the activity manager and is responsible for generating and transmitting occurrence reports. The Field Supervisor is identified as the designated manager so that notification, reporting, and transmittal takes place in the required time during off-shift operations or when the Project Manager is not present. Elements of the INEL Occurrence Categorization and Notification process are summarized below:

- Occurrence will be categorized as an Emergency, Unusual Occurrence, or Off-Normal Occurrence as specified in DOE Order 5000.3A (DOE, 1990)
- For Emergencies or Unusual Occurrences, DOE-ID Warning Communications Center (WCC) will be notified. The WCC will establish additional appropriate communication links
- For Reportable Occurrences, DOE-ID Facility Representative will be notified
- Notifications should include the following information: name of individual; location of event; brief description of occurrence; time of discovery and categorization; actions taken; actions anticipated to mitigate occurrence; name, location, and phone number of individual in charge at scene.

An Occurrence Report will be prepared for all Reportable Occurrences according to the instructions provided in DOE 5000.3A and DOE-ID Supplemental Directive 5000.3B. The Project Manager and Field Supervisor are trained in proper occurrence identification and notification procedures, and all personnel are trained to initiate immediate notification of any work-related occurrences to their supervisor. Detailed guidance for incident investigation and reporting, including the level of reporting required, is provided in the activity-specific Health and Safety Plan and in Contractor Health and Safety manuals and procedures. Company procedures currently are established, approved, and implemented for all ERP activities.

12.4 Configuration and Documentation Management

The objectives of the configuration and documentation management program are to assure that the records of the INEL ERP activities are prepared and maintained to furnish objective, auditable evidence of safety and quality. To meet the objectives of the configuration and documentation management program, the requirements and responsibilities for records control are established and documented in accordance with DOE 1324.2A (DOE, 1992), DOE 5700.6C (DOE, 1991d), and associated DOE-ID Supplemental Directives.

12.4.1 Records Control System

Requirements for records control are established in DOE 1324.2A (DOE, 1992). A records system will be established by the Project Manager at the earliest practical time consistent with the work schedule of the activity. Documents that relate to quality or safety will be prepared, issued, and changed in a controlled manner. The system will provide for the following:

- Identification of documents to be controlled and specified distribution
- Identification of responsible organizations for the preparation, review, approval, and issuance of documents
- Evaluation of documentation adequacy, completeness, and correctness prior to approval, release, and distribution.

12.4.2 Change Control

The design or facility change control process promotes orderly project change. The objectives of the change control process are to assure that proposed changes to design or facilities are properly assessed; that only authorized changes are incorporated; that changes are incorporated in a timely manner; and that traceability to the originally approved technical baseline is maintained. The design and facility change control process involves the following steps:

- Change identification
- Development of documentation
- Evaluation
- Approval/disapproval
- Implementation.

The change control process will include guidelines for assessing and approving proposed changes and authorizing and implementing approved changes to the design baseline.

12.5 Self Assessments, Appraisals, and Independent Reviews

The self assessment, independent review, and appraisal of safety performance is accomplished through the independent safety review system. The program is developed in accordance with DOE 5482.1B (DOE, 1991a), DOE 5480.5 (DOE, 1986), and DOE 5700.6C (DOE, 1991d), and corresponding DOE-ID Supplemental Directives. Self assessments are conducted as directed by the Secretary of DOE in a Secretary of Energy Notice (DOE, 1991b). The quality, frequency, and depth of the program is commensurate with the level of hazard attendant to the respective operating activities. The purpose of the program is to provide independent assurance that ERP activities maintain a high degree of safety, health protection, quality, and environmental compliance.

12.5.1 Self Assessments

Self assessments provide feedback to senior management on effectiveness of line management implementation and oversight of environmental, safety, and health programs in satisfying DOE Directives and applicable regulations and requirements. The self assessment program includes design, construction, and operational assessments which sample performance in the environmental, safety, and health arenas and gauge the adequacy of compliance. The basic approach of the self assessment program conducted by the INEL ERP follows:

- Creation and maintenance of a list of self assessment areas based on applicable requirements
- Creation and maintenance of a method of cross-referencing each self assessment area to appropriate requirements
- Performance of assessments by objective examination of applicable work areas, activities, or processes; review and analysis of applicable documents, records, or procedures; and interviews of cognizant personnel
- Documentation of scope and findings of the assessment in an assessment report
- Categorization of issues based upon associated risk to the environment, safety, and/or health
- Identification, implementation, and monitoring of corrective actions.

The INEL ERP self assessment program periodically is reviewed by management for adequacy of performance.

12.5.2 Appraisals and Independent Reviews

The contractor ERP specifies minimum review level requirements for safety documents or safety issues based on hazards present. Technical requirements are independently reviewed by appropriate disciplines, with focus on compliance with applicable safety limits, technical requirements, and specifications; quality assurance/quality control; and applicable DOE, Federal, state, and local requirements. Reviews focus on deficiencies in design or operation of structures, systems, or components that could affect risk. Chapter 18 provides additional discussion of quality assurance audits. Approval of safety documents requires concurrence by independent safety reviewers as specified in procedures established by the Health and Safety Plan or applicable company procedures. In accordance with DOE-ID Supplemental Directive 5482.1B (DOE-ID, 1991b), appropriate corrective actions will be taken on deficiencies identified in ES&H appraisals. An initial report and quarterly reports will be submitted to DOE-ID.

12.6 Staffing and Personnel Qualifications

The organizational structure and activity staffing for ERP activities reflect the resources and expertise required to successfully perform the activities while minimizing risk to personnel health and safety. Staffing and personnel qualification requirements are dependent on the hazard level of the ERP activity. All activities will meet the minimum staffing of 29 CFR 1910.120, which requires a general supervisor, a site safety and health supervisor, and site personnel. For Hazard Category 3 or less than Hazard Category 3 threshold activities, the responsibilities and qualifications of key ERP activity personnel, as summarized in the following sections, are based on DOE 5480.20 (DOE, 1991c). Staffing requirements for each ERP activity are specified in the Health and Safety Plan.

12.6.1 Project Manager

The Project Manager is responsible for ensuring that all activities conducted during the project are in compliance with Occupational Safety and Health (OSHA), EPA, DOE, United States Department of Transportation (DOT), and State of Idaho requirements. The Project Manager is responsible for ensuring that tasks comply with the Health and Safety Plan, and for directing project reporting functions. Typical qualifications of a Project Manager are a baccalaureate degree and four years of experience. Job-related education or experience may be substituted for a degree on a case-by-case basis.

12.6.2 Field Supervisor

The Field Supervisor is responsible for the safe and successful completion of activities at the activity site. The supervisor manages field operations and executes the workplan and schedule; enforces site control; and documents site activities. Health and safety issues at the site are directed to the supervisor, and emergency actions are directed by the supervisor. If the supervisor leaves the site, an alternate, qualified individual is appointed to act as supervisor. Typically, qualifications of a field supervisor include three years of work experience. Full-time academic training may be substituted for a portion of the work experience on a case-by-case basis.

12.6.3 Site Personnel

Site personnel consist of the operators, technicians, and maintenance personnel necessary for safe and efficient performance of specific tasks. All site personnel are responsible for understanding and complying with the requirements of the Health and Safety Plan. Task site personnel must be alert to potentially unsafe situations, and are authorized to stop work and notify the field supervisor or the health and safety officer (Section 12.6.4) when unsafe conditions are identified. Typically, site personnel have a minimum of one year of work experience, but training may be substituted for work experience on a case-by-case basis.

12.6.4 Health and Safety Officer

The Health and Safety Officer serves as the primary contact for health and safety issues at the site. The Health and Safety Officer advises the field supervisor on all aspects of health and safety and is authorized to stop work at the site if any operation threatens the worker or public health and safety. The Health and Safety Officer has other specific responsibilities as stated in the Health and Safety Plan. Typically, qualifications of the Health and Safety Officer include three years of work experience. Full-time academic training may be substituted for a portion of the work experience on a case-by-case basis.

12.6.5 Technical Support Personnel

Technical support personnel are responsible for supervision and performance of technical support functions for the ERP activity. They should have expertise in mechanical, electrical, instrumentation and control, chemistry, radiation and hazardous material protection, training, safety, quality assurance, or remedial design/remedial action (RD/RA) technology. Typically, qualifications of technical support personnel include a baccalaureate degree in science or engineering and two years of work experience. Job-related education or experience may be substituted for a degree on a case-by-case basis.

12.6.6 Subcontractor Personnel

Subcontractor personnel may fulfill any of the roles specified above for ERP activities and should have commensurate qualifications. Subcontractor personnel will receive training in the Health and Safety Plan, and will comply with the Plan during all site activities. Subcontractors will comply with all quality assurance, document control, emergency planning, and occurrence reporting as outlined in this chapter.

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CHAPTER 13.0

PROCEDURES AND TRAINING

June 20, 1994

ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY

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13.0 PROCEDURES AND TRAINING

13.1 Procedures

The United States Department of Energy (DOE) in DOE 5480.19 (DOE, 1992a) requires the preparation and use of written procedures to cover normal and abnormal (emergency) conditions. Furthermore, the development of written procedures is required for maintenance operations by DOE 4330.4A (DOE, 1990). The proper use of procedures helps in the management of identified risk for Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP) activities including environmental remediation and decontamination and decommissioning (D&D) (DOE, 1992b). Required procedures are referenced in the activity-specific Health and Safety Plan.

Each contractor is required to develop written procedures and training courses for ERP activities at the INEL. These procedures will be developed by individuals knowledgeable of the operation; revised as necessary to reflect current operating practices and requirements; and reviewed for completeness a minimum of every two years. Procedures shall be controlled to ensure that individuals have the most current copy of a procedure. Table 13-1 summarizes general procedure documentation requirements.

Safety analysis requirements will be included in procedures and training when needed to ensure that the safety bases documented in the environmental remediation or D&D activity safety analysis documentation, technical safety requirements (TSRs), and Health and Safety Plan are met. Procedures and training may need to address safety analysis requirements pertaining to, but not limited to, staff qualifications, operating support, operational readiness reviews/readiness assessments, unreviewed safety question assessments, and radioactive and hazardous material inventory control/monitoring.

NOTE: Safety analysis requirements or commitments contained in the BSAF are identified and documented in a database. This BSAF commitment database is used in the derivation of TSRs and is reproduced in Appendix 16A. The BSAF database can be annotated by the responsible environmental restoration contractor to identify applicable commitments based on activity-specific safety analysis and how they will be implemented (for example, by design, procedure, training). This annotated BSAF commitment database can then identify safety analysis commitments that procedure writers and training program developers must cover.

13.1.1 General Procedures

Written procedures covering the conduct of operations during normal, abnormal, and emergency conditions, as well as surveillance, testing, and maintenance, support the safe remediation of environmentally contaminated sites and D&D of facilities. Written procedures will be augmented by the Health and Safety Plan or workplan which identifies activity-specific hazards and establishes personnel and equipment protection. Examples of procedures common to both environmental remediation and D&D include the following:

TABLE 13-1. PROCEDURES AND TRAINING DOCUMENTATION SUMMARY.

Examples of Implementing Documents That Establish Contractor's Process for Meeting DOE Requirements			
PROCEDURE DOCUMENT REQUIRED by DOE Order 5480.19	PROCEDURE DEVELOPMENT DOCUMENTS		
	EG&G	WINCO	MK-FIC
Procedure Format Specification	EG&G Idaho, Inc. Company Procedures Manual, Section 1.1	WINCO Standard Operating Procedure (WSOP) WA-4 "Developing Standard Operating Procedures"	Construction Management Services Manual (CMSM) 2A-1-01
Procedure Verification	EG&G Idaho, Inc. Company Procedures Manual, Section 1.1	WSOP WA-4 "Developing Standard Operating Procedures"	CMSM 1A-1-01
Procedure Approval	EG&G Idaho, Inc. Company Procedures Manual, Section 1.1	WSOP WA-11 "Reviewing and Approving Integrated Plant Document System (IPDS) Documents"	CMSM 2A-1-01
Lessons Learned Changes	EG&G Idaho, Inc. Company Procedures Manual, Section 1.1	WSOP WQ-10.4 "Lessons Learned"	CMSM 2A-2-06
Biannual Procedure Review & Update	EG&G Idaho, Inc. Company Procedures Manual, Section 1.1	WSOP WA-11 "Reviewing and Approving IPDS Documents"	---
Issuance of Current and Revised Procedures	EG&G Idaho, Inc. Company Procedures Manual, Section 1.1	WSOP WA-17 "Controlled Distribution of IPDS Documents"	CMSM 9A-2-06
DOCUMENTATION REQUIRED by DOE Order 5480.20	TRAINING DOCUMENTS		
	EG&G	WINCO	MK-FIC
Required Training Identified	EG&G Idaho, Inc. Company Procedures Manual. A "Site Level Training Requirements Manual" (in preparation) is expected to replace this manual in 1994, Section 1-11	WSOP WT-3 "Qualification and Training"	CMSM 2A-3-02
Notification of Personnel	Training Records and Information Network (TRAIN) ¹	WSOP WT-1 "Training Administration"	CMSM SA-3-02
Training Performed	TRAIN ¹	WSOP WT-1 "Training Administration"	CMSM 2A-3-02
Training Documented	TRAIN ¹	WSOP WT-2 "Training Records Management"	CMSM 2A-3-02
Training Update Notification Procedures	TRAIN ¹	WSOP WT-5 "Extending Qualifications for Certification"	CMSM 2A-3-02

¹ TRAIN is a computer records system.

- Calibration and use of industrial hygiene monitoring equipment
- Calibration and use of health physics monitoring equipment
- Equipment decontamination procedures
- Personnel decontamination procedures
- Personal protective equipment (PPE) selection protocols to include gloves, coveralls, and respirators
- Lockout/tagout procedures
- Confined space entry procedures
- Issuance of safe use permits such as "hot work" permits.

13.1.2 Procedures Unique to Environmental Remediation

Examples of procedures unique to environmental remediation include the following:

- Soil sampling procedures
- Monitoring well sampling procedures
- Monitoring well installation procedures
- Trenching and shoring.

13.1.3 Procedures Unique to D&D

Examples of procedures unique to D&D include the following:

- Asbestos removal
- Abrasive blasting of surfaces
- Acetylene torch cutting of metal structures or components
- Material surface contamination sampling procedures.

13.1.4 Human Factors Considerations

If the analyses in Chapters 5 or 11 assume or require human interaction for preventing or mitigating a significant hazard or accident, human factors analysis methods will be applied in the development of procedures and training. Human factors methods are discussed in Chapter 14. Human factors task analysis techniques will ensure that actions required by procedures are within normal human capabilities, and that the expectations for workers involved in ERP activities are realistic and achievable. Similarly, the content and effectiveness of training programs will be established using human factors task analysis methods.

13.2 Personnel Training and Qualifications

DOE 5480.20 (DOE, 1991a) defines training requirements for individuals who work at DOE facilities. General training required by DOE 5480.20 includes the following:

- General description of facilities
- Job-related policies, procedures, and instruction
- Radiological health and safety program
- Facility emergency plans
- Industrial safety program
- Industrial hygiene program
- Fire protection program
- Security program
- Quality assurance program.

Training will be conducted by professional subject matter experts. The general training is augmented by specific training required for ERP work. Generally, training is promulgated and required by various Occupational Safety and Health Administration (OSHA) regulations. OSHA training requirements are summarized in Table 13-2. Specifics of each type of training summarized in Table 13-2 may be found in the cited regulation. Training for radiation workers will be performed as required by the *DOE Radiological Control Manual* (DOE, 1992c).

DOE 5480.18A (DOE, 1991b) is not applicable to ERP activities at the INEL as work does not involve or require the operation of a nuclear reactor. Reactors or facilities in a standby status are exempt from this regulation. D&D can not be performed on an operating reactor and environmental remediation does not involve reactors. However, DOE 5480.18A does apply to other INEL activities and is generally considered in the development of all INEL training programs; therefore, the principal criteria contained in DOE 5480.18A concerning the development of all INEL training programs will be followed in the development of training programs for ERP activities at the INEL. This includes the following:

- Systematic analysis of jobs to be performed
- Derivation of learning objectives from the analysis which describes desired performance after training
- Design and implementation of training based on learning objectives
- Evaluation of trainee mastery of objectives during training

TABLE 13-2. TRAINING REQUIRED UNDER THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA).

REGULATION NUMBER	REGULATION NAME	REGULATION TRAINING SUMMARY
29 CFR 1910.95 29 CFR 1926.52 DOE 5480.10	Occupational Noise Exposure	Requires individuals potentially exposed to noise levels above 85 dBA-8 hr time-weighted average (TWA) [80 dBA (DOE, 1985)] to receive training on hazards of noise and preventive measures.
29 CFR 1910.96 DOE RCM	Ionizing Radiation	Requires training of individuals to work safely in and around radiological areas; and training to maintain individual radiation exposures and radiation exposures to others as low as reasonably achievable (ALARA).
29 CFR 1910.119	Process Safety Management of Highly Hazardous Chemicals	Requires training of process operators for any process which involves a specified chemical above threshold quantity. Training must include hazards, operating procedures, safe work practices, and emergency operations.
29 CFR 1910.120	Hazardous Waste Operations & Emergency Response	<ol style="list-style-type: none"> 1. 40-Hour initial training for work on uncontrolled hazardous waste sites; 3 days supervised onsite experience. 2. 24-Hour initial training for work on hazardous waste site where no exposure above established exposure limits is anticipated; 1 day supervised onsite experience. 3. 8-hour annual update. 4. 8-hour supervisor training.
29 CFR 1910.120	Emergency Response for Chemical Spill Cleanup Teams	Requires initial 24-hour training/8-hour update for chemical release cleanup crew.
29 CFR 1910.134	Respiratory Protection	Requires fit testing and training in use of specific respirator type for potential respirator user.
29 CFR 1910.146	Confined Space Entry	Requires training for entry into confined spaces.
29 CFR 1910.147	Lockout/Tagout	Requires training of employees who maintain moving equipment in lockout/tagout before equipment serviced.
29 CFR 1910.157	Fire Extinguishers	Requires training in use of fire extinguishers.
29 CFR 1910.1001 29 CFR 1926.58	Asbestos	Requires training/medical monitoring for individuals potentially exposed above asbestos action level.
29 CFR 1910.1025 29 CFR 1926.62	Lead	Requires training of individuals potentially exposed above lead action level.
29 CFR 1910.1030 29 CFR 1926.50	Medical Services & First Aid	Requires first aid-trained person at jobsite when emergency medical services not reasonably accessible. Requires training in bloodborne pathogens.
29 CFR 1910.1200 29 CFR 1926.59	Hazard Communication	Requires training in health hazards of chemicals to which worker potentially exposed.
29 CFR 1926.652	Trenching & Shoring	Requires training of individuals performing excavations requiring shoring before entry.

- Evaluation and review of training based on performance of trained personnel in the job setting.

All training shall be documented. Individuals who attend courses sign an attendance sheet. A copy of the attendance sheet is forwarded to the training coordinator responsible for logging the training into a master data bank. Each contractor maintains duplicate copies of all employee training records.

13.2.1 Specialized Activity Training

Training required for each activity may vary depending on hazards present. Training beyond general training provided to all employees will be included in each activity-specific Health and Safety Plan or workplan. This training may include the following: 40-Hour Hazardous Waste Management Training (HAZWOPER) and associated updates; respiratory protection to include respirator fit testing; first aid; confined space entry; lockout/tagout; and lead, asbestos, and radiation safety. Table 13-3 summarizes required training for workers on ERP projects.

INEL contractors manage respective training programs as described in training manuals or safety and health manuals, such as EG&G's *Environmental Restoration and Waste Management Department Health and Safety Program* (EG&G, 1993) and WINCO's *Training Information Manual* (WINCO, 1993a) and *Industrial Safety Manual* (WINCO, 1993b). These manuals address such topics as development of training program content; qualification of instructors; staff positions with certification requirements; methods for factoring operating experience into training programs; and methods for evaluation and improvement of the effectiveness of the training provided to operators, maintenance, and technical support personnel.

TABLE 13-3. SPECIALIZED ACTIVITY TRAINING.

TRAINING CATEGORY	GENERAL REMEDI- ATION WORKER	GENERAL D&D WORKER	RADIATION WORKER	HAZARDOUS WASTE SITE WORKER	HAZARDOUS WASTE SITE SUPERVISOR	ASBESTOS ABATEMENT WORKER	ASBESTOS ABATEMENT SUPERVISOR	LEAD ABATEMENT WORKER	HAZARDOUS MATERIALS RESPONSE TEAM
DOE Required Training ¹	R	R	R	R	R	R	R	R	R
Radiological Worker I	A	A	R	A	A	A	A	A	R
Radiological Worker II	A	A	R	A	A	A	A	A	A
Fire Extinguisher	R	R	R	R	R	R	R	R	R
Hazard Communication	R	R	R	R	R	R	R	R	R
Lockout/Tagout	A	A	A	A	A	A	A	A	A
Trenching & Shoring	A	NA	NA	A	A	NA	NA	NA	NA
Respirator	A	A	R	R	R	R	R	R	R
First Aid	A	A	A	A	A	A	A	A	A
Asbestos	NA	NA	NA	NA	NA	R	R	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	R	NA
24-Hour HAZWOPER	R	A	A	NA	NA	NA	NA	NA	NA
40-Hour HAZWOPER	A	A	A	R	R	NA	NA	NA	NA
8-Hour HAZWOPER Supervisor	NA	NA	NA	NA	R	NA	NA	NA	NA
24-Hour HAZMAT	NA	NA	NA	NA	NA	NA	NA	NA	R

A = As required for a specific operation

R = Required

NA = Not applicable, not required for operation

¹Basic Training required by DOE 5480.20.

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CHAPTER 14.0

HUMAN FACTORS

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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14.0 HUMAN FACTORS

This chapter discusses human factors engineering requirements of the United States Department of Energy (DOE); that is, issues involving human-machine design and layout and environmental factors affecting human performance. Task-centered human factors issues such as oversight, training, and procedures are discussed in Chapters 12, 13, and 15. Human reliability analysis is a subject in Chapters 5 and 11.

The policy of DOE is to ensure that appropriate human factors are considered in the design, operation, and maintenance of DOE's nonreactor nuclear facilities (DOE, 1989). The Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP) activities, including environmental remediation and decontamination and decommissioning (D&D), generally do not involve the design of new facilities, modification of existing facilities, or the risk of release of radioactive material offsite. However, when reliable human performance by an operating crew is important to safety, and in proportion to that importance-to-safety, DOE requires a systematic inquiry into the optimization of the design of the human-machine interface (DOE, 1992a). For ERP activities that are Hazard Category 3 or less than the Hazard Category 3 threshold, the importance of human factors is expected to be small, though there may be exceptions. If hazard analyses or accident analyses assume or require reliable human interaction to mitigate or prevent a significant hazard or accident, then the application of specific human factors considerations during planning, requirements analysis, design, and test and evaluation should be documented as described in this chapter.

Human factors engineering often is applied to the design of industrial equipment and protective clothing used in the workplace, as indicated in Table 14-1. Human factors are considered during preparation of the activity-specific Health and Safety Plan required by 29 CFR 1910.120 (DOL, 1993a) for hazardous waste operations. Routine application of human factors to mitigate common industrial hazards need not be described in the safety analyses.

14.1 Human Factors Identification

ERP activities in which human interaction is assumed or required to prevent or mitigate a significant hazard or accident will be identified from the analyses in Chapters 5 and 11. Human factors may become significant in activities including the following: potential hazards related to managing radioactive and hazardous wastes; release or spill of gases, liquids, and solids contaminated with radioactive and hazardous wastes; accidents involving some or all of the radioactive and hazardous waste inventories potentially generated and managed at the environmental remediation and D&D sites; and consequences of a major accident requiring the evacuation of the environmental remediation and D&D sites. Human factors can become significant to ERP personnel and may cause or contribute to improper handling of an accident involving radioactive or hazardous wastes from ERP activities. Proper procedures, adequate training, alertness during work, effective systems control, communications, and proper operation of equipment and machines are methods applied to avoid potential human errors during ERP activities.

TABLE 14-1. HUMAN FACTORS ENGINEERING IN THE DESIGN OF INDUSTRIAL EQUIPMENT AND FACILITIES.

HUMAN-MACHINE INTERFACE CONSIDERATIONS
<p>HUMAN PERFORMANCE CRITERIA AND REQUIREMENTS</p> <ul style="list-style-type: none"> • Operator needs/requirements • Number/types of personnel required • Knowledge, special skills, operator aids • Communication requirements • Decisions made by operators • Necessary operator interactions • Potential safety hazards • Concurrent emergency conditions
<p>MACHINE PERFORMANCE CRITERIA AND REQUIREMENTS</p> <ul style="list-style-type: none"> • Equipment/controls that fail in safe, closed, or neutral modes • Equipment that accommodates operator body dimensions, flexibility, strength • Control panels, worktables and counters, enclosures, seating, storage, and special clothing suitable for operators • Hand tool design and use • Accessible equipment and instrumentation • Cross coupling shall be avoided (electrical systems, pressurized breathing systems, air, liquid/hydraulic, pneumatic systems)

For each ERP activity, the hazard analysis (Chapter 5) and accident analysis (Chapter 11) should be carefully reviewed to determine the importance-to-safety of human-machine interactions. For example, the accident analysis should discuss failure modes of either equipment or personnel found to be particularly "important to safety."

Once specific equipment and human interactions important to safety are identified, the criteria, standards, and requirements pertaining to the design of respective man-machine interfaces should be listed. Applicable requirements from DOE 5480.23 (DOE, 1992a) and DOE 6430.1A, Section 1300-12 (DOE, 1989), should be listed. Criteria for meeting each requirement should be identified from human-factors engineering standards referenced by DOE, including the following:

- American National Standards Institute/Human Factors Society (ANSI/HFS, 1988), *Human Factors Engineering of Visual Display Terminal Work Stations*; February 4, Standard 100-88
- United States Department of Defense (DoD, 1989), *Human Engineering Design Criteria for Military Systems, Equipment, and Facilities*, March, MIL-STD-1472D
- Institute of Electrical and Electronic Engineers (IEEE, 1988), *Guide for the Application of Human Factors Engineering to Systems, Equipment, and Facilities of Nuclear Generating Stations*, October, Standard 1023
- Nuclear Regulatory Commission (NRC, 1981), *Guidelines for Control Room Design Reviews*, September, NUREG-0700

- Nuclear Regulatory Commission (NRC, 1985), *Human Engineering Guidelines for the Evaluation and Assessment of Video Display Units*, July, NUREG/CR-4227
- University of California Research Laboratory (UCRL, 1985), *Human Factors Design Guidelines for Maintainability of Energy Nuclear Facilities*, June, UCRL-15673.

A draft DOE Standard, *Human Factors Engineering Design Criteria* (DOE-STD-HFAC, undated) was distributed by DOE for interim use. The standard organizes and formats much of the material contained in human factors engineering standards for use in DOE facilities. Standards and criteria relevant to the human factors evaluation may be found in Occupational Safety and Health (OSHA) general industry and construction standards. Some examples include the following: 29 CFR 1926.200, *Accident Prevention Signs and Tags*; 29 CFR 1926.201, *Signaling*; 29 CFR 1926.416, *Lockout and Tagging of Circuits*; 29 CFR 1926.860, *Selective Demolition by Explosives*; 29 CFR 1910.119, *Process Safety Management of Highly Hazardous Chemicals*; 29 CFR 1910.144, *Safety Color Code for Marking Physical Hazards*; and 29 CFR 1910.147, *The Control of Hazardous Energy* (lockout/tagout). Additional human factors standards designated by DOE may be found indexed in DOE 5480.4 (DOE, 1991) under the topics *Industrial Safety* and *Industrial Hygiene*. The results of human factors engineering evaluations are interpreted in the context of complying with applicable radiological, chemical, and industrial safety requirements of DOE.

After significant human factors issues in Chapter 5 and 11 are identified and DOE-approved safety and health standards are reviewed to select applicable criteria for evaluating compliance, an examination of the environmental remediation or D&D facility (or applicable design documents if no facility exists) will be conducted to evaluate specific human factors engineering issues relevant to design. Deficiencies will be noted, and an evaluation made of the relevance of each deficiency; of the potential to mitigate each deficiency through administrative controls; and of deficiencies to be addressed by engineering design of facilities or equipment.

14.2 Engineering Design Considerations

If important-to-safety human factors are identified for an ERP activity, the process outlined in DOE 6430.1A (DOE, 1989) to integrate human factors engineering into system development shall be followed and documented in this section. This process proceeds through four phases: planning; requirements analysis; system design; and system test and evaluation. A human factors engineering program plan appropriate to the level of importance of a facility or system shall be developed. The plan shall detail the kinds of human factors engineering analyses and evaluations necessary for the design. Some key elements of this process include the following:

- Analyses of systems requirements appropriate to the importance of the system and the level of risk associated with system failure
- Systematic examination of needs and requirements of the system user

- Performance of analyses for systems important to safety to ensure that risks are minimized and directed to areas of human-machine function allocation task analysis
- Analyses of impact of error or of no action on safety
- Listing of worker needs and requirements, such as information and control requirements, knowledge requirements, worker aids, worker decisions, communication requirements, necessary worker interactions, and potential safety hazards
- Consideration of task conditions associated with high work load and/or emergency conditions
- Consideration of tasks performed concurrently, to a high degree of accuracy, in short time periods, and/or with a high degree of skill
- Inclusion of knowledgeable human factors engineers on design teams and design review teams
- Performance of tests and evaluations to verify that system can be operated and maintained by intended user personnel
- Planning of tests to observe the system under normal and abnormal procedures and scenarios
- Incorporation of findings from tests and evaluations into design
- Conduct of final testing after completion of system development.

The knowledge and experience of personnel actually using equipment and machines designed or selected for activities should be incorporated into system design. Personnel needs and requirements shall be systematically examined and used as part of the design process. Awareness of human versus machine capabilities must be considered during engineering design. Human factors engineering design considerations include performance criteria for both humans and machines. All equipment should have accessible and understandable safety features and be covered by a well-defined maintenance program.

The following two sections provide additional information on principles of human behavior related to safety and component arrangement that may be useful in the human factors evaluation of engineering design considerations when required for ERP activities.

14.2.1 Principles of Human Behavior Related to Safety

The following section paraphrases United States Department of Defense (DoD, 1981) guidelines for designing or selecting equipment which incorporates the human behavior aspect of human factors. These principles are considered applicable to engineering design considerations for ERP activities.

The principles in this section are based on how workers actually use equipment in the field, and on what may actually occur during equipment use. These principles address human error, misuse of equipment, and other behaviors that lead to unsafe actions. The following human behavior principles related to safety can be applied to any system design:

- Adequate equipment should be provided that is properly designed to do the task effectively to avoid increased risk and/or degraded performance that may result if equipment users modify equipment or violate procedures
- Procedures should be comprehensive, understandable, and require only tasks or operations within the physical and knowledge capabilities of affected personnel
- Equipment should be designed to more easily be used safely than unsafely, and to minimize the potential for and consequences of misuse
- Proposed controls of identified hazards should be evaluated to assess level of effectiveness
- When appropriate, realistic tests with mockups and prototypes to verify that the system will work should be conducted
- Equipment should be designed and procedures written to take advantage of operator expectations to minimize errors
- Equipment should be designed to minimize the necessity for warnings on the equipment or in operations manuals
- Training protocols should be established to ensure quality and promote standardization. Identification of hazards and an explanation of potential consequences of unsafe behavior should be addressed in training
- Equipment should be designed to be inherently safe to use, rather than relying on special safety training to prevent accidents
- Sound engineering principles, management support, approved procedures, and job-specific training for equipment, tools, or processes should be ensured
- Designers should provide complete, legible, understandable identification of parts potentially damaged or injurious if incorrectly identified
- If used, checklists should be verified for clarity and completeness
- Equipment that is easy to use and maintain should be chosen.

In summary, designers should consider that most safety problems in operational equipment arise not from defects in the equipment, but because of improper use. Therefore, designers must strive to anticipate how equipment might be misused, and to design so misuse becomes unlikely and effects of misuse are not catastrophic.

14.2.2 Component Arrangement

All controls and displays used as part of the ERP system shall be designed to promote efficient use of task-related components, rapid location, and operator awareness. The following are some of the component arrangement concepts to be considered in the design or selection of equipment for use during ERP activities (DOE, 1989):

- Components should be grouped on the basis of specific criteria for tasks to be accomplished. Alternative groupings, based on the sequence or frequency of use, should be considered
- Groupings by graphic-spatial methods such as demarcation and spacing of components should be emphasized
- Components should not be hidden within a component grouping
- A mirror image arrangement of components should be avoided
- Displays should be placed above and close to the related control
- When several components related by flow direction (valve-pump-valve) are placed in sequence, the direction of the sequence (top-to-bottom, left-to-right) should be consistent for each similar situation
- Component grouping techniques, system mimics, and system demarcation should be labeled in a hierarchical manner
- Component control actuation mode should be simple (on/off/auto)
- Labels on all components should be legible and conform to human visual capabilities
- Equipment and safety-related parts of equipment should be identified by approved labels. The label must state clearly and concisely the function and purpose of the item
- Labels should be easily understood and label design should be consistent.

14.3 Environmental Considerations

If reliable, correct, and effective human-machine interactions are identified in Chapter 5 or 11 as important to safety, then the work environment factors that might degrade the performance of operations personnel are described in this chapter. Work environment factors to be considered

include physical access, the need for protective clothing or breathing apparatus, noise levels, temperature, humidity, distractions, and other factors bearing upon physical comfort, alertness, or fitness. Some factors are covered by codes and standards for which DOE 5480.4 (DOE, 1991) requires compliance. Examples of construction safety and health regulations that address environmental work factors include 29 CFR 1926.56, *Illumination*; 29 CFR 1926.28, *Personal Protective Equipment*; 29 CFR 1926.52, *Occupational Noise Exposure*; 29 CFR 1926.53, *Ionizing Radiation*; 29 CFR 1926.103, *Respiratory Protection*; 29 CFR 1926.353, *Ventilation and Protection in Welding, Cutting, and Heating*; and 29 CFR 1910.146, *Confined Space Entry*. Methods to be used to comply with these regulations, particularly the use of personal protection equipment (PPE) and necessity for confined space entry, are addressed in activity-specific Health and Safety Plans.

14.3.1 Potential Human Performance Impairing Factors

The safe conduct of ERP activities requires that involved personnel be alert, aware of responsibilities, and qualified to perform required tasks. Environmental conditions that can impair human performance and may be associated with ERP activities include the following:

- Extreme weather conditions resulting in heat stress or hypothermia
- Poor lighting
- Use of PPE to protect against radiation and hazardous materials
- High levels of noise or vibrations that irritate or distract personnel.

The human factors considerations in controlling environmental conditions will be addressed in the Health and Safety Plan prepared for each ERP activity. This plan specifies procedures for work in extreme weather, reducing high noise levels, operational approaches including work/rest regimens to mitigate heat stress, and minimum illumination levels.

The following two sections summarize human factors considerations relevant to PPE use and confined space entry to ensure that these considerations are addressed appropriately in the Health and Safety Plan.

14.3.2 Personal Protective Equipment (PPE)

Human factors considerations in the use of PPE during ERP activities should be addressed. The use of PPE generally limits ability to work over extended periods. Work breaks alleviate heat stress or discomfort caused by wearing PPE. Tasks requiring a high degree of manual dexterity may be impacted adversely by the use of PPE and should be assessed for human factors implications.

Health and Safety Plans should address required PPE and installation of emergency showers and eyewashes at each ERP site. DOE Order 6430.1A (DOE, 1989) requires the following human factors considerations regarding PPE:

- Proper garments and breathing apparatus should be used
- PPE should minimize impairment of operational performance and provide adequate tactile sensitivity and ability to see, reach, move, communicate, and hear
- All PPE shall be stored in easily accessible areas around ERP sites and inspected periodically to verify good condition
- PPE shall provide the intended level of protection and be comfortable to the user while working.

Personnel shall be trained in proper selection, use, maintenance, and storage of PPE and obtain medical approval for use in accordance with 29 CFR 1910 (DOL, 1993b). The review and approval process for the activity-specific Health and Safety Plan provides a technical endorsement of specified PPE for intended use conditions.

14.3.3 Confined Space Entry

If confined space work is required during ERP activities, then appropriate human factors considerations should be applied. These human factors considerations can be found in guidelines issued by the American National Standards Institute (ANSI, 1989), and in Occupational Safety and Health Administration (OSHA) regulations in 29 CFR 1910.146 (DOL, 1993b). Entry to confined spaces is controlled by a permit issued under contractor procedures that comply with OSHA regulation 29 CFR 1910.146.

14.4 Document Development Considerations

Human factors in the preparation, approval, and implementation phases of procedures and training are addressed in Chapter 13.

If reliable human performance is identified as important to safety, then the human factors engineering program plan described in Section 14.2 shall indicate, if appropriate, that the procedures and training developed for that equipment shall be reviewed by a human factors engineer.

14.5 Performance Considerations

This section is reserved for special evaluations of the ability of ERP personnel to accomplish safety responsibilities under emergency or accident conditions. Special evaluations could include simulated operations testing. Such special evaluations are not expected for the Hazard Category 3 or less than the Hazard Category 3 threshold ERP activities within the scope of the BSAF.

If necessary, occurrence report data may be used to establish the ability of facility staff to fulfill responsibilities in potential accident environments. This reliability assessment can be focused on human performance specified in Chapter 11 to prevent or mitigate significant hazards. A list of required actions from Chapter 11 can be compared with the text of root cause analysis sections of occurrence reports to determine the frequency that human

error is cited in occurrence reports as causing failures in operations involving similar required behavior. A larger database for this determination of reliability can be obtained if occurrence reports below the threshold for reporting under DOE 5000.3B (DOE, 1992b) (and its precursor 5000.3A) are used. Furthermore, occurrence reports for other similar facilities operated by DOE may be used.

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CHAPTER 15.0

INITIAL TESTING, INSERVICE SURVEILLANCE, AND MAINTENANCE

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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15.0 INITIAL TESTING, INSERVICE SURVEILLANCE, AND MAINTENANCE

The following sections of Chapter 15 describe initial testing, inservice surveillance, and maintenance for Environmental Restoration Program (ERP) activities, including environmental remediation and decontamination and decommissioning (D&D), at the Idaho National Engineering Laboratory (INEL).

Initial testing will be performed and documented to ensure performance as designed and the adequacy of the systems, components, and facilities involved in ERP activities. Initial testing will be conducted on new systems, components, and facilities before placement in service. Inservice surveillance and maintenance will be performed after the systems, components, and facilities are placed into service to ensure continued safe function and operation. At a minimum, the inservice surveillance will document material conditions that indicate deterioration or improper operation; unsafe conditions; and apparent failures of components and safety equipment. Systems, components, and facilities will be maintained in a manner which promotes operational safety, worker health, environmental protection and compliance, property preservation, and cost-effectiveness.

ERP projects generally will be treated as construction sites subject to the applicable requirements of 29 CFR 1926 (DOL, 1993). This regulation includes requirements for construction equipment, environmental controls, underground construction, demolition, and other related safety issues. Life safety requirements for this type of construction project differ from requirements for general industrial structures in normal operation.

Generally, standard industrial and manufacturer-recommended initial testing, inservice surveillance, and maintenance will be sufficient for Hazard Category 3 or less than the Hazard Category 3 threshold ERP activities, within the scope of this Baseline Safety Analysis File (BSAF).

15.1 Initial Testing

15.1.1 Initial Testing and Inspection of New Facilities

Initial testing and inspection will be conducted to analyze new systems, components, or facilities to ensure that basic design and safety specifications are satisfied. Initial testing and inspection will include the following elements:

- Compliance with design plans and configuration specifications
- Compliance with system and component operational specifications
- System and component material and manufacturer requirements
- Proper operation of safety devices and monitoring and alarm devices
- Operational capacities, speeds, throughputs

15.1.2 Operational Readiness Reviews and Readiness Assessments

To demonstrate safety for startup (or restart) of an environmental remediation or D&D activity, an independent review of readiness will be conducted as required by United States Department of Energy (DOE) 5480.31, *Startup and Restart of Nuclear Facilities* (DOE, 1993). DOE 5480.31 includes requirements for Operational Readiness Reviews and Readiness Assessments that may be required dependent on the hazard category of the activity.

For environmental remediation and D&D activities within the scope of the BSAF, Operational Readiness Reviews are required as follows:

- For the initial startup of new Hazard Category 3 activities
- For the restart of an activity after an unplanned shutdown directed by a DOE management official for safety, or because of operations outside the safety basis
- When deemed appropriate by DOE management officials.

An Operational Readiness Review is a disciplined, systematic, documented, performance-based examination of facilities, equipment, personnel, procedures, and management control systems to ensure that an activity will be conducted safely within the approved safety envelope as defined by the activity safety basis. Operational Readiness Reviews require preparation of a formal plan-of-action, Operational Readiness Review Implementation Plan, and Final Report. The resolution of all findings from the Operational Readiness Review must be documented and maintained with the plan-of-action, Implementation Plan, and Final Report. The Operational Readiness Review must be detailed and at least meet the minimum core requirements included in Attachment 2 of DOE 5480.31 (DOE, 1993). These requirements include, but are not limited to the following:

- Determination whether design and construction of facility meet required engineering and safety standards
- Development of procedures and documentation to ensure correct and safe operations of the facility or system
- Documentation of qualification of personnel and implementation of training program
- Facility safety documentation including a program to confirm and periodically reconfirm the condition and operability of the safety system
- Systematic review of the facility conformance to applicable DOE Orders including a compliance schedule for cases of identified nonconformance
- Establishment and implementation of emergency procedures program and maintenance of records

- Adequate startup or restart test program which simultaneously confirms operability of equipment, viability of procedures, and the training of operators
- Review of facility modifications to identify potential impacts on procedures, training, and qualifications.

The DOE-STD-3006-93, *Planning and Conduct of Operation Readiness Reviews (ORRs)* provides additional guidance for the development and conduct of ORRs as required by DOE 5480.31 (DOE, 1993).

For startups and restarts of environmental remediation and D&D activities not requiring an Operational Readiness Review, the need for a Readiness Assessment will be assessed in accordance with DOE-Idaho Operations Office (DOE-ID) procedures. Readiness Assessments follow a graded approach and may be short and simple for environmental remediation and D&D activities below the Hazard Category 3 threshold.

15.2 Inservice Surveillance

15.2.1 Scope

Inservice surveillance is conducted to ensure that systems or components are operating in a safe manner and as intended for the operation involved; and to identify any existing or potential problems which could present a safety hazard to personnel, a threat to the environment, or damage to equipment. Requirements for inservice surveillance or inspections of hazardous waste storage areas are contained in 40 CFR 265.174 (EPA, 1993) for containers (such as, 55-gallon drums, overpacks, and portable tanks) and in 40 CFR 265.195 for tank systems (underground and aboveground). The scope of inservice surveillance will cover equipment, systems, or components involved in ERP activities. This includes instrumentation used to monitor areas for health and safety hazards such as radiation, airborne hazardous chemicals, and fires. Normal construction-type activities not involving any risks beyond that normally encountered in construction work, will not require inservice surveillance (for example, removal of soil contaminated with low levels of hazardous materials or demolition of a building with low levels of contamination, not involving any specialized equipment or controls).

The level of surveillance required will be dependent on the type of system and components involved (for example, pumps, compressors, or high-pressure gas cylinders); the level of risk involved (that is, the type and amount of contaminants and hazardous materials involved); and the life cycle of the activity (short term vs. long term). Specific requirements for the type of instrumentation and inspections required will depend on the individual project. These requirements will be included in the Health and Safety Plan, the operations and maintenance plan, or the system operating procedure. Requirements for conduct of inservice surveillance are contained in the *EG&G Maintenance Management Program Requirements Manual* (EG&G, 1992); the MK-FIC Procedure, "Quality Assurance Surveillance" (MK-FIC, 1993); and the WINCO Standard Operating Procedure No. WE-20, "Preventive Maintenance Activities" (WINCO, 1990).

15.2.2 Schedule

Inservice surveillance activities will follow an approved schedule based on the hazards involved and any applicable codes or regulations. The potential hazards associated with specific equipment and systems, type of contamination present, and level of exposure to personnel will be factored into the schedule. Schedules for inservice surveillance will be developed as part of a system's or facility's operation and maintenance plan, or will be prepared as part of procedures required for the continued operation of facility equipment.

Table 15-1 provides examples of items to be included in a surveillance schedule and suggested frequency of inspections for those items. This table should be augmented with sufficient description and notes to ensure that adequate instruction is provided for personnel to perform the necessary surveillance actions. Inspection frequency will depend on potential hazards involved with a particular system or facility. Information in Table 15-1 is provided to demonstrate examples of best management practices, and is not required by regulations, with the exception of inspections for hazardous waste containment and storage systems. Each surveillance requirement shall be performed within the specified time interval with a maximum extension of 25% of the specified interval between any two consecutive surveillances.

Each surveillance requirement will be evaluated concerning resultant safety effects and required actions to return to a safe operating condition if the surveillance requirement is not performed as specified. Resulting actions from nonperformance of surveillance requirements will be dependent on the specific potential hazard risks associated with nonperformance.

15.2.3 Compliance with Applicable Codes and Standards

Inservice surveillance schedules and activities will include adequate inspections for determination if systems or equipment are being operated in compliance with applicable codes and standards. Included in these inspections will be operating equipment that could affect compliance with applicable regulations relating to worker safety and environmental conditions.

15.3 Maintenance

15.3.1 Compliance with DOE Order 4330.4A, *Maintenance Management Program*

DOE 4330.4A (DOE, 1990) provides policy and objectives for the establishment of programs for management and performance of maintenance and repair of DOE property, which includes facilities. The basic policy follows:

- Maintenance management programs for all DOE facilities shall be consistent with DOE 4330.4A
- Property shall be maintained to promote operational safety, worker health, environmental protection and compliance, property preservation, and cost-effectiveness

TABLE 15-1. EXAMPLES OF SCHEDULED SURVEILLANCE ACTIONS AND FREQUENCY.

ITEM	INSPECTION ACTION	INSPECTION FREQUENCY
Radiation Detection Instrumentation	Check calibration date/verify operation	Daily
Organic Vapor Detector (% LEL monitors)	Check calibration date/verify operation	Daily
Fire/Smoke Detectors	Check operation	Weekly
Fire Suppression Systems	Check operation	Monthly
Treatment System Alarms	Check status/operation	Daily - Hazardous waste operations Weekly - Nonhazardous operations
Hazardous Waste Storage/Containment Structures	Inspect condition of structure for signs of leakage	Daily
Nonhazardous Waste Storage/Containment Structures	Inspect condition of structure for signs of leakage	Weekly
High Efficiency Particulate Air (HEPA) Filter, Sand Bed, or Cartridge Filter	Verify differential pressure within operating limits	Daily
Pumps	Verify discharge pressure/differential pressure/flowrate within operating limits	Daily - Hazardous waste operations Weekly - Nonhazardous operations
Charcoal Filter	Verify removal efficiency is within operating limits	Weekly
Alarms (High level, low flow)	Verify operation	Daily - Hazardous waste operations Weekly - Nonhazardous operations
Piping Systems	Verify proper valve alignment/no leakage	Daily - Hazardous waste operations Weekly - Nonhazardous operations
Automatic Control Systems	Verify proper setting (auto/hand/off) and operation	Daily - Hazardous waste operations Weekly - Nonhazardous operations
Battery Backup	Verify charging system operation/batteries holding charge	Weekly Weekly
Diesel Generator	Verify fuel tank full/generator operation	Weekly Monthly

- Structures, components, and systems important to safe operation of a property or facility shall be subject to a maintenance program
- Periodic examination of structures, systems, components, and equipment shall be performed to determine deterioration or technical obsolescence.

Included among the objectives of the maintenance policy are the assurance of the reliability, safety, and operability of structures, systems, and components; and the assurance of compliance with current environmental, safety, and health standards. Furthermore, a graded approach by line management in development and implementation of maintenance programs is stipulated.

A maintenance program as required by DOE 4330.4A (DOE, 1990) will be developed, implemented, and documented to ensure that maintenance activities are conducted to preserve or restore the availability, operability, and reliability of structures, systems, and components important to safe and reliable operation of ERP activities. Periodic examinations to determine whether deterioration has occurred and to identify and address technical obsolescence that threatens performance, safety, or facility preservation will be included, if necessary. The maintenance program will consist of maintenance plans or procedures structured to satisfy the requirements of DOE 4330.4A and supplemented by specific stipulations relating to particular equipment requirements. Requirements of acceptance are contained in EG&G's *Maintenance Management Program Requirements Manual* (EG&G, 1992) and WINCO's *WINCO Maintenance Management Program* (WINCO, 1992).

15.3.2 Limitations on Routine Maintenance and Repair on Components Important to Safety

Since engineered safety features and safety class structures, systems, and components are not expected to be required for Hazard Category 3 or less than the Hazard Category 3 threshold activities, ERP activities, plans, provisions, or compensatory actions developed to prevent the limitations of maintenance and repair from degrading safety will not normally be required. Required compensatory actions related to limitations on the maintenance and repair of systems or equipment required to ensure worker safety will be included as part of the radiation protection and hazardous material protection programs (Chapters 9 and 10).

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CHAPTER 16.0

DERIVATION OF TECHNICAL SAFETY REQUIREMENTS

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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16. DERIVATION OF TECHNICAL SAFETY REQUIREMENTS

This chapter describes the derivation of the Baseline Technical Safety Requirement (TSR) File from the Baseline Safety Analysis File (BSAF). Presented in Section 16.1 is the methodology, including criteria, used to derive the Baseline TSR File. The methodology is applicable and should be used to derive additional required TSRs, based on activity-specific safety analysis documentation. Activities whose radioactive material inventory is less than the Hazard Category 3 threshold criteria do not require TSRs as discussed in Section 16.1.2. Section 16.2 identifies commitments made in each BSAF chapter that meet the criteria for a TSR. Section 16.3 consolidates and summarizes TSRs required by BSAF commitments.

The Baseline TSR File is intended to be used as a template and to serve as the starting point for developing TSRs required for individual Hazard Category 3 environmental remediation and D&D activities. The Baseline TSR File must be reviewed for applicability to individual activity safety bases and revised as needed. This may include the deletion or modification of the Baseline TSR File administrative controls. The individual activity safety bases must be reviewed to determine whether additional TSRs not in the Baseline TSR File are needed for the specific activity.

16.1 Technical Safety Requirement Derivation Methodology

After presenting TSR background information in Section 16.1.1, this section describes the methodology for derivation of TSRs for Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP) activities which include environmental remediation and decontamination and decommissioning (D&D). This methodology is applicable to deriving TSRs from the BSAF or from activity-specific safety analysis documentation.

16.1.1 DOE 5480.22 Requirements and Guidelines

TSRs are defined in United States Department of Energy (DOE) 5480.22 (DOE, 1992a) as "those requirements that define the conditions, safe boundaries, and the management or administrative controls necessary to ensure the safe operation of a nuclear facility and to reduce the potential risk to the public and facility workers from uncontrolled releases of radioactive materials or from radiation exposures due to inadvertent criticality." DOE 5480.22 states that TSRs are composed of the following:

- Use and Application - section of the TSR document that contains definitions of terms, operating modes, frequency notations, and actions to be taken in the event of violation of TSR operating limits or surveillance requirements
- Safety Limits (SLs) - limits on process variables associated with those physical barriers, generally passive, that are necessary for the intended facility function and which are found to be required to guard against the uncontrolled releases of radioactive and other hazardous materials

- Operating Limits
 - Limiting Control Settings (LCSs) - safety system settings that control process variables to prevent exceeding SLs
 - Limiting Conditions for Operation (LCOs) - lowest functional capability or performance level of safety-related structures, systems, components, and support systems required for normal safe operation of the facility
- Surveillance Requirements (SRs) - requirements relating to test, calibration, or inspection to ensure that the necessary operability and quality of safety-related structures, systems, components, and support systems required for safe operation of the facility are maintained
- Administrative Controls - provisions relating to organization and management, procedures, recordkeeping, reviews, and audits necessary to ensure safe operation of the facility
- Appendices
 - Basis Appendix - provides summary statements of the reasons for the operating limits and associated surveillance requirements. The basis shows how the numeric value, the condition, or the surveillance does fulfill the purpose derived from the safety documentation
 - Design Features Appendix - describes passive design features of the facility that, if altered or modified, would have a significant effect on safe operation.

Attachment 1, "Guidelines for Technical Safety Requirements," to DOE 5480.22 (DOE, 1992a), recognizes that the number and type (that is, SL, LCO, administrative control) of TSRs required will depend on the hazards posed by and the complexity of the DOE facility or operation. For DOE nonreactor nuclear operations with very limited or no engineered systems, Attachment 1 states that safety control of operations is through worker protection programs and/or environmental protection programs rather than TSRs. An example for this kind of operation is an environmental restoration project involving cleanup of radioactive contamination.

16.1.2 BSAF TSR Basis

In accordance with DOE 5480.22 (DOE, 1992a), TSRs are based on the activity-specific safety analysis report (SAR). The TSRs set forth the operating limits and surveillance requirements; the basis of the requirements; safety boundaries; and management or administrative controls necessary both to protect the health and safety of the public and to minimize the potential risk to workers from the uncontrolled release of radioactive or other hazardous materials and from radiation exposure due to inadvertent criticality. Since the BSAF provides the safety basis common to ERP activities and will be

incorporated by reference into activity-specific safety analyses documentation, the BSAF is the basis of the Baseline TSR File that will be used to develop activity-specific TSRs.

Since the BSAF is intended to cover ERP activities that only pose a significant localized hazard (that is, Hazard Category 3) or are below the DOE-STD-1027-92 (DOE, 1992b) Hazard Category 3 thresholds, BSAF TSRs are not required to protect the health and safety of the public, but are primarily to minimize the worker risk from uncontrolled releases of radioactive or other hazardous material. Because activities that pose criticality hazards are classified Hazard Category 2, BSAF TSRs are not required to protect against inadvertent criticalities.

The Baseline TSR File is limited to administrative controls. This results since there are four criteria, any one of which identify requirements in the safety analysis that may require SLs, LCSs, or LCOs. The following are the criteria:

- Prevention - requirement to monitor a process variable or confinement barrier assumed in the safety analysis necessary to prevent an enveloping accident sequence that may result in a release of radioactive material and surpass established consequence criteria
- Initial Condition - process variable under the control of the operator and a key initial condition of the enveloping safety analysis as documented in the SAR
- Mitigation - structure, system, or component assumed in the enveloping safety analysis to function or actuate to mitigate an enveloping accident scenario
- Process variable, structure, system, or component of primary importance in limiting the likelihood or severity of an accident sequence that dominates risk.

Section 4.4 of the BSAF states that engineered safety features (ESFs) and safety class structures are not expected for those activities covered by the BSAF. That is, by definition of Hazard Category 3, the unmitigated release of available radioactive or hazardous materials has only the potential for localized consequences and should not generally require ESFs or safety class structures. Therefore, SLs, LCSs, LCOs, and associated SRs are normally not required. Only administrative controls are normally necessary for activities covered by the BSAF.

In addition, ERP activities below the DOE-STD-1027-92 Hazard Category 3 threshold (DOE, 1992b) pose risk to workers below that for Hazard Category 3 activities and are exempt from the safety analysis requirements of DOE 5480.23 (DOE, 1992c). Therefore, these activities require no TSRs. That is, while the administrative controls required by the BSAF may be applicable to these activities, they are not TSRs.

16.1.3 BSAF TSR Identification Methodology

The Baseline TSR File (that is, administrative control) is derived from an evaluation of commitments in the BSAF. BSAF commitments are defined as follows:

Any concept in the BSAF that (1) establishes guidelines for the operation, reliability, availability, or maintainability of any system or subsystem that is required for safe operation of a facility within the risk accepted by DOE; (2) limits the risk accepted by DOE; (3) establishes (directly or indirectly by reference) a parametric value that if changed could increase the risk relative to the safety or protection of workers, the public, or the environment.

The BSAF commitments are evaluated using the following questions (criteria) to identify those commitments that require incorporation into the Baseline TSR File or activity-specific TSRs that follow. To identify additional required TSRs, the methodology and criteria for administrative TSRs that follow should be applied to activity-specific SARs for Hazard Category 3 ERP activities that reference the BSAF. One or more questions answered "yes" should be included as a TSR or a requirement within a TSR.

1. Does the commitment identify requirements with respect to personnel responsibilities, organization, staffing, support, qualification, or training necessary to ensure the activity is conducted safely?

Personnel's responsibilities and organization define who is responsible for the safe conduct of an activity and the chain of command. Staffing, support, qualification, and training define the appropriate personnel required to be at the work site and the required level of qualification for each position. Support may include personnel not directly essential on the work site, but potentially necessary if technical difficulties arise.

2. Does the commitment identify programmatic requirements relied upon for safe conduct of an activity (for example, radiation protection program)?

Some programs are implemented by procedure as these programs address requirements not related to safety (for example, audits and reporting). This criterion identifies those programs important to safe operation of an activity that should be elevated to a TSR level.

3. Does the commitment identify aspects of an activity that could affect the activity hazard classification?

Hazard classifications of some activities may change if the total inventory at a site is combined or if the hazard classification is based on inventories near the appropriate thresholds and an unexpected concentration is found. These situations should be controlled to ensure that the safety analysis remains an enveloping document. (Note: Commitments requiring administrative control TSRs to ensure the hazard classification of an activity will be located and maintained in activity-specific safety analyses documentation.)

4. Does the commitment identify reviews, audits, and reporting requirements considered to be important to ensuring safety?

Generally, these programs are implemented by procedure and need only be elevated to a TSR if important to ensuring safety.

Table 16-1 presents the above criteria as a checklist. A "yes" to one or more criteria makes the commitment a TSR. The BSAF commitments in each BSAF chapter are first evaluated independently (Section 16.2). A summary of BSAF commitments that require TSRs is then prepared that consolidates the commitments according to the suggested format in the guidelines attached to DOE 5480.22 (DOE, 1992a) to eliminate duplication.

Typically, compliance with administrative TSRs must occur at all times. However, circumstances may exist that dictate an administrative TSR need only be met at a certain time under specific conditions. This should be identified in the TSR.

TABLE 16-1. ADMINISTRATIVE CONTROL COMMITMENT CRITERIA

YES	NO	CRITERIA	
☐	☐	1.	Does the commitment identify requirements with respect to personnel responsibilities, organization, staffing, support, qualification, or training necessary to ensure the activity is conducted safely?
☐	☐	2.	Does the commitment identify programmatic requirements relied upon for safe conduct of an activity (for example, radiation protection program)?
☐	☐	3.	Does the commitment identify aspects of an activity that could affect the activity hazard classification?
☐	☐	4.	Does the commitment identify reviews, audits, and reporting requirements considered to be important to ensuring safety?

16.2 Baseline TSR File Derivation

This section presents the results of applying the TSR derivation methodology described in Section 16.1 to the BSAF. That is, the database of

BSAF commitments was evaluated against the criteria in Table 16-1 to identify those BSAF commitments that should be administrative control TSRs. The list of BSAF commitments and documentation of the complete evaluation process is contained in Appendix 16A.

Since the BSAF commitments are organized by BSAF chapter, the review and this section are organized in the same order as the 21 BSAF chapters. For each BSAF chapter, this section independently identifies commitments meeting one or more of the criteria for administrative control TSRs. Within each chapter, similar or related BSAF commitments requiring inclusion as administrative control TSRs are consolidated. Based on these identified commitments from each BSAF chapter, a consolidated list of commitments that meet the criteria for administrative controls are presented in Table 16-2, organized by the topics suggested in Attachment 1 to DOE 5480.22 (DOE, 1992a) for administrative controls.

16.2.1 Chapter 1 - Executive Summary

No commitments are contained in this chapter. This chapter discusses the purpose, scope, limitations, and use of the BSAF; provides an overview of the INEL ERP; and provides guidelines for the format and content of the Executive Summary in activity-specific safety analysis documentation.

16.2.2 Chapter 2 - Applicable Statutes, Rules, Regulations, and Departmental Orders

Commitments requiring an administrative TSR include a process safety management program in compliance with 29 CFR 1910.119 (DOL, 1993a) for activities that use hazardous materials in excess of established thresholds and the establishment of a health and safety program in compliance with 29 CFR 1910.120 (DOL, 1993b).

16.2.3 Chapter 3 - Site Characteristics

No TSRs are required by the commitments in this chapter. Chapter 3 provides a description of the site location, demography, regional and local meteorology, nearby facilities, land use, hydrology, and geology and seismology. The commitments in this chapter establish design criteria and information and parameters for use in the hazard and accident analyses, but can not be controlled to any significant extent and, therefore, are not appropriate for inclusion as TSRs.

16.2.4 Chapter 4 - Facility Description and Operation

One commitment in this chapter necessitates an administrative TSR for a surveillance and maintenance program for surplus facilities awaiting D&D. Another commitment requires that other supporting facilities, services, and utilities necessary to perform the activity be identified and maintained.

16.2.5 Chapter 5 - Hazard Analysis and Classification of the Facility

No commitments are contained in this chapter that provides guidelines for identifying the inventory of radioactive and hazardous material at

TABLE 16-2. BSAF ADMINISTRATIVE TSRS

ADMINISTRATIVE TSR	DESCRIPTION
1. Contractor Responsibility	Defines responsibilities of the project manager, field supervisor, health and safety officer, and site personnel as appropriate for the activity.
2. Contractor Organization	Defines the relationship of the responsible personnel identified in "1" and the relationship to other supporting facilities, services, and utilities required to ensure safety.
3. Procedures	Requires written procedures covering normal, abnormal, and emergency conditions, and surveillance, testing, and maintenance.
4. Programs	Requires programs to be in place as appropriate for the activity such as radiation protection program; industrial safety program; industrial hygiene program; quality assurance program; document control program; initial testing, inservice surveillance, and maintenance program; emergency response program; health and safety program; and process safety management program.
5. Minimum Operations Shift Complement	BSAF does not identify the minimum number of responsible personnel that must be at the activity site for safe operation. (Note: The minimum number of shift personnel will be established in the activity-specific SAR or Health and Safety Plan).
6. Operating Support	Defines the technical support required for safe operation including, but not limited to, support in the areas of waste storage, treatment, and disposal; transportation; fire protection; security; and emergency response.
7. Qualification and Training	Defines the minimum acceptable personnel qualifications and the training program for participation in ERP activities.
8. Operability Definition and Implementation Principles	Not normally applicable since engineered safety systems and safety class systems and components are not expected to be required for ERP activities classified as Hazard Category 3.
9. Technical Safety Requirement Basis Control	Defines document control requirements for the BSAF, activity-specific SAR, and the activity-specific TSR; and the requirements for annual BSAF and activity-specific SAR updates.
10. Review and Audits	Requires that self assessment, independent review, and appraisal of performance; operational readiness reviews; and unreviewed safety question reviews will be conducted as appropriate. Those activities that involve common construction equipment and procedures are exempt.
11. Reporting Requirements	Defines reporting requirements for emergencies, unusual occurrences, and offnormal occurrences.

environmental remediation and D&D sites, for hazard analysis, and for classification of the facility or activity.

16.2.6 Chapter 6 - Principal Health and Safety Criteria

Commitments in this chapter that require an administrative TSR include a radiological control program, an industrial hygiene program, emergency operation procedures, staff qualifications, and a training program.

16.2.7 Chapter 7 - Radioactive and Hazardous Material Waste Management

Commitments identified in this chapter that require an administrative TSR include a radiological control program and an industrial hygiene program.

16.2.8 Chapter 8 - Inadvertent Criticality Protection

No commitments are contained in this chapter that provides guidelines for demonstrating that the inventory of fissile material for the activity does not pose a criticality safety concern. This chapter is limited to this scope since activities that pose a criticality concern are classified as Hazard Category 2 and are outside the scope of the BSAF.

16.2.9 Chapter 9 - Radiation Protection

Commitments identified in this chapter that require an administrative TSR include a radiological control program. Other commitments made are part of the radiological control program and include personnel responsibilities, monitoring, work area entry requirements, personnel protection equipment, personnel training and qualifications, and various other items.

16.2.10 Chapter 10 - Hazardous Material Protection

Commitments identify the need for a TSR that requires an industrial safety program. Other commitments included as part of this TSR are work permits and when they are required. Other commitments identify a TSR that requires an industrial hygiene program. This program includes ventilation requirements, response with respect to exceedance of an exposure limit, and specification of personal protective equipment. Two commitments require that a TSR for reviews and audits should include surveys to identify and evaluate health hazards, and recommend solutions to any deficiencies identified.

16.2.11 Chapter 11 - Analysis of Normal, Abnormal, and Accident Conditions

No commitments are contained in this chapter that provides guidelines for performing and documenting analysis of normal, abnormal, and accident conditions.

16.2.12 Chapter 12 - Management, Organization, and Institutional Safety Provisions

Commitments identify the need for a TSR for a minimum operations shift complement. This TSR states that at a minimum a project manager, field supervisor, health and safety officer, and site personnel are required for an environmental restoration project. Other commitments requiring an administrative TSR are procedures for a health and safety plan and a training program.

16.2.13 Chapter 13 - Procedures and Training

Commitments identified that require a TSR include procedures and training courses for the activity and for radiation workers. Others indicate

the need for a document control program to ensure that individuals have the most current copy of various procedures.

16.2.14 Chapter 14 - Human Factors

No commitments are contained in this chapter that provides guidelines for identifying the need for human factors analysis, and if a need is identified, provides guidelines on performing and documenting the analysis.

16.2.15 Chapter 15 - Initial Testing, Inservice Surveillance, and Maintenance

Commitments identified that indicate the need for a TSR include operability definition and implementation principles, a surveillance and maintenance program, and reviews and audits. These TSRs include requirements to ensure that systems are operable prior to conduct of associated activities.

16.2.16 Chapter 16 - Derivation of Technical Safety Requirements

Chapter 16 contains no commitments requiring TSRs as this chapter contains guidance on derivation of TSRs and identifies those commitments made in other chapters as administrative TSRs.

16.2.17 Chapter 17 - Operational Safety

Commitments in this chapter require administrative TSRs for contractor responsibilities; operability definitions and implementation principles; and procedures that address the conduct of maintenance, security, emergency response, and work area access control.

16.2.18 Chapter 18 - Quality Assurance

Commitments identified require TSRs for a quality assurance program that meets the requirements of DOE 5700.6C (DOE, 1991) and for contractor responsibilities for the implementation, assessment, and improvement of the program.

16.2.19 Chapter 19 - Emergency Preparedness

Commitments identified require TSRs for emergency response and training for emergency response procedures. Some commitments that are part of the TSR for emergency response procedures include reporting requirements, personnel responsibilities, and organization.

16.2.20 Chapter 20 - Provisions for Decontamination and Decommissioning

No commitments are identified that require administrative TSRs.

16.2.21 Chapter 21 - Applicable Facility Design Codes and Standards

No commitments are identified that require administrative TSRs.

16.3 Summary of BSAF Derivation of TSRs

Table 16-2 is a summary of the Baseline TSR File consolidated from Section 16.2 and Appendix 16A and organized by the topics suggested in Attachment 1 to DOE 5480.22 (DOE, 1992a). These administrative TSRs are further developed in the format required by DOE 5480.22 in a separate document, *Baseline Technical Safety Requirements File for Environmental Restoration Activities at the INEL*. These administrative TSRs apply to Hazard Category 3 ERP activities for which the BSAF is incorporated by reference.

16.0 REFERENCES

Department of Energy (DOE, 1991), *Quality Assurance*, DOE, Washington, D.C., DOE 5700.6C.

Department of Energy (DOE, 1992a), *Technical Safety Requirements*, DOE, Washington, D.C., Change 001 (9/15/92), DOE 5480.22.

Department of Energy (DOE, 1992b), *Hazard Characterization and Accident Analysis Techniques for Compliance with DOE Order 5480.23, Nuclear Safety Analysis Reports*, DOE, Washington, D.C., DOE-STD-1027-92.

Department of Energy (DOE, 1992c), *Nuclear Safety Analysis Reports*, DOE, Washington, D.C., DOE 5480.23.

Department of Labor (DOL, 1993a), *Process Safety Management of Highly Hazardous Chemicals*, U.S. Government Printing Office, Washington, D.C., 29 CFR 1910.119.

Department of Labor (DOL, 1993b), *Hazardous Waste Operations and Emergency Response*, U.S. Government Printing Office, Washington, D.C., 29 CFR 1910.120.

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APPENDIX 16A

DERIVATION OF TSRS FROM BSAF COMMITMENTS

June 20, 1994

**ENVIRONMENTAL RESTORATION DIVISION
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

APPENDIX 16A DERIVATION OF TSRS FROM BSAF COMMITMENTS

This appendix contains the detailed documentation of the derivation of Technical Safety Requirements (TSRs) from Baseline Safety Analysis File (BSAF) commitments. The derivation methodology, as explained in Section 16.1.3, evaluates each identified BSAF commitment versus a set of questions or criteria to determine whether the commitment requires incorporation into administrative control TSRs.

BSAF commitments are direct quotes from the BSAF that meet the following definition:

Any concept in the BSAF that establishes guidelines for the operation, reliability, availability, or maintainability of any system or subsystem that is required for safe operation of a facility within the risk accepted by DOE; limits the risk accepted by DOE; establishes (directly or indirectly by reference) a parametric value that if changed could increase the risk relative to the safety or protection of workers, the public, or the environment.

The BSAF commitments, and therefore the TSR evaluation presented here, are organized by chapter. Only those chapters where commitments were identified are included. Chapters without commitments requiring incorporation into administrative control TSRs are identified and explained in Section 16.2.

The database of BSAF commitments forms the basis of the TSR evaluation. The database was expanded to document evaluation results. The tracking method used was invented for the sole purpose of counting the number of unique TSRs. That is, sub-tier requirements are not specifically in the TSRs, they are incorporated by reference to the various programs. The first column is the BSAF page number on which the commitment appears. The second column is the section or the section number and/or paragraph number where the commitment appears. The third column is the BSAF commitment which is a direct quote from the BSAF. The fourth column shows which of the DOE 5480.22 Attachment 1 (DOE, 1992) administrative control topics may be associated with the commitment. Topics are labeled as Sections 2.4(a) through 2.4(k) and are contractor responsibilities; contractor organization; procedures; programs; minimum operations shift complement; operating support; facility staff qualifications and training; operability definition and implementation principles; technical safety requirement basis control; reviews and audits; and reporting requirements. The fifth column identifies the commitment as being an administrative TSR by assigning an arbitrary number. Each is given a consecutive number to cross reference other commitments that are a subset of those commitments identified as administrative TSRs. The sixth column identifies those commitments that are subsets of another commitment that has been identified as a TSR.

For example, 2.4(d) in the fourth column indicates that the commitment may be associated with the topic named "programs" in DOE 5480.22 Attachment 1. A "1." or any other number in column five indicates a new potential TSR has been identified. A "1.1" in the sixth column indicates that this commitment may be a requirement of an already identified TSR. That is, the first digit is the TSR identifier; the second indicates that the commitment is the first ("1.") identified that is a requirement of a TSR identified as 1. This technique simplifies the summaries presented in Sections 16.2 and 16.3.

BSAF COMMITMENT TABLE FORM

PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
2-1	2.1/1	This section identifies statutes, rules, regulations, and DOE Directives applicable to safety of INEL ERP activities. These documents address engineering, operations management, program management, and safety oversight requirements. Applicable Federal and State of Idaho statutes and regulations are listed in Table 2-1 (All tables are grouped together at the end of this chapter). There are no applicable local requirements. Applicable DOE Directives are listed in Table 2-2.	NA	NA-Listing of rules, regs, and orders do not warrant a TSR. Specifics are discussed in other chapters.	NA
2-1	2.2/1	Title 29, <u>Code of Federal Regulations</u> (CFR) 1910.119 (DOL, 1993a), specifies that a process safety management program must be implemented for ERP activities that either use hazardous chemicals in excess of the threshold quantities listed in Appendix A of the regulation or use pressurized flammables in excess of 10,000 pounds.	2.4(d)	1.	NA
2-2	2.2/2	The process safety management program shall include provisions for worker participation and for review of information developed in accordance with program requisites. The required information will include chemical safety information, process technical descriptions and specifications, process hazard analyses, operating procedures (including steps for each operating phase, operating limits, safety and health considerations, and safety systems and functions), training programs, and pre-startup safety reviews.	2.4(d)	NA	1.1
2-2	2.2/3	Title 29, <u>Code of Federal Regulations</u> (CFR) 1910.119 (DOL, 1993a), specifies that a process safety management program must be implemented for activities that either use hazardous chemicals in excess of the threshold quantities listed in Appendix A of the regulation or use pressurized flammables in excess of 10,000 pounds.	2.4(d)	NA	1.2
2-2	2.2/4	The process safety management program shall contain provisions to prevent accidents during operation or to mitigate accidents should they occur. Provisions shall be made for hot work permitting, process change control, investigation of incidents, emergency planning and response, and compliance audits.	2.4(d)	NA	1.3

BSAF COMMITMENT TABLE FORM

PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
2-2	2.3/1-2	Title 29 CFR 1910.120(b) (DOL, 1993b) specifies the contents of safety and health programs. The program must include identification of safety and health hazards; evaluation of hazard magnitude; provisions for control of hazards; and plans for emergency response for hazardous waste operations. 29 CFR 1910.120(b)(4) (DOL, 1993b) requires development of a Health and Safety Plan. Table 2-4 lists the elements of a Health and Safety Plan and provides cross-references to the BSAF chapter where the elements are discussed.	2.4(c)	NA	2.1
2-3	2.3/3	The <u>INEL Federal Facility Agreement and Consent Order</u> (FFA/CO) (INEL, 1991) specifies that DOE must submit Health and Safety Plans to the United States Environmental Protection Agency (EPA) and the Idaho Department of Health and Welfare (IDHW) for environmental remediation activities specified in the FFA/CO. Comments from EPA and IDHW are incorporated into the final Health and Safety Plans. Unresolved Health and Safety Plan issues among the involved agencies are addressed through the dispute resolution provisions of the FFA/CO.	NA	Submittal of the HSP to the EPA does not warrant a TSR	NA

BSAF COMMITMENT TABLE FORM

PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
3-28	3.5.4/2	For radiological assessments of normal operations, atmospheric data collected by the INEL meteorological network is used to calculate long term dispersion estimates, such as annual average, sector-averaged atmospheric dispersion factors ($\bar{X}/Q_s$), at the locations of interest. Data collected at the seven INEL facility complexes from 1987 to 1991 are documented in Leonard (1991a and 1991b). Atmospheric data is issued by NOAA.	NA	NA-Statement relates to safety analysis envelope development not safe operation	NA
3-28	3.5.4/5	For pollutants with an annual time-averaged exposure standard (such as, nitrogen dioxide), the required meteorological data is a long-term (for example, 5-year) joint frequency distribution (JFD) of wind direction, wind speed, and atmospheric stability class. These data are developed from the same NOAA hourly statistics used for radiological modeling.	NA	NA-Statement relates to safety analysis envelope development not safe operation	NA
3-29	3.5.4/6	For pollutants with hourly time-averaged exposure standards (for example, 8-hour for carbon monoxide), sequential hourly meteorological data are required for wind direction, wind speed, stability class, and mixing height. If available, at least 5 years of this hourly data should be used in the assessment to ensure that worst-case dispersion conditions are considered. In all cases, the meteorological data should be taken from the tower height closest to the release height. For releases near ground level, wind data from a 10-meter height should be used.	NA	NA-Statement relates to safety analysis envelope development not safe operation	NA
3-29	3.5.4/7	For scenarios involving particulate or passive gas (density similar to air) releases, dispersion conditions should be the same as in radiological analyses (that is, Stability Class F and 2 meters per second wind speed). Although NOAA suggested a 0.5 meter per second wind speed for receptors within 2 kilometers, this may produce unrealistically high downwind concentrations because of limitations in the Gaussian plume model. Modeling guidance from the EPA recommends that wind speeds less than 1 meter per second should be entered as 1 meter per second. Therefore, for general assessments, worst-case diffusive transport should be modeled using F and 1 meter per second. This same guidance is given in the DOE Guidance for Hazards Assessment (DOE, 1992).	NA	NA-Statement relates to safety analysis envelope development not safe operation	NA

BSAF COMMITMENT TABLE FORM

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3-29	3.5.4/8	For scenarios involving non-passive (dense) gas dispersion, worst-case diffusive conditions may be different than those for passive gas dispersion. Although higher wind speeds generally increase the dispersion, significant increase in the emission rate may result. In addition, near-field dense gas dispersion is not as sensitive to the stability class parameter. For these cases, a number of refined model simulations should be made using various stability class and wind speed combinations to determine the highest downwind concentration. These simulations can be accomplished with the United States Environmental Protection Agency (EPA) TSCREEN model (EPA, 1990) which has a built-in range of wind speeds with associated stability categories.	NA	NA-Statement relates to safety analysis envelope development not safe operation	NA

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PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
4-1	4.0/1	The goal of ERP activities is to undertake as necessary remedial actions at potential release sites at the INEL to protect the health of INEL personnel, the public, and the environment.	NA	NA-General statement and does not warrant a TSR	NA
4-1	4.0/2	The environmental remediation program follows requirements set forth in the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the INEL Federal Facility Agreement and Consent Order (FFA/CO).	NA	NA-General statement and does not warrant a TSR	NA
4-1	4.0/2	The D&D process follows the requirements of DOE Order 5820.2A (DOE, 1988), Chapter V.	NA	NA-General statement and does not warrant a TSR	NA
4-1	4.1/1	For each WAG, environmental remediation activities include an assessment phase to characterize the nature and extent of contamination and a cleanup/remediation phase (including implementation of interim and final remedial actions). When the extent and nature of contamination constitutes a potential threat to human health and safety or the environment, the latter cleanup or remediation phase is implemented.	NA	NA-General Statement and does not warrant a TSR	NA
4-2	4.1.1/1	The goal of the environmental remediation process is to ensure that releases or threatened releases of hazardous substances at the INEL are thoroughly investigated and that appropriate response actions are undertaken and completed as necessary to protect human health and the environment. One of the purposes of the FFA/CO is to establish a procedural framework and schedule for developing, prioritizing, implementing, and monitoring appropriate response actions at the INEL in accordance with CERCLA, the Resource Conservation and Recovery Act (RCRA), and the Idaho Hazardous Waste Management Act (HWMA).	NA	NA-General statement and does not warrant a TSR	NA
4-2	4.1.1/2	Implementation of the FFA/CO is accomplished by the <u>Action Plan For Implementation of the Federal Facility Agreement And Consent Order</u> (INEL, 1991b).	NA	NA-General statement and does not warrant a TSR	NA

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4-2	4.1.1/3	The Remedial Design encompasses plans and specifications for remedial action including design analysis, an operation and maintenance plan, a Quality Assurance Project Plan, a Health and Safety Plan, and the results of additional studies such as a safety analyses.	NA	NA-General statement and does not warrant a TSR	NA
4-45	4.2.1/1	D&D activities address the management of surplus radioactively contaminated facilities to permit other uses of those facilities or the occupied land. D&D activities will be performed to ensure that releases and exposure to radioactively contaminated and other hazardous materials are in compliance with Federal and state standards. D&D projects will meet the requirements of DOE Order 5820.2A, Chapter V - "Decommissioning of Radioactively Contaminated Facilities (DOE, 1988)."	NA	NA-General statement	NA
4-45	4.2.1/5	Facilities awaiting D&D are maintained to limit exposure of workers, the public, and the environment to potential hazards.	2.4(d)	3.	NA
4-52	4.3.1/1	Different types of remedial action techniques will be employed to clean the sites to acceptable levels as part of the CERCLA-based FFA/CO process.	NA	NA-General statement	NA
4-64	4.3.3/1	A surveillance and maintenance program is required by DOE Order 5820.2A, Chapter V (DOE, 1988).	NA	NA	3.1
4-64	4.3.3/1	The purposes of the surveillance and maintenance function for surplus facilities awaiting D&D are to ensure adequate containment of contamination; and to provide physical safety and security controls and regulated surveillance to maintain the facilities in a manner that will minimize potential hazards to the public, workers and the environment. Elements of the D&D surveillance and maintenance program follow: <ul style="list-style-type: none"> • Surveillance and maintenance planning to accomplish the appropriate integration of facility conditions, surveillance frequencies, security requirements, routine maintenance, and major facility repair • Performance and documentation of periodic inspections at each surplus facility • Deficiency control system that provides for the prioritization, tracking, resolution, and documentation of identified deficiencies • Performance of maintenance, repair, and cleanup tasks required to correct deficiencies and complete routine scheduled maintenance. 	2.4(d)	NA	3.2

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4-62	4.4/1	For these environmental remediation and D&D activities within the scope of the BSAF, the unmitigated release of the available inventory of radioactive and/or hazardous material has the potential for only significant localized consequences (Section 5.3).	NA	NA-General statement	NA
4-65	4.4/2	Structures, systems, and components important to worker safety may be required for environmental remediation and D&D activities. Table 4-60 lists design features important to environmental remediation and D&D activities at the INEL, that may be required dependent on the hazards to which workers may be exposed. Standard industrial controls apply for areas such as electrical and fire safety.	NA	NA-General statement	NA
4-66	4.5/1	Supporting facilities necessary for environmental remediation and D&D activities include waste storage, treatment, and disposal facilities (onsite and offsite), including WERF and RWMC; and personnel support facilities for sanitation, staging areas, and offices. Services required in support of environmental remediation and D&D activities include transportation of radioactive, hazardous, and solid waste; fire protection; security; and emergency response personnel and equipment.	2.4(f)	4.	NA

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PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
6-1	6.1.1/1	ERP activities with a potential for a criticality event are outside the scope of the Baseline Safety Analysis File (BSAF).	NA	NA- Definition	NA
6-1	6.1.2/1	Radiation protection criteria are drawn from requirements including 10 CFR 835 (DOE, 1994) and DOE directives DOE 5480.11 (DOE, 1988a), DOE 5400.5 (DOE, 1990), and DOE Notice 5480.6 (DOE, 1992), which directs the use of the <u>Radiological Control Manual</u> (DOE-ID, 1992a). 10 CFR 835 will supplant DOE 5480.11 in accordance with the DOE plan and schedule for compliance with the rule.	2.4(d)	5.	NA
6-1	6.1.2/2	Normal operating criteria are intended to maintain radiation dose below operational limits and to assist in optimizing radiation dose at levels as-low-as-reasonably-achievable (ALARA). Operational radiation protection criteria are presented in Table 6-1 and establish administrative control levels, action levels requiring monitoring and assessment of normal operational radiation hazards, use of protective equipment, and notification of workers.	2.4(d)	NA	5.1
6-1	6.1.2/3	Table 6-2 presents the limiting operational criteria for radiation protection of workers, the public, and the environment.	NA	List is NA-already part of a TSR. A separate TSR is not required.	NA
6-9	6.1.2/4	Criteria for siting and designing nuclear facilities and nuclear operations are provided in Table 6-3.	NA	List is NA-already part of a TSR. A separate TSR is not required.	NA
6-9	6.1.3/1	Hazardous material protection criteria for workers are based on a chemical's Threshold Limit Value (TLV) (ACGIH, 1992), or Permissible Exposure Limit (PEL), (DOL, 1993 and 1991), whichever provides greater protection.	NA	NA-General statement	NA
6-9	6.1.3/2	Table 6-4 contains a listing of general recommended PPE criteria for normal work operations.	NA	List is NA-already part of a TSR. A separate TSR is not required.	NA

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6-9	6.1.3/2	Table 6-4 should be used in conjunction with Tables 6-5 and 6-6. Table 6-5 contains exposure limits for chemicals that may be constituents of contaminated soils or other particulates that may be encountered during ERP activities.	NA	NA-Recommendations do not require a TSR	NA
6-16	6.1.3/4	For estimated or monitored airborne concentrations of chemicals, consideration shall be given to chemicals with similar effects on body systems such as the respiratory tract, liver, nervous system, kidneys, and reproductive systems.	NA	NA-Statement not related to safe operation	NA
6-16	6.1.3/5	The following formula should be used to calculate additive effects: <ul style="list-style-type: none"> (Chemical 1 airborne concentration in ppm / TLV or PEL of Chemical 1) + (Chemical 2 airborne concentration in ppm / TLV or PEL of Chemical 2) + (Chemical 3 airborne concentration in ppm / TLV or PEL of Chemical 3) + other chemicals with similar effects = X <p>If X is > 1, overexposure potential If X is ≤ 1, should not result in overexposure</p>	NA	NA-Statement relates to safety analysis envelope development not safe operation	NA
			NA	NA-Statement relates to safety analysis envelope development not safe operation	NA
		If the additive effects are greater than 1, then an overexposure can be expected. That is, even though the airborne concentration for each individual chemical may be below its respective TLV, the additive effects of the chemicals could create a health concern.	NA	NA-Statement relates to safety analysis envelope development not safe operation	NA

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6-16	6.1.3/7	The level of PPE required and the actual type of glove material, coverall material, and respirator will be determined by an industrial hygienist based on the chemicals involved for the specific ERP activity. PPE requirements will be specified in the activity-specific Health and Safety Plan.	2.4(d)	NA	6.1
6-16	6.1.3/7	The industrial hygienist will evaluate the possibilities of higher chemical exposures due to accidents or chemical incidents. If there is a credible likelihood of accident conditions or chemical incidents occurring, the industrial hygienist may specify in the Site Health and Safety Plan, the requirement for upgraded emergency PPE.	2.4(d)	NA	6.2
6-17	6.1.3/8	The exposure criteria for INEL co-located workers and the general public are based on protection of co-located workers, visitors, or other members of the public from chemical exposures that are likely to be of short duration, such as spills of materials that are usually in closed containers. If an ERPG-1 value has not been issued for a certain chemical, then the TLV (8-hour time weighted average) may be used. If there is not a TLV, then 0.1 of the IDLH level may be used. If chemical airborne concentrations exceed ERPG-1 concentrations, evacuation of INEL co-located workers and possibly the general public should be considered.	NA	NA-Statement is already part of a TSR	NA
6-17	6.1.3/8	If an ERPG-1 value has not been issued for a certain chemical, then the TLV may be used. If a TLV is not present then 0.1 of the IDLH level may be used. If chemical airborne concentrations exceed ERPG-1 concentrations, evacuation of INEL co-located workers and possibly the general public should be considered.	2.4(c)	7.	NA

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6-17	6.1.4/2	The industrial hygiene organization shall identify the health hazards associated with chemical exposures and possible physical exposures including noise, ultraviolet radiation, heat or cold stress, and non-ionizing radiation, as well as situations such as confined spaces. The safety organization shall identify safety hazards associated with construction type activities including, but not limited to, vehicular traffic patterns; machine guarding or moving equipment; fall protection when working at heights; electrical grounding; electrical safety; fire and explosion protection (including storage of flammable materials on a site, and use and storage of explosives); uneven or slippery working or walking surfaces; compressed air or gas use and associated pressure vessels and relief valves; and blocked exit ways in buildings. An industrial hygienist and safety professional shall work with the environmental remediation or D&D project manager to gain an understanding of the scope of the activity along with any chemical and physical hazard data which is available for the site. This chemical data may be obtained from sample analysis or from reviewing the previous use history of the site or facility. Using this information, the industrial hygienist shall prescribe the proper PPE to wear, decontamination procedures, and personal and area air monitoring to be performed. The industrial hygienist shall include this information in the activity-specific Health and Safety Plan which is required by Federal OSHA regulation 29 CFR 1910.120 (DOL, 1993a).	2.4(d)	NA	6.3
6-18	6.1.4/3	The industrial hygiene organization shall ensure a training program is in place, implemented, and maintained, which shall include the 40-hour and associated 8-hour annual updates required by 29 CFR 1910.120. Training for the 40-hour and 8-hour courses includes use of monitoring equipment, personal and equipment decontamination, medical surveillance requirements, proper use and limitations of PPE, container handling, emergency response, engineering controls to limit personal chemical exposure, and site hazard identification and assessment. Additionally, training shall be implemented and maintained for hazard communication required by 29 CFR 1910.1200; respiratory protection required by 29 CFR 1910.134 and ANSI Z88.2-1980, update 1992 (ANSI, 1992); hearing conservation required by 29 CFR 1910.94; and necessary training required by chemical statutes found in 29 CFR 1910.1001 through 1050 (DOL, 1993c) and in 29 CFR 1926 (DOL, 1993b). Training requirements are summarized in Chapter 13.	2.4(d)	NA	6.4

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6-18	6.1.4/4	The industrial hygiene and safety organizations shall maintain an adequate number of instruments to properly evaluate chemical and physical exposures on environmental remediation sites and D&D locations. The industrial hygiene organization shall maintain an adequate staffing level to allow industrial hygienists to properly prepare, review, and approve health and safety plans and to personally evaluate the activities occurring at the environmental remediation sites and D&D locations. The safety organization shall maintain an adequate safety staff to allow safety professionals to evaluate activities which are occurring at environmental remediation sites and D&D locations.	NA	NA-Statement is already part of a TSR	NA
6-19	6.1.5/2	Environmental remediation and D&D facilities may fall within the requirements for improved risk because of the presence of toxic chemicals and/or radioactive contamination.	NA	NA-General statement	NA
6-19	6.1.5/4	These fire protection requirements for facilities apply to new facilities or extensively modified existing facilities built or required for ERP activities.	NA	NA-General statement	NA
6-19	6.1.5/4	For ERP activities involving only construction-type activities, 29 CFR 1926.150 (DOL, 1993b) must be followed which provides requirements concerning fire extinguishers for the job site.	NA	NA-Statement already part of a TSR	NA
6-19	6.1.6/1	DOE policy is that all applicable Federal, state, and local environmental laws and regulations and DOE requirements will be followed.	NA	NA-General statement	NA
6-19	6.1.6/2	The regulatory levels for each contaminant typically found at the INEL are provided in Table 6-7, "Regulatory Levels for Toxic and Radioactive Contaminants." If new hazardous constituents are identified through further investigations, they shall be reviewed against the regulations cited in Table 6-7.	NA	NA-Statement already part of a TSR	NA
6-19	6.1.6/2	If new hazardous constituents are identified through further investigations, they shall be reviewed against the regulations cited in Table 6-6.	NA	NA-Statement already part of a TSR	NA
6-22	6.1.6/3	Monitoring of ambient conditions is performed by taking samples of air, groundwater, surface water, drinking water, and agricultural products at numerous locations on and near the INEL site.	NA	NA-General statement	NA
6-22	6.1.6/3	For environmental remediation and D&D projects potentially involving contaminants other than those currently being monitored or involving unusual circumstances (such as a large amount of contaminants anticipated from cleanup operations), additional environmental ambient monitoring may be required.	NA	NA-General statement	NA

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PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
6-22	6.1.6/4	The effluents must be periodically monitored and analyzed to determine if the effluent meets all applicable regulations and standards. The ERP contractor is responsible for administering an effluent monitoring program adequate to demonstrate compliance with applicable environmental regulations and standards.	NA	NA-Required for EPA not for safe operation	NA
6-22	6.1.6/3	For environmental remediation and D&D projects potentially involving contaminants other than those currently being monitored or involving unusual circumstances (such as a large amount of contaminants anticipated from cleanup operations), additional environmental ambient monitoring may be required.	NA	NA-General statement	NA
6-22	6.1.6/4	The effluents must be periodically monitored and analyzed to determine if the effluent meets all applicable regulations and standards. The ERP contractor is responsible for administering an effluent monitoring program adequate to demonstrate compliance with applicable environmental regulations and standards.	NA	NA-Required for EPA not for safe operation	NA
6-22	6.1.7/1	The structural design of facilities shall conform to applicable sections of DOE Order 6430.1A <u>General Design Criteria Manual</u> (DOE, 1989), and the requirements of the DOE-ID Architectural Engineering Standards (DOE-ID, 1992).	NA	NA-Statement not related to safe operation	NA
6-23	6.1.7/1	Facilities used for ERP activities will typically fall into either the General Use category or the Important, or Low Hazard category.	NA	NA-General statement	NA
6-24	6.1.7/6	Due to the low probability of tornadoes at the INEL site, designs and evaluations do not normally require inclusion of criteria for tornado wind loading.	NA	NA-General statement	NA
6-24	6.1.7/7	Earthquake, or seismic, loading shall be considered in the design of all permanent buildings, structures, cranes, and towers. For design purposes, the simultaneous occurrence of an earthquake with any other limiting site-related event, such as high winds, fire, or flood, need not be considered except where the joint occurrence is causally related. Such instances will be identified in specific design criteria. <u>DOE-ID Architectural Engineering Standards</u> specifies that for General Use and Important or Low Hazard facilities, the Uniform Building Code (UBC) shall govern and shall be used as the basis for design. For an Important or Low Hazard facility containing radioactive materials not generally accepted by the public, an importance factor "I" of 2.0 shall be used in the UBC seismic design formula along with the seismic zone. <u>DOE-ID Architectural Engineering Standards</u> provides the criteria to be used to evaluate Moderate and High Hazard facilities.	NA	NA-Statement not related to safe operation	NA

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6-24	6.1.7/8	The project design criteria must establish the design basis flood (DBFL), based on the location of the facility, required to support ERP activities. Whenever possible, the facilities should be located above the DBFL to mitigate any potential flood hazards. If the facilities will be located below the DBFL, the design criteria of DOE Order 6430.1A will apply, which requires that design loads from flooding shall comply with UCRL-15910.	NA	NA-Statement not related to safe operation	NA
6-24	6.2.1/1	The hazard grade system for INEL ERP activities is designed to ensure the proper identification and application of design requirements, codes, standards, and administrative controls to ERP activities.	NA	NA-General statement	NA
6-25	6.2.1/1	Administrative controls including but not limited to management controls; procedures and training; initial testing; inservice surveillance and monitoring; and quality assurance should be instituted commensurate with the hazard level determination for an activity similar to design requirements, codes, and standards.	NA	NA-General statement	NA
6-25	6.2.1/1	Each chapter of the BSAF that contains design requirements or administrative controls provides, as applicable and appropriate, the level of controls required, based on the hazard level determined for the specific activity.	NA	NA-General statement	NA
6-25	6.2.1/2	The hazard grade system defines hazards levels using the principal health and safety criteria presented in Section 6.1.	NA	NA-Definition	NA
6-25	6.2.1/2	To support the definition of hazard levels, Table 6-8, "Environmental Hazard Criteria," consolidates factors affecting environmental conditions into a qualitative rating of the severity of environmental contamination from a potential release.	NA	NA-Definition	NA
6-25	6.2.1/3	Table 6-9 uses fire protection criteria and physical hazards to categorize physical hazards for use in defining hazard levels for ERP activities. Where the potential exists for rupture of equipment or explosions due to failure of pressurized systems or systems involving flammable gases or vapors, the physical hazard category in Table 6-9 should be increased one level.	NA	NA-General statement	NA
6-25	6.2.2/1	Hazard levels are defined by the criteria presented in Table 6-10. These criteria are from Section 6.1 and are based on DOE Directives, and Federal or state regulations.	NA	NA-General statement	NA
6-30	6.2.2/1	Note that the criteria for Hazard Levels 1 and 2 contained in Table 6-10 are provided only for completeness as these levels are expected to be outside the scope of the BSAF.	NA	NA-General statement	NA

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PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
6-30	6.2.2/2	Placement of an activity, or a specific aspect of an activity, at a particular hazard level is determined by comparing all criteria in that level (that is, radiation, chemical, and physical criteria for the public, co-located INEL workers, ERP workers, the environment, and structures/systems) to the potential hazards associated with the activity.	NA	NA-Guidance statement	NA
6-30	6.2.2/2	If one or more criteria require a higher hazard level, then that activity must be elevated to that higher hazard level.	NA	NA-Guidance statement	NA
6-30	6.2.2/2	Placement of an activity, or a specific aspect of an activity, at a particular hazard level is determined by comparing all criteria in that level (that is, radiation, chemical, and physical criteria for the public, co-located INEL workers, ERP workers, the environment, and structures/systems) to the potential hazards associated with the activity.	NA	NA-Guidance statement	NA

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7-1	7.0/1	Protection of the public, workers, and the environment are integral factors in the management of these wastestreams resulting from ERP activities.	NA	NA-General statement	NA
7-1	7.0/2	The ERP waste management options include the following activities which may occur in parallel: <ul style="list-style-type: none"> • Removal of waste and reuse of all recyclable materials • Minimization of additional waste generation during cleanup activities by control of emissions to air and water • Remediation of waste in place • Treatment, storage, and disposal (TSD) of waste at onsite facility, if possible • Treatment and disposal of waste at offsite facility, if only alternative 	NA	NA-General statement	NA
7-1	7.1/1	Radioactive, hazardous, and mixed wastes will be managed in a manner that assures protection of the health and safety of the public, employees, and the environment.	NA	NA-General statement	NA
7-2	7.1/1	The objectives of the INEL waste management program are to ensure compliance with applicable guidelines and regulatory requirements; conserve resources; and eliminate or generate a minimum of waste and pollution.	NA	NA-General statement	NA

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PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
7-2	7.1/2	<p>The waste management practices at the INEL must comply with the following Federal and state laws and regulations and DOE Directives:</p> <ul style="list-style-type: none"> • 40 Code of Federal Regulations (CFR) 191 (EPA, 1993b) • 40 CFR 260 (EPA, 1993c) • 40 CFR 261 (EPA, 1993d) • 40 CFR 262 (EPA, 1993e) • 40 CFR 263 (EPA, 1993f) • 40 CFR 264 (EPA, 1993g) • 40 CFR 265 (EPA, 1993h) • 49 CFR 171 (DOT, 1993a) • 49 CFR 173 (DOT, 1993b) • Resource Conservation and Recovery Act of 1976 (RCRA) • Hazardous and Solid Waste Amendments of 1984 (HSWA) • Toxic Substances Control Act of 1976 (TSCA) • Clean Air Act of 1970 (CAA) • Federal Water Pollution Control Act (Clean Water Act of 1972) • Safe Drinking Water Act of 1974 • Atomic Energy Act of 1954 • Low-Level Radioactive Waste Policy Act of 1985 • Nuclear Waste Policy Act of 1982 • Idaho Department of Health and Welfare Rules and Regulations, Title 1, Chapter 1, 5, and 17 • Idaho Code Sections 39-101 through 39-130, Section 39, Chapters 44 and 36 • DOE 5820.2A (DOE, 1988a), <u>Radioactive Waste Management</u> • DOE 5400.3 (DOE, 1989), <u>Hazardous and Radioactive Mixed Waste Program</u> • DOE 5480.1B (DOE, 1986), <u>Environment, Safety, and Health Program for Department of Energy Operations</u> • DOE 5400.1 (DOE, 1988b), <u>General Environmental Protection Program</u> • DOE 5400.5 (DOE, 1990), <u>Radiation Protection of the Public and the Environment</u> • DOE 5480.4 (DOE, 1992b), <u>Environmental, Safety, and Health Protection Standards</u> • DOE 5480.3 (DOE, 1985), <u>Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes.</u> 	NA	NA-List items not related to safe operation or are already part of a TSR	NA

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7-3	7.1/4	If waste is treated, stored, or disposed at the specific environmental remediation site or D&D facility, all applicable state and Federal regulations will be followed.	NA	NA-General statement	
7-3	7.1/4	Interim storage requirements under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) are under negotiation with applicable Federal and state agencies.	NA	NA-General statement	NA
7-3	7.1/4	Interim storage for RCRA classified wastes will follow Federal and state regulations.	NA	NA-General statement	NA
7-3	7.1/5	The industrial or commercial solid waste generated at the INEL is disposed onsite at the landfill complex located at the Central Facilities Area.	NA	NA-General statement	NA
7-3	7.1/6	Non-hazardous liquid effluents are sent onsite to either sewage waste treatment facilities or ponds/sanitary lagoons. These wastestreams are sampled and monitored.	NA	NA-General statement	NA
7-4	7.1/7	Hazardous waste at the INEL is treated, stored, or disposed at INEL facilities or sent to permitted offsite TSD facilities.	NA	NA-General statement	NA
7-4	7.1/8	Radioactive wastes are treated, stored, and disposed according to the appropriate waste acceptance criteria documents.	NA	NA-General statement	NA
7-4	7.1/10	The final treatment or disposal method for wastestreams currently under remediation at the INEL is not determined for every wastestream. Under certain circumstances, determination of the anticipated TSD method is impossible, particularly if further characterization activity is required to determine quantities or waste constituents; or if regulatory conditions or technological capabilities prevent TSD method determination. In such instances, anticipated TSD methods are labeled "indeterminate."	NA	NA-General statement	NA
7-6	7.2.2/3	Waste minimization practices will be a prime consideration in ERP activities.	NA	NA-General statement	NA
7-6	7.2.2/4	Source reduction is preferable to waste treatment and will be an important aspect of ERP activities. Generated environmental restoration wastes will be evaluated for the applicability of recycling or reclamation activities. Those wastes that cannot be recycled will be treated to reduce volume and/or toxicity. Wastes with no accepted method of treatment or disposal will be stored until a method of treatment or disposal is developed.	NA	NA-General statement	NA

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7-6	7.2.2/5	<p>The following statements summarize goals and objectives of the DOE-ID Waste Minimization Program (WMP), applicable to the ERP activities. Dashed items are methods applicable to achievement of the goals and objectives for waste generated by ERP activities.</p> <ul style="list-style-type: none"> • Meet or exceed applicable policies and requirements <ul style="list-style-type: none"> - Prepare yearly program review and conduct audits upon completion of each ERP activity • Ensure waste minimization practices are a prime consideration in ERP activities <ul style="list-style-type: none"> - Require all generators to develop waste minimization implementation plans (WMIPs) - Provide appropriate training for all employees and additional appropriate training for managers, auditors, and trainers - Provide incentives for developing waste minimization ideas • Ensure consideration of waste management/waste minimization issues before approval of new or existing programs, including the ERP • Obtain management commitment to waste minimization activities <ul style="list-style-type: none"> - Require special training for managers - Require managers to sign statement of commitment. 	NA	NA-General statement	NA
7-7	7.2.3/3	<p>The following is a summary of waste minimization techniques for the ERP:</p> <ul style="list-style-type: none"> • <u>Decontamination</u>: Removal of radioactive, mixed, or hazardous components from a material, resulting in a less toxic or easier-to-handle waste • <u>Housekeeping</u>: Performance of activities that result in reduced material use and reduced material waste through proper operations and spill prevention • <u>Reclamation</u>: Recovery of secondary materials from a wastestream for useful purposes. Form of recycling • <u>Recycling</u>: Reuse of waste with attendant generation of a valuable substance. For purposes of the WMP, recycling refers to all such activities not considered reclamation or reuse • <u>Reuse</u>: Subsequent use of a material within a process or use of a waste material in another process • <u>Waste Segregation</u>: Separation of waste types to reduce or eliminate contamination from other wastes, or to permit selective handling or treatment. 	NA	NA-Definitions	NA

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7-11	7.4/1	The methods chosen to control or mitigate gaseous waste from these activities will be governed by the following considerations: <ul style="list-style-type: none"> • Concentration and characteristics of radioactive, hazardous, or mixed waste • Exposure pathways and targets • Probability of release or emission. 	NA	NA-General statement	NA
7-13	7.4/5	The operating philosophy and objectives of gaseous waste treatment are to prevent any regulatory concern releases (emissions) of hazardous gaseous wastes into the environment, using trap and treat technologies.	NA	NA-General statement	NA
7-13	7.4.1/2	Treatment technologies for gaseous wastes will be determined prior to ERP activities at any given site. Equipment and systems, engineering drawings, and flow paths to show location of equipment, crucial components, and instrumentation will be provided when technologies are selected.	NA	NA-General statement	NA
7-14	7.5/3	The operating philosophy and objectives for the management of liquid radioactive, hazardous, and mixed wastes are to minimize waste generation and to apply best demonstrated available technology (BDAT) to manage any waste generated.	NA	NA-General statement	NA
7-14	7.5/3	Measures to prevent or minimize spills or releases will be implemented to protect human life and the environment.	2.4(d)	NA	5.3,6.6
7-14	7.5/4	Treatment technologies for liquid wastes will be determined prior to ERP activities at any given site. Equipment and systems, engineering drawings, and flow paths to show location of equipment, critical components, and instrumentation will be provided when technologies are selected.	NA	NA-General statement	NA
7-14	7.6/2	The operating philosophy and objectives for management of solid waste are to minimize the amount of solid radioactive, hazardous, and mixed wastes generated. Any wastes generated should be managed using the best technical standards available and in compliance with DOE Directives, and state and Federal laws and regulations.	NA	NA-General statement	NA

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8-1	8.1/1	Chapter 8 of the activity-specific safety analysis shall conservatively demonstrate no potential for a criticality hazard.	NA	NA-Guidance statement	NA
8-1	8.1/2	Chapter 8 of the activity-specific safety analysis shall conservatively estimate the total fissile material involved in the specific ERP, consistent with material inventories in Chapter 5 of the safety analysis documentation. The estimate shall include the total mass of each fissile radionuclide within the defined activity boundary, including bulk contamination, surface contamination, and contaminated systems and components.	NA	NA-Guidance statement	NA
8-1	8.1/3	The estimates shall employ isotopic analyses and gross activity analyses from available site or facility characterization surveys.	NA	NA-Guidance statement	NA
8-1	8.1/3	Gross alpha survey measurements for fissile mass shall be scaled to the most conservative single fissile nuclide or conservative fissile nuclide mixture identified in available isotopic analyses from the site or facility. Nuclides used for gross activity scaling shall be assumed to be in a conservative chemical form, consistent with available radiochemical data. The fissile material quantities shall be compared with the single-parameter fissile mass limits of the following standards: <ul style="list-style-type: none"> • DOE-STD-1027-92 (DOE, 1992a) • ANSI/ANS 8.1-1983 (ANSI, 1983) • ANSI/ANS 8.15-1981 (ANSI, 1981) • ANSI/ANS 8.12-1978 (ANSI, 1978). 	NA	NA-Guidance statement	NA
8-1	8.1/5	If the estimates of the total fissile material involved in the ERP activity exceed the fissile mass limits, segmentation as allowed by DOE-STD-1027-92 (DOE, 1992a) may preclude the possibility of a nuclear criticality. Segmentation credit may be taken only if fissile material in one segment is independent from and cannot interact with material in another segment. Credit for segmentation shall not be taken if administrative controls or active systems are relied upon to prevent material interaction between segments.	NA	NA-Guidance statement	NA
8-2	8.1/6	The hazard evaluation shall demonstrate that the quantities of fissile material involved in any segment do not exceed the single-parameter fissile mass limits stated in the cited standards, with a margin to protect against uncertainties.	NA	NA-Guidance statement	NA

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9-1	9.0/1	The Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP) protects personnel and the public from radiation and radioactive materials through a radiological control program administered by the local Radiological Control Organization, as defined in the United States Department of Energy (DOE) Idaho Operations Office (ID) Radiological Control Manual (RCM) (DOE-ID, 1992a).	2.4(d)	NA	5.2
9-1	9.0/1	The responsible Radiological Control Organization implements radiological controls for ERP activities by arrangement with the environmental restoration contractor.	2.4(d)	NA	5.3
9-1	9.0/2	<u>Radiation Protection for Occupational Workers</u> , 10 CFR 835 (DOE, 1994), contains the primary requirements for occupational radiation protection throughout the DOE Complex. The DOE RCM (DOE, 1992) requires that a site-specific RCM be developed to implement the primary requirements. The DOE-ID RCM (DOE-ID, 1992a) is the site-specific RCM for the INEL, including ERP activities. INEL contractors in the Radiological Control Organization employ DOE-approved, contractor-specific, and facility-specific RCMs. The content and format of the DOE-ID RCM and contractor RCMs are consistent with the DOE RCM.	2.4(d)	NA	5.4
9-1	9.0/3	The radiological protection program incorporates requirements from 10 CFR 835 (DOE, 1994), DOE 5400.5 (DOE, 1990), DOE 5480.11 (DOE, 1988a), the DOE-ID RCM (DOE-ID, 1992a), and the DOE-approved contractor RCM applicable to the ERP activity. ERP contractor compliance with these requirements forms the radiation protection safety basis. The Radiological Control Organization will comply with revisions to DOE radiation protection requirements. The Baseline Safety Analysis File (BSAF) will be annually updated to reflect ongoing revisions to DOE requirements.	2.4(d)	NA	5.5
9-1	9.1//1	Guidance to Federal agencies directs that there should be no occupational exposure of workers to ionizing radiation without the expectation of an overall benefit from the activity causing the exposure (EPA, 1987). Therefore, radiation exposure of the ERP work force and public is controlled to assure that radiation exposures are below regulatory limits and as low as reasonably achievable (ALARA).	2.4(d)	NA	5.6

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9-1	9.1.1/1	The INEL ALARA Committee with jurisdiction over ERP activities makes recommendations to management toward minimizing radiation exposure and radiological releases. The Committee evaluates ERP items such as construction and design of new facilities and systems; planned major modifications of work activities; and plans for exposure, waste, and release minimization. The Committee receives the results of all ERP radiation protection reviews and audits, both internal and external.	2.4(d)	NA	5.7
9-2	9.1.2/1	The INEL establishes, approves, and maintains a radiological performance goals program (DOE-ID, 1992a). Performance goals are measurable and auditable. Radiological performance goals are reviewed at least annually and revised as appropriate.	NA	NA-General statement	NA
9-2	9.1.3/1	Administrative control levels are established by the DOE-ID RCM at levels below regulatory limits to administratively control and help reduce individual and collective radiation dose (DOE-ID, 1992a). These control levels are multi-tiered with increasing levels of authority required to approve higher administrative control levels. Chapter 6 presents administrative control levels as part of the principal safety criteria.	NA	NA-Statement already part of a TSR	NA
9-2	9.1.4/1	ERP activities with the potential to exceed DOE-ID ALARA review levels undergo an ALARA review (DOE-ID, 1992a). At those operations with routine, recurring processes, special management attention is directed to radiological activities infrequently conducted or representative of first-time operations. Job-specific radiological requirements identified as part of the ALARA review are documented in the activity-specific Health and Safety Plan or workplan.	2.4(d)	NA	5.8
9-2	9.1.4//2	Pre-job briefings are held prior to work conducted under the formal ALARA review process (DOE-ID, 1992a). Pre-job briefings are typically conducted by the field supervisor.	2.4(d)	NA	5.9
9-2	9.1.4/2	Workers and supervisors directly participating in the job, cognizant radiological control personnel, and representatives from involved support organizations attend the briefing. The summary of topics discussed at the pre-job briefing and attendance are documented.	NA	NA-General statement	NA
9-2	9.1.4/4	ERP activity-specific Health and Safety Plans are reviewed to identify and incorporate radiological requirements and ALARA techniques such as engineering controls and dose and contamination reduction considerations. These reviews are the responsibility of line management, with support and concurrence from the INEL Radiological Control Organization (DOE-ID, 1992a).	2.4(d)	NA	5.10

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9-3	9.2/4	Gamma exposure will be controlled through minimizing time spent in radiation areas; maximizing distance to contaminated materials; and shielding provided by existing structures or soil layers. Additional temporary shielding may be added as appropriate and optimal under the ALARA evaluation process.	2.4(d)	NA	5.11
9-3	9.2/6	Radiation protection personnel evaluate each activity for application of engineering controls to reduce airborne contamination at the source.	NA	NA-General statement	NA
9-3	9.2/6	Internal exposures are expected to be ALARA and well below 100 mrem per year committed effective dose equivalent (CEDE).	NA	NA-General statement	NA
9-4	9.3/1	Radiation protection objectives for the design of ERP radiation protection features are prevention of radionuclide contamination and of exposure of INEL personnel, the public, and the environment; and the safe management of radioactive wastes from ERP activities. To meet these objectives, engineering design considerations address identification of radiation hazards, causes, consequences, and likelihood of occurrence. The system for confinement, shielding, ventilation, and monitoring is designed in accordance with the ALARA philosophy. Contingencies eliminate or mitigate the radiological impact of a system failure. Design engineers review proposed designs and offer alternatives as part of the ALARA process. Radiation protection features are selected as required by the State of Idaho, Environmental Protection Agency (EPA), and DOE 5480.11 (DOE, 1988a) and DOE 5400.5 (DOE, 1990).	NA	NA-General statement and guidance	NA
9-4	9.3/2	DOE-ID policy is to design facilities in accordance with DOE-ID Order 6430.1A (DOE-ID, 1989), which references DOE Order 6430.1A (DOE, 1989), and in compliance with the codes and standards contained in DOE-ID <u>Architectural Engineering Standards</u> (DOE-ID, 1992b). DOE-ID Order 6430.1A provides that design goals be established below occupational dose limits to incorporate the ALARA concept into facility design. The shielding design basis goal is less than 1 rem effective dose equivalent (EDE) per year to an individual, based on normal conduct of operations (DOE-ID, 1989). Consistent with this goal, the DOE-ID RCM (DOE-ID, 1992a) recommends an overall radiological design goal of less than 500 mrem EDE per year to an individual.	NA	NA-General statement	NA
9-4	9.3/3	ERP processes are designed to confine radioactive materials and control routine releases so that operating areas of structures do not exceed 10% derived air concentration (DAC) and so that public exposure is less than the limits specified in the DOE Order 5400.5 (DOE, 1990), with all releases ALARA.	NA	NA-General statement	NA

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9-4	9.3/4	Monitoring systems are provided to assess releases from ERP sites, and are tested periodically (DOE-ID, 1989). Equipment is provided as directed by the RCM (DOE-ID, 1992a) to monitor both direct radiation and airborne radioactive material at the ERP site. This equipment may be portable. Alarm functions are provided to alert workers to unexpected changes in radiation levels or airborne concentrations.	2.4(d)	NA	5.12
9-4	9.3/5	Facilities erected for ERP use are designed to limit spread of radionuclide contamination and to allow ease of decontamination. Measures include containment systems separable from structures; waste treatment and ventilation systems localized to the contamination source; prevention of dead-leg piping and inaccessible areas of contamination or accumulation; modular shielding material; and materials selected for ease of decontamination (DOE-ID, 1989).	NA	NA-General statement	NA
9-5	9.4/1	Guidelines for assessing radiation exposure from normal operation of ERP workers, workers at nearby INEL facilities, and the general public beyond the INEL site boundary are summarized in this section. Quantitative radiation exposure assessments will generally not be necessary in the safety analysis of ERP activities covered by the BSAF. However, activity-specific safety analysis documentation must include an assessment of expected occupational radiation dose to workers and radiation dose to nearby facility workers and the public from normal operational releases of radioactive material. The results of the assessment are compared to relevant radiation protection requirements and ALARA guidelines in DOE 5480.11 (DOE, 1988a), DOE 5400.5 (DOE, 1990), and the RCM (DOE-ID, 1992a).	NA	NA-Guidance statement	NA
9-5	9.4/2	Potential radiation hazards are assessed by determining the consequences to human and environmental targets in various domains as a result of normal ERP activities. Both onsite and offsite effects of normal operation are considered. Mitigation measures that reduce the magnitude of normal operational consequences are considered. These measures include normal functioning of filtration, shielding, containment, and ventilation systems.	2.4(d)	NA	5.13
9-5	9.4/3	Expected worker doses can be estimated based on monitored dose from prior, similar ERP activities. Worker doses can be calculated based on the time workers are expected to spend in areas where they can be exposed to direct radiation, or can receive indirect radiation exposure by inhalation or ingestion of radioactive material. Exposure by direct radiation is estimated from the expected time workers spend in known or projected radiation fields.	NA	NA-Guidance statement	NA

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9-5	9.4/4	Calculation of doses due to airborne radioactive material and liquid effluent, if necessary, begins by establishing average airborne concentrations in the workplace and in air effluent, and liquid concentrations in effluent. DACs from DOE 5480.11 (DOE, 1988a) are compared to workplace measurements as an index of performance. Derived Concentration Guides (DCGs) from DOE 5400.5 (DOE, 1990) are applied for air and liquid effluent performance indicators. For those ERP sites where no drinking water pathway exists, compliance with DOE 5400.5 (DOE, 1990) may be demonstrated by compliance with the liquid DCG.	NA	NA-Guidance statement	NA
9-5	9.4/5	Using air and liquid concentrations and release rates, computer codes such as AIRDOS and CAP88 can be employed if needed to determine doses to various receptors, including the INEL facility worker; maximally-exposed individual at the site boundary; and 50-mile radius collective population dose.	NA	NA-Guidance statement	NA
9-5	9.5/1	ERP activities incorporate site-specific or program-specific radiological control methods. The Health and Safety Plan and RWPs specify controls for all types of ERP activities at the specific site. The Health and Safety Plan is discussed in Section 9.6.	NA	NA-General statement	NA
9-5	9.5/2	The RWP informs workers of area radiological conditions and entry requirements and provides a mechanism to relate worker exposure to specific work activities.	2.4(d)	NA	5.14
9-6	9.5.1/1	External occupational radiation exposure from ERP activities are limited to levels specified in DOE 5480.11 (DOE, 1988a) and DOE-ID RCM (DOE-ID, 1992a). Within these limits, exposure is controlled ALARA using evaluation and control methods described in Section 9.1. Structures, systems, and components are designed so that personnel shall not be expected to receive more than 500 mrem total effective dose equivalent (TEDE) due to routine operations (DOE-ID, 1992a).	2.4(d)	NA	5.15
9-6	9.5.1/2	External radiation dose control is accomplished by monitoring ERP personnel for external radiation and tracking of doses received; establishing operational dose limits and administrative dose control levels; establishing radiological goals; identifying and controlling radiation sources; controlling access to radiation areas; and incorporating radiation protection design features in ERP facilities and equipment.	2.4(d)	NA	5.16

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9-6	9.5.1/3	External exposure is anticipated by radiological monitoring and surveys (Sections 9.5.7 and 9.5.8) to characterize work areas prior to ERP activities. Work control documents, such as the Site Health and Safety Plan and RWP (Section 9.5), employ survey data to inform workers of potential hazards so external dose can be minimized through instructions on work time, distance to radiation sources, and shielding. Access control requirements assure that only qualified individuals have access to Controlled Areas and potentially incur exposure for a given ERP activity (Section 9.5.12).	2.4(d)	NA	5.17
9-6	9.5.1/4	While within the area, workers and radiation protection personnel remain cognizant of, and avoid or shield, external radiation sources identified by surveys and work documents. Primary dosimeters, self-reading dosimeters, and continuing surveys provide data on actual exposure incurred and current radiological conditions. The worker and radiation protection personnel evaluate doses received and ongoing workplace surveys, identifying unnecessary exposure and mitigating such exposures when reasonable.	2.4(d)	NA	5.18
9-6	9.5.1/5	Challenging radiological goals (Section 9.1.2) and administrative limits are set based on operating experience at the INEL and within the ERP. Dosimeter data is tracked to ascertain external exposure control performance relative to goals and administrative limits.	NA	NA-General statement	NA
9-6	9.5.2/1	Personnel dosimetry is provided for workers expected to receive an annual external whole body dose greater than 100 mrem or an annual dose to the extremities, lens of the eye, or skin greater than 10 percent of the corresponding limits specified in the RCM (DOE-ID, 1992a). Neutron dosimetry is provided when a person is likely to exceed 100 mrem annually from neutrons.	NA	NA-General statement	NA
9-6	9.5.2/2	Personnel external dosimeters include, but are not limited to, thermoluminescent dosimeters (TLDs), track etch dosimeters, and neutron sensitive film. INEL personnel dosimeters are accredited through DOELAP.	NA	NA-General statement	NA
9-7	9.5.2/3	Exposures of INEL personnel's skin, lens of the eye, and extremities are reported separately when monitored. Multiple dosimeters are issued to personnel to assess whole body exposure in non-uniform radiation fields.	NA	NA-General statement	NA
9-7	9.5.2/5	Supplemental dosimeters are issued to personnel prior to entry into a High Radiation Area, when a person could exceed 10 percent of an administrative control level for external radiation in 1 work day, or when required by an RWP.	NA	NA-General statement	NA

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9-7	9.5.2/6	Supplemental dosimeters are worn simultaneously with the primary dosimeter, read periodically while in use, and not allowed to exceed 75 percent of full scale.	NA	NA-General statement	NA
9-7	9.5.2/7	Routine work on an RWP is stopped when supplemental dosimeter readings indicate total exposure or rate of exposure substantially greater than planned. The Radiological Control Organization is consulted prior to continuation of work.	2.4(d)	NA	5.19
9-7	9.5.2/9	When dose results from a pocket or electronic dosimeter differ by more than 50 percent from the primary dosimeter result and the primary dosimeter result is greater than 100 mrem, an investigation is initiated to explain the difference.	NA	NA-General statement	NA
9-7	9.5.3/1	To minimize internal exposures, contamination is controlled at the source. Airborne radioactivity and contamination are reduced where such reductions are ALARA (DOE-ID, 1992a). Work is planned to avoid the routine use of respiratory protection devices.	2.4(d)	NA	5.20
9-7	9.5.3/2	The minimization and control of internal exposure is conducted in accordance with the following hierarchy of controls (DOE-ID, 1992a): <ul style="list-style-type: none"> • Engineering controls, including containment of radioactive material at the source wherever practicable • Administrative controls, including access restrictions and the use of specific work practices designed to minimize airborne contamination • Respiratory protection, to limit internal exposures when engineering and administrative controls are applied and the potential for airborne radioactivity still exists. 	NA	NA-Statement already part of a TSR	NA

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9-8	9.5.3/3	If intakes of radioactive material are indicated which could result in a CEDE greater than 100 mrem, the following actions are taken (DOE-ID, 1992a): <ul style="list-style-type: none"> • Identification of personnel potentially exposed to airborne radioactivity • Obtaining of nasal smears for qualitative indication of intakes, where appropriate • Analysis of air samples to determine airborne concentrations, where appropriate • Determination of duration of potential exposure to airborne radioactivity • Performance of bioassay appropriate for radionuclides involved • Evaluation of dose prior to permitting worker to return to radiological work. 	2.4(d)	NA	5.21
9-8	9.5.4/1	Individuals working on ERP activities are classified by job tasks to evaluate internal exposure potential. If the potential exposure exceeds RCM trigger levels, the individuals are included in the bioassay program. As a minimum, all employees scheduled to become Radiation Workers and likely to receive intakes resulting in greater than 100 mrem, undergo initial, periodic, and termination baseline whole body counts or bioassays in accordance with the RCM (DOE-ID, 1992a).	NA	NA-General statement	NA
9-9	9.5.5/1	Radiological instruments are used only to measure radiation for which calibrations are valid. DOE Order 5480.4 (DOE, 1991b) mandates requirements contained in American National Standards Institute (ANSI) N323 (ANSI, 1983) for radiological instrumentation calibration. Calibration of radiological instruments is accomplished in facilities designed and operated in accordance with the recommendations of ANSI-N323 (ANSI, 1983), employing National Institute of Standards and Technology (NIST) traceable sources.	2.4(d)	NA	5.22
9-9	9.5.5/2	Supplemental electronic dosimeters, area radiation monitors, and portable instruments are calibrated semi-annually. Radiological instruments undergo calibration prior to use following any preventive or corrective maintenance or any adjustment that voids the previous calibration. A functional check to test all components involved in an alarm or trip function is performed semi-annually (ANSI, 1983).	2.4(d)	NA	5.23

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9-9	9.5.5/3	Instruments with "as found" readings, indicating the instrument may have been used while out of calibration, are reported to the Radiological Control Organization. If underresponse of -20% is identified, the Radiological Control Organization reviews surveys performed with the instrument while it was out of calibration and takes corrective action (ANSI, 1983).	NA	NA-General statement	NA
9-9	9.5.6/1	Engineering controls and work practices for ERP activities are designed to control radioactive materials at the source, so that respiratory protection can be reduced (DOE-ID, 1992a).	2.4(d)	NA	5.24
9-9	9.5.6/2	Respirators are issued only to personnel trained, fitted, and medically qualified to wear the specific type of respirator. Training and qualification testing are performed annually. Positive controls are maintained for the issue, use, and return of respirators to ensure that only qualified personnel wear respirators.	2.4(d)	NA	5.25
9-9	9.5.6/3	Each prospective respirator wearer receives a medical assessment prior to being fit-tested. The medical assessment determines if an employee's medical condition precludes the use of respirators. The ability of an employee to accommodate additional stress placed on the body when working in a respirator is part of this assessment.	NA	NA-Descriptive statement	NA
9-10	9.5.6/4	The selection of respiratory protection equipment includes consideration of worker safety, comfort, and efficiency. Positive pressure respiratory protection devices are used wherever practicable to alleviate fatigue and increase comfort.	NA	NA-Descriptive statement	NA
9-10	9.5.7/1	Air monitoring equipment is routinely calibrated and maintained at least once each year (DOE-ID, 1992).	NA	NA-Descriptive statement	NA
9-10	9.5.7/2	Air sampling equipment is used in areas where, under normal operating conditions, a person is likely to receive an annual intake of 2 percent or more of the specified annual limit of intake (ALI) values, or 40 DAC hours.	2.4(d)	NA	5.26
9-10	9.5.7/2	Air sampling equipment is positioned to representatively measure air concentrations to which persons are exposed (DOE-ID, 1992a).	NA	NA-General statement	NA

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9-10	9.5.7/3	Continuous air monitoring (CAM) equipment is installed in occupied areas where a person without respiratory protection is likely to be exposed to a concentration of radioactivity in air exceeding 1 DAC or where there is a need to alert potentially exposed workers to unexpected increases in the airborne radioactivity levels.	2.4(d)	NA	5.27
9-10	9.5.7/4	Continuous air monitors are capable of measuring 8 DAC-hours (DOE, 1988a). CAM equipment has alarm capability to alert personnel that immediate action is necessary to minimize or terminate inhalation exposures. The proper operation of CAM equipment is verified daily by performing an operational check (DOE-ID, 1992a).	2.4(d)	NA	5.28
9-10	9.5.8/1	Surveys for radiation, contamination, and airborne radioactive materials are performed as specified in the RCM and RWPs (DOE-ID, 1992a).	2.4(d)	NA	5.29
9-10	9.5.8/2	Monitoring is performed only by trained and qualified personnel, using properly calibrated instruments. Instruments used to perform radiation surveys are response-checked daily or prior to operation. When response checks are not within ± 20 percent of the expected value, the instrument is removed from service (ANSI, 1983).	2.4(d)	NA	5.30
9-10	9.5.8/3	Radiological control personnel perform area radiation surveys, including dose rate measurements of the general area; dose rates at a distance of 30 centimeters from a source or surface of interest to evaluate potential whole body exposures; and dose rates on contact with potential sources of radiation where there is a potential for hands-on work (DOE, 1988a).	NA	NA- Descriptive statement	NA
9-11	9.5.8/4	Radiation area monitors (not including area monitoring dosimeters) are placed in very high radiation areas when such monitoring is necessary for physical access control (DOE-ID, 1992a).	2.4(d)	NA	5.31
9-11	9.5.8/5	Radiation area monitors are considered for frequently occupied locations with the potential for unexpected increases in dose rates and in remote locations where a local indication of dose rates prior to personnel entering remote locations are required. However, radiation area monitors are not substituted for radiation exposure surveys in characterizing a workplace (DOE-ID, 1992a).	2.4(d)	NA	5.32

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9-11	9.5.8/6	Radiation area monitors are tested at least quarterly to verify audible alarm system operability and audibility under ambient working conditions and operability of visual alarms when so equipped. If installed instrumentation is removed from service for maintenance or calibration, a radiation monitoring program providing at least equal detection capability is maintained (DOE-ID, 1992a).	2.4(d)	NA	5.33
9-11	9.5.8/7	Control of radioactive contamination is achieved by using engineering controls and worker performance to contain contamination at the source; by reducing existing areas of contamination; and by promptly decontaminating areas that become contaminated.	2.4(d)	NA	5.34
9-11	9.5.8/8	Routine surface contamination surveys are conducted in accordance with the RCM (DOE-ID, 1992a). Requirements for assessing representative samples of bulk material (such as sand, sweeping compounds, or plate steel), not suitable for normal, loose, and fixed contamination-level assessment techniques, are specified in DOE Order 5400.5 (DOE, 1990). Contaminated soil not releasable in accordance with DOE Order 5400.5 (DOE, 1990) is posted as a Soil Contamination Area (DOE-ID, 1992a).	NA	NA-General statement	NA
9-11	9.5.8/9	Personnel perform a whole body frisk immediately upon exiting Contamination Areas, High Contamination Areas, and Airborne Radioactivity Areas and as directed by the RWP or the Radiological Control Organization (DOE, 1988a).	NA	NA-General statement	NA
9-11	9.5.8/10	ERP personnel exiting a Radiological Buffer Area containing Contamination, High Contamination, or Airborne Radioactivity Areas perform a hand and foot frisk. This frisk is optional if the Radiological Buffer Area exit is immediately adjacent to the location where the exiting worker already has performed a whole body frisk (DOE-ID, 1992a).	NA	NA-General statement	NA
9-11	9.5.8/11	Personnel frisking is performed after removal of protective clothing and prior to washing or showering. Personal items such as notebooks, papers, and flashlights are subject to the same frisking requirements as the person carrying them. Instructions for personnel frisking are posted adjacent to personnel frisking instruments or monitors.	NA	NA-General statement	NA
9-12	9.5.8/12	When personnel detect skin contamination, they notify the Radiological Control Organization. The extent of skin contamination is determined prior to initiating decontamination procedures (DOE-ID, 1992a).	NA	NA-General statement	NA

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9-12	9.5.8/13	Emergency medical care is administered immediately for injuries involving radioactive materials in accordance with National Council on Radiation Protection (NCRP) <u>Measurements Report Number 65</u> (NCRP, 1980). Medical treatment of injuries takes precedence over radiological considerations.	NA	NA- Descriptive statement	NA
9-12	9.5.8/14	The DOE-ID RCM (DOE-ID, 1992a) defines radioactive material as any material, equipment, or system component determined to be contaminated. Items located in known or suspected Contamination, High Contamination, or Airborne Radioactivity Areas with the potential to become contaminated are considered radioactive material. Radioactive material includes activated material, sealed and unsealed sources, and materials that emit radiation.	NA	NA- Descriptive statement	NA
9-12	9.5.8/15	Materials in Contamination, High Contamination, or Airborne Radioactivity Areas are considered radioactive material until surveyed and released. Radioactive material within Contamination, High Contamination, or Airborne Radioactivity Areas, that is confirmed or suspected of having removable radioactive contamination levels greater than RCM values, is labeled and packaged prior to release to Controlled Areas (DOE-ID, 1992a).	NA	NA-General statement	NA
9-12	9.5.8/16	Radioactive material in Controlled Areas or Radioactive Material Areas is surveyed prior to release to uncontrolled areas. DOE Order 5400.5 (DOE, 1990) describes criteria for releasing radioactive material to uncontrolled areas. Radioactive material to be released is evaluated for contamination under any coatings or contamination in depth or volume, such as activated material or smelted contaminated material. Labels are removed or defaced prior to release of radioactive material for unrestricted use.	NA	NA- Descriptive statement	NA
9-12	9.5.8/17	In cases where outdoor storage of ERP radioactive material is necessary, the integrity of containers will prevent degradation from weathering and subsequent release of radioactive material (DOE-ID, 1992a).	NA	NA-General statement	NA
9-12	9.5.8/18	DOE Order N 5400.9 (DOE, 1991a) describes how sealed sources are controlled and maintained. Unsealed sources are controlled and maintained in a similar manner except for integrity testing.	NA	NA-General statement	NA
9-12	9.5.8/19	The contamination limits of 49 CFR 173 are used to control any shipment which uses a non-DOE conveyance for any portion of the overall transportation route. RCM contamination values are applied as controlling limits for onsite and offsite transportation when using a DOE conveyance. Receipt surveys of radioactive material shipments are performed by the Radiological Control Organization.	NA	NA- Descriptive statement	NA

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9-13	9.5.8/20	Onsite transfers over nonpublic thoroughfares or between facilities on the same site are performed in accordance with written procedures using pre-approved routes. Onsite transfers over public thoroughfares are performed in accordance with United States Department of Transportation (DOT) shipping requirements (DOT, 1993).	NA	NA- Descriptive statement	NA
9-13	9.5.8/21	Drivers of DOE and non-DOE motor vehicles have a copy of the emergency response plan, or the emergency response information required by 49 CFR 172.600, during transport onsite or offsite (DOT, 1993).	NA	NA- Descriptive statement	NA
9-13	9.5.9/1	If more than one radiological condition (such as contamination and high radiation) exists in the same area, each condition is identified. Postings at entrance points to Radiological Areas contain basic entry requirements, such as dosimetry, RWP, and respirator required (DOE-ID, 1992a).	NA	NA-General statement	NA
9-13	9.5.9/2	Controlled Areas within the ERP activity boundary are clearly posted to alert personnel to the presence of radiation and radioactive materials above natural background levels. Activity-specific Controlled Area posting is not required if the ERP boundary is within previously defined and posted INEL Controlled Area boundaries. Personnel entering only the Controlled Area without entering Radiation, Contamination, Airborne Radioactivity, or Radiological Buffer Areas are not expected to receive more than 100 mrem in a year (DOE, 1988a).	NA	NA-General statement	NA
9-13	9.5.9/3	A Radiological Buffer Area is established within the Controlled Area to provide a second boundary to minimize the spread of contamination.	NA	NA- Descriptive statement	NA
9-13	9.5.9/3	At a minimum, the Radiological Buffer Area includes the area adjacent to any exit from and entrance to Contamination, High Contamination, and Airborne Radioactivity Areas (DOE-ID, 1992a).	NA	NA-General statement	NA
9-13	9.5.9/4	Areas are posted to alert personnel to the presence of external radiation in accordance with the RCM (DOE-ID, 1992a).	2.4(d)	NA	5.35
9-13	9.5.9/5	<u>Posting Contamination and Airborne Radioactivity Areas.</u> Areas are posted to alert personnel to contamination in accordance with the RCM (DOE-ID, 1992a). DAC values used with RCM airborne area posting criteria are found in DOE 5480.11 (DOE, 1988a).	2.4(d)	NA	5.36

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9-13,14	9.5.9/6,7	Areas where radioactive materials are used, handled, or stored are posted "Caution, Radioactive Material." Radioactive Material Areas are located within Controlled Areas. Posting for Radioactive Material Areas is not required when the radioactive material is inside a Contamination, High Contamination, or Airborne Radioactivity Area (DOE-ID, 1992a).	NA	NA- Descriptive statement	NA
		Underground Radioactive Material Areas are established to indicate the presence of underground items that contain radioactive materials such as pipelines, radioactive cribs, covered ponds, covered ditches, catch tanks, inactive burial grounds, and sites of known, covered, unplanned releases (spills). Underground Radioactive Material Areas are posted "UNDERGROUND RADIOACTIVE MATERIAL." Underground Radioactive Material Areas may be located inside or outside Controlled Areas and are exempt from entry and exit requirements (DOE-ID, 1992a).	NA	NA-General statement	NA
9-14	9.5.10/1	Radiation protection records related to ERP activities are retained to document the effectiveness of the radiation protection program and demonstrate compliance with DOE Orders 1324.2A (DOE, 1988b), 5484.1B (DOE, 1981), 5480.11 (DOE, 1988a), and the RCM (DOE-ID, 1992a).	NA	NA-General statement	NA
9-14	9.5.10/2	DOE Order 1324.2A (DOE, 1988b) provides implementing instructions, records inventory requirements, disposition schedules, and provisions for the transfer of records. The Privacy Act of 1974 contains requirements to protect the privacy of individual records.	NA	NA- Descriptive statement	NA

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9-14	9.5.10/3	<p>A radiological records management program ensures that auditable records and reports are controlled through the stages of creation, distribution, use, arrangement, storage, retrieval, and disposition, consistent with DOE Order 1324.2A (DOE, 1988b) and the Privacy Act. The records management program includes the following:</p> <ul style="list-style-type: none"> • Radiological policy statements • Radiological control procedures • Individual radiological doses • Internal and external dosimetry policies and procedures (including bases documents) • Personnel training (course records and individual records) • ALARA records • Radiological instrumentation test, repair, and calibration records • Radiological surveys • Area monitoring dosimetry results • RWPs • Radiological performance indicators and assessments • Radiological safety analysis and evaluation reports • Quality assurance records • Radiological incident and occurrence reports (and critique reports, if applicable) • Accountability records for sealed sources • Records for release of material to Controlled Areas • Reports of loss of radioactive material. 	NA	NA-Statement already included as part of a TSR	NA
9-15	9.5.10/4	Where radiological services (for example, dosimetry and laboratory analyses) are purchased, records of results will reside in the custody of the Radiological Control Organization.	NA	NA-General statement	NA
9-15	9.5.11/2	Standardized INEL core course training material is used for General Employee Radiological Training, Radiological Worker I and II training, and Radiological Control Technician training. However, ERP site-specific aspects of radiological training are provided, with emphasis on the activity-specific Health and Safety Plan. Site-specific training for General Employee Radiological Training and Radiological Worker I and II training may be included with other site orientation training (DOE-ID, 1992a).	2.4(d)	NA	5.37
9-15	9.5.11/3	Written examinations for General Employee Radiological Training, Radiological Worker I and II training, and Radiological Control Technician qualification are used to demonstrate satisfactory completion of theoretical and classroom material (DOE-ID, 1992a).	NA	NA-General statement	NA

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9-15	9.5.11/4	General Employee Radiological Training is completed every 2 years. In alternate years when full retraining is not offered, the latest course materials are distributed for self-study (DOE-ID, 1992a).	NA	NA-General statement	NA
9-15	9.5.11/5	Radiological Worker I and II retraining is completed every 2 years. In alternate years when retraining is not performed, refresher training is completed (DOE-ID, 1992a).	NA	NA-General statement	NA
9-15	9.5.11/6	Site-specific training and refresher training includes information regarding changes in requirements and updates of lessons learned from operations and maintenance experience and occurrence reporting for the INEL, ERP, and across the DOE complex (DOE-ID, 1992a).	NA	NA-Descriptive statement	NA
9-15	9.5.12/1	Entry and exit controls are implemented at ERP sites to ensure only properly trained and equipped personnel enter Controlled or Radiological Areas to prevent unnecessary radiation dose and contamination spread. Successful completion of Visitor Orientation or General Employee Radiological Training is required for unescorted entry into Controlled Areas (DOE-ID, 1992a).	NA	NA-General statement	NA
9-16	9.5.12/2	Radiological workers from other DOE or DOE-contractor facilities may receive the same occupational exposure as an INEL radiological worker if they have met the following conditions: <ul style="list-style-type: none"> • Provision of record of current Radiological Worker I or II standardized core training • Completion of site-specific Radiological Worker I or II training at facilities where they will work • Provision of personal radiation dose records for previous years and written estimates for current year. 	NA	NA-General statement	NA
9-16	9.5.12/3	Minimum requirements for unescorted entry into Radiological Buffer Areas include the following (DOE-ID, 1992a): <ul style="list-style-type: none"> • Radiological Worker I training • Personnel dosimetry, as appropriate. 	NA	NA-Descriptive statement	NA
9-16	9.5.12/4	Personnel who exit a Radiological Buffer Area containing Contamination Areas, High Contamination Areas, or Airborne Radioactivity Areas monitor themselves and personal belongings for contamination.	NA	NA-General statement	NA

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9-16	9.5.12/5	Radiological Worker I training is required for unescorted entry into Radioactive Material Areas containing either of the following (DOE-ID, 1992a): <ul style="list-style-type: none"> • Sealed radioactive sources • Labeled and packaged radioactive material. 	NA	NA-General statement	NA
9-16	9.5.12/7	Minimum requirements for unescorted entry into Radiation Areas include the following (DOE-ID, 1992a): <ul style="list-style-type: none"> • Radiological Worker I training • Worker's signature on the RWP, as applicable • Personnel dosimetry. 	NA	NA-General statement	NA
9-16	9.5.12/8	Access to High Radiation Areas. Physical controls to prevent inadvertent or unauthorized access to High and Very High Radiation Areas are maintained in accordance with the DOE-ID RCM (DOE-ID, 1992a) and DOE 5480.11 (DOE, 1988a). Minimum requirements for unescorted entry into High Radiation Areas include the following (DOE-ID, 1992a): <ul style="list-style-type: none"> • Radiological Worker II training • Worker's signature on the RWP • Personnel and supplemental dosimeters • Survey meter or dose rate indicating device available at the work area. 	NA	NA-General statement	NA
9-17	9.5.12/9	Minimum requirements for unescorted entry into High Radiation Areas where dose rates exist such that a worker could exceed a whole body dose of 1 rem in one hour include requirements for entry to High Radiation Areas and the following (DOE-ID, 1992a): <ul style="list-style-type: none"> • Determination of the worker's current exposure, based on primary and supplemental dosimeter readings • Pre-job briefing, as applicable • Review and determination by the Radiological Control Organization regarding the required level of Radiological Control Technician coverage. 	NA	NA-General statement	NA

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9-17	9.5.12/10	<u>Access to Very High Radiation Areas.</u> Physical controls to prevent inadvertent or unauthorized access to Very High Radiation Areas are maintained in accordance with the DOE-ID RCM (DOE-ID, 1992a), and DOE 5480.11 (DOE, 1988a). Workers are prevented from entry to Very High Radiation Areas when the radiation source is exposed and very high radiation fields are present. In addition to the controls required for High Radiation Areas, a survey is performed prior to the first entry to the area after the source has been secured or shielded to verify the very high radiation field has been terminated (DOE-ID, 1992a).	2.4(d)	NA	5.38
9-17	9.5.12/11	Facility operations personnel are notified prior to ERP personnel entry to areas where operational or system changes made by operations personnel could result in significantly increased area dose rates. The number, issue, and use of keys are strictly controlled where locked entryways are used to control access to High and Very High Radiation Areas (DOE-ID, 1992a).	NA	NA- Descriptive statement	NA
9-17	9.5.12/12	Minimum requirements for unescorted entry into Contamination Areas include the following (DOE-ID, 1992a): <ul style="list-style-type: none"> • Radiological Worker II training • Worker's signature on the RWP, as applicable • Protective clothing • Personnel dosimetry, as appropriate. 	NA	NA-General statement	NA
9-18	9.5.12/13	Minimum requirements for unescorted entry into High Contamination or Airborne Radioactivity Areas include the following (DOE-ID, 1992a): <ul style="list-style-type: none"> • Radiological Worker II training • Worker's signature on the RWP • Protective clothing and respiratory protection, as specified by the RWP • Pre-job briefing for High Contamination or Airborne Radioactivity Areas, as applicable • Personnel dosimetry, as appropriate. 	NA	NA-General statement	NA
9-18	9.5.12/14	Requirements for personnel exiting Contamination, High Contamination, or Airborne Radioactivity Areas include the following (DOE-ID, 1992a): <ul style="list-style-type: none"> • Removal of protective clothing as specified in the RCM • Performance of whole body frisking to detect personnel contamination • Monitoring of tools or equipment removed from the area for release or for retention in a contaminated tool crib. 	NA	NA-General statement	NA

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9-18	9.5.12/15	Exit points from Contamination, High Contamination, or Airborne Radioactivity Areas include the following: <ul style="list-style-type: none"> • Step-off pad maintained free of radioactive contamination outside the exit point, contiguous with the area boundary • Labeled containers inside the area boundary for the collection of protective clothing and equipment • Contamination monitoring equipment located as close to the step-off pad as background radiation levels permit. 	NA	NA- Descriptive statement	NA
9-18	9.5.12/16	Site procedures and the Site Health and Safety Plan identify area entry requirements and access restrictions for visitors.	2.4(d)	NA	5.39
9-19	9.5.12/17	Visitors are prevented from entering Very High Radiation Areas, High Contamination, and Airborne Radioactivity Areas.	NA	NA- Descriptive statement	NA
9-19	9.6/1	The requirements and contents of the Site Health and Safety Plan for the performance of ERP activities are provided in 29 CFR 1910.120 (DOL, 1993). The contents of the Site Health and Safety Plan include the following: <ul style="list-style-type: none"> • Personnel training • Medical surveillance • Hazard evaluation • Levels of protection and personal protective equipment • Site control measures • Environmental and personnel monitoring • Decontamination procedures • Emergency procedures, equipment, and information • Confined space entry • Spill Containment program. 	2.4(c)	NA	2.2
9-19	9.6/2	The conduct of all ERP activities must meet the requirements stipulated in the Site Health and Safety Plan.	NA	NA-General statement	NA

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10-1	10.0/1	The Baseline Safety Analysis File (BSAF) will be annually updated to reflect any revisions to DOE requirements.	NA	NA-General statement	NA
10-2	10.1.1/3	Activity-specific Health and Safety Plans identify the potential for exposure to carcinogens and exposure to other chemicals at levels exceeding applicable limits, so that the extent of applicable ALARA requirements can be determined. A partial list of carcinogens, including only those chemicals for which OSHA has promulgated specific regulations, is provided in Table 10-1 to facilitate the determination of ALARA requirements for a specific ERP activity.	2.4(c)	NA	2.3
10-6	10.3.2/1	Pursuant to "Toxic and Hazardous Substances - Subpart Z," 29 CFR 1910.1000(e) (DOL, 1993c), to achieve compliance with the designated limits for toxic and hazardous air contaminants, administrative or engineering controls will be implemented whenever feasible. If such controls are not feasible to achieve full compliance, protective equipment or other protective measures will be used to keep within prescribed limits for exposure of employees to air contaminants.	2.4(d)	NA	6.5
10-6	10.3.2/3	If industrial processes or facilities are designed to support ERP activities, design criteria required by DOE will be applied during design; and design drawings will be reviewed by a qualified industrial hygienist to ensure correct interpretation of the DOE criteria.	NA	NA-Statement not related to safe operation	NA
10-7	10.3.2/7	Systems shall be designed to maintain the required capture air velocities for source contaminant control	NA	NA-General statement	NA
10-8	10.3.2/8	Supply and exhaust ventilation systems for industrial-type facilities and laboratories shall be provided in the ventilation quantities required to maintain OSHA air quality limits; all the PELs established by 29 CFR 1910; and all ACGIH TLVs.	2.4(d)	NA	6.6
10-8	10.3.2/8	Make-up air shall be provided in the quantities required to maintain positive or negative room static pressure requirements and to offset local exhaust air quantities (DOE, 1989).	NA	NA-Statement already part of a TSR	NA
10-8	10.3.2/10	Equipment designed to control hazardous material may involve monitoring systems or air cleaning devices that serve to limit environmental releases. In these cases, the design will conform to all applicable permit requirements, environmental standards, and DOE requirements related to environmental protection.	NA	NA-General statement	NA

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10-10	10.4.3/4	The activity-specific Health and Safety Plan will indicate worker protection measures to be implemented if exposure limits are exceeded, and a monitoring plan to verify calculated exposure estimates (Section 10.5.1). In developing the Health and Safety Plan, consideration is given to the severity of exposure; the numbers of workers involved; the duration of exposure; and the feasibility of reducing exposure levels.	2.4(c)	NA	2.4
10-12	10.5.1/2	OSHA regulations require planning and communication of hazard assessment information to employees. As part of the Site Health and Safety Plan, a safety and health hazard analysis is provided for each site, task, and operation identified in the workplan for cleanup of hazardous wastes as required by 29 CFR 1910.120(b)(ii)(a).	NA	NA- Descriptive statement	NA
10-12	10.5.1/3	<u>Task and Site Description.</u> The Health and Safety Plan will include a clear statement of the scope of work and a description of site characteristics.	NA	NA-General statement	NA
10-13	10.5.1/5	The Health and Safety Plan will note that those general requirements apply to all employees and subcontractors, and augment the general training with activity-specific topics to be covered in briefings or on-the-job training.	2.4(c)	NA	2.5
10-13	10.5.1/6	Medical examinations are provided for all ERP workers to comply with 29 CFR 1910.120(f). Additional medical surveillance requirements for a specific activity, such as bioassays, and their frequencies, will be stated in the Site Health and Safety Plan.	NA	NA- Descriptive statement	NA
10-13	10.5.1/7	Health and Safety Plans will include an evaluation of the potential hazards to be encountered during the planned ERP activity.	NA	NA-General statement	NA
10-13	10.5.1/8	The Health and Safety Plan will name all chemicals identified as potential site contaminants, and describe the potential for exposures exceeding exposure limits, IDLH concentrations, potential skin absorption and irritation, eye irritation, or oxygen deficiency.	NA	NA-General statement	NA
10-14	10.5.1/10	The frequency and types of air monitoring, radiological monitoring, personnel monitoring, and environmental sampling are spelled out in the monitoring plan.	NA	NA-General statement	NA
10-15	10.5.1/13	The Health and Safety Plan will specify personal protective equipment to be used by employees for each task and operation to be conducted.	2.4(c)	NA	2.6
10-15	10.5.1/13	The personal protective clothing specified in the Site Health and Safety Plan must provide effective protection against the identified hazards, when properly used.	NA	NA-General statement	NA

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10-15	10.5.1/14	The Health and Safety Plan will describe the processes to be used to remove contaminants from personnel and equipment. Criteria by which personnel and equipment will be judged "clean" will be established.	NA	NA-General statement	NA
10-15	10.5.1/15	If worker entry to confined spaces is required, the Site Health and Safety Plan will identify procedures to be used to ensure compliance with requirements of 29 CFR 1910.146.	NA	NA-General statement	NA
10-15	10.5.1/16	The Health and Safety Plan will address the methods to be used to minimize the quantities of hazardous wastes generated.	NA	NA-General statement	NA
10-15	10.5.1/16	If there is a potential for a spill or environmental release of hazardous material, measures to be taken to prevent or mitigate such spills or releases will be included in the Health and Safety Plan.	2.4(c)	NA	2.7
10-16	10.5.1/19	A safety review committee or other independent review group reviews Health and Safety Plans.	NA	NA-Descriptive statement	NA
10-17	10.5.3/1	Samples that require laboratory analysis are submitted to a laboratory accredited by the American Industrial Hygiene Association (AIHA).	NA	NA-General statement	NA
10-17	10.5.4/1	Workplaces and operations are periodically surveyed to identify both potential and existing health hazards and evaluate them using DOE-approved criteria as required by DOE Order 5480.10 (DOE, 1985).	2.4(j)	8.	NA
10-17	10.5.4/1	Recommendations to correct identified deficiencies or eliminate hazards are made in writing to the responsible manager.	2.4(j)	NA	8.1

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10-17	10.5.5/1	Records related to hazardous material exposure associated with ERP activities are retained to document the effectiveness of the hazardous material protection program and demonstrate compliance with applicable DOE Orders. Records and reports are controlled through the stages of creation, distribution, storage, retrieval, and disposition consistent with DOE Order 1324.2A (DOE, 1988b) and the Privacy Act. Records subject to retention requirements include the following: <ul style="list-style-type: none"> • Exposure monitoring results • Personnel training (individual records) • Training records (lesson plans, evaluations) • Instrument test, repair, and calibration records • Medical examinations and bioassay tests • Industrial hygiene survey reports • Hazardous material incident reports • Hazardous material occurrence reports • Program appraisal and/or self-assessment reports. 	NA	NA- Descriptive statement	NA
10-18	10.5.5/2	medical and employee exposure records are retained for at least 30 years, as required by 29 CFR 1910.20.	NA	NA- Descriptive statement	NA
10-19	10.5.6/1	Monitoring of exposure conditions using instruments is performed only by trained and qualified personnel.	2.4(d)	NA	6.7
10-19	10.5.7/1	Monitoring of hazardous material exposures is conducted using instruments or sampling devices calibrated and maintained to ensure accurate and reproducible results.	2.4(d)	NA	6.8
10-19	10.5.7/1	Records of instrument calibration activities are maintained, and labels are placed on all monitoring equipment indicating the date when calibration is necessary. If feasible, instruments are field calibrated prior to each use.	NA	NA-General statement	NA
10-19	10.5.7/1	Defective instruments are taken out of service to prevent inadvertent use and segregated until properly disposed, repaired, or calibrated.	NA	NA-General statement	NA
10-19	10.5.8/1	OSHA regulations [29 CFR 1910.120(c)(8)] require that "any information concerning the chemical, physical, and toxicological properties of each substance known or expected to be present on site that is available to the employer and relevant to the duties an employee is expected to perform shall be made available to the affected employees."	NA	NA-General statement	NA

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10-19	10.5.9/2	Industrial hygienists review all applicable work control documents and purchase requisitions for products that contain hazardous materials to evaluate the potential hazard, employee health risk, effectiveness of controls, special regulatory requirements, and employee training requirements.	NA	NA-General statement	NA
10-20	10.6/3	The Health and Safety Plan will state which permit types are required and who will issue them.	2.4(d)	9.	2.8,5.40, 6.7
10-20	10.6/3	A "construction safe work permit" must be initiated before work begins.	2.4(d)	NA	9.1

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12-3	12.1.3/2	The INEL contractor is responsible for the development and enforcement of an Environment, Safety, and Health (ES&H) Program.	NA	NA-General statement	NA
12-3	12.1.4/1	The Project Management organization includes at a minimum the following elements: Project Manager with overall responsibility for safety and regulatory compliance and interface between the environmental remediation or D&D project and technical support organizations and subcontractors; Field Supervisor with responsibility and authority to direct all field operations; Health and Safety Officer with responsibility and authority to develop and implement the Health and Safety Plan and verify compliance; and all other personnel necessary for activity-specific operations and emergency response.	2.4(a)	10.	NA
12-3	12.1.4/2	The Health and Safety Plan establishes the specific chain of command and specifies the overall responsibilities of supervisors and employees.	2.4(b)	11.	NA
12-3	12.1.6/1	It is the responsibility of the Project Manager to assure that subcontractor personnel receive appropriate health and safety training as required by the Health and Safety Plan.	2.4(a)	NA	10.1
12-4	12.2.1/1	An approved Health and Safety Plan provides necessary controls for safe and efficient operation. An approved Health and Safety Plan will be in place for each ERP activity. The detailed elements of the Plan, as required by 29 CFR 1910.120, are itemized in Section 2.3, and are discussed in Sections 9.6 and 10.5.1.	2.4(c)	NA	2.9
12-4	12.2.2/1	A training program will be established for ERP activities to train personnel on facility and operating requirements and to assure suitable response by personnel to any abnormal occurrence. The training program is designed to stress safety consciousness and is described in Chapter 13.	2.4(g)	12.	NA
12-5	12.3/1	Procedures for occurrence reporting are established by DOE 5000.3A (DOE, 1990) and DOE-ID Supplemental Directive 5000.3B (DOE-ID, 1991a) to notify contractor management and DOE-ID of safety-related occurrences at ERP sites and facilities.	NA	NA-Descriptive statement	NA
12-5	12.3/1	The Project Manager is designated the activity manager and is responsible for generating and transmitting occurrence reports.	NA	NA-Descriptive statement	NA

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PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHEMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
12-5	12.3/2	An Occurrence Report will be prepared for all Reportable Occurrences according to the instructions provided in DOE Order 5000.3A and DOE-ID Supplemental Directive 5000.3B. The Project Manager and Field Supervisor are trained in proper occurrence identification and notification procedures, and all personnel are trained to initiate immediate notification of any work-related occurrences to their supervisor.	NA	NA- Descriptive statement	NA
12-5	12.4/1	To meet the objectives of the configuration and documentation management program, the requirements and responsibilities for records control are established and documented in accordance with DOE Orders 1324.2A (DOE, 1992), DOE 5700.6C (DOE, 1991d), and associated DOE-ID Supplemental Directives.	NA	NA- Descriptive statement	NA
12-6	12.4.1/1	Documents that relate to quality or safety will be prepared, issued, and changed in a controlled manner. The system will provide for the following: <ul style="list-style-type: none"> • Identification of documents to be controlled and specified distribution • Identification of responsible organizations for the preparation, review, approval, and issuance of documents • Evaluation of documentation adequacy, completeness, and correctness prior to approval, release, and distribution. 	NA	NA-General statement	NA
12-7	12.5.1/1	The basic approach of the self assessment program conducted by the INEL ERP follows: <ul style="list-style-type: none"> • Creation and maintenance of a list of self assessment areas based on applicable requirements • Creation and maintenance of a method of cross-referencing each self assessment area to appropriate requirements • Performance of assessments by objective examination of applicable work areas, activities, or processes; review and analysis of applicable documents, records, or procedures; and interviews of cognizant personnel • Documentation of scope and findings of the assessment in an assessment report • Categorization of issues based upon associated risk to the environment, safety, and/or health • Identification, implementation, and monitoring of corrective actions. 	NA	NA- Descriptive statement	NA
12-7	12.5.1/2	The INEL ERP self assessment program periodically is reviewed by management for adequacy of performance.	NA	NA-General statement	NA

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12-7	12.5.2/1	Technical requirements are independently reviewed by appropriate disciplines, with focus on compliance with applicable safety limits, technical requirements, and specifications; quality assurance/quality control; and applicable DOE, Federal, state, and local requirements.	NA	NA- Descriptive statement	NA
12-7	12.5.2/1	Approval of safety documents requires concurrence by independent safety reviewers as specified in procedures established by the Health and Safety Plan or applicable company procedures.	NA	NA-General statement	NA
12-8	12.6/1	Staffing requirements for each ERP activity are specified in the Health and Safety Plan.	2.4(e)	13.	NA
12-8	12.6/1	For Hazard Category 3 or less than Hazard Category 3 threshold activities, the responsibilities and qualifications of key ERP activity personnel, as summarized in the following sections, are based on DOE Order 5480.20 (DOE, 1991c).	NA	NA-General statement	NA
12-8	12.6/1	Staffing requirements for each ERP activity are specified in the Site Health and Safety Plan.	2.4(c)	NA	2.10

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PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
13-1	13.1/2	Each contractor is required to develop written procedures and training courses for ERP activities at INEL.	2.4(c)	13.	NA
13-1	13.1/2	Procedures shall be controlled to ensure that individuals have the most current copy of a procedure.	2.4(c)	NA	13.1
13-3	13.1.4/1	If the analyses in Chapters 5 or 11 assume or require human interaction for preventing or mitigating a significant hazard or accident, human factors analysis methods will be applied in the development of procedures and training. Human factors methods are discussed in Chapter 14. Human factors task analysis techniques will ensure that actions required by procedures are within normal human capabilities, and that the expectations for workers involved in ERP activities are realistic and achievable. Similarly, the content and effectiveness of training programs will be established using human factors task analysis methods.	2.4(c)	NA	13.2
13-4	13.2/2	Training will be conducted by professional subject matter experts.	NA	NA-General statement	NA
13-4	13.2/2	Training for radiation workers will be performed as required by the <u>DOE Radiological Control Manual</u> (DOE, 1992c).	2.4(d)	NA	5.44
13-6	13.2/4	All training shall be documented.	NA	NA-General statement	NA
13-4	13.2.1/1	Training beyond general training provided to all employees will be included in each activity-specific Health and Safety Plan or workplan.	NA	NA-Descriptive statement	NA

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PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
14-1	14.0/2	However, when reliable human performance by an operating crew is important to safety, and in proportion to that importance-to-safety, DOE requires a systematic inquiry into the optimization of the design of the human-machine interface (DOE, 1992a).	NA	NA-Guidance statement	NA
14-1	14.0/2	If hazard analyses or accident analyses assume or require reliable human interaction to mitigate or prevent a significant hazard or accident, then the application of specific human factors considerations during planning, requirements analysis, design, and test and evaluation should be documented as described in this chapter.	NA	NA-Guidance statement	NA
14-3	14.1/6	After significant human factors issues in Chapter 5 and 11 are identified and DOE-approved safety and health standards are reviewed to select applicable criteria for evaluating compliance, an examination of the environmental remediation or D&D facility (or applicable design documents if no facility exists) will be conducted to evaluate specific human factors engineering issues relevant to design.	NA	NA-Descriptive statement	NA
14-3	14.2/1	If important-to-safety human factors are identified for an ERP activity, the process outlined in DOE Order 6430.1A (DOE, 1989) to integrate human factors engineering into system development shall be followed and documented in this section.	NA	NA-Descriptive statement	NA
14-6	14.3/1	If reliable, correct, and effective human-machine interactions are identified in Chapter 5 or 11 as important to safety, then the work environment factors that might degrade the performance of operations personnel are described in this chapter.	NA	NA-Guidance statement	NA
14-7	14.3.1/2	The human factors considerations in controlling environmental conditions will be addressed in the Health and Safety Plan prepared for each ERP activity. This plan specifies procedures for work in extreme weather, reducing high noise levels, operational approaches including work/rest regimens to mitigate heat stress, and minimum illumination levels.	NA	NA-Descriptive statement	NA
14-8	14.3.2/2	All PPE shall be stored in easily accessible areas around ERP sites and inspected periodically to verify good condition	NA	NA-General statement	NA
14-8	14.3.2/2	PPE shall provide the intended level of protection and be comfortable to the user while working.	NA	NA-General statement	NA
14-8	14.3.3/1	Entry to confined spaces is controlled by a permit issued under contractor procedures that comply with OSHA regulation 29 CFR 1910.146.	NA	NA-General statement	NA

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14-8	14.4/2	If reliable human performance is identified as important to safety, then the human factors engineering program plan described in Section 14.2 shall indicate, if appropriate, that the procedures and training developed for that equipment shall be reviewed by a human factors engineer.	NA	NA-Guidance statement	NA

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15-1	15.0/2	Initial testing will be performed and documented to ensure performance as designed and the adequacy of the systems, components, and facilities involved in ERP activities.	2.4(h)	15.	NA
15-1	15.0/2	Inservice surveillance and maintenance will be performed after the systems, components, and facilities are placed into service to ensure continued safe function and operation.	2.4(d)	NA	3.2
15-1	15.0/2	Systems, components, and facilities will be maintained in a manner which promotes operational safety, worker health, environmental protection and compliance, property preservation, and cost-effectiveness.	NA	NA-General statement	NA
15-4	15.3.1/1	DOE Order 4330.4A (DOE, 1990) provides policy and objectives for the establishment of programs for management and performance of maintenance and repair of DOE property, which includes facilities. The basic policy follows: <ul style="list-style-type: none"> • Maintenance management programs for all DOE facilities shall be consistent with DOE Order 4330.4A • Property shall be maintained to promote operational safety, worker health, environmental protection and compliance, property preservation, and cost-effectiveness • Structures, components, and systems important to safe operation of a property or facility shall be subject to a maintenance program • Periodic examination of structures, systems, components, and equipment shall be performed to determine deterioration or technical obsolescence. 	2.4(j)	NA	8.1
15-6	15.3.1/3	A maintenance program as required by DOE Order 4330.4A (DOE, 1990) will be developed, implemented, and documented to ensure that maintenance activities are conducted to preserve or restore the availability, operability, and reliability of structures, systems, and components important to safe and reliable operation of ERP activities.	2.4(d)	NA	3.3

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PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
17-1	17.1.1/4	Site personnel are responsible for performing tasks safely at specific work locations.	2.4(a)	NA	10.2
17-2	17.1.2/1	Maintenance activities will be performed in accordance with manufacturer recommendations and activity-specific technical safety requirements.	2.4(h)	NA	15.1
17-2	17.1.3/1	A Health and Safety Officer is assigned to the ERP activity location to address on-location health and safety issues. The Health and Safety Officer has the authority to stop the ERP activity at any time.	2.4(a)	NA	10.3
17-2	17.1.3/5	Formal audits and appraisals are scheduled and conducted by organizations independent from the ERP, and are reported to management. Findings of audits are documented in a formal commitment tracking system.	NA	NA-General statement	NA
17-7	17.2.2/1	Access to ERP activity sites is controlled by physical security measures specified in activity-specific Health and Safety Plans, as required by 29 CFR 1910.120 (b)(4)(ii)(F) (DOL, 1993b).	2.4(c)	NA	2.13
17-7	17.2.3/1	Activity-specific Health and Safety Plans will define the extent and nature of communications to protect the work force, including how employees will be alerted during emergencies.	2.4(c)	NA	2.14
17-7	17.2.5/1	Required emergency notifications will be identified in the activity-specific Health and Safety Plan. Emergency events and unusual or abnormal occurrences reportable under DOE 5000.3B (DOE, 1993a) are investigated, categorized, and reported in accordance with written procedures for occurrence reporting.	NA	NA-Descriptive statement	NA
17-7	17.2.6/1	Unusual or abnormal occurrences reportable under DOE Order 5000.3B (DOE, 1993a) will be fully investigated by qualified individuals.	NA	NA-General statement	NA
17-9	17.5/2	The fire protection program at INEL shall meet or exceed the minimum requirements established by the National Fire Protection Association (NFPA) for the best protected class of industrial risks.	NA	NA-General statement	NA
17-9	17.5/4	The activity-specific Health and Safety Plan required by 29 CFR 1920.120 (DOL, 1993b) will discuss the issues of fire protection and suppression.	NA	NA-Descriptive statement	NA
17-9	17.5/4	The emergency response section of the Health and Safety Plan will address recognition of emergency situations, provision of emergency equipment, and coordination with emergency response organizations.	2.4(c)	NA	2.15

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PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
17-8	17.3/1	The safe storage and criticality safety of special nuclear materials are not safety concerns generally applicable to ERP activities within the scope of the Baseline Safety Analysis File (BSAF) (Chapter 8). If encountered, however, procedures for handling of special nuclear materials shall be implemented consistent with the requirements of DOE Order 5632.2A (DOE, 1989). Additional safety analyses will be conducted as appropriate.	NA	NA-Guidance statement	NA
17-9	17.5/4	If there is a credible potential for a release of chemical or radiological waste from fire, then further fire protection measures may be required for the site.	NA	NA-Guidance statement	NA
17-10	17.7/2	Each facility at the INEL is required to prepare a site-specific Safeguards and Security Plan and/or Master Safeguards and Security Agreement, which defines the appropriate level and strategy for particular security interests on a site-specific basis, consistent with operational requirements, applicable threat, target attractiveness, and potential risks.	2.4(c)	NA	2.16
17-10	17.7/3	The Health and Safety Plan required for each ERP activity will include construction area access measures which will be employed to keep individuals other than properly protected workers off the site.	2.4(c)	NA	2.17
17-10	17.8/1	Reviews and audits of the safety aspects of operation will be conducted in accordance with DOE Order 5480.1B (DOE, 1986b), DOE Order 5480.5 (DOE, 1986a), and DOE Order 5700.6C (DOE, 1991) requirements and applicable implementing procedures.	NA	NA-General statement	NA
17-11	17.8/2	The activity-specific Health and Safety Plan will contain plans for inspections by the Health and Safety Officer to determine the effectiveness of the Plan and to remedy deficiencies as required by 20 CFR 1910.120(G)(4)(iv).	NA	NA-Descriptive statement	NA

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1 PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
18-1	18.1/1	Senior management shall be responsible for QAP implementation, assessment, and improvement.	2.4(a)	NA	10.4
18-1	18.1/1	M&O contractors shall develop their QAPs by applying QA criteria specified in Section 18-2.	2.4(d)	16.	NA

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19-1	19.1.1/1	ERP activities comply with OSHA regulations for emergency plans in accordance with 29 CFR 1910.38 (DOL, 1993a); or, if ERP employees act as responders, 29 CFR 1910.120 (DOL, 1993b).	NA	NA- Descriptive statement	NA
19-1	19.1.1/2	ERP activities comply with EPA regulations in 40 CFR 300 (EPA, 1993a), 40 CFR 302 (EPA, 1993b), and 40 CFR 355 (EPA, 1993c).	NA	NA- Descriptive statement	NA
19-2	19.1.1/9	The DOE <u>Emergency Management Guides</u> (DOE, 1993b) provide acceptable methods for meeting DOE 5500 Series Orders emergency planning requirements. The guides are used by DOE elements and contractors to develop acceptable site-specific plans and procedures.	NA	NA- Descriptive statement	NA
19-2	19.1.2/2	Each DOE ERP contractor developed an Emergency Plan or Policy for corporate response to an INEL emergency, delineating acceptable means to comply with DOE emergency preparedness requirements within the contractor's purview. In addition, emergency planning and preparedness for each area and major facility at the INEL is addressed by area or facility emergency plans developed by the responsible DOE contractor.	NA	NA- Descriptive statement	NA
19-3	19.1.2/3	Health and Safety Plans provide specific emergency response information for each ERP activity. The Health and Safety Plan complies with the emergency response planning provisions of 29 CFR 1910.120 (DOL, 1993b) or 29 CFR 1910.38 (DOL, 1993a). The Health and Safety Plan contains instructions for minor emergencies and reportable occurrences, with reference to the INEL Area or Facility Emergency Plan applicable to a Reportable Occurrence or Operational Emergency at the ERP activity site.	2.4(c)	NA	2.18
19-3	19.2/1	DOE-ID administers the emergency response program at the INEL. Contractors provide day-to-day emergency response support at INEL facilities. The role of DOE-ID and contractor emergency response organizations (EROs) is to mitigate the consequences of an emergency. EROs provide initial and ongoing support and assistance to emergency response workers, performing actions that involve direct mitigation of the emergency event.	NA	NA- Descriptive statement	NA
19-3	19.2/2	Each contractor is responsible for emergency planning at respective facilities.	NA	NA-General statement	NA

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19-3	19.2.1/1	Acting under direction of the DOE-ID Emergency Management Section (EMS), the INEL site support contractors appointed an INEL Offsite Emergency Planning Coordinator. The role of the coordinator is to represent DOE-ID and all the INEL contractors in the coordination of all offsite emergency planning issues among the INEL and state, local, and tribal agencies.	NA	NA- Descriptive statement	NA
19-3	19.2.1/2	County emergency managers are designated as points of contact for joint planning activities within local jurisdictions. The INEL Offsite Emergency Planning Coordinator works through each emergency manager under direction of the DOE-ID EMS.	NA	NA- Descriptive statement	NA
19-3	19.2.1/3	The INEL Offsite Emergency Planning Coordinator works closely with the Native American Liaison Office and the Community Response Coordinator for the Fort Hall Indian Reservation to conduct joint emergency planning with the Tribe.	NA	NA- Descriptive statement	NA
19-4	19.2.1/4	The INEL Emergency Planning Coordinating Committee (EPCC) was established for coordination of overall emergency planning activities. The INEL Transportation Emergency Preparedness Program (ITEPP) was established to coordinate transportation emergency activities.	NA	NA- Descriptive statement	NA
19-4	19.2.1/5	The EPCC meets regularly to evaluate and coordinate resolution of INEL emergency preparedness issues. EPCC consists of representatives from DOE operating contractors, the construction contractor, and DOE-ID.	NA	NA- Descriptive statement	NA
19-4	19.2.1/7	The ITEPP Committee periodically meets to expedite development of INEL transportation emergency management and transportation safety policies. The committee consists of emergency management and transportation safety representatives from DOE operating contractors, the construction contractor, and DOE-ID.	NA	NA- Descriptive statement	NA
19-4	19.2.1/8	Each ERP activity integrates with the INEL ERO through an interface agreement. The agreement defines the responsibilities of the ERP contractor and the INEL operating contractor with jurisdiction over the facility or area containing the ERP site.	NA	NA- Descriptive statement	NA

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19-4	19.2.2/1	INEL contractors have the authority and are responsible for performing the following: <ul style="list-style-type: none"> • Recognizing that an emergency condition exists and providing classification and assessment • Performing immediate actions and providing recommendations for the protection of health and safety of emergency workers, the INEL population, and the public • Performing immediate actions and providing recommendations for the protection of property and the environment • Notifying members of facility EROs, DOE-ID, DOE-Headquarters, and affected state, local, tribal agencies, other Federal agencies, and other INEL facilities. 	2.4(c)	NA	2.19
19-4	19.2.2/2	During emergencies, the Incident Command System (ICS), developed by the National Interagency Incident Management System (NIIMS), will be used.	NA	NA-General statement	NA
19-5	19.2.2/2	The INEL ICS organization has the following major functional areas: <ul style="list-style-type: none"> • Command • Operations • Logistics • Planning • Finance/Legal (EOC level only). 	NA	NA-Descriptive statement	NA
19-5	19.2.2/4	The first responder on the scene at the originating facility will be in charge at the scene until relieved by appropriate emergency response personnel.	2.4(a)	NA	10.5
19-5	19.2.2/5	ERP Incident command is initially established by the Field Supervisor (FS) or other onsite authority responsible for the ERP activity. The FS implements the OSHA safety and health plan for minor occurrences most likely to be encountered during ERP activities. Depending on the nature of the emergency and the need for assistance, the FS will obtain any additional assistance through the designated area or facility Emergency Action Manager (EAM). The EAM will activate the Facility or Area ERO for a serious Reportable Occurrence or an Operational Emergency. Incident command probably will remain at the ERP site for any credible emergencies.	2.4(a)	NA	10.6
19-5	19.2.2/6	If the event requires activating a facility emergency control center (ECC), incident command will be transferred to the ECC EAM. A facility ERO is always in command of emergency response at the originating facility.	NA	NA-Descriptive statement	NA

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PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
19-6	19.2.2/7	The EAM may delegate authority to security forces to conduct on-scene and incident command during the tactical phase of security emergencies (such as with potential for weapons fire, security alarm response, hostage negotiations, or similar situations). In these situations, the facility ERO provides support to protect personnel, treat and rescue victims, and manage other plant-related response. The facility EAM will maintain command and control of facility emergency response, while security forces will retain command and control of security tactical operations.	2.4(a)	NA	10.7
19-6	19.2.2/8	An affected facility will retain command of response within its facility and will coordinate actions with other INEL organizations. An affected facility ERO will coordinate directly with an originating facility's organization until the EOC is activated.	2.4(a)	NA	10.8
19-6	19.2.2/9	Some emergencies, such as a catastrophic earthquake, could affect the entire INEL without originating at any specific facility. In such cases, each facility ERO will direct response within the respective facility. Overall emergency response command will be accomplished through the EOC. Each facility will coordinate actions with others through the EOC to the extent practicable.	NA	NA- Descriptive statement	NA
19-8	19.2.4/1	Senior contractor management conducts an appraisal of the ERP on alternate years with the DOE-ID appraisals.	NA	NA-General statement	NA
19-8	19.2.4/1	The area or facility emergency organization, including any tenant ERP activities, would be audited as part of any internal, DOE-ID, or DOE Headquarters audits. The results of the appraisals are factored into revisions in the contractors' and facilities' emergency preparedness programs.	NA	NA-General statement	NA
19-8	19.3/1	A Health and Safety Plan developed in accordance with Title 29, <u>Code of Federal Regulations</u> (CFR) 1910.120 (DOL, 1993b) contains the emergency plan for each specific ERP activity. The Health and Safety Plan references the INEL facility and area-specific emergency plans; the contractors' emergency plans; and the DOE-ID INEL Emergency Plan (DOE-ID, 1993). Procedures will be developed, as necessary, for specific operational actions to detect, assess, and mitigate accidents and take protective actions.	2.4(c)	NA	2.20

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19-8	19.3/2	The facility or area emergency plan promulgated under DOE 5500 Series Orders controls all emergency response activities within its area of jurisdiction, including any tenant ERP activities. ERP Site Health and Safety Plans are consistent with these facility and area plans. The interface agreement between the ERP contractor and the facility operating contractor provides that ERP personnel follow the directions of the facility or area plan when activated.	NA	NA- Descriptive statement	NA
19-8	19.3.1/1	Emergency response equipment for ERP activities must provide for detection of potential hazards, protection of personnel, handling of contaminated or injured personnel, preservation of equipment and property, and protection of the local environment.	NA	NA- Descriptive statement	NA
19-8	19.3.1/2	Detection devices are installed in work areas to detect and warn of workplace hazards in accordance with requirements for radiation monitoring or hazardous materials monitoring (Chapters 5, 9, and 10). Explanatory signs or tags are posted immediately adjacent to the warning device to describe the hazardous condition. Procedures explain the action to be taken in response to warning devices. A summary of specific response actions is posted adjacent to moveable hazardous material or radiation monitors in remote locations.	2.4(d)	NA	5.42, 6.8, 9.1
19-9	19.3.1/3	Supplementary warning equipment to notify or signal site personnel of an evacuation is provided to assure prompt and complete evacuation of affected areas. An evacuation plan map is kept at the site. The map indicates evacuation routes from the task site to assembly areas and to emergency support facilities.	2.4(c)	NA	2.21
19-9	19.3.1/4	At least one 20-lb fire extinguisher is readily available and at hand during operations.	NA	NA-General statement	NA
19-9	19.3.1/5	Portable eyewash fountains and sufficient potable water for flushing are readily available for the duration of the task. The task industrial hygienist determines the number and location of portable eyewash stations.	NA	NA-General statement	NA
19-9	19.3.1/6	The health and safety support staff evaluates the potential for radioactive material spills and, if appropriate, recommends placement of one or more contamination spill kits.	NA	NA-General statement	NA

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PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
19-9	19.3.2/1	There are four locations from which to operate and support an emergency response: from the originating facility; from site support facilities; from DOE facilities; and from state/local facilities. Two facilities, the originating facility ECC and facility control room, are operated by the originating facility contractor. The EOC, CFA ECC, Warning Communications Center (WCC), Reception Center, Decontamination Center, Transportation Staging Areas, and Public Information Center are operated by the site support contractor. DOE-ID provides oversight to emergency response activities in the EOC. Decontamination activities in the Decontamination Centers are supervised by the originating facility contractor health physics and industrial hygiene personnel.	NA	NA- Descriptive statement	NA
19-9	19.3.2/2	The following facilities have separate, stand-alone ECCs: the ICPP, TRA, Argonne National Laboratory-West (ANL-W), and the Naval Reactors Facility (NRF).	NA	NA- Descriptive statement	NA
19-9	19.3.2/3	The WCC is located in Room 92 of the DOE-ID Headquarters Building, Idaho Falls, Idaho. The WCC serves as the emergency notification and activation center for the INEL. The WCC is staffed continuously 365 days a year and is responsible for facilitating notifications as requested by the on-scene commander EAM or the ED. The WCC maintains ERO duty rosters and activates the INEL EOC.	NA	NA- Descriptive statement	NA
19-10	19.3.2/4	A list of decontamination facilities follows: <ul style="list-style-type: none"> • <u>TAN</u> - Radiological showers in the Decontamination Room (TAN 633) • <u>TRA</u> - Equipment decontamination facility (TRA 667) • <u>CFA</u> - Primary INEL personnel decontamination facility in the CF 602 Medical Building • <u>WROC/WERF/PBF</u> - Radiological decontamination showers in each of the change rooms in the PBF Reactor Building • <u>ICPP</u> - ICPP Equipment Decontamination Facility (CPP 659). 	NA	NA- Descriptive statement	NA
19-10	19.3.2/5	Other INEL facilities establish temporary decontamination centers as the need arises.	NA	NA-General statement	NA
19-10	19.3.2/6	The DOE-ID Fire Department has three stations on the INEL site. The main station is located in the CFA; TAN and ANL-W have substations. All three fire stations are staffed 24 hours a day by career firefighters trained as Emergency Medical Technicians.	NA	NA- Descriptive statement	NA

BSAF COMMITMENT TABLE FORM

PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
19-10	19.3.2/6	The DOE-ID Fire Department maintains a specially equipped hazardous materials vehicle used in the event of hazardous chemical incidents.	NA	NA- Descriptive statement	NA
19-10	19.3.2/7	The DOE-ID Fire Department provides ambulance service on the INEL site. In addition, medical dispensaries located on the site provide assessment and treatment for ill or injured personnel within site boundaries. The CFA dispensary is staffed by a physician and nurses; the other dispensaries are staffed by nurses and a visiting physician who rotates among the dispensaries.	NA	NA- Descriptive statement	NA
19-10	19.3.2/10	The CFA Medical Facility, located at CFA-603 is the principal triage treatment and medical decontamination facility, unless otherwise designated by the Site Medical Director. This facility functions as the primary personnel decontamination facility for the INEL.	NA	NA- Descriptive statement	NA
19-11	19.3.2/11	The Willow Creek Building (WCB) medical facility, located at WCB S-1, is available for medical administrative activities including preparation and dispensing of necessary medications such as potassium iodide (KI). WCB may be activated nights and weekends at the direction of the Medical Director.		NA- Descriptive statement	NA
19-11	19.3.3/1	The Health and Safety Plan prepared in accordance with 29 CFR 1910.120 (DOL, 1993b) defines types of emergencies which could occur at the ERP site.	NA	NA-General statement	NA
19-11	19.3.3/1	If any of these occurrences are detected, emergency procedures are implemented.	2.4(c)	NA	2.22
19-11	19.3.3/2	Procedures and plans governing safety at ERP sites contain action levels facilitating ready detection by personnel of conditions warranting operations shutdown, including Off-Normal Occurrences and Unusual Occurrences as defined in DOE 5000.3B (DOE, 1993).	2.4(c)	NA	2.23
19-11	19.3.3/3	Emergency Action Levels (EALs) specifically apply to Operational Emergencies and are implemented in the Area or Facility Emergency Plan.	2.4(c)	NA	2.24
19-11	19.3.3/3	A system of EALs and event classifications ensure the rapid recognition of accident indicators and the timely commitment of response resources. A system of pre-approved decisions is developed by each facility to allow onsite supervisory personnel (for example, shift supervisors and duty officers) to make rapid decisions affecting personnel, facilities, and resources in response to an emergency.	2.4(c)	NA	2.25

BSAF COMMITMENT TABLE FORM

PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
19-11	19.3.3/4	EALs define specific conditions to invoke emergency classifications for each type of hazard included in the facility-specific hazard assessment.	NA	NA- Descriptive statement	NA
19-11	19.3.3/5	DOE-ID facility EALs are to be developed, at a minimum, in accordance with the following categories: <ul style="list-style-type: none"> • Radiological • Nonradiological hazardous material • Fire and explosion • Natural and external phenomena • Security. 	2.4(c)	NA	2.26
19-12	19.3.4/2	Occurrences contained in DOE 5000.3B, Attachment I, are identified and notification procedures completed as soon as sufficient information is obtained, but within 2 hours of categorization as an Unusual Occurrence or 80 hours of an Off-Normal Occurrence (DOE, 1993).	NA	NA- Descriptive statement	NA
19-12	19.3.4/4	ERP activities require process safety management programs if hazardous chemicals are present in excess of the threshold quantities in 29 CFR 1910.119 (DOL, 1993c) or quantities of material are possessed that exceed the threshold planning quantities of 40 CFR 355 (EPA, 1993c).	2.4(d)	NA	1.4
19-12	19.3.4/4	All ERP activities operated under Process Safety Management programs or exceeding 40 CFR 355 threshold quantities develop and maintain plans and procedures for detecting, classifying, and reporting emergencies in accordance with DOE 5500.2B.	2.4(d)	NA	1.5
19-13	19.3.5/1	The following protective actions are conducted under the facility or area emergency plan and the ERP Site Health and Safety Plan, as coordinated through the interface agreement. If an ERP emergency affects both ERP and non-ERP personnel, the facility or area emergency plan will be activated and the protective actions will be implemented by the EAM. Conversely, ERP personnel will respond to activation of the area or facility plan during a non-ERP emergency as required.	2.4(c)	NA	2.27

BSAF COMMITMENT TABLE FORM

PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
19-13	19.3.5/2	Any life-threatening emergency such as a significant fire, explosion, or hazardous release, initiates an ERP site personnel evacuation using the shortest possible route, without regard for decontamination, personnel contamination, or surface contamination spread. Decontamination activities are addressed after personnel are safe from injury. In the event of a fire or explosion, all personnel not essential to controlling the situation are evacuated from the ERP site and fire and/or explosives experts are notified. The Field Supervisor is responsible for ensuring that appropriate evacuation procedures are followed in the event of an ERP emergency.	2.4(c)	NA	2.28
19-13	19.3.5/3	In the event of an occupational injury or illness in the exclusion (contaminated) zone, personnel must take necessary immediate actions in accordance with procedures and staff training. The Field Supervisor assesses the situation and activates emergency response procedures in consultation with the health and safety support staff. If work is halted at the site because of an injury, operational personnel do not reenter the exclusion zone for routine operations until the cause of the injury or illness is identified and corrected.	2.4(c)	NA	2.29
19-13	19.3.5/4	Injuries or illnesses incurred in the support zone are addressed as in the exclusion zone.	NA	NA- Descriptive statement	NA
19-13	19.3.5/5	A contaminated, injured worker is accompanied by at least one worker, preferably an industrial hygienist or radiation protection worker, to inform medical personnel of the level of decontamination performed before leaving the work area and to provide specific details about the illness or injury.	2.4(c)	NA	2.30
19-13	19.3.5/6	Any worker experiencing personal protective equipment failure is instructed to leave the exclusion zone, accompanied by a workmate. The health and safety support staff evaluates the situation and determines if exposure to hazardous or radioactive materials occurred. Re-entry will not be permitted until the equipment has been repaired or replaced.	2.4(c)	NA	2.31
19-13	19.3.5/7	If site equipment fails to operate properly, the Field Supervisor will be notified and will determine the effect of the failure on continued operations. If the failure affects safety of personnel or prevents completion of defined tasks, operations personnel leave the task site in a secure condition until the situation is evaluated and corrected.	2.4(c)	NA	2.32

BSAF COMMITMENT TABLE FORM

PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
19-13	19.3.5/8	If hazardous or radioactive material is spilled or released, personnel refer to the area emergency preparedness procedures for spills and report the spill to area personnel as directed. Spills of petroleum products, decontamination solutions, calibration materials, equipment fuels, and other hazardous liquids must be assessed.	2.4(c)	NA	2.33
19-14	19.3.5/9	Following any evacuation of the site because of health and safety-related issues, hazards are reassessed by the health and safety support staff and the cause of the hazard is corrected. The Health and Safety Plan, workplan, operating procedures, operational safety requirements, and emergency plans shall be reviewed for adequacy and site personnel shall be briefed on any changes prior to resuming operations.	NA	NA- Descriptive statement	NA
19-14	19.3.5/10	Team personnel reentering the evacuated zone to assess conditions shall use the same level of personal protective equipment as prior to evacuation, or protective equipment Class C, whichever is more restrictive.	2.4(c)	NA	2.34
19-14	19.3.6/1	The Field Supervisor is notified of any accidents, injuries, illnesses, or conditions potentially threatening to the ongoing safety of the activity. Upon site evacuation or any reportable occurrence, in accordance with DOE 5000.3B (DOE, 1993), the Field Supervisor promptly notifies the WCC, explaining the nature of the occurrence; actions underway; and emergency response assistance needed; followed by notification of the Area EAM. All occurrences related to safety and health and actions taken to aid personnel and mitigate the emergency are recorded in field logs.	NA	NA- Descriptive statement	NA
19-14	19.3.6/2	The EAM will ensure that state, local, and tribal authorities receive notification within 15 minutes after an Operational Emergency has been classified.	NA	NA- Descriptive statement	NA
19-14	19.3.6/4	After the initial notification is complete, offsite agencies will be updated as new information becomes available or at intervals of no longer than 60 minutes.	NA	NA- Descriptive statement	NA
19-14	19.3.6/5	For an emergency that has been classified as an alert, site area emergency, or general emergency, the EAM may order the actuation of audible emergency warning sirens in the area. Siren-generated signals serve as the primary means for notifying personnel, visitors, and transients in the immediate area.	NA	NA- Descriptive statement	NA

BSAF COMMITMENT TABLE FORM

PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
19-14	19.3.7/1	Fundamental training for emergency response consists of safety and health plan training in accordance with 29 CFR 1910.120(e) (DOL, 1993a). Visitors not required to be familiar with the specific Site Health and Safety Plan shall be briefed on site emergency procedures and escorted.	2.4(g)	NA	12.2
19-15	19.3.7/2	ERP management assures that all personnel are briefed on emergency equipment; the nature of safety warning devices in their area; and appropriate responses. Emergency communications protocols and responsibilities are explained prior to work. Management assures that workers are familiar with evacuation procedures, evacuation routes, and the nature and location of the emergency response facilities.	2.4(a)	NA	10.9
19-15	19.3.7/3	ERP management must conduct an annual exercise to evaluate personnel performance. All communications during such drills are prefaced and followed by a statement clearly identifying the situation as a drill. Each drill or any actual emergency or reportable occurrence is followed by a critique and any deficiencies identified in the emergency plan are corrected.	NA	NA-General statement	NA
19-15	19.3.7/4	In addition to ERP-specific training for emergency response, ERP personnel are trained to respond to the facility or area emergency plan for the ERP site. The DOE contractor responsible for the facility or area will assure that ERP personnel are trained, in accordance with the interface agreement. The training includes general employee response to area or facility emergencies, with additional training for ERP supervision on the interface between the ERP staff and the facility or area ERO.	2.4(g)	NA	12.3

BSAF COMMITMENT TABLE FORM

PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
20-1	20.1/2	Requirements for D&D methods contained in DOE Order 6430.1A, Section 1300-11 (DOE, 1989), shall be followed. Requirements are summarized in the following discussion.	NA	NA-General statement	NA
20-2	20.1.2/3	Operating procedures ensure that under normal operating conditions, contamination is contained in the expected locations. Furthermore, operating procedures facilitate prevention of accidents and define mitigative actions to be taken to reduce the potential spread of contamination from an accidental event. Procedures are developed, reviewed, and approved as discussed in Chapter 13.0.	NA	NA-Descriptive statement	NA
20-3	20.2/1	Operational records are maintained for contaminated facilities for use in the future preparation of D&D plans.	NA	NA-General statement	NA
20-3	20.3/1	Facilities constructed and operated to support ERP activities are decontaminated to acceptable levels, as applicable, for reuse, recycling, or disposal and removal.	NA	NA-General statement	NA
20-3	20.3/2	Any site contamination resulting from the facility's operations are remediated in accordance with the requirements of DOE 5400.5, Chapter IV (DOE, 1990); the environmental remediation action record of decision (ROD); or other established standards commensurate with the proposed site use.	NA	NA-General statement	NA
20-3	20.3/3	The policy and guidelines in DOE Order 5820.2A, Chapter V (DOE, 1988), for the decommissioning of radioactively contaminated facilities shall be followed, as applicable.	NA	NA-Descriptive statement	NA

BSAF COMMITMENT TABLE FORM

PAGE NUMBER	SECTION/ PARAGRAPH NUMBER	COMMITMENT (Direct quote from the BSAF)	DOE ORDER 5480.22 ATTACHMENT 1 ID	BSAF TSR	BSAF TSR REQUIREMENT
21-1	21.0/1	The United States Department of Energy (DOE) requires that designs follow DOE and nationally recognized codes and standards.	NA	NA-General statement	NA
21-1	21.0/1	As part of the conceptual design of an environmental remediation or D&D system, the codes and standards contained in DOE 6430.1A shall be reviewed to determine applicability. To ensure that adequate resources are provided for environmental, safety, and health (ES&H) protection as part of the design and	NA	NA-General statement	NA
21-1	21.0/2	To determine what codes and standards are applicable to a specific system design, the hazard classification under DOE Order 5480.28, <u>Natural Phenomena Hazard Mitigation</u> (DOE, 1993), and/or UCRL-15910, <u>Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena</u> ,	NA	NA-General statement	NA
21-1	21.0/2	The latest edition of any particular standard shall be the one considered applicable.	NA	NA-General statement	NA

CHAPTER 17.0

OPERATIONAL SAFETY

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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17.0 OPERATIONAL SAFETY

17.1 Organizational Structure

The following sections summarize the general organizational structure for operations, maintenance, and safety of Environmental Restoration Program (ERP) activities including environmental remediation and decontamination and decommissioning (D&D) at the Idaho National Engineering Laboratory (INEL). The organization for a specific ERP activity will be contained in the Health and Safety Plan for that activity.

17.1.1 Operations

Chapter 12 describes the INEL organizational elements that might be involved in an ERP activity. The organization conducting the environmental remediation or D&D activity is the first line of defense for ensuring safe operations. The organization is comprised of the following elements:

- Project Manager
- Field Supervisor
- Health and Safety Officer
- Site Personnel

The Project Manager has overall responsibility for ensuring that the activity is conducted in accordance with applicable health and safety programs. The Project Manager is responsible for all reporting functions.

The Field Supervisor supports the Project Manager in conducting operations. The Field Supervisor has day-to-day supervisory authority and responsibility for compliance with established controls and procedures. Specifically, the Field Supervisor is responsible for operations of all systems and components and for ensuring that activities are conducted safely, in accordance with the applicable procedures and requirements.

The Health and Safety Officer has the authority and knowledge required to establish and verify compliance with applicable safety and health requirements. The Health and Safety Officer is identified by name in the Health and Safety Plan, as required by 29 CFR 1910.120 (DOL, 1993b).

Site personnel are responsible for performing tasks safely at specific work locations. Site personnel are empowered to stop any activity they feel endangers the workers or the environment. All operations personnel are trained in safe work practices and the hazards that may be encountered during performance of ERP activities.

17.1.2 Maintenance

A range of maintenance functions from routine and minor activities to non-routine or major maintenance may be performed. Maintenance may be performed within the activity operations organization or by organizations

above the activity level. Maintenance activities will be performed in accordance with manufacturer recommendations and activity-specific technical safety requirements. Technical support personnel are available to perform various maintenance activities.

17.1.3 Safety

Safety is emphasized at all levels of ERP operations, both within the organization performing the activity and through independent reviews and audits. A Health and Safety Officer is assigned to the ERP activity to address on-location health and safety issues. The Health and Safety Officer has the authority to stop the ERP activity at any time.

Additional safety functions may vary depending on the hazards and types of operations involved in a specific ERP activity. Additional responsibilities for these functions may be assigned to the onsite supervisor, industrial hygienist, radiological control technician, fire protection engineer, safety engineer, and/or environmental compliance engineer. These functions and responsibilities are identified in the activity-specific Health and Safety Plan.

Cognizant discipline support is provided by Technical Support personnel. Cognizant discipline support includes quality engineering, industrial safety, industrial hygiene, fire protection engineering, environmental engineering, and radiological control engineering.

The INEL ERP's Safety Review Committee reviews Health and Safety Plans, safety analysis documentation, and safety-related issue resolutions. The purpose of the Safety Review Committee is to provide independent assurance that operations maintain a high degree of safety, health protection, quality, and environmental compliance.

Formal audits and appraisals are scheduled and conducted by organizations independent from the ERP, and are reported to management. Findings of audits are documented in a formal commitment tracking system.

17.2 Operations

The ERP operations organization will ensure that a high level of performance in operations is achieved through effective implementation and control of operations activities. Requirements of United States Department of Energy (DOE) 5480.19 (DOE, 1990), *Conduct of Operations*, are discussed in the following sections (except for operations organization and administration which are discussed above in Section 17.1) and are summarized in Table 17-1. Table 17-1 identifies for each applicable DOE 5480.19 requirement, the general implementing document for ERP activities, if known. Some activities listed in Table 17-1 may not be relevant to a specific ERP activity. For example, requirements for equipment and piping labeling in Chapter XVIII do not apply if there is no equipment/piping involved in the proposed activity.

Note: This conduct of operations matrix may be used in activity-specific safety analysis documentation to specify applicable requirements and implementing documents.

TABLE 17-1. ENVIRONMENTAL RESTORATION PROGRAM (ERP) CONDUCT OF OPERATIONS MATRIX.

SPECIFIC GUIDELINE DOE 5480.19	GUIDELINE APPLIES TO INEL ERP OPERATIONS (Y/N)	MANAGEMENT AND OPERATING (M&O) CONTRACTORS OR REMEDIAL DECISION/REMEDIAL ACTION (RD/RA) IMPLEMENTATION DOCUMENTS
Chapter 1: Operations Organization and Administration		
1. Operations Policies	Y	Remedial Action Work Plan
2. Resources	Y	Remedial Action Work Plan
3. Monitoring of Operating Performance	Y	Remedial Action Work Plan
4. Accountability	Y	Remedial Action Work Plan
5. Management Training	Y	Remedial Action Work Plan; Health and Safety Plan
6. Planning for Safety	Y	Remedial Action Work Plan; Health and Safety Plan
Chapter II: Shift Routines and Operating Practices		
1. Status Practices	Y	
2. Safety Practices	Y	
3. Operator Inspection Tours	Y	
4. Round/Tour Inspection Sheets	Y	
5. Personnel Protection	Y	Remedial Action Work Plan; Health and Safety Plan
6. Response to Indications	Y	
7. Resetting Protection Devices	Y	
8. Load Changes	Y	
9. Authority to Operate Equipment	Y	Remedial Action Work Plan
10. Shift Operating Changes	Y	
11. Potentially Distractive Written Materials and Devices	N	
CHAPTER III: CONTROL AREA ACTIVITIES		
1. Control Area Activities	Y	
2. Professional Behavior	Y	
3. Monitoring Main Control Boards	Y	
4. Control Operator Ancillary Duties	Y	
5. Operation of Control Area Equipment	Y	

TABLE 17-1. ENVIRONMENTAL RESTORATION PROGRAM (ERP) CONDUCT OF OPERATIONS MATRIX (CONTINUED).

SPECIFIC GUIDELINE DOE 5480.19	GUIDELINE APPLIES TO INEL ERP OPERATIONS (Y/N)	MANAGEMENT AND OPERATING (M&O) CONTRACTORS OR REMEDIAL DECISION/REMEDIAL ACTION (RD/RA) IMPLEMENTATION DOCUMENTS
CHAPTER IV: OPERATIONS COMMUNICATIONS		
1. Emergency Communication Systems	Y	Remedial Action Work Plan; Health and Safety Plan
2. Public Address System	N	
3. Contacting Operators	Y	Remedial Action Work Plan; Health and Safety Plan
4. Radios	Y	Remedial Action Work Plan; Health and Safety Plan
CHAPTER V: CONTROL OF ON-SHIFT TRAINING		
1. Adherence to Training Program	Y	Remedial Action Work Plan; Health and Safety Plan
2. On-Shift Instructor Qualifications	N	
3. Qualified Operator Supervision and Control of Trainees	N	
4. Operator Qualifications Program Approval	Y	Remedial Action Work Plan; Health and Safety Plan
5. Training Documentation	Y	Remedial Action Work Plan; Health and Safety Plan
6. Suspension of Training	Y	
7. Maximum Number of Trainees	N	
CHAPTER VI: INVESTIGATION OF ABNORMAL EVENTS		
1. Events Requiring Investigation	Y	Health and Safety Plan
2. Investigation Responsibility	Y	Health and Safety Plan
3. Investigator Qualification	Y	
4. Information Gathered	Y	
5. Event Investigation	Y	
6. Investigative Report	Y	
7. Event Training	Y	
8. Event Trending	Y	
9. Sabotage	Y	

TABLE 17-1. ENVIRONMENTAL RESTORATION PROGRAM (ERP) CONDUCT OF OPERATIONS MATRIX (CONTINUED).

SPECIFIC GUIDELINE DOE 5480.19	GUIDELINE APPLIES TO INEL ERP OPERATIONS (Y/N)	MANAGEMENT AND OPERATING (M&O) CONTRACTORS OR REMEDIAL DECISION/REMEDIAL ACTION (RD/RA) IMPLEMENTATION DOCUMENTS
CHAPTER VII: NOTIFICATIONS		
1. Notification Procedures	Y	Remedial Action Work Plan; Health and Safety Plan
2. Notification Responsibility	Y	Remedial Action Work Plan; Health and Safety Plan
3. Names and Phone Numbers	Y	Remedial Action Work Plan; Health and Safety Plan
4. Documentation	Y	Remedial Action Work Plan; Health and Safety Plan
5. Communication Equipment	Y	Remedial Action Work Plan; Health and Safety Plan
CHAPTER VIII: CONTROL OF EQUIPMENT AND SYSTEM STATUS		
1. Status Change Authorization and Reporting	Y	
2. Equipment and Systems Alignments	Y	
3. Equipment Locking and Tagging	Y	Health and Safety Plan
4. Operational Limits Compliance	Y	Remedial Action Work Plan
5. Equipment Deficiency, Identification, and Documentation	Y	
6. Work Authorization and Documentation	Y	
7. Equipment Post-Maintenance Testing, and Return to Service	Y	Remedial Action Work Plan
8. Alarm Status	Y	Remedial Action Work Plan
9. Temporary Modification Control	Y	
10 Distribution and Control of Equipment and Systems Documents	Y	Remedial Action Work Plan
CHAPTER IX: LOCKOUTS AND TAGOUTS		
1. Lockout/Tagout Use	Y	Health and Safety Plan
2. Lockout/Tagout Implementation	Y	Health and Safety Plan

TABLE 17-1. ENVIRONMENTAL RESTORATION PROGRAM (ERP) CONDUCT OF OPERATIONS MATRIX (CONCLUDED).

SPECIFIC GUIDELINE DOE 5480.19	GUIDELINE APPLIES TO INEL ERP OPERATIONS (Y/N)	MANAGEMENT AND OPERATING (M&O) CONTRACTORS OR REMEDIAL DECISION/REMEDIAL ACTION (RD/RA) IMPLEMENTATION DOCUMENTS
3. Protective Material and Hardware	N	
4. Lockout/Tagout Program	Y	Health and Safety Plan
5. Procedures for Lockout/Tagout	Y	
6. Application of Lockout/Tagout	Y	Health and Safety Plan
7. Testing or Positioning of Equipment or Components	Y	
8. Periodic Inspections	Y	
9. Caution Tags	Y	
10. Training and Communication	Y	
11. Notification of Personnel	Y	
12. Outside Contractors	Y	
13. Group Lockouts or Tagouts	Y	
14. Shift or Personnel Changes	N	
CHAPTER X: INDEPENDENT VERIFICATION	N	
CHAPTER XI: LOGKEEPING	N	
CHAPTER XII: OPERATIONS TURNOVER	N	
CHAPTER XIII: OPERATIONS ASPECTS OF FACILITY CHEMISTRY AND UNIQUE PROCESSES	N	
CHAPTER XIV: REQUIRED READING		
1. File Index	Y	
2. Reading Assignments	Y	
3. Required Dates for Completion of Reading	Y	
4. Documentation	Y	
5. Review	N	
CHAPTER XV: TIMELY ORDERS	N	
CHAPTER XVI: OPERATIONS PROCEDURES	Y	Remedial Action Work Plan
CHAPTER XVII: OPERATOR AIDS	N	
CHAPTER XVIII: EQUIPMENT AND PIPING LABELING	Y	Health and Safety Plan

17.2.1 Shift Routines and Operating Practices

Safe work practices are established with written work procedures and work permits, as described in Chapter 13. Examples of specific implementing documents for operation practices are listed in Table 17-1.

17.2.2 Controlled Area Activities

Access to ERP activity sites is controlled by physical security measures specified in activity-specific Health and Safety Plans, as required by 29 CFR 1910.120 (b)(4)(ii)(F) (DOL, 1993b). This documentation will include the placement of work zones, including an exclusion zone, hot line, contamination reduction corridor, contamination reduction zone, and support zone, as well as standard operating procedures and safe work practices to be followed in controlled areas.

17.2.3 Communications Within Controlled Areas of ERP Activities

Supervision is responsible for ensuring that employees working in the field are informed about potential hazard encounters. Activity-specific Health and Safety Plans will define the extent and nature of communications to protect the work force, including how employees will be alerted during emergencies. If essential emergency communication systems are important to assure safety, they will comply with specifications described in Chapter 14 for human factors engineering.

17.2.4 Control of On-Shift Training

Training programs and requirements related to qualification of instructors and documentation of training are discussed in Chapter 13.

17.2.5 Notifications and Reporting Practices

If conditions in the field change, the field representative must notify management. After evaluation, the plan of the day should be modified, as warranted, to account for new circumstances. Required emergency notifications will be identified in the activity-specific Health and Safety Plan. Emergency events and unusual or abnormal occurrences reportable under DOE 5000.3B (DOE, 1993a) are investigated, categorized, and reported in accordance with written procedures for occurrence reporting.

17.2.6 Investigation of Abnormal Events

Unusual or abnormal occurrences reportable under DOE 5000.3B (DOE, 1993a) will be fully investigated by qualified individuals. Operating experience and occurrence reports will be analyzed to improve safety.

17.2.7 Control of Equipment and System Status

Requirements of DOE 5480.23 (DOE, 1992) that apply to control of equipment, if applicable to an ERP activity, are generally implemented through written procedures covering such items as status change authorization,

equipment lockout and tagout, post-maintenance testing, and alarm status. Examples of implementing documents are given in Table 17-1.

17.2.8 Independent Verification Practices

The quality assurance program at the INEL is described in Chapter 18.

17.2.9 Independent Reviews

INEL established a process for review of documents, described in Chapter 13, and for independent review of the Health and Safety Program implementation, described in Chapter 12.

17.2.10 Operations Turnover Practices

Implementing documents that describe operation turnover practices are generally not applicable to ERP activities that are Hazard Category 3 or below the Hazard Category 3 threshold criteria.

17.2.11 Control of Operations Procedures

The method for controlling the authorization of procedure changes and modifications to design, construction, and operation of ERP activities affecting safety is described in Chapter 12.

17.3 Handling of Special Nuclear Materials

The safe storage and criticality safety of special nuclear materials are not safety concerns generally applicable to ERP activities within the scope of the Baseline Safety Analysis File (BSAF) (Chapter 8). If encountered, however, procedures for handling of special nuclear materials shall be implemented consistent with the requirements of DOE 5632.2A (DOE, 1989). Additional safety analyses will be conducted as appropriate.

17.4 Radiation Protection

The radiological control program that protects workers and the public from radiation and radioactive materials at the INEL is described in Chapter 9.

17.5 Fire Protection

Requirements for a comprehensive fire protection program were established by DOE in DOE 5480.7A (DOE, 1993b). Objectives of the fire protection program include the following:

- Minimize potential for occurrence of a fire
- Ensure that a fire does not cause an onsite or offsite release of radiological and other hazardous material that will threaten the public health and safety or the environment

- Provide an acceptable degree of life safety to DOE and contractor personnel
- Ensure that process control and safety systems are not damaged by fire.

The fire protection program at the INEL shall meet or exceed the minimum requirements established by the National Fire Protection Association (NFPA) for the best protected class of industrial risks. These requirements include a reliable water supply of acceptable quality for fire suppression; construction materials criteria acceptable for facility occupancy; automatic fire extinguishing systems; a fully staffed, trained, and equipped emergency response force; a means to summon the emergency response force in the event of a fire; and a means to notify and evacuate building occupants in the event of a fire. This level of protection includes inspection, maintenance, and testing of fire protection features.

For areas subject to significant life safety risks, serious property damage, program interruption, or loss of safety class equipment as indicated in Chapter 5 or Chapter 11, additional protective measures may be deemed necessary as determined by the local authority with jurisdiction. These requirements, if applicable, will be documented in the activity-specific Health and Safety Plan.

The activity-specific Health and Safety Plan required by 29 CFR 1920.120 (DOL, 1993b) will discuss the issues of fire protection and suppression. Section 29 CFR 1910.120 (c)(3) requires identification of potentially explosive or flammable situations. The emergency response section of the Health and Safety Plan will address recognition of emergency situations, provision of emergency equipment, and coordination with emergency response organizations. Since ERP activities involve construction, the provisions of 29 CFR 1926.150 (DOL, 1993a) will be followed. These provisions cover the placement of fire extinguisher types on construction sites. Fire extinguishers, when properly used, are the first line of defense in the event of a fire. If there is a credible potential for a release of chemical or radiological waste from fire, then further fire protection measures may be required for the site. The activity-specific Health and Safety Plan is written to ensure and verify that sufficient provisions are made for the control of chemical risks associated with operation, maintenance, surveillance, and emergency response.

Fire protection back-up support is available through the INEL Fire Department. The INEL Fire Department maintains three stations on the INEL site. The main station is located in the Central Facilities Area (CFA); Test Area North (TAN) and Argonne National Laboratories-West (ANL-W) have substations. All three fire stations are staffed 24 hours a day by career fire fighters trained as Emergency Medical Technicians. Each of the three stations has the equipment and expertise to respond to explosions, fires, spills, and medical emergencies. The INEL Fire Department maintains a specially-equipped, hazardous materials vehicle used in the event of hazardous chemicals incidents.

The EG&G Training and Emergency Action Unit provides a training coordinator to work with the Idaho Falls emergency planner to ensure that INEL emergency response personnel maintain proficiency in ability to respond to emergency or accident situations.

DOE 5480.7A (DOE, 1993b) indicates that property scheduled for D&D would not be considered a loss if it were destroyed by fire. Therefore, provisions of DOE 5480.7A do not apply to D&D activities since the Order deals with the protection of useful property from damage or destruction by fire. However, DOE 5480.7A would apply if there was a credible potential for release of radioactive materials or chemicals from a fire.

17.6 Hazardous Material Protection

The protection of workers and the public from hazardous materials through implementation of industrial hygiene, industrial safety, and construction safety programs at the INEL is described in Chapter 10. One element of the hazardous material protection program is the preparation of activity-specific Health and Safety Plans, described in Section 10.5.1. Information regarding the identification of chemical risks that may be associated with operation, maintenance, or surveillance of ERP activities is provided in Chapter 5. Chemical hazards that may affect emergency response workers are addressed in Section 19.3.5 of Chapter 19, "Emergency Preparedness."

17.7 Security

The primary security function performed by the INEL security force is the control of all access points at site boundaries and within facilities. Individuals entering the INEL are required to pass through one of the access points monitored by security personnel. Escorts may be required in some controlled areas.

Security systems at the INEL apply to material control and accountability, physical protection, and personnel protection. Each facility at the INEL is required to prepare a site-specific Safeguards and Security Plan and/or Master Safeguards and Security Agreement, which defines the appropriate level and strategy for particular security interests on a site-specific basis, consistent with operational requirements, applicable threat, target attractiveness, and potential risks.

ERP activities are primarily concerned with construction area access to protect against unauthorized entry, which could endanger human health and the environment. The Health and Safety Plan required for each ERP activity will include construction area access measures which will be employed to keep individuals other than properly protected workers off the site. Measures can include the use of barrier tape, barricades, or fencing.

17.8 Review and Audit

Reviews and audits of the safety aspects of operation will be conducted in accordance with DOE 5480.1B (DOE, 1986b), DOE 5480.5 (DOE, 1986a), and DOE 5700.6C (DOE, 1991) requirements and applicable implementing

procedures. Review and audit requirements and procedures are described in Chapters 12 and 18.

The activity-specific Health and Safety Plan will contain plans for inspections by the Health and Safety Officer to determine the effectiveness of the Plan and to remedy deficiencies as required by 20 CFR 1910.120(G)(4)(iv).

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CHAPTER 18.0

QUALITY ASSURANCE

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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18.0 QUALITY ASSURANCE

United States Department of Energy (DOE) Order 5700.6C, *Quality Assurance* (DOE, 1991), establishes the overall quality assurance (QA) requirements for DOE. It is DOE policy to establish QA policy and requirements to ensure that risks and environmental impacts are minimized and that safety, reliability, and performance are maximized through the application of effective management systems commensurate with the risks posed by the facility or operation. DOE 5700.6C implements DOE's policy to ensure that QA requirements are clearly specified for that broad spectrum of work performed by DOE and its contractors. The objectives are to ensure the following:

- Provision by senior management of planning, organization, direction, control, and support to achieve the DOE organization's objectives
- Achievement of quality by the line organization
- Review of overall performance using a rigorous assessment process.

DOE-Idaho Operations Office (DOE-ID) issued the latest revision of DOE-ID Supplemental Directive 5700.6E (DOE-ID, 1993) which established DOE-ID's authorities, responsibilities, local guidance, and local direction for implementation of DOE 5700.6C. This DOE-ID Directive takes precedence over all other DOE-ID Supplemental Directives in cases where there may be conflict in QA requirements.

Sections 18-1 and 18-2 of this chapter discuss how QA objectives are to be met. Section 18-1 provides general requirements for development of Quality Assurance Programs (QAPs) and Quality Assurance Project Plans (QAPjPs) satisfying DOE 5700.6C and other applicable DOE Directives, standards, and regulations. Section 18-2 summarizes the ten criteria of DOE 5700.6C and manner of implementation by the Management and Operations (M&O) or Remedial Design/Remedial Action (RD/RA) contractors.

18.1 General Requirements

Senior management shall be responsible for QAP implementation, assessment, and improvement. M&O contractors shall develop their QAPs by applying QA criteria specified in Section 18-2.

The QAP shall include a discussion of how the criteria will be satisfied, taking into consideration risk associated with specific work (DOE, 1991).

DOE 5700.6C is not a stand alone "national standard." Appropriate standards shall be used, as applicable, to develop and implement QAPs. For Environmental Restoration Program (ERP) activities including environmental remediation and decontamination and decommissioning (D&D), the two most pertinent "standards" are the following:

- American Society of Mechanical Engineers (ASME) NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities* (ASME, 1989), which applies to nuclear work performed within the Idaho National Engineering Laboratory (INEL) site
- Environmental Protection Agency (EPA) QAMS-005/80, *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans* (EPA, 1980), which applies to monitoring and measurement for each specific project or continuing operation (or group of similar projects or continuing operations).

The relationship of these standards to individual criteria of DOE Order 5700.6C is shown in Table 18-1. The basic approach to application of DOE Order 5700.6C is to assure that the QAP addresses the ten criteria of the Order commensurate with the risk of activities performed. The QAP should implement appropriate standards applicable to specific activities being performed. In addition, specific QA requirements may be imposed on certain activities through other DOE Directives. These additional requirements should be included in the QAPs so that an integrated management system is developed. In addition, individual QAPjPs and implementing procedures may be required depending on the following variables:

- Association of risk and complexity with the activity
- Requirements of applicable standards (for example, Environmental Protection Agency (EPA) QAMS-005/80)
- Requirements of other applicable DOE Directives
- Contractual or other commitments to implement plans and procedures.

Table 18-2 demonstrates the relationship of several other pertinent DOE Directives, national standards, and regulations to the ten criteria of DOE 5700.6C. These pertinent Directives, standards, and regulation should be considered in development of contractor QAPs.

QAP requirement documents and implementing procedures have a hierarchical relationship. Figure 18-1 represents the hierarchy of QA documents.

Contractors must obtain DOE approval for new QAPs prior to commencing work. Each of the INEL M&O and RD/RA contractors are responsible for ERP activities at Idaho National Engineering Laboratory (INEL) and have quality assurance programs delineated in the following documents:

WINCO:	<i>Quality Assurance Program Manual (QAPM) and QAPM Matrix</i>
EG&G:	<i>Quality Program Plan, QPP-258, Rev. 2, March 1992</i>
MK-FIC:	<i>CMSM 5-1-01, Quality Assurance Program, Rev. 0, January 1993</i>

TABLE 18-1. DOE 5700.6C RELATIONSHIP TO NQA-1 AND QAMS 005/80.

DOE 5700.6C CRITERIA	NQA-1 CRITERIA	QAMS 005/80 ELEMENTS
Management:		
1. Program	1. Organization 2. Quality Assurance Program	5.4 Project Organization and Responsibility 5.3 Project Description 5.16 Quality Assurance Reports to Management
2. Personnel Training and Qualification	2. Quality Assurance Program	5.3 Project Description 5.16 Quality Assurance Reports to Management
3. Quality Improvement	15. Control of Nonconforming Items 16. Corrective Action	5.15 Corrective Action
4. Documents and Records	4. Procurement Document Control 5. Instruction, Procedures, and Drawings 6. Document Control 17. Quality Assurance Records	5.1 Title Page 5.2 Table of Contents
Performance:		
5. Work Processes	5. Instruction, Procedures, and Drawings 8. Identification and Control of Items 9. Control of Processes 12. Control of Measuring and Test Equipment 13. Handling, Storage, and Shipping	5.7 Sample Custody 5.9 Analytical Procedures 5.8 Calibration Procedures and Frequency 5.13 Preventive Maintenance 5.6 Sampling Procedures
6. Design	3. Design Control	5.5 QA Objectives in Measurement Data in Terms of Precision, Accuracy, Completeness, Representativeness, and Comparability 5.6 Sampling Procedures 5.10 Data Reduction, Validation, and Reporting 5.11 Internal Quality Control Checks 5.14 Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness
7. Procurement	3. Design Control 4. Procurement Document Control 7. Control of Purchased Items and Services 15. Control of Non-Conforming Items	5.5 QA Objectives in Measurement Data in Terms of Precision, Accuracy, Completeness, Representativeness, and Comparability 5.6 Sampling Procedures 5.10 Data Reduction, Validation, and Reporting 5.11 Internal Quality Control Checks 5.14 Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness

TABLE 18-1. DOE 5700.6C RELATIONSHIP TO NQA-1 AND QAMS 005/80 (CONCLUDED).

DOE 5700.6C CRITERIA	NQA-1 CRITERIA	QAMS 005/80 ELEMENTS
8. Inspection and Acceptance Testing	4. Procurement Document Control 10. Inspection 11. Test Control 12. Control of Measuring and Test Equipment 14. Inspection, Test, and Operating Status	5.8 Calibration Procedure and Frequency
Assessment:		
9. Management Assessment	2. Quality Assurance Program	5.3 Project Description 5.16 Quality Assurance Reports to Management
10. Independent Assessment	16. Corrective Action 18. Audits	5.15 Corrective Action 5.12 Performance and System Audits

TABLE 18-2. RELATIONSHIP OF 5700.6C TO OTHER DOE DIRECTIVES, STANDARDS, AND REGULATIONS

DIRECTIVES/STANDARDS/REGULATIONS	DOE 5700.6C CRITERIA									
	1	2	3	4	5	6	7	8	9	10
DOE 6430.1A DOE ID 6430.1A	•	•	•	•	•	•	•	•	•	•
DOE 5400.1	•	•		•	•	•				•
DOE 4700.1 DOE-ID SD 4700.1	•	•	•	•	•	•	•	•	•	•
DOE 1324.2A				•						
DOE-ID Architectural Engineering Standards	•			•	•	•		•		
DoD MIL-C-45662								•		
36 CFR Ch. XII Subch. B				•						
29 CFR 1910.119(i)(1)(j)(o)		•		•		•		•		•

Figure 18-1. Hierarchy of Quality Assurance Documents.

As stated in DOE-ID *Supplemental Directive* 5700.6E (DOE-ID, 1993), "ID Contractor QAPs/QAPjPs have previously been approved and implemented based on established standards such as DOE 5700.6C, *Quality Assurance*, ASME NQA-1, *Quality Assurance Program Requirements for Nuclear Facilities*, and MIL-STD-45662, *Calibration System Requirements*. These are the minimum standards required. DOE-ID and DOE-ID Contractors may add other standards and requirements, as necessary such as QAMS 005-80, DOE/RW-0333P, and RW-0215. Emphasis should be on continuous improvement, training, and prevention rather than detection and correction. However, DOE 5700.6C, ASME-NQA-1, and MIL-STD-45662 shall be used as the basis for development of quality assurance programs and a graded approach shall be used in the application of these standards.

18.2 Quality Assurance Criteria

The following discussion covers the ten criteria of the requirements Sections 9.b, 9.c, and 9.d of DOE 5700.6C (DOE, 1991). Criteria are specific management system elements to be addressed in all QAPs. Risk is the fundamental consideration in determining to what extent the QAP should be applied to items and processes. Risk is a quantitative and/or qualitative expression of possible loss. Both the probability of the occurrence of the event causing harm or loss and the consequences of that event are considered in determining risk. The following factors should be considered in determining risk: consequences of failure; probability of failure; data generation function; complexity or uniqueness of design or fabrication; special controls; ability to demonstrate functional compliance; quality history; degree of standardization; impact on the environment; and impact on schedule or cost or both. Organizations should use proven risk-related, qualitative and quantitative information, where available.

DOE-ID 5700.6E (DOE-ID, 1993) provides additional definition and guidance on the application of the graded approach for QAPs. It defines "quality levels" to be determined for the work to be performed and for the corresponding QAP and QAPjPs. To aid in implementation, DOE-ID 5700.6E provides typical examples for each quality level.

Each of the M&O and RD/RA contractors has met the requirement for QAPs as indicated in Section 18.1. For cross reference, the relevant section of each of these QAPs is identified below under the applicable criterion of the DOE Directive. The applicable requirements of the QAPs shall be followed as shall additional requirements contained in supplemental QAPjPs and procedures.

Contractors required to develop individual QAPjPs for specific ERP activities are required to address only the applicable criteria of DOE 5700.6C in the QAPjP. Contractors should *consider* each criterion, and include only criteria applicable to activities to be performed. For example, a task to develop documentation for a D&D activity may not involve any specific procurement activities, and Criterion 7 (Procurement) need not be addressed for this specific QAPjP.

18.2.1 Management

Criterion 1 - Program

This criterion requires the following:

- Development, implementation, and maintenance of written QAPs by organization's management
- Description in QAP of organizational structure, functional responsibilities, levels of authority, and interfaces for those managing, performing, and assessing adequacy of work
- Description in QAP of the management system including planning, scheduling, and cost control considerations.

INEL contractors address this criterion in the following:

WINCO: Quality Methods and Procedures (QMP) 1-1, Organization; QMP 2-1, Quality Assurance Program
EG&G: QPP-258, Element QP-2, Quality Program; *Quality Program Plan* (QPP)-258, Element QP-1, Organization;
MK-FIC: CMSM 5-1-01, QAP Element Number 1.0, Program.

For ERP activities involving monitoring and measuring, data quality is of primary importance, and a project specific QAPjP meeting the requirements of EPA QAMS 005/80 may be required in addition to the organization's QAP.

Criterion 2 - Personnel Training and Qualification

This criterion requires the following:

- Training and qualifications of personnel to ensure capability of performing assigned work
- Provision to personnel of continuing training to ensure maintenance of job proficiency.

INEL contractors address this criterion in the following:

WINCO: QMP 2-1, Quality Assurance Program
EG&G: QPP-258, Element QP-2, Quality Program
MK-FIC: CMSM 5-1-01, QAP Element Number 2.0, Personnel Training and Qualification.

Criterion 3 - Quality Improvement

This criterion requires the following:

- Establishment and implementation by the organization of processes to detect and prevent quality problems and assurance of quality improvement

- Identification, control, and correction of items and processes not meeting established requirements
- Inclusion of identification of causes of problems and prevention of recurrences in correction
- Review and data analysis of item reliability, process implementation, and other quality-related information to identify items and processes requiring improvement.

INEL contractors address this criterion in the following:

WINCO: QMP 15-1, Control of Nonconforming Items
QMP 16-1, Corrective Action
EG&G: QPP-258, Element QP-15, Control of Nonconforming Items
QPP-258, Element QP-16, Corrective Action
MK-FIC: CMSM 5-1-01, QAP Element Number 3.0, Quality Improvement.

Criterion 4 - Documents and Records

This criterion requires the following:

- Preparation, review, approval, issuance, use, and revision of documents to prescribe processes, specify requirements, or establish design
- Preparation, review, approval, and maintenance of records.

INEL contractors address this criterion in the following:

WINCO: QMP 4-1, Procurement Document Control
QMP 5-1, Instructions, Procedures, and Drawings
QMP 6-1, Document Control
QMP 17-1, Quality Assurance Records
EG&G: QPP-258, Element QP-4, Procurement Document Control
QPP-258, Element QP-5, Instruction, Procedures, and Drawings
QPP-258, Element QP-6, Document Control
QPP-258, Element QP-17, Quality Records
MK-FIC: CMSM 5-1-01, QAP Element Number 4.0, Documents and Records.

The established records management system must satisfy the applicable requirements of DOE Order 1324.2A (DOE, 1988). This Order requires retention of records for specific periods depending on the category assigned to the record. In addition, records required to be archived as *Federal Records* are subject to the requirements of the National Archives and Records Administration, 36 CFR, Chapter XII, Subchapter B, "Records Management."

18.2.2 Performance

Criterion 5 - Work Processes

This criterion requires the following:

- Performance of work to establish technical standards and administrative controls
- Performance of work under controlled conditions using approved instructions, procedures, or other appropriate means
- Identification and control of items to ensure proper use
- Maintenance of items to prevent damage, loss, or deterioration
- Calibration and maintenance of equipment for process monitoring or data collection.

INEL contractors address this criterion in the following:

WINCO:	QMP 5-1, Instruction, Procedures, and Drawings
	QMP 8-1, Identification and Control of Items
	QMP 9-1, Control of Processes
	QMP 12-1, Control of Measuring and Test Equipment
	QMP 13-1, Handling, Storage, and Shipping
EG&G:	QPP-258, Element QP-5, Instructions, Procedures, and Drawings
	QPP-258, Element QP-8, Identification and Control of Items
	QPP-258, Element QP-9, Control of Processes
	QPP-258, Element QP-12, Control of Test and Measuring Equipment
	QPP-258, Element QP-13, Handling, Storage, and Shipping
MK-FIC:	CMSM 5-1-01, QAP Element Number 5.0, Work Processes

Calibration of monitoring and data collection equipment must be performed in accordance with appropriate national standards such as MIL-STD-45662 "Calibration System Requirements" (DoD, 1988).

Criterion 6 - Design

This criterion requires the following:

- Design of items and processes using sound engineering and scientific principles and appropriate standards
- Incorporation of applicable requirements and design bases into design work and changes
- Identification and control of design interfaces

- Verification or validation of adequacy of design products by individuals or groups other than those who performed the work
- Completion of verification and validation work before approval and implementation of design.

INEL contractors address this criterion in the following:

WINCO: QMP 3-1, Design Control Requirements
QMP 3-3, Quality Levels
EG&G: QPP-258, Element QP-3, Design Control
QPP-258, Element QP-21, Computer Software Configuration Management
QPP-258, Element QP-4, Procurement Document Control
QPP-258, Element QP-7, Computer Software Configuration Management
QPP-258, Element QP-15, Computer Software Configuration Management
MK-FIC: CMSM 5-1-01, QAP Element Number 6.0, Design

Criterion 7 - Procurement

This criterion requires the following:

- Assurance by the organization that procured items and services meet established requirements and performs, as specified
- Evaluation and selection of prospective suppliers on the basis of specified criteria
- Assurance by the organization that approved suppliers continue to provide acceptable items and services.

INEL contractors address this criterion in the following:

WINCO: QMP 3-1, Design Control Requirements
QMP 3-3, Quality Levels
QMP 4-1, Procurement Document Control
QMP 7-1, Control of Purchased Items and Services
QMP 7-3, Source Inspection and Supplier Surveillance
QMP 15-1, Control of Nonconforming Items
EG&G: QPP-258, Element QP-4, Procurement Document Control
QPP-258, Element QP-7, Computer Software Configuration Management
QPP-258, Element QP-15, Computer Software Configuration Management
MK-FIC: CMSM 5-1-01, QAP Element Number 7.0, Procurement

Requirements for procurement of crucial items and services such as analytical laboratory services, calibration services, and solid waste disposal contractor services should be addressed in the procurement procedures/process. The organization must ensure that design, inspection, and acceptance testing are specified adequately in the procurement documentation.

Criterion 8 - Inspection and Acceptance Testing

This criterion requires the following:

- Conduct of inspection and acceptance testing of specified items and processes using established acceptance and performance criteria
- Calibration and maintenance of equipment for inspections and tests.

INEL contractors address this criterion in the following:

WINCO: QMP 4-1, Procurement Document Control
QMP 10-1, Inspection
QMP 11-1, Test Control
QMP 11-2, Software Control
QMP 12-1, Control of Measuring and Test Equipment
QMP 14-1, Inspection, Test and Operating Status
EG&G: QPP-258, Element QP-4, Procurement Document Control
QPP-258, Element QP-10, Inspection
QPP-258, Element QP-11, Test Control
QPP-258, Element QP-12, Control of Test and Measuring
Equipment
QPP-258, Element QP-14, Inspection, Test, and Operating
Status
MK-FIC: QPP-258, Element QP-19, Readiness Review
CMSM 5-1-01, QAP Element Number 8.0, Inspection and
Acceptance Testing

18.2.3 Assessment

Criterion 9 - Management Assessment

This criterion requires the following:

- Periodic assessment by management at all levels of integrated QAP and performance
- Identification and correction of problems that hinder the organization from achieving its objectives.

INEL contractors address this criterion in the following:

WINCO: QMP 2-1, Quality Assurance Program
EG&G: QPP-258, Element QP-2, Quality Program
MK-FIC: CMSM 5-1-01, QAP Element Number 9.9, Management
Assessment.

Criterion 10 - Independent Assessment

This criterion requires the following:

- Conduct of planned and periodic independent assessments to measure quality and process effectiveness and to promote improvement
- Assignment of sufficient authority and freedom to carry out responsibilities to the organization performing independent assessments from the line organization
- Technical qualification and knowledge of areas assessed of individual conducting independent assessments.

INEL contractors address this criterion in the following:

WINCO:	QMP 16-1, Corrective Action QMP 18-1, WINCO QA Audit Requirements QMP 18-6, Self-Assessment
EG&G:	QPP-258, Element QP-16, Corrective Action QPP-258, Element QP-18, Quality Audits
MK-FIC:	CMSM 5-1-01, QAP Element Number 10.0, Independent Assessment.

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CHAPTER 19.0

EMERGENCY PREPAREDNESS

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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19.0 EMERGENCY PREPAREDNESS

Emergency preparedness for the Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP) activities is part of the INEL emergency management program. This chapter describes how ERP activities are integrated into the existing INEL program.

19.1 Policy and Objectives

United States Department of Energy (DOE) policy is to operate facilities and activities in a responsible manner, preventing emergencies and effectively mitigating emergencies should they occur, thereby assuring the safety and health of workers, the public, and the environment. These responsibilities include maintaining emergency preparedness and response capabilities; establishing public and interagency communications; identifying emergency events; performing appropriate notifications; and implementing mitigating actions, including protective actions. Emergency management is the final barrier in the DOE defense-in-depth concept (DOE, 1992).

Section 19.1.1 discusses applicable DOE, United States Environmental Protection Agency (EPA), and Occupational Safety and Health Administration (OSHA) requirements. Section 19.1.2 describes the INEL Emergency Preparedness Plan.

19.1.1 Emergency Management Requirements

ERP activities comply with OSHA regulations for emergency plans in accordance with 29 CFR 1910.38 (DOL, 1993a); or, if ERP employees act as responders, 29 CFR 1910.120 (DOL, 1993b). These regulations require plans for responsibilities, communications, emergency detection, assembly areas, site control, evacuations, decontamination, medical aid, critiques, and personal protective equipment.

ERP activities comply with EPA regulations in 40 CFR 300 (EPA, 1993a), 40 CFR 302 (EPA, 1993b), and 40 CFR 355 (EPA, 1993c). These requirements describe the National Contingency Plan for oil and hazardous substances; establish reportable quantities and notification requirements for releases; and establish threshold planning quantities and planning requirements for coordination of offsite and onsite response.

Site-wide emergency management encompassing ERP activities will comply with DOE 5500 Series Orders for emergency planning and preparedness, consistent with the schedule of the DOE-Idaho Operations Office (DOE-ID) Emergency Readiness Assurance Plan. The DOE Emergency Management System (EMS) covers the development, coordination, testing, and validation of emergency plans and procedures, as described in the DOE 5500 Series Orders. DOE 5500.1B (DOE, 1991) emphasizes the overall responsibilities of DOE Headquarters and DOE field personnel for emergency planning and response.

DOE 5500.2B (DOE, 1991b) describes the three categories of DOE emergencies: Operational Emergencies, which involve accidents with potentially significant health and safety impacts; Energy Emergencies; and Continuity of

Government Emergencies. ERP activities will be involved only with Operational Emergencies. DOE 5500.2B provides guidance for classification of Operational Emergencies and specifies notifications to be made by various DOE elements. Event classification ensures an appropriate level of DOE and contractor response during an emergency.

DOE 5500.3A (DOE, 1991c) establishes requirements for planning and preparedness for Operational Emergencies, including promulgating plans and procedures, training personnel, maintaining emergency response capabilities, and exercising emergency response actions.

DOE 5500.4A (DOE, 1992) provides policies for communications between the public, DOE elements, contractors, and other authorities during an emergency.

DOE 5500.10 (DOE, 1991d) contains requirements of the emergency readiness assurance program for exercises, audits, and critiques.

The DOE *Emergency Management Guides* (DOE, 1993b) provide acceptable methods for meeting DOE 5500 Series Orders emergency planning requirements. The guides are used by DOE elements and contractors to develop acceptable site-specific plans and procedures.

DOE 5000.3B (DOE, 1993a) establishes a system for reporting operations information, including Operational Emergencies and Reportable Occurrences, and tracking appropriate corrective actions to prevent recurrence.

19.1.2 Emergency Plans

In compliance with the above regulations, DOE Directives, and Emergency Management Guides, the DOE-ID prepared a DOE-ID INEL/West Valley Demonstration Project (WVDP) Emergency Preparedness Plan (DOE-ID, 1993). The Plan provides site-specific direction for DOE and contractors to respond to emergencies at the INEL. The DOE-ID Plan provides overall coordination between DOE contractor emergency plans and procedures and the response of DOE field elements.

Each DOE ERP contractor developed an Emergency Plan or Policy for corporate response to an INEL emergency, delineating acceptable means to comply with DOE emergency preparedness requirements within the contractor's purview. In addition, emergency planning and preparedness for each area and major facility at the INEL is addressed by area emergency plans or facility emergency plans developed by the responsible DOE contractor. Emergency plans were prepared for Idaho Chemical Processing Plant (ICPP), Radioactive Waste Management Complex (RWMC), Test Area North (TAN), Test Reactor Area (TRA), Waste Reduction Operations Complex/Waste Experimental Reduction Facility/Power Burst Facility (WROC/WERF/PBF), and the Central Facilities Area (CFA) and INEL proper. The Central Facilities Area (CFA) INEL Emergency Plan addresses the CFA and all remaining areas of INEL not otherwise covered by specific area plans or facility plans.

Health and Safety Plans provide specific emergency response information for each ERP activity. The Health and Safety Plan complies with the emergency response planning provisions of 29 CFR 1910.120 (DOL, 1993b) or 29 CFR 1910.38 (DOL, 1993a). The Health and Safety Plan contains instructions for minor emergencies and reportable occurrences, with reference to the INEL Area or Facility Emergency Plan applicable to a Reportable Occurrence or Operational Emergency at the ERP activity site.

19.2 Emergency Response Organization (ERO)

DOE-ID administers the emergency response program at the INEL. Contractors provide day-to-day emergency response support at INEL facilities. The role of DOE-ID and contractor emergency response organizations (EROs) is to mitigate the consequences of an emergency. EROs provide initial and ongoing support and assistance to emergency response workers, performing actions that involve direct mitigation of the emergency event. This section describes the INEL EROs and the roles of providing support and assistance during emergency response efforts.

DOE-ID has an extensive emergency planning and preparedness function. DOE-ID provides oversight of contractor emergency planning and preparedness programs. Each contractor is responsible for emergency planning at respective facilities.

19.2.1 Organizational Interfaces

The INEL Offsite Emergency Planning Coordination Program began in April 1991. DOE-ID chose a single point of contact for offsite liaison to meet the offsite planning requirements of the DOE 5500 Series Orders. Acting under direction of the DOE-ID Emergency Management Section (EMS), the INEL site support contractors appointed an INEL Offsite Emergency Planning Coordinator. The role of the coordinator is to represent DOE-ID and all the INEL contractors in the coordination of all offsite emergency planning issues among the INEL and state, local, and tribal agencies. The primary focus of the program is to establish interfaces through designated points of contact with state, local, and tribal agencies and to formalize relationships through Memorandums of Understanding (MOUs) and other planning activities.

The State of Idaho identified the Bureau of Disaster Services as the point of contact for emergency planning issues between the State and the INEL. The Bureau provides technical support on planning and training issues to the five counties contiguous to the INEL. County emergency managers are designated as points of contact for joint planning activities within local jurisdictions. The INEL Offsite Emergency Planning Coordinator works through each emergency manager under direction of the DOE-ID EMS.

Interfaces with the Shoshone-Bannock Tribe are coordinated with the Native American Liaison Program in the DOE-ID Office of External Affairs. The INEL Offsite Emergency Planning Coordinator works closely with the Native American Liaison Office and the Community Response Coordinator for the Fort Hall Indian Reservation to conduct joint emergency planning with the Tribe. Oversight for emergency planning activities is provided by the DOE-ID EMS.

DOE-ID and INEL contractors have established working committees to coordinate and enhance planning activities at the INEL. The INEL Emergency Planning Coordinating Committee (EPCC) was established for coordination of overall emergency planning activities. The INEL Transportation Emergency Preparedness Program (ITEPP) was established to coordinate transportation emergency activities.

The EPCC meets regularly to evaluate and coordinate resolution of INEL emergency preparedness issues. EPCC consists of representatives from DOE operating contractors, the construction contractor, and DOE-ID. The EPCC contributes to the formation of policy and coordination between represented organizations.

An EPCC objective is to achieve maximum possible standardization of emergency management systems and programs at the INEL. The committee reviews and comments on policies, plans, procedures, and other documents in draft stages.

The ITEPP Committee periodically meets to expedite development of INEL transportation emergency management and transportation safety policies. The Committee consists of emergency management and transportation safety representatives from DOE operating contractors, the construction contractor, and DOE-ID.

Each ERP activity integrates with the INEL ERO through an interface agreement. The agreement defines the responsibilities of the ERP contractor and the INEL operating contractor with jurisdiction over the facility or area containing the ERP site.

19.2.2 Operational Responsibilities and Incident Command

Contractors are responsible for emergencies at respective facilities. INEL contractors have the authority and are responsible for performing the following:

- Recognizing that an emergency condition exists and providing classification and assessment
- Performing immediate actions and providing recommendations for the protection of health and safety of emergency workers, the INEL population, and the public
- Performing immediate actions and providing recommendations for the protection of property and the environment
- Notifying members of facility EROs, DOE-ID, DOE-Headquarters, and affected state, local, tribal agencies, other Federal agencies, and other INEL facilities.

During emergencies, the Incident Command System (ICS), developed by the National Interagency Incident Management System (NIIMS), will be used. The ICS is an emergency management system designed to function from the time

an incident occurs (even at less-than-emergency category levels) until the requirements for emergency management and operations no longer exist.

The INEL ICS organization has the following major functional areas:

- Command
- Operations
- Logistics
- Planning
- Finance/Legal (EOC level only).

The DOE-ID ERO consists of several duty officers. Each of the major functional areas, with the exception of logistics, have an assigned DOE-ID Duty Officer acting in an oversight role.

The first responder on the scene at the originating facility will be in charge at the scene until relieved by appropriate emergency response personnel. First responders may report immediately to the scene or to a predetermined staging area in accordance with response procedures and directions that depend on alarms and condition-specific instructions. First responders are only responsible for protecting people and assessing the emergency condition from a safe distance until assistance and additional response personnel arrive.

ERP incident command is initially established by the Field Supervisor (FS) or other onsite authority responsible for the ERP activity. The FS implements the OSHA safety and health plan for minor occurrences most likely to be encountered during ERP activities. Depending on the nature of the emergency and the need for assistance, the FS will obtain any additional assistance through the designated area or facility Emergency Action Manager (EAM). The EAM will activate the Facility or Area ERO for a serious Reportable Occurrence or an Operational Emergency. Incident command probably will remain at the ERP site for any credible emergencies.

In initial stages, incident command will be established on-scene by the ERP consistent with incident response team leaders. If the event requires activating a facility emergency control center (ECC), incident command will be transferred to the ECC EAM. A facility ERO is always in command of emergency response at the originating facility. Incident command will normally remain at the originating facility with the EAM. However, this command may be transferred to a responsible facility Emergency Director (ED) at the Emergency Operations Center (EOC) under certain conditions defined in the facility emergency plans. DOE-ID may relieve a contractor of command in accordance with the DOE contract or through authority specified in applicable DOE Directives or Federal regulations. Other Federal agencies, such as the Federal Bureau of Investigation, may relieve the contractor of command as specified in established agreements between DOE and these agencies.

The EAM may delegate authority to security forces to conduct on-scene and incident command during the tactical phase of security emergencies (such as with potential for weapons fire, security alarm response, hostage negotiations, or similar situations). In these situations, the facility ERO provides support to protect personnel, treat and rescue victims, and manage other plant-related response. The facility EAM will maintain command and control of facility emergency response, while security forces will retain command and control of security tactical operations.

An affected facility will retain command of response within its facility and will coordinate actions with other INEL organizations. An affected facility ERO will coordinate directly with an originating facility's organization until the EOC is activated.

Some emergencies, such as a catastrophic earthquake, could affect the entire INEL without originating at any specific facility. In such cases, each facility ERO will direct response within the respective facility. Overall emergency response command will be accomplished through the EOC. Each facility will coordinate actions with others through the EOC to the extent practicable. The DOE-ID Manager/Duty Officer will appoint an ED in the EOC in such emergencies.

19.2.3 Offsite Emergency Response Support

Federal, state, county, local, and private agencies are the offsite emergency response support agencies. These agencies, under the direction of the Governor of the State of Idaho, through the Idaho Bureau of Disaster Services (BDS), provide support required to respond to an emergency at the INEL, if requested.

During an emergency, each agency is expected to function in accordance with its assigned emergency response role. Support agencies provide personnel and equipment potentially necessary to support INEL emergency response organizations. Some support agencies have preassigned direct responsibilities. Others are expected to be in a state of readiness to support the emergency response effort, as the need arises.

The following Federal agencies may play a direct role in support of DOE and DOE-ID during an emergency at the INEL:

- Department of Health and Human Services - Public Health Service, Agency for Toxic Substances, and Disease Registry
- Department of the Interior - Bureau of Land Management
- Environmental Protection Agency
- Federal Bureau of Investigation
- Federal Emergency Management Agency

- National Response Center
- Federal Radiological Monitoring and Assessment Center.

The following Idaho State agencies will provide support to the INEL during emergencies when requested:

- Idaho Bureau of Disaster Services (BDS)

BDS is the designated State agency with direct responsibility for general planning and overall coordination of the State's emergency assistance in response to natural or human-caused disasters as detailed in the State of Idaho Emergency Plan.

- Idaho Department of Health and Welfare (IDHW)

IDHW is responsible for the overall Radiation Emergency Response Plan, Annex 13 to the Hazardous Materials Emergency Response Plan. IDHW has overall responsibility for protection of the public health and safety of the general populace from the hazards of a radiological emergency at the INEL.

- The Idaho Department of Law Enforcement - Idaho State Police (ISP)

ISP has the responsibility and power to safeguard and protect State of Idaho highways and regulate traffic on all Idaho highways and roads. ISP dispatches an emergency response team to the accident scene, or as close as possible, to take necessary actions to isolate and secure the area, minimize public exposure, and provide assistance to local law enforcement officials in charge of the incident.

The following county support agencies and local support organizations will provide support to the INEL during emergencies when requested:

- Idaho County Support Agencies

- Bingham County Sheriff's Department
- Bonneville County Sheriff's Department
- Butte County Sheriff's Department
- Clark County Sheriff's Department
- Bannock Regional Medical Center, Pocatello, Idaho
- Jefferson County Sheriff's Department

- Local Support Agencies

- Arco Fire Department, Arco, Idaho
- Blackfoot Fire Department, Blackfoot, Idaho
- Eastern Idaho Regional Medical Center, Idaho Falls, Idaho
- Idaho Falls Fire Department, Idaho Falls, Idaho
- Bannock Regional Medical Center, Pocatello, Idaho
- Pocatello Regional Medical Center, Pocatello, Idaho.

Bingham, Bonneville, Butte, Clark, and Jefferson Counties are the local county governmental jurisdictions surrounding the INEL. They are responsible for implementing emergency plans during emergencies at the INEL.

Normally, the civil defense/emergency management director for each county is the designated official with executive authority and responsibility for planning and coordination of the county's emergency response. The civil defense/emergency management director activates the county EOC and coordinates the response of involved county support agencies during the course of the INEL emergency, as detailed in the county's emergency plan.

19.2.4 Emergency Response Organization Appraisals

Internal or independent DOE-ID appraisals of the area and facility emergency preparedness organizations are conducted at least once a year in accordance with DOE 5500.10 (DOE, 1991d). Senior contractor management conducts an appraisal of the ERP on alternate years with the DOE-ID appraisals. DOE Headquarters annually conducts technical safety appraisals of the major facilities. The area or facility emergency organization, including any tenant ERP activities, would be audited as part of any internal, DOE-ID, or DOE Headquarters audits. The results of the appraisals are factored into revisions in the contractors' and facilities' emergency preparedness programs.

19.3 Emergency Plan Description

A Health and Safety Plan developed in accordance with Title 29, *Code of Federal Regulations* (CFR) 1910.120 (DOL, 1993b) contains the emergency plan for each specific ERP activity. The Health and Safety Plan references the INEL facility and area-specific emergency plans; the contractors' emergency plans; and the DOE-ID INEL Emergency Plan (DOE-ID, 1993). Procedures will be developed, as necessary, for specific operational actions to detect, assess, and mitigate accidents and take protective actions.

The facility or area emergency plan promulgated under DOE 5500 Series Orders controls all emergency response activities within its area of jurisdiction, including any tenant ERP activities. ERP Health and Safety Plans are consistent with these facility and area plans. The interface agreement between the ERP contractor and the facility operating contractor provides that ERP personnel follow the directions of the facility or area plan when activated.

19.3.1 ERP Emergency Response Equipment

Emergency response equipment for ERP activities must provide for detection of potential hazards, protection of personnel, handling of contaminated or injured personnel, preservation of equipment and property, and protection of the local environment.

Detection devices are installed in work areas to detect and warn of workplace hazards in accordance with requirements for radiation monitoring or hazardous materials monitoring (Chapters 5, 9, and 10). Explanatory signs or tags are posted immediately adjacent to the warning device to describe the hazardous condition. Procedures explain the action to be taken in response to

warning devices. A summary of specific response actions is posted adjacent to moveable hazardous material or radiation monitors in remote locations.

Supplementary warning equipment to notify or signal site personnel of an evacuation is provided to assure prompt and complete evacuation of affected areas. An evacuation plan map is kept at the site. The map indicates evacuation routes from the activity site to assembly areas and to emergency support facilities.

At least one 20-lb fire extinguisher is readily available and at hand during operations. Additional fire extinguishers may be required by the Health and Safety Plan to assure immediate availability for larger facilities.

Portable eyewash fountains and sufficient potable water for flushing are readily available for the duration of the task. The task industrial hygienist determines the number and location of portable eyewash stations.

The health and safety support staff evaluates the potential for radioactive material spills and, if appropriate, recommends placement of one or more contamination spill kits. These kits contain plastic bags; absorbent material; latex gloves and liners; plastic shoe covers with rubber overshoes; smear survey wipes and holding bags; pencils, grease pencils, and paper; radiological postings and labels; yellow rope; yellow plastic sheeting; and duct tape. The health and safety support staff may recommend staging additional spill mitigation supplies, if appropriate.

19.3.2 Emergency Response Facilities

There are four locations from which to operate and support an emergency response: from the originating facility; from site support facilities; from DOE facilities; and from state/local facilities. Two facilities, the originating facility ECC and facility control room, are operated by the originating facility contractor. The EOC, CFA ECC, Warning Communications Center (WCC), Reception Center, Decontamination Center, Transportation Staging Areas, and Public Information Center are operated by the site support contractor. DOE-ID provides oversight to emergency response activities in the EOC. Decontamination activities in the Decontamination Centers are supervised by the originating facility contractor health physics and industrial hygiene personnel. Each offsite municipality operates a local EOC. In addition, most municipalities are served by a local dispatch center.

The following facilities have separate, stand-alone ECCs: the ICPP, TRA, Argonne National Laboratory-West (ANL-W), and the Naval Reactors Facility (NRF). All other EOCs and ECCs, including the INEL EOC, are multi-purpose facilities. Most are used for conference rooms.

The WCC is located in Room 92 of the DOE-ID Headquarters Building, Idaho Falls, Idaho. The WCC serves as the emergency notification and activation center for the INEL. The WCC is staffed continuously 365 days a year and is responsible for facilitating notifications as requested by the on-scene commander EAM or the ED. The WCC maintains ERO duty rosters and activates the INEL EOC.

There are several personnel and equipment decontamination centers at the DOE-ID INEL facilities. A list of decontamination facilities follows:

- *TAN* - Radiological showers in the Decontamination Room (TAN 633)
- *TRA* - Equipment decontamination facility (TRA 667)
- *CFA* - Primary INEL personnel decontamination facility in the CFA 602 Medical Building
- *WROC/WERF/PBF* - Radiological decontamination showers in each of the change rooms in the PBF Reactor Building
- *ICPP* - ICPP Equipment Decontamination Facility (CPP 659).

Other INEL facilities establish temporary decontamination centers as the need arises.

The DOE-ID Fire Department has three stations on the INEL site. The main station is located in the CFA; TAN and ANL-W have substations. All three fire stations are staffed 24 hours a day by career firefighters trained as Emergency Medical Technicians. Each of the three stations has the equipment and expertise to respond to explosions, fires, spills, and medical emergencies. The DOE-ID Fire Department maintains a specially equipped hazardous materials vehicle used in the event of hazardous chemical incidents. In addition, the seven-county area surrounding the INEL has 18 fire districts. The 18 districts operate a total of 30 fire stations staffed by 179 paid and 313 volunteer firefighters.

The DOE-ID Fire Department provides ambulance service on the INEL site. In addition, medical dispensaries located on the site provide assessment and treatment for ill or injured personnel within site boundaries. The CFA dispensary is staffed by a physician and nurses; the other dispensaries are staffed by nurses and a visiting physician who rotates among the dispensaries.

Ambulance services in the region are provided by some of the county governments and the cities of Blackfoot, Dubois, Idaho Falls, and Pocatello fire departments. Residents in Butte County receive ambulance service from a private ambulance company, the Lost River Ambulance Service. In addition to ambulance service, the seven-county area is served by four quick response units, two medical helicopters, and one clinic specializing in emergency medical services.

Eight hospitals serve the seven-county region. No hospitals are located in Clark or Jefferson counties. The Eastern Idaho Regional Medical Center in Idaho Falls is the largest hospital in the region with 311 beds. Lost Rivers District Hospital in Butte County has only four licensed beds.

The CFA Medical Facility, located at CFA-603, is the principal triage treatment and medical decontamination facility, unless otherwise designated by the Site Medical Director. This facility functions as the primary personnel decontamination facility for the INEL.

The Willow Creek Building (WCB) medical facility, located at WCB S-1, is available for medical administrative activities including preparation and dispensing of necessary medications such as potassium iodide (KI). WCB may be activated nights and weekends at the direction of the Medical Director.

The medical facilities at ANL-W, ICPP, NRF, TRA, and TAN have limited emergency medical capability and ordinarily would not be available in a facility evacuation.

19.3.3 Emergency Assessment and Action Levels

The Health and Safety Plan prepared in accordance with 29 CFR 1910.120 (DOL, 1993b) defines types of emergencies which could occur at the ERP site. These emergencies may include, but not be limited to, personnel occupational injury or illness within the exclusion (contaminated) zone; personnel occupational illness or injury in the support zone; fire or explosion; personal protective equipment failure; and hazardous or radioactive material spills or releases. If any of these occurrences are detected, emergency procedures are implemented.

Procedures and plans governing safety at ERP sites contain action levels facilitating ready detection by personnel of conditions warranting operations shutdown, including Off-Normal Occurrences and Unusual Occurrences as defined in DOE 5000.3B (DOE, 1993a). These action levels may incorporate alarm levels and measurement acceptance criteria as necessary. Examples of items warranting operations shutdown include explosive vapors exceeding 10% lower explosive limit (LEL); stop work orders from health physics personnel; appearance of waste materials in soil even in the absence of detectable radiation levels; and halting of work during inclement weather.

Emergency Action Levels (EALs) specifically apply to Operational Emergencies and are implemented in the Area or Facility Emergency Plan. A system of EALs and event classifications ensure the rapid recognition of accident indicators and the timely commitment of response resources. A system of pre-approved decisions is developed by each facility to allow onsite supervisory personnel (for example, shift supervisors and duty officers) to make rapid decisions affecting personnel, facilities, and resources in response to an emergency.

EALs provide clearly defined, nonambiguous criteria for initiating predefined actions to mitigate or prevent emergency events. EALs define specific conditions to invoke emergency classifications for each type of hazard included in the facility-specific hazard assessment.

DOE-ID facility EALs are to be developed, at a minimum, in accordance with the following categories:

- Radiological
- Nonradiological hazardous material
- Fire and explosion

- Natural and external phenomena
- Security.

19.3.4 Classification of Emergencies

Occurrences. DOE 5000.3B (DOE, 1993a) delineates the notification process for significant Reportable Occurrences. These include Off-Normal Occurrences, Unusual Occurrences, and Emergencies. Off-Normal Occurrences are abnormal or unplanned events or conditions that adversely affect, potentially affect, or are indicative of degradation of safety, security, environmental, or health protection performance or operation of a facility. Unusual Occurrences have a significant impact, or potential for significant impact, on safety, environment, security, or operations.

DOE 5000.3B, Attachment I, provides criteria for categorization of Unusual Occurrences and Off-Normal Occurrences. Occurrences contained in DOE 5000.3B, Attachment I, are identified and notification procedures completed as soon as sufficient information is obtained, but within 2 hours of categorization as an Unusual Occurrence or 80 hours of an Off-Normal Occurrence (DOE, 1993a).

Operational Emergencies. DOE 5500.1B (DOE, 1991a) establishes the DOE Emergency Management System for Operational Emergencies. DOE 5500.2B (DOE, 1991b) specifies emergency classifications to assure thorough and coordinated response to Operational Emergencies, consistent with DOE 5500.1B. Operational Emergencies may involve radioactive materials or non-radioactive materials with dangerous or toxic properties designated as hazardous materials. Operational emergency classifications are based on EPA protective action guides (PAG) or American Industrial Hygiene Association (AIHA) Emergency Response Planning Guidelines (ERPGs). An "alert" classification is not expected to exceed small fractions of these guidelines onsite. A "site area emergency" classification is not expected to exceed these guidelines offsite. A "general emergency" may approach or exceed these guidelines on public highways or offsite. Operational emergencies involving radioactive materials are not credible for Category 3 ERP activities due to the limited radionuclide inventory for Category 3.

ERP activities require process safety management programs if hazardous chemicals are present in excess of the threshold quantities in 29 CFR 1910.119 (DOL, 1993c) or quantities of material are possessed that exceed the threshold planning quantities of 40 CFR 355 (EPA, 1993c). Sufficient quantities of hazardous material may be accidentally released during these activities to cause significant toxic effects. Such emergencies may warrant classification as an operational emergency and activation of the Site Emergency Plan. All ERP activities operated under process safety management programs or exceeding 40 CFR 355 threshold quantities develop and maintain plans and procedures for detecting, classifying, and reporting emergencies in accordance with DOE 5500.2B.

19.3.5 ERP Protective Actions

The following protective actions are conducted under the facility or area emergency plan and the activity-specific Health and Safety Plan, as coordinated through the interface agreement. If an ERP emergency affects both ERP and non-ERP personnel, the facility or area emergency plan will be activated and the protective actions will be implemented by the EAM. Conversely, ERP personnel will respond to activation of the area or facility plan during a non-ERP emergency as required. In any case, offsite protective actions, such as public evacuations, are not expected as a result of ERP emergencies.

Any life-threatening emergency such as a significant fire, explosion, or hazardous release, initiates an ERP site personnel evacuation using the shortest possible route, without regard for decontamination, personnel contamination, or surface contamination spread. Decontamination activities are addressed after personnel are safe from injury. In the event of a fire or explosion, all personnel not essential to controlling the situation are evacuated from the ERP site and fire and/or explosives experts are notified. The Field Supervisor is responsible for ensuring that appropriate evacuation procedures are followed in the event of an ERP emergency.

In the event of an occupational injury or illness in the exclusion (contaminated) zone, personnel must take necessary immediate actions in accordance with procedures and staff training. The Field Supervisor assesses the situation and activates emergency response procedures in consultation with the health and safety support staff. If work is halted at the site because of an injury, operational personnel do not reenter the exclusion zone for routine operations until the cause of the injury or illness is identified and corrected.

Injuries or illnesses incurred in the support zone are addressed as in the exclusion zone. Routine operations may resume when the cause of the injury or illness is identified and corrected, or if the Field Supervisor and health and safety support staff conclude that the cause of the illness or injury will not affect continued performance.

A contaminated, injured worker is accompanied by at least one worker, preferably an industrial hygienist or radiation protection worker, to inform medical personnel of the level of decontamination performed before leaving the work area and to provide specific details about the illness or injury.

Any worker experiencing personal protective equipment failure is instructed to leave the exclusion zone, accompanied by a workmate. The health and safety support staff evaluates the situation and determines if exposure to hazardous or radioactive materials occurred. Re-entry will not be permitted until the equipment has been repaired or replaced.

If site equipment fails to operate properly, the Field Supervisor will be notified and will determine the effect of the failure on continued operations. If the failure affects safety of personnel or prevents completion of defined tasks, operations personnel leave the task site in a secure condition until the situation is evaluated and corrected.

If hazardous or radioactive material is spilled or released, personnel refer to the area emergency preparedness procedures for spills and report the spill to area personnel as directed. Spills of petroleum products, decontamination solutions, calibration materials, equipment fuels, and other hazardous liquids must be assessed.

Following any evacuation of the site because of health and safety-related issues, hazards are reassessed by the health and safety support staff and the cause of the hazard is corrected. The Health and Safety Plan, workplan, operating procedures, operational safety requirements, and emergency plans shall be reviewed for adequacy and site personnel shall be briefed on any changes prior to resuming operations.

Team personnel reentering the evacuated zone to assess conditions shall use the same level of personal protective equipment as prior to evacuation, or protective equipment Class C, whichever is more restrictive. Class A or B protective equipment may be prescribed by health and safety personnel, as appropriate.

19.3.6 Notifications

The Field Supervisor is notified of any accidents, injuries, illnesses, or conditions potentially threatening to the ongoing safety of the activity. Upon site evacuation or any reportable occurrence, in accordance with DOE 5000.3B (DOE, 1993a), the Field Supervisor promptly notifies the WCC, explaining the nature of the occurrence; actions underway; and emergency response assistance needed; followed by notification of the Area EAM. All occurrences related to safety and health and actions taken to aid personnel and mitigate the emergency are recorded in field logs.

The EAM will ensure that state, local, and tribal authorities receive notification within 15 minutes after an operational emergency is classified.

When DOE Headquarters is notified by the WCC, DOE Headquarters will ensure that appropriate Federal emergency response agencies and organizations are notified, as necessary.

After the initial notification is complete, offsite agencies will be updated as new information becomes available or at intervals of no longer than 60 minutes.

For an emergency that has been classified as an alert, site area emergency, or general emergency, the EAM may order the actuation of audible emergency warning sirens in the area. Siren-generated signals serve as the primary means for notifying personnel, visitors, and transients in the immediate area.

19.3.7 Emergency Preparedness Training and Exercises

Fundamental training for emergency response consists of safety and health plan training in accordance with 29 CFR 1910.120(e) (DOL, 1993b). Visitors not required to be familiar with the activity-specific Health and Safety Plan shall be briefed on site emergency procedures and escorted.

ERP management assures that all personnel are briefed on emergency equipment; the nature of safety warning devices in their area; and appropriate responses. Emergency communications protocols and responsibilities are explained prior to work. Management assures that workers are familiar with evacuation procedures, evacuation routes, and the nature and location of the emergency response facilities.

ERP management must conduct an annual exercise to evaluate personnel performance. All communications during such drills are prefaced and followed by a statement clearly identifying the situation as a drill. Each drill or any actual emergency or reportable occurrence is followed by a critique and any deficiencies identified in the emergency plan are corrected.

In addition to ERP-specific training for emergency response, ERP personnel are trained to respond to the facility or area emergency plan for the ERP site. The DOE contractor responsible for the facility or area will assure that ERP personnel are trained, in accordance with the interface agreement. The training includes general employee response to area or facility emergencies, with additional training for ERP supervision on the interface between the ERP staff and the facility or area ERO.

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- Department of Energy (DOE, 1991c), *Planning and Preparedness for Operational Emergencies*, DOE, Washington, D.C., Change 001 (7/10/91), DOE 5500.3A.
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- Environmental Protection Agency (EPA, 1993a), *National Oil and Hazardous Substances Contingency Plan*, U.S. Government Printing Office, Washington, D.C., 40 CFR 300.
- Environmental Protection Agency (EPA, 1993b), *Designation, Reportable Quantities, and Notification*, U.S. Government Printing Office, Washington, D.C., 40 CFR 302.
- Environmental Protection Agency (EPA, 1993c), *Emergency Planning and Notification*, U.S. Government Printing Office, Washington, D.C., 40 CFR 355.

CHAPTER 20.0

PROVISIONS FOR DECONTAMINATION AND DECOMMISSIONING

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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20.0 PROVISIONS FOR DECONTAMINATION AND DECOMMISSIONING

The provisions for decontamination and decommissioning (D&D) in this chapter are only applicable for new facilities or for significant modifications to existing facilities required for environmental restoration activities.

20.1 Minimizing Site and Environmental Contamination

Facilities in which radioactive or other hazardous materials are used, are designed and operated to simplify D&D and increase the potential for reuse. Applicable and appropriate design features and operating procedures that simplify and facilitate D&D, based on relevant decommissioning methods and potential reuse, will be identified during the planning and design phase.

Requirements for D&D methods contained in DOE 6430.1A, Section 1300-11 (DOE, 1989), shall be followed. Requirements are summarized in the following discussion.

20.1.1 Decontamination

Design of the areas in a facility that may become contaminated with radioactive or other hazardous materials under normal or abnormal operating conditions should incorporate measures to simplify future decontamination. Such items as service piping, conduits, and ductwork are kept to a minimum in these areas and are arranged to facilitate decontamination. Filters are positioned in ventilation systems in locations that minimize contamination of ductwork. Walls, ceilings, and floors are finished with washable or strippable coverings commensurate with anticipated process fluids and decontamination techniques to be used in the facility. In some areas, metal liners are required. If necessary, all cracks, crevices, and joints are caulked or sealed and finished smoothly to prevent contaminated material accumulation in inaccessible areas. Underlying goals are to minimize construction and decontamination costs and waste.

20.1.2 Decommissioning

The following design principles are considered for facilities handling radioactive and hazardous materials:

- Use of modular, separable confinements for radioactive and other hazardous materials to preclude contamination of fixed portions of the structure
- Use of localized liquid transfer systems to avoid long runs of buried contaminated piping; emphasis on localized batch solidification of liquid waste; special provisions in design to ensure integrity of joints in buried pipelines
- Location of exhaust filtration components of the ventilation systems at or near individual enclosures to minimize long runs of internally contaminated ductwork

- Use of equipment, including effluent decontamination equipment, that prevents, as much as possible, accumulation of radioactive or other hazardous materials in relatively inaccessible areas including curves and turns in piping and ductwork; use of accessible, removable inspection covers to allow visual inspection
- Selection of easily decontaminated materials to reduce the amount of radioactive and hazardous materials requiring disposal
- Selection of designs that ease cut-up, dismantlement, removal, and packaging of contaminated equipment from the facility (for example, removal and dismantlement of air filtration equipment, large tanks, vessels, equipment, and ductwork)
- Use of modular radiation shielding in place of monolithic shielding walls
- Use of lifting lugs on large tanks and equipment
- Use of fully drainable piping systems that carry contaminated or potentially contaminated liquids.

In addition to the above requirements for D&D in DOE 6430.1A (DOE, 1989), the following design considerations are applicable, based on previous D&D experiences:

- Design of equipment such as hoods, pumps, and ventilation ducting to minimum volume specifications for ease of decontamination and reduction of contaminated volume of resulting waste
- Incorporation into new facilities of collection tanks for diversion of liquid waste so that tank contents can be analyzed prior to discharge
- Consideration of purchasing or designing equipment that can be easily decontaminated
- Use of process equipment made of materials that will not interact chemically with the hazardous or radioactive materials
- Choice of materials to minimize decontamination costs and resulting waste.

Operating procedures ensure that under normal operating conditions, contamination is contained in the expected locations. Furthermore, operating procedures facilitate prevention of accidents and define mitigative actions to be taken to reduce the potential spread of contamination from an accidental event. Procedures are developed, reviewed, and approved as discussed in Chapter 13.0.

20.2 Recordkeeping of Operations

Operational records are maintained for contaminated facilities for use in the future preparation of D&D plans. Operational records include facility design drawings and modifications, data on contamination levels, prior decontamination activities, and incident reports required by DOE Directives. Recordkeeping requirements include the following information:

- Identification of all radioactive and hazardous materials
- Identification of areas of facility or site contaminated as well as type and quantity of radioactive and hazardous material
- Inventory of contaminated equipment and systems.

20.3 Site Restoration Plans

Facilities constructed and operated to support ERP activities are decontaminated to acceptable levels, as applicable, for reuse, recycling, or disposal and removal. Typical facilities include the following:

- Temporary or portable personnel and equipment decontamination facilities
- Temporary or portable process facilities; for example, groundwater treatment, soil washing
- Temporary radioactive or hazardous waste storage buildings
- Access control facilities and fences
- Temporary office facilities.

Any site contamination resulting from the facility's operations are remediated in accordance with the requirements of DOE 5400.5, Chapter IV (DOE, 1990); the environmental remediation action Record of Decision (ROD); or other established standards commensurate with the proposed site use.

The policy and guidelines in DOE 5820.2A, Chapter V (DOE, 1988), for the decommissioning of radioactively contaminated facilities shall be followed, as applicable. These policies and guidelines describe radiological, chemical, and physical D&D processes. A decision analysis will be applied to select preferred D&D alternative methods. Selection of preferred methods is followed by development of a detailed D&D plan.

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Department of Energy (DOE, 1988), *Radioactive Waste Management*, DOE, Washington, D.C., DOE 5480.2A.

Department of Energy (DOE, 1989), *General Design Criteria*, DOE, Washington, D.C., DOE 6430.1A.

Department of Energy (DOE, 1990), *Radiation Protection of the Public and the Environment*, DOE, Washington, D.C., Change 001-002 (1/7/93), DOE 5400.5

CHAPTER 21.0

APPLICABLE FACILITY DESIGN CODES AND STANDARDS

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

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21.0 APPLICABLE FACILITY DESIGN CODES AND STANDARDS

This chapter identifies the applicable design codes and standards important to preventing or mitigating hazards for structures, systems, and components of environmental remediation and decontamination and decommissioning (D&D) activities of the Environmental Restoration Program (ERP). The United States Department of Energy (DOE) requires that designs follow DOE and nationally recognized codes and standards. The top level design standard is DOE Order 6430.1A, *General Design Criteria* (DOE, 1989), which states that "all Department facilities are to be designed and constructed to be reasonable and adequate for their intended purpose and consistent with health, safety, security, and environmental protection requirements." As part of the conceptual design of an environmental remediation or D&D system, the codes and standards contained in DOE 6430.1A shall be reviewed to determine applicability. To ensure that adequate resources are provided for environmental, safety, and health (ES&H) protection as part of the design and operation of environmental remediation and D&D systems, the requirements of DOE Order 5480.4, *Environmental Protection, Safety, and Health Protection Standards* (DOE, 1991), must be followed. DOE 5480.4 specifies and provides requirements for the application of the mandatory ES&H standards, and provides a listing of reference ES&H standards. The next highest design standards are the DOE-Idaho Operations Office (DOE-ID) *Architectural Engineering Standards* (DOE-ID, 1992a), and ID-12044, *Operational Safety Design Criteria Manual* (DOE-ID, 1992b). These Idaho National Engineering Laboratory (INEL)-related design guidelines apply the requirements of DOE 6430.1A and DOE 5480.4 to the INEL in particular and provide more details specific to the requirements of the INEL site. *The Operational Safety Design Criteria Manual* supplements *DOE-ID Architectural Engineering Standards* by elaborating on health and safety considerations and fire protection.

The following sections provide a listing of design codes and standards applicable to ERP activities. To determine what codes and standards are applicable to a specific system design, the hazard classification under DOE Order 5480.28, *Natural Phenomena Hazard Mitigation* (DOE, 1993), and/or UCRL-15910, *Design and Evaluation Guidelines for Department of Energy Facilities Subjected to Natural Phenomena*, must be determined. The occupancy category under the Uniform Building Code (UBC) and National Fire Protection Association (NFPA) 101, *Life Safety Code*, must be determined. Sections in this chapter contain lists by major technical discipline followed by areas of specific design considerations and by types of systems with the associated design code or standard listed for the most appropriate subject. In some cases, the same design code or standard may be listed for more than one subject. This listing of design codes and standards is not intended to be inclusive of all potentially applicable codes and standards. The list is intended to be a reference source and to provide the most common references for designing an environmental remediation system or D&D support system. The latest edition of any particular standard shall be the one considered applicable.

21.1 Structural, Mechanical, and Electrical

21.1.1 Natural Phenomena (such as, wind, tornado, flood, seismic, snow)

- UCRL 15910, *Design and Evaluation Guidelines for DOE Facilities Subjected to Natural Phenomena Hazards*, 1988.

21.1.2 Mechanical (such as, piping, tanks)

- American Society of Mechanical Engineers (ASME), *Boiler and Pressure Vessel Code*
- American National Standards Institute (ANSI) B31.3, *Chemical Plant and Petroleum Refinery Piping*
- International Conference of Building Officials, *Uniform Building Code*
- International Association of Plumbing and Mechanical Officials, *Uniform Plumbing Code*
- 40 *Code of Federal Regulations* (CFR) 260, 261, 262, 263, 264, 265, 270, 271 (for storage of hazardous waste)
- 40 *CFR* 280, 281 (for storage of petroleum product)
- API 1615 "Installation of Underground Petroleum Storage Tanks"
- API 1604 "Removal and Disposal of Used USTs".

21.1.3 Electrical

- Institute of Electrical and Electronics Engineers (IEEE) 493, *Recommended Practice for Design of Reliable Industrial and Commercial Power Systems*
- National Fire Protection Association (NFPA) 70, *National Electrical Code*
- International Conference of Building Officials, *Uniform Building Code*
- National Electrical Manufacturer's Association (NEMA)
- National Electrical Safety Code (NESC).

21.1.4 Instrumentation and Control

- ANSI C2, *National Electrical Safety Code*
- Underwriter's Laboratory (UL) 508, *Industrial Control Equipment*
- Instrument Society of America (ISA).

21.1.5 Structural

- American Institute of Steel Construction (AISC) N690, *Nuclear Facilities: Steel Safety-Related Structures for Design, Fabrication, and Erection*
- American Society of Civil Engineers (ASCE)-7, *Building Code Requirements for Minimum Design Loads in Buildings and Other Structures*
- American Association of State Highway Transportation Officials (AASHTO)
- American Society for Testing Materials (ASTM)
- Idaho Standards for Public Works Construction
- INEL Welding Manual
- American Concrete Institute (ACI) 318, *Building Code Requirements for Reinforced Concrete*.

21.2 Systems

21.2.1 Containment/Confinement Barriers and Systems

- 40 CFR 112 (spill prevention, control, and countermeasures requirements)
- 40 CFR 265.193 (containment and detection of releases for tank systems)
- 40 CFR 264.175 (containment requirements for container storage facilities)
- 40 CFR 265.253 (containment requirements for Waste Piles).

21.2.2 Effluent Treatment Systems

- United States Environmental Protection Agency (EPA), 625/1-80-012, *Design Manual: On-Site Wastewater Treatment and Disposal Systems*
- 40 CFR 125 (regulations on criteria and standards for the Pollutant Discharge Elimination System)
- 40 CFR 401 (regulations on general provisions for effluent guidelines and standards)
- INEL Site-wide Stormwater Pollution Prevention Plan.

21.2.3 Ventilation and Offgas Systems

- American Society of Heating, Refrigeration, and Air Conditioning Engineers (ASHRAE) Standard 62, *Ventilation for Acceptable Indoor Air Quality*
- Steel Metal and Air-Conditioning Contractors National Association (SMACNA) Heating, Ventilation, and Air Conditioning (HVAC), *Duct Design Manual*.

21.2.4 Radiation Shielding

- American Nuclear Society (ANS) 6.4, *Guidelines on the Nuclear Analysis and Design of Concrete Radiation Shielding for Nuclear Power Plants*
- ANS 6.4.2, *Specification for Radiation Shielding Materials*
- ACI 349, *Code Requirements for Nuclear Safety-Related Concrete Structures*
- EPA, *Radiation Protection Guidance to the Federal Agencies for Occupational Exposure, Federal Register*, Vol. 52, No. 17, 1987
- DOE/EV/1830-TS, 4-80, "A Guide for Reducing Radiation Exposure to As Low As Reasonably Achievable (ALARA)."

21.2.5 Waste-Handling and Treatment Systems (including interim storage facilities for hazardous, radioactive, and mixed waste)

- 40 CFR 260, 261, 262, 263, 264, 265 (hazardous waste management requirements)
- 40 CFR 761 (polychlorinated biphenyl storage)
- Toxic Substances Control Act (TSCA)
- DOE-ID 10112, Revision 3, *INEL Low Level Radioactive Waste Criteria*, 1987
- DOE-ID 10074, Revision 4, *INEL Transuranic Waste Acceptance Criteria*, 1987.

21.2.6 Industrial and Chemical Safety Systems

- ANSI Z358.1, *Eyewash and Shower Equipment, Emergency*
- 29 CFR 1910, *Occupational Safety and Health Standards*.

21.2.7 Fire Protection

- NFPA 30, *Flammable and Combustible Liquids Code*
- NFPA 101, *Life Safety Code*.

21.2.8 Radiation Monitoring

- ANSI N13.1, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*
- ANSI N42.18, *Specification and Performance of Onsite Instrumentation for Continuously Monitoring Radioactive Effluents*
- DOE/EA-0173T, *Environmental Regulation Guide for Radiological Effluent Monitoring and Environmental Surveillance*.

21.2.9 Hazardous Chemical Monitoring

- 29 CFR 1910.120 (hazardous waste operations and emergency response).

21.2.10 Environmental Monitoring Systems

- 40 CFR 61, *National Emission Standards for Hazardous Air Pollutants* (NESHAPS)
- 40 CFR 265.15 (general inspection requirements)
- DOE/EA-0173T, *Environmental Regulation Guide for Radiological Effluent Monitoring and Environmental Surveillance*.

21.2.11 Sample/Injection and Withdrawal/Extraction Wells

- DOE *Drilling and Safety Manual* (EG&G).

21.3 Construction

21.3.1 Rigging

- 29 CFR 1926.251 (Rigging equipment for material)
- NE F 8-6, "Hoisting and Rigging of Critical Components and Related Equipment" (Oak Ridge National Laboratory)
- DOE-ID-10500, *Hoisting and Rigging Manual*, April 1993.

21.3.2 Demolition

- 29 CFR 1926, Subpart T - *Demolition*.

21.3.3 Shoring

- 29 CFR 1926, Subpart P - *Excavations*
- Scaffolding, Shoring, and Framing Institute (SSFI) SH 300, *Steel Frame Shoring Safety*.

21.4 Transportation

21.4.1 Radioactive Waste

- DOE 5820.2A, *Radioactive Waste Management*
- 49 CFR 100-179, *Department of Transportation Hazardous Materials Regulations*
- DOE 1540.1, *Materials Transportation and Traffic Management*
- 10 CFR 71, *Packaging of Radioactive Materials for Transport*
- International Atomic Energy Agency (IAEA) Safety Series No. 6, *Regulations for the Safe Transport of Radioactive Material*
- DOE 5480.3, *Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes*.

21.4.2 Hazardous Waste

- 40 CFR 262, 263 (standards applicable to generators and transporters of hazardous waste)
- 49 CFR Subpart C, Parts 171-179 (hazardous materials transportation requirements)
- DOE 5480.3, *Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes*.

21.4.3 Mixed Waste

- 40 CFR 262, 263 (standards applicable to generators and transporters of hazardous waste)
- 49 CFR Subpart C, Parts 171-179 (hazardous materials transportation requirements)
- DOE 5480.3, *Safety Requirements for the Packaging and Transportation of Hazardous Materials, Hazardous Substances, and Hazardous Wastes*
- DOE 1540.1, *Materials Transportation and Traffic Management*

- DOE 5820.2A, *Radioactive Waste Management*
- 49 CFR 100-179, *Department of Transportation Hazardous Materials Regulations*
- 10 CFR 71, *Packaging of Radioactive Materials for Transport*
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Department of Energy (DOE, 1993), *Natural Phenomena Hazards Mitigation*, DOE, Washington, D.C., DOE 5480.28.

Department of Energy-Idaho Operations Office (DOE-ID, 1992a), *DOE-ID Architectural Engineering Standards*, DOE-ID, Idaho Falls, ID.

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**IDAHO NATIONAL ENGINEERING LABORATORY
(INEL)**

ENVIRONMENTAL RESTORATION PROGRAM (ERP)

BASELINE TECHNICAL SAFETY REQUIREMENT FILE

June 20, 1994

**ENVIRONMENTAL RESTORATION PROGRAM
IDAHO OPERATIONS OFFICE
UNITED STATES DEPARTMENT OF ENERGY**

PREFACE

United States Department of Energy (DOE) Order 5480.22, "Technical Safety Requirements," requires that technical safety requirements (TSRs) be prepared for DOE nuclear facilities. TSRs are those requirements that define the conditions, safe boundaries, and the management or administrative controls necessary to ensure the safe operation of a nuclear facility and to reduce the potential risk to the public and facility workers from uncontrolled releases of radioactive materials or from radiation exposures due to inadvertent criticality. For the Idaho National Engineering Laboratory (INEL) Environmental Restoration Program (ERP), which encompasses environmental remediation and decontamination and decommissioning (D&D) activities at the INEL, TSRs are required for activities classified as Hazard Category 1,2, or 3 in accordance with DOE 5480.23 and DOE-STD-1027-92. TSRs are not required for environmental remediation and D&D activities with inventories of radioactive material available for release below the Hazard Category 3 thresholds in DOE-STD-1027-92.

To assist in the preparation, review, and approval of TSRs for environmental remediation and D&D activities and to provide consistency, this Baseline TSR File was developed. The Baseline TSR File meets the criteria, content, scope, and format delineated in DOE 5480.22 and the guidelines for TSRs included in Attachment 1 to the Order. This Baseline TSR File is principally derived from the INEL ERP Baseline Safety Analysis File (BSAF). The BSAF provides safety bases common to environmental remediation and D&D activities at the INEL and will be incorporated by reference into the safety analysis documentation prepared for individual environmental remediation and D&D activities with appropriate justification and, as needed, revisions and additions.

The Baseline TSR File is intended to be used as a template and to serve as the starting point for developing TSRs required for individual Hazard Category 3 environmental remediation and D&D activities. The Baseline TSR File must be reviewed for applicability to individual activity safety bases and revised as needed. This may include the deletion or modification of the Baseline TSR File administrative controls. The individual activity safety bases also must be reviewed to determine whether, in addition to the TSRs in the Baseline TSR File, there is a need for TSRs specific to the activity.

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ACRONYMS, ABBREVIATIONS, AND SYMBOLS

BSAF	Baseline Safety Analysis File
D&D	Decontamination and Decommissioning
DOE	United States Department of Energy
DOE-ID	DOE-Idaho Operations Office
EPA	Environmental Protection Agency
ERP	Environmental Restoration Program
INEL	Idaho National Engineering Laboratory
LCO	Limiting Condition for Operation
LCS	Limiting Control Setting
OSHA	Occupational Safety and Health Administration
SAR	Safety Analysis Report
SR	Surveillance Requirement
TSD	Treatment, Storage, and Disposal
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question

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1.0 USE AND APPLICATION

1.1 DEFINITIONS

TERM	DEFINITION
ADMINISTRATIVE CONTROL	ADMINISTRATIVE CONTROLS are the provisions relating to organization and management, procedures, record-keeping, reviews, and audits necessary to ensure safe operation of the facility.
CONTROL DOCUMENT	A document whose content is maintained uniform among the copies by an administrative control system.
HAZARD CATEGORY 3	The hazard category for which the hazard analysis shows the potential for only significant localized consequences.
HAZARDOUS MATERIAL	Any solid, liquid, or gaseous material that is toxic, explosive, flammable, corrosive, or otherwise physically or biologically threatening to health. Petroleum products are excluded from this definition.
LIMITING CONDITION FOR OPERATION	A LIMITING CONDITION FOR OPERATION is the lowest functional capability or performance level of safety-related structures, systems, components, and their support systems required for normal safe operation of a facility.
LIMITING CONTROL SETTINGS	LIMITING CONTROL SETTINGS are settings on systems that control process variables to prevent exceeding SAFETY LIMITS.
SAFETY LIMIT	SAFETY LIMITS are limits on process variables associated with those physical barriers, generally passive, that are necessary for the intended facility function and which are found to be required to guard against the uncontrolled release of radioactivity and other hazardous materials.
SURVEILLANCE REQUIREMENTS	SURVEILLANCE REQUIREMENTS are requirements relating to test, calibration, or inspection to ensure that the necessary operability and quality of safety-related structures, systems, components, and their support systems required for safe operation of the facility are maintained.

TERM	DEFINITION
TSR VIOLATION	<p>A TSR VIOLATION occurs as the result of one of the following four circumstances:</p> <ul style="list-style-type: none">(a) Exceeding a SAFETY LIMIT (SL)(b) Failure to take the action specified within the required time limit following:<ul style="list-style-type: none">(1) exceedance of a LIMITING CONTROL SETTING (LCS)(2) failure to meet a LIMITING CONDITION FOR OPERATION (LCO)(3) failure to successfully meet a SURVEILLANCE REQUIREMENT (SR)(c) Failure to perform surveillance within the required time limit(d) Failure to comply with an ADMINISTRATIVE CONTROL.

1.2 OPERATIONAL MODES

Note: Listed below are the operational modes for nonreactor nuclear facilities as recommended in the Attachment 1 guidelines to DOE 5480.22. HAZARD CATEGORY 3 environmental remediation and D&D activities generally require only administrative controls and the differentiation of operational modes is normally not necessary. If required, the operational mode definitions here shall be reviewed and revised as necessary and appropriate for specific environmental remediation or D&D activities.

- (1) Operation Mode - mission or current campaign of the facility is being performed.
- (2) Shutdown Mode - mission or current campaign of facility is not being performed and is incapable of being performed in its present condition.
- (3) Warm Standby - facility is not operating and still retains its inventory of radioactive and/or hazardous material.
- (4) Cold Standby - facility is not being operated and the radioactive and/or hazardous material inventory has been removed.
- (5) Repair Mode - mission can not be performed in facility's current condition.

1.3 FREQUENCY NOTATION

The frequency of surveillance, if required, will be defined in the individual TSR.

2.0 SAFETY LIMITS

2.1 SAFETY LIMITS

The bounding worst case unmitigated release of radioactive or hazardous material for HAZARD CATEGORY 3 environmental remediation and D&D activities has the potential for only significant localized consequences. SAFETY LIMITS are not normally required.

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3/4 OPERATIONAL LIMITS AND SURVEILLANCE REQUIREMENTS

3/4.1 OPERATIONAL LIMITS AND SURVEILLANCE REQUIREMENTS

The bounding worst case unmitigated release of radioactive or hazardous material for HAZARD CATEGORY 3 environmental remediation and D&D activities has potential for only significant localized consequences. Preventive or mitigative engineered safety features or safety-related systems and components are not expected. Therefore, operational limits (that is, LIMITED CONTROL SETTINGS, or LIMITING CONDITIONS FOR OPERATION or SURVEILLANCE REQUIREMENTS) are not normally required.

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5.0 ADMINISTRATIVE CONTROLS

If compliance with an ADMINISTRATIVE CONTROL is not achieved, corrective action shall be taken to ensure compliance. ADMINISTRATIVE CONTROLS apply at all times, unless otherwise noted.

5.1 CONTRACTOR RESPONSIBILITY

The project organization includes, at a minimum, the following personnel with the identified responsibilities:

- Project Manager with overall responsibility for safety and regulatory compliance and interface between the project and technical support organizations and subcontractors
- Field Supervisor with responsibility and authority to direct all field operations, day to day supervisory authority, and responsibility for compliance with established control procedures
- Health and Safety Officer with responsibility and authority to develop and implement the Health and Safety Plan and verify compliance
- Site Personnel with responsibility for performing tasks safely and empowered to stop any activity that endangers workers or the environment.

5.2 CONTRACTOR ORGANIZATION

The [Contractor Name] ERP organization has overall responsibility for assuring that activities are performed safely. The relationship of the ERP organization, project organization, technical support, and subcontractor support is shown in Figure 5-1. The ERP organization is responsible for developing and implementing the following documentation:

- Health and Safety Plan
- Environmental Remediation or D&D Plan
- Safety Analysis Report
- Quality Assurance Project Plan

[Contractor Name] is responsible for the development and enforcement of a Safety and Health Program. The Safety and Health Program shall follow the requirements of DOE Directives and the regulations of other Federal agencies and the State of Idaho. The ERP organization is responsible for ensuring the project is performed in compliance with Safety and Health Program requirements. (See Section 5.4 for specific Safety and Health Program requirements.)

Figure 5.1 Generalized INEL Environmental Restoration Program Organization.

5.3 PROCEDURES

Written procedures shall cover the conduct of activities during normal, abnormal, and emergency conditions and surveillance, testing, and maintenance. The procedures shall be revised as necessary, based on use in the field, and reviewed for completeness at a minimum of every two years.

5.4 PROGRAMS

Safety and Health Program

A Safety and Health Program shall be in place and implemented to identify, evaluate, and control safety and health hazards, and provide for emergency response.

A Health and Safety Plan shall be written, approved, and maintained addressing the following elements as required by 29 CFR 1910.120:

- Safety and health risk and hazard analysis
- Employee training assignments
- Personal protective equipment
- Medical surveillance
- Frequency and types of appropriate air monitoring, personnel monitoring, and environmental sampling
- Site control measures
- Decontamination procedures
- Emergency response.

Radiation Protection Program

A Radiation Protection Program that meets the requirements of the DOE-ID Radiological Control Manual (DOE-ID 10399) shall be in place, implemented, and maintained.

Industrial Hygiene Program

An Industrial Hygiene Program that meets the requirements of DOE 5480.10 and DOE-ID Supplemental Directive 5480.10 shall be in place, implemented, and maintained.

Industrial Safety Program

An Industrial Safety Program that meets the occupational safety and health standards in DOE 5480.4 shall be in place, implemented, and maintained.

Process Safety Management Program

A Process Safety Management Program that meets the requirements of 29 CFR 1910.119 shall be implemented. (Note: Required if using hazardous chemicals in excess of the threshold quantities listed in Appendix A of the regulation or using pressurized flammables in excess of 10,000 pounds. Fuels consumed on the worksite; flammables stored or transferred at atmospheric conditions and below their boiling point; oil and gas drilling facilities; and normally unoccupied remote facilities are exempted from process safety management requirements.)

Emergency Preparedness Program

An Emergency Preparedness Program that meets the requirements of Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) regulations and DOE Directives shall be in place, implemented, and maintained.

Document Control Program

A configuration and documentation management program shall be implemented to assure records of the activity are prepared and maintained to furnish objective auditable evidence of safety and quality. The requirements and responsibilities for document and records control shall be established and documented in accordance with DOE 1324.2A, DOE 5700.6C, and associated DOE-ID Supplemental Directives.

Quality Assurance Program

A Quality Assurance Program meeting the requirements of DOE 5700.6C shall be in place, implemented, and maintained.

5.5 MINIMUM OPERATIONS SHIFT COMPLEMENT

The minimum operations shift complement shall be specified, as required, by the activity-specific safety analysis documentation or the Health and Safety Plan.

5.6 OPERATING SUPPORT

The following operational support is required:

[Examples of operational support that may be required in activity-specific TSRs are listed below:

- Fire Protection

- Emergency Preparedness
- Security
- Radioactive, hazardous, and/or hazardous waste treatment, storage, and disposal (TSD).]

5.7 FACILITY STAFF QUALIFICATIONS AND TRAINING

The Project Manager, Field Supervisor, Health and Safety Officer, and Site Personnel shall meet the minimum personnel qualifications of DOE 5480.20.

A training program shall be established that meets the general training required by DOE 5480.20 and the special training required by the DOE-ID Radiological Control Manual and OSHA regulations. The training program development shall follow the principal criteria in DOE 5480.18A.

5.8 OPERABILITY DEFINITION AND IMPLEMENTATION PRINCIPLES

Not applicable since engineered safety systems and safety systems and components are not expected to be required for environmental remediation and D&D activities classified as HAZARD CATEGORY 3.

5.9 TECHNICAL SAFETY REQUIREMENT BASIS CONTROL

The safety basis (BSAF and activity-specific safety analysis) and the TSRs shall be under the document control program described in Section 5.4. The safety analysis documentation shall be updated annually in accordance with the requirements in DOE 5480.23.

5.10 REVIEW AND AUDITS

Reviews: Self assessment, independent review, and appraisal of safety performance shall be accomplished through an independent safety review system. The program shall meet the requirements of DOE 5482.1B, DOE 5480.5, and DOE 5700.6C. Self assessments will be conducted as directed by the Secretary of DOE in Secretary of Energy Notice SEN-35-91.

Unreviewed Safety Question Review: Procedures shall be in place and implemented to establish an unreviewed safety question (USQ) review process that meets the requirements of DOE 5480.21.

Operational Readiness Review: Operational readiness shall be conducted in accordance with DOE 5480.31.

5.11 REPORTING REQUIREMENTS

Procedures shall be in place, implemented, and maintained for occurrence reporting in accordance with the requirements of DOE 5000.3B.

5.12 RADIOACTIVE AND HAZARDOUS MATERIAL INVENTORY CONTROLS

Characterization sampling and monitoring, and/or surveillance, shall be performed to verify and/or control the available inventory of radioactive and hazardous material below that used to establish the hazard classification of the activity. [Note: Required if the inventory of available radioactive and hazardous material is close to the Hazard Category 2 threshold limits and there is reasonable uncertainty regarding the estimated inventory (for example, limited characterization data).]

APPENDIX A BASES

Since there are normally no SAFETY LIMITS or OPERATIONAL LIMITS/SURVEILLANCE REQUIREMENTS, BASES are not normally required.

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APPENDIX B DESIGN FEATURES

The bounding worst case unmitigated release of radioactive or hazardous material for HAZARD CATEGORY 3 environmental remediation and D&D activities has potential for only significant localized consequences. Safety-related design features are not normally required.