Volume I

Inspection of Environment, Safety, and Health Management of the

Idaho Operations Office and Idaho National Engineering and Environmental Laboratory

ISM

DEPARTMENT OF ENERGY • UNITED STATES OF AMERICA

September 2003

Office of Independent Oversight and Performance Assurance
Office of the Secretary of Energy

INDEPENDENT OVERSIGHT
INSPECTION OF
ENVIRONMENT, SAFETY, AND HEALTH MANAGEMENT
AT THE
IDAHO OPERATIONS OFFICE AND
IDAHO NATIONAL ENGINEERING AND ENVIRONMENTAL LABORATORY

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Acronyms

AHA	Activity Hazards Assessment
ALARA	As Low As Reasonably Achievable
ASME	American Society for Mechanical Engineering
ATR	Advanced Test Reactor
BBWI	Bechtel BWXT Idaho, LLC
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CY	Calendar Year
D&D	Decontamination and Decommissioning
DD&D	Deactivation, Decontamination, and Demolition
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EDF	Engineering Design File
EFIS	Emergency Firewater Injection System
EM	DOE Office of Environmental Management
EPN	Emergency Procedure Network
ES&H	Environment, Safety, and Health
ESH&QA	Environment, Safety, and Health and Quality Assurance
FEB	Facility Evaluation Board
FRAM	Functions, Responsibilities, and Authorities Manual
FR	Facility Representative
FY	Fiscal Year
gpm	Gallons Per Minute
HASP	Health and Safety Plan
HEPA	High Efficiency Particulate Air
ICARE	Issue Communication and Resolution Environment
ICP	Idaho Completion Project
ID	Idaho Operations Office
IHR	Independent Hazard Review
INEEL	Idaho National Engineering and Environmental Laboratory
INPO	Institute for Nuclear Power Operations
INTEC	Idaho Nuclear Technology and Engineering Center
IRC	INEEL Research Center
ISI	In-Service Inspection
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
ISO	International Organization for Standardization
JSA	Job Safety Analysis
LCO	Limiting Conditions for Operations
LOCA	Loss-of-Coolant Accident
MCP	Management Control Procedure
NCR	Nonconformance Report
NE	DOE Office of Nuclear Energy, Science and Technology
NPSH	Net Positive Suction Head
OA	Office of Independent Oversight and Performance Assurance
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
PAA	DOE Headquarters Office of Performance Assessment and Analysis
PAAA	Price-Anderson Amendments Act

Acronyms (continued)

PCP	Primary Coolant Pump
PCS	Primary Coolant System
PDD	Program Description Document
P&ID	Piping and Instrumentation Design
PM	Preventive Maintenance
PPE	Personal Protective Equipment
PRD	Program Requirements Document
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
R&D	Research and Development
RWP	Radiation Work Permit
SAA	Satellite Accumulation Area
SAR	Safety Analysis Report
S/CI	Suspect/Counterfeit Item
SME	Subject Matter Expert
SSCs	Structures, Systems, and Components
TAN	Test Area North
TLD	Thermoluminescent Dosimeter
TSR	Technical Safety Requirement
TRA	Test Reactor Area
UFSAR	Updated Final Safety Analysis Report
USQ	Unreviewed Safety Question
WGS	Waste Generator Services

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Volume I

1.0 INTRODUCTION

The Secretary of Energy's Office of Independent Oversight and Performance Assurance (OA) conducted an inspection of environment, safety, and health (ES&H) and emergency management programs at the U.S. Department of Energy (DOE) Idaho National Engineering and Environmental Laboratory (INEEL) site in August and September 2003. The inspection was performed jointly by the OA Office of Environment, Safety and Health Evaluations and the Office of Emergency Management Oversight. This volume discusses the results of the review of the INEEL ES&H programs. The results of the review of the INEEL emergency management program are discussed in Volume II of this report, and the combined results are discussed in a summary report.

The DOE Office of Nuclear Energy, Science and Technology (NE) was recently established as the lead program secretarial office for INEEL. As such, it has overall Headquarters responsibility for programmatic direction, funding of activities, and ES&H at the site, which will also include responsibility for the Argonne National Laboratory – West facility, currently overseen by the Chicago Operations Office. The DOE Office of Environmental Management (EM) is responsible for certain decontamination and decommissioning (D&D) and environmental restoration projects at INEEL. At the site level, line management responsibility for INEEL operations and safety falls under the Manager of the Idaho Operations Office (ID). INEEL is managed and operated for DOE by Bechtel BWXT Idaho, LLC (BBWI), whose members include Bechtel National, Inc.; BWX Technologies Company; and a consortium of eight regional universities.

INEEL is a multi-purpose laboratory that performs work for NE, other DOE program offices, other Federal agencies, and work for others. INEEL activities include nuclear reactor technology research and development, waste management, D&D of facilities, environmental restoration, advanced energy production, defense-related support, technology transfer, and non-nuclear research and development projects. INEEL has experienced a significant increase in D&D and programmatic work in the past few years for a variety of reasons (e.g., D&D projects have been accelerated).

INEEL consists of eight primary facilities situated on nearly 900 square miles in a rural, sparsely populated sector of high-desert terrain in southeastern Idaho. Site buildings and structures are clustered within these facilities, which are typically several hundred acres in size and are usually separated from each other by large tracts of undeveloped land. In addition, several laboratories and administrative offices are located in the city of Idaho Falls.

INEEL activities involve various potential hazards that need to be effectively controlled. These hazards include external radiation, radiological contamination, hazardous chemicals, and various physical hazards associated with facility operations (e.g., machine operations, high-voltage electrical equipment, pressurized systems, hoisting and rigging heavy loads, and noise). Significant quantities of radiological and chemical hazardous materials are present in various forms at INEEL.

EM and NE are restructuring their approach to line management of INEEL activities to provide for more clear lines of responsibility and direction. Correspondingly, ID will be reorganized to facilitate line management direction and oversight of the two major mission areas (i.e., environmental management and research/technical support). ID plans to issue separate contracts for these two mission areas when the current contract period ends. In response to these DOE Headquarters initiatives, BBWI recently (July 2003) reorganized to spin off an organizational element that has responsibility for environmental management activities at the INEEL site. EM projects at INEEL (e.g., cleanup of legacy waste and cleanup and/or closure of selected contaminated facilities) performed by BBWI are now consolidated under an integrated project named the Idaho Completion Project.

Throughout the evaluation of ES&H programs, OA reviewed the role of DOE organizations in providing direction to contractors and conducting line management oversight of contractor activities. OA evaluations emphasized contractor self-assessments, including issues management, and DOE line management oversight in ensuring effective ES&H programs. In reviewing DOE line management oversight, OA focused on the effectiveness of ID in managing the INEEL contractors, including such management functions as setting expectations, providing implementation guidance, allocating resources, monitoring and assessing contractor performance, and monitoring and evaluating contractor self-assessments. Similarly, OA focused on the effectiveness of contractor self-assessment programs, which DOE expects to provide comprehensive reviews of performance in all aspects of ES&H.

The purpose of the ES&H portion of this inspection was to assess the effectiveness of selected aspects of ES&H management as implemented by INEEL under the direction of ID. The ES&H portion of the inspection was organized to evaluate four related aspects of the integrated safety management (ISM) program:

- ID and BBWI implementation of selected ISM guiding principles, including safety-related roles and responsibilities (ISM Guiding Principle #2) and identification of safety standards and requirements (ISM Guiding Principle #5). INEEL efforts to address the new 10 CFR 830, Subpart B, requirements for design safety reviews for nuclear facilities and implementation of suspect/counterfeit item (S/CI) requirements were addressed.

- ID and BBWI feedback and continuous improvement systems.

- BBWI implementation of the core functions of safety management for various work activities, including construction, maintenance, D&D, research, and operations.

- Functionality of selected essential systems at the Advanced Test Reactor (ATR), including systems that mitigate loss-of-coolant accidents at the reactor and spent fuel pool (e.g., emergency firewater coolant injection, primary coolant pump shutdown systems, and various support systems).

The OA inspection team used a selective sampling approach to determine the effectiveness of ID and BBWI in implementing DOE ES&H requirements. The approach involved examining selected institutional programs that support the ISM program and implementation of requirements at selected INEEL facilities and activities. The review of the core functions of safety management focused on specific facilities and activities, including research activities at the INEEL Research Center (IRC); construction and tank cleaning activities at the Idaho Nuclear Technology and Engineering Center (INTEC); and D&D activities at Test Area North (TAN). In reviewing these programs and activities, OA devoted particular attention to selected ES&H requirements, including work control processes; S/CI controls; subcontractor ES&H controls; radiological work planning and permits; assessment and control of contaminants (e.g., beryllium); injury and illness record keeping; hoisting and rigging requirements; and radiological controls.

Section 2 of this volume provides an overall discussion of the results of the review of the INEEL ES&H programs, including positive aspects and weaknesses. Section 3 provides OA's conclusions regarding the overall effectiveness of ID and BBWI management of the ES&H programs. Section 4 presents the ratings assigned during this review. Appendix A provides supplemental information, including team composition. Appendix B identifies the specific findings that require corrective action and follow-up. Appendix C presents the results of the review of selected guiding principles of ISM. Appendix D presents the results of the review of the ID and contractor feedback and continuous improvement processes. Appendix E provides the results of the review of the application of the core functions of ISM for the selected INEEL activities. The results of the review of essential system functionality are discussed in Appendix F.

2.0 RESULTS

2.1 Positive Attributes

Although a number of implementation deficiencies were observed, many aspects of ISM are effectively implemented at INEEL. Most work observed by OA was performed with a high regard for safety. As discussed below, some aspects of ID and BBWI ES&H programs are particularly effective.

INEEL has achieved improvements in worker safety and environmental performance indicators. In the past few years, work activities at INEEL have increased significantly as D&D efforts have been accelerated, and INEEL facilities are used to support over 25 major R&D customers. For example, INEEL has decommissioned over 29,000 square feet of buildings at TAN this year, removed 60 Three Mile Island spent fuel racks ahead of schedule, and completed some key construction projects ahead of schedule. During this time, INEEL achieved significant improvements in quantitative worker safety and environmental management performance indicators. In the worker safety arena, the total injury case rate, total recordable case rate, and lost workday case rate have decreased by 47 percent, 70 percent, and 43 percent, respectively, from 1999 to 2003. In the environmental protection arena, the number of environmental violations has decreased significantly. The development and maturation of ISM and other ES&H-related programs (e.g., Voluntary Protection Program and environmental management system) have contributed to the performance improvements. For example, INEEL has performed over 23,000 behavior-based safety observations under its Worker Applied Safety Program.

Many aspects of the BBWI ISM program are rigorous, comprehensive, and effectively implemented. Although some implementation weaknesses were identified, the ISM program at INEEL is mature, comprehensive, well designed, and well documented. Roles and responsibilities are defined in detail in institutional documents and implementing procedures. The BBWI processes for managing requirements are comprehensive and effective and have several noteworthy aspects (procedures reference source requirements for each procedural step, a computer-based Requirements Management Tracking System, and assurance that workers receive training on new procedures before issuance). The BBWI Integrated Assessment Program provides a systematic framework for analyzing assessment results, determining assessment priorities, and improving assessment processes. BBWI has been proactive in developing and implementing an environmental management system that is integrated into ISM. S/CI requirements have been effectively addressed and integrated into ISM and facility procedures, including reporting processes.

The use of vacuum excavators and air-powered lances at TAN and INTEC efficiently and effectively reduces hazards associated with excavations. This practice provides a significant safety improvement over traditional excavation methods, particularly in the INEEL environment where underground surveys are not precise and facility drawings cannot be relied upon for accurate characterization of potential underground hazards. The air-powered lance loosens and disturbs the soil without forceful cutting action that may otherwise cause damage to unknown buried utilities. The methodology would be beneficial for consideration at other DOE sites.

The Radiological Control Information Management System electronic radiological work permit system is used effectively as part of the site as-low-as-reasonably-achievable (ALARA) program to control entry into radiological areas and to track personnel and task-specific doses. The Radiological Control Information Management System is a radiological control records database management program. The site began using the system in 1997 and has periodically added features and/or improved the utility to workers and management. Currently, the system controls employee entries into radiological areas based upon employee radiological training, predefined ALARA controls, and administrative requirements. A bioassay tracking analysis and dose assignment database was added in

1999. A variety of user-defined reports can be easily produced to provide useful insights about effectiveness of work planning and radiological controls. The site is working to improve the system's work planning utility through seamless integration with the system currently used to generate individual work packages. While other sites use similar systems to manage radiological work permits and provide electronic access control to radiological areas, INEEL's use of the system to track individual exposures and restrict access to radiological areas based on expired training, cumulative dose, or other parameters is an innovative practice that other DOE sites should consider.

2.2 Program Weaknesses

Although INEEL has a mature ISM program, weaknesses were identified in some important aspects of ISM implementation at the facility and activity levels.

ID has not implemented the line management oversight process as defined in the approved oversight procedure. ID has adequately defined and documented responsibilities to reflect its new organization and approach to line management oversight. However, some line oversight processes are not yet effectively implemented. For example, the mechanism to translate findings by the Facility Representatives into corrective actions by the contractor is not currently functioning because the requisite oversight analysis teams have not been established. In addition, ID has not yet provided the training to ensure that responsibilities are communicated and understood, and it does not have a structured self-assessment program. Further, the quality of surveillances and assessments varies significantly.

Weaknesses in the ATR design analyses raise concerns whether the systems designed to mitigate loss-of-coolant accidents (LOCAs) adequately protect against all potential accident scenarios. The design weaknesses identified had one or more of the following attributes: (1) failure to consider all accident phenomena in the accident analyses, (2) insufficient analysis of some potential accidents, and (3) inadequate justification for assumptions relied on to support the accident analysis. The design weaknesses are exacerbated by weaknesses identified in the configuration management program (e.g., updated final safety analysis report and plant drawings are not maintained accurate), preventative maintenance program (e.g., vendor recommendations are not incorporated into the maintenance program), and one surveillance test (operability of firewater pump) that could adversely impact the reliability of the Emergency Firewater Injection System and the LOCA primary coolant pump shutoff system. In worst-case scenarios, the systems may not function as intended to effectively mitigate a LOCA and prevent fuel damage. Notwithstanding a number of positive aspects, the identified design analysis weaknesses warrant a detailed evaluation of the specific concerns and a management review to determine why these concerns were not previously identified, including the underlying factors that may reduce the effectiveness of engineering evaluations and safety analyses.

INTEC and TAN field supervision and safety professionals have not ensured that work activities are performed within established hazard controls and requirements listed in work packages. Although most work observed was conducted in accordance with identified controls, the OA team identified unsafe work practices and safety deficiencies at the facilities inspected. Many instances of work were not conducted in strict compliance with procedural steps, work package requirements, posted controls, or other documented requirements, resulting in potentially unsafe conditions. In several cases, weaknesses, combined with problems in identification and implementation of controls, led to stopping or pausing work in order to mitigate deficient conditions. The observed deficiencies indicate that supervisors and workers do not always ensure strict procedural compliance and sometimes make non-conservative decisions about how and when to apply procedural requirements or work package requirements and controls. In some cases, there is evidence of an overreliance on individual expertise and knowledge, without applicable reference to site procedures and requirements, resulting in unnecessary exposure to hazards.

The level of rigor and formality applied to radiological hazards analyses at the Building 616 D&D project was not sufficient to demonstrate that all relevant radiological hazards were clearly analyzed and that corresponding controls were adequate. BBWI has not clearly evaluated the hazards associated with potential beta radiation dose to workers' extremities in a manner sufficient to demonstrate that existing controls in radiological work permits or ALARA reviews are adequate. In addition, BBWI has not developed a clear technical justification in internal dosimetry technical basis documents for not performing Strontium-90 (Sr-90) urinalysis as part of the random whole body counting bioassay program at Building 616.

BBWI's independent hazard review (IHR) process does not sufficiently document IRC management expectations for some elements of planning and conducting research to ensure a consistent and adequate level of hazard review commensurate with the hazard and the complexity of the work being performed. The IHR process has been effective in integrating INEEL subject matter experts and peer reviews into the planning and conduct of research and development work conducted at the IRC laboratories. Although performance metrics for the IHR process are good, the IHR process lacks sufficient documentation in some areas. For example, the IHR process does not provide sufficient written guidance on when and how an existing IHR package should be revised, on the need for and use of procedures when conducting research activities, or how a graded approach to hazards analysis should be conducted. The IHR process relies on the collaborative judgment made by the research team to implement the appropriate management expectations without requiring that all expectations be documented. This people-based process can result in inconsistent outcomes and is vulnerable to schedule pressures and changes in personnel.

3.0 CONCLUSIONS

The ISM program at INEEL has continued to improve and mature. Many aspects of ES&H requirements are effectively implemented, and some aspects of ISM implementation are noteworthy. However, weaknesses in implementation of ISM are evident in a number of important areas, including the unreviewed safety question (USQ) process, ID line management oversight, and certain elements of BBWI implementation of ES&H requirements at the working level. In addition, deficiencies in the ATR essential systems will require extensive analysis to ensure an effective resolution.

ID and BBWI management are supportive of safety and understand and accept their line management responsibility. ID and BBWI have coordinated their efforts to establish an appropriate set of contractual requirements, and they have worked together to address 10 CFR 830, Subpart B, requirements. BBWI met the regulatory schedule milestones for submitting safety basis packages. ID has reviewed all submittals and approved the submittals for 12 nuclear facilities; 15 other submittals are still in the DOE review and approval process. BBWI has an effective process for identifying requirements and ensuring that they are clearly incorporated into working-level processes and procedures. Responsibilities and expectations are clearly defined at all levels of the BBWI organization. BBWI has effectively integrated S/CI requirements into facility procedures. Although there are some implementation weaknesses, BBWI has a well-documented assessment and issues management program and performs numerous assessments. In most respects, the BBWI ISM program documentation and structure are among the most rigorous, detailed, and mature in the DOE complex.

The ATR has several design deficiencies that were not adequately analyzed in the safety analysis. Weaknesses in configuration management, surveillance testing, and maintenance have the potential to further reduce the margin of safety. ID and BBWI decided to shut down the ATR to address a related design question on August 21, 2003. NE has been engaged in discussions with ID and BBWI regarding these potentially significant issues with the ATR. NE personnel recognize that resource limitations in past years may have contributed to some aspects of the deficiencies (e.g., not funding a design reconstitution). NE indicated that resource levels would be reexamined and that NE would increase its involvement in addressing ATR issues.

Many aspects of work that the OA team observed at INEEL were performed with a high regard for safety. With some exceptions, the work activities were well defined and the potential hazards were effectively identified and analyzed. In most cases, effective hazard controls were in place and effectively implemented. Some aspects of BBWI implementation of ES&H requirements are particularly rigorous and comprehensive. However, weaknesses were identified in the implementation of a number of hazard controls and procedures, and ES&H requirements were not always rigorously implemented at the working level. Facility management, supervisors, and ES&H personnel did not always take sufficient action to ensure that requirements were being effectively implemented. In addition, the USQ process at INEEL needs improvement to ensure that DOE requirements are correctly reflected and effectively implemented, and to prevent operations outside the authorized safety envelope. When viewed collectively, the implementation deficiencies identified for the specific facilities inspected indicate a need for increased rigor and attention to detail in implementing ISM processes. The current lack of adequate ID line management oversight processes is another contributor to implementation deficiencies. The maintenance of a culture based on safely conducting work in accordance with approved procedures and work packages is a significant management challenge that must be continuously addressed to prevent erosion of the improvements realized from the ISM implementation efforts of the past several years.

The ID senior management team recognizes the need to address the current deficiencies in ID's implementation of responsibilities and establish individual and organizational accountability for effectively meeting mission objectives and management expectations. ID management also recognizes that there are significant challenges facing ID and INEEL, including the ongoing transition, reorganizations, major procurement efforts, recent reductions in funding and force, and the increased workload associated with accelerated site cleanup. ID is actively working on addressing such challenges and implementing its new approach to oversight.

Overall, the ISM programs at INEEL are mature and well structured and effectively address many of the potential hazards. However, there are deficiencies in several important aspects of the INEEL ISM, including worker safety controls, adherence to requirements, the USQ process, and ID line management oversight. NE, ID, BBWI, and EM need to ensure that the deficiencies identified at the specific facilities reviewed are rigorously evaluated to determine root causes and recurrence controls. Because some of the deficiencies could have sitewide implications, management should direct assessments to determine whether similar deficiencies exist at other INEEL facilities. In addition, NE, ID, and BBWI recognize that the weaknesses in the ATR design analyses, configuration management, testing, and maintenance will require a detailed evaluation to determine their safety significance and the appropriate corrective actions. NE, ID, and BBWI should consider the following actions to ensure that root causes for the ATR weaknesses are identified and addressed:

- Perform an ATR design evaluation that addresses the full range of potential concerns and evaluates potential changes to ensure that the ATR can be safely shut down in the event of a worst-case accident scenario.

- Communicate management's expectation for a safety culture that promotes a questioning attitude among the engineering staff and demands the rigor and attention to detail necessary to meet the quality engineering standards associated with an operating nuclear reactor.

- Review the level of historic and current resource allocations to ATR to ensure that future allocations are sufficient to address residual risk and sustain effective operations and maintenance.

4.0 RATINGS

The ratings reflect the current status of the reviewed elements of the INEEL ISM program:

Safety Management System Ratings

Guiding Principle #2 – Clear Roles and Responsibilities ....EFFECTIVE PERFORMANCE
Guiding Principle #5 – Identification of Standards and Requirements.......EFFECTIVE PERFORMANCE

Feedback and Improvement

Core Function #5 – Feedback and Continuous Improvement ....NEEDS IMPROVEMENT

Implementation of Core Functions for Selected Work Activities

Core Function #1 – Define the Scope of Work.......................................EFFECTIVE PERFORMANCE
Core Function #2 – Analyze the Hazards..EFFECTIVE PERFORMANCE
Core Function #3 – Develop and Implement Hazard Controls..........................NEEDS IMPROVEMENT
Core Function #4 – Perform Work Within Controls ....NEEDS IMPROVEMENT

Essential System Functionality

Design and Configuration Management ....SIGNIFICANT WEAKNESS
Surveillance, Testing, and Maintenance ....NEEDS IMPROVEMENT
Operations...EFFECTIVE PERFORMANCE

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APPENDIX A

Supplemental Information

A.1 Dates of Review

Scoping Visit	June 3-5, 2003
Onsite Inspection Visit	August 11-22, 2003
Report Validation and Closeout	September 3-5, 2003

A.2 Review Team Composition

A.2.1 Management

Glenn Podonsky, Director, Office of Independent Oversight and Performance Assurance
Michael Kilpatrick, Deputy Director, Office of Independent Oversight and Performance Assurance
Patricia Worthington, Director, Office of Environment, Safety and Health Evaluations
Thomas Staker, Deputy Director, Office of Environment, Safety and Health Evaluations

A.2.2 Quality Review Board

Michael Kilpatrick
Charles Lewis
Robert Nelson
Patricia Worthington
Dean Hickman

A.2.3 Review Team

Charles Lewis, Director, Office of Emergency Management Oversight (Team Leader)
William Miller (Overall ES&H Lead)

Ali Ghovanlou (Management Systems Lead)
Robert Compton
Albert Gibson
Timothy Martin

Jim O'Brien (Essential System Functionality Lead)
Michael Gilroy
Don Prevatte
Michael Shlyamberg

Brad Davy (Core Functions Lead)
Mark Good
Joe Lischinsky
Jim Lockridge
Edward Stafford
Mario Vigliani

A.2.4 Administrative Support

Lee Roginski
Tom Davis

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APPENDIX B

Site-Specific Findings

Table B-1. Site-Specific Findings Requiring Corrective Action Plans

FINDING STATEMENTS	REFER TO PAGES
1. Idaho Operations Office (ID) and Bechtel BWXT Idaho, LLC (BBWI) have not ensured that the Idaho National Engineering and Environmental Laboratory (INEEL) unreviewed safety question process is effectively designed and implemented.	20
2. ID has not implemented the line management oversight process and issues management process, as defined in the approved oversight procedure, to ensure that important deficiencies are corrected and that ID self-assessment processes result in continuous improvement.	24
3. The level of rigor and formality applied to radiological hazards analyses at the Building 616 decontamination and decommissioning project was not sufficient to demonstrate that all relevant radiological hazards were clearly analyzed and that corresponding controls were adequate.	38
4. MCP-3571, *Independent Hazard Review*, and other related documents do not sufficiently document INEEL Research Center management expectations for some elements of planning and conducting research to ensure a consistent and adequate level of hazard review commensurate with the hazard and the complexity of the work being performed.	41
5. Idaho Nuclear Technology and Engineering Center and Test Area North field supervision and safety professionals have not ensured that work activities are performed within established hazard controls and requirements listed in work packages.	51
6. Some potential accidents and accident phenomena have not been adequately analyzed and documented to provide assurance that Advanced Test Reactor (ATR) safety systems are capable of mitigating loss-of-coolant accidents in accordance with the ATR updated final safety analysis report (UFSAR).	58
7. The U.S. Department of Energy has not supported and BBWI has not implemented an effective configuration control program to ensure that the ATR design meets all technical and procedural requirements as required by PRD-115, *Configuration Management*.	60
8. BBWI has not established a technically adequate surveillance program for testing the operability of the ATR firewater pumps as required by technical safety requirement (TSR) limiting conditions for operations (LCO) 3.2.1.2, surveillance requirement 4.2.1.2.8, and UFSAR Chapter 14.	61
9. BBWI has not implemented the American Society for Mechanical Engineering (ASME) Section XI inspection requirements for the Emergency Firewater Injection System check valves specified in the in-service inspection plan referenced in UFSAR Chapter 14.	61

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APPENDIX C

Guiding Principles of Safety Management Implementation

C.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluation of safety management systems focused on selected guiding principles of integrated safety management (ISM) as applied at the Idaho National Engineering and Environmental Laboratory (INEEL). OA examined Guiding Principle #2 (Clear Roles and Responsibilities) and Guiding Principle #5 (Identification of Standards and Requirements). OA also selectively followed up on the status of ongoing actions in several areas of interest to the Defense Nuclear Facilities Safety Board, including implementation of 10 CFR 830, Subpart B, and suspect/counterfeit item (S/CI) requirements.

DOE Headquarters Office of Nuclear Energy, Science and Technology (NE), DOE Headquarters Office of Environmental Management (EM), Idaho Operations Office (ID), Bechtel BWXT Idaho, LLC (BBWI), and subcontractor personnel were interviewed to determine their understanding of the ISM program and their responsibilities, as well as the status of ongoing initiatives and corrective actions. The OA team reviewed various documents and records, including ISM program documents; environment, safety, and health (ES&H) procedures; functions, responsibilities, and authorities manuals (FRAMs); ES&H manuals; contract provisions related to safety; subcontract provisions; selected aspects of staffing, training, and qualifications of technical personnel; and various INEEL plans and initiatives. In evaluating the guiding principles, the results of the OA review of the core functions were considered.

The review of the guiding principles focused on institutional programs and implementation of institutional requirements at the INEEL Research Center (IRC), Idaho Nuclear Technology and Engineering Center (INTEC), and Test Area North (TAN). Limited aspects of implementation of responsibilities and requirements at the Advanced Test Reactor (ATR) were also reviewed.

C.2 RESULTS

C.2.1 Clear Roles and Responsibilities

Guiding Principle #2: Clear and unambiguous lines of authority and responsibility for ensuring safety shall be established and maintained at all organizational levels within the Department and its contractors.

DOE Headquarters Office of Nuclear Energy, Science and Technology, and DOE Headquarters Office of Environmental Management

EM and NE are restructuring some aspect of their approach to line management of INEEL activities to provide for more clear lines of responsibility and direction. Correspondingly, ID will be reorganized to facilitate line management direction and oversight of the two major mission areas (i.e., environmental management and research/technical support). NE and EM are working with ID to establish a "seamless" approach to DOE line management. In this concept, the program office and field office will work more closely and act as a single organization. For example, program management functions historically performed by field offices might be assigned to Headquarters or vice versa such that DOE makes optimal use of its resources and capabilities.

As a part of this approach, separate contracts for these two mission areas will be issued when the current contract period ends. In response to these DOE Headquarters initiatives, BBWI recently (July 2003) reorganized to spin off an organizational element that has responsibility for environmental management activities at the INEEL site. EM projects that are performed by BBWI, including accelerated cleanup of legacy waste and closure of selected contaminated facilities, are now consolidated under a new integrated project named the Idaho Completion Project (ICP).

NE has been engaged in discussions with ID and BBWI about the potentially significant issues with the ATR (see Appendix F). NE personnel recognize that resource limitations in past years may have contributed to some aspects of the deficiencies (e.g., not funding a design reconstitution). NE indicated that resource levels would be reexamined and that NE would increase its involvement in addressing ATR issues.

Idaho Operations Office

ID is being reorganized to facilitate line management direction and oversight of its two major mission areas (i.e., environmental management and research/technical support). The ID FRAM is being revised to reflect the reorganization and other changes in policies, approach, and organizations that have occurred since the FRAM was last revised in calendar year (CY) 2000. The revised FRAM was scheduled to be issued in June 2003 but has been delayed; ID indicated that issuance is imminent. The revised draft FRAM appropriately defines organizational functions, roles, and responsibilities for overseeing ES&H aspects of contractor performance.

ID has communicated appropriate ES&H expectations to the contractors through several mechanisms, including an annual Comprehensive Performance-Based Incentive Plan. Section 3 of this document for fiscal year (FY) 2002 defines six specific performance measures for safety (e.g., completion of the *Nuclear Facility Safety Basis Work Plan* to satisfy the requirements of the 10 CFR 830 Rule, and achievement of a challenging "Environmental Violations Index"). In addition to these performance measures, ID provides adequate guidance to the contractor for meeting contractor requirements in accordance with annually defined milestones through the performance evaluation guidance reports. Finally, the Safety Performance Objectives Measures and Commitment Report summarizes the agreed-upon annual commitments by the contractor. Roles, responsibilities, and accountability for monitoring contractors' performance measures are appropriately defined at ID.

ID is also revising its approach to line management oversight (see Appendix D). ID issued a procedure in May 2003 that provides a detailed description of the roles and responsibilities of ID safety significant functions, organizations, positions, and interfaces. The procedure is provided as Section I, Chapter 4, of the assistant managers' manuals and is entitled *Line Environment, Health, Safety and Quality Assurance*. The new procedure establishes the ID Deputy Assistant Manager for Operations as the individual responsible for coordination of line oversight activities, which are performed primarily by Facility Representatives and ES&H subject matter experts (SMEs). The new procedure establishes a structured process, with clear responsibilities, for providing feedback to the contractor through formal channels (e.g., direction through the contracting officer or contracting officer representatives).

The organizational functions and position-specific ES&H and line oversight roles and responsibilities are appropriately defined and documented through the revised FRAM (draft) and new oversight procedure. However, a number of aspects of the new oversight procedure have not yet been implemented or are not currently functioning effectively. For example, the responsibilities of the ID Facility Representatives and SMEs are adequately defined in the new oversight procedure, but these individuals have not been trained on the new procedure and do not yet have an adequate understanding of the new processes. In addition, responsibilities have been established for new functions, such as ES&H analysis teams, but these functions/teams are not currently functioning and their responsibilities are not being implemented. (See Finding #2 in Appendix D.)

The ID senior management team recognizes the need to address the current deficiencies in ID's implementation of responsibilities and establish individual and organizational accountability for effectively meeting mission objectives and management expectations. ID management also recognizes that there are significant challenges facing ID and INEEL, including the ongoing transition, reorganizations, major procurement efforts, recent reductions in funding and force, and the increased workload associated with accelerated site cleanup. ID is actively working on addressing such challenges and implementing its new approach to oversight. For example, ID senior managers recently held offsite meetings to discuss issues and develop plans to address them.

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Institutional Roles and Responsibilities. The principal documents delineating BBWI roles and responsibilities for ISM are the sitewide INEEL Integrated Safety Management System (ISMS) Program Description Document, the ICP Line Management and Operations Manual, and the INEEL Line Management and Operations Manual. Subcontractor roles and responsibilities are also consolidated in the INEEL Subcontractors Requirement Program Description. Collectively, these documents adequately define management ES&H-related expectations for all organizations (including subcontractors), managers, and individuals.

The institutional documents clearly describe broad roles and responsibilities for ES&H, including those for key line managers, support organizations, such committees as the Senior Operational Review Board, and such positions as nuclear facility manager, non-nuclear facility manager, SMEs, and senior supervisory watch. Roles, responsibilities, and processes for maintaining and improving the ISMS are also clearly delineated. ISM processes and activities (e.g., conduct of operations, conduct of maintenance, and hazards analysis and control) and associated responsibilities are clearly described. Expectations and responsibilities for BBWI feedback and improvement activities, such as the Facility Evaluation Board and Facility Excellence Program, are comprehensive and well defined.

BBWI has clearly defined position-specific roles and responsibilities in various documents, such as project execution plans, management control procedures (MCPs), interface and tenant user agreements, and employee position descriptions. BBWI makes extensive use of deployed or assigned staff to support projects, including the ICP, and has clearly defined their responsibilities and interfaces. Roles, responsibilities, accountability, and authorities of key management positions have been established and documented on the INEEL intranet.

In general, the institutional roles and responsibilities for ES&H-related functions are clearly defined as part of a mature ISM program. The structure and documentation of the institutional INEEL ISM program are noteworthy. However, as discussed under Guiding Principle #5, there are weaknesses in the institutional unreviewed safety question (USQ) process and its implementation. A few of the USQ weaknesses involve inappropriate assignment of responsibilities and authorities. For example, some USQ screening functions are assigned to personnel who do not have sufficient training in the USQ process.

Work Authorization/Facility- and Activity-Level Roles and Responsibilities. Additional program-specific roles and responsibilities for work at the facility and activity level are well defined in various documents, including functional and activity program manuals, description and requirements documents, MCPs, standards, guides, and charters. The position-specific roles and responsibilities for activity-level hazard identification, analysis, and development of controls are also clearly defined for the various INEEL activities: the integrated work control process (IWCP) is applicable to maintenance, projects, construction, environmental remediation, and decontamination and decommissioning (D&D); independent hazard review (IHR) is applicable to research and development (R&D); and hazard identification analysis and control of operational activities is applicable to operational activities. Management and staff interviewed by OA were knowledgeable of their individual roles and responsibilities for the conduct of work; environment, safety, health and quality assurance (ESH&QA); and ISM.

For R&D work at the IRC evaluated by OA, roles and responsibilities are well defined and understood. Associate Laboratory Directors are responsible for R&D work activities and recognize that line management is responsible and accountable for safety. Facility managers, maintenance coordinators, and ES&H coordinators have well-defined responsibilities for supporting R&D efforts and ensuring that ES&H requirements are met. Institutional and program-specific documents provide the necessary details on roles and responsibilities of the safety management chain and clarify interactions among principal investigators, facility managers, department managers, custodians, and ES&H coordinators. ES&H SMEs are deployed to IRC from support organizations, and interfaces among various organizations and associated roles and responsibilities are clearly defined through tenant user agreements, interface agreements, or memoranda of understanding between organizational entities.

Although IRC roles and responsibilities are well defined, as discussed in Appendix E, IRC needs to better document management expectations for certain aspects of hazard identification, analysis, and control (see Finding #4). Because of this weakness, the IRC research work control process relies on some written instructions and a collaboration of researchers, principal investigators, and ES&H coordinators to ensure safety. A review of several projects indicates that the current IRC personnel understand their responsibilities for safety and are effectively executing them despite insufficient documented expectations. IRC staff are consistently performing hazards analysis and establishing ES&H controls that are more rigorous than the minimum specified in the IHR process. However, addressing the IHR process weakness would enable IRC to further improve its definition of responsibilities and reduce the reliance on individual expertise.

For observed work activities (e.g., D&D, maintenance, and construction) at INTEC and TAN, roles and responsibilities are well defined and clearly communicated. Much of the work at these facilities is performed as part of the ICP. Facility managers, maintenance coordinators, and ES&H coordinators have well-defined responsibilities for supporting D&D efforts and facility operations and ensuring that ES&H requirements are met. Institutional and program-specific documents adequately define ES&H roles and responsibilities. BBWI's ICP, which is established as a separate division to perform the D&D and environmental restoration activities, obtains some ES&H support from the INEEL ES&H organization. Established program descriptions, project execution plans, procedures, and interface agreements comprehensively define roles and responsibilities for safety management and clarify interface requirements. BBWI ICP project managers develop detailed project execution plans, work plans, project work orders, and interface agreements that adequately define responsibilities and interfaces for authorizing work and ensuring safety. Structured processes, such as the plan-of-the-week/plan-of-the-day process, are used to authorize individual work activities and appropriately identify responsibilities and authorities. These processes are well designed and documented. For example, to ensure that nuclear facility managers can maintain the facility within the safety basis, the authorization of the start of project work is reserved to the Operations Management organization using the plan-of-the-week/plan-of-the-day process.

Processes and responsibilities are well defined at INTEC and TAN and many aspects are effectively implemented. However, some ES&H responsibilities were not effectively implemented by field supervisors, ES&H support personnel, and workers. In a few cases, supervisors and ES&H personnel allowed work to be performed in a manner that was not consistent with documented requirements.

Facility management has not ensured that supervisors and ES&H personnel are rigorously enforcing ES&H requirements and ISM expectations. (See Finding #5 in Appendix E.)

At the ATR, some configuration management requirements and responsibilities have not been established and implemented. As part of the process of becoming the INEEL contractor, BBWI identified a legacy concern associated with the adequacy of as-built drawings and information. In addition to controlling risk and preventing further degradation, BBWI's closure plan for this concern included a provision for obtaining funding and implementing a recovery project for identifying, prioritizing, and resolving legacy as-built deficiencies. The resulting sitewide requirements for this activity, including MCP-3767, *Configuration Management and Design Recovery Planning*, apply to all nuclear facilities, non-nuclear facilities, and site areas at INEEL. This procedure directs actions necessary to develop and implement plans utilizing a graded approach to establish technical baseline requirements and to identify and recover missing and inadequate technical baseline documentation for non-conforming legacy structures, systems, and components (SSCs). The MCP contains detailed requirements for the plan's development, content, review, and approval.

The ATR has a 1999 plan, PLN-534, *ATR Configuration Management Implementation and Recovery Plan*, that documents a path forward for implementing the INEEL configuration management program, including the process for defining the scope and schedule for the identification and recovery of missing or inadequate design information, which may be necessary to safely operate the ATR in accordance with its authorization basis, and the processes for implementing the design recovery schedule. However, ATR PLN-534 predates MCP-3767 and does not meet many of the MCP-3767 requirements (e.g., clear assignments of key roles and responsibilities; a list of facilities/systems, their hazard category/class, their expected remaining lifetime, their current life-cycle phase, the recommended technical baseline required, and justification for inclusion or exclusion from the list; a list of the results of the technical baseline documentation assessments; and a recovery work package that includes scope, costs, and schedule).

Prioritized recovery plans have been developed for most INEEL site–areas, and several site areas have funding for implementation. However, ATR has not developed the plan required by MCP-3767. ATR personnel indicate that specific ATR funding for development of a project plan and its implementation has not been established. In addition, responsibilities for implementing configuration management responsibilities have not always been effectively implemented (e.g., modifications were not reflected in the authorization basis). (See Finding #7 in Appendix F.)

Summary of Guiding Principle #2. ID has adequately defined and documented responsibilities to reflect its revised organization and approach to line management oversight. However, as discussed in Appendix D, some of those processes are not yet effectively implemented, and ID has not yet provided the training to ensure that responsibilities are communicated and understood.

BBWI has effectively defined, documented, and communicated institutional roles and responsibilities important to ES&H. With a few exceptions related to USQ responsibilities, the institutional responsibilities and interfaces are well defined, detailed, comprehensive, and understood by managers and staff. At the facility level and activity level, roles and responsibilities for ES&H are well defined and effectively communicated. In most cases, BBWI processes provide detailed information and clearly define expectations and responsibilities. However, as discussed in Appendices D, E, and F and Guiding Principle #5, implementation of certain responsibilities at the facility and activity level has not been effective in some cases (supervision and enforcement of worker safety requirements, USQ requirements, configuration management at ATR). While the responsibilities are appropriate and well defined, management needs to reinforce expectations for implementing ES&H responsibilities at the facility and activity level.

C.2.2 Identification of Standards and Requirements

Guiding Principle #5: Before work is performed, the associated hazards shall be evaluated and an agreed-upon set of safety standards shall be established that, if properly implemented, will provide adequate assurance that the public, the workers, and the environment are protected from adverse consequences.

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ID has established an adequate formal process for incorporating new and revised DOE directives into the BBWI contract. The process includes provisions for review by ID SMEs and for impact assessment by BBWI. The process requires applicable directives, laws, and regulations to be included in contract attachments (Lists A and B). ID requires BBWI to update these attachments regularly. The attachments contain an appropriate set of safety requirements for control of work at INEEL/ICP, and these requirements have been maintained current with respect to laws, regulations, and DOE directives. ID has included a clause in the BBWI contract requiring the contractor to flow down these safety requirements into subcontracts. However, ID has not established a formal process for identifying and flowing down safety requirements that are applicable to the Federal staff or regularly updating the FRAM to reflect changing requirements.

As discussed under the BBWI portion of this section, the USQ process has a number of weaknesses that have contributed to inadequate USQ screens. ID reviewed and approved the BBWI USQ process as required by 10 CFR 830. However, ID's review was not sufficient to identify USQ process weaknesses, and ID has not performed sufficient assessments to identify implementation deficiencies (see Finding #1).

10 CFR 830, Subpart B, Safety Basis Submittals. ID has established an adequate process for review and approval of safety basis submittals required by 10 CFR 830, Subpart B. The process is consistent with DOE Standard (STD) 1104-96, *Review and Approval of Nuclear Facility Safety Basis Documents*. ID orders were issued to provide requirements and guidance for the preparation of safety basis documents and to establish ID processes for review and approval of these documents. The review process includes a review by the responsible ID line program organizations and an independent review by the Senior Safety Review Committee, which includes managers from other ID organizations, prior to approval by the ID Manager.

ID expectations for schedule and quality of 10 CFR 830, Subpart B, safety basis submittals have been clearly conveyed to BBWI. Deliverables and schedules were defined in the *Nuclear Facility Safety Basis Work Plan* (PLN-489), which was approved by both ID and BBWI. ID has conservatively required BBWI to apply the requirements of 10 CFR 830, Subpart B, to high and moderate hazard non-nuclear facilities, although the regulations only require a documented safety analysis (DSA) for Category 1, 2, and 3 nuclear facilities. Consistent with the schedule and ID direction, BBWI submitted all required DSAs and technical safety requirements (TSRs) to ID by the April 10, 2003, regulatory deadline. Quality expectations were defined in a review checklist that was developed jointly by ID and BBWI. ID uses this checklist to review and evaluate the quality of BBWI submittals. A portion of the BBWI award fee is based on the quality of the submittals.

ID has devoted appropriate levels of management attention and resources to the review and approval of safety basis submittals. The safety basis submittals for 12 of 27 facilities have been approved by the ID Manager. The remaining 15 facilities (12 nuclear and 3 non-nuclear) are in the DOE review and approval process. Five DSAs are with BBWI for DOE comment resolution, and the remaining 10 facilities are in DOE review. Reviews by ID have identified some safety basis deficiencies, which resulted in the need for comment resolution and revision periods that were longer than anticipated. BBWI periodically updates PLN-489 to reflect the BBWI schedule for submitting safety basis documents to ID. However, PLN-489 does not reflect changes in the DOE review and approval process caused by the comments or changes in ID or BBWI priorities.

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Comprehensive and rigorous programs and procedures have been established for the management of safety requirements. The contractual source requirements (Lists A and B) have been systematically updated and transmitted to the site workforce through a comprehensive set of sitewide program requirements documents (PRDs) and MCPs. Review and implementation of new and revised sitewide requirements implementation documents are effectively coordinated by a Facility Operations Review and Implementation Board.

BBWI has effective processes for managing flowdown of requirements to the working level. BBWI has directed its facility managers to use the sitewide documents (e.g., MCPs) to the extent practicable rather than develop facility-specific requirements/processes. This practice has promoted efficiency and consistency across INEEL facilities. Flowdown of safety basis requirements into facility-specific procedures is also effective. Procedures have been established at each INEEL/ICP facility for the flowdown of safety basis requirements into facility-specific procedures.

BBWI also has an effective process for flowdown of safety requirements to subcontractors. A formal procurement process includes provisions for appropriate involvement of ES&H specialists in the solicitation, award, and administration of service contracts. BBWI maintains a Subcontractor Requirements Manual, which effectively identifies requirements applicable to subcontractors. Hazards and applicable portions of the manual are identified in each subcontract. Subcontractor technical representatives monitor safety and coordinate needed ES&H support and reviews by BBWI safety personnel. OA reviewed two construction subcontracts issued by BBWI and observed work performed under these contracts. Appropriate ES&H requirements were included in the contracts, and no significant deficiencies were observed at the job sites.

The BBWI processes for managing requirements are noteworthy. No significant deficiencies were identified, and the BBWI process has several noteworthy aspects:

- The MCPs include references to source requirements for each procedural step, and a computer-based Requirements Management Tracking System provides for electronic tracking of the roll-down of source requirements. BBWI personnel are assigned responsibility for maintaining this integration for each DOE directive.

- BBWI assures that workers receive the training needed for implementation of sitewide procedures. New and revised sitewide procedures are not released for use until required training is at least 80 percent complete.

- Processes ensure that new and revised laws and regulations are integrated into site procedures. The Federal Register and Idaho Administrative Bulletins are reviewed periodically, and responsible managers are notified of potentially applicable requirements.

- BBWI devotes attention and resources to assessing the adequacy of the requirements management processes. Annual reviews are performed by SMEs to determine the continued adequacy of source requirements and implementing documents. The BBWI central organization conducted audits to confirm the adequacy of these procedures

BBWI has been aggressive in implementing a sitewide environmental management system (EMS) in accordance with DOE Order 450.1, *Environmental Protection Program*. DOE Order 450.1 was issued January 15, 2003, and was added to the BBWI contract in July 2003, following an impact assessment and development of sitewide implementing procedures. Implementation of the sitewide EMS has been completed and integrated with the ISMS. The EMS met registration requirements of the International Organization for Standardization (ISO) 14001 in 2002, and BBWI has maintained registration of the EMS through two subsequent semiannual surveillances.

Suspect/counterfeit items. Requirements for identification and control of S/CIs have been effectively implemented through BBWI procedures and training. DOE expectations for the identification and control of S/CIs, as specified by DOE Order 440.1A, Attachment 2, Section 22, have been included in the DOE/INEEL contract. Appropriate procedures for implementation of these contractual requirements have been issued in an MCP and the Subcontractor Requirements Manual. The BBWI S/CI program includes provisions for annual self-assessments of implementation.

BBWI receives and evaluates S/CI information from INEEL and other DOE sites. The BBWI program includes provisions for reviewing S/CI lessons learned and Occurrence Reporting and Processing System (ORPS) reports generated at other sites for applicability to INEEL.

The S/CI MCP also includes effective provisions for documenting the discovery of S/CI items in nonconformance reports (NCRs) and ORPS reports and for notifying the S/CI SME of these reports. Five NCRs and five ORPS reports have been issued by BBWI this year. The BBWI SME for S/CI understands his responsibilities for development and implementation of the S/CI program.

S/CI training has been significantly strengthened in recent years. A computer-based S/CI training course has been established as mandatory training for appropriate groups of employees. The training course is a requirement for qualification in ten job classifications. Sixteen hundred employees have received the training. Six hundred employees have also received contracted hands-on S/CI awareness training. BBWI provides S/CI training to its subcontractors.

10 CFR 830, Subpart B, Safety Basis Submittals. BBWI has made adequate progress in the development of safety basis documents. 10 CFR 830.207 required BBWI to submit safety basis documents for hazard Category 1, 2, and 3 nuclear facilities to DOE for approval by April 10, 2003. BBWI met this milestone by submitting DSAs and TSRs for 24 nuclear facilities, including one Category 1, 18 Category 2, and 5 Category 3 facilities. Consistent with ID's direction, three non-nuclear facilities packages were also submitted.

At the time of the OA inspection, ID had approved the safety basis submittals for 11 nuclear facilities, including the sitewide safety analysis report (SAR). BBWI was addressing ID comments on documents for the remaining 16 facilities. Comment resolution, DOE approval, and implementation of safety basis documents for the remaining 16 nuclear facilities were expected by mid-CY 2004. This schedule appears to be achievable based on interviews with ID and BBWI.

USQ Process. BBWI has established a company-wide USQ process pursuant to 10 CFR 830.203 for maintaining safety basis information current. The BBWI USQ process was submitted to ID for approval in April 2001 and was approved by ID in July 2001. The approved USQ process has been implemented site wide. Although established and approved by ID, there are a number of weaknesses in the BBWI USQ process and deficiencies in its implementation, as discussed in the following paragraphs.

Screening process weaknesses and implementation deficiencies resulted in the failure to perform some required USQ evaluations. BBWI included screening as part of its USQ process pursuant to the guidance in DOE Guide 424.1-1, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements*. Several screening-related process weaknesses and implementation deficiencies resulted in the failure to perform some USQ evaluations when required. Although the missed evaluations would not likely have resulted in a positive USQ determination, the process weaknesses and implementation deficiencies provided a potential for such failures. Process weaknesses and implementation deficiencies included:

- **Responsibilities for determining the need for USQ screens are not appropriately assigned in some cases.** The Facility Operations Review and Implementation Board is assigned responsibility (per MPC-123) for identifying changes to company-wide procedures that require USQ screens. However, since none of the Board members have been trained or qualified as USQ screeners, the Board relies on qualified line organizations for this determination. The potential for error is further increased because the BBWI USQ process does not clearly specify criteria for facility-specific USQ screenings when changing company-wide procedures that may potentially affect nuclear facility safety bases. In one instance, a sitewide procedure (excavation) was revised without being screened against the facility SAR, even though this procedure was the implementing procedure for a specific SAR safety requirement. In addition, the BBWI Document Management Control System authorizes document owners, who may not be qualified screeners or evaluators, to determine the need for USQ screening by completing Box 14 on “Document Action Request” forms.

- **Some screening questions were not clear.** A screening question to determine if a situation involved a change to facilities as described in the DSA asks if the change affects the function of SSCs described in the safety basis. The term "affects" is not defined and is subject to different interpretations. In addition, 10 CFR 830.203 requires evaluation of all changes to facilities described, not just those for which screenings determine functions were affected. Another question asks if the proposed change significantly affects the description of SSCs in the safety basis. The term "significantly" is not defined.

- **Screening forms prompt the user to perform evaluations that should have been performed using the USQ evaluation process.** Screening forms require "potential effects" of changes to be described. Answering this question requires more analysis than is necessary or appropriate in a screening process. This question would be more appropriately addressed in the USQ evaluation process and subsequent analysis. Unnecessary and inappropriate evaluation was performed on several screenings.

- **Multiple screening forms introduced the potential for errors.** 10 CFR 830.203 requires application of the USQ process to four specific situations. BBWI has established a separate screening form for each of these situations plus an additional form for screening SAR and DSA revisions. The BBWI process does not provide criteria for selecting the appropriate form and does not require documentation of the basis for form selection or the extent to which questions on other forms were considered. Screeners are expected to select the appropriate form based upon their evaluation of the situation. Inappropriate forms were selected in some cases.

- **A note on the procedure screening form permits exclusions that could result in USQs.** It states “As used in these screening questions, the term ‘procedure revisions’ means a revision that causes a change in the manner that work is performed under the procedure, not just any change to a procedural document.” The term “manner” is not defined. Use of this term could result in the failure to perform evaluations of all changes to procedures as described in DSAs as required by 10 CFR 830.203(d).

- **The BBWI USQ process was not applied to potential inadequacies in safety analyses supporting the SAR for the ATR.** 10 CFR 830.203(d) requires implementation of a DOE-approved USQ process in situations where a DSA could be inadequate because the analysis may not be bounding or may be otherwise inadequate. 10 CFR 830.203(g) identifies additional actions that must be taken in this situation, including action, as appropriate, to place or maintain the facility in a safe condition, and the performance of a USQ determination. During a review of ATR safety-related systems, the OA team determined that the basis for some assertions made in the ATR SAR had not been well justified or documented and potentially important phenomena had not been accounted for in the accident analyses (see Appendix F for details). Rather than enter the USQ processes as required, BBWI continued to perform analysis to determine the impact of the concern. The regulations require entering the USQ process when a potential inadequacy is identified rather than waiting until informal evaluations outside the USQ process are performed. BBWI formally applied the USQ process on August 21, 2003, and BBWI decided to shut down the ATR to evaluate a concern with the dry piping. However, some identified items were not formally reported to DOE as potentially inadequate safety analyses, and there were delays in entering the USQ process for some of the issues.

USQ process weaknesses contributed to incorrect screenings in some cases. For example, screening is accomplished by providing yes or no answers to questions on screening forms; any yes answer requires a USQ evaluation to be performed. Some questions that should have been answered yes were incorrectly answered no or not applicable, and thus required evaluations were not performed. In addition, in one case, a potentially inadequate safety analysis identified during screening was not reported to DOE as required. A safety analysis, prepared for a fuel shipping cask activity, was not based upon the most recent cask specifications (i.e., was not based upon the latest revision of the applicable SAR). A screening of this situation, using the BBWI New Information Screening Form, produced a positive result. This information was not reported to DOE as a potentially inadequate safety analysis as required by the BBWI USQ process and 10 CFR 830.203(g). A subsequent BBWI USQ evaluation concluded that this situation did not include a USQ.

Categorical exclusions permitted by the process were not well supported by documented evaluations. The use of a categorical exclusion is appropriate only to the extent that each exclusion is evaluated prior to use to ensure that it will not result in a USQ. Once evaluated and determined not to involve a USQ, a categorical exclusion may be included in a USQ process and used without further evaluation. Eight categorical exclusions are specified in BBWI PRD-113, *Unreviewed Safety Questions*. PRD-113 did not include or reference evaluations to demonstrate that these exclusions will not result in USQs. Some of the listed exclusions may not be supportable:

- Exclusion 3.3.3 states, in part, that "work orders that cover maintenance of existing SSCs and that are not facility modifications as defined in MCP-2811 are excluded from consideration as facility changes in the USQ process." This exclusion does not address temporary changes that may occur during maintenance that may affect other SSCs. Such changes as installation of temporary shielding, removal of interferences, or interruption of services to other SSCs could introduce USQs.

- Exclusion 3.3.2 states, in part, that "company-wide administrative procedures that do not deal with hazards at specific facilities and do not implement specific safety commitments in facility safety basis documents, are excluded from the USQ determination process." The meaning of the phrase "administrative procedures" is not clear, and the exclusion could be interpreted as applicable to company-wide procedures for administering such safety programs as radiation and criticality safety.

- Exclusion 3.3.5 categorically excludes laboratory tests and experiments that are controlled by approved procedures that have been screened. This provision may be appropriate if the controlling procedures are specific to the experiment to be performed but may not be appropriate if the only procedures are broad, such as sitewide radiological control procedures.

- The BBWI USQ process does not include provisions for documenting the application of categorical exclusions. Documenting the application of categorical exclusions through the screening process would be more consistent with the guidance in DOE Guide 424.1-1 and the record keeping requirements of 10 CFR 830.6.

Finding #1: ID and BBWI have not ensured that the INEEL USQ process is effectively designed and implemented.

BBWI had independently identified many of the same process weaknesses and implementation deficiencies identified by the OA team. For example, a BBWI audit of the USQ screening forms that were provided to the OA team found many of the same implementation deficiencies that were subsequently identified by the OA team. However, some of these weaknesses and deficiencies have been longstanding and are similar to the finding identified in the DOE Headquarters independent oversight safety management evaluation performed in 2000. INEEL developed a corrective action plan, and corrective actions were completed and verified in January 2002. However, continued problems in this area indicate that corrective actions were not fully effective (see Appendix D).

Summary of Guiding Principle #5. ID and BBWI have established an appropriate set of safety requirements in the BBWI contract, and BBWI has maintained a requirements management program that ensures that safety requirements flow down to employees and subcontractors responsible for implementation. The BBWI process has several noteworthy aspects that enhance its effectiveness (including use of sitewide procedures to the extent practicable and formal processes for flowdown of new and revised laws and regulations into site procedures). ID and BBWI have met regulatory deadlines and are making adequate progress in the development and approval of safety basis documents. The INEEL S/CI program is well designed.

However, the ID-approved USQ process for maintaining these documents current has not been fully effective. The screening portion of this process does not ensure that USQ evaluations are performed when required, and process implementation deficiencies indicate the need for more effective training. Implementation deficiencies were particularly evident at the ATR, when the process was not applied to evaluate potentially inadequate safety analyses. Self-assessments and corrective actions have not been effective in addressing longstanding deficiencies in the USQ process and process implementation. This deficiency warrants timely corrective action but is an isolated deficiency within an overall effective requirements management program.

C.3 CONCLUSIONS

Although a number of deficiencies remain, ID and BBWI have made significant improvements in the ISM program at INEEL. With some exceptions, clear roles and responsibilities have been established and communicated to responsible staff. The processes for establishing requirements and incorporating them into work instructions are effective. ID and BBWI have devoted significant resources and attention to the timely completion of 10 CFR 830, Subpart B, requirements and met regulatory requirements for the initial submittals. However, longstanding weaknesses in the ID-approved BBWI USQ process and implementation deficiencies need to be addressed through improvements in procedures and training.

C.4 RATINGS

The ratings of the guiding principles reflect the status of the reviewed elements of the INEEL program.

Guiding Principle #2 – Clear Roles and Responsibilities .... EFFECTIVE PERFORMANCE
Guiding Principle #5 – Identification of Standards and Requirements.......EFFECTIVE PERFORMANCE

C.5 OPPORTUNITIES FOR IMPROVEMENT

This OA inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are intended to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

Idaho Operations Office

1. **Enhance processes for communicating requirements and commitments applicable to Federal staff.** Specific actions to consider include:

   - Establish a formal process for identifying and flowing down safety requirements that are applicable to Federal staff.

   - Include provisions for maintaining the FRAM current with respect to DOE directives and regulatory requirements.

   - Update the schedule in PLN-489 for completion of remaining reviews and approvals of safety basis documents.

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1. **Evaluate and revise the USQ process.** Specific actions to consider include:

   - Revise USQ screening forms. Consider including the four situations requiring USQ process implementation pursuant to 10 CFR 830.203(d) on the screening form(s).

   - Consider use of a single form with fewer questions, supplemented with additional training.

   - Perform an evaluation to support the use of each categorical exclusion permitted by PRD-113.

   - Analyze implementation deficiencies and perform a root cause assessment. Take actions to address root causes and prevent recurrences.

APPENDIX D

Feedback and Continuous Improvement (Core Function 5)

D.1 INTRODUCTION

The Office of Independent Oversight and Performance Assurance (OA) evaluated feedback and improvement programs at the Idaho National Engineering and Environmental Laboratory (INEEL). The organizations that were reviewed included the U.S. Department of Energy (DOE) Idaho Operations Office (ID) and Bechtel BWXT Idaho, LLC (BBWI). The OA review focused on feedback and improvement programs as they are applied to environment, safety, and health (ES&H) programs at the facilities and activities selected for review on this inspection: the Idaho Nuclear Technology and Engineering Center (INTEC), Test Area North (TAN), the INEEL Research Center (IRC), and the Test Reactor Area (TRA).

The OA team examined the ID line management oversight of integrated safety management (ISM) processes and implementation of selected line management oversight functions, including the Facility Representative (FR) program, ES&H assessments, ID oversight procedures, ID self-assessments, the issues management process, the lessons-learned program, and the process for reviewing occurrence reports. The OA team reviewed BBWI processes for feedback and continuous improvement and implementation of those processes, including assessment processes, corrective action/issues management, lessons learned, and employee concerns. Processes and implementation for BBWI monitoring and evaluation of subcontractor safety programs and performance were also examined.

D.2 RESULTS

D.2.1 ID Line Management Oversight

The ID management team is using a number of mechanisms to define its expectations, monitor the performance of the contractor, and provide feedback to the contractor. Most FRs and subject matter experts (SMEs) are appropriately qualified. ID managers are involved in monthly and quarterly scheduled meetings to discuss performance, and to monitor milestones and achievements in relation to established requirements and guidance.

ID has recently (in the past year) revised its line management oversight process in accordance with DOE Policy 450.5, *Line Environment, Safety and Health Oversight,* which stresses the importance of the contractor's self-assessment program as the cornerstone for oversight activities. ID issued a new procedure in May 2003 that describes the new approach and expectations for line management oversight functions. The new process and procedure incorporates recommendations from a February 2003 assessment of ID oversight that was chartered by ID management and performed by an external organization that has extensive experience in assessment programs—the Institute for Nuclear Power Operations (INPO). The new process also emphasizes structured processes for analyzing deficiencies and transmitting them to the contractor through structured channels. For example, the process calls for an information package to be created monthly to summarize the results of observations, occurrences, surveillances, and assessments. This package is used within ID to discuss issues and culminates in monthly feedback to the contractor that has been analyzed within ID and approved for communication to the contractor. Further, in preparation for the monthly meeting, ID and the contractor each develop a status report that includes an evaluation of a number of important performance measures.

Although a process has been defined, many important aspects of the new process have not been completed and or are not effectively implemented:

- Many SMEs and FRs have not been adequately trained in the execution of the new process. SMEs and FRs were not fully involved in the development of the ID oversight procedure, and many SMEs and FRs had limited knowledge of the new process or revised expectations for their functions.

- Although the new ID oversight procedure reflects a number of the INPO recommendations, activities to implement these recommendations lack formality and structure. As a result, some of the essential elements of the new process, such as establishment of oversight analysis teams that will perform analysis in various ES&H functional areas, have not yet been completed. Resources have not been assigned to completing tasks and implementing the new oversight procedure based on an adequate evaluation of resources.

- The mechanism to translate findings by the FRs into corrective actions by the contractor, as defined by the ID oversight procedure, is not functioning. The procedure requires observations and findings by the FRs to be transmitted to the contractor after review by an oversight analysis team. However, the oversight analysis teams have not been established, and this mechanism cannot be used effectively at this time.

- Although oversight requirements for emergency management are defined in a recently approved ID manual, programmatic assessments and technical document reviews are not being performed. Volume 2 of this report contains a more detailed discussion of this issue.

- ID does not have an integrated schedule for performing line management oversight activities, such as assessments. The ID Deputy Assistant Manager for Operations is responsible for coordination of oversight activities and recognizes the challenge and complexities involved with developing an integrated schedule. The task for developing such a schedule has recently been assigned to an ID manager. However, better analysis capability and more robust coordination among various groups is needed to ensure that a meaningful schedule is developed and effectively implemented.

- The monthly contractor performance notes lack technical details and are not comprehensive enough to lead to meaningful technical discussions and decisions.

- Based on recent status reports, ID and the contractor have divergent views on performance in several important areas, such as issues management. An effective mechanism for communications and resolution of these discrepancies has not been established.

- ID does not have a structured self-assessment program that provides regular feedback on the effectiveness of ID line oversight processes and management functions.

A number of other weaknesses hinder the effectiveness of current ID line management oversight activities:

- The quality of FR surveillances is inconsistent and varies significantly from facility to facility and individual to individual.

- Effective actions are not always taken by ID management to correct deficiencies identified in ID line oversight programs. For example, in March 2002, a finding was entered in the Oversight Information Management System (OIMS)—a tracking database used by ID—that identified deficiencies in the

INTEC FR program monthly reports. The issue was administratively closed in June 2003, although no effective corrective action was taken.

- SMEs and FRs use several databases for documentation and follow-up of surveillance, and for maintaining assessments, oversight plans, and schedules, but these tools are not always used consistently and effectively. For example, several important assessments to be conducted by ID (e.g., validation of contractor corrective actions related to mitigation of a number of recent adverse events) have not been entered into OIMS as a scheduled review.

- The quality of annual oversight plans developed by various ID organizations is inconsistent, and some plans lack sufficient detail and are not based on adequate analysis of past performance. The ID manager responsible for SMEs estimates that 80 percent of SME team time is occupied by addressing emerging issues (e.g., DOE Headquarters concerns, Defense Nuclear Facilities Safety Board interests, and events and incidents), which limits time available to perform assessments and surveillances.

- Many surveillances and assessments are limited in scope, do not provide adequate information to support conclusions, do not identify root causes, or do not provide sufficient information to facilitate effective resolution of ES&H issues. For example, an ID self-assessment of its oversight activities related to an INEEL Type B accident is less than two pages long, and mostly discusses historic problems with the OIMS database.

Finding #2: ID has not implemented the line management oversight process and issues management process, as defined in the approved oversight procedure, to ensure that important deficiencies are corrected and that ID self-assessment processes result in continuous improvement.

D.2.2 BBWI Feedback and Improvement Systems

Assessments. BBWI has established a comprehensive integrated assessment program incorporating management self-assessments, functional area program reviews, and several types of independent assessments of ES&H programs and performance. The expectations and requirements for this program are delineated in a number of plans, program documents, institutional procedures, and implementing instructions. All assessments are compiled annually into integrated schedules for each organization and the site. Assessments mandated by regulations, DOE orders, and BBWI directives have been compiled into a single institutional list that forms the foundation of the integrated assessment program and provides assurance that required assessments will be performed on schedule. In addition, line management and functional area managers are required to identify and perform additional (elective) assessments to ensure that ES&H programs and performance are appropriately evaluated. Institutional-level functional area managers are required to perform independent assessments of program implementation by the line. An independent oversight organization performs a limited number of assessments in response to management requests, and reviews line management self-assessments to improve performance (including "shadow" assessments to observe and evaluate line management self-assessments). With a few exceptions (discussed later), the BBWI assessment processes are well designed and implemented.

Approximately six comprehensive independent evaluations of site area safety performance are conducted annually by a team of SMEs called the Facility Evaluation Board (FEB). The FEB assessments evaluate numerous technical areas and management systems, including an overall evaluation of the implementation of ISM. On an annual basis, FEB planning and implementation adapts assessments to past performance on a sitewide and area basis, considering past FEB findings, Occurrence Reporting and Processing System (ORPS) and non-compliance tracking system reports, and Issue Communication and Resolution Environment (ICARE) deficiencies. The use of regular SME team members provides for continuity and historical knowledge, and ensures that those SMEs are familiar with how facilities are implementing functional program requirements. FEBs have demonstrated a self-critical approach to assessments and have downgraded performance ratings when deteriorating performance is identified. An annual ISM program review identifies institutional issues and focus areas for the following year. The FEB process is mature and effectively implemented and is enhancing ES&H by identifying deficiencies for corrective action.

The BBWI integrated assessment program provides a systematic framework for analyzing assessment results, determining assessment priorities, and improving assessment processes. This program provides a risk-based approach for managing assessments. It considers all assessments performed during the past year and provides a systematic approach for identifying areas for improvement and establishing assessment priorities for the next year. Senior BBWI management is closely involved through the Senior Operations Review Board. Over the past three years, the integrated assessment program process has been refined and improved by redefining assessment categories, revising procedures, clarifying management responsibilities, and increasing management involvement in assessment scheduling.

As a result of the integrated assessment program and other analysis, BBWI has several ongoing initiatives to address acknowledged weaknesses in the quality of management assessments and line management's concerns about the number of assessments being performed. The different types of assessment activities (e.g., inspections, surveillances, assessments, management reviews) have been formally defined to clarify requirements and promote consistency. Where practical, assessments have been consolidated, including incorporation into independent FEB and functional area assessments. Computer-based and subcontracted classroom training is being provided to improve management assessment skills. The institutional assessment coordinator is working with functional area managers, SMEs, and line coordinators to refine the selection process for elective assessments. Assessment coordinators assigned for each site area and project provide assistance and direction in the planning, execution, and tracking of management self-assessment activities. The institutional coordinator is conducting quality reviews and evaluations of many management and functional area assessments, and is briefing senior management. These initiatives are appropriate measures for improving the quality of BBWI assessments.

Most of the formal management assessments reviewed by the OA team were effective in reviewing programs and performance and identifying deficiencies and weaknesses to drive improvement. The FEB assessments are comprehensive, in-depth, multi-disciplinary reviews of each site area that are identifying many areas for improving performance and providing senior management with an ongoing picture of the site's implementation of ISM. In addition to formal management self-assessments, the line employs a variety of other mechanisms that acquire feedback on safety conditions and performance, including surveillances, Senior Supervisor Watch observation of work, the senior management Facility Excellence Program, and health and safety inspections. The senior supervisory watch program, expanded earlier this year in response to ID and BBWI management concerns related to work control and lockout/tagout performance, is providing daily management presence in the field and frequent interactions with workers at INTEC and TAN.

Some implementation and documentation weaknesses were observed:

- The OA team identified weaknesses in the rigor and quality of self-assessment planning and execution. Although progress is being made, line and functional area organizations still do not consistently perform appropriate elective assessments based on risk and site/facility-specific circumstances.

- TAN has not yet established the risk-based frequency for mandatory or elective assessments. The basis for conducting many functional area and line elective assessments every five years is not documented. When TAN management and operations separated from INTEC earlier this year, the need to review management assessment requirements was not considered; as a result, some required and other scheduled assessments were not performed and will not be performed in fiscal year (FY) 2003. This issue was identified by TAN and later by the Performance Assurance organization and was subsequently put into the ICARE system on July 16, 2003.

- The program for conducting periodic evaluations of workplaces and activities by workers, supervisors, managers, and safety professionals required by DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, and site procedures had not been adequately defined or implemented at INTEC. These program deficiencies, identified in July 2003, indicated insufficient program ownership and included the failure to request or conduct inspections, failure to clearly define the zones for inspection to ensure that all areas were inspected, failure to clearly identify issues and document resolutions, and failure to track or verify corrective actions. Corrective actions are being developed by a task team under the direction of the INTEC ES&H manager.

- Recently performed management and functional area self-assessments did not identify fundamental deficiencies in programs and performance, such as the deficiencies in INTEC scaffolding, lessons learned, unreviewed safety questions, and research and development hazards analysis and change control processes. For example, the FEB assessment of the TRA in November 2002 evaluated engineering and maintenance aspects of the same system evaluated by OA during the essential system functionality review (i.e., the Emergency Firewater Injection System), but it did not identify deficiencies in testing, preventive maintenance, or configuration management (see Appendix F).

Although these areas need to be addressed, BBWI has established a program that effectively evaluates programs and performance across the broad spectrum of safety functions and site work activities.

Issues Management. The framework for an effective, risk-based issues management system has been established in program description documents and management control procedures. Procedures detail corrective action documentation, resolution and tracking requirements, causal analysis processes, and trending and analysis of issues. ID and BBWI have self-identified concerns with the effectiveness of the issues management program in preventing recurrences; as part of its corrective actions, BBWI is revising the institutional procedure for the corrective action system to provide more guidance for identifying issues and recurring issues, and for clarifying details for formal extent of condition reviews.

BBWI does extensive monitoring and analysis of numerous performance indicators and measures that are communicated monthly to ID and used by BBWI management to monitor performance trends and areas needing additional attention. Each month, performance for over 30 measures in six topical areas, including safety, environment, operations, and quality, is tabulated and compared to prior year performance and is given a color-coded rating to provide a visual representation of overall performance. This data is compiled and further analyzed in quarterly reports. In addition, performance in key ISM system processes and functional support programs is evaluated and documented in an annual report that summarizes improvements, issues, and progress towards achievement of annual goals and expectations set in concert with ID management. A new program description document and several implementing procedures are in development to further enhance the effectiveness of these analytical processes.

The ICARE system provides a robust vehicle to record safety concerns and deficiencies and facilitate formal categorization, analysis, and the establishment and tracking of corrective actions. Separate instructions and processes detail the requirements for processing issues related to material non-conformance, event reporting, and Price-Anderson Amendments Act screenings and non-compliances. Corrective action coordinators for each project, program, and site area promote consistency and quality in

ICARE data input and corrective action plans. Corrective Action Review Boards (CARBs) have been chartered and are functioning at each site area and project to provide management oversight of the issues management process.

Although BBWI has established a rigorous and comprehensive process for identifying and resolving safety issues, a few deficiencies in line management implementation and documentation of the program persist as discussed below.

Several deficiencies relate to the use of the ICARE system to document and resolve safety deficiencies. For example, recent senior supervisory watch observations, which resulted in stopping two decontamination and decommissioning projects at INTEC to generate or revise work control documents, were not documented in ICARE. The recently identified deficiencies in the INTEC health and safety inspection program were not documented in ICARE. Findings from recent emergency management program assessments were tracked in a commitment tracking system rather than the issues management program. Some ICARE reports identified multiple deficiencies, but cited only a single apparent cause that could not apply to all deficiencies.

Evaluations are not always rigorously performed such that corrective actions fully address the issues and provide appropriate recurrence controls. For example, after miscommunication resulted in the premature demolition of a small building at TAN in early calendar year (CY) 2003, the event evaluation did not identify and address the Environmental Protection Agency requirements for reporting buildings to be demolished and for performing asbestos hazard reviews. In another case, a TRA laboratory exceeded combustible loading requirements and did not have a combustible loading program. These deficiencies were attributed to personnel being unaware of requirements, but the corrective actions did not address the lack of a program or training to prevent recurrence.

Weaknesses were identified in other aspects of issues management processes:

- Minutes from the CARB meetings at TAN and INTEC do not reflect any rigorous evaluation of the analysis and action plans for ICARE items (although the meetings appear to be functioning as a valuable tool for addressing feedback and improvement status and initiatives and other management issues).

- Little quantitative analysis of issues for recurrence is performed, especially in individual organizations. Initiatives under development are intended to improve the analysis of ICARE data.

- Unsafe and unsatisfactory conditions identified during monthly health and safety walkdowns are not being trended or analyzed to focus attention on recurrence controls.

- Process and performance weaknesses that do not violate requirements, and thus do not constitute a deficiency per the issue management process, are not always being put into ICARE or otherwise addressed to drive continuous improvement and are often not formally tracked.

- The issues management process does not always provide for adequate validation and documentation of the effectiveness of significant deficiency corrective actions by line management as required by the procedure. In one case, the corrective action to an ISM implementation deficiency identified in ICARE as significant consisted of issuing an integrated management plan rather than specific corrective actions to address the direct and root causes. Although this plan described existing ISM processes and controls and listed 15 management safety initiatives as recommendations, there was no mechanism for tracking completion of each of these initiatives or for performing the required effectiveness validations.

- Weaknesses in management of safety issues were identified in injury and illness evaluations and employee concerns programs (discussed below).

These deficiencies were not pervasive, but they indicate a need for further improvements. Management self-assessments and FEB assessments also continue to self-identify issues related to inadequate application of the INEEL corrective action program and to drive improvements.

Lessons Learned. The contractor has established an adequate process and organizational structure for effectively identifying, evaluating, and applying lessons learned. The institutional procedure provides for screening of externally generated lessons learned, identification of high-priority lessons learned with potential applicability to the INEEL, documented reviews by designated SMEs to establish applicability and any needed actions, and dissemination to line and support organizations for action. Other external lessons learned with applicability to INEEL activities are also forwarded to line and support coordinators. Lessons learned from events and successful work activities at the INEEL are developed and disseminated both internally and to the DOE complex. All lessons learned deemed applicable to the INEEL are posted on a user-friendly, searchable, web-based database for easy access to potential users. Screening for potential applicability was conservative and many lessons learned are being posted to the database (e.g., over 150 in the first seven months of CY 2003). Training materials at INTEC reflected incorporation of lessons learned into site training as required by site procedures. Minutes from senior management meetings, site area CARB meetings, and tailgate safety sessions reflect communication of lessons learned to managers and workers. Many BBWI personnel have received training on the lessons-learned system, and use of the system is steadily increasing as reflected in a tracking feature of the online database.

Although the lessons-learned procedures are robust and there is evidence of communication of much lessons-learned information, the INEEL does not consistently and appropriately apply lessons learned in some cases because of a lack of rigor and formality in the implementation of the program. Few external lessons learned are being classified as "high priority" as defined by the institutional procedure (i.e., the last high-priority classification was made in February 2002). Although the institutional staff is forwarding many external lessons learned to SMEs for review, the documentation of these evaluations, including for lessons categorized as high priority, are typically incomplete or technically inadequate, and in many cases, there is no response to lower priority lessons. In almost every case, any actions identified by SMEs and disseminated to the line are in the form of recommendations rather than directed actions that require feedback or follow-up. The institutional staff receives no feedback on line inspection results or the implementation of other recommended actions from the line or SMEs. In most cases, the recommended actions detailed in the lessons-learned reports are not specifically tailored to INEEL processes, and specific personnel responsible for taking corrective actions are not designated in the reports. INEEL is aware of most of these weaknesses and has drafted a revision to the institutional procedure to clarify expectations and strengthen the process. However, improvements in this area will depend on rigorous implementation and effective monitoring by line management and the functional area owner.

Employee Concerns Program. INEEL employees are encouraged to report and seek resolution of safety concerns through supervision or the ES&H team staff, but workers can also report concerns to the employee concerns staff in the Human Resources organization, requesting confidentiality and anonymity. Few ES&H-related concerns are reported using the formal employee concerns process (ten in FY 2002, and four through the first ten months of FY 2003). Records of ES&H-related concerns and dispositions were generally well documented and included appropriate resolutions and investigation of the concerns and associated details.

However, several aspects of the employee concerns program could be strengthened. Employee concern packages were sometimes closed based on discussions and/or proposed actions by line management rather than actual actions taken or formally documented in other systems, such as ICARE or a work order. For example, a case where leaking pipes were causing a slipping hazard was closed based on the SME response that they were planning to procure rubber mats as a temporary fix pending allocation of funds to repair the piping. The concerns office conducts only limited follow-up or verification of the actual implementation or effectiveness of the resolution. Explicit feedback from the concerned individuals regarding the final resolution of their concerns is not solicited.

Some actions by ES&H SMEs and line management appeared to be inadequate and were not questioned by the employee concerns office. For example, in the instance cited above involving leaking pipes, no compensatory measures were identified, such as signs, use of absorbents, or rerouting of traffic. In another case, an employee concern raised issues that warranted entry into ICARE, but the issues (i.e., radiation technicians on temporary loan to another site area had not received appropriate site area specific training in lockout/tagout, confined space, or radiation protection requirements or conditions) were addressed without using the INEEL issues management program as required by the employee concerns and issues management procedures.

Other Feedback Mechanisms. In addition to the assessment program, other feedback mechanisms have been established to provide continuous improvement. The Voluntary Protection Program, Worker Applied Safety Process (WASP) behavior-based observation and feedback process, and employee safety teams provide effective vehicles to involve workers in inspections and safety feedback. Other mechanisms providing feedback and continuous improvement information to contractor management include meetings of union safety committees, the Facility Operations Review and Implementation Board, and the Senior Operations Review Board. The monthly Senior Operations Review Board meetings provide senior management with the current status of safety performance and improvement initiatives, and include discussions of recent incidents and lessons learned.

Management at INTEC has established an especially effective mechanism for two-way communications between management and workers related to current issues, including safety initiatives and lessons learned. Monthly "Communication Meetings" involve managers conducting scripted one-hour, small-group discussions with the INTEC workforce. The managers address different organizations each month to provide fresh perspectives. Questions and comments are addressed on the spot if possible, and all are collected, binned if appropriate, tracked, and addressed, with the answers posted on the INTEC training intranet website.

Formal, documented post-job reviews by workers and supervisors specified in INEEL procedures provide feedback to work package planners and management after completion of maintenance and modification work. A formal tracking system was being employed at TAN to document post-maintenance review comments and their resolutions, which is an improvement over the informal post-job review process noted during the CY 2000 independent oversight evaluation. However, the FEB recently identified that post-job reviews were rarely documented and were being inadequately tracked at INTEC. Corrective actions are being taken at INTEC. In addition, INEEL construction post-job review practices provide for only one post-job review, which occurs at the end of the project. A single post-job review does not ensure timely feedback, particularly for long duration (many projects take several months) and multi-stage projects. No post-job reviews have been documented for any construction tasks performed at the INTEC tank farm this year. Various other feedback mechanisms, such as lessons learned, inspections, and safety meetings, provide day-to-day feedback during project execution. However, construction personnel are not using the task evaluation forms of Management Control Procedure (MCP)-3003 to document lessons learned at the completion of project subtasks detailed in work order changes.

DOE Headquarters EH-3, Office of Performance Assessment and Analysis (PAA), documented INEEL's recent reduction in the radiological event rate and solicited the site's input regarding effective work control practices. Summaries of the radiological work control enhancement initiatives taken at INEEL were provided for DOE-wide feedback and improvement as "good practices" in the PAA Office's DOE-wide ORPS evaluation report issued in 2003.

The INEEL has developed a sound procedure for addressing injuries and illnesses that encompasses anyone doing work at INEEL. Evaluations of the conditions and causes of Occupational Safety and Health Administration (OSHA) recordable injuries and first aid cases are documented on forms that are consistent with DOE requirements. Injury and illness statistics for INEEL are very good and are continuously improving, with lost workday and recordable injury case rates declining since 1998 and well below DOE complex and industry averages. However, the evaluations and documentation of the dispositions for many injury cases lacked sufficient rigor to demonstrate that the causes of injuries were being adequately identified or that appropriate recurrence controls were being implemented. For example, in two cases medical facility reports and the accident reports reflect that, contrary to training and procedural requirements, the injured workers did not report to the medical facility until the following day. The injury report did not address the delay in reporting or any remedial actions. In one of those cases, which involved a possible chemical burn, the supervisor inappropriately determined that a root cause analysis was not needed because no first aid was provided. In other cases, likely work control deficiencies (e.g., "no personal protective equipment worn") were not documented or addressed.

D.3 CONCLUSIONS

ID has some elements of a line management oversight program (e.g., experienced FRs) and has issued a new line oversight procedure that has a number of positive elements. However, many elements of the new program are not currently being implemented, and the overall line management oversight program is not effective in evaluating effective contractor ES&H performance and promoting continuous improvement in INEEL and ID activities.

BBWI has implemented generally effective processes that are providing feedback and improvement in safety performance at INEEL in many areas. Formal programs have been established for conducting independent and management assessments, documenting deficiencies, tracking corrective actions, addressing employee concerns, and identifying and communicating lessons learned. BBWI has a proactive process for annually reviewing assessment results and determining areas where additional improvements are needed. However, some aspects of BBWI assurance processes have not been rigorously implemented by the line organizations or fully effective in identifying and addressing performance deficiencies in some areas (e.g., unreviewed safety question processes, strict compliance with requirements, radiation protection, and scaffolding). Documentation, evaluation, and resolution of safety deficiencies to prevent recurrence were not always consistently performed by line management. The adequacy of evaluation and implementation of lessons learned cannot be demonstrated because of a lack of rigor in documentation for this program.

Although improvements in BBWI line organization implementation and documentation are warranted in some areas, the overall program is comprehensive and well designed. The BBWI assessments, other feedback activities, and issues management processes are identifying and correcting deficiencies and contributing to improved ES&H at INEEL.

D.4 RATING

Core Function #5 – Feedback and Continuous Improvement .... NEEDS IMPROVEMENT

D.5 OPPORTUNITIES FOR IMPROVEMENT

This OA review identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are intended to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

Idaho Operations Office

1. **Systematically implement the new line management oversight process and ensure its effectiveness on an expedited basis.** Specific actions to consider include:

   - Update the May 2003 project plan to include more effective implementation of the new processes that identify major tasks to complete, milestones, responsible individuals, and resources.
   - Strengthen the training of SMEs and FRs to ensure that expectations are understood.
   - Systematically evaluate and strengthen new and current processes, such as development of information packages/contractor notes, surveillances, oversight plans, dispute resolution processes, and implementation of issues management activities and tools.
   - Establish a structured self-assessment program that considers risks and past performance.
   - Accelerate efforts to develop a systematic approach for developing and regularly updating an integrated line oversight activity schedule.

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1. **Continue to strengthen self-assessment performance and hold line management accountable for effective implementation.** Specific actions to consider include:

   - Ensure that all organizations have established and documented the risk basis for the frequency and scheduling of mandatory and elective assessments.
   - Continue independent assessment reviews and feedback, with a focus on strengthening the depth and rigor of management assessment criteria and evaluations. Establish a method to measure improvement or attainment of acceptable performance before terminating this elective improvement tool.
   - Further clarify the types of assessments that must be included in the integrated schedule to achieve consistency across all organizations.
   - Strengthen the depth and rigor of FEB assessments of the design and operability of essential safety systems at higher risk facilities. Consider supplementing FEB staffing with additional engineering expertise or technical specialists for the system being evaluated.

2. **Improve compliance with implementation of the issues management system.** Specific actions to consider include:

   - Ensure that all FEBs include rigorous evaluations of line use of the formal issues management process, including documentation in ICARE as well as the adequacy of categorizations, and considerations of cause and extent of condition in corrective actions.

   - Ensure that the new category of issues identified as "concerns" (formerly "B" issues) in FEB reports are screened by line management against the criteria for inclusion in ICARE and that FEB reports communicate this expectation.

   - Include in FEB reports or supporting documentation a more detailed description of the scope of assessment and a summary of results in each topical area in addition to the current listing of noteworthy practices, strengths, issues, and concerns.

   - Strengthen the rigor and formality of issue evaluations and dispositions documented in employee concerns and illness and injury programs.

   - Reestablish the role of the CARBs in focusing line management attention on the adequacy of causal analysis and corrective action plans for ICARE deficiencies.

   - Reinstitute regular counterpart meetings for assessment, issues management, and lessons-learned coordinators and their functional area SMEs to promote information exchange and improvements in processes and implementation.

3. **Improve the rigor and formality in implementing the lessons-learned program.** Specific actions to consider include:

   - Ensure that screening for high-priority lessons learned are conducted as required by procedure and that expectations for formal reviews by SMEs are clearly communicated.

   - Ensure that the planned revision to the institutional procedure clearly defines the requirements for determining and documenting the applicability reviews and needed actions and provides guidance criteria on the prioritization of external lessons learned.

   - Ensure that all SME reviews are documented, complete, and returned to the institutional lessons-learned office.

   - Tailor recommended actions to INEEL organizations, programs, and systems. Ensure that actions deemed necessary are not categorized as "recommended." Designate specific responsible parties to take directed actions.

   - Establish procedural requirements that line and support organizations provide formal feedback to SMEs and the institutional lessons-learned office detailing the actions taken and the results. When directed actions are specified, require SMEs to concur that the actions taken by site organizations are appropriate and sufficient before closing the lessons learned.

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APPENDIX E

Core Function Implementation (Core Functions 1-4)

E.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluated work planning and control and implementation of the first four core functions of integrated safety management (ISM) at selected Idaho National Engineering and Environmental Laboratory (INEEL) facilities and activities. The OA review of the ISM core functions focused on environment, safety, and health (ES&H) programs at selected facilities and activities managed by Bechtel BWXT Idaho, LLC (BBWI).

Facilities reviewed included: the INEEL Research Center (IRC), the Idaho Nuclear Technology and Engineering Center (INTEC), and Test Area North (TAN). IRC is INEEL's primary research complex, with activities in the areas of fundamental and applied research and development (R&D) in science and engineering areas critical to national and DOE missions (e.g., environmental engineering, biotechnology, system engineering, intelligent automation and remote systems, nuclear science, and chemical separations and processing). The IRC complex consists of over 60 laboratories and is categorized as a low-hazard, non-nuclear facility. INTEC provides safe interim storage for government-owned spent nuclear fuels, and develops new approaches and technologies to prepare spent fuel and other nuclear materials for eventual disposal in a national repository. INTEC is also the center for the INEEL's high-level waste treatment program. TAN consists of facilities for handling, storage, examination, and research of spent nuclear fuel. TAN also houses the Specific Manufacturing Capability Project, which performs work for the U.S. Department of Defense.

INEEL has established and implemented standard sitewide work control processes for INEEL activities. The integrated work control process standard (STD-101) establishes requirements for construction, maintenance, decontamination and decommissioning (D&D) activities, and R&D support. Management control procedures (MCPs) establish requirements for R&D, operations, and environmental activities. The work control processes establish broad requirements for defining the work, identifying and analyzing job and facility hazards, and documenting controls. Additional INEEL manuals and procedures, such as the ES&H Manual, provide additional ES&H requirements and guidance.

The OA team reviewed policies and procedures, evaluated the implementation of work control processes, and observed work activities at the IRC, INTEC, and TAN. At IRC, OA examined application of ES&H requirements in selected research projects/activities, including phosphazene synthesis experiments in Laboratory A-7, Analytical Chemistry in IRC Laboratories B-15 and A-1, operation of the IRC machine shop, and low-activity radiological experiments performed in Laboratory A-14. Work activities reviewed at INTEC included the Idaho Completion Project tank cleaning project, tank farm operations and supporting activities, and selected aspects of programmatic and infrastructure maintenance. At TAN, the OA team reviewed work activities in support of the INEEL Deactivation, Decontamination, and Demolition (DD&D) program. Projects reviewed included DD&D activities at the Building 616 former Liquid Waste Treatment Plant and associated underground waste transfer pipes, as well as DD&D of Building 602, the former engineering building. This approach enabled OA to evaluate the implementation of work control processes governing a broad spectrum of work.

E.2 RESULTS

E.2.1 Core Function #1 – Define the Scope of Work

Missions are translated into work, expectations are set, tasks are identified and prioritized, and resources are allocated.

INEEL Research Center. The independent hazard review (IHR) process, as defined in MCP-3571 and Program Description Document (PDD)-1015, is used to define and plan research laboratory activities at IRC. The IHR process is a mature process that emphasizes line management responsibility, close interaction with ES&H subject matter experts and facility management, and independent peer safety reviews. The IRC R&D work control process is comprehensive and envelopes the variety of research and research-related tasks typically associated with the design, setup, testing, and operation of a research project. Research work and service and maintenance work performed by the research staff is well defined through IHR checklists and mitigation plans. Experimental setup and testing is defined through a combination of the IHR and job safety analysis (JSA) processes. Research equipment maintenance performed by vendors, and machine shop work performed by researchers is addressed though JSAs.

The principal investigator identifies the necessary information for input to the IHR process. This information is typically abstracted from the research proposal and documented in an IHR mitigation plan or JSA. For the research projects reviewed by the OA team, the description of work provided in the IHR project/activity description was sufficient to describe the overall research project and identify the dominant hazards.

Idaho Nuclear Technology and Engineering Center. Tank farm closure work activities are adequately defined by project work orders (which are high-level work orders for large tasks), project work order changes, D&D plans, drawings, and specifications. The project schedule defines major project line items and milestones, while weekly and daily activities are addressed and well documented through plan-of-the-week schedules, plan-of-the-day meetings, and pre-job briefings. The daily pre-job briefings were detailed, covered the planned tasks, and included both job and facility hazards. Daily meetings were well attended by project managers, construction personnel, tank farm operations personnel, safety professionals, and radiological protection staff. Radiological support work was adequately defined through the pre-job briefings, procedures, and radiological work permits (RWPs).

For programmatic and infrastructure maintenance, work packages had clearly defined statements of work scope, with amplifying instructions to break down work activities into manageable subtasks. With few exceptions, the level of detail and rigor was appropriate and was based on the classification of the work package and risk of the work (e.g., work request exempt, minor work, expedited work, or planned work packages). Work scopes and definition of work have greatly improved in the past few years. Walkdowns are performed for many expedited maintenance work orders and all planned work packages to ensure that the scope of work is properly defined and well understood prior to completing the hazards analysis and developing appropriate controls. Craft, work planners, and safety personnel participate on walkdowns and contribute to well-planned and documented work packages.

Although generally adequate, one deficiency was identified with work definition for a maintenance work order. The work package for steam valve work at the high-level waste facility allowed craft personnel broad latitude to replace any pipe necessary to perform the work. Such broad work scopes could result in unplanned and unapproved facility modifications (e.g., cutting pipes).

Test Area North. The project/facility-level scopes of work for BBWI D&D work at TAN are well defined in several project documents, such as D&D plans and health and safety plans. For example, the

D&D plan for the TAN-616 Liquid Waste Treatment Plant separates the project into three major phases and specifies equipment lists, task breakdown lists, and task sequence descriptions for each task. At the activity level, planned work orders (which provide detailed work instructions) for D&D work provide the description of the applicable scope of work and were generally sufficient to enable subsequent hazards analysis. In most cases, the planned work orders provided well-defined work scopes, bounding conditions, and provided summary-level task breakdown lists. For example, BBWI asbestos inspection and abatement work packages provide well-defined, comprehensive scopes of work. Asbestos inspection reports characterizing the work were thorough and descriptive, and the reports incorporated photographs of locations that have material containing asbestos.

Although scope of work was well defined in most cases, the disassembly and removal of some components used during D&D work were not specifically addressed by the work package. For example, disassembly and removal of a large high efficiency particulate air (HEPA) vacuum unit at Building 616 involved unique radiation and equipment-related hazards but was performed under a generic work order step (i.e., "remove any remaining tools and equipment that need to be removed from the evaporator pit or waste decontamination area"). From a planning perspective, the work was not defined such that the hazards associated with this activity could have been fully identified and analyzed. In another example, planned removal of a scaffold from inside Building 616 was not specifically addressed by the work package, thereby eliminating the opportunity to analyze potential hazards associated with that activity.

Summary. The scope of most work activities is sufficiently described and defined to specify what work is to be performed and to allow subsequent identification of the associated hazards. In a few cases, the use of broad work scopes in work orders limited the ability to clearly identify the specific tasks to be undertaken, making it more difficult to identify and analyze all specific task hazards. The use of the broader work definitions reduces the effort spent in planning jobs in advance, and may give the appearance of completing work more efficiently. However, this practice places an overreliance on supervisors, workers, and safety personnel to further define the work and identify hazards that may not be well documented in work packages. Overall, work definitions were effective, but work planners and supervisors need to remain alert to the potential risks associated with broad work definitions.

E.2.2 Core Function #2 – Analyze the Hazards

Hazards associated with the work are identified, analyzed, and categorized.

INEEL Research Center. The IHR process has a number of provisions that promote effective hazards analysis. The IHR process effectively integrates ES&H subject matter experts with researchers to identify and analyze hazards. The IHR also requires that all IHRs be reviewed by a multi-disciplined IHR group before research activities are authorized to begin.

For research and research support activities evaluated by the OA team, hazards were identified, appropriately analyzed, and documented in IHRs and JSAs. According to MCP-3571, the principal investigator is responsible for creating a list of potential hazards that could be encountered during R&D activities. The list of hazards typically becomes the basis for further analysis and formulation of hazard controls.

Exposure assessments for potential chemical and biological exposures and physical stressors are performed and/or documented by the Industrial Hygiene (IH) organization for IRC research and research support activities. The exposure assessment process described in the exposure assessment procedure (MCP-153) meets the intent of DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, and was judged by the DOE Headquarters Office of Worker Health and Safety (EH-5) as being a noteworthy program in June 2002. The exposure assessment process at IRC has been effective in the identification and quantification of hazards for R&D work; however, in some cases, the identification of hazard controls has not been adequately incorporated into IHRs (see Core Function #3).

The facility hazards lists are not being maintained in a few cases. A facility hazards list documents information about laboratory hazards for work planning, and informs workers of facility hazards that may be encountered. At IRC, a facility hazards list is prepared for most laboratories and is used as a work planning tool, principally by the IRC maintenance staff. In general, the facility hazards lists for three of the four projects/activities reviewed by the OA team identified the dominant laboratory hazards.

However, the facility hazard list for analytical chemistry laboratories (Laboratories B-15 and A-1) did not identify the potential presence of small quantities of radiological material in solution. In November 2001, an IHR (IRC-01-899) was modified to permit the introduction of low-activity radiological samples into Laboratories B-15 and A-1, but the facility hazards list was not updated by facility management because the presence of the radiological material was judged by facility ES&H management not to present a hazard to workers. Although the activity of the samples is low, the IHR modification indicates that an RWP will be used during the preparation of the samples, a sticker will be placed on the analysis equipment indicating "potential radiological contamination," and the exhaust of the instruments will be monitored for contamination after every 25 to 35 samples. The facility hazards list procedure (MCP-6206) indicates that general hazards, such as tripping and stairs, are not required to be listed in a facility hazards list. However, there is no such exemption for radiological material, even in the very small quantities found by the OA team. Furthermore, the expectations of IRC facility management are that the facility hazards list will be reviewed and updated, as necessary, when IHRs are revised. This expectation is not documented in the IHR procedure, and it was not an action item to update the facility hazards list identified on any of the IHR activity modification packages reviewed by the OA team.

In some cases, "ordinary hazards" are not clearly identified or excluded in IHRs. According to the R&D program description (PDD-1015), during the planning of research work, the researcher and/or principal investigator is required to decide which research or research-related activities present only ordinary laboratory hazards that can be addressed using the "skill of the researcher." "Ordinary hazards" are defined in PDD-1015 as those hazards that are typically encountered in the laboratory environment, mitigated through the use of ordinary laboratory safety practices, and typically result only in minor injuries. The IHR process as described in MCP-3571 does not discuss "ordinary hazards" or "skill of the researcher" because all hazards are to be addressed in the IHR process. As a result, there is a conflict between the guidance provided to the principal investigators in the R&D program document PDD-1015 and in MCP-3571. Because the "skill of the researcher" is a pilot program, the implementing procedure has yet to be revised. (See Finding #4, and Core Function #3.)

Idaho Nuclear Technology and Engineering Center. The INEEL Integrated Work Control Planning Standard 101 Project Work Order (Chapter 6) and the associated hazard screening processes were being effectively implemented for project and maintenance work observed at INTEC. For tank farm closure work, the project hazards are identified and documented in the project work order hazards matrix, task-specific construction JSAs, as-low-as-reasonably-achievable (ALARA) reviews, RWPs, and safe work permits. These documents provided comprehensive identification of the project hazards and suggested controls for those hazards. For expedited and planned programmatic and infrastructure maintenance work, job hazards are identified and documented in formal work packages and communicated to workers during pre-job briefings, with signature acknowledgement documented in the work packages. Observation of work and work packages reviewed indicated that implementation of the process is consistent and mature.

For environmental hazard identification and evaluation, the comprehensive INEEL environmental checklist is effectively used to identify potential sources of environmental impact. The checklists for tank closure work activities serve as the review and approval tool and provide a project description for each respective environmental action. The checklists enable waste generator services (WGS) personnel to determine whether proposed actions affect any of the twenty or so environmental aspects, such as air pollutants; discharge to wastewater systems or groundwater; radioactive, hazardous/mixed waste generation and management; and interaction with wildlife/habitat. Waste management personnel used the checklists effectively to evaluate environmental impacts.

INEEL took appropriate corrective actions to address an issue identified by a DOE independent oversight safety management evaluation in 2000 regarding the potential to discharge radiologically contaminated water into an existing percolation pond, and the potential impact on the soil column of the new replacement percolation pond, contrary to DOE Order 5400.5, *Radiation Protection of the Public and the Environment*. As a corrective action, INTEC conducted an effective evaluation of service waste sources for radiological discharge risk. Facility managers evaluated the service waste collection systems within their facilities with a concurrent review by INTEC Engineering. These evaluations included physical inspections, drawing reviews, procedure reviews, and operating history reviews. The evaluation concluded that for INTEC facilities, sufficient engineered (physical) barriers have been implemented to prevent discharge of contamination due to improper configuration of the service waste collection system or operational upset conditions. The evaluation identified two systems in which engineered barriers were not adequate, and appropriate corrective actions were completed to remove these systems from service or implement adequate engineered barriers.

The sitewide beryllium characterization inventory did not identify that beryllium was contained in tank farm hazardous waste streams, tank contents, and process lines at INTEC. The characterization did not identify tank farm waste contaminants and associated systems as a potential source of beryllium. As a result, the potential for exposure to beryllium was not evaluated in an Industrial Hygiene exposure assessment or considered for inclusion in the tank farm JSAs. Although quantities and concentrations of beryllium are low and current personal protective equipment (PPE) requirements are probably adequate to protect workers from exposures, it is important to consider chemical hazards that have low exposure limits, or where the health effect from exposure is not threshold dependant (such as beryllium). Additionally, documentation may be necessary to perform required hazard communications to INTEC workers, especially those who may be in the beryllium surveillance program and sensitized to beryllium.

Test Area North. Hazards analysis for D&D work is performed using Standard 101 (Chapters 1 through 5), which addresses the integrated work control process (IWCP) for maintenance, modifications, construction, D&D, and environmental remediation project activities. The standard uses the hazard profile screening checklist to identify the hazards associated with the work and requires the ES&H disciplines to be involved in the analysis process. A hazard mitigation guide is used to analyze the hazards and identify the controls to mitigate these hazards.

Most hazards for the D&D work were well characterized and documented. The project-level hazards for Building 616 D&D are addressed through the health and safety plan (HASP). Activity-level hazards assessments for all TAN D&D work are tailored to the activity through the IWCP. Most work packages contained a comprehensive listing of hazards for work to be performed and the associated controls.

The management and staff at TAN are effectively performing appropriate analysis when unanticipated hazards are encountered in the course of D&D work. For example, the TAN operations group effectively addressed an unanticipated situation where workers encountered yellow plastic covering potentially contaminated soil during an excavation. The shift supervisor stopped work on the excavation when it was determined that the yellow plastic could have been placed there because of a nearby mercury spill remediation area. The site performed an investigation of the mercury remediation and the reasons for installing the yellow plastic, including document reviews and interviews with workers involved in the original installation of the plastic and the original mercury remediation. The investigation was methodical and thorough, and it concluded that the plastic was not associated with mercury but was indeed placed there because of radioactive contamination concerns (which was an anticipated hazard for which appropriate controls were in place).

While work packages and field observations indicated that most hazards associated with the work were appropriately analyzed and identified, some radiological hazards associated with the Building 616 D&D project were not clearly and effectively analyzed. This type of D&D work involves ongoing hands-on contact with contaminated materials, piping, and building materials. Because of the presence of Strontium-90 (Sr-90) and Cesium-137 (Cs-137), contact beta dose rates near workers' hands and arms could be significantly higher than those recorded by whole body thermoluminescent dosimeters (TLDs) worn on the chest. Radiological survey records in Building 616 verify the presence of discrete locations, such as portions of piping systems and related building components that have significantly higher contact beta dose rates. With the exception of one identified task where extremity monitoring was prescribed, BBWI has not demonstrated through ALARA reviews or other specific job task documentation that the hazards associated with potential beta radiation dose to workers' extremities have been clearly evaluated and that proper controls have been implemented in RWPs, in accordance with MCP-189 for all work activities where there is a potential to exceed extremity monitoring criteria. No records supporting the evaluation of anticipated extremity doses from various D&D work evolutions were available to support the lack of extremity dosimetry in work areas where contact dose rates were high enough to exceed MCP-189 criteria. In addition, there is no mechanism within MCP-189 to ensure that annual extremity doses (cumulative doses) are evaluated and compared with regulatory thresholds requiring extremity monitoring. The current MCP-189 thresholds are based on dose rates and do not include consideration of annual doses.

Additionally, BBWI has not developed a clear technical justification in internal dosimetry technical basis documents or work planning documents to demonstrate why Sr-90 urinalysis does not have to be performed for workers as part of the random whole body counting bioassay program at Building 616. Sr-90 is a contaminant of concern in Building 616; however, only whole body counts for Cs-137 are performed for the randomly selected workers who receive bioassay monitoring. Although the use of positive whole body counting for Cs-137 as an alert to conduct Sr-90 monitoring is discussed in technical basis documents, the sensitivity and minimum detectable activities of Sr-90 and corresponding doses, inferred from indirect Cs-137 whole body counting results, are not described.

Finding #3: The level of rigor and formality applied to radiological hazards analyses at the Building 616 D&D project was not sufficient to demonstrate that all relevant radiological hazards were clearly analyzed and that corresponding controls were adequate.

Another identified concern was that the percentage of Sr-90 contained within mixed fission products present at Building 616 may need to be evaluated to determine whether a more restrictive contamination limit should be instituted for certain areas. A 1996 DOE Headquarters technical position paper clarified the use of more restrictive contamination limits as the percentage of Sr-90 in mixed fission products increases with the age of the material. While not a specific regulatory requirement, BBWI was unaware of the Headquarters recommendations and has no documented analysis to show whether the percentage of Sr-90 in various areas of Building 616 should result in the use of a more restrictive limit than the mixed fission product limit being used for postings and decontamination goals.

Summary. The variety of work activities at INEEL has the potential to expose workers to a broad spectrum of workplace hazards. INEEL has sound institutional processes for the identification and analysis of those hazards. There has been steady improvement in the quality of hazard screenings and documentation of those hazards in work documents, and most hazards were effectively identified and analyzed. In a few cases observed by the OA team, those processes were not implemented with sufficient rigor, and consequently, some potential hazards were not fully identified, analyzed, and communicated to workers. Because of the use of broad work orders and broadly defined hazard control sets, the work planning processes rely on individual knowledge of hazards during the course of work in a few cases, rather than the clear standards and rigorous analysis of hazards. Although some improvements in implementation and documentation of processes are warranted, most aspects of hazards analysis at the evaluated INEEL facilities/activities are effective, and significant hazards are effectively identified and analyzed.

E.2.3 Core Function #3 – Develop and Implement Hazard Controls

Safety standards and requirements are identified and agreed upon, controls to prevent/mitigate hazards are identified, the safety envelope is established, and controls are implemented.

INEEL Research Center. The IHR process provides a variety of mechanisms for identifying, defining, and documenting the hazard controls for eliminating or mitigating the hazards. The R&D program description (PDD-1015) appropriately indicates that the hazard mitigation methods to be used, in order of preference, are engineering controls, administrative controls, and PPE.

Engineering controls in the IRC laboratories are appropriate to control a number of hazards identified in IHRs and JSAs. Laboratory ventilation systems, including fume hoods and local exhaust ventilation systems, evaluated in Laboratories A-1, A-7, and B-15 were adequately designed for the hazards they were intended to mitigate, were being maintained within their specified testing frequency, and were being used by the research staff as designed. Entry to most laboratories within the IRC is controlled through key card access and is typically granted by the laboratory manager only after verification of training and qualifications. In the IRC machine shop, emergency shutoff switches were identified for power tools, and machine guards were in place and used by shop workers.

The rigorous use of engineering controls within the IRC laboratories has minimized the requirement for PPE. The majority of research using hazardous chemicals is performed in fume hoods or with the aid of local ventilation exhaust, thereby eliminating the need for respiratory protection, except in unusual circumstances as directed by the Industrial Hygiene organization. The requirements for chemical and/or thermal protective gloves and face protection, when required, are described in the IRC chemical hygiene plan and are further detailed in the IHRs.

Administrative controls, such as safety signs, when clearly identified in IHRs and JSAs were appropriate and communicated the hazards. Hazardous chemicals in Laboratories A-1, A-7, and B-15 were inventoried, stored in the appropriate cabinets, and labeled in accordance with INEEL procedures and the IRC chemical hygiene plan. Researchers demonstrated knowledge of the hazards and controls associated with the use of a wide variety of hazardous chemicals. Training requirements for researchers and technicians are identified in a training requirements checklist, which is included in each IHR.

In general, hazard controls are well documented in a number of sections of each IHR. An overall presentation of hazard controls is provided in the IHR Hazard Assessment and Mitigation Plan. INEEL institutional procedures that address hazard controls are identified in the Hazard Mitigation Checklist, and procedures are cross-referenced to the hazard. Specific PPE requirements are identified in the exposure survey form, and the hazard controls are linked to the hazard. Other administrative controls addressed in the IHR include an identification of equipment procedures, associated research activities, provisions for unattended activities and the requirements when working alone, and controls for waste generation and handling and storage of waste.

The IHRs reviewed by the OA team adequately described the hazards and hazard mitigations intended to control or eliminate the hazard. Based on the review of a number of recent projects and IHRs, the IHR process has been effective in identifying and controlling research and research-related hazards at the IRC. However, elements of the IHR process are not documented. To date, the success of the IHR process has been attributable principally to the training and qualifications of the research staff, an effective integration of ES&H subject matter experts with research work, and the communication of safety expectations by laboratory and facility management. In most cases, the IHR process was implemented in a manner that is much more rigorous than the documented requirements, as defined in IHR process documents PDD-1015 and MCP-3571.

The IHR process relies to an extent on the collaborative judgments by the research team to implement the appropriate management expectations without having to document those expectations. Some concerns stemming from insufficient written guidance in the IHR process for defining work or documenting ordinary hazards were discussed in previous subsections. Additional concerns are discussed below.

MCP-3571 does not provide guidance on when and how an existing IHR package should be revised. The process and management expectations for modifying or revising an IHR, other than in context of modifying an IHR when initiating a new R&D activity, are not documented in MCP-3571. Sections of MCP-3571 have typically been used to revise an IHR, although the scope of MCP-3571 does not include modifications in its applicability; however, even in this application, the process for revising an IHR has shortcomings in the following areas:

- MCP-3571 does not provide guidance, clear thresholds, or requirements for when an IHR must be revised (e.g., increased hazard level, and increased pressures or quantities of chemicals). For example, the INEEL Facility Evaluation Board recently identified an R&D issue at the Test Reactor Area in which research workers modified an installed off-the-shelf hydrogen fluoride detector to include an alarm system without revising a JSA or IHR to document the equipment safety modification. In a similar example, the same INEEL Facility Evaluation Board identified an R&D issue at the Remote Mockup Test Facility in which the "introduction of new hazards requiring modifications to Independent Hazard Review documentation were being performed without reviews and approvals as required by MCP-3571."

- There is no guidance in MCP-3571 describing when a change in the configuration of experimental apparatus requires a revision to the IHR.

- MCP-3571 does not describe how an IHR revision is to be performed, documented, and approved, and under what conditions research work must be stopped until the IHR revision has been approved.

- MCP-3571 does not describe the process for administrative revisions to IHRs (e.g., changes in principal investigators or new training requirements).

MCP-3571 does not describe a graded approach to the conduct of hazard reviews as recommended by the DOE Integrated Safety Management System Guide, which states that "the formality and review of the review process and the extent of documentation and level of authority should be based on the hazard and complexity of the work being performed." Although implementation of the IHR process has inherent management expectations for a graded approach when performing hazards analysis, MCP-3571 and related procedures do not reflect this graded approach, as indicated by the following:

- MCP-3571 does not require an increased level of hazards analysis for R&D projects that present a greater risk to research workers, although IRC management expectations are that increased rigor would be required. For example, IRC facility management has, on occasion, required additional formal hazards analysis (e.g., failure mode and effects analysis) be conducted for some R&D projects involving complex experimental apparatus and potential pressure hazards.

- MCP-3571 indicates that pre-job reviews and walkdowns are to be performed at the discretion of the principal investigator and/or subject matter expert, but no guidance is provided on the extent of these reviews with higher risk activities, or whether management requires a pre-job review or readiness determination for R&D activities that are more hazardous.

The IHR process, as defined in MCP-3571, does not provide guidance about the need for and/or use of procedures and checklists in support of research or research support activities:

- Although most IHRs provide some description of equipment procedures, there is no guidance provided in MCP-3571 for developing written instructions, checklists, and/or procedures for R&D activities. For example, the recent scale-ups of research activities from the traditional bench scales research to more complex apparatus have necessitated the use of more formal operating instructions and checklists (e.g., diesel reformer, cold crucible, and centrifuge-related experiments). However, there is limited written guidance on the use of checklists.

- When equipment procedures are identified in an IHR, MCP-3571 does not provide guidance about procedure usage (e.g., in-hand step-by-step, as reference but present in the laboratory, or general knowledge). Currently, the need and/or use of procedures for performing research work is established at the discretion of the researcher with some management expectations, but no written guidance.

- MCP-3571 provides limited guidance about the use of manufacturers' equipment manuals, which in some cases have not been followed by researchers. For example, a contributing cause to the rupture of a laboratory gas-drying unit that occurred in December 2002 in Laboratory A-10 and injured three workers was that the principal investigator was unfamiliar with the pressure requirements stated in the vendor's manual.

In addition, the IHR process, as defined in MCP-3571, has not provided sufficient guidance concerning the documentation required to identify controls for off-normal events or emergencies. Although most IHRs address emergency scenarios and the expected hazard mitigation, JSAs used for research-related activities may not include a description of off-normal events. For example, off-normal events and emergency shutdown procedures for equipment in the IRC machine shop are not identified or documented in JSAs or shop procedures. In addition, briefings provided to researchers do not addresses emergency shutdown of machine shop equipment, and some equipment emergency shutdown controls are not clearly marked or labeled, particularly for older shop equipment.

Finding #4: MCP-3571, *Independent Hazard Review*, and other related documents do not sufficiently document IRC management expectations for some elements of planning and conducting research to ensure a consistent and adequate level of hazard review commensurate with the hazard and the complexity of the work being performed.

Hazard controls for potential exposure of researchers to chemical, biological, and physical hazards are identified and documented in exposure assessments performed by industrial hygienists. Although these exposure assessments are generally robust, in some cases, hazard controls have not been sufficiently defined for inclusion into JSAs and IHRs. For example, the exposure assessment performed for the IRC machine shop recommends "signs" as an administrative control. However, the exposure assessment does not specify the type of signs (e.g., safety glasses and hearing protection). As a result, the requirement for signs was not incorporated into the JSA for the IRC machine shop.

In another example, Industrial Hygiene noise dosimetry indicates that some workers in the IRC machine shop are exposed to high levels of noise (above 85 dBa), which would require them to be in a hearing conservation program according to INEEL procedures. However, the exposure assessment and JSA do not provide thresholds for enrolling machine shop workers in the hearing conservation program, and do not specify how the work area should be posted to protect workers from the noise hazard.

In some cases, hazards are identified in the research activity and documented in the IHR, and the industrial hygienist elects not to perform an exposure assessment but does not document the basis for that decision in the IHR. Documentation of such decisions is particularly important for chemical hazards that have low exposure limits and/or when the health effect from exposure is not threshold dependent (e.g., beryllium, asbestos).

Idaho Nuclear Technology and Engineering Center. The tank farm technical safety requirements (TSRs) and documented safety analyses (DSAs) requirements are effectively implemented through appropriate administrative and technical procedures. For example, the implementing procedure for the TSR-required waste compatibility control program adequately ensures that only compatible wastes are introduced into the waste tanks by requiring all waste streams to be characterized. The procedure supplies sufficient information in the appendices to determine allowable wastes, as well as providing a list of prohibited chemicals. DSA safety requirements, such as those for transfer monitoring and tank purge flow instrumentation and calibration, are effectively implemented in facility-specific operating and response procedures, round sheets, and calibration procedures.

With some exceptions (discussed below), controls for tank farm work were properly implemented. A significant amount of work involved high heat stress conditions, working in restrictive tank risers (valve vaults), working in high radiation and highly contaminated areas using supplied breathing air, and performing grinding, cutting, and welding operations. This difficult work was performed within established documented controls. Environmental management and WGS personnel worked in close coordination with tank farm operations and closure project personnel to ensure that waste streams were identified and that generated waste was properly disposed.

There has been a significant improvement in the quality, organization, and content of maintenance work orders and work instructions to the craft since the 2000 independent oversight safety management evaluation. Both programmatic and infrastructure work order instructions are presented in a technical procedure format with prerequisites and limitations, step-by-step actions, notes, and cautions. Mandatory step-by-step sequences are identified, and hazard controls are integrated into work instructions. There was effective integration of environmental requirements and consideration of waste streams. Each work request is prepared in a standard format to ensure consistency across facilities.

Many INTEC (also TAN) trenching operations use an air-powered lance and soil vacuum as an engineered control to perform safe excavations. The practice provides a significant enhancement and safety improvement over traditional trenching methods and is particularly beneficial at INEEL because many utilities are buried and their location is uncertain. The air-powered lance loosens and disturbs the soil without the forceful cutting action of power and hand excavating and thus is less likely to cause damage to unknown buried utilities. INEEL management has recognized the safety improvement of this practice and plans to implement it at other locations.

Although many aspects of hazard controls are effective, some weaknesses were identified as discussed below.

Some radiological controls implemented by the RWP for a work activity were less conservative than those specified by the ALARA review. The RWP for process line work in the B-3 and B-4 valve boxes is supported by a comprehensive ALARA review conducted by the radiological controls organization and is used as a valuable hazards analysis tool to determine effective controls. However, some controls in the ALARA review were not incorporated into the RWP requirements. The ALARA review specified that work would be controlled through full-time radiological control technicians (RCTs), but the resulting RWP for the task required only periodic radiological control coverage. When alerted to the discrepancy, rather than implement the prescribed ALARA controls, INTEC revised the ALARA review to be less conservative by eliminating the provision for continuous RCT coverage. The activity involved hazards and controls for which continuous RCT coverage could be important, such as supplied air respirator work (cutting, grinding, and welding) in a high radiation and high contamination area (tent and valve vault), performing radiological air sampling, wearing alarming dosimetry, and other administrative and engineering controls.

Job-specific bioassay requirements contained in INTEC Internal Dosimetry Engineering Design File (EDF) No. INTEC-2001-001 Rev. 3 have not been implemented for INTEC workers at the tank farms. The INTEC EDF establishes bioassay requirements that include: a routine bioassay program for workers deemed to have the highest potential for internal contamination; a job-specific program for workers based on the work and the risk of radiological intake; an event-based bioassay based on intake or a potential intake event; and a random bioassay for those workers with less potential for intake as determined by the radiological protection engineer. The EDF requires performing job-specific bioassays as necessary for all radiation workers and states that the internal dosimetry program at INTEC requires bioassay for extensive work in contaminated areas where a wide use of protective clothing and/or respiratory protection has been deemed necessary (job-specific bioassay sampling). Contrary to these requirements, job-specific bioassay sampling was not required by ALARA reviews or RWPs for some work involving PPE, including extensive radiological work in tents, and valve box work activities on the tank farms. Although bioassays were being performed for some tank farm personnel as a result of random sampling, there was no formally planned and documented job-specific tank farm bioassay sampling or a documented rationale for individuals randomly selected.

Engineering review and documentation for a few modifications and changes were not rigorous, were not performed in accordance with configuration procedures, and had the potential to adversely affect safety.

- Containment tent air conditioning was modified without adequate engineering review and documentation. As a result, one radiological and locked high radiation area containment tent was pressurized, creating the potential for release of radioactive contamination to the environment. The tank farm B-4 containment tent is a locked high radiation area and normally uses an industrial (rated 700 cubic feet per minute) HEPA filtered vacuum system to maintain negative pressure. Record-breaking high temperatures necessitated adding a large air conditioning unit to the B-4 containment tent, which pressurized the tent and potentially resulted in an unfiltered effluent. Engineering aspects of the modifications to the containment tent were not formally considered in the initial construction and design review or when the modification was made. Air conditioning units for other smaller containment tents (which use small household air conditioning units) were also modified without formal review and documentation; however, the containment features were not adversely impacted.

- The lifting lugs, fabricated from "U" bolts that were added to a steam jet drip pan, did not receive adequate engineering review and documentation. The lifting lugs were not depicted on engineering drawings of the drip pan, and no engineering calculation was performed to ensure their adequacy. Failure of the lifting lugs could result in injury to workers during lifting operations.

Although many requirements associated with the operation of the portable breathing air compressor at the tank farm are well documented, they do not adequately address monitoring the temperature of breathing air delivered to workers. One worker indicated that the breathing air was very hot and caused discomfort while working in PPE during a record-breaking heat wave, in which temperatures were over 100 F at the tank farm. An INTEC technical procedure for Portable Breathing Air Units (COM-COM-001) requires the compressor operator to request that supervision determine if work should be stopped and rescheduled when ambient temperatures exceed 90 F. Although Industrial Hygiene has a supply of air line coolers and such options as cooling ice baths, procedures make no reference to the potential need for this cooling, and coolers were not in use during this period of record temperatures. Further, the pre-job briefing did not address potential high temperature of breathing air. The main air line from the compressor was not configured in a manner to prevent further heating of the supplied air (i.e., the dark-colored line ran for over 100 feet and was exposed to sun and high ground temperatures).

The preceding deficiencies observed by the team are indicative of a need for more rigor in applying the mechanisms that ensure that all appropriate controls are adequately identified and communicated to workers during work planning. The current system relies heavily on individual expertise to be aware of the controls identified in sitewide policies and procedures. Consequently, some controls that are not frequently referenced or used during the course of work are overlooked or forgotten. The failure to clearly identify and implement these controls during the work planning process may result in unintended consequences (such as pressurizing containment tents), additional risk to workers (shortened work rest routines from overheated breathing air), or unmonitored exposures (lack of bioassay). (See Finding #5.)

Although most DSA requirements were properly implemented, in one case, a tank farm program safety requirement had not been incorporated into facility documents as assumed in the DSA. The tank farm DSAs reference an INTEC excavation program and refer to the operational requirements manual for further details on the program. INTEC has no separate excavation program and uses the INEEL program. According to INTEC personnel, the operational requirements manual has never referenced the excavation program. Following notification of this discrepancy, the facility performed an unreviewed safety question (USQ) screening, which resulted in a negative response and thus did not require a USQ determination.

Test Area North. In D&D work, many of the traditional engineered hazard controls do not exist. Buildings often do not have such utilities as installed lighting and ventilation, and structures originally designed to contain and isolate hazardous materials are being demolished. Because of these unique conditions, temporary engineered controls, such as portable HEPA filtration or automated equipment, are relied on in some cases. For example, the site's use of a vacuum excavator is an effective practice for efficiently and effectively minimizing the hazards associated with excavations where underground surveys are not precise and facility drawings cannot be relied upon for accurate characterization of potential underground hazards. However, the predominant hazard controls used at D&D sites are administrative controls and PPE.

In most cases, use of INEEL's IWCP results in the effective identification of the appropriate hazard controls. IWCP work packages contain specific hazard lists and corresponding control sets. For example, an excavation work package for vacuum excavation identified high noise as a potential hazard, and an Industrial Hygiene noise exposure assessment for work producing elevated noise was performed. Controls identified from the exposure assessment were identified and implemented. High noise areas were posted, and craft workers and RCTs working with or around the high noise area were wearing hearing protection, were enrolled in the hearing conservation program, and had current training on hearing conservation as required by site procedures.

Radiological hazard controls are generically identified in the work packages and are further analyzed and tailored by the radiation control department, resulting in job-specific controls specified in RWPs. Workers must read and concur with the requirements of the RWP and do so using the Radiological Control Information Management System electronic RWP system. This system controls employee entries into radiological areas based upon employee radiological training, predefined ALARA controls, and administrative requirements, and was found to be an effective tool used as part of the site ALARA program to control entry into radiological areas and track personnel and task-specific doses.

Project-level radiological controls were appropriate in most cases. Because of its intrusive nature, D&D work can result in generation of significant airborne radioactivity. Accordingly, radiological control personnel appropriately require respiratory protection and air sampling. As part of the process, they also use available characterization information to establish a conservative project derived air concentration based on the most restrictive isotope of concern (Sr-90) for evaluating air sample results.

Environmental hazards associated with waste streams from the D&D work were effectively addressed. WGS personnel are routinely engaged in the Building 616 work planning and control process to identify waste streams and provide specific direction for proper waste segregation and disposition. Individual waste codes are used to identify specific waste streams generated during work and to ensure proper segregation of waste. WGS requirements are integrated into the work order, and WGS concurrence is required before work packages are authorized for use.

Although most control sets were effectively identified for the analyzed hazards, the OA team identified deficiencies in the implementation and communication of some controls for TAN work activities, as described below.

In some cases, the work package for the TAN waste transfer line excavation provided ambiguous requirements for control of excavation hazards. For example, the work package hazard controls section stated, "protect employees at the edge of the excavation of 6 feet or more in depth from falling," but did not specify that this should only apply to wells, pits, shafts, or similar excavations (an Occupational Safety and Health Administration [OSHA] regulation). By not specifying the applicability condition as listed in the OSHA regulation, the work order requirement was then applicable to all excavations 6 feet or more in depth, although workers did not follow this requirement for all excavations (see Core Function #4). In another example, the requirements for ground slopes (based on soil classification) were ambiguous and inconsistent in different sections of the work package. In a third example, the work package required that the excavation be inspected prior to entry using an excavation inspection form, but only required a single signature in the work package documenting the inspection, which did not specify which of the multiple excavations were actually inspected. The package did not specifically require the inspection form to be filled out, and therefore inspectors only used it as guidance. All of these deficiencies contributed to failures described in the Core Function #4 section of this appendix. The site is in the process of implementing a major revision to the site excavation procedure that, if properly implemented, will clarify and simplify many of these requirements across the site and in the appropriate work packages.

Although many Industrial Hygiene exposure assessments were clearly linked to work packages (e.g., asbestos removal and demolition for TAN 602), exposure assessments for Building 616 were not adequately linked to work packages. As a result, controls resulting from Industrial Hygiene exposure assessments were not always properly reflected in the master work package as required by the IWCP site standard. For example, Industrial Hygiene exposure assessment letters did not always list the applicable work order or specific task being evaluated. One exposure assessment (vacuum for noise and heat stress) does not indicate which work order, specific project, or piece of equipment it applies to. The results indicated a requirement for additional controls that were not reflected in the master work order. Exposure assessment letters were also unclear in that they listed some controls as being required when there was no intention to implement the controls unless certain exposure conditions were met. For example, cadmium and lead medical surveillance are listed as required controls for Building 616 work; however, these are not being required or implemented based on the actual exposure conditions.

In another concern, the linkage between job-specific RWPs and specific work steps in the planned work order was not sufficient to ensure that the proper controls would be implemented for all individual work tasks, in accordance with the IWCP. The site IWCP standard requires that the specific RWP number be reflected in the applicable work step(s) of the planned work order. Building 616 planned work orders do not follow this requirement, and in two instances, the choice of an appropriate RWP was not readily evident to workers, supervisors, or RCTs. In one case, personnel were working the HEPA vacuum unit disassembly effort, where no specific RWP had been developed to cover potential airborne work outside the evaporator pit. In this case, the RCTs decided to use the RWP for "Install Hot Tap, lockdown, and power wash," which was for work inside the evaporator pit room. This RWP had appropriate controls for the work and was chosen because of the need for respiratory protection and double layers of anti-contamination clothing, even though the task breakdown and scope was not representative of the specific activity to be performed. In a second case, a worker performing outside support (a task not defined in the work order) was unsure which RWP was to be used and signed in on the RWP for Tent Support, at the direction of an RCT. The worker did not follow the PPE requirements of the RWP because there was no intention to go beyond the radiological boundary area in performing outside support duties. Under that scenario, no RWP would have been required; however, the specific task or associated controls were not included in the work package.

D&D work at TAN involves the use of respiratory protection to control radioactive material intakes. DOE STD-1121-98 recommends that workers participate in routine bioassay monitoring if respiratory protection is used to limit the intake of radioactivity (i.e., respiratory protection factors are being used to limit the estimated intake of radioactivity). The INEEL technical basis document for internal dosimetry specifies a rationale for not requiring routine bioassay monitoring for all workers based on vast historical evidence showing a lack of intakes during previous routine monitoring. This approach is consistent with information presented in the DOE standard. However, under these conditions, the standard also recommends limited surveillance of representative workers to provide continuing verification that routine bioassays are not required, such as performing confirmatory bioassays for work groups involving sampling a small fraction (e.g., 10 percent) of the group at a relatively constant rate. While random bioassays have been prescribed for the Building 616 D&D project, details regarding implementation are not specified in work planning documents, and INEEL has no requirements or standards to ensure proper administration of a random confirmatory bioassay program (e.g., no guidance on selection of workers, the number of workers that should be monitored, and monitoring frequency). Currently, administration of the program is left to the subjective discretion of the cognizant radiological engineer and/or facility radiological control manager, resulting in a possibility for inconsistent and/or incomplete monitoring needed to verify effectiveness of internal exposure controls.

Summary. The site has an extensive system of procedures that define controls for the expected hazards at INEEL. Those procedures, when followed correctly, result in an effective set of hazard controls for work. Work documents have significantly improved, including the specification and documentation of job activity, and radiological and environmental controls. In some cases, those procedures and work packages were not always followed or used, resulting in hazard controls not being clearly defined and used by the workers. In the IWCP, the procedural controls are tailored to the specific activity through the work control process; however, in some cases, the controls were not specific enough to be fully effective. In other cases, the controls were left to be determined during the course of work, sometimes resulting in uncoordinated or conflicting control sets, or required controls being missed entirely. The failure to adequately follow site procedures for developing and implementing hazard controls resulted in some work being performed under potentially unsafe conditions.

E.2.4 Core Function #4 – Perform Work Within Controls

Readiness is confirmed and work is performed safely.

INEEL Research Center. The IHR process requires that the facility manager review the IHR against the IRC authorization basis (an auditable safety analysis) prior to granting authorization to perform work. The analytical chemistry research conducted in Laboratories B-15 and A-1, and the phosphazene synthesis experiments conducted in A-7, were within the scope of the auditable safety analysis, and research was appropriately evaluated and authorized by the IHR group and the facility manager prior to being performed.

Research work conducted within IRC is being performed safely. Recordable injury case rates at the IRC have been well below the INEEL site average recordable injury case rates for the past ten years, and were at their lowest levels during the past three years. In addition, work observed in IRC laboratories was being performed in accordance with the controls identified in IHRs, including research on adsorption of metals in soils being conducted in Laboratory A-14, and polymer synthesis research being performed in Laboratory A-7. Radiological controls established for activities conducted in Laboratory A-14 were appropriate for the materials in use at the time of the observation.

The generation and storage of hazardous waste is rigorously controlled at the IRC by INEEL WGS. For example, continuous tracking of generated wastes coupled with inspections conducted by WGS provides a useful assessment tool to ensure that the laboratory maintains its small quantity generator status. Observation of a Resource Conservation and Recovery Act (RCRA) temporary accumulation area inspection conducted by WGS verified that the inspection was well planned, thorough, and performed in accordance with the applicable site procedure requirements. Another recent inspection of the RCRA satellite accumulation area (SAA) in Laboratory A-14 conducted by the laboratory custodian was rigorous and identified several deficiencies, such as an outdated waste registration form. All recent inspections of the SAA in Laboratory A-14 were recorded in the SAA logbook.

Although IRC laboratory practices establish the individual laboratory custodian as a line manager designee for day-to-day oversight of laboratory activities, some laboratory custodians do not have sufficient authority to resolve ES&H issues with principal investigators. For example, past research activities conducted in Laboratory A-14 have resulted in the generation of small quantities of radioactive waste residuals, which have remained in storage within the laboratory for over one year. Research activities conducted within the IRC radiological laboratory spaces (primarily A-14) routinely generate small quantities of hazardous, mixed, and low-level radioactive wastes. These wastes are managed in a manner that typically does not result in the accumulation of legacy wastes once an experiment is concluded. However, in some cases, these wastes have not been dispositioned by the principal investigator even after repeated requests from the laboratory custodian. The principal investigator attributes the lack of action to the lack of a charge code for this activity, and the laboratory custodian has been unable to resolve the conflict through management channels.

Idaho Nuclear Technology and Engineering Center. A significant amount of tank farm work has been accomplished without injury in a difficult construction environment. The BBWI total construction severity index trend (e.g., accidents, injuries, lost time), which includes management, construction, and subcontractor personnel, has significantly decreased and was zero in many of the last 18 months. The line management and radiological control organizations have ensured that extensive work performed in PPE (anti-contamination clothing, fire-resistant clothing, and breathing air units) in high radiation and contamination environments was performed with minimal contamination events. Housekeeping on the tank farm was generally good, and workers were careful to watch out for the many hazards present on the construction site.

Communication between tank farm operations, the tank closure project, and supporting disciplines is good. Frequent project status meetings and daily pre-job meetings ensure that the status of work is clearly understood, authorized, and communicated to all personnel working on the tank farm. Operations personnel monitor the tank farm and properly performed rounds and safety requirement log recordings. An operator observed performing rounds by the OA team was knowledgeable of the equipment and monitoring requirements. Most aspects of consideration of heat stress conditions on the tank farm were excellent during record-breaking weather. Pre-job briefings reiterated MCP requirements that were carefully considered and implemented. To control heat stress, conservative stay times were calculated and used, frequent breaks were encouraged without production pressure, cool fluids were available just outside the radiological boundary area, and air conditioning was used in containment tents.

WGS provides direct support to INTEC tank cleaning operations to ensure the availability of waste management expertise and assist in the site's disposal certification for hazardous, mixed, and low-level radioactive waste. Waste management activities conducted in support of tank cleaning operations largely consist of the management and maintenance of a less-than-90-day hazardous waste storage area and an SAA. Containers and logs were appropriately maintained. Waste contained in both the less-than-90-day area and SAA was being tracked in the site Integrated Waste Tracking System, which provided both a container profile and a waste material/characterization profile.

Programmatic and infrastructure maintenance activities were well controlled using documented work packages. Maintenance craft were knowledgeable of the technical aspects of the job and work packages. Work packages were approved, and authorization to start work was documented in work packages by facility operations personnel just prior to the start of work. Readiness to perform work was also verified by joint workability walkdowns of "ready to work" maintenance work orders by the craft and supervisors. These workability reviews add a final verification and barrier to ensure that the assigned work can be performed safely in the field.

Notwithstanding the many improvements and safe work observed in most cases, several work practices were not conducted in compliance with requirements, and safety deficiencies placed workers at risk.

- Work was being performed on a number of deficient scaffolds. Although inspected as satisfactory by BBWI, nearly all of the scaffolds and work platforms on the tank farm had deficiencies with plank spacing, guardrails, barriers, or toe boards. Erection, inspection, and day-to-day walkthroughs/monitoring were not adequate to identify and correct the unsafe conditions. Use of the scaffold erection checklist provided in the scaffold procedure was not mandatory and was not used consistently. A sitewide scaffold and fall protection functional assessment performed in December 2002 identified similar concerns with scaffold fall protection, "competent person" training, and scaffold erector knowledge. An INTEC senior supervisor watch stopped work on a Building 664 scaffold in June 2003 because scaffold erectors were standing on a single plank and not wearing hardhats as required by procedure.

- Some unsafe work practices were identified during lifting operations associated with the removal of the rain cover and 1400-pound shield plugs from tank farm tube riser 7. As examples, personnel put their hands and arms under the suspended rain cover to take samples, hand tended loads rather than using tag lines, and moved near and under the plane of the suspended load. Supervision of this activity was not adequate to ensure worker safety.

- A worker pulled himself up on a scaffold support bar above a working platform two times with both feet off the platform. There was no guardrail in that area of the platform. Work was paused after the practice was noted. The worker was immediately counseled by a supervisor, and the issue was briefed at the next pre-job briefing.

- Workers failed to perform a required procedural step during tank riser 7 work, which required vacuuming potentially contaminated dust and debris from exposed surfaces of shield plugs with a HEPA vacuum to minimize the spread of contamination. The procedure was not in hand or referenced during the job steps.

- Some workers at INTEC were observed frisking hands and articles (i.e., work gloves) at a scan rate not in accordance with radiological worker training and good health physics practices.

- A few safety deficiencies within the construction area included unguarded open energized electrical panels, an unguarded extension cord routed through doorways, multiple chained extension cords, and an improperly secured gas cylinder. These deficiencies were promptly corrected.

- Carpenters were observed operating power tools without hearing protection. Although noise levels may not have exceeded time-weighted-average limits for an eight-hour period, work times were not being monitored.

- During annual preventative maintenance on an INTEC boiler, the lock and chain for a propane valve under lockout/tagout was not positioned to provide positive control of the propane supply valve to the boiler (the utility supervisor promptly paused work to resolve the issue).

- During programmatic maintenance for a leaking steam line union at the high-level waste facility, the OA team observed work performed outside the stated scope (repacking steam valves) of the work order and without an approved work order change.

These deficiencies indicate a range of concerns with management oversight, job supervision, competence and training, and failures to implement procedural and safety requirements (see Finding #5).

INTEC organizations took numerous short-term corrective actions and initiated long-term corrective actions for the identified deficiencies. For example, during the inspection, all scaffolds at INEEL were inspected for similar deficiencies. An occurrence report was initiated for the programmatic and implementation deficiencies with the scaffold program and tank farm deficiencies. Other safety deficiencies on the tank farm were corrected on the spot. The deficiencies and corrective actions were discussed as lessons learned at subsequent pre-job briefings and plan-of-the-day meetings.

Test Area North. At TAN, readiness to perform work is effectively verified and controlled through plan-of-the-day meetings, and pre-shift and pre-job briefings. The published plan of the day is used to authorize the day's work and for a weekly look ahead. Pre-job and pre-shift briefings for TAN D&D projects involved supervisors and workers, and effectively communicated work hazards and controls through a variety of techniques. Effective techniques included discussions of the Institute for Nuclear Power Operations (INPO)-based human factors "error precursor" card, and worker participation each day in a roundtable discussion of job-specific hazards and controls.

In most cases, workers performed work safely in accordance with established controls. For example, workers performing vacuum truck activities generally conducted their activities in accordance with work package and permit controls. All required PPE was utilized, and workers were particularly aware of hearing protection, frequently reminding observers of the need for hearing protection. At Building 616, PPE donning practices were appropriate, workers demonstrated effective communications while working in respiratory protection using direct verbal and radio methods, and for several jobs, another person followed along with required work steps to ensure proper conduct and provided assistance as requested. RCTs were proficient in conducting and documenting surveys in support of D&D and radiological work control. Radiological surveys were performed and documented in an appropriate manner using survey forms, and for the most part, health physics survey records were complete. Air sample calculations were performed correctly using a procedure, and forms were legible and complete.

Several concerns were identified in observed radiological practices on the Building 616 D&D work in the areas of contamination control and ALARA optimization. For example, during disassembly and removal of a HEPA vacuum unit in Building 616, necessary tools and equipment were not effectively pre-staged prior to working, resulting in some unnecessary delays while workers were in the radiation area. Specifically, delays resulted from not readying the air sampler such that it could be easily powered on from outside the tent, not placing necessary bags inside the tent before breaching the vacuum system to avoid the need for bag-in and bag-out of the tent, and not ensuring a drum lid was taken into the tent so workers would not have to wait for it to be located and passed in. In addition, workers handling the drum, lid, ring, and other potential sharp or pinch points did not don leather gloves, as required by the work package, to reduce the potential for punctures and inadvertent personnel contamination. Masslin wipes and smear samples were not placed in a protective bag prior to passing them into the transfer port, resulting in an increased potential for contamination to be transferred outside the controlled area. No air sampling was conducted outside the controlled area to verify tent integrity. Qualitative tent integrity checks for negative airflow are conducted daily prior to work; however, additional checks are not required to determine whether airflow changes have occurred due to changing environmental conditions within the tent while workers are working.

Although most work activities at TAN were performed safely, some cases were identified where workers performed work in unsafe conditions, conditions outside the bounds of established controls, or without the appropriate training as described below.

In several cases, personnel did not follow established controls during excavation activities at TAN. At one excavation, industrial safety professionals did not follow site procedure and work package requirements on excavations and verbally changed excavation controls without the proper review and documentation of the changes in the work package. Workers and field supervisors, who are qualified as competent persons for excavation, accepted this verbal change without questioning the need to change work package controls. The industrial safety professionals and supervision did not correct the work package, even after the safety of the excavation was questioned by a facility operator. The BBWI investigation of the incident determined that personnel had entered the excavation and were exposed to a potentially unsafe condition. In addition, several workers entered the excavation without the prerequisite safety inspection by a competent person. TAN reported this incident in the Occurrence Reporting and Processing System as an off-normal occurrence. In another example of failure to follow the work order controls, workers working at the edge of this excavation were not protected from falling as required by the work package. While this requirement may not have been appropriate (see Core Function #3), supervision and safety professionals allowed work to continue in violation of the work package requirement without revising the requirement. In another example, workers placed excavated materials within two feet of a different excavation, creating the potential for spoils to fall into the excavation, and creating an unsafe slope within the excavation. While there is no evidence that workers actually entered this excavation in this condition, workers placed the excavation in an unsafe condition by not following work package requirements. Finally, during work at a third excavation, workers performed excavation activities without a six-foot distance between the excavation and the exclusion rope as required by the work package.

Another industrial concern was that workers in the contaminated areas of Building 616 were not wearing hard hats as required by the work package and site requirements. Work inside Building 616 involved using and working around scaffolding and other bump and overhead hazards. Industrial safety and project personnel indicated that they have not required hard hats because of the difficulty with wearing them in conjunction with respiratory protection and other PPE. However this justification has not been documented and is contrary to work package and procedure requirements. The lack of head protection is in conflict with the requirements of the HASP and work order, which state that hard hats will be worn whenever working in an area with overhead obstructions or the potential exists for falling objects from above. In addition, the site procedure on scaffold use requires use of hard hats while on or underneath scaffolds.

In the training area, TAN supervisors have allowed some workers to enter contaminated areas of Building 616 without the OSHA hazard communication training required by the work order and the HASP. The INEEL hazard communication course is intended to meet required employee training specified in OSHA 29 CFR 1910.1200(h) for exposure to hazardous chemicals and is required for those workers who are likely to be exposed to hazardous chemicals as a result of their work activities. RWP entry logs indicate that several workers have entered the Building 616 work areas and evaporator pit without required training, where there is a potential for exposure to chemicals regulated by the RCRA and the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Further, the HASP requires hazard communication training for all workers on the project, and there are a number of additional workers who have entered the Building 616 work zone (outside the building) who have not received this training. Managers believe that certain categories of workers, such as those not entering the 616 Building evaporator pit, are exempt from this training, but this is not reflected in the project HASP. Hazard communication and related training concerns have been previously identified by a BBWI self-assessment for DD&D work at Building 616; however, corrective actions have not been fully effective, as evidenced by workers continuing to work without the requisite training.

A common element in the above work performance deficiencies is that management, supervisors, ES&H professionals, and workers did not ensure that work was performed within established hazard controls. Management needs to communicate and enforce expectations for rigorous compliance with work package and other safety requirements.

Finding #5: INTEC and TAN field supervision and safety professionals have not ensured that work activities are performed within established hazard controls and requirements listed in work packages.

Summary. Most work observed was conducted in accordance with identified controls, and INEEL has achieved low accident and injury rates. However, the OA team identified unsafe work practices and safety deficiencies at the facilities inspected. The OA team noted many instances of work that were not conducted in strict compliance with procedural steps, work package requirements, posted controls, or other documented requirements, resulting in potentially unsafe conditions. In several cases, weaknesses, combined with problems in identification and implementation of controls, led to stopping or pausing work in order to mitigate deficient conditions.

E.3 CONCLUSIONS

There have been many improvements to the INEEL processes and procedures for implementing the core functions of ISM in the past few years. The quality of safety and ISM program and process procedures are indicative of a mature ISM system, and there were many positive actions that contributed to the safe conduct of work. Notwithstanding the improvements identified, the observed deficiencies indicate that supervisors and workers do not always ensure strict procedural compliance and sometimes make non-conservative decisions about how and when to apply procedural requirements or work package requirements and controls. In some cases, there is evidence of an overreliance on individual expertise and knowledge, without applicable reference to site procedures and requirements, resulting in unnecessary exposure to hazards. The maintenance of a culture based on safely conducting work in accordance with approved procedures and work packages is a significant management challenge that must be continuously addressed to prevent erosion of the improvements realized from the ISM implementation efforts of the past several years.

E.4 RATINGS

The ratings of the first four core functions reflect the status of the reviewed ISM program elements at INEEL facilities managed by BBWI.

Core Function #1 – Define the Scope of Work.................................. EFFECTIVE PERFORMANCE
Core Function #2 – Analyze the Hazards... EFFECTIVE PERFORMANCE
Core Function #3 – Develop and Implement Hazard Controls..................... NEEDS IMPROVEMENT
Core Function #4 – Perform Work Within Controls .... NEEDS IMPROVEMENT

E.5 OPPORTUNITIES FOR IMPROVEMENT

This OA inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are intended to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

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1. **Strengthen the documentation of the R&D IHR process to include additional instructions and guidance for researchers and to document management expectations for R&D work control.** Such instructions and guidance could define IRC management expectations with respect to:

    - Work definition, and the mandatory topics that must be included in the work scope (e.g., scope of the work, resources needed, location of the work, and interface requirements with IRC facility management)

    - IRC's graded approach to the identification and documentation of hazards (e.g., consideration of ordinary hazards and skill of the researcher, and criteria for when a hazard checklist is not sufficient for analyzing the hazards)

    - Pre-job reviews (how pre-job reviews are to be conducted, when a walkdown is recommended and/or required, and the conduct of pre-job reviews and walkdowns)

    - The process for revising an IHR and conducting annual IHR reviews

    - Considerations for developing and using procedures, checklists, experiment drawings, and vendor manuals

- Defining a safety envelope for the R&D project, and establishing a means for maintaining configuration control

- Options for identifying and analyzing potential off-normal events.

2. **Review the effectiveness of the Industrial Hygiene exposure assessment process as defined in MCP-153.** Specific actions to consider include:

   - Improve clarity in Industrial Hygiene exposure assessment letters to accurately reflect the specific work order and specific evolution that is being evaluated.

   - Eliminate or clarify “boilerplate” administrative controls, such as signs, medical surveillance, and procedures that do not provide specific guidance to line management.

   - When sampling or monitoring is performed in support of an exposure assessment, include the monitoring or sampling results, or a summary of the results, and the impact on the work activity (e.g., additional controls).

   - Ensure that all of the controls identified in the exposure assessment are incorporated into the work package. Reference the exposure assessment number and date in the work package. Periodically assess the effectiveness to which controls are being incorporated into work packages or IHRs.

   - If the industrial hygienist elects not to document the exposure assessment, include a brief explanation in the work package or IHR, particularly for those hazardous substances that may have significant health effects, or to which some individuals may be more susceptible, or for which the health effect has no threshold (e.g., beryllium, asbestos, and mold).

   - Consider advisory statements in the JSA for those chemical hazards that have low exposure limits and/or for which the health effect from exposure is not threshold dependant (i.e., beryllium). Advisory statements would be particularly useful to any INTEC workers in the Beryllium Surveillance Program by providing information about the likelihood of coming into contact with these materials.

3. **Conduct a review of Radiological Control requirements for current and planned RWPs within INTEC.** Specific actions to consider include:

   - Consider more aggressive job coverage and radiological survey performance as work tasks become more invasive or where extensive use of administrative controls and PPE is required.

   - Review RWPs for consistency of requirements. Examine potential conflicting requirements previously cited between ALARA reviews and RWPs. Ensure that Radiological Control reviews RWPs for consistency across all INTEC tank farm task-specific RWPs to ensure that appropriate controls are in place.

4. **Increase emphasis on rigor and formality associated with radiological work planning and control to ensure that a documented and justifiable technical basis for radiological decision-making is maintained.** Specific actions to consider include:

- Ensure that all radiological hazards associated with planned work are described in detail in work plans, HASPs, RWPs, and/or ALARA reviews and that the basis for establishment or elimination of potentially applicable controls is documented.

- Revisit and revise MCP-189 as necessary to identify expectations for conducting and documenting extremity monitoring evaluations and to include consideration of annual doses when determining the need for extremity monitoring.

- Review the 1996 Headquarters technical position on contamination limits for aging mixed fission products and determine its applicability to the INEEL radiation protection program.

- Improve checklists used in conducting ALARA reviews to ensure that a documented description of how each required element of the ALARA review has been incorporated into the proposed work.

- Establish worksheets to be used by RCTs and/or radiological engineers for computing task-specific projected doses to be used in determining the need for such controls as extremity monitoring.

- At the project level, ensure that it is clear in such work control documents as RWPs how ALARA review results have been incorporated into the project planning. Consider attaching additional sheets with narrative to the RWP to discuss why there was a need for an ALARA review and the unique hazards and/or important controls to be applied to the work.

- Review the radiological EDFs to verify that radiological program requirements are translated into procedures and checklists such that EDF requirements are consistently implemented across the site.

5. **Increase attention on ensuring adequate task breakdown and linkage between hazards and controls in work order work packages, consistent with STD-101.** Specific actions to consider include:

   - When developing work steps, review the task breakdown to ensure that all hazards associated with work that could be performed under the work step can be identified. If not, further subdivide work steps into discrete tasks with a manageable span of control.

   - During RWP development, ensure that pre-planning and task definition is sufficient to allow all specific RWPs to be easily associated with the work order step(s) to which they will apply.

   - Ensure work packages include references between specific RWPs that will be used and the corresponding work step(s).

   - When Industrial Hygiene exposure assessments and/or sampling results identify the need to change hazard controls, ensure that work control documents are updated to reflect the assessments and Industrial Hygiene requirements.

6. **Establish uniform site standards and requirements for line management to follow regarding confirmatory/job-specific bioassays for groups of radiological workers who are exposed to high hazards but are not required to participate in a routine bioassay program.** Specific actions to consider include:

- Develop an MCP, or incorporate into an existing internal dosimetry MCP, information that line management is expected to use to evaluate the need for confirmatory/job-specific bioassays as well as a specific regimen to be followed when implementing confirmatory bioassays. At a minimum, workgroup definition, worker selection criteria, frequencies, and the expected percentage of workers within each work group should be described.

- Review and update site internal dosimetry technical basis documents and individual facility EDFs as necessary to ensure consistent application of site bioassay requirements.

7. **Improve programs and practices associated with scaffold erection and inspection at INEEL.** Specific actions to consider include:

   - Consider revising the scaffold program requirements document to make the use of the scaffold inspection checklists mandatory for the erection and inspection of all scaffolds.

   - Evaluate initial training and consider conducting periodic retraining that would ensure that scaffold erectors and inspectors maintain a high degree of knowledge and competence.

   - Consider using pictures, mockups, and practical demonstrations to verify and improve performance and compliance with OSHA scaffold requirements.

8. **Enhance worker safety provisions and supervisory and worker adherence to controls.** Specific actions to consider include:

   - Review configuration management and modification thresholds for changes, which may not be on authorization bases or mission critical equipment but can affect work safety (lifting lugs, containment tents, system changes, etc.), to ensure that thresholds trigger appropriate engineering reviews.

   - Force account workers to attend and consider sending supervisors to the ten-hour OSHA safety course (or similar course) in order to improve recognition of safety deficiencies on construction and D&D work sites (those who have not attended).

   - Consider developing and using an excavation checklist to ensure that excavations are initially done correctly and are maintained in a safe condition while work is being performed.

   - Reemphasize management commitment to strict compliance with requirements, including the need to stop work and change procedures, work orders, and other work instructions when necessary.

   - Ensure that supervisors and ES&H personnel understand and enforce management expectations for compliance with requirements.

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APPENDIX F

Essential System Functionality

F.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluated essential system functionality of selected systems at the Idaho National Engineering and Environmental Laboratory (INEEL) Advanced Test Reactor (ATR). INEEL is managed and operated for DOE by Bechtel BWXT Idaho, LLC (BBWI), and line management responsibility for operations and safety falls under the Manager of the Idaho Operations Office (ID).

The purpose of an essential system functionality review is to evaluate the functionality and operability of a facility's systems and subsystems essential to safe operation. The review criteria are similar to the criteria for the Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2000-2 implementation plan reviews; however, OA reviews also include an evaluation of selected portions of system design and operation.

For this inspection, the OA team selected for review those systems designed to mitigate loss of coolant accidents (LOCAs) at the ATR. The ATR is a 250 MWth nuclear reactor designed for studying the effects of intense irradiation on materials. The reactor fuel is aluminum clad metallic uranium and the reactor operates at high neutron and heat flux. Because of the properties of the fuel and heat flux, forced water flow cooling of the fuel is needed to prevent reactor core damage in the initial stages of a LOCA. The primary system for mitigating LOCAs at the ATR is the Emergency Firewater Injection System (EFIS). The LOCA primary coolant pump (PCP) shutoff system complements the EFIS.

The OA team's review of these systems focused on elements of system design, configuration control, surveillance and testing, maintenance, and operations that are important to ensuring that the systems can perform their safety function. The OA team performed a detailed analysis of the safety basis of the systems, including a critical review of parameters and assumptions made in safety analysis reports (SARs).

F.2 RESULTS

F.2.1 Design and Configuration Control

Design. The ATR was designed and constructed in the 1950s and 1960s according to the design and safety standards in place at that time. Since its original design, ATR systems have been modified on several occasions to enhance protection against potential LOCAs. System modifications include a number of seismic upgrades, the addition of an upper-level injection system to the EFIS, and the addition (in 1999) of the LOCA PCP shutoff system. In addition, the ATR safety basis document has been revised on several occasions and some updated safety standards have been adopted, including facility-specific general design criteria based on the Nuclear Regulatory Commission (NRC) nuclear power plant general design criteria.

The engineering staff responsible for the safety analysis of the ATR demonstrated competence in their areas of their responsibility. For example, the staff was knowledgeable of the pertinent plant design specifications, was highly motivated, and demonstrated a strong sense of awareness and ownership of their assigned responsibilities. The ATR design staff and supporting engineering organizations have performed a large number of technical analyses utilizing sophisticated codes.

However, the following design analysis weaknesses identified during this review raise concerns about the adequacy of the ATR design to mitigate all potential LOCAs:

- **Vortexing in the primary coolant surge tank was not considered in the LOCA PCP shutdown system design analyses to show that air entrainment into the primary coolant system (PCS) would be precluded.** The LOCA PCP shutdown system is designed to shut down the PCPs 65 seconds after a LOCA to prevent drawing the surge tank level down to the point where air could be drawn into the primary system. Air in the system could negatively affect PCP performance and reactor core heat transfer. The supporting design analyses did not account for vortexing as the water level approaches the tank bottom, which could allow air entrainment earlier than predicted. Further evaluation is needed to determine whether the current system will perform as required under all potential LOCA conditions.

- **The introduction of air into the reactor from the normally dry piping between the level control (injection) valves and check valves for both upper and lower EFIS subsystems was not analyzed.** The description of the EFIS in the SAR recognizes that the piping between the level control valves and the check valves is connected to a drain and therefore is essentially dry (this design is to prevent back leakage of primary coolant). However, the phenomena associated with transporting air into the reactor vessel and potentially into the core upon EFIS actuation during a LOCA were not analyzed in the SAR.

- **Failure of the PCS surge tank vent line was not considered in the updated accident analysis**. The maximum design basis break size identified in the updated final safety analysis report (UFSAR) was a three-inch equivalent break in PCS piping outside the radiographic boundaries. The OA team identified two potentially more limiting break locations: the two-inch vent line from the primary surge tank to the primary degassing tank, and the one-inch air supply line to the surge tank. These lines are not within the radiographic boundary or upgraded seismic analyzed boundary. Although these lines were addressed in earlier UFSARs supporting safety analyses and were found to be enveloped by the three-inch line break, these lines were not addressed when the UFSAR analyses were updated to support the current UFSAR using improved models. In response to OA team questions, the ATR staff performed new preliminary analyses using the improved models, which indicated that one aspect of the three-inch line break might not be enveloping. Specifically, a break in these lines could vent the pressurizing air from the surge tank rapidly and thereby cause a more rapid decrease in PCS pressure than is currently analyzed. This more rapid pressure decrease could have two negative effects on core cooling that are not currently analyzed: (1) at the very high decay heat rate during the first few seconds after reactor trip, the low PCS pressure may allow core boiling, which would dramatically reduce heat transfer, and (2) the minimum required net positive suction head (NPSH) for the PCPs is reached much sooner (per the ATR staff, as early as 15 seconds into the event versus the 30 seconds currently predicted by the analyses), at which point PCS flow would be dramatically reduced, also contributing to reduced core cooling at a point in time where core heat flux is still very high.

- **The potential for reactor coolant system or reactor core damage because of PCP failure when running under severely inadequate NPSH conditions has not been adequately analyzed.** For the largest design basis LOCA, the PCPs, which must continue to operate for at least 60 seconds to maintain core cooling, reach a condition of severely inadequate NPSH at about 30 seconds (per the current analyses), at which point pump flow will drop dramatically, and severe cavitation would be expected. Although ATR analyses showed that the reduced pump flow would provide adequate core cooling and flow margins, there was no objective evidence that the PCPs could survive the strong cavitation and pump interaction. Mechanical failure of these pumps could create the potential for reactor coolant system damage or emergency cooling pump flow diversion due to PCP check valve damage. These phenomena associated with potential pump failure have not been adequately analyzed.

These weaknesses each had one or more of the following attributes: (1) failure to consider all accident phenomena in the accident analyses, (2) insufficient analysis of some potential accidents, and (3) inadequate justification for assumptions relied on to support the accident analysis.

Finding #6: Some potential accidents and accident phenomena have not been adequately analyzed and documented to provide assurance that ATR safety systems are capable of mitigating LOCAs in accordance with the ATR UFSAR.

On August 21, 2003, ATR management decided to shut down the ATR to evaluate the delay in emergency firewater injection caused by air contained in the firewater injection lines. This delay had not been considered in the UFSAR LOCA analysis.

As discussed previously, INEEL contractors have taken steps to improve ATR capability and have performed numerous technical analyses. Furthermore, BBWI has taken aggressive actions to address the concerns identified by the OA team during this assessment. However, the following concerns were not identified by BBWI or previous site contractors, indicating several potential underlying factors that may reduce the effectiveness of engineering evaluations and safety analyses:

- **Insufficient questioning of assumptions and attention to detail.** Although over past years, many design concerns have been identified and addressed by the ATR staff, some of the dispositions of concerns (that were reviewed by the OA team) appear to have insufficient depth and attention to detail to ensure that they were adequate to resolve the original concern and did not create new concerns.

- **Pressures of day-to-day priorities inhibit backward-looking reviews.** INEEL personnel indicated that pressure to meet day-to-day engineering demands and schedules was a steadily increasing challenge, especially in view of continuing reductions in engineering resources.

- **Ineffective critical self-assessments and independent checks.** Current processes do not provide sufficient review of the technical adequacy of the design and authorization basis.

- **Inadequate review of industry experience.** The identified vortexing concern has a long history of recognition and corrective action by the nuclear power industry, indicating a lack of effective review of nuclear power industry experience and/or personnel with nuclear power industry –experience in the organization.

Configuration Control. Configuration control is important to maintain the safety basis and tools (such as working drawings and procedures) that are used in the day-to-day operations of the facility. For older facilities, such as ATR, effective configuration control may require reconstituting design information that was not properly or adequately captured previously.

BBWI has established some elements of a configuration management program, including the unreviewed safety question process and procedure revision protocols. For example, BBWI has a modification procedure that specifies requirements for making modification and associated actions (e.g., identifying documents, such as the SAR and piping diagrams, that need to be modified). In a number of cases reviewed by OA, these processes were implemented correctly.

However, there are several configuration control weaknesses:

- **The SAR was not updated to reflect modifications made to the firewater supply tanks.** In the 1999 to 2001 timeframe, three aboveground firewater supply tanks were modified such that the volumes in the tanks were reduced from 500,000 to 375,000 gallons. However, the SAR was not modified as required by the modification procedure. The document change packages for two of the tank modifications did not identify the SAR as an affected document; the change package for the third modification identified the SAR as an affected document, but the SAR change was not performed.

- **BBWI has not maintained adequate configuration control of documentation.** The piping and instrumentation diagram (P&ID) for the ATR EFIS does not reflect the actual piping configuration. For example, a substantial portion of the interconnected piping (not directly related to injection) was not included in this P&ID (nor was there a reference to a P&ID), which details this piping. Furthermore, this P&ID did not identify a drain valve (GB-874) upstream of the level control valve or a radiation monitor on the upper firewater injection line. The failure to identify the drain valve contributed to this valve not being identified as a safety-related valve needed in the EFIS valve alignment checklist for ensuring EFIS operability. In addition, BBWI does not have a formal system to control superceded calculations to ensure that the appropriate revisions are used.

- **The PCS surge tank level limits were not calculated in accordance with the facility procedure and contain some errors.** The surge tank upper and lower tank level limits ensure that the tank air volume is within the bounds established by the accident analyses, and are included in the technical safety requirements (TSRs). This calculation of these limits was not formally generated, reviewed, and approved as required by the facility calculation procedure. Additionally, the calculation did not contain any documented links between the TSRs, the physical arrangement of instrument hardware, and the readout instrument indications. Further, the calculation of volume versus level, which formed the basis for these limits, did not correctly account for the tank geometry. BBWI corrected this discrepancy promptly, and initial BBWI evaluation indicates that this error is not likely to impact safety.

- **BBWI has not implemented a fully effective program ("system interaction program") for identifying and analyzing non-safety components that could impact safe ty components.** The SAR requires evaluation of system interaction; however, BBWI does not have a formal program for identifying non-safety components that could impact safety components, guidance on evaluating such interactions, or a process for involving engineers from both the Operations and Systems organizations in these evaluations. This deficiency was identified during OA's walkdown of the EFIS, when questions were raised about the adequacy of the installation of non-safety nitrogen cylinders used for the EFIS.

- **There is insufficient documentation supporting the UFSAR statement that the Test Reactor Area (TRA) large diameter fire protection system piping does not fail during an earthquake.** The EFIS is connected to the TRA fire protection system. If non-safety piping fails, the EFIS may not deliver sufficient flow to the ATR core. Although the UFSAR stated that this piping will not fail, documentation of the analysis supporting this assertion was not complete. The ATR staff walkdown and preliminary evaluation concluded that this piping would most likely survive the safe shutdown earthquake; however, this was not a rigorous evaluation. ATR plans to perform further detailed analysis to support the UFSAR statement.

As discussed in Appendix C, BBWI identified a legacy concern associated with the adequacy of as-built drawings and information. In addition to controlling risk and preventing further degradation, BBWI's closure plan for this concern included a provision for obtaining funding and implementing a recovery project for identifying, prioritizing, and resolving legacy as-built deficiencies. However, this effort was not funded in accordance with the DOE and BBWI processes for determining priorities and allocating available resources.

Finding #7: **DOE has not supported and BBWI has not implemented an effective configuration control program to ensure that the ATR design meets all technical and procedural requirements as required by PRD-115, *Configuration Management*.**

In summary, ID, BBWI, and previous contractor organizations have implemented a number of modifications to improve the capability of the ATR to mitigate LOCAs, and established some elements of a configuration management program. However, a number of important assumptions made in the safety basis have not been adequately documented or justified. In addition, an important physical phenomenon, vortexing in the PCS surge tank, was not considered in the supporting analyses for the 1999 upgrade to the ATR. Furthermore, BBWI's configuration control program has some significant deficiencies that could adversely impact the reliability of the EFIS and LOCA PCP shutoff system. Because of these design and configuration control deficiencies, the systems may not function as intended during a LOCA.

F.2.2 Surveillance, Testing, and Maintenance

Surveillance and testing of the EFIS and LOCA PCP shutoff system is governed by the TSRs. The TSRs establish appropriate requirements for functional testing of critical components at a frequency to assure operability of the components. The TSR surveillance and test acceptance criteria are appropriately based on the UFSAR. In addition, a TSR basis document was developed to describe the rationale for the acceptance criteria and test frequencies.

Most BBWI surveillance and test procedures are complete, clear, and concise, and have the appropriate level of detail and data sheets. Workers are involved in procedure improvements and have appropriately corrected, updated, and improved several procedures reviewed by the OA team. Surveillance, testing, and inspections are conducted at their prescribed frequencies and have been appropriately performed and documented. In addition, the system engineer has performed some trending of surveillance results, such as the EFIS injection valve stroke time.

ATR personnel have developed an effective tracking program specifically for the purpose of managing the numerous surveillances scheduled and performed during outages and start-ups. The program develops a comprehensive package for each outage (contained in the ATR reactor cycle control document and the periodic checks document) that lists the required procedures to be performed prior to the start of the next cycle. Using the ATR surveillance tracker database, the OA team performed a random sampling of the past two years of surveillances; no examples were identified in which surveillances were missed or performed beyond the frequency limits.

One surveillance procedure had some critical technical flaws such that it did not appropriately test the operability of a firewater pump. Specifically, the "Emergency Fire Water Pumps In-service Functional Test" procedure contains a flow test acceptance criterion that is less than the EFIS injection flow analyzed in the SAR. Additionally, no apparent linkage was established between the test acceptance criteria and EFIS injection flow used in the SAR. Therefore the pump could be determined to be operable by the surveillance even though it does not meet the SAR limits. This situation could result in a TSR limiting conditions for operations (LCO) not being met. However, actual pump flows recorded for the surveillance records reviewed by the OA team were not below the SAR limits.

Additionally, fire protection pump surveillances are not performed in accordance with the surveillance requirements of American Society for Mechanical Engineering (ASME) Section XI, which are committed to in the ATR in-service inspection (ISI) plan. Specific deficiencies include:

- ASME requirements for establishing a test reference value based upon results of pre-service testing or from the results of the first in-service test have not been met. There is no specific test reference value specified in the procedure (and no documentation that one was ever established).

- ASME requirements to establish an acceptance criterion that is no more than 10 percent deviation from the reference value have not been met. For example, diesel pump #2 and the electric driven pumps have an acceptance flow of 1,200 to 5,000 gallons per minute (gpm). This range is much larger than 10 percent of a reference value (even if one had been established).

- ASME requirements for accuracy of results (within 2 percent) have not been met. The surveillance procedure allows for diesel driven pumps to operate in the range between 1,700 and 1,900 revolutions per minute (rpm). This range was specified because of the limited accuracy of the instruments.

- ASME requirements for actions to be taken if the test results are outside of the acceptance criteria have not been included in the surveillance procedure.

Finding #8: BBWI has not established a technically adequate surveillance program for testing the operability of the ATR firewater pumps as required by TSR LCO 3.2.1.2, surveillance requirement 4.2.1.2.8, and UFSAR Chapter 14.

In addition to the specific technical concerns identified with the emergency firewater pump surveillance procedure, several errors were introduced into surveillance procedures during procedure revisions. For example, incorrect step references, TSR references, ordering of steps, and footnotes were identified. Some of these errors could impact safety. For example, a TSR acceptance criterion was increased from 3,500 gpm to 5,000 gpm, and a changed footnote contributed to problems in meeting ISI requirements for the EFIS check valves. These errors were not identified by the ATR internal procedural review process, indicating a need for more rigorous review and quality assurance.

Finally, a concern was identified with ATR's implementation of ISI requirements for the EFIS injection check valves. Specifically, the testing, inspection, and maintenance requirements of the ISI plan for EFIS upper and lower injection check valves have not been performed since 1994. Because full flow testing of the check valves was not a viable option for the 100-day functionality test, ATR committed to adhere to the ASME Section XI requirements in their ISI plan to ensure proper functioning of the upper and lower EFIS system check valves. The commitment required that one of the four lower check valves be removed and inspected for excessive wear or corrosion every two years (and that they be sequenced so that all are inspected within eight years) to ensure full operability of the valves. ATR personnel's best estimates indicate the valves were last removed and inspected during the previous core internal change-out in 1994.

Finding #9: BBWI has not implemented the ASME Section XI inspection requirements for the EFIS check valves specified in the ISI plan referenced in UFSAR Chapter 14.

In addition to the TSR surveillance program, BBWI performs a large number of preventive maintenance (PM) activities on the ATR as a whole, and some PM activities (e.g., instrument calibrations) on the EFIS and LOCA PCP shutoff system. An effective PM program is important to minimize failures and increase reliability. Personnel who perform maintenance activities were experienced and had a good understanding of the components and operating history.

Based on staff experience, judgment, and funding considerations, BBWI has decided to utilize TSR surveillances performed on the components of the EFIS and LOCA PCP to determine when corrective maintenance needs to be performed on many EFIS and LOCA PCP system components rather than utilizing a conventional PM program, and thus has only two PM activities for these systems. BBWI has adopted a philosophy that adherence to the TSRs will adequately ensure operability and reliability of the EFIS and LOCA pump shutoff system. In effect, this philosophy results in running system components until an obvious failure occurs or a failure is detected in a test, rather than performing PM to condition, repair, or replace equipment prior to failure. However, this approach does not account for safety equipment not addressed by the TSRs. In addition, two specific deficiencies were noted with this approach.

- ATR did not review, evaluate, and perform the recommended PM called for in the vendor manual for the upper firewater injection system level control valves. These valves currently have substantial leakage through the packing as a result of corrosion and pitting of the valve stem. Efforts to reduce the leaking (e.g., tightening the packing) have caused valve stroke times to exceed TSR limits and have been discontinued.

- No PM has been specified for the safety-related, normally-energized solenoid valves that control the level control valves; a vendor manual for the solenoids was not available at the ATR.

The ATR corrective maintenance program is effective in keeping the maintenance backlogs for the EFIS and LOCA PCP acceptably low. Most recent corrective maintenance activities have focused on repairing the leaking level control valves, which are currently scheduled for replacement.

In summary, BBWI performs most TSR-required testing and surveillance effectively and has a systematic process for tracking TSR surveillance and tests. However, one test procedure has deficiencies that could result in an inadequate determination of operability in accordance with SAR parameters, and ISIs for some critical components have not been performed. While corrective maintenance backlogs are low, BBWI has only a limited PM program for the two systems reviewed by the team, and some components are not adequately maintained. The deficiencies in surveillance and testing and PM programs reduce the assurance of operability and reliability of safety-related components.

F.2.3 Operations

The OA team evaluated operating procedures and operator training to determine how well operators are prepared to take appropriate actions in case of a LOCA (focusing on the operation of the EFIS and LOCA PCP shutoff system). Furthermore, the OA team evaluated normal operations as they pertained to ensuring the EFIS and LOCA PCP shutoff system were in the proper operating configuration.

ATR has established a good set of operating procedures to guide normal and emergency operations for the safety systems under review. The procedure set includes: valve lineups for restoring systems to operable status, alarm response procedures, abnormal operating procedures, and the emergency procedure network (EPN) set of procedures. The EPN procedures are based on the commercial nuclear pressurized water reactor emergency operating procedures and include optimal and functional recovery procedures. These procedures provide redundant methods for mitigating accidents and are organized to place emphasis on mitigating the worst conditions while keeping track of other important parameters (such as reactor building confinement).

The operations training and qualification program is well defined and appropriate for preparing operations personnel to operate the ATR under normal and upset conditions. The program is described in a TRA training program document and includes qualification/certification requirements for trainers and operating personnel (e.g., reactor operators and senior reactor operators). For example, reactor operator certification requirements include reactor operator school attendance, reactor operator on-the-job training checklist completion, a minimum of six months' experience as a certified Experiment Operator at ATR, a comprehensive written examination, operational evaluation, and oral examination by a TRA oral board. Furthermore, reactor operators and senior reactor operators are reevaluated biennially to retain their qualification. In addition, ATR has maintained a simulator to provide hands-on training, including training on response to such emergency situations as LOCAs, and has established a five-shift operating staff rotation to support its extensive training activities. The resources and attention devoted to the operations training and qualification program demonstrate management support to this important aspect of safe operation of the ATR.

Furthermore, the Operations Department has taken aggressive actions to minimize operator errors. The ATR Operations Department developed a training class based on the Institute for Nuclear Power Operations (INPO) human factors program. Operators have been provided with "task preview" cards ("yellow cards") to refer to when doing work to minimize error precursors. Refresher classes use case studies and focus on error precursors to emphasize the benefits of the program. The Operations Manager is continuing to work to emphasize the need to eliminate any errors.

Notwithstanding the many positive aspects of ATR operations, one procedural weakness was identified that could impact safety. The LOCA "Optimal Recovery" emergency operating procedure includes a reference page used in parallel with the main procedure that can cause some important steps in the main procedure to be skipped (such as closing primary coolant valves). This problem was observed during an operator training exercise on the simulator. The ATR Operations Department has initiated action to correct this problem.

Other aspects of procedures that did not have direct impacts on safety but that could be clarified included:

- An alarm response procedure did not adequately address human factors considerations. One section was isolated from the next, with a mostly blank page that did not include a caution to continue to the next section (an operator using this procedure during an interview did not go on to the section after the mostly blank page).

- No instructions are provided about acceptability of resetting LOCA pump timers if they are inadvertently started (which has occurred in the past).

- The Operations Department does not have a high-level/summary procedure that details how the EPN procedures set (functional and optimal recovery procedures) should be used. Such a procedure would be beneficial because the multiple procedures may be entered concurrently depending on event conditions. In addition, multiple operations shift personnel may be using a procedure concurrently. Training is provided on procedure usage, and a 1991 vintage EPN user guide is referenced as part of the training and provides some useful information. However, it is important that the expectation for procedure use is clear.

In addition, although reactor operators and senior reactor operators demonstrated good understanding of the purpose and operations of the EFIS and LOCA pump shutoff systems during interviews and a plant walkdown, some weaknesses were identified with understanding of setpoints for activating the LOCA pump shutoff timers.

In summary, BBWI has established a good program (training and qualification) to prepare personnel to operate the EFIS and the LOCA PCP shutdown system. While a few aspects of procedures could be further improved, the ATR procedures provide detailed information and are effective in ensuring safe operations. Operators demonstrated good understanding of these systems (as well as the ATR's response to potential LOCAs), and they demonstrated the ability to utilize the emergency operating procedures to respond to potential LOCAs.

F.3 CONCLUSIONS

Although the ATR has undergone some significant modifications and re-analysis to improve its capability to mitigate LOCAs, a number of design weaknesses exist that raise concerns whether the LOCA mitigation systems reviewed (i.e., the EFIS and the LOCA PCP shutoff system) adequately protect against all potential LOCAs. The design weaknesses identified had one or more of the following attributes: (1) failure to consider all accident phenomena in the accident analyses, (2) insufficient analysis of some potential accidents, and (3) inadequate justification for assumptions relied on to support the accident analysis. In addition, the configuration management program for the ATR has some weaknesses that further reduce assurance that the systems reviewed will function as needed during a LOCA (e.g., the UFSAR and plant drawings are not maintained accurate).

BBWI has established a generally effective surveillance and testing program for the two systems reviewed, and the corrective maintenance program is keeping backlogs low. However, one surveillance test procedure had some deficiencies such that it was not an appropriate test for operability of some important components. Furthermore, ISIs for some critical components have not been performed, and the PM program for the EFIS has not been fully developed to maintain its reliability both in the near and long terms (e.g., vendor recommendations are not incorporated into the maintenance program).

ATR continues to have a strong program (e.g., procedures and training) for preparing operating personnel to take appropriate actions to operate these standby emergency systems in case of a LOCA. In particular, the ATR utilizes a reactor simulator for providing hands-on experience for responding to emergency conditions and has dedicated the resources for an extensive training program. Furthermore, BBWI management has taken some aggressive actions to improve operator performance and minimize errors.

Notwithstanding a number of positive aspects, the weaknesses identified in design, configuration management, PM, and surveillance testing raise concerns that, in worst-case scenarios, the systems may not function as intended to effectively mitigate a LOCA. ATR management should consider performing an ATR design evaluation that addresses the full range of potential concerns and potential design/operation changes to ensure that the ATR can be safely shut down in the event of a worst-case accident scenario. ATR management should also consider performing evaluations to identify and address root causes for the deficiencies in safety analysis, configuration management, testing, and maintenance, including a critical review of the funding support history as cost-effective corrective actions are identified. In addition, management should consider actions that ensure that a safety culture exists, promote a questioning attitude among the engineering staff, and demand the rigor and attention to detail necessary to meet the quality engineering standards associated with an operating nuclear reactor.

F.4 RATINGS

Design and Configuration Management ....SIGNIFICANT WEAKNESS
Surveillance, Testing, and Maintenance ....NEEDS IMPROVEMENT
Operations..EFFECTIVE PERFORMANCE

F.5 OPPORTUNITIES FOR IMPROVEMENT

This OA inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are intended to be reviewed and evaluated by the responsible line management, and accepted, rejected, or modified as appropriate, in accordance with site-specific program objectives and priorities.

1. **Establish and implement a plan to confirm the adequacy of the ATR safety design.** Specific actions to consider include:

   - Perform a critical verification review of all UFSAR and TSR/TSR bases' performance statements and technical data. Verify that all UFSAR and TSR/TSR bases' performance statements and technical data for safety structures, systems, and components are supported by analyses and/or documented sources.

   - Perform detailed reviews of these analyses and sources to verify their accuracy, correctness, completeness, validity, and conformance with commitments, codes, standards, and regulations. Document and correct errors identified in accordance with procedures.

2. **Enhance the configuration management program.** Specific actions to consider include:

   - Implement previously proposed plans to reconstitute and document the design basis.

   - Review engineering drawings to determine the essential set of drawings that needs to be controlled. Ensure appropriate references between drawings are provided.

   - Perform comparison walkdowns of all safety structures, systems, and components against current design documents to verify their correctness and completeness.

   - Develop a database tool to facilitate tracking the completion of changes to affected documents to reflect design changes.

3. **Upgrade the existing industry experience review program.** Specific actions to consider include:

   - Upgrade the ATR's existing industry experience review program to include documents published by the NRC and the commercial nuclear power industry that may also benefit ATR in all of the areas reviewed by this assessment, including design, analyses, surveillance and testing, maintenance, and operations.

   - Participate in events sponsored by the American Nuclear Society, where such information is commonly exchanged.

4. **Establish a program of periodic technical self-assessments of essential system functionality for selected systems that includes detailed assessment of parameters, assumptions, and authorization bases.** Specific actions to consider include:

   - Focus initially on technical performance and compliance. (The results of the technical assessments can provide starting points for effective follow-on procedural/work management assessments.)

- Establish an assessment team with a mix of outside, recognized industry technical/assessment experts and onsite technical staff to best utilize the expertise and objectivity of the outside experts and the site-specific knowledge and technical expertise of onsite personnel. Ensure that onsite staff work closely with outside experts to take optimum advantage of knowledge transfer to the onsite staff.

5. **Strengthen the EFIS and the LOCA PCP shutoff system surveillance and test program.** Specific actions to consider include:

   - Assess pump surveillance procedures for compliance with ASME Section XI requirements (current as well as future, in preparation for the next update).

   - Assign responsibility for all aspects of ISI surveillance testing, including pump and valve testing, to an individual or organization with the appropriate expertise, training, resources, and accountability.

   - Focus on increasing attention to detail during performance of quality reviews for technical documents (TSR surveillance procedures) to eliminate administrative errors.

6. **Enhance the PM program to improve the reliability of important components.** Specific actions to consider include:

   - For critical components, recover applicable vendor manuals for review and incorporation of vendor PM recommendations into procedures.

   - Review and analyze the inclusion of the EFIS and the LOCA PCP system in the PM program.

   - Expedite the acquisition of spare check valves for the EFIS system, and conduct the appropriate inspection of all affected check valves (per ISI) that were not inspected as scheduled.

   - Review specifications for the LCV-CC-1-615 and LCV-CC-1-616 valves to ensure that they are appropriate for their intended application. Evaluate whether a different valve type would be appropriate for this application.
   - Review the ISI report and plan to ensure that all inspections are completed as required.

7. **Enhance operations procedures to improve usability.** Specific actions to consider include:

   - Develop a reference/basis document that explains the purpose for important setpoints and actions in the emergency procedures.

   - Develop a high-level/summary procedure that delineates expectations for use of the EPN in the control room.

   - Develop guidelines for performing procedure reviews (e.g., system engineering involvement and when training is required).

   - Add setpoints to alarm response procedures rather than referring the user to additional procedures (which could slow response time during abnormal or emergency conditions).

- Review reference pages of the EPN procedures to ensure that steps are logically ordered so that the actions can be performed prior to exceeding the criteria for the action (e.g., inject *prior* to exceeding 200 F).

- Clarify linkage between the two documents that are used to define and verify the critical firewater path.

- Walk down the valve alignment checklist with an operator(s) in the field to ensure that all valves are appropriately identified on the checklist and the P&ID and that they are appropriately labeled. Add references in the checklists procedure that identify the P&ID(s) utilized in developing the checklists.