Volume I

Inspection of
Environment, Safety,
and Health Management
at the

Oak Ridge Operations Office
and
East Tennessee Technology Park

May 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
OAK RIDGE OPERATIONS OFFICE AND
EAST TENNESSEE TECHNOLOGY PARK

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Table of Contents

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Acronyms

AHA	Activity Hazard Assessment
AMEM	OR Assistant Manager for Environmental Management
ARAR	Applicable or Relevant and Appropriate Requirements
BCS	Boundary Control Station
BJC	Bechtel Jacobs Company
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COR	Contracting Officer's Representative
CY	Calendar Year
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
EE/CA	Engineering Evaluation/Cost Analysis
EM	DOE Office of Environmental Management
EM-3	EM Chief Operating Officer
EMWMF	Environmental Management Waste Management Facility
ES&H	Environment, Safety, and Health
ETTP	East Tennessee Technology Park
EWP	Enhanced Work Plan
FRAM	Functions, Responsibilities, and Authorities Manual
FY	Fiscal Year
HASP	Health and Safety Plan
HEPA	High Efficiency Particulate Air
ICATS	Issues and Corrective Action Tracking System
ISM	Integrated Safety Management
MSDS	Material Safety Data Sheet
NCR	Non-Conformance Report
OA	Office of Independent Oversight and Performance Assurance
OJT	On-the-Job Training
OR	Oak Ridge Operations Office
ORPS	Occurrence Reporting and Processing System
OSHA	Occupational Safety and Health Administration
PAAA	Price-Anderson Amendments Act
PAPR	Powered Air Purifying Respirator
PCB	Polychlorinated Biphenyl
PCM	Personnel Contamination Monitor
PPE	Personal Protective Equipment
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RWP	Radiation Work Permit
SME	Subject Matter Expert
S/RID	Standards/Requirements Identification Document
SSC	Structures, Systems, and Components
STR	Subcontractor Technical Representative
TLD	Thermoluminescent Dosimeter
TSCA	Toxic Substances Control Act
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination
WGS	BJC Waste Generator Services
WSS	Work Smart Standards

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INDEPENDENT OVERSIGHT INSPECTION OF ENVIRONMENT, SAFETY, AND HEALTH MANAGEMENT AT THE OAK RIDGE OPERATIONS OFFICE AND EAST TENNESSEE TECHNOLOGY PARK

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) East Tennessee Technology Park (ETTP) site in April-May 2003. The inspection was performed as a joint effort 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 ETTP ES&H programs. The results of the review of the ETTP emergency management program are discussed in Volume II of this report, and the combined results are discussed in a summary report.

At DOE Headquarters, the DOE Office of Science is the landlord for the Oak Ridge Reservation. The Office of Environmental Management (EM) has primary line management responsibility for the closure project at ETTP. As such, EM has overall Headquarters responsibility for programmatic direction, funding of activities, and ES&H at the site. At the site level, line management responsibility for ETTP operations and safety falls under the Manager of the Oak Ridge Operations Office (OR). Within OR, the Office of the Assistant Manager for Environmental Management (AMEM) is responsible for ETTP. The ETTP site is managed and operated by the Bechtel Jacobs Company, LLC (BJC). BJC has a management and integration contract with DOE, and uses subcontractors to perform most work activities. BNFL PLC performs decontamination and decommissioning (D&D) activities under a separate contract with DOE, managed through the OR Asset Utilization organization.

The ETTP site is located on the DOE-owned Oak Ridge Reservation in eastern Tennessee about 12 miles from downtown Oak Ridge, Tennessee, and about 20 miles from Knoxville, Tennessee. ETTP's historical mission involved enrichment of uranium using the gaseous diffusion process. The various activities associated with the enrichment process involved large quantities of radioactive materials, generated various radioactive and hazardous wastes, and resulted in contamination of operational facilities. Enrichment operations were discontinued in 1987.

The current missions of the ETTP site include managing radioactive wastes, maintaining facilities pending their disposition, characterizing hazardous materials and conditions, D&D of facilities, and environmental cleanup and restoration for the eventual site transition to public use. In addition, ETTP currently leases selected facilities to private-sector companies as part of its site reindustrialization effort. ETTP activities involve various potential hazards that need to be effectively controlled, including exposure to external radiation, radiological contamination, hazardous chemicals, and various physical hazards associated with facility operations (e.g., machine operations, high-voltage electrical equipment, hoisting and rigging heavy loads, and noise).

Throughout the inspection of ES&H programs, OA reviewed the role of EM and OR in providing direction to contractors and conducting line management oversight of contractor activities. OA is placing more emphasis on the review of contractor self-assessments and EM and OR line management oversight in ensuring effective ES&H programs. In reviewing line management oversight, OA focused on the effectiveness of OR in overseeing ETTP contractors, including such management functions as setting expectations, providing implementation guidance, monitoring and assessing contractor performance, and monitoring and evaluating contractor self-assessments.

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

- OR and ETTP contractor 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), including OR and ETTP efforts to address the new 10 CFR 830, Subpart B, requirements for the safety basis of nuclear facilities.

- OR and ETTP contractor feedback and continuous improvement systems.

- BJC implementation of the core functions of safety management for various work activities, including subcontracted work, asbestos abatement, waste management, and radiological work.

- BNFL implementation of the core functions of safety management at the Three Building D&D Project (K-29, K-31, and K-33), including operation of the supercompactor, hoisting and rigging, radiological work, industrial hygiene monitoring, waste management, radiological characterization, and contamination control.

The OA inspection team used a selective sampling approach to determine the effectiveness of OR and ETTP in implementing DOE requirements. The approach involved examining selected institutional programs that support the ISM program, such as OR, BJC, and BNFL assessment programs. To determine the effectiveness of the institutional programs, the OA team examined implementation of requirements at selected ETTP organizations and facilities. Specific work activities that were reviewed included decontamination, plasma arc cutting, equipment removal, asbestos abatement, maintenance, and waste management. OA focused on implementation of selected safety requirements during these work activities, including subcontractor work control processes, flowdown of ES&H requirements to subcontractors, medical program requirements, asbestos requirements, radiological work planning and permits, control of air contaminants (e.g., metals and radiological), noise abatement, injury and illness recordkeeping, hoisting and rigging requirements, and radiological controls.

Section 2 of this volume provides an overall discussion of the results of the review of the ETTP ES&H programs, including positive aspects and weaknesses. Section 3 provides OA's conclusions regarding the overall effectiveness of OR and ETTP 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 OR and contractor feedback and continuous improvement processes. Appendices E and F provide the results of the review of the application of the core functions of ISM for the selected BJC and BNFL activities, respectively.

2.0 RESULTS

2.1 Positive Attributes

Although a number of implementation deficiencies were observed, the work control systems provide an effective framework for identifying, analyzing, and controlling hazards. Most work observed by OA was performed with a high regard for safety. As discussed below, some aspects of EM, OR, BJC, and BNFL ES&H programs are particularly effective.

EM has provided significant management attention and resources to ensure effective implementation of 10 CFR 830, Subpart B, by BJC at ETTP and other BJC-managed facilities. EM established a Safety Basis Special Project Team in early 2003 to support development, review, and approval of the documented safety analyses (DSAs) required by 10 CFR 830, Subpart B. The Project Team was staffed with 22 members from EM, OR, and other EM sites, selected for their qualifications and performance on similar tasks. Support provided to BJC by the Safety Basis Special Project Team was instrumental in meeting the regulatory due date for submitting the DSAs. The revised DSAs are a significant improvement over the previous ETTP authorization bases.

OR and BJC have worked together effectively to strengthen the site-specific ES&H requirements. The DOE/BJC contract, which applies to facilities and activities at ETTP and two other DOE sites, contains a comprehensive set of ES&H requirements covering the broad scope of work and range of hazards associated with work at these three sites. These requirements have been tailored to each site, consistent with DOE policy and guidance, through a Work Smart Standards process and a standards and requirements identification process. In recent months, BJC has taken a number of steps to improve contractual requirements and ensure that requirements flow down to the working level. Subject matter experts have reassessed the adequacy of contractual requirements, resulting in the appropriate addition of some new requirements. ES&H subject matter experts have also made several changes in implementing procedures to ensure that contractual requirements flow down through company procedures and subcontracts. An external review of the requirements management program was performed to assess the effectiveness of these steps, resulting in further improvements. The OR and BJC efforts have resulted in significant improvements in the BJC Work Smart Standards, standards and requirements identification documents, and implementing procedures. The current requirements set is appropriate for the hazards at the site, and there is reasonable assurance that these requirements have been incorporated into BJC implementing documents. However, processes for updating the requirements need to be established, and processes for ensuring that requirements are incorporated into subcontractor and lower-tier subcontractor implementing documents need to be improved.

BNFL has established a good safety record, demonstrated a strong management commitment to improving worker safety, and actively involved the Knoxville Building and Construction Trades labor organization in the BNFL safety program. The BNFL safety record, as measured by rates of recordable injuries and illnesses and lost workday cases, is better than the general industry safety record for companies performing similar D&D-type work. Recently, BNFL's safety performance was recognized by the National Safety Council, and BNFL was awarded a second Certificate of Merit for having achieved one million hours of work without a lost-time injury. The National Safety Council also awarded BNFL the Excellence Achievement Award, for having attained a lost-workday case rate less than one half the national average rate for similar industries as defined by the Bureau of Labor Statistics. BNFL management commitment to improving worker safety has contributed to the good safety record. The BNFL Joint Labor/Management Safety Committee has been effective in encouraging an open exchange of safety issues between BNFL management and labor. The Knoxville Building and Construction Trades organization has been active in promoting workers' safe behavior. The BNFL Safety Committee and subcommittees have also been proactive in identifying and resolving safety concerns, and

in promoting a safety-conscious approach within the workforce. BNFL management has also demonstrated commitment to safety by devoting resources to hazard controls that improve the overall working environment. For example, to control potential exposure hazards from airborne contaminants, BNFL has provided its workers with state-of-the-art respirators, even though BNFL could have met the requirements by using measures that were less expensive, and less comfortable for the workers. BNFL has also established or improved a number of facility engineering controls, resulting in improved safety and working conditions. For example, to minimize the use of temporary electrical grounding connections and avoid electrical shock hazards, BNFL installed ground fault circuit interrupter receptacles throughout Buildings K-29 and K-31. In response to a behavioral-based evaluation conducted by the BNFL Safety Committee, BNFL also replaced the central lighting in Buildings K-29, K-31, and K-33 to reduce the need for portable lighting.

Safety has been appropriately integrated into the BJC procurement process. As a management and integration contractor, BJC uses subcontractors to perform most work activities, including the potentially hazardous work. Therefore, BJC has taken effective steps to ensure that ES&H is appropriately considered in the procurement of services to work at ETTP. Bidders on BJC subcontracts are prequalified based upon their past safety performance. ES&H subject matter representatives are involved throughout the procurement process, from development of requests for proposals to development of final contracts. Safety requirements to be included in subcontracts are updated and tailored for specific subcontracts by ES&H subject matter experts. The BJC requirements management process ensures that changes to ES&H requirements in the DOE/BJC contract are incorporated into BJC subcontracts when applicable. However, implementation of requirements by subcontractors and lower-tier subcontractors needs improvement.

2.2 Program Weaknesses

Although the framework for the ETTP ISM program is in place, weaknesses were identified in some important aspects of ISM systems, work control processes, implementation of requirements, and feedback and improvement systems.

Weaknesses in important aspects of OR/AMEM, BJC, and BNFL feedback and improvement processes are hindering further improvements in the implementation of ISM at ETTP. Although all three organizations perform numerous assessments and have some effective processes, all three organizations have weaknesses in various aspects of assessments, issues management, lessons-learned programs, and other feedback mechanisms. OR/AMEM has not established an effective process that evaluates safety trends and assigns and prioritizes appropriate oversight activities into an annual oversight plan. In addition, OR does not yet have sufficient Facility Representative coverage of D&D efforts and does not have a lessons-learned program. BJC feedback and improvement processes have not ensured that its subcontractors establish and implement ISM programs and feedback and improvement processes such as assessments, issues management, lessons learned, and employee concerns programs. Further, BJC has not ensured that all injuries and operational events are properly documented and evaluated for causes and preventive actions. BNFL processes have not ensured that all operational incidents, deficient conditions, and performance errors are fully and effectively evaluated or documented. Because of these deficiencies, management had not identified and corrected a number of ES&H process and performance problems in ETTP facilities.

The unreviewed safety question (USQ) process has weaknesses that could lead to potential non-compliance with 10 CFR 830, Subpart B. BJC and BNFL did not correctly incorporate significant elements of 10 CFR 830, Subpart B, requirements into their USQ procedures. Some of the identified weaknesses resulted in part because of inconsistencies and ambiguities in the DOE USQ Guide. As a result, changes in facilities or procedures, or discovery of conditions potentially outside the safety basis,

could result in undetected USQs. Deficiencies in the USQ procedures have contributed to deficiencies in implementing the USQ processes. For example, nine of ten recent BNFL procedure changes were improperly screened. Additionally, an identified potential inadequacy in the safety basis for the Three Building D&D project was not evaluated through the USQ process or reported through the Occurrence Reporting and Processing System (ORPS). EM and OR did not perform adequate reviews to ensure that the deficiencies in the BJC and BNFL USQ procedures were identified and corrected.

BNFL's implementation of ISM has deficiencies in hazard control implementation and procedural adherence. Although most aspects are effective, BNFL hazard control processes were not always effectively implemented. BNFL has extensively sampled metal fumes; however, BNFL has not sufficiently sampled and analyzed the potential hazards from ozone and nitrogen oxides resulting from plasma arc cutting to determine the potential for worker exposure to these hazards. BNFL has not ensured that all floor openings have coverings that completely cover the opening, are adequately secured in place, and are labeled in accordance with Occupational Safety and Health Administration requirements. BNFL has not sufficiently implemented requirements for fixed and removable radiological contamination surveys. In addition, BNFL and subcontractor personnel did not rigorously implement some aspects of BNFL procedures and safety requirements, indicating a need for improvement in procedural adherence and conduct of operations.

BJC and its subcontractors have not been fully effective in implementing ISM core function elements, such as procedural adherence, hazard controls, medical requirements, and waste management requirements. BJC and subcontractor work control processes do not ensure that all appropriate hazard controls are identified and implemented for known hazards, thus increasing the potential for worker exposure to those hazards. Workers did not follow all hazard controls outlined in BJC subcontractor activity hazard assessments or other control mechanisms in the areas of lockout/tagout, radiation protection, and industrial hygiene. Continued storage of hazardous lithium compounds under the poor environmental conditions in the K-25 building has resulted in container degradation. In addition, BJC has not established adequate measures to ensure that subcontractors fully implement DOE medical and waste management requirements. Some subcontractor documents and practices do not fully meet applicable ES&H requirements.

BNFL and BJC have not established sufficient processes for updating contractual requirements as regulations change. BNFL has not established effective processes for ensuring that its Work Smart Standards are consistent with regulations, including Occupational Safety and Health Administration construction and general industry requirements, and industry consensus standards. In addition, BNFL processes do not ensure that ES&H requirements in Work Smart Standards are incorporated into policies, procedures, and subcontracts. While the baseline set of Work Smart Standards is complete, BJC has not established a systematic process to ensure that Work Smart Standards and implementing procedures will remain current with respect to regulatory requirements and consensus standards.

3.0 CONCLUSIONS

The ISM program at ETTP has significantly improved from three years ago, when ISM deficiencies identified through internal and external reviews of ETTP prompted OR to rescind approval for the OR and BJC ISM programs. Since then, BJC has revamped its ISM program and has devoted significant attention to the establishment and implementation of ES&H roles and responsibilities. Similarly, BNFL has devoted attention and resources to improving its ISM program. The results of this OA inspection indicate that work remains to address a number of deficiencies in ISM processes and implementation of those processes. However, the results of this inspection also indicate that ETTP has made significant progress in the past three years in addressing systemic deficiencies.

EM¸ OR, and contractor management are supportive of safety and understand and accept their line management responsibility. BJC and BNFL have developed generally adequate ISM program documents that define appropriate policies and practices. Their respective contracts identify an appropriate set of requirements. In most cases, requirements have been incorporated into adequate processes and procedures, and most ES&H requirements are adequately communicated and understood by ETTP managers and workers. Despite recent efforts to improve their respective Work Smart Standards, neither contractor has established effective mechanisms to ensure that changes in existing requirements, or new regulations, are adequately identified, evaluated, and incorporated into their contracts. Weaknesses in ensuring that subcontractors meet identified requirements further reduce assurance that requirements are effectively implemented. Improvements are needed in BJC and BNFL processes for updating contractual requirements to ensure continuing effectiveness.

Under the leadership of EM, the DSAs for ETTP have been completed in accordance with the 10 CFR 830, Subpart B, schedule milestones. The new DSAs are a significant improvement over the previous generation of fragmented authorization basis documents. However, the BJC and BNFL USQ processes need improvement to ensure that the 10 CFR 830, Subpart B, requirements are correctly reflected and effectively implemented, and to prevent operations or activities outside the authorized safety envelope.

Many aspects of work that the OA team observed at ETTP were performed with a high regard for safety. With a few 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. 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.

Some aspects of OR/AMEM, BJC, and BNFL feedback and improvement programs are established and effective. Many assessments and inspections are performed, and many corrective actions are taken to address assessment findings. However, process and performance weaknesses in certain aspects of assessments, issues management, and lessons learned need to be addressed to ensure timely identification and resolution of ES&H deficiencies and continuous improvement.

Overall, the ISM programs at ETTP have improved. However, a number of weaknesses in ES&H processes and programs warrant management attention, with particular attention to feedback and improvement processes, implementation of worker safety controls, procedural adherence, and USQ programs.

4.0 RATINGS

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

Safety Management System Ratings

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

Feedback and Improvement

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

BJC 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

BNFL 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

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APPENDIX A

Supplemental Information

A.1 Dates of Review

Scoping Visit	February 25 - 27, 2003
Onsite Inspection Visit	April 28 - May 9, 2003
Report Validation and Closeout	May 20 - 22, 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	Patricia Worthington
Charles Lewis	Thomas Staker
Dean Hickman	Robert Nelson

A.2.3 Review Team

Kathy McCarty, Deputy Director, Office of Emergency Management Oversight (Team Leader)
Bradley Davy, ES&H Lead
Vic Crawford
Marvin Mielke
William Miller
Ching San Huang
Robert Compton
Albert Gibson
Mark Good
Joe Lischinsky
Jim Lockridge
Don Prevatte
Ed 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. EM and OR review and approval of BJC and BNFL USQ procedures did not ensure that all facility and procedure changes and discovered conditions would be adequately evaluated, analyzed, and approved as required by 10 CFR 830, Subpart B, creating the potential for an undetected USQ.	18
2. BJC has not established a systematic process for ensuring that Work Smart Standards and implementing procedures are kept current with external regulatory requirements and consensus standards.	19
3. BJC has not established adequate measures to ensure that subcontractors fully implement DOE medical and waste management requirements, and subcontractor documents and practices do not always meet applicable ES&H requirements.	20
4. Weaknesses in the BJC USQ procedure could lead to an undetected USQ and potential non-compliance with 10 CFR 830, Subpart B.	22
5. BNFL has not established effective processes for ensuring that WSS are consistent with regulations, including OSHA construction and general industry requirements, and industry consensus standards or for ensuring that ES&H requirements in WSS are incorporated into policies, procedures, and subcontracts.	23
6. Weaknesses in the BNFL USQ procedure could lead to an undetected USQ and potential non-compliance with 10 CFR 830, Subpart B.	25
7. OR/AMEM has not established an effective process for evaluating safety trends and prioritizing oversight activities into an annual oversight plan that ensures an adequate evaluation of contractor ES&H performance and promotes continuous ES&H improvement. In addition, the oversight processes documentation is not current, Facility Representative coverage of D&D efforts is insufficient, issues management processes are not fully utilized, and no lessons-learned program has been established.	33
8. BJC feedback and improvement programs have not ensured that BJC and its subcontractors effectively implement ISM. Weaknesses were evident in assessments, issues management, lessons learned, and employee concerns programs.	35
9. BJC has not ensured that all injuries and operational events are properly documented and evaluated for causes and preventive actions.	37
10. Some operational incidents, deficient conditions, and performance errors have not been fully and effectively evaluated or documented by BNFL to establish causal factors and effective recurrence controls, or to determine reportability.	41

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

FINDING STATEMENTS	REFER TO PAGES
11. BJC and subcontractor work control processes do not ensure that all appropriate hazard controls are identified and implemented for known hazards, resulting in an increased potential for worker exposure to those hazards.	51
12. Workers did not follow all hazard controls outlined in BJC subcontractor AHAs or other control mechanisms in the areas of lockout/tagout, radiation protection, and industrial hygiene.	53
13. Continued storage of hazardous lithium compounds under the poor environmental conditions in the K-25 building has resulted in container degradation and an increased risk to workers and the environment.	54
14. BNFL has not sufficiently sampled and analyzed the potential hazards from ozone and nitrogen oxides resulting from plasma arc cutting to determine the potential for worker exposure to these hazards.	60
15. BNFL has not ensured that all floor openings have coverings that completely cover the opening, are adequately secured in place, and are labeled in accordance with OSHA requirements; personnel, tools, or equipment could therefore fall into or through the openings.	64
16. BNFL has not sufficiently implemented requirements for fixed and removable radiological contamination surveys to document specific radiological conditions and changes in radiological conditions during work, establish the technical basis for controls, and convey information on specific radiological hazards to workers as part of the radiation work permit process.	65
17. BNFL and subcontractor personnel did not rigorously implement some aspects of BNFL procedures and safety requirements.	68

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 East Tennessee Technology Park (ETTP). OA examined Guiding Principle #2 (Clear Roles and Responsibilities) and Guiding Principle #5 (Identification of Standards and Requirements). These guiding principles were selected based on a review of ETTP's past performance and the status of ISM development. 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.

DOE Headquarters Office of Environmental Management (EM); the Oak Ridge Operations Office (OR); Bechtel Jacobs Company, LLC (BJC); BNFL PLC; 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 ETTP plans and initiatives. In evaluating the guiding principles, the results of the OA review of the core functions were considered.

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.

Department of Energy

As a result of several internal and external ES&H reviews of BJC operations at sites under the cognizance of OR in the fiscal year (FY) 2000/2001 time frame, EM and OR recognized that the ISM program at ETTP and other BJC sites was not adequate. Consequently, OR rescinded the approval of the ISM program for OR and for BJC operations in November 2001. Since then, EM, OR, and the OR Assistant Manager for Environmental Management (AMEM), who has responsibility for ETTP and other EM facilities under OR's jurisdiction, have taken significant actions to enhance ES&H management and ensure that BJC contractors and subcontractors take appropriate actions to establish and implement an effective ISM program. Currently, OR is planning to perform a validation review to determine the status of the OR and BJC ISM programs and actions needed to address remaining deficiencies. The planned review of the OR portion of the ISM program has been delayed to address recognized deficiencies (e.g., the outdated FRAM).

EM is currently providing appropriate safety-related direction and assistance to OR and AMEM. EM has carefully limited its delegation of authority to OR. For example, EM-1 withdrew OR's delegation of authority for the approval of safety basis documents for EM facilities.

EM has taken a lead role in the efforts to update the safety basis documents. EM chartered a Safety Basis Special Project Team, assigned EM personnel from the DOE complex to support the ETTP effort, and streamlined the approval process. EM has worked directly with BJC and BNFL to facilitate efforts to meet the demanding deadlines for developing an approved set of documented safety analyses (DSAs) for ETTP.

Senior EM managers are actively involved in ES&H at ETTP. The EM Chief Operating Officer (EM-3) interfaces at least weekly with AMEM to discuss trends in safety for EM sites. The current safety focus areas are on-the-job injury, lockout/tagout, personnel contamination, and transportation incidents. EM-3 has also directed AMEM to ensure that new incidents in these safety focus areas are immediately reported to EM-3. In addition, the EM Office of Safety and Engineering is directly involved with AMEM when major events occur at ETTP and meets regularly with the BNFL corporate safety officer.

OR and AMEM are currently undergoing a leadership transition. The current OR Manager was previously the AMEM and is also performing the duties of the AMEM. A new AMEM has been selected and has started to become familiar with ETTP.

OR senior management is actively involved in ES&H at ETTP. Items of safety importance requiring OR's direct involvement and support are identified, tracked, and discussed during routine OR senior staff meetings. The OR Manager's current priorities related to ETTP include completing the revision to the OR FRAM, completing ISM revalidation, finalizing the AMEM reorganization, and completing the BJC closure contract negotiations.

Within OR, the roles and responsibilities for ETTP are described in the current FRAM for the AMEM and contracting officer's representative (COR) positions. Detailed roles and responsibilities for the AMEM organization are described in OR Organizational Manual 110. However, these documents are significantly out of date. The lack of current, accurate, and approved documentation of roles and responsibilities for ETTP is well understood by EM, OR, and AMEM and was identified as a major deficiency in an OR ISM self-assessment completed in April 2003. AMEM has responded to this deficiency by submitting changes to the OR Organizational Manual and has submitted a formal request to EM-1 describing and requesting approval for a new AMEM organizational structure. AMEM procedures are also being revised to reflect the new AMEM organization.

Although documentation is out of date, numerous interviews conducted at different levels of the organization reveal that OR personnel assigned to support the ETTP Closure project and the Three-Building Decontamination and Decommissioning (D&D) project understand their roles and responsibilities. The AMEM ETTP Project Manager for the K-25/27 D&D Project and the Project Manager for BNFL are appropriately performing their assigned roles and responsibilities and are directly involved in ES&H issues involved with their respective projects. The AMEM Project Manager for the K-25 Closure project closely watches the trends in worker injuries and when necessary ensures that BJC conducts "safety pauses" to assess and correct safety problems. For example, AMEM ensured that BJC and one of its subcontractors resolved an adverse trend in hand and back injuries. BJC's subcontractor conducted a safety pause to analyze the problem and institute a set of corrective actions (e.g., the use of a better glove to protect the hands from cuts and reinforced training on lifting to prevent back strains).

The AMEM Facility Representatives' roles and responsibilities are clearly defined in the AMEM Facility Representative procedure, and the Facility Representatives assigned to the BNFL and K-25 projects are knowledgeable of their responsibilities. The AMEM organization currently has 16 fully qualified Facility Representatives. The effectiveness of the Facility Representative program is further discussed in Appendix D.

Within the AMEM organization, various organizations have appropriate responsibilities and processes for communicating ES&H-related information. For example, the AMEM weekly staff meeting provides information and direction to AMEM directors on current ES&H issues and lessons learned. In addition, Facility Representatives meet weekly to share information, and they issue a monthly report to OR managers. They also meet monthly with the OR Manager to address facility ES&H issues.

There is good communication about ES&H matters between the AMEM staff and the BJC staff at all levels of the organization. Facility Representatives have daily interactions with the BJC facility managers, subcontractor technical representatives, and safety advocates. The AMEM project managers have daily communications with the BJC project managers, and the AMEM ETTP Closure Project Director has daily interactions with the BJC ETTP Manager of Projects. For the ETTP Closure Project, several routine management meetings between DOE and BJC are held to promote communication, review ES&H and ISM status and issues, and determine needed actions.

AMEM appropriately conducts routine project review meetings and uses the award fee process to hold BJC accountable for ES&H performance. For example, the management fee for FY 2002 was reduced because of performance issues in several ES&H areas, and the performance-based incentive fee for FY 2002 was reduced because of performance concerns with the DSA submittals at that time.

A few deficiencies were identified with the current AMEM organization's roles, responsibilities, and authorities. AMEM has not assigned a Lessons Learned Coordinator, and therefore lessons learned are not formally reviewed, distributed, and tracked (see Appendix D). In addition, performance appraisals for the AMEM staff do not include ES&H objectives, limiting the ability to hold individual managers accountable for ES&H performance. Further, OR pollution prevention oversight of ETTP has decreased because funding was eliminated after EM transferred the pollution prevention program to the DOE Office of Environment, Safety and Health. As a result, OR and ETTP contractors have spent significantly less time on the pollution prevention program, and future opportunities for pollution prevention may not be fully evaluated for implementation.

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Since its ISM approval was revoked, BJC has revamped its ISM program and has devoted significant attention to the establishment and implementation of ES&H roles and responsibilities. The results of this OA inspection (see deficiencies identified in Guiding Principle #5 and Appendices D and E) indicate a number of remaining deficiencies in ISM processes and implementation of those processes. However, the results of this inspection also indicate that ETTP has made significant progress in addressing systemic deficiencies in the past three years.

BJC roles and responsibilities are clearly defined in policy, procedures, and the ISM description. The BJC employees who were interviewed were fully knowledgeable of their roles and responsibilities. An effective training process has contributed to the good knowledge of ES&H roles and responsibilities demonstrated by BJC personnel. Each position has a current training position description that describes roles and responsibilities and training requirements, and when an employee is assigned to a position, a Position Assignment Form is completed, reviewed, and approved by the employee and his/her supervisor.

BJC has established a clear policy and procedure for stop-work authority. During a recent safety pause briefing by the BJC ETTP Manager of Projects to his staff, the key aspects of stop-work authority were emphasized.

BJC has appointed and formally documented a cadre of subject matter experts (SMEs). The roles and responsibilities of an SME are clearly defined, and only appropriately qualified individuals have been assigned as SMEs. For example, the unreviewed safety question (USQ) SME was fully knowledgeable of the applicable roles and responsibilities and has extensive qualifications and experience, significant facility-specific knowledge, a comprehensive understanding of the applicable regulatory requirements and guidance, and a detailed awareness of many of the subtleties and nuances of performing USQ activities in a manner that avoids most common pitfalls and produces a quality product. This individual is working to address recognized deficiencies in USQ processes (see discussion under Guiding Principle #5).

BJC has established and maintains an appropriate set of ISM performance measures. For example, one important performance metric is the subcontractor ES&H program performance evaluation in which subcontractors are graded in several ES&H areas, and an average score is determined and trends are plotted. Subcontractors that receive a low score are put on a watch list for increased BJC monitoring. Currently, no subcontactors are on that list.

BJC has established an effective performance evaluation process that rates its employees with respect to ISM implementation. BJC employees are provided annual feedback from their supervisors on their ES&H conduct. BJC also has a formal process for disciplining workers when required.

One concern was identified with BJC roles and responsibilities. Specifically, several key BJC personnel, including the current BJC K-25 Facility Manager, are currently performing additional duties while newly hired BJC staff members await the security clearances they need to fully perform their jobs. As a result, some ES&H-related responsibilities, such as management walkdowns, are not being performed at the appropriate frequency.

BNFL

Under EM and OR direction, BNFL has also taken significant action to enhance its ISM program, including ES&H roles and responsibilities. Roles and responsibilities for BNFL managers are well defined and understood, and ES&H responsibilities are adequately addressed in the BNFL health and safety plan. In addition, BNFL managers and workers are held accountable for safety performance. For example, disciplinary action has been taken for unsatisfactory safety performance, including dismissal and time off without pay.

Safety is appropriately addressed in the objectives and measures of middle management incentive plans and performance evaluations. For example, management bonuses are based upon achieving objective targets established in incentive plans. Employees are also recognized and rewarded for good safety performance.

Summary of Guiding Principle #2. The EM, OR, and AMEM ES&H roles and responsibilities are in a state of transition as ETTP shifts to an accelerated closure project and the OR and AMEM management team changes. These changes exacerbate the deficiencies associated with many of the key documents being out of date. Despite these challenges, EM, OR, and AMEM have taken various actions to communicate ES&H-related roles and responsibilities to their staff and establish priorities and expectations. As a result, the roles and responsibilities are well understood and effectively implemented with few exceptions (e.g., lessons learned, pollution prevention, and accountability through performance appraisals). AMEM is taking appropriate action to address the out-of-date documents that define roles and responsibilities. AMEM has also established appropriate processes for communicating with BJC and uses appropriate mechanisms (e.g., safety pauses and fee determination processes) for holding contractors accountable and ensuring corrective actions.

BJC and BNFL roles and responsibilities are clearly and comprehensively defined. Further, observations and interviews confirmed that roles and responsibilities are well understood and implemented as required, with few exceptions. Appropriate processes are in place to provide incentives and to hold managers accountable for effective performance of their responsibilities. Although a number of ES&H deficiencies were identified (see Appendices D and E), the BJC ISM program has improved substantially since the approval for the BJC program was revoked in November 2001. Similarly, BNFL has made improvements to their program. Although a number of deficiencies in ISM programs and implementation remain, the recent BJC and BNFL efforts to better identify and implement ES&H roles and responsibilities have contributed to the observed improvements in the ISM system.

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.

Department of Energy

OR has established comprehensive ES&H requirements applicable to BJC, BNFL, and their subcontractors at ETTP. These requirements, which are based upon agreements between OR and these contractors, were developed and formalized in DOE contracts pursuant to DOE Policy 450.3, *Authorizing the Use of the Necessary and Sufficient Process for Standards-Based ES&H Management.* The DOE/BJC contract, which is applicable to facilities and activities at ETTP and two other DOE OR sites, contains a comprehensive set of ES&H requirements that is appropriate for the broad scope of work and range of hazards associated with work at these three sites. Applicability of these requirements has been tailored, consistent with DOE policy and guidance, through both a Work Smart Standards (WSS) process and a standards and requirements identification (S/RID) process. Requirements established in the DOE/BNFL contract are appropriate for the scope of BNFL work at ETTP. The OA team identified no performance deficiencies that were attributed to inadequate requirements at the contract level for either of these organizations.

OR has established systematic processes for reviewing new and revised DOE directives for applicability to BJC and BNFL and for incorporating appropriate changes into contractual requirements. An OR Directives Management Team coordinates reviews of DOE directives for potential applicability to BJC in accordance with a formal OR procedure. For BNFL requirements, the COR personally reviews new and revised DOE directives and adds those that he considers necessary to ensure safety to the BNFL WSS. The COR obtains support in this review from OR SMEs as needed and considers results of impact assessments performed by BNFL prior to imposing new requirements. This process for making changes to the DOE/BNFL contract is described in a 1998 memo from the COR to BNFL. These processes are being used effectively to assess the applicability and impact of new and revised DOE directives, such as the recently issued DOE Order 450.1, *Environmental Protection Program.* However, the OR Directives Management Team provides only limited documentation of the basis for their decisions.

ES&H requirements in BJC and BNFL contracts also include state and Federal regulations and industry consensus standards. OR does not have a systematic process for identifying applicable changes to regulatory requirements or industry standards but relies primarily upon its contractors to identify applicable changes and propose appropriate contract revisions in these areas. BJC and BNFL are required to comply with state and Federal regulations whether they are listed in the contracts or not.

DOE has not established requirements to assure the preservation and availability of occupational medical records of BJC subcontractor employees. Although OR owns and preserves medical records generated by BJC at the ETTP site, similar medical records generated by subcontractor medical providers are not managed in the same manner. Medical records are generated and kept by subcontractor medical providers for pre-employment, Occupational Safety and Health Administration (OSHA) mandatory examinations, and medical surveillance purposes. Subcontractors are required to implement DOE Order 440.1A, which requires record retention but states no specific expectations for storage, permanent retention, or future access. Thus, records maintained by individual medical providers for subcontractor employees may not be available for future access. This issue is a DOE-wide concern that applies to ETTP and other DOE sites and in part stems from ambiguities and unclear expectations in DOE directives. Subcontractor employees typically perform activities (e.g., asbestos abatement) that have a potential for exposure to hazardous materials and negative health effects. Therefore, subcontractors should have provisions for medical documentation that are comparable to those for prime contractor employees. This is a best practice that would support future efforts by DOE to retrieve ES&H data, respond to compensation and litigation claims, and support epidemiological research.

EM has provided strong support to the implementation of 10 CFR 830, Subpart B, requirements at ETTP. This regulation, issued in January 2001, requires contractors to establish and maintain safety bases for Hazard Category 1, 2, or 3 DOE nuclear facilities. EM established a Safety Basis Special Project Team at the Oak Ridge site in early 2003 for review and approval of BJC DSAs. The team was staffed with 22 members from EM, OR, and other EM sites. The team members were selected based on their qualifications and performance on similar tasks. Support provided to BJC by the Safety Basis Special Project Team was instrumental in the timely submittal of BJC DSAs to DOE before April 10, 2003, the mandated due date. With one exception, the DSAs submitted by BJC and BNFL appear to have been generally developed and documented in accordance with the requirements of 10 CFR 830, Subpart B, and associated DOE guidance. The exception involved the Three-Building D&D Project DSA, which did not address the toxicological hazards of releases of uranium compounds.

EM and OR review of the draft BJC and BNFL USQ procedures did not identify some potential weaknesses and non-conservative approaches in those procedures (as described later in this section). While these weaknesses do not indicate that either procedure is specifically out of compliance with 10 CFR 830, Subpart B, following the procedures verbatim in some instances could lead to non-compliance as a result of changes not being adequately reviewed.

Finding #1: EM and OR review and approval of BJC and BNFL USQ procedures did not ensure that all facility and procedure changes and discovered conditions would be adequately evaluated, analyzed, and approved as required by 10 CFR 830, Subpart B, creating the potential for an undetected USQ.

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In recent months, BJC has taken a number of steps to assure that appropriate ES&H requirements are specified in its contract with DOE and that these requirements are tailored and flowed down through company documents to individuals responsible for implementation. SMEs have reassessed the adequacy of requirements in the DOE/BJC contract and proposed the addition of new requirements to the contract. Appropriate requirements have been added. SMEs have also made several changes in implementing procedures to assure that WSS and S/RID requirements flow down through company procedures and subcontracts. An external review of the requirements management program was performed in July 2002 to assess the effectiveness of these steps, and corrective actions to address identified deficiencies are being tracked in the BJC Issues and Corrective Action Tracking System. These steps have resulted in

significant improvements in the BJC WSS, S/RIDs, and implementing procedures. The current requirements in the WSS and S/RIDs are appropriate for the hazards at the site, and there is reasonable assurance that these requirements have been incorporated into BJC implementing documents. As discussed later in this section, additional actions are needed to ensure that the ES&H requirements in the DOE/BJC contract remain current with respect to external requirements, and that these requirements are effectively implemented by BJC subcontractors.

Safety has been appropriately integrated into the BJC procurement process. As a management and integration contractor, BJC accomplishes most of the hazardous work at ETTP through its subcontractors. The OA team examined the BJC procurement process to determine whether ES&H was appropriately considered in the procurement of services to perform this work. Bidders on BJC subcontracts are prequalified based upon their past safety performance. ES&H representatives are involved throughout the procurement process, including development of requests for proposals and development of final contracts. Safety requirements to be included in subcontracts are contained in a "proforma" document that the SMEs tailor for specific subcontracts and keep current. The BJC requirements management process ensures that changes to ES&H requirements in the DOE/BJC contract are incorporated into BJC subcontracts when applicable.

Although recent BJC efforts to identify applicable ES&H requirements and to incorporate these requirements into implementing procedures have been effective, processes have not been established to ensure that these requirements and implementing procedures will be kept current with changing regulatory requirements and consensus standards. BJC has established a formal process for assuring that the WSS and implementing procedures will be revised when necessary to incorporate changes to applicable DOE directives. However, BJC does not have a formal process for identifying and determining the applicability of new or revised regulations or consensus standards. SMEs are assigned broad responsibility for keeping WSS and procedures current, but there is no process or procedure for ensuring that SMEs effectively and consistently carry out this responsibility.

Finding #2: BJC has not established a systematic process for ensuring that Work Smart Standards and implementing procedures are kept current with external regulatory requirements and consensus standards.

The BJC requirements management program has generally been effective in incorporating ES&H requirements into subcontracts but has not ensured consistent subcontractor compliance with these requirements. Pursuant to its contract with DOE, BJC is responsible for compliance with the ES&H requirements in that contract regardless of who performs the work. Measures established by BJC to assure compliance include approval of subcontractor health and safety plans by BJC after contracts are awarded, performance of readiness reviews before authorizing subcontractors to perform work on site, and routine monitoring of subcontractors' safety performance by BJC safety advocates and subcontractor technical representatives.

Although these measures are appropriate, they have not been effectively executed to ensure subcontractor compliance with ES&H requirements in a few areas. In the occupational medical area, most requirements in DOE Order 440.1A were appropriately tailored for applicability to BJC subcontractors and were included in subcontracts. However, some of these requirements were not fully implemented by subcontractors. For example, subcontracted physicians and medical staff had not:

- Coordinated with other safety and health professionals (e.g., industrial hygienists, health physicists, safety specialists) to identify work-related or work site hazards and their possible health risks to employees as required by DOE Order 440.1A, Attachment 2, Paragraph 19.c.(1)(a)

- Maintained current knowledge of actual or potential work-related hazards (physical, chemical biological, ergonomic) as required by DOE Order 440.1A, Attachment 2, Paragraph 19.c.(1)(b).

In addition, the DOE Order 440.1A requirement to protect and permanently store employee medical records was not included in the BJC "proforma," which is the source document for development of subcontracts, and was not included in at least one subcontract.

BJC did not identify these deficiencies during review of the subcontractor's ES&H Plan or during the readiness review performed prior to authorizing onsite work. K-25 project personnel did not seek any BJC medical subject matter advice or interface during the readiness review process, and consequently, several key elements of the subcontractor medical programs were not addressed. Also, in the area of occupational medicine, the subcontractor's medical and first aid procedures did not adequately reflect BJC safety plan requirements to treat ill or injured employees only at the ETTP Site Clinic.

The subcontractor's procedures and practices were also inconsistent with ES&H requirements in the waste management area. Subcontractor work in K-25 is being performed in accordance with agreements reached with Federal and state regulators under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. The Engineering Evaluation/Cost Analysis for the D&D of the K-25 and K-27 buildings at ETTP identify Resource Conservation and Recovery Act requirements as Applicable or Relevant and Appropriate Requirements (ARARs) for the management of hazardous waste. However, the subcontractor procedures and practices for hazardous waste management were not consistent with these ARARs. For example, the ARARs included specific requirements for management of expired mercury vapor lamps that had not been implemented in the hazardous waste management area.

Finding #3: BJC has not established adequate measures to ensure that subcontractors fully implement DOE medical and waste management requirements, and subcontractor documents and practices do not always meet applicable ES&H requirements.

OA's review of efforts at ETTP to meet 10 CFR 830, Subpart B, requirements indicates that BJC assigned sufficient staff to the development of DSAs to make all submittals on or before the April 10, 2003, deadline. BJC's generation and submittal of the K-25/K-27 DSA, including the technical safety requirements (TSRs), was one of 20 BJC was required to produce for all facilities under its contract, which included other facilities at ETTP, Portsmouth, and Paducah. The first draft of the K-25/K-27 DSA was submitted to DOE in December 2002. DOE determined that the draft required further refinements to reflect lessons learned from the DOE review of other documents, and subsequent collaborative efforts between BJC and the DOE Special Project Team produced a revision that was resubmitted to DOE in a timely manner. BJC facility managers were integrated into the DOE Special Project Team as contributors to DSA development, thereby fostering better ownership at the facility level. OA's review of a sampling of existing work process procedures revealed that they contained appropriate references to the DSA and the USQ program to ensure that facility activities and changes are considered and performed within the DSA.

BJC has taken steps to strengthen its unreviewed safety question determination (USQD) process. The BJC USQ procedure (Revision 7) was approved by EM on August 2, 2002, before the regulatory deadline. Shortly after, a new Nuclear Safety Manager with extensive DSA and USQ program experience was brought into the organization to direct all DSA activities, including the USQ program. Significant improvements in the USQ program were observed since that time, including procedure upgrades, expanded training, more rigor in procedure enforcement, increased product sampling, qualification of a large cadre of personnel to perform USQDs, and instituting a requirement that subcontractors use the BJC procedure. Overall, the USQ procedure adequately addressed most of the elements of 10 CFR 830,

Subpart B, and DOE Guide 424.1-1, *Implementation Guide For Use In Addressing Unreviewed Safety Question Requirements*.

In December 2002, an OR assessment of the USQ program identified a number of weaknesses. These weaknesses were being addressed and tracked in a BJC corrective action plan that was ongoing during this OA assessment. However, the OA team identified a number of additional areas where the USQ procedure remained non-conservative or weak, possibly leading to non-compliance with 10 CFR 830:

- Non-conservative screening criteria: The BJC USQD procedure and the associated form add non-conservative qualifiers to the 10 CFR 830, Subpart B, requirements. 10 CFR 830, Subpart B, requires determining whether there are changes to the facility or procedures as described in the DSA; if so, a USQD must be performed. The DOE guide explicitly reinforces this expectation. However, the screening worksheet in the BJC procedure asks non-conservative questions that require the screener to first consider the characteristics of the structures, systems, and components (SSCs) or procedure and then evaluate the ways they may be affected. The CFR requires such considerations and evaluations to be made later as part of a USQD. The procedure creates the potential to screen out changes for which USQDs should be performed.

- Too narrow "margin of safety" definition: The procedure contains conflicting and incorrect directions and discussions, and incorrect wording on its USQD form, Question 7, for the term "Margin of Safety." Where this term appears in the procedure, it is generally accompanied by the phrase, "as defined in the bases of the TSR" or similar words, which narrow the scope of consideration. The CFR does not contain such qualifying phrases and thus requires broader review. The DOE guide indicates that the DSA in its broadest sense should be considered, not just the TSR bases.

- Categorical exclusion of maintenance procedure changes: The DOE USQ guide properly recognizes that changes to certain types of procedures may be "Categorically Excluded" from the requirement to perform USQDs. The guide also identifies maintenance procedures as an example of a categorical exclusion, and BJC has repeated this example in their procedure. Certain types of maintenance procedures (e.g., procedures for grounds maintenance or changing light bulbs) may legitimately be categorically excluded. However, maintenance procedures as a general category should not be categorically excluded because they may encompass SSCs that are described in the DSA.

The following additional weaknesses were identified in the procedure:

- Inadequate personnel qualification requirements: The procedure requires that USQ document preparers and reviewers have a high school diploma and six months of site/nuclear experience. This is inadequate and inconsistent with the qualifications requirements in DOE Order 5480.20A for nuclear facility Technical Staff (i.e., a degree in engineering or sciences, two years of job-related experience, and one year of nuclear experience). The BJC *Nuclear Quality Assurance* procedure commits to this DOE order. Weaknesses in qualification requirements were previously identified by the DOE Special Project Team.

- Inadequate reviewer independence: The DOE USQ guide states that the document reviewer "be independent in the sense that he/she has not been involved in the preparation of the USQ documents." The BJC procedure requires only that the reviewer "did not participate in the selection of the particular approach."

- Not addressing interim conditions of changes to SSCs: The interim conditions of the facility while modifications are being implemented may be outside the safety bases, even if the completed

modifications are not. Modifications performed in stages, because of schedule, budget, or operational constraints, may also leave the facility in an unanalyzed interim condition. Failure to address such conditions is a gap in the BJC procedure.

Some of these weaknesses resulted in part from inconsistencies and ambiguities in the DOE USQ guide.

Finding #4: Weaknesses in the BJC USQ procedure could lead to an undetected USQ and potential non-compliance with 10 CFR 830, Subpart B.

BNFL

ES&H requirements for the BNFL Three-Building D&D project are contained in the DOE/BNFL contract as a set of WSS. The contract requires that these WSS be maintained as set forth in DOE Manual 450.3-1, *The DOE Closure Process for Necessary and Sufficient Sets of Standards*. Three revisions to this document have been issued since that time to keep the WSS up to date with changes to facilities, hazards, and requirements. The current set of requirements is appropriate for the hazards associated with the project.

BNFL has integrated safety into the procurement process for subcontracted services. Although BNFL itself performs most of the hazardous work associated with the Three-Building D&D project, some tasks, such as building decontamination, are subcontracted. Review of procedures and records indicates that the BNFL ES&H staff have been involved in developing statements of work (including descriptions of hazards and controls) and in developing purchase requisitions. Bidders are prequalified based, in part, on past safety performance. Bids are reviewed by ES&H specialists if such review is considered necessary by procurement management. After award of the contract, safety performance is monitored by a subcontractor technical representative and BNFL safety personnel, and the results of this monitoring are discussed in weekly meetings between the representative and subcontractor management. Although ES&H personnel have been involved in procurement activities, the process for assuring that all applicable ES&H requirements are included in subcontracts has not been fully effective, as discussed later in this section.

BNFL has not established a process for assuring that WSS and project procedures remain consistent with regulations and industry consensus standards but has instead relied principally upon DOE for the identification of needed changes to ES&H requirements. BNFL established its *Work Smart Standards* policy to define criteria, responsibilities, and protocols for requesting and receiving revisions to these WSS, but this policy does not include provisions for identifying changes to applicable Federal or state regulations. Such provisions are important because BNFL is required by contract to comply with applicable state and Federal regulatory requirements, whether these requirements are listed in WSS or not. BNFL's WSS policy erroneously states that DOE is obligated by the DOE/BNFL contract to promptly notify BNFL of changes to applicable Federal and state regulatory requirements. Similarly, the policy does not provide for review of new or revised industry standards to identify those necessary to assure safety or to propose addition of these standards to WSS. In fact, the policy (paragraph 4.4.2 of Policy PO-CS-006) states that no contract changes will be requested except to reduce cost or improve efficiency.

BNFL had previously identified deficiencies in the WSS policy and in the flowdown of WSS requirements into implementing procedures. Specifically, an internal BNFL review in September 2002 identified that annual hazard communication training had not been provided because the training manager was not aware that it was required. Corrective action for this finding was limited in scope to flowdown of training requirements. Subsequent review of this issue by BNFL in December 2002 identified that the WSS policy did not establish an adequate process to identify and tailor applicable requirements in the

WSS and did not assign responsibilities for maintaining or implementing these standards. A gap analysis performed by BNFL identified several deficiencies in the flowdown of WSS requirements into implementing policies and procedures. This broader finding was addressed in a corrective action plan issued during the OA inspection. If effectively implemented, the corrective action plan should adequately address the requirements management deficiencies discussed in this OA report. However, at the time of the OA inspection, most corrective actions were incomplete, and the timeliness of actions taken had not been commensurate with the significance of this finding.

The OA team identified continuing deficiencies in the flowdown of WSS requirements into BNFL procedures. For example, although the BNFL gap analysis concluded that the flowdown of OSHA safety requirements from WSS through implementing procedures was adequate, the OA team identified significant deficiencies in this area. Specifically, BNFL WSS and procedures had not been sufficiently tailored to ensure appropriate application of OSHA requirements for General Industry (29 CFR 1910) and Construction (29 CFR 1926) to specific types of BNFL work activities and facilities, resulting in conflicting and inconsistent incorporation of these requirements in procedures and work plans. Although the OSHA Standards for General Industry and for Construction had been included in the BNFL WSS, the integration of these standards into BNFL procedures and the application of the standards in work plans were inconsistent and occasionally conflicting. For example, the requirements for guarding floor and wall openings and holes are different in General Industry (1910.23) and Construction standards (1926.502). The General Industry requirements include additional guarding requirements, such as railings or administrative controls, which are not addressed in the Construction standard or in BNFL procedures. Similarly, the BNFL hot work procedures were based on the Construction hot work requirements (1926.352) but also included some, but not all, of the hot work requirements of 1910.252. For hearing protection, in some cases BNFL imposed more requirements than were addressed in 1926.52 (e.g., performing annual audiograms), but fewer requirements than were addressed in some sections of 1910.95 (e.g., establishing a hearing conservation program). Some BNFL managers had informally determined that the General Industry standards applied only to specific plant areas, such as the Supercompactor Facility, whereas other BNFL managers had equally applied both the General Industry and Construction standards for all work activities.

Deficiencies were also noted in the process for flowdown of requirements from BNFL WSS to subcontractors. The BNFL Procurement organization has maintained a generic set of requirements as a source document for procurements. However, there was no formal process, nor were responsibilities clearly assigned, for keeping the ES&H requirements in this document current with respect to WSS. Some requirements in BNFL WSS were not imposed on one BNFL subcontractor. The BNFL gap analysis did not identify this deficiency.

Finding #5: BNFL has not established effective processes for ensuring that WSS are consistent with regulations, including OSHA construction and general industry requirements, and industry consensus standards or for ensuring that ES&H requirements in WSS are incorporated into policies, procedures, and subcontracts.

The DSA for the Three-Building D&D project was submitted by BNFL before the CFR deadline and was approved by DOE in February 2003. The new DSA was a substantial improvement over the previous authorization basis, which was scattered among several documents and thus difficult to use. One technical deficiency was identified in the approved DSA. Specifically, the DSA did not include an analysis of the chemical toxicity of uranium for two analyzed event scenarios that had the potential to expose workers to hazardous levels of airborne uranium compounds: (1) crane load drop or impact, and (2) earthquake. Although both analyses addressed the radiological hazard of these potential events, neither addressed the toxicological hazard. The toxicological hazard should be addressed because, for the

low enrichments associated with the Three-Building D&D project, uranium's toxicological hazard could be significantly more limiting than its radiological hazard. At the completion of this OA inspection, this condition had not been identified by the contractor as a Potentially Inadequate Safety Analysis, as required by the BNFL USQ procedure.

The OA team determined that the basic elements for DSA implementation and maintenance were in place. These included an authorization basis procedure, which clearly identified the authorization basis elements, and work process procedure elements to assure that activities were analyzed and performed within the DSA.

EM approved the BNFL USQ procedure on August 12, 2002. Overall, it adequately addresses most of the elements of the CFR and guidance provided by DOE. In March 2003, OR performed an assessment of the program and identified a number of concerns. The assessment report was issued May 2, 2003, with a request for a corrective action plan within 30 days. The OA team discovered several significant areas where the USQ procedure was non-conservative or weak, which could lead to non-compliances with 10 CFR 830:

- Non-conservative screening criteria: The BNFL deficiency in this area is essentially the same as that described for BJC above.

- Too narrow "margin of safety" definition: The BNFL deficiency in this area is essentially the same as that described for BJC above.

- Non-conservative instructions regarding USQD probability questions: In accordance with the DOE guide, Questions 1 and 3 of the USQD process address whether the change increases the probability of an accident or malfunction, respectively. The BNFL procedure adds a non-conservative criterion to these questions. The procedure states that if the proposed change, test, experiment, or as-found condition meets the design, material, and construction standards applicable to the SSC being modified, then the change does not increase that probability. This assumption is invalid, in that changes in the design, material, and construction could significantly degrade the capabilities of SSCs while remaining completely within the original standards.

- Incorrect probability criterion attached to USQD question regarding different type of accident or malfunction: Question 5 of the DOE guide addresses whether the change creates the possibility of an accident or malfunction of a different type than previously evaluated in the safety analysis. However, the BNFL procedure discussion states that "accidents or malfunctions of a different type are limited to those that are considered to be as likely or more likely than those considered in the approved safety analysis." This assumption improperly imposes probability restrictions to the consideration. According to the CFR and the DOE guide, increases in probability are required to be addressed separately, and only in USQD Questions 1 and 3.

An additional weakness identified in the procedure related to inadequate and unnecessarily restrictive qualifications requirements. The procedure requires that personnel who prepare USQ screenings have only an unspecified level of USQ training and an unspecified level of facility-specific knowledge. Although none of the BNFL screeners was found to be underqualified, there are no requirements for education, overall experience, or specific nuclear experience. The procedure also requires that to be qualified to perform USQDs one must have five years of *operations* experience in a nuclear facility. Taken literally, startup, maintenance, or testing experience would not be adequate according to the procedure, although such technical experience may provide adequate qualifications. Some of these weaknesses resulted in part from inconsistencies and ambiguities in the DOE USQ guide.

The OA team also sampled USQ documents generated since approval of the new procedure. Of ten procedure change screenings reviewed, nine were incorrectly screened out because the changes were judged not to *affect* the procedure, which is an improper screening criterion. From this sample the OA team concluded that most procedure changes were incorrectly screened out as a result of the non-conservative screening criteria.

Finding #6: Weaknesses in the BNFL USQ procedure could lead to an undetected USQ and potential non-compliance with 10 CFR 830, Subpart B.

Summary of Guiding Principle #5. DOE has established appropriate ES&H requirements in BJC and BNFL contracts and has established processes for reviewing new and revised DOE directives for applicability to BJC and BNFL and for incorporating appropriate changes into contractual requirements. OR relies principally upon BJC and BNFL to identify applicable changes in regulatory requirements and consensus standards and to propose contract changes to incorporate these changes when needed, but neither BJC nor BNFL has established a systematic process for identifying such requirements.

EM's Safety Basis Special Project Team has been effective in developing DSAs that meet the requirements of 10 CFR 830, Subpart B. The Special Project Team efforts have resulted in timely submittals and improvements in the ETTP safety basis. However, OA identified a number of deficiencies in BJC and BNFL USQ procedures. Correction of these deficiencies is essential to the proper maintenance of recently developed DSAs.

In recent months, BJC has taken a number of steps to ensure that appropriate requirements are specified in its contract with DOE and that these requirements are tailored and flowed down through company documents to the individuals responsible for implementing these requirements. However, effective processes for updating the WSS need to be established.

Applicable ES&H requirements for the BNFL Three-Building D&D and Recycle project are contained in the DOE/BNFL contract. However, BNFL has not established effective processes for the flowdown of these requirements through implementing procedures. BNFL identified this deficiency about six months ago, but corrective actions are not complete.

C.3 CONCLUSIONS

Although a number of deficiencies remain, EM, OR, AMEM, and ETTP contractors have made significant improvements in the ISM program at ETTP. With a few exceptions, clear roles and responsibilities have been established and communicated to responsible staff. Most aspects of processes for establishing requirements and incorporating them into work instructions are effective, although some deficiencies remain to be addressed in some elements of BJC and BNFL processes. EM, OR, BJC, and BNFL have devoted significant resources and attention to the timely completion of 10 CFR 830, Subpart B, requirements. The DSA documents produced through this effort are a significant improvement, although one technical deficiency needs additional attention. The BJC and BNFL USQ processes are improving but still have a number of weaknesses that warrant increased management attention.

C.4 RATINGS

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

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

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.

Department of Energy

1. **Ensure that the OR FRAM and the OR Organization Manual are revised in a timely manner and adequately reviewed to ensure comprehensiveness and quality**.

2. **Include ES&H performance in the performance appraisal process for AMEM staff**.

3. **Establish systematic processes for identifying applicable changes to regulatory requirements and industry consensus standards, or assure that such processes are established by BJC and BNFL.** Consider the following process elements:

   - Systematic review of Federal Register Notices and changes to state requirements, and notification of responsible individuals of changes with potential applicability

   - Provisions to assure timely incorporation of applicable regulations into baseline requirements

   - Provisions to assure timely incorporation of necessary industry standards into baseline requirements, including assignment of clear responsibilities to SMEs for reviewing new and revised standards that are within their areas of expertise and for proposing changes to baseline requirements and procedures to incorporate necessary requirements.

4. **Enhance the value of applicability determinations coordinated by the OR Directives Management Team by including more information in documented determinations.** Include the following information on correspondence to line organizations:

   - The basis for applicability determinations made by OR SMEs

   - Insights, based on OR SME review, regarding the costs and benefits of incorporating new and revised requirements into baseline requirements.

5. **Provide the services of the OR Directives Management Team to the BNFL COR, similar to the services provided to the BJC COR.** Services to consider include:

   - Coordination of initial applicability determinations by OR SMEs for new and revised DOE directives

   - Maintenance of official DOE records of applicability reviews, impact assessments, and related correspondence.

6. **Establish a mechanism for assuring that subcontractor medical records generated by community medical providers are adequately preserved and accessible for DOE and DOE prime and subcontractors in order to monitor site safety systems, potential health effects to workers, and future epidemiological research.**

7. **Enhance USQ training of DOE personnel who review or approve USQ programs or documents to address the deficiencies that were observed in BJC and BNFL USQ procedures.**

8. **Work with the DOE Office of Environment, Safety and Health to revise DOE Guide 424.1-1, *Implementation Guide For Use In Addressing Unreviewed Safety Question Requirements*.** Consider the following specific changes:

   - Remove the example of maintenance procedures being categorically excluded from the requirement to perform USQDs and add legitimate examples, such as janitorial procedures.

   - In the discussion of Question 3 of the USQD process, replace the word "failure" with the word "malfunction," to accurately reflect the CFR's requirement.

   - Add Question 4 regarding consequences of malfunction of equipment and a discussion of this question to the sample worksheet.

Bechtel Jacobs

1. **Establish a more systematic process for ensuring that ES&H requirements in WSS are effectively implemented through lower-tier documents.** Specific actions to consider include:

   - Ensure that a specific SME is assigned the responsibility for assuring flowdown of all WSS.

   - Require assigned SMEs to periodically certify that WSS are up to date and adequately implemented through lower-tier documents.

2. **Enhance oversight and control of subcontractors to assure compliance with ES&H requirements.** Specific actions to consider include:

   - Identify the causes for a subcontractor not meeting BJC ES&H requirements.

   - Determine the extent to which these causes could affect compliance by other BJC subcontractors.

   - Strengthen monitoring and control of subcontractors to address identified causes.

3. **Revise the current USQ procedure to fully comply with the requirements of 10 CFR 830, Subpart B, and the guidance of DOE Guide 424.1-1.** Specific changes to consider include:

   - Revise the screening criteria and discussions for SSC or procedure changes to address whether the change is to an SSC or procedure, in the broadest sense of the safety analyses.

   - Require that personnel generating, reviewing, and approving USQ screenings and USQDs be qualified to the standards of DOE Order 5480.20A or equivalent.

   - Change the independence criterion for reviewers of USQ documents to require that each one "be independent in the sense that he/she has not been involved in the preparation of the USQ documents."

   - Change "Margin of Safety" questions and discussions to remove the phrase "as defined in the bases of the TSR" or similar words, and add discussion to encompass "margin" as discussed or implied anywhere in the DSA.

   - Add the requirement that all changes involving criticality safety bypass screening and undergo a mandatory USQD per the USQ guide.

   - Add discussion of the potential for USQs in interim conditions of the facility while changes are being implemented.

   - Remove the example of maintenance procedures being categorically excluded from the requirement to perform USQDs and add legitimate examples, such as janitorial procedures.

4. **Ensure that essential ES&H functions are performed as required while new employees await their security clearances.** Evaluate options for accelerating security clearances (e.g., accelerated access authorization) or redistributing workloads.

BNFL

1. **Continue implementation of the corrective action plan to strengthen requirements management.** Consider the following in implementation of this plan:

   - Revise Policy PO-CS-006, *Work Smart Standards,* to include provisions for proposing changes to WSS that may be necessary to assure safety.

   - Eliminate dependence on DOE, or obtain agreement from DOE regarding support to be provided, for identifying new and revised applicable regulations.

   - Ensure that a specific SME is assigned the responsibility for assuring flowdown of all WSS.

   - Require assigned SMEs to periodically certify that WSS are up to date and adequately implemented through lower-tier documents.

   - Complete a more thorough gap analysis to better define specific flowdown deficiencies.

   - Develop a more rigorous process for assuring flowdown of new and revised WSS requirements into such documents as policies, procedures, enhanced work plans, subcontracts, and training lesson plans.

2. **Perform toxicity analyses of events in the basis for interim operations involving release of uranium compounds to determine whether the effects are more limiting than the radiological effects**. For completeness, revise the basis for interim operations to include discussion of these effects, even if they are less limiting.

3. **Revise the current USQ procedure to fully comply with the requirements of 10 CFR 830, Subpart B, and the guidance of DOE Guide 424.1-1.** Specific changes to consider include:

   - Revise the screening criteria and discussions for SSC or procedure changes to address whether the change is to an SSC or procedure, in the broadest sense of the safety analyses.

   - Require that personnel generating, reviewing, and approving USQ screenings be qualified at least to the standards of DOE Order 5480.20A or equivalent.

   - Change "Margin of Safety" questions and discussions to remove the phrase "as defined in the bases of the TSR" or similar words, and add discussion to encompass "margin" as discussed or implied anywhere in the DSA.

   - Add the requirement that all changes involving criticality safety bypass screening and undergo a mandatory USQD per the USQ guide.

   - Remove the existing instruction that small changes in margin in the non-conservative direction need not be considered a reduction in the margin. Add a discussion of the fact that the direction of the change in probability, consequences, or margin is the important factor in determining whether a USQ exists, not the magnitude.

   - Remove all discussion in Questions 1 and 3 that says changes meeting the design, material, and construction standards or similar language are not a USQ.

   - Remove all discussion of probability from the discussion of Question 5 of the USQD process, which addresses whether the change creates the possibility of an accident or malfunction of a different type than previously evaluated in the safety analysis.

   - Change the wording of the experience requirements to perform USQDs from five years of operations experience in a nuclear facility to five years of technical experience.

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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 East Tennessee Technology Park (ETTP). The organizations that were reviewed included the U.S. Department of Energy (DOE) Oak Ridge Operations Office (OR), the OR Office of the Assistant Manager for Environmental Management (AMEM), and the ETTP prime contractors—Bechtel Jacobs Company, LLC (BJC) and BNFL PLC. The OA review focused on feedback and improvement programs as they are applied to environment, safety, and health (ES&H) programs at the K-25 facility and the Three-Building Decontamination and Decommissioning (D&D) project.

The OA team examined the OR/AMEM line management oversight of integrated safety management (ISM) processes and implementation of selected line management oversight functions, including the Facility Representative program, ES&H assessments, OR/AMEM oversight procedures, the issues management process, the lessons-learned program, and the process for reviewing occurrence reports. The OA team reviewed BJC and BNFL 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 BJC monitoring and evaluation of subcontractor safety programs and performance were also examined. Selected aspects of feedback and improvement processes implemented by one BJC subcontractor (the K-25 asbestos abatement subcontractor) were also examined. The selective review of subcontractor activities was performed to provide insights about the effectiveness of BJC in establishing expectations for its subcontractors and ensuring that subcontractors meets those expectations.

D.2 RESULTS

D.2.1 OR Line Management Oversight

AMEM has clearly defined most of the oversight process in a set of AMEM-specific procedures. The AMEM procedure entitled *EM ES&H Oversight Program* comprehensively defines the responsibilities for line management oversight for the different levels of the organization (contracting officer's representative, program group leaders, team leaders, site office managers, Facility Representative group leader, and EM ES&H support team leader). The procedure also provides general requirements for the oversight program, including provisions for establishing an operational awareness program, reviewing and approving corrective action plans submitted by the contractor, developing quarterly oversight schedules, and performing management walkthroughs. Additional procedures describe how to perform specific oversight processes, including walkthroughs, assessments and corrective actions, and the Facility Representative program.

For the Three-Building D&D project, OR/AMEM oversight includes one Facility Representative (who performs daily walkthroughs), the Environmental Management Support Team (which performs monthly reviews according to an annual schedule), and a few unscheduled walkthroughs. The Environmental Management Support Team reports to the OR Assistant Manager for ES&H, and its members are matrixed to AMEM to provide dedicated line management oversight of OR sites that are under the cognizance of the AMEM. In addition, OR/AMEM performed assessments over the past year in a

number of areas: documented safety analyses, bioassay program, unreviewed safety question determination process, radiation and criticality alarm system, and criticality safety. Most of the recent assessments were performed to support the documented safety analysis development project. The Facility Representative is fully qualified and demonstrated thorough knowledge of the facilities during OA observations of walkthroughs. The Facility Representative meets with BNFL once a week, and findings are presented and tracked via the contractor's issues database. The Environmental Management Support Team walkthroughs and assessments are documented and formally transmitted to BNFL.

For the K-25 facility, OR/AMEM oversight includes one Facility Representative, the Environmental Management Support Team, and miscellaneous walkthroughs being performed by the closure project director, team leader, and project manager. The K-25 Facility Representative is fully qualified and knowledgeable of the facility. In recent months, OR/AMEM has conducted some ES&H assessments, mostly related to the documented safety analysis project. In addition, when an incident occurs, the closure project director and the responsible facility project manager perform a walkdown of the incident in the field. Assessments and any walkthroughs that contain findings are formally transmitted to BJC for action.

The Facility Representatives are effectively reviewing occurrence reports and ensuring that reports are technically correct before they are approved. The Facility Representatives have rejected a significant fraction of BJC occurrence reports, prompting AMEM to formally direct BJC to correct weaknesses in occurrence report development. BJC has taken steps to improve the quality of occurrence reports, with particular emphasis on their root cause analysis. A few BNFL occurrence reports are significantly overdue because the Facility Representative and BNFL have not agreed on the resolution of comments. Completion of occurrence report corrective actions is generally verified by the responsible Facility Representative within individual facilities. However, corrective actions for institutional deficiencies are not being formally assigned for closure verification by AMEM.

Although there are some positive attributes, weaknesses were identified in the OR/AMEM line management oversight processes and implementation of those processes at the Three-Building D&D and K-25 projects. Considering the size of the buildings, the continually changing nature and hazards of D&D activities, and the continuous operations (D&D activities are performed 24 hours a day, 7 days a week), one Facility Representative cannot provide sufficient coverage of the Three-Building D&D project. AMEM has determined that two additional Facility Representatives are needed and plans to assign them to the project by June 2003. In addition, many AMEM oversight procedures are significantly out of date, and a major effort is in progress to update them to reflect the recent organizational changes and use of the new OR issues management system (ORION2).

In general, the Facility Representatives and many Environmental Management Support Team ES&H subject matter experts (SMEs) are currently not performing their normal oversight responsibilities because many members are supporting special projects. Several of the Facility Representatives have been temporarily assigned to support the documented safety analysis review and implementation project and various Type B accident investigations. These reassignments have significantly reduced coverage in many ETTP facilities for the last several months. The percentage of field time for the Facility Representatives was significantly below the goal (which is 40 percent time in the facility) over the last few months, and few walkthroughs have been performed. Also, part of the ES&H support group has also been redirected to support several projects, limiting its ability to conduct line oversight at ETTP facilities in all the needed safety areas. The reduced level of line oversight over this period of time reduces the ability of AMEM to identify and correct deficiencies in day-to-day work activities at ETTP facilities, such as the deficiencies identified by this OA inspection and discussed in Appendices C, E, and F. AMEM management has acknowledged this risk but also recognizes the importance of documented safety analyses to long-term facility safety and therefore approved the temporary staff redeployments. However,

AMEM has not developed a temporary oversight plan to ensure that the most hazardous operations will continue to receive adequate levels of AMEM line oversight.

In a broader sense, AMEM has not systematically evaluated where it should apply line oversight resources during normal conditions. Based on OR Order 450, *ORO Assessment Program*, AMEM, as the line manager, is responsible for developing a comprehensive assessment program that addresses the requirements in a balanced manner and is consistent with the feedback and improvement function of ISM. No process has been defined for systematically examining contractor performance and assigning the appropriate oversight activities (assessments and walkthroughs) to review operations and recognized ES&H weaknesses. The DOE Office of Environmental Management has identified a number of ES&H weaknesses as areas for priority attention, such as lockout/tagout deficiencies and transportation incidents, but AMEM does not have a systematic process for focusing line oversight efforts on such management priorities. In addition, AMEM has not developed an oversight plan to ensure that the major safety areas are reviewed on a long-term, recurring basis. AMEM has begun developing such a plan, but progress has been slow, in part because assessment staff were deployed to other high priority tasks, such as safety management system reviews, readiness reviews, and procedure development.

Since the inception of the new issues management system in November 2002, AMEM has partially input the related oversight activities into the ORION2 system. The Nuclear and Operational Safety Performance Team has entered most of the assessments and corrective action plans into the database. The OR ETTP Closure Project Division has entered walkthroughs from their facilities that contain findings into ORION2, but walkthroughs that do not result in findings are not always noted in the database. The Facility Representatives for BNFL and K-25 and two of the Environmental Management Support Team SMEs have not started using the system to enter their walkthroughs (although walkthroughs that contain findings for BJC facilities are entered by the OR ETTP Closure Project Division). The new system provides an effective framework, but management attention is needed to ensure that all the required oversight data is entered into the ORION2 system at the completion of walkthroughs and assessments, particularly for Facility Representatives who rely on this system to document their activities.

AMEM has not established a lessons-learned program or designated a lessons-learned coordinator. Currently, OR sends lessons learned to the AMEM staff for information only. As a result, lessons learned are not being tracked and evaluated by SMEs, and response actions are not being assigned to AMEM staff when necessary to address lessons learned. A recent lessons learned involving hazardous material had action steps that were not entered in ORION2 for tracking and had not been completed by the required deadline.

Finding #7: OR/AMEM has not established an effective process for evaluating safety trends and prioritizing oversight activities into an annual oversight plan that ensures an adequate evaluation of contractor ES&H performance and promotes continuous ES&H improvement. In addition, the oversight processes documentation is not current, Facility Representative coverage of D&D efforts is insufficient, issues management processes are not fully utilized, and no lessons-learned program has been established.

D.2.2 BJC and BJC Subcontractor Feedback and Improvement Systems

Assessments

BJC and its subcontractors conduct various types of assessments, including independent assessments, management assessments, BJC walkdown inspections of subcontractors, self-assessments, multidisciplinary readiness reviews for new subcontractor projects/major evolutions, and day-to-day

surveillance activities. BJC develops an annual schedule integrating all of these assessment activities as well as planned DOE assessments.

BJC performs numerous assessments of subcontractor performance. For example, the BJC quality assurance organization performed ten independent assessments in 2002, and BJC subcontractor technical representatives (STRs), safety advocates, quality engineers, and ES&H SMEs coordinate their efforts to conduct weekly walkdown inspections of subcontractor work areas. The weekly walkdown inspections use a formal checklist and regularly address selected ES&H focus areas. BJC also performs several periodic evaluations of subcontractor ES&H performance, including a monthly "scorecard" and a semiannual evaluation against ISM criteria. BJC STRs regularly discuss safety performance with subcontractor management, including at weekly status meetings. The K-25 abatement subcontractor has established schedules for quality assurance assessments and performs numerous inspections, including daily walkdown inspections of work areas and activities and weekly inspections by health and safety personnel jointly with sub-tier subcontractor foremen.

Although some deficiencies are evident in processes and their implementation as discussed below, these varied and numerous BJC and subcontractor assessments are effective in identifying and documenting facility conditions and safety process and performance deficiencies in many important aspects of ES&H. For the most part, assessment processes are adequately documented (e.g., procedures define the processes), and assessment results are documented and appropriately communicated to the respective organizational elements. As discussed in Appendix E, ES&H provisions were effectively implemented in many areas (e.g., fall protection, electrical safety, hearing protection, waste management, and control of contamination). The numerous and varied assessments are performed by knowledgeable personnel, who devote significant attention to observations of work activities and facility conditions. These assessment processes appear to have contributed to the observed good performance in a number of important safety areas.

Notwithstanding the positive aspects, the assessment programs have not been fully effective in identifying weaknesses in some aspects of ES&H programs, including missing certain hazard controls, insufficient procedural adherence, and a lack of rigor in implementing some safety requirements (see Appendix E). Process and performance weaknesses identified with the BJC assessment programs include:

- The weekly walkdown inspections, the most direct and frequent BJC oversight assessment tool, are not cited as a discrete activity on the integrated assessment and oversight plan.

- Although five formal BJC surveillances of K-25 abatement processes and activities were scheduled in calendar year (CY) 2002, only one is scheduled for CY 2003.

- BJC's November 2001 Readiness Review of the K-25 asbestos abatement subcontractor verified the adequacy of program documents (e.g., quality assurance plan and ES&H plan) but did not establish the adequacy of safety program implementing procedures. No structured follow-up assessments were performed to ensure that all appropriate implementing instructions had been established and were effectively implemented.

- Assessments of subcontractor training and procedure implementation by the K-25 asbestos abatement subcontractor, which are identified as mandatory in the BJC oversight procedure, are not being scheduled or performed as required.

In addition, BJC has not ensured that subcontractor feedback and improvement processes are effectively implemented. As discussed later in this section, weaknesses in subcontractor feedback processes were noted in the areas of injury and illness evaluations, medical surveillance, lessons learned, and employee

concerns. In addition, the following weaknesses in the K-25 asbestos abatement subcontractor's assessment program indicate a need for increased BJC management attention and improvements in BJC processes for directing and monitoring subcontractor performance:

- Approximately half of the scheduled quality assurance assessments in CY 2002 were not performed.

- No specific ES&H assessments were performed in CY 2002. The subcontractor's original CY 2002 assessment schedule called for a few ES&H assessments, and was approved by BJC. However, the schedule was subsequently revised in mid-2002 eliminating those few ES&H assessments. There is no documentation of the rationale for these revisions.

- No specific ES&H assessments are shown in the CY 2003 schedule.

Overall, the BJC and subcontractor assessment processes as applied to the K-25 asbestos abatement subcontractor activities are effective in some areas; for example, numerous and recurring walkdown inspections are effective processes for watching work activities and observing facility conditions. However, the more in-depth assessments (e.g., assessments of ES&H programs) are performed infrequently or are not rigorous. As a result, BJC processes are not fully effective in identifying some types of weaknesses (e.g., missing hazard controls) that are difficult to identify without an in-depth evaluation. As a result, deficiencies in these areas persist, as discussed in Appendix E. In addition, BJC has not provided sufficient direction and monitoring of the K-25 asbestos abatement subcontractor's feedback and improvement programs to ensure that they are fully effective.

Finding #8: BJC feedback and improvement programs have not ensured that BJC and its subcontractors effectively implement ISM. Weaknesses were evident in assessments, issues management, lessons learned, and employee concerns programs.

Issues and Corrective Action Management

BJC has established a formal, graded approach for managing the documentation, evaluation, and resolution of most assessment findings, Occurrence Reporting and Processing System (ORPS) reportable events, and Price-Anderson Amendments Act (PAAA) non-compliance corrective actions. A robust database, called the Issues and Corrective Action Tracking System (ICATS), supports tracking and trending corrective actions. Some deficiencies identified during the weekly BJC walkdowns are entered into ICATS. BJC management has recently been reviewing all walkdown findings, ensuring more rigorous categorization of issues for input to ICATS, and directing formal responses from subcontractors.

BJC STRs have taken appropriate actions in a number of areas to hold the K-25 asbestos abatement subcontractor accountable for improving safety performance, such as the recent efforts to reduce injuries from cuts and punctures. The K-25 asbestos abatement subcontractor has been responsive in addressing safety concerns raised by BJC assessments, as evidenced by several work pauses, including a full day stand-down with significant involvement of subcontractor workers in identifying methods for performance improvement. With some exceptions, the K-25 asbestos abatement subcontractor adequately documents safety issues on non-conformance reports (NCRs) and maintains a database to track corrective actions.

Notwithstanding the generally effective management of issues, there are weaknesses in some aspects of issues management, especially the categorization and processing of findings identified through mechanisms other than structured assessments (e.g., management walkthroughs). As a result of process

and implementation weaknesses, some issues are not being consistently evaluated and corrected. Specific areas of weakness include:

- BJC does not always effectively track and document corrective actions required of subcontractors. The K-25 asbestos abatement project does not have a tracking system for issues that are not captured by the ICATS process. In one case, a response to a K-25 asbestos abatement subcontractor performance issue identified during a BJC assessment had not been received seven weeks after the response due date identified in an STR letter. In another case, a known issue of inadequate documentation by the K-25 asbestos abatement subcontractor of an event on an NCR was not formally communicated to the subcontractor, and the issue was inappropriately identified as closed.

- The classification of deficiencies identified during weekly walkdown inspections is not defined in the oversight procedure but outlined in an uncontrolled guidance document. BJC's monthly, color-coded "scorecards" and semiannual ISM evaluations are provided to the K-25 asbestos abatement subcontractor informally, without clear expectations for formal responses or corrective action plans for unsatisfactory performance areas.

- BJC failed to file an ORPS report in February 2003 when a sitewide operational emergency was declared after an emergency action level (greater than five inches of rain) was triggered.

- The K-25 asbestos abatement subcontractor did not perform or document an incident assessment for spills as required by the ES&H manual. Although documented on a subcontractor NCR, neither the subcontractor nor BJC conducted the required investigation and documentation of two events involving rupture of large bladder bags, which resulted in spills of potentially contaminated liquids at the ETTP site. The subcontractor's NCR for the first event addressed potential deficiencies in the design of the bladder, but did not address potential deficiencies in work control and organizational interfaces. The second event was inadequately described on the NCR, which failed to describe the spill of potentially contaminated water or the events that resulted in the spill.

In one instance, BJC did not ensure that a subcontractor accurately reported, investigated, and corrected the causes of injuries and illnesses. The K-25 asbestos abatement subcontractor documentation and disposition of a February 2003 incident resulting in an injury was not sufficient to demonstrate that appropriate immediate corrective or long-term preventive actions were taken. In this instance, a worker was injured with a cut on his leg when a light fixture fell on him while it was being removed from a suspended ceiling by his supervisor. The documentation of this incident failed to address the work control aspects of this event (e.g., insufficient work planning and controls to preclude the individual from standing in a potentially hazardous location). Follow-up actions for this event were also inadequate in three ways. First, this type of work was to be suspended until the activity hazards assessment (AHA) could be revised, but there were no details or milestones for the revision process, and it had not been revised at the time of the OA inspection. Second, the K-25 asbestos abatement subcontractor has no mechanism for ensuring that this type of work will not be performed before the AHA change is completed and verified to be effective. Third, no lessons learned were developed for this event.

Although the K-25 asbestos abatement subcontractor retains some injury and illness investigation records, there was not always evidence of analysis, corrective/preventive actions, or mechanisms to ensure proper resolution. The subcontract specifies that the subcontractor supervisor is to complete a Supervisor Incident/Accident Investigation Report for accidents of any kind and forward it to the STR. These forms have not been completed by the K-25 asbestos abatement subcontractor, and the STR has not taken action to ensure the subcontractor's completion of the forms. The subcontract also specifies that the subcontractor is to implement the BJC accident/incident reporting and record keeping procedure. However, this BJC procedure does not provide adequate details on the requirements for reporting and

record keeping. Specifically, it requires that all injuries and illnesses be investigated, but does not provide adequate specification for documentation. It also specifies that all incidents, including those not involving an injury or illness, be documented but does not indicate whether any investigation is required or expectations for documentation. Initial incident reporting forms are usually completed and reflect the immediate action taken. However, with few exceptions, the K-25 asbestos abatement subcontractor was unable to provide documentation reflecting investigations of injuries and incidents, analysis of causes, or specification of preventive actions.

Finding #9: BJC has not ensured that all injuries and operational events are properly documented and evaluated for causes and preventive actions.

BJC has recently initiated several new entities and processes to improve ISM implementation. A Closure Project Evaluation Board and ISM Improvement Organization have been formed. These entities have various subgroups that are addressing such issues as a "Six Sigma" review of the integrated assessment process, ISM program maintenance, closure project evaluations, and preparation for ISM re-verification. Several new procedures on management assessments, trending, and the integrated assessment and oversight program have been drafted. An Issues Review Board of managers has been formed and is screening issues for validity, trends, and proper classification for entry into ICATS. Another management panel, the Corrective Action Review Board, has been formed to screen corrective actions and compensatory measures for validity, proper cause determination, and effectiveness of proposed recurrence controls. These initiatives are appropriate steps to address some of the weaknesses identified by the OA team. For example, reviews of issues by the Issues Review Board have resulted in more rigorous evaluation of safety deficiencies.

Lessons Learned

Externally-generated lessons learned are being screened for applicability to ETTP projects, lessons-learned reports are being generated from internal events, and external and internal lessons learned are being disseminated to workers. An internal web site provides an extensive and accessible collection of lessons learned. To assist users in identifying potentially applicable lessons, the web site provides a search function that allows sorting by date, classification level, activity, functional area, hazard, and keywords. The web site also provides a list of contacts and links to external lessons-learned sources. A BJC institutional lessons-learned coordinator serves as the program owner and screener for external lessons learned. Personnel in line organizations have been designated as local coordinators and points of contact for generating and sharing lessons learned. Project quality assurance personnel distribute lessons learned to STRs with the expectation that they will be communicated to subcontractors. The program requires completion of a feedback form for all distributed lessons learned except for those classified as "information only." The lessons-learned program manager has forwarded approximately 200 lessons learned for further dissemination in the last two years.

Notwithstanding the communication of many lessons learned at ETTP, the effectiveness of the program as it affects subcontractors is limited and poorly documented. DOE expectations for lessons learned are documented in a DOE standard and a handbook and are briefly referred to in the DOE ISM policy and other directives. However, requirements for applying lessons learned are not clearly established in DOE or OR directives, and BJC has not included any specific expectations related to formal lessons-learned programs in subcontract documents. Although there is evidence that some lessons learned are being communicated to subcontractors by the STRs, with the exception of an initial pre-start of work transmittal, there was no documentation of routine transmittals to the K-25 asbestos abatement subcontractor. In addition, the K-25 asbestos abatement subcontractor has not established a procedure or process for evaluating and communicating lessons learned to its employees or subcontractors and does not

maintain records or files of lessons learned. Subcontractor workers and supervisors do not have routine access to computers to access the BJC lessons-learned web site. Feedback forms on applicability reviews and directed actions are not consistently returned to, or monitored by, the BJC lessons-learned coordinators. Although the required feedback form is available electronically, it is not consistently used by recipients, nor is it used to evaluate program implementation. The implementation of the lessons-learned program by the K-25 asbestos abatement subcontractor has not been assessed (see Finding #8).

Employee Concerns Programs

BJC employees and subcontractors are encouraged to voice any safety concerns to their immediate supervision for resolution. If concerned workers choose not to work through supervision or desire confidentiality or anonymity, several other vehicles are available for reporting concerns. A formal employee concerns process is adequately documented in a procedure and adequately communicated to BJC workers (e.g., a web site, employee training). The evaluations, disposition, and documentation for employee concerns reported to BJC in the last 15 months were timely, thorough, and appropriate.

Another institutional program called "I Care-We Care" provides a forum for documenting and resolving employee safety concerns with the involvement of line and union workers, site management, and ES&H support organizations. This program is adequately defined in a formal procedure and effectively communicated to workers. The "I Care-We Care" program is administered by a committee of union workers, BJC management, and ES&H support personnel that conduct evaluations of concerns submitted by employees. Approximately 150 "I Care-We Care" concerns have been reported since January 2002. Based on a sample of data and completed concern resolution reports, with some exceptions as discussed below, these concerns are adequately evaluated and resolved in a timely manner and feedback is provided to the concerned individual.

Although these processes are providing for resolution of many employee concerns, there are a number of weaknesses in the procedures and implementation of these programs, especially for subcontractors to BJC and lower-tier subcontractors. BJC has not ensured that appropriate employee concerns processes have been established and that employee concerns are adequately addressed for subcontractor employees. The communication of expectations and availability of BJC and DOE avenues to address concerns are insufficient for some subcontractors (e.g., subcontractors do not receive employee concern orientation modules and handouts). Although the K-25 asbestos abatement subcontractor ISM program implementation plan states that safety concerns can be resolved through the BJC "I Care-We Care" program or an internal employee concerns program, neither process was documented or communicated to employees of the K-25 asbestos abatement subcontractor or lower-tier subcontractors. In addition, these subcontractors do not have ready access to the boxes used to submit concerns. The BJC employee concerns office has evaluated implementation of contract requirements for employee concerns programs for some subcontractors (i.e., the 32 workforce transition subcontractors, which are subcontractors that have hired the many former prime contractor workers and have special contract provisions related to their workforce) but not for the other 70 plus subcontractors on site (including the K-25 asbestos abatement subcontractor). Only five bulletin boards on site have posters for the employee concerns program. Although workers performing asbestos abatement in K-25 stated that they were aware of mechanisms to raise safety concerns with their supervisors, no formal subcontractor processes have been established or formally communicated to workers (see Finding #8).

In addition, the evaluation and disposition of some "I Care-We Care" issues are not sufficiently documented, and the process is not well advertised or made easily accessible for many subcontractor workers (i.e., those not in the Paper, Allied-Industrial, Chemical and Energy Workers International Union). For example, one concern was submitted on training for personnel who work with lead; the documentation for closing this concern noted that the concerned individual agreed to drop the concern

after a discussion with his supervisor but did not address the validity of the lead problem or the need for clarification of training requirements. Records for a number of issues with potential safety concerns reflect closure, with little or no description of the basis for disposition or an indication that issues were in fact resolved, other than a brief electronic mail or written statement. There were also several inconsistencies between the BJC procedure and the actual practices of the committee (e.g., use of forms and an outdated "significance scorecard" not cited in the procedure).

D.2.3 BNFL Feedback and Improvement Systems

Assessments

BNFL generates and solicits feedback on safety-related workplace and material conditions, processes, and performance through a variety of assessment processes. The BNFL Quality Assurance organization performed 12 independent assessments in the last year, and 20 are scheduled for CY 2003. The BNFL corporate office also conducts an annual quality assurance audit. Recent independent assessments have been generally comprehensive and in-depth program reviews that have identified substantive issues for improvement. Operational and support organizations are conducting numerous management assessments.

ES&H personnel conduct periodic safety and housekeeping walkdowns, using a checklist that includes material condition elements and observing work activities and the implementation of safety requirements by workers. Safety committee personnel conduct monthly safety and housekeeping walkdowns on a schedule that covers all areas of the project once a year. Results from these walkdown activities are entered into a module in the issues management system database for trending and for tracking of corrective actions if not corrected immediately. The ES&H department has developed a set of checklists on pocket-sized cards that identify key safety elements or requirements for various ES&H topic areas. Line supervisors document observations of work and workplace conditions using these checklists, and the results are tabulated and trended monthly by the ES&H manager.

BNFL has established a behavior-based safety observation program, with approximately 150 trained observers. Typically 25 to 30 active observers are conducting approximately 100 observations per month, identifying and correcting unsafe behaviors and providing positive feedback for safe behavior. BNFL also has an active program for soliciting information and suggestions from workers about potentially unsafe conditions, hazards, and near misses.

The OA team identified a few areas for improvement in the performance of assessments. Only one of the management assessments scheduled by Supercompactor Operations for CY 2002 and none of the Removal Operations organization's CY 2002 assessments was performed. BNFL identified the failure to perform scheduled assessments earlier this year, and the status of planned assessments is now being discussed at senior staff meetings with the Project General Manager.

Issues and Corrective Action Management

Safety issues identified by the assessment and feedback mechanisms discussed above are dispositioned and tracked in several ways. Resolutions for near-miss/safety suggestions are tracked in a safety committee database. Supervisor observations are generally corrected on the spot, but the ES&H manager reviews and trends observations in each topical area monthly. BNFL has recently revised its formal issues management process to include more lower-level findings, enhancing the ability to identify adverse trends and precursor conditions. The formal issues management system employs a graded approach to safety issues using a four-level, risk-based rating system that dictates the level of rigor required for evaluation and causal analysis, development and tracking of corrective and preventive actions, verification requirements, and approval authority. In most cases reviewed by the OA team, safety issues

were appropriately categorized and evaluated, and appropriate corrective actions were established. For example, the investigation, analysis, and corrective actions for a June 2002 event, reported via ORPS, where roof panels were dropped to a truck bed, were comprehensive and well documented.

However, the OA team identified several deficiencies in BNFL's implementation of issues management. BNFL employees have documented the evaluation and resolution of many recent safety issues or apparent safety issues, using safety suggestion/near-miss/hazard identification cards; however, the documentation has not been sufficient to describe the validity of the issue, adequately evaluate causes, or establish appropriate corrective actions and recurrence controls. Although discussions with BNFL management indicated that investigations were conducted and corrective actions were taken, the adequacy of these efforts could not be verified because of inadequate documentation. Issues that had not been documented in the BNFL issues management system, which would have initiated a more formal analysis and corrective action process, include:

- A February 2003 safety suggestion describing a lift where an improperly cut pipe section dropped unexpectedly, almost hitting two people. The corrective action noted was that crews were briefed on precautions to be taken in lowering pipe. There was no discussion of the work planning or supervision aspects of the event. The event was not reported or screened as an ORPS-reportable near miss or documented on an incident report, and no critique was held. The OA team witnessed another situation in which a converter was being readied for a critical lift with piping that had not been disconnected; in this case, an employee noticed the problem before the item was lifted.

- Workers identified a charged and in-service sprinkler line during a piping removal task and stopped work. The foreman stated it had been overlooked and that a new work document was required to remove it. There was no further evaluation of how an energized line was overlooked during preparation of the original work documents.

- A safety suggestion indicating that new "flame resistant" coveralls were not as flame retardant as previous coveralls, with sparks burning holes in the coveralls and street clothes. The issue was closed after BNFL conducted an investigation and decided to remove the new coveralls from the inventory. However, there was no further discussion concerning the adequacy of the processes for procurement and testing of new types of coveralls. The effectiveness of flame retardant coveralls is particularly important because of the large amount of hot work performed by BNFL and the previous incidents involving clothing fires at ETTP (including a 1997 fatality involving non-flame-retardant anti-contamination clothing that caught fire during a welding activity).

As described in Appendix F, the OA inspection team observed that a firewatch during plasma arc cutting was not performed as required. BNFL had recently identified other firewatch deficiencies through two different feedback mechanisms, but evaluations and disposition of these incidents were inadequate and ineffective in preventing recurrence. A behavior-based safety observation in February 2003 stated that work was being performed with plasma arc cutting torches without trained firewatches. The resolution was simply a re-statement of existing requirements (i.e., supervisors are responsible to identify training requirements and assign trained firewatches, and workers are responsible for telling the supervisor if they are not trained). There was no discussion of any actions to investigate or verify training of firewatches. In March 2003, six incidents where firewatches were not performed properly were documented on supervisor safety observation cards. This situation was not identified as an adverse trend.

The OA team's review of a BNFL listing of several near-miss events indicated that not all of these events had been adequately evaluated or documented to ensure appropriate ORPS reportability screening or the identification of root causes and preventive actions. Although this listing was not intended to be based on

the criteria for a near miss in accordance with the ORPS process, the incidents described included several ORPS-reported events and other events that appear to meet the intent of a reportable near miss in accordance with DOE Order 232.1A. Required documentation of appropriate evaluation, such as incident reports, critique minutes, or NCRs, could not be located for an event in March 2002 where a piece of metal was dragged off a waste container and shattered an operator cab windshield. No documentation could be located for another near-miss event where a scissor lift was pulled over when a material transport vehicle pulled a rope laid over the lift basket.

BNFL injury and illness/incident reporting procedures do not adequately define or describe terms and processes. The BNFL injury procedure does not specify that all injuries are to be evaluated by the medical unit or delineate requirements for documenting first aid cases. Two BNFL procedures for injury and illness reporting and for medical clinic paperwork are in conflict regarding completion of a Supervisor's Accident/Investigation Report for first aid cases. These forms, which require documentation of causes and specific recurrence controls, are not being completed except for Occupational Safety and Health Administration (OSHA) reportable injuries.

BNFL's response to an OSHA recordable injury of a BNFL subcontractor in February 2003 failed to promptly investigate the event, fully document the extent of the event, and specify appropriate preventive actions. In this event, workers used improper equipment and techniques to remove a 220-pound ceiling-mounted transformer. The transformer dislodged, fell to the floor of a scissor lift, and struck a worker's hardhat, causing a neck injury. The incident report was not completed until five days after the event. Also, witness statements were not completed, and the critique was not timely (performed five days after the event). The critique indicated that a stop-work order had been issued and that work crews were instructed by the supervisor about the accident and the unsafe practices involved; however, the critique did not identify any further actions to be taken, did not address the supervisor's failure to notify Safety and Health of the event in a timely manner, and did not address work control aspects of the event, such as inadequate supervision, training, pre-job briefings, or subcontractor oversight. It is not clear that all personnel involved in removal operations were made aware of this event and its causes.

All safety and housekeeping inspection findings input to the issues management system appear to be classified as Category 4 significance level (minimal/negligible impact on safety), regardless of the issue. For instance, Safety and Health personnel recently identified a situation in which a crane with a load was not manned by the operator and was improperly set up to lift an unknown weight; this event was classified as Category 4. This issue was closed the next day based on correcting the setup on the spot and subsequently holding a "toolbox talk" with an unspecified group of workers.

Finding #10: Some operational incidents, deficient conditions, and performance errors have not been fully and effectively evaluated or documented by BNFL to establish causal factors and effective recurrence controls, or to determine reportability.

A recent BNFL management assessment identified weaknesses in its PAAA process and implementation. The current process lacks sufficient guidance or documentation of PAAA potential non-compliance screening. BNFL identified numerous cases where issues from various sources had not been properly screened for PAAA compliance and instances where potential non-compliances were not identified. BNFL has taken appropriate actions to address these issues, including drafting a major revision to the PAAA program procedure, screening numerous issues from various sources for CY 2002 to date, and reporting potential non-compliances as required.

Lessons Learned

BNFL has established a formal lessons-learned process that identifies applicable externally and internally generated lessons learned, incorporates them into a database, and distributes them to selected managers and supervisors for communication to workers. The lessons-learned coordinator screens items from the DOE lessons-learned system and from other sources, such as the Consumer Product Safety Commission, for applicability to the BNFL project at ETTP. Personnel involved with evaluation of BNFL incidents, events, or conditions, including the lessons-learned coordinator, create communiqués in the form of Safety Notes, Radiological Notes, Toolbox Topics, or a Lessons Learned. Typically, these lessons are communicated to workers by supervisors at safety meetings. The procedure for development of enhanced work plans (EWPs) specifies that the lessons-learned database be reviewed and pertinent lessons be listed in the EWPs. The EWPs reviewed by the OA team listed appropriate lessons learned.

The OA team identified several weaknesses in the implementation of the BNFL lessons-learned program:

- Some lessons learned issued by BNFL do not describe the event or conditions that precipitated the event or the lesson to be learned, and do not effectively demonstrate the adverse impacts that can result from a failure to comply with requirements.

- The process requires the coordinator to identify and document in the database when responses or actions are required by the recipients; however, the documentation of these responses and actions is usually by electronic mail to the coordinator and is not retained as a record. When the previous lessons-learned coordinator left the company in March 2003, there was no turnover of information, so BNFL could not demonstrate proper implementation of the process.

- There is no linkage between lessons learned and development of training lesson plans in BNFL procedures.

- BNFL is not sharing lessons learned with the DOE complex. Since September 2001, only one lesson learned has been transmitted for dissemination to the DOE complex.

- No action or response was identified for a relevant lesson learned issued by Hanford in August 2002, and incorporated into the BNFL lessons-learned database. This event identified decreased flame resistance due to laundering of welders' flame resistant coveralls. Considering the amount of hot work performed at ETTP by BNFL and the number of burn incidents occurring on site, lessons learned involving a decrease in flame resistance would appear relevant to BNFL activities.

D.3 CONCLUSIONS

OR/AMEM has established some elements of an effective line oversight program. The Facility Representatives are qualified and knowledgeable of ETTP operations. However, the current effectiveness of line management oversight programs is diminished by the temporary re-assignment of Facility Representatives and SMEs to other tasks that are also important to safety. In addition, Facility Representative coverage of the Three-Building D&D project is currently insufficient, though it is being enhanced through assignment of additional Facility Representatives. The current processes for line oversight also need improvement in the areas of planning and prioritization of oversight activities, lessons learned, documentation of some activities, and updates of procedures to reflect current organizations and assignments.

BJC has implemented generally effective processes that are providing feedback and improvement in safety performance at ETTP. 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. BJC management is effectively compiling and evaluating safety-related indicators to focus attention and drive performance improvements. However, BJC processes have not been fully effective in ensuring that subcontractors establish and effectively implement ISM elements. BJC and its subcontractors need additional improvement in the areas of assessments, recurrence controls for incidents and injuries, and some aspects of lessons-learned and employee concerns programs. BJC has various ongoing initiatives that could increase the effectiveness of feedback and improvement and address identified weaknesses.

BNFL has established a variety of processes that provide continuous feedback on safety programs and performance, as well as on physical conditions in work areas. Deficiencies identified by these processes are usually evaluated and documented collectively in databases for trending of safety problems and tracking of corrective actions. BNFL has established a generally robust, risk-based issues management program that is being enhanced and expanded to capture all types of safety issues. External lessons learned are screened for applicability and internal lessons learned are documented, and both types are compiled in a database and disseminated to the workforce through supervisors and toolbox safety meetings. Notwithstanding these generally effective feedback and continuous improvement programs, not all safety issues are being adequately documented, evaluated for risk and reportability, analyzed for causal factors, or resolved with appropriate recurrence controls. Some precursors and adverse trends have not been effectively identified to prevent recurrence. The completion of scheduled management assessments and the programs for lessons learned and PAAA require continued management attention.

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.

Oak Ridge Operations Office

1. **Develop an AMEM annual oversight plan**. Specific actions to consider include:

   - Develop a process that reviews contractor trends as one factor in decisions on line oversight priorities and resource allocations.

   - Develop a process that defines how AMEM oversight is prioritized and assigned.

   - Develop a process to ensure that all major ES&H areas are reviewed for the AMEM projects within some acceptable interval.

2. **Develop a lessons-learned program.** Specific actions to consider include:

   - Define the roles and responsibilities of the lessons-learned coordinator.
   - Develop a procedure that defines how lessons learned will be tracked and distributed.
   - Establish specific contractual expectations for OR contractors regarding lessons-learned programs.

3. **Ensure that the OR issues management system is fully utilized to provide the expected benefits.** Specific actions to consider include:

   - Determine the current status of implementation of ORION2 by the different AMEM organizations.
   - Develop and implement a detailed schedule for completing ORION2 implementation.
   - Ensure that corrective actions that are institutional for the contractor are formally assigned for closure verification.

Bechtel Jacobs

1. **Strengthen the processes for directing, monitoring, and evaluating subcontractor safety management processes and performance.** Specific actions to consider include:

   - Establish individual oversight plans for each subcontractor that are tailored to project activities and the hazards, risks, and scope of work and that ensure adequate assessment of all ES&H functional areas. Focus the reviews that take place early in a project, including readiness reviews, on processes, with subsequent routine evaluations focusing on implementation.
   - Clarify and formalize management expectations for subcontractor oversight procedures regarding oversight plan requirements, especially with regard to mandatory assessments and the communication and processing of deficiencies identified during oversight reviews and inspections.
   - Clarify management expectations in BJC procedures and contract documents for investigation, documentation, and reporting of injury, illness, and operational incidents and accidents by BJC and subcontractors. Ensure that appropriate investigations of causes are conducted, recurrence controls are established and implemented, reporting to management and DOE is performed as required, and sufficient documentation is completed and retained.
   - Incorporate clear expectations for lessons-learned programs in future subcontracts.

2. **Strengthen issues management and assessment of BJC and subcontractor safety assessment programs.** Specific actions to consider include:

   - Increase the frequency and level of involvement of ES&H-related program owners and SMEs in ensuring the adequacy of subcontractor programs, processes, and performance.
   - Conduct management assessments of the implementation of employee concerns and "I Care-We Care" programs for non-"workforce transition" subcontractors.

- Conduct management assessments of the implementation of the BJC lessons-learned program by projects and subcontractors.

- Evaluate the benefits of conducting periodic ISM implementation reviews of subcontractors that perform hands-on field work, using teams of SMEs from various ES&H disciplines and STRs, safety advocates, and quality engineers from other subcontracts or projects.

- Ensure that oversight involves routine evaluations to ensure that subcontractors have established and properly implemented robust self-assessment and issues management processes.

- Institute additional controls to ensure that the evaluation and resolution of "I Care-We Care" concerns are thoroughly and accurately documented and screened for management as ICATS issues when appropriate.

- Enhance procedures and guidance for reporting, evaluating, and resolving events, injuries, and operational incidents, including analysis of events and establishment of recurrence controls.

BNFL

1. **Strengthen safety and health inspections and walkdowns by Health and Safety staff, line supervisors, and the safety committee.** Specific actions to consider include**:**

   - Review and revise procedures to ensure that safety issues are fully documented, evaluated, and resolved.

   - Improve the documentation of inspections and walkdowns to describe and characterize the extent of conditions and activities observed, in addition to the current practice of noting instances of unsafe conditions and performance.

   - Ensure that all verified safety issues are incorporated into the issues management system, properly classified as to significance, and conservatively reviewed for reporting in accordance with the DOE ORPS.

2. **Strengthen processes for managing, documenting, and analyzing events, issues, and lessons learned.** Specific actions to consider include:

   - Identify and revise as appropriate all procedures that result in the identification of safety issues to ensure linkage to and consistency with the new issues management process and procedure.

   - Ensure that all injuries, incidents, and operational events are properly documented, thoroughly analyzed for causes and recurrence controls, and evaluated for reporting in accordance with DOE ORPS.

   - Establish a method for providing auditable evidence of proper evaluation of lessons learned for applicability and for actions taken.

   - Establish a process that screens internally generated lessons learned for dissemination to the DOE complex that will promote sharing of lessons learned with other sites.

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APPENDIX E

BJC 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 at selected Bechtel Jacobs Company, LLC (BJC)-controlled portions of East Tennessee Technology Park (ETTP). The evaluation focused on safety performance during conduct of the first phase of facility decontamination and decommissioning (D&D) in the K-25 building and operations associated with the Oak Ridge Filter Test Facility. The K-25 building D&D is being performed in accordance with agreements reached with Federal and state regulators as part of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as defined in the *Engineering Evaluation/Cost Analysis (EE/CA) for the Decontamination and Decommissioning of the K-25 and K-27 Buildings at ETTP*.

Observed work activities included asbestos and man-made fiber removal and related activities in the K-25 building; high efficiency particulate air (HEPA) filter unpacking, testing, and packaging in the Oak Ridge Filter Test Facility; and waste management activities in the K-25 building. Procedures and policies, such as stop-work policies, were evaluated, and hazards analysis and control systems were examined. This approach enabled OA to evaluate the implementation of work control processes governing a broad spectrum of work. BJC subcontractors within the scope of this evaluation implement the core functions of integrated safety management primarily through activity hazard assessments (AHAs) as specified in the BJC subcontracts. The AHAs identify the activity-level scope of work, the tasks required to perform the work, the hazards associated with each task, and the necessary controls. In the K-25 hazardous material abatement project, the primary subcontractor and their subcontractors use AHAs as the primary work documents that identify and analyze hazards, identify and implement controls, and perform work. In the Filter Test Facility, the facility operating contractor and their teaming partners in the Facility Maintenance, Surveillance, Inspection, and Testing subcontract use a work control plan (equivalent to the AHA process) for core routine work; the work control plan includes approved procedures and pre-job hazard briefing forms as the primary work control documents.

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.

The project/facility-level scopes of work for BJC subcontractors are adequately defined in the associated contracts and project plans. For example, the contract and associated exhibits for the K-25/27 hazardous material abatement project extensively describe the scope of work. The facility-level scope of work in the Oak Ridge Filter Test Facility is adequately described in the contract for Facility Maintenance, Surveillance, Inspection, and Testing. The activity-level scopes of work are described in the AHAs for hazardous material abatement tasks and in operating procedures for Filter Test Facility activities. For example, the *Asbestos and MMF[man-made fiber] removal utilizing a vacuum truck* AHA provides a detailed description of the operation, equipment, and location of the work. The hazardous material abatement subcontractor's management has determined that the work scopes could be better defined by

transitioning to more job-specific AHAs and is replacing the 12 currently approved AHAs with approximately 17 that will cover essentially the same work with a greater degree of job specificity.

The environmental aspects of the project have been incorporated in the project/facility scopes of work for the hazardous materials abatement subcontractor based on requirements established by the EE/CA. These scopes of work are adequately defined in AHAs and work plans. For example, the hazardous material abatement subcontractor's Waste Management Plan describes hazardous material removal actions, waste management operations, and disposal paths. As approved by the EE/CA, most of the waste generated during this project will be disposed of at the Environmental Management Waste Management Facility (EMWMF) located at the Y-12 National Security Complex or at Oak Ridge Reservation landfills. Therefore, AHAs that define transport of waste to these facilities have also been developed. Although most waste management work has been adequately defined, the scope of work for management of mercury as a hazardous waste has not been fully defined.

Summary. BJC subcontractor work activities and waste management functions have effective frameworks in place for defining the scope of work. Facility/project-level and task-level scopes of work are generally well documented through appropriate mechanisms.

E.2.2 Core Function #2 – Analyze the Hazards

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

BJC subcontractors use the AHA process effectively for hazards analysis. For example, the hazardous material abatement subcontractor effectively used the AHA process to identify and analyze the hazards associated with hazardous material abatement tasks in the K-25 building. The AHAs are comprehensive and address all pertinent hazards, such as asbestos, man-made fibers, mercury, sharp edge hazards, fall hazards, and radiation hazards. The AHA process also identified and analyzed hazards associated with waste management activities, such as removal of hazardous waste and collection of legacy mercury found in numerous mercury switches.

In addition to the AHA process, routine hazards analyses for ongoing hazardous material abatement work activities include effective mechanisms for sampling and surveillance of existing hazards and effectiveness of controls. For example, a hazardous material abatement third-tier subcontractor routinely analyzes measurements of airborne concentrations (both area and personal) of asbestos-containing materials or potentially asbestos-containing material fibers and radionuclides in the K-25 building. Thousands of these samples have been analyzed since the beginning of the project. In another example, BJC environment, safety, and health (ES&H) professionals have performed over 40 illumination survey activities to identify and quantify working illumination conditions in the K-25 building.

Hazards analyses for routine Oak Ridge Filter Test Facility activities were performed as part of the operational procedure development process. The operations procedures are effective in identifying the hazards associated with HEPA filter testing activities; however, some controls for those hazards were missed (see the discussion in Section E.2.2).

Pollution prevention/waste minimization was an integral part of project planning for the K-25 building D&D. Additional pollution prevention opportunities have been identified by the BJC based on an ongoing analysis of work. For example, the subcontractor was requested to limit the introduction of materials into radiologically contaminated areas because such materials (e.g., packing boxes) could require treatment as low-level waste.

Although the established hazards analysis process was effectively implemented for most activities associated with the D&D project, in two cases the process was not followed and hazards were not fully analyzed. First, the potential hazards associated with use of water mist with chemical additives during asbestos abatement activities were not sufficiently analyzed or documented. The *Asbestos and Man Made Fibers Removal* AHA did not address all hazards that could be present during misting activities. Consequently, for some chemicals, material safety data sheet (MSDS) recommendations were not addressed, and workers may not have been aware of the hazards. For example, the AHA did not address potential adverse health effects of mists containing water of unknown quality, or the use of encapsulant, wetting, and anti-freezing agents. Additionally, the misting/chemical additive practice was not addressed in the process for selecting respiratory protection. Second, several incidents involving vacuum truck bladder bags have occurred because hazards resulting from the addition of excess water during vacuum truck operations had not been fully analyzed. These bladder bag incidents, discussed in Appendix D, posed a risk to the environment because of the potential for asbestos release and addition of excess water to the CERCLA cell. BJC and the subcontractors have taken appropriate action to address these deficiencies; they stopped using additives and suspended bladder bag shipments. However, continued vigilance is needed to ensure that the established AHA process is consistently implemented.

Summary. Mechanisms for hazard identification and analysis have been adequately implemented for abatement activities, waste management, and Filter Test Facility operations. However, not all potential hazards associated with two abatement activities were identified or sufficiently analyzed. Although these isolated deficiencies indicate a need for greater rigor and attention to detail in implementing the established and effective hazards analysis process, BJC processes are generally effective in ensuring that the most significant hazards are 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.

Engineering controls are used where feasible for BJC subcontractor work. For example, the Filter Test Facility uses interlocks on the HEPA test machines to address pinch hazards. In K-25, hazardous material abatement work uses engineering controls, such as vacuum trucks, where feasible; however, many traditional facility engineering controls are not available in the deactivated K-25 building. Consequently, BJC subcontractors apply administrative controls in most cases. The predominant administrative controls for abatement activities are AHAs, supplemented by other controls, such as postings, radiological work permits (RWPs), and personal protective equipment (PPE). In the Filter Test Facility, the predominant administrative controls are operating procedures.

BJC subcontractor AHAs, work control plans, MSDS files, RWPs, procedures, and work instructions generally provide a clear description of hazards and identified controls. For example, the AHAs for asbestos abatement activities within the regulated area include comprehensive descriptions of hazards, cautions, and associated controls, such as requirements for worker fall protection, PPE, ergonomics, and radiation protection. The hazardous material abatement subcontractor also maintains accurate and comprehensive MSDS files for use by workers and supervision. In most cases, these controls were sufficiently detailed to be correctly and consistently implemented, including the establishment of a well-defined and controlled boundary for the asbestos regulated area.

Routine radiological control program requirements at K-25 have been effective for managing radiological conditions for most activities. K-25 has implemented an appropriate level of control through an established RWP program and establishment of radiological boundary control stations, which are effective in preventing the spread of contamination outside of the radiological areas.

BJC provides effective waste management support during D&D activities through deployed technical experts as team members on the D&D project. For example, the ETTP Environmental, Safety and Health's Environmental Compliance support organization has assigned a technical support contractor to the D&D project to assist the hazardous materials abatement subcontractor in meeting environmental compliance requirements. In addition, BJC's Waste Generator Services (WGS) supports BJC project teams in the areas of waste management and certification of radioactive waste. WGS also has a core team of waste experts who develop BJC standard waste management specifications for use by subcontractors in developing their required waste management plans. The deployment of technical experts as team members provides an effective and comprehensive approach to waste management support to the waste generators.

BJC's Reservation Cleanup and Waste Management project manages several projects/facilities used for disposal of waste from the K-25 D&D project, such as the EMWMF and Oak Ridge Reservation landfill. This organization has established appropriate controls to ensure that waste streams are properly managed. For example, a Waste Acceptance Criteria Attainment special project (independent of EMWMF operations) works directly with waste generators to provide assurance that the CERCLA waste going to EMWMF meets the disposal requirements defined in the waste acceptance criteria established for this CERCLA cell.

Although most hazard controls were effective, some controls were missing or ineffective:

- The hazardous material abatement subcontractor does not have a process for resolving conflicting PPE requirements between RWPs and AHAs. PPE requirements contained in AHAs for asbestos abatement differ from those contained in the RWP for the same activity. The RWP for asbestos abatement activities in the regulated area requires the use of work gloves over surgeon's gloves when performing hands-on work. However, the AHA allows some routine work activities without the use of work gloves, and the AHA requires leather or Kevlar gloves only during activities that risk worker contact with sharp edges. Abatement personnel were most familiar with AHA requirements as a result of daily briefings of AHA controls. Consequently, workers performed some other routine work using only surgeon's gloves, contrary to the requirements of the RWP.

- Posted directions at the K-25 building Boundary Control Station do not require workers to remove their outer layer of surgeon's gloves before respirator removal, as would be in keeping with good health physics practices.

- The AHA for asbestos and man-made fibers removal requires a full face respirator with only a P-100 (HEPA) filter for encapsulation of abated areas with residual fibers; however, the manufacturer's MSDS for safe handling and use information for the encapsulant recommends the use of organic vapor cartridges with a pre-filter for mist or dust.

- BJC does not have an effective mechanism to ensure that industrial hygiene personnel are notified of power interruptions during sample collection. Area asbestos and man-made fiber samples are collected using a manual method in which initial flow rates are recorded, with start and stop times, to calculate total flow and compare to the airborne concentration limits. During the OA evaluation period, power in the regulated abatement area was lost, including power to the air sample pumps, on at least two separate occasions. According to workers, these type of power losses occur frequently.

- Damaged floor panels on the K-25 operating level are marked by painted crosshatches; however, no mechanism has been implemented to ensure that these panels remain visible to personnel walking on

the operating level. Deterioration and subsequent falling of gypsum ceiling panels create dust and debris that obscure the damaged panels. During this OA inspection, a number of people were seen to unknowingly walk across at least one obscured crosshatched area.

- At the Filter Test Facility, the procedure development and review process did not identify the need for emergency eyewash capabilities when using dioctyl phthalate, as recommended by the MSDS. Additionally, the Filter Test Facility operating contractor had not implemented the hazards analysis process required by the contract until this deficiency was discovered by OA during this inspection.

- The AHA addressing mercury switch removal did not adequately implement requirements of the Occupational Safety and Health Administration (OSHA) standards on lockout/tagout. The AHA specified that work was to be performed on potentially energized equipment but lacked lockout/tagout requirements or an appropriate justification. Although the OSHA standard provides for an exemption when lockout/tagout is not feasible, the BJC procedure provides no guidance on implementing that exemption.

The number and variety of deficiencies in implementing hazard controls indicate that BJC and subcontractor managers and supervisors have not applied sufficient attention to detail in ensuring appropriate hazard controls.

Finding #11: BJC and subcontractor work control processes do not ensure that all appropriate hazard controls are identified and implemented for known hazards, resulting in an increased potential for worker exposure to those hazards.

Summary. K-25 and Filter Test Facility work activities demonstrate an adequate level of controls in many areas, including asbestos safety, radiation protection, and industrial safety. In addition, physical and administrative controls are generally adequate for BJC waste management activities performed by subcontractors at K-25, the EMWMF, and the Oak Ridge Reservation landfill. However, the BJC subcontractors did not identify and implement all appropriate hazard controls in several areas. Management attention is needed to ensure that hazard controls are comprehensively and consistently identified, documented, and implemented in a manner that is suitable for worker use.

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

Readiness is confirmed and work is performed safely.

Readiness to perform abatement work is effectively verified through daily activity reports, daily pre-job briefings, and weekly planning meetings. For example, hazardous material abatement subcontractor pre-job briefings included presentations of relevant safety topics and an integrated safety management system focus area discussion. The daily pre-job briefings also include discussions of the specific tasks and work locations for the day. The pre-job briefings cover AHA controls. The controls applicable to everyone are discussed in the general meeting, and then foremen cover the task-specific controls in breakout meetings with their workers. (A deficiency in these breakout sessions is discussed later in this section).

Many general asbestos abatement and filter testing activities are performed safely and in accordance with established controls as specified in AHAs, work plans, and procedures. For example, workers in the asbestos regulated area effectively performed work within controls associated with hearing conservation, fall protection, ergonomics, electrical safety (related to the use of extension cords and power tools), and ladder safety. In all cases, workers were fully aware of their stop-work authority and indicated that they would not hesitate to use it if a potentially dangerous situation arose. Workers were also aware of

mechanisms for raising safety concerns and were comfortable with discussing safety questions or concerns with their supervisors.

The hazardous material abatement subcontractor is effectively managing the asbestos waste generated during the abatement project. The asbestos is removed and double-bagged as required. At the EMWMF and the sanitary landfill receiving waste from the project, operators provide a quick physical check of loads to identify unacceptable items, such as ripped bags or liquids. Facilities at these landfills, such as equipment servicing areas, administrative buildings, and plant fencing and gates, are well maintained.

In most cases, other waste generated during the project is adequately managed. A hazardous waste storage area is under the control of the waste management operator, and mercury waste is stored within secondary containment. However, a number of waste management actions have not been performed in accordance with requirements. As discussed in Appendix C, several of these deficiencies occurred because the EE/CA requirements for managing mercury waste had not been included in the hazardous materials abatement subcontractor waste management plan and resulting AHAs or operating requirements. Additional concerns with managing hazardous waste include potential water intrusion into the area and general clutter adjacent to the area. When OA identified these concerns, BJC and their subcontractors took prompt corrective action.

The hazardous waste management subcontractor is effectively operating the remaining mixed waste vaults in K-25. The amount of Resource Conservation and Recovery Act (RCRA) radioactive (mixed) waste has been significantly reduced in the K-25 vaults. The October 2000 Investigation of the Gaseous Diffusion Plant by the DOE Office of Environment, Safety and Health found that in several of these vaults, RCRA waste was located in pools of water. These vaults have since been emptied and the RCRA units closed with state approval. The remaining vaults have dry floors, the required spill response equipment is in place, the containers are in acceptable condition, and appropriate signs are in place. Actions to treat the remaining mixed and low-level waste is proceeding on a schedule that will ensure that the vaults are closed under RCRA before there is an impact to the K-25 D&D project.

Although most work is performed safely, the OA team identified a number of cases in which workers were not implementing required hazard controls listed in AHAs, postings, and checklists:

- Although sufficient lighting was provided and available for use in the regulated asbestos abatement area, individual workers and work teams moved away from the adequately lighted work locations as work progressed. In these cases, lights often were not relocated, and individuals eventually worked in locations with illumination levels below that required by the AHA.

- Asbestos abatement workers sometimes used the water spray mode of the airless sprayers instead of the misting mode, contrary to the requirements of the AHA. Although this practice did not violate the building safety limits, it was outside the bounds of the applicable nuclear criticality safety determination.

- The asbestos abatement pre-job briefings did not cover all AHA controls as required by the hazardous material abatement contract and the subcontractor's institutional-level ES&H plan. Although most general controls were covered in the main pre-job briefing, task-specific pre-job briefings conducted by the crew foremen did not use copies of the AHAs and did not cover all remaining controls. For example, the AHA control prohibiting use of airless sprayers in any other mode than misting was not covered in any of the briefings observed by OA.

- K-25 building workers did not follow the appropriate doffing sequence. In several cases, workers removed their respiratory protection before removing potentially contaminated PPE, contrary to the doffing sequence posted at the Boundary Control Station.

- In several cases, workers did not notify radiological control technicians (RCTs) when PPE integrity was compromised (torn disposable coveralls) as required by the limiting conditions listed in the applicable RWP. The workers' and supervisor's response to these events was to place duct tape over an opening and continue work instead of requesting RCT evaluation and direction, which would typically require a survey and replacement of the damaged PPE.

- Abatement personnel did not stop work when they discovered the loss of power to a stationary air sampler and did not notify the RCTs of the stoppage of the air sampler near the vacuum truck (used to fill bladder bags on the vault level of the building for asbestos abatement). Although the workers were aware that a breaker had tripped, they did not realize that the air sampler also lost power and therefore did not cease operation, nor did they notify the RCTs as required by the RWP. The high noise level of the vacuum truck may have contributed to the workers not realizing that the air sampler had stopped.

- A hazardous material abatement subcontractor worker performed four successive weekly inspection checks indicating a current inspection on the fire extinguisher in the hazardous waste storage area. However, the inspection tag on the extinguisher located in the mercury storage area had expired during the month before these checks.

- BJC safety personnel discovered that electrical workers in the building housing the Filter Test Facility used electrical tape to modify an electrical switch so that a lockout device would fit. The lockout device fell off when the panel was opened during a walkdown of the lockout, indicating that this method did not constitute a substantial lockout device as required by OSHA standards. The workers did not stop work as required by the stop-work procedure when the lockout device did not fit.

In all these cases, DOE, BJC, and their subcontractors took prompt action to correct the conditions. The high number of generic controls listed in the current AHAs may contribute to these deficiencies, and the subcontractor's progress towards more job-specific AHAs will alleviate some of the problems. However, the number of observed deficiencies indicates a systemic weakness in procedural adherence and a need for workers and supervisors to continually and rigorously follow established safety requirements.

Finding #12: Workers did not follow all hazard controls outlined in BJC subcontractor AHAs or other control mechanisms in the areas of lockout/tagout, radiation protection, and industrial hygiene.

Lithium compound storage facilities and container conditions in the K-25 vaults are not suitable for continued safe storage. DOE's 1994 Chemical Safety Vulnerability Working Group report stated that the lithium was stored in K-25 in steel drums that were subject to long-term effects of corrosion due to diurnal and seasonal extremes of temperature and humidity. Water is still present in the storage area, and the wet conditions in the vaults have resulted in continued rusting of the drums. In addition, the metal pallets used to stack drums two high are not designed for this application. Plans to move these drums to Y-12 facilities have been initiated and will appropriately address this longstanding deficiency.

Finding #13: Continued storage of hazardous lithium compounds under the poor environmental conditions in the K-25 building has resulted in container degradation and an increased risk to workers and the environment.

Summary. Although most BJC subcontract work is performed safely, a significant number of ES&H requirements were not rigorously and effectively implemented, indicating that substantial improvement in procedure and safety requirement compliance is needed for both workers and supervisors. In the waste management area, the hazardous material abatement subcontractor generally performs activities involving asbestos waste within the K-25 building in accordance with requirements. The BJC hazardous waste management subcontractor is effectively operating mixed waste vaults in K-25; the volume of legacy mixed waste has been significantly reduced; and vaults have been closed with state approval. Lithium storage facilities and container conditions in the K-25 vaults are not suitable for continued safe storage.

E.3 CONCLUSIONS

Most aspects of work at ETTP facilities managed by BJC are performed consistent with the core functions of integrated safety management, and most engineering and administrative controls are appropriate for the hazards. Workers are actively involved in integrated safety management and fully understand their right to stop work to address safety concerns.

However, the identified deficiencies indicate a need for improvements in implementation of some hazard control processes and ES&H requirements. A long-standing deficiency in lithium storage practices also needs increased management attention. BJC has a good understanding of the identified weaknesses and has initiated several appropriate corrective actions. However, increased management attention is needed to ensure timely improvements in processes and performance.

E.4 RATINGS

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

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.

1. **Provide increased management attention to the radiological control aspects of the hazardous materials abatement project**. Specific actions to consider include:

- Provide additional workplace instruction and oversight on radiological controls contained in RWPs, appropriate contamination control techniques, and Boundary Control Station procedures.

- Conduct a review of radiological control requirements for current and planned RWPs within K-25.

- Consider more aggressive job coverage and radiological survey performance as work tasks become more invasive or in areas with limited radiological characterization.

- Review RWPs for consistency of requirements, including examination of potential conflicting requirements between AHAs and RWPs, and consistency across all K-25 task-specific RWPs to ensure that appropriate controls are in place.

2. **Review the field use of stationary fiber air sampling systems to ensure accurate results**. Specific actions to consider include:

   - Develop a formal mechanism for ensuring that actual sample run times are captured for calculation of air volume sampled per unit time.

   - Evaluate utilization of equipment for stationary fiber air sampling similar to the stationary (area) radiological air sampling trains currently in use at K-25, which use flow rate meters and integrators to account for air volume collected during the sample period.

3. **Review management of mercury as a hazardous waste**. Specific actions to consider include:

   - Develop and implement specific requirements for managing mercury as a hazardous waste in accordance with requirements established in the EE/CA.

   - Ensure that mercury storage containers do not contact water that could intrude into the storage area.

   - Control adjacent clutter to reduce fire loading.

4. **Review management of vacuum truck bladder bags to determine how to reduce excess water in order to help reduce the potential for bag failure and introduction of water into the EMWMF**.

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APPENDIX F

BNFL Core Function Implementation (Core Functions 1-4)

F.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of Independent Oversight and Performance Assurance (OA) evaluated work planning and control processes and implementation of the first four core functions of integrated safety management (ISM) at the BNFL Three-Building Decontamination and Decommissioning (D&D) project in Buildings K-29, K-31, and K-33 within the East Tennessee Technology Park (ETTP). The evaluation focused on safety performance during the conduct of D&D work activities by BNFL and major subcontractors. BNFL performs most of the work itself, but uses four primary subcontractors for decontamination of building surfaces, cutting of concrete equipment pedestals, removal of electrical components and conduit, and asbestos abatement. The scope of the BNFL project includes removal of all equipment and decontamination for subsequent reindustrialization of the three buildings. Like other abatement work at ETTP, this project is being performed in accordance with agreements reached with Federal and state regulators as part of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA).

The OA team reviewed a variety of work activities performed by BNFL and subcontractors in all three buildings. The work included supercompactor operations, removal of converters and compressors, hoisting and rigging, process piping removal, plasma cutting, concrete pedestal removal, ventilation ductwork removal, asbestos abatement, conduit removal, and waste management. Most D&D work is performed in areas that are radiologically contaminated, and work activities involve a wide variety of hazards and conditions (e.g., industrial, chemical, and radiological hazards, and degraded facilities) that must be adequately identified, analyzed, and controlled to ensure worker protection. Consequently, the OA inspection focused on radiological controls and industrial hygiene and safety. OA also reviewed environmental areas, including pollution prevention and waste management activities at facilities where BNFL or BNFL subcontractors generate, store, or handle waste material for disposition. This work includes waste sorting, loading, shipment preparation, and transport.

BNFL uses enhanced work plans (EWPs) to govern the various D&D work activities on the project. The EWPs address the scope of work, hazards, and controls, and they reference BNFL procedures and permits necessary for various tasks and serve as bounding documents. EWPs for complex and/or higher-risk work contain step-by-step work instructions. More than 150 EWPs have been developed for such work activities as converter and compressor removal, removal of process piping, conduit and raceway removal, container and equipment loading, handling of radioactive trash, and asbestos abatement.

F.2 RESULTS

F.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.

The BNFL Three-Building D&D project work is defined in the contract specifications of the DOE/BNFL contract. Performance milestones and D&D schedules define major tasks. EWPs for specific D&D tasks, supplemented by program requirement procedures, govern D&D tasks and adequately define the scope of most facility- and activity-level work activities.

BNFL has several recurring meetings that contribute to safety and the definition of work activities. Plan-of-the-day meetings are held every day for the next day's work using the approved plan-of-the-day schedule, which identifies jobs scheduled for the week. Daily pre-shift and pre-job briefings provide additional information on individual jobs. Additional planning meetings are held for larger jobs and at the start of new evolutions.

BNFL completed a major revision of the EWP procedure in October 2002 and has recently revised a number of the EWPs based on the revised procedure. Recently revised EWPs are of better quality and also better define work activities and provide more detailed work instructions. As a result, hazards can be more clearly identified, defined, and linked to work activities. Stop-work conditions are explicitly defined in a "bounding conditions" section of each EWP, and a requirement for performing post-job reviews has been included in the EWP process. The enhanced EWP process provides for prioritization of work, including waste management, based on the risk of the activities being performed. Allocation of resources, based on EWP training and discipline requirements, is appropriate and includes an adequate skill mix to accomplish the work. For most work, such as process piping and process equipment removal, work definition and work steps are detailed and comprehensive. For example, the revised EWP for major component removal in the K-31 building has step-by-step work definition for each removal activity, such as the removal of converters and Freon piping.

BNFL has implemented a clearly defined scope of work for managing wastes generated from the Three-Building D&D project as governed by the CERCLA process. A Three-Building D&D project waste management plan addresses the necessary elements to ensure that generated wastes are managed in a safe and compliant manner. Most of the waste is sent to the Nevada Test Site and a private waste disposal site in Utah for disposal, and a small amount of waste is sent to the Oak Ridge Reservation Environmental Management Waste Management Facility. The potential waste generation sources have been adequately defined to allow the analysis of waste handling, pollution prevention/waste minimization, storage, and disposal and to facilitate effective implementation of the waste management program.

Although most EWPs adequately bound the scope of work, a few do not have a sufficient work or task breakdown necessary for the identification of hazards and development of corresponding controls. For example, the electrical maintenance EWP applies to all three buildings and allows a broad range of electrical D&D and installation work. It does not adequately define the scope or list the multitude of tasks that may be performed under the EWP (e.g., plasma arc machine maintenance) so that all potential workplace hazards (e.g., chemical hazards associated with plasma arc machine coolant) can be identified, based on a graded approach. The definition of individual tasks facilitates identifying and analyzing all hazards for the specific work. BNFL has recognized that some other older EWPs may have deficiencies of this nature, and many have been revised.

In the maintenance area, processes for allocating resources and prioritizing work activities did not ensure that equipment preventive maintenance inspections (e.g., for forklifts, man lifts, and boom cranes) were performed on schedule. The BNFL Surveillance and Maintenance organization indicated that the current 20-percent backlog on equipment preventive maintenance was attributable to BNFL's reassignment of two workers to D&D activities and the recent loss of qualified maintenance personnel to other organizations. BNFL has taken steps to identify replacement personnel, and some are in training. However, the temporary personnel shortages caused deferral of equipment preventive maintenance that could affect worker safety (see Core Function #4).

Summary. Work activities are generally well defined through approved project schedules, EWPs, and procedures that address different types of work. Work activities are scheduled and further defined through line management reviews and plan-of-the-day meetings, and significant work evolutions are

discussed with workers during daily crew and pre-job briefings. Work is appropriately prioritized, and work assignments reflect an appropriate skill mix of the proper trades and disciplines to perform work activities. In most cases, adequate resources are available to accomplish the required work. A few EWPs would benefit from improved description of individual tasks. Weaknesses in resource allocation and prioritization, which contributed to deferred preventive maintenance on some industrial equipment, were identified by BNFL, and BNFL has initiated corrective action.

F.2.2 Core Function #2 – Analyze the Hazards

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

At the facility level, activities for the Three-Building D&D project were screened by BNFL to determine the facility hazard category based on the facility's mission, type, inventory of material handled, and other categorization criteria. The results of the facility-level hazards analysis are documented in the project's basis for interim operation. At the activity level, hazards are assessed in accordance with the EWP process.

Both radiological and non-radiological exposure hazards in the workplace are generally well characterized, understood, and documented in EWPs or technical reports. Noise hazards, for example, are routinely evaluated for work areas and exposure groups. In addition, the two dominant non-radiological airborne exposure hazards, metal fumes from cutting operations and silica dust from concrete cutting operations, are well characterized in baseline sampling data, and are re-evaluated semiannually, or more frequently if required. An aggressive heat stress monitoring program is used to determine work/rest regimens for work in hot environments. The potential for non-uranium contaminants, such as transuranics and technetium-99 (Tc-99) from past use of recycled uranium at ETTP, is well understood, and BNFL has taken the appropriate steps to evaluate this hazard and modify radiological controls accordingly. For example, BNFL has extensively sampled work areas for potential transuranic contamination and has documented the results of these investigations in building-specific reports. Based on the results of sampling, the uranium-to-transuranic ratios were appropriately calculated and used to identify areas where transuranic contamination would be the dominant hazard. These areas are posted and controlled separately from uranium-contaminated areas. In addition, based on the potential for encountering transuranic contaminants, a more restrictive derived air concentration for the project was appropriately calculated and is being used to evaluate air sample results and determine special bioassay needs. For environmental hazards, the BNFL EWP process, as evidenced in K-33 waste operations, includes adequate analyses of waste management-related hazards associated with the removal, packaging, and disposal of asbestos and chromium.

Pollution prevention and waste minimization have been an integral part of the Three-Building D&D project and have resulted in an overall reduction of hazards to workers Since the commencement of the project, BNFL has implemented an effective program for analyzing ongoing work activities to identify additional opportunities for pollution prevention and waste minimization. For example, the Supercompactor Facility has achieved a significant waste volume reduction ratio (10 to 1), thereby minimizing the volume of waste being sent to offsite disposal facilities. In addition, by petitioning the State of Utah, BNFL received approval to dispose of K-29 and K-31 ductwork off site without having to remove the ductwork gaskets. This action has reduced worker exposures to radiation, polychlorinated biphenyls (PCBs), and chromium, and has reduced disposal cost by nearly $7 million.

Although most hazards associated with BNFL operations are identified and characterized, in a few cases the hazards posed by individual work activities were not fully addressed in the work control documents for those activities. For example, diamond wire sawing of concrete pedestals requires cooling water, resulting in some water splatter. Some workers on the diamond wire saw cutting job are exposed to wet

conditions, so contamination could soak through their cloth anti-contamination clothing (legs and knees). The contamination potential from wet clothing is not addressed in the concrete sawing EWP or radiological work permit (RWP). In another example, the hazards associated with the inadvertent release of water (and thus of potential contaminants) from systems other than steam and condensate were not fully addressed in the EWP for removal of non-hazardous pipe or the EWP for removal of sprinkler lines in K-29.

Although BNFL has an aggressive program for characterizing metal fume hazards associated with plasma arc metal cutting, some hazards have not been fully analyzed and addressed in EWPs (particularly the older EWPs). Plasma arc cutting on steel piping, components, and cell structures, which is extensively performed within the BNFL Three-Building D&D project, can produce a variety of fumes depending on the type of metal being cut and the coating on the metal. Significant concentrations of these fumes can present a health risk to workers. The metal fumes from plasma arc cutting are identified and described in the BNFL Health and Safety Plan (HASP), and worker exposure to metal fumes is controlled through respiratory protection and local ventilation. A sampling and monitoring plan for metal fumes from plasma arc cutting is well documented in the BNFL HASP, and data on metal fumes is obtained by BNFL Industrial Hygiene though periodic sampling of metal fumes in a worker's breathing zone. Plasma arc cutting also produces a very bright ultraviolet and infrared light that varies in intensity with the arc current. However, the ultraviolet light from the plasma cutting arc can also produce ozone and nitrogen oxides (NO, NO_2), as described in the Construction Safety and Health Bulletin issued by the Occupational Safety and Health Administration (OSHA) on Welding Health Hazards. BNFL has conducted only minimal sampling of the ozone and nitrogen gases and has not sufficiently characterized the hazard to workers from these gases for the current variety of plasma arc cutters and work practices. Workers who experience acute overexposure to ozone and nitrogen oxides could experience adverse health effects (e.g., headache, irritation to the eyes and mucous membranes), and chronic overexposure could result in fluid in the lungs. At this time, workers have not identified or expressed concerns about such symptoms, and the lack of adverse symptoms may indicate that exposures are minimal. The most recent sampling for ozone was performed in calendar year 2000 with short-term sampling using direct reading detector tubes, which are not representative of a worker's exposure for an extended work shift, as required by OSHA. Of the direct reading measurements obtained at that time, most results did not identify the presence of ozone. However, two of three direct reading measurements (0.15 ppm, 0.1 ppm, and 0.05 ppm) were above the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Level Value of 0.08 ppm for employees performing moderate work. If workers had been exposed to ozone at these levels for a ten-hour shift, the ACGIH threshold level values would have been exceeded in two of the three cases. Furthermore, although the Powered Air Purifying Respirator (PAPR) hood and filter provides workers a protection factor of 1000 or greater against metal fumes, it provides no protection against ozone or nitrogen oxides. In addition, the potential hazards from ozone and nitrogen oxides are not addressed in the BNFL HASP, the BNFL safety and health procedures, or EWPs under which plasma arc cutting is performed.

Finding #14: BNFL has not sufficiently sampled and analyzed the potential hazards from ozone and nitrogen oxides resulting from plasma arc cutting to determine the potential for worker exposure to these hazards.

Summary. With few exceptions, environment, safety, and health (ES&H) hazards have been identified, analyzed, and documented in EWPs, the BNFL HASP, procedures, and associated documents. Prioritized D&D work based on risk is reducing hazards by eliminating contamination sources, such as process piping and equipment. A few work activity-level hazards were not fully addressed in EWPs, and the hazards of nitrogen oxides and ozone from extensive plasma arc cutting operations have not been

sufficiently analyzed and documented. However, BNFL and its subcontractors have effectively identified and analyzed the most prevalent and significant hazards associated with the D&D activities.

F.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.

At BNFL, the EWP process is the institutional mechanism for documenting hazards and the necessary controls to establish a safety basis for performing D&D work. The EWP requires documentation for work identification, hazard identification and analysis, a hazard control matrix, and other documentation, such as subject matter expert (SME) checklists, to ensure appropriate involvement of ES&H professionals in the development and implementation of controls.

BNFL uses some engineering controls, such as ground fault circuit interrupters. However, many traditional facility engineering controls are not feasible for D&D work in deactivated buildings. Consequently, BNFL and its subcontractors apply administrative controls in most cases, such as EWPs, permits, and personal protective equipment (PPE).

In general, BNFL hazard controls for the most significant safety hazards and non-radiological health hazards are well defined, communicated to workers, and consistently implemented. BNFL has maintained a strong emphasis on prevalent industrial hazards, such as hot work, hoisting and rigging, fall protection, and electrical safety. BNFL has also worked closely with the manufacturers of plasma arc cutting machines to enhance the performance and safety of the machines through the development of trigger guards that make inadvertent machine actuation less likely. Recently, BNFL has been prototyping a remotely operated plasma arc cutter system for some piping. Local ventilation systems are also used extensively throughout the buildings to minimize fumes from plasma arc cutting.

The primary radiological hazard at the Three-Building D&D project is internal exposure to radioactive materials. The BNFL radiological control program has been generally effective in managing and controlling intakes, as evidenced by a significant amount of air sampling and bioassay data. This data generally shows low airborne concentrations and uranium activity in quarterly bioassay sample results. BNFL is also taking steps to improve the rigor and conduct of radiological operations in Building K-29, where uranium enrichments were higher and contamination control challenges are more significant. The higher specific activity of uranium and prevalent Tc-99 contamination in K-29 results in a greater potential for contamination events (due to increased mobility of Tc-99) as well as higher dose per unit intake of uranium. Examples of changes in practices that have been made in K-29 include a PPE requirement for double anti-contamination coveralls, more radiological control technician (RCT) coverage of work activities, the presence of RCTs in the field, and a bioassay program for Tc-99.

BNFL line managers and SMEs have also been effective in the identification, development, and implementation of hazard controls. The BNFL ES&H and radiological control managers are knowledgeable of the hazards associated with D&D operations, and have been proactive in establishing appropriate hazard controls. ES&H SMEs are actively involved in the review of EWPs, and the results of their reviews are documented on SME checklists that are included in the EWP work package. Proactive efforts to better control and/or reduce worker exposure to hot environments, plasma arc cutting fumes, and airborne dust, radioactivity, and silica from various D&D and hazardous waste operations were evident. The BNFL Senior Safety Review Committee reviews most EWPs to ensure that hazards and hazard controls have been identified and adequately documented in EWPs.

BNFL has the technical expertise and procedures to ensure effective management of waste. A waste minimization/pollution prevention policy is in place that details measures and controls for integrating pollution prevention and waste minimization into the D&D effort. SMEs are located in waste operations and environmental compliance, and provide mutual support to accomplish assigned responsibilities. EWPs for the work that OA observed provided integrated controls to ensure proper management of wastes resulting from operations.

BNFL has a strong management commitment to improving the safety of workers and the work environment through the implementation of hazard controls that, in some cases, are more rigorous than the level of control required by regulations. For example, BNFL has issued full-hood PAPRs to plasma arc cutters, although a less comfortable and less expensive full-face PAPR could have met applicable requirements. The high level of protection afforded by the PAPRs has likely been a factor in keeping radiological doses and intakes of radioactive and other hazardous materials low. BNFL has also established or improved a number of facility engineering controls resulting in improved safety and working conditions. For example, to minimize electrical shock hazards, BNFL installed ground fault circuit interrupter receptacles in K-29 and K-31. In response to a behavioral-based evaluation conducted by the BNFL Safety Committee, BNFL replaced the lamps in these three buildings to provide improved illumination in all working spaces and reduce the need for portable lighting.

While there are a number of positive aspects in the development and implementation of controls, some weaknesses were identified in the rigor of hazard controls and their supporting technical bases. These concerns, discussed below, could adversely impact worker safety and the positive BNFL safety record.

In the area of staff qualifications and training, most BNFL worker training requirements are identified through training needs assessments, and line managers are routinely informed of the status of a worker's training. However, the BNFL training and qualification program for plasma arc cutters does not sufficiently define and test knowledge and performance expectations for workers who use the cutters. Plasma arc cutting is a significant activity within the BNFL Three-Building D&D project, with over 130 plasma arc cutters being maintained by BNFL Electrical Maintenance. The BNFL training and qualification program for plasma arc cutting consists of two hours of on-the-job training (OJT). There is no classroom training for plasma arc cutting and no prerequisites for OJT, such as reading and understanding the BNFL plasma arc cutting procedures or the manufacturer's operating and maintenance manuals. The BNFL Training Department does not have a record of any worker having read the plasma arc cutting procedure. Successful completion of OJT is based on the satisfactory completion of five performance tasks, several of which have no clear performance standards. The content of OJT is minimally defined in the Plasma Arc Cutting procedure, and does not discuss the theory of operation, response to abnormal operating conditions, lessons learned, or other topics normally considered in similar training. Furthermore, instruction and performance testing have not included, or are inconsistent with, important topics in the manufacturer's manuals, such as coolant level inspections and plasma gas purging. To date, no significant injuries or illnesses have resulted from plasma arc cutting operations. However, the lack of a more formal training and qualification program for plasma arc cutters may be a contributing factor to a number of recent safety concerns related to plasma arc cutting, such as minor burns, and the incomplete cutting of a steel plate resulting in an unbalanced load.

The OA team also determined that some administrative controls identified in EWPs, RWPs, and general practices were implemented without a well-documented technical basis or justification. For example, BNFL has established that workers who are more than 20 feet from a plasma arc cutting operation are exempt from respiratory protection requirements; this is documented in several EWPs. While the radiological control and safety and health departments have air-monitoring data that may support this requirement, the data has not been sufficiently analyzed and documented to clearly justify this assumption. In some cases, concentrations of metal fumes at the location of the plasma arc cutting are

well above the OSHA permissible exposure limit. In another example, some workers in K-31 doff their respirators before they reach the Boundary Control Stations (BCSs), while other workers are not required to wear dust masks in a "respiratory protection required" area if in transit to the PAPR storage locations. The technical basis, including air monitoring data, for the requirement to wear dust masks, or not, is not sufficiently documented to support these work practices. In another example, there is no written guidance for properly wearing thermoluminescent dosimeters (TLDs) inside or outside of protective clothing, and workers were observed doing both. Where potential beta hazards exist, wearing TLDs inside the coverall may underestimate the actual beta dose to any exposed skin areas.

The potential for spread of contamination outside radiological areas has always been a concern of BNFL management due to the large numbers of personnel entering and exiting contamination areas on a daily basis. BNFL has been generally successful in contamination control, as evidenced by the relatively small number of personnel contamination events. Personnel enter and exit contamination areas through BCSs set up for donning and doffing protective clothing in a manner intended to prevent the spread of contamination to uncontaminated areas. All personnel exiting a BCS are expected to self-monitor using whole-body personnel contamination monitors (PCMs) before leaving the area, and RCTs survey the BCSs for contamination daily.

Despite the small number of contamination events, a lack of rigor in implementing some contamination controls was noted that could result in inadvertent spread of contamination, particularly for the small percentage of workers who may encounter highly contaminated areas. First, donning and doffing practices are not posted at BCSs to ensure that proper methods are consistently used for doffing potentially-contaminated items. Dust masks are used extensively, but there is no procedural expectation concerning the proper sequence for doffing dust masks; they are sometimes not doffed as part of the doffing process but are left on until after exiting the PCM. Workers exiting PCMs are not required to step to a known clean area but are allowed to intermingle in the same areas with those who have not yet been monitored, sometimes in order to discard their dust masks in the radioactive waste receptacles at the doffing station. Anti-contamination clothing bins located at the doffing stations were overflowing at times during shift changes or breaks, resulting in potential for unnecessary contact with contamination. Several individuals had either long hair or beards in contact with outer protective clothing, resulting in unnecessary contact with potential contamination. Hoods and skullcaps were not normally listed as requirements on RWPs, although they are appropriate for controlling the potential for hair contamination.

A revision of the BNFL EWP procedure and subsequent revision of many EWPs have improved the quality of the description of hazard controls in EWPs. However, some older EWPs contain deficiencies and have not been updated to the new EWP procedure standards. In a few cases, hazard controls or changes in hazard controls have not been incorporated into EWPs in a timely manner. For example, the K-31 EWP for major component removal did not include controls, such as a checklist or procedural requirement, to ensure that all piping was disconnected prior to lifting converters or compressors. Material safety data sheet (MSDS) hazard controls for the plasma arc machine cooling fluids were not incorporated into the electrical maintenance EWP. The EWP for concrete cutting has not been revised to reflect current waste characterization practices, which no longer require testing of acidity to ensure that waste is not hazardous. BNFL initiated corrective action on most of these specific observations during this inspection period.

Because D&D work involves removal of piping and ductwork, a large number of floor openings exist and have temporary coverings. In K-33, temporary plywood floor covers for openings in the cell floor were not adequately controlled as required by applicable OSHA requirements in 29 CFR 1926 and 1910. Numerous temporary covers were not secured to the floor, and the covers for two floor openings were out of place (with openings of 15 to 20 inches); such openings could allow personnel, tools, or equipment to fall through or into the openings. 29 CFR 1926 requires that floor openings be covered; secured when

installed to prevent accidental displacement by wind, equipment, or employees; and either color-coded or marked with the word "hole" or "cover" to provide warning of the hazard. Temporary floor covers in K-33 were not color-coded or marked with the word "hole" or "cover," and many were not secured to the floor to prevent inadvertent displacement. The openings also presented hazards to workers on the operating floor if tools or material fell through the hole. BNFL personnel promptly covered the open holes and initiated an issue management form to document the issue and provide corrective action (see Appendix C).

Finding #15: BNFL has not ensured that all floor openings have coverings that completely cover the opening, are adequately secured in place, and are labeled in accordance with OSHA requirements; personnel, tools, or equipment could therefore fall into or through the openings.

Hazard control postings, barriers, and demarcation are extensively used throughout the BNFL project to warn personnel, control access to work areas, and specify control requirements. Although most warnings and postings were appropriate, some inaccurately reflected hazards and controls for the conditions present in the work area. For example, on the K-29 operating floor, an asbestos abatement area was posted as a "respiratory protection required" area even though workers were not working with friable asbestos materials, and workers and supervisors believed the posting was inaccurate. In another example, although BNFL indicated that most legacy postings have been removed, an outdated posting on a converter cell in K-31 indicated a potential oxygen-deficient atmosphere within the cell enclosure. Because the cell enclosure had been removed, there is no longer a potential for an oxygen-deficient atmosphere, but the legacy posting could mislead workers. Radiological contamination area postings did not accurately reflect actual conditions in many work areas and generally far exceeded the actual contamination levels present. As a result, radiological controls and practices for some work activities appeared less than adequate for the posted conditions, but have not resulted in significant adverse effects because only low levels of contamination are actually present. While the practice of overposting may be convenient, it could lead supervisors and workers to become complacent and desensitized to the true intent of the posting and falsely believe that past work practices will continue to be effective under the conditions actually indicated by the area postings. In the supercompactor, a fall protection concern was identified adjacent to the unprotected edge of the chute. The demarcation for the unprotected edge (12-14 foot drop) was worn and not clearly visible. Supercompactor personnel promptly corrected this deficiency. Some waste storage areas are roped off and are posted only as "RCRA Storage Array or Area" or "TSCA Waste Storage Area" without "hazardous" or "toxic" wordings posted to warn other workers who may not be familiar with the Resource Conservation and Recovery Act (RCRA) or Toxic Substance Control Act (TSCA) acronyms. Many potentially hazardous waste drums stored in RCRA storage areas had no hazardous waste labeling (e.g., drums awaiting inspection).

Nearly all work conducted within the BNFL Three-Building D&D project is performed in radiologically contaminated areas. In conjunction with the EWP, the RWP is the primary written authorization used to establish radiological controls for all radiological work activities. While generally adequate, the scope and span of control for some RWPs were too broad to consistently and accurately convey specific requirements for discrete job evolutions and to ensure that controls are adequately tailored to the work being performed. For example, the RWP for hands-on work covers a multitude of tasks, which are not specifically identified on the RWP. As a result, workers cannot always readily determine which controls are required for a particular task. This RWP requires "routine air sampling," but many tasks allowed under the RWP do not receive any air sampling and the decisions are left to the subjective discretion of RCTs or radiological safety technicians. Also, diamond wire saw cutting (see Core Function #2) is performed under this RWP, and although the EWP requires air sampling, it is not always performed based on an informal determination by the Radiological Control organization that it is not necessary. However, the determination is not clear from the RWP, not documented, and conflicts with the EWP requirements.

A significant amount of the D&D work at BNFL involves disturbing radiologically contaminated surfaces. As previously discussed, the entire cell floors of all three buildings are currently posted as "high contamination areas" even though the actual contamination levels for many areas are well below this threshold and do not meet the definition of a "high contamination area." RCTs are assigned to provide radiological support and guidance to work crews. However, most coverage is intermittent and the actual radiological conditions for a particular work area are difficult to ascertain because of the lack of documented surveys for fixed and removable radiological contamination in specific work areas. Very little documented radiological survey information is available for large areas of Building K-31 and K-33 where ongoing radiological work, such as concrete removal, compressor and converter disassembly, and piping removal, is performed. Regulations and BNFL policies and procedures require that radiological surveys must be performed "to document radiological conditions in the workplace, identify and control potential sources of personnel exposure to radiation and/or radioactive material, detect significant changes in radiological conditions (i.e., job and fixed contamination surveys) or as required by RWP." These procedures require documented radiological surveys or appropriate pre-job surveys as a prerequisite to developing an RWP, along with inclusion of the radiological survey results in the RWP, to convey all radiological hazard information to workers. Surveys are also necessary to identify and document any changes in radiological conditions during work that might affect worker or environmental safety. Operations such as cutting or grinding in contamination and high-contamination areas can create removable contamination and airborne activity by disturbing existing fixed contamination surfaces. The current lack of documented survey information related to ongoing work at BNFL hinders workers in determining the specific range of radiological conditions they may encounter during work, resulting in a potential to miss opportunities for effective application of the as-low-as-reasonably-achievable (ALARA) principle. In addition, the lack of survey information affects BNFL's ability to demonstrate proper review and evaluation of radiological conditions to verify the adequacy of prescribed controls, both before and during work.

Finding #16: BNFL has not sufficiently implemented requirements for fixed and removable radiological contamination surveys to document specific radiological conditions and changes in radiological conditions during work, establish the technical basis for controls, and convey information on specific radiological hazards to workers as part of the RWP process.

Deficiencies in the BNFL radiological control procedures contribute to this finding. Radiological survey, documentation, and air sampling requirements specified in 10 CFR 835 flow down to the working level through BNFL Radiological Control policies and procedures. In a number of areas, the implementing procedure requirements for radiological surveys, air sampling, operational controls, and RWPs are vague, leaving implementation decisions to the discretion of the procedure users and leading to inconsistent implementation of requirements. For example, it is unclear from the procedures whether some actions are required, expected, or simply guidance that may or may not be followed. Mixing the words "should," "shall," "must," "guidance," and "requirements" in the same procedures results in unclear requirements and confusion as to where requirements are mandatory. As a result, implementation of radiological controls can vary and depends on the expertise of individuals rather than clear standards.

In some cases, expectations for the proper implementation of requirements are not clearly defined in procedures. For example, the air sampling procedure requires "air sampling" whenever respiratory protection is being used; however, the placement and types of air samples needed (e.g., boundary/breathing zone) when respiratory protection is in use is not clearly specified in the procedure. As a result, air sampling requirements for some specific work evolutions are not clearly specified in RWPs, such as the RWP for hot work on the K-33 cell floor, which defines the air sampling requirements "as needed." (See Finding #17, under Core Function #4.)

Summary. Overall, many hazard controls for BNFL D&D work activities are appropriate for the hazard being mitigated, are adequately communicated to workers, and are well documented in EWPs, procedures, and permits. However, some weaknesses were identified that could impact the continuing safety of operations and BNFL's ability to demonstrate that its hazard control processes continue to meet all DOE ISM expectations. Some industrial safety hazard controls and some radiological controls have not been designed or implemented with sufficient rigor to ensure and demonstrate effectiveness. EWPs have not always been updated as necessary to incorporate changes in hazard controls or revisions in the EWP program, which may impact the level of safety in some areas. In some cases, requirements have not been adequately defined, or the technical bases for hazard controls are not adequately documented.

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

Readiness is confirmed, and work is performed safely.

Readiness to perform work at BNFL is assured through formal plan-of-the-day meetings, pre-shift safety meetings, and pre-job briefings that communicate schedules, emergent work, safety information, and changing conditions within the three buildings. The OA team's observation of several of these meetings indicated that they were effective. The published plan-of-the-week schedule is used to authorize the next day's work and to provide a weekly look ahead. BNFL maintains a 24 hours per day, 7 days per week work schedule, with two 12-hour shifts per day using a shift manager as the central point of contact and management authority for operations.

With few exceptions, the BNFL work observed by the OA team was performed safely and without incident. The BNFL safety record (as measured by recordable injuries and illnesses and lost workday case rates) is better than the general industry safety record for companies performing similar D&D work. Recently, BNFL's safety performance was recognized by the National Safety Council, which awarded BNFL a second Certificate of Merit for one million hours without a lost time injury. The National Safety Council also awarded BNFL the Excellence Achievement Award for their lost workday case rate of less than half the average rate among similar industries as defined by the Bureau of Labor Statistics. The BNFL Joint Labor/Management Safety Committee has been effective in encouraging an open exchange of safety issues between BNFL management and labor. The BNFL Safety Committee and subcommittees have been also been proactive in addressing safety concerns and promoting a safety-conscious approach within the workforce. In addition, BNFL has maintained a high level of compliance with state and Federal environmental regulations. BNFL is effectively managing supercompactor waste management operations with respect to environmental safety regulations, ensuring that waste items sent to the compactor meet the acceptance criteria for offsite disposal.

BNFL has a sound, formal stop-work program guided by a detailed procedure. BNFL actively uses the formal stop-work program for safety issues. Employees who were interviewed were aware of their stop-work authorities and responsibilities and stated that they would not hesitate to stop work for safety concerns. No fear of reprisal for stopping work was evident at the worker or supervisor level, and management promoted the concept of stop work. The stop-work procedure requires full documentation of formal stop-work actions and notification of appropriate supervisors and management, and it drives corrective actions and management reviews before work restarts. The procedure requires that when in doubt, a stop-work condition is declared. As an improvement to the EWP process, new EWPs contain bounding conditions as stop-work thresholds.

One area for improvement was identified in the stop-work process. The stop-work procedure does not require any documentation or notification for informal stop-work actions. For informal stop-work conditions, the procedure allows the responsible supervisor (an interested party) to restart work without

notification to Safety and Health or management. Without notification, opportunities for trending may be lost.

BNFL has established both hazardous waste and TSCA waste storage areas in the three buildings, and the waste handling and storage in these areas is generally adequate. For example, liquid wastes are brought into diked or secondary containment areas; the waste containers are closed, in good condition, and stored within designated areas. The storage areas are inspected routinely and properly by waste management personnel.

A significant amount of work is being performed with few recordable injuries or illnesses, and the BNFL safety record is generally good. Nonetheless, the OA team identified a number of examples of failure to follow specific procedures and requirements that could adversely affect worker safety during job performance. The deficiencies identified below indicate a weakness in procedural adherence that, if not effectively addressed, could result in more serious events:

- D&D work was performed using forklifts, scissor lifts, basket cranes, and other wheeled equipment that were long overdue for preventive maintenance. Two crews were observed using BNFL man lifts that had been overdue for preventive maintenance for over a year. Workers and supervisors had not verified that inspections were current during pre-use checks. Some pieces of rental and subcontractor equipment lacked tags indicating current preventive maintenance status.

- A fire watch monitoring two welders performing plasma cutting did not maintain line of sight with the fire extinguisher ready for instant use. The fire watch was not positioned where the fire extinguisher spray could be directed on the employee (within 15 feet). Although the fire watch was promptly counseled, the supervisor and radiological safety technician did not notice the deficiency. A review of supervisor safety cards indicated that BNFL had identified six "at-risk" behaviors associated with fire watches during March 2003.

- In K-29, a converter was being readied for a critical lift before all the attached piping had been disconnected. The error was noticed and corrected prior to the lift. A deficiency in the EWP may have contributed to the error (see Core Function #3).

- Controls for airborne radioactivity were not consistently implemented as required by procedures or RWPs. In a number of instances, the RWP and procedural requirements to wear personal air samplers and conduct boundary air sampling were not followed; the affected work included cutting and dismantling converters in the K-33 D&D shop, removing louvers in K-29, and performing hot work in K-31. In the K-33 D&D shop, the RWP requires collection of routine and breathing zone samples for hot work. While boundary air samples were being collected, no breathing zone sampler was worn by any of the workers, and the radiological safety technician advised that this action had not been performed for some time. Similarly, the converter disassembly area was posted as an airborne radiation area, but only a boundary air sampler was running; no breathing zone samples were being taken as required by procedure and as necessary to demonstrate the effectiveness of respiratory protection. In K-29, workers wore respiratory protection while cutting louvers but did not wear personal air samplers as required. In K-31, workers performing hot work to cut expansion beams did not wear personal air samplers as required. In this case, the workers started the shift correctly with a personal air sampler, removed it for a break, and never put it back on before restarting work.

- Workers on the K-29 operating floor were observed working without respiratory protection in a roped-off asbestos area posted as "respirators required." BNFL's investigation of this matter concluded that the posting was incorrect; however, the workers did not adhere to the posting or verify that the posting was corrected before starting work in the area.

- A few electrical safety practices were contrary to electrical safety program requirements. Several electrical cords were damaged and still in use, and cords crossed vehicle travel paths. Several fluorescent lighting fixtures were hanging by one rod. In recent months, BNFL has also identified several electrical safety deficiencies involving extension cords.

- Several deficiencies were observed in the K-29, K-31, and K-33 waste storage areas. Plastic sheeting at one diked liquid hazardous waste storage area in K-33 had openings that were not fully covered, thereby defeating the integrity of the dike. Three 55-gallon scrap metal drums containing PCBs in K-33 had free liquid on top of the drums. In K-29, a broken lead acid battery was improperly stored in a low-level waste storage area without secondary containment, and a lead sprinkler head storage drum was placed in a satellite accumulation area without authorization.

Finding #17: BNFL and subcontractor personnel did not rigorously implement some aspects of BNFL procedures and safety requirements.

Summary. A significant amount of hazardous construction-like work is being performed safely by BNFL and its subcontractors, as indicated by a project safety record (recordable injuries and illnesses) that is better than the general industry safety record for companies performing similar type work. Most work observed by the OA team was performed without incident. However, in a number of cases, requirements and procedures were not being followed, creating potential risks to workers. Many of these examples were readily observable deficiencies. Although BNFL management promptly initiated corrective action for the identified deficiencies, additional management and supervisory attention is needed to ensure that all safety requirements and procedures are strictly followed.

F.3 CONCLUSIONS

Overall, the BNFL work control process, as evidenced in the implementation of EWP, has resulted in most work being performed safely and in accordance with the core functions of ISM. In general, most work is well enough defined in EWPs that hazards can be identified and analyzed. The hazards analysis process effectively involves workers, safety and health SMEs, and line managers. Most hazards are identified, but a few, such as ozone and nitrogen oxides, have not been sufficiently analyzed or documented. The EWP process enables hazard controls to be identified and documented, although in some cases this process did not result in clearly identified and documented controls. Some radiological controls, such as radiological survey requirements, have not been adequately defined and implemented to facilitate communication of hazards to workers. Additional rigor is needed in some training and qualification programs and in documenting technical bases for some assumptions in EWPs. While most work was performed safely, the OA team identified a number of examples of failure to follow procedures and requirements; these could affect worker safety and environmental compliance. For most of the deficiencies identified by the OA team, BNFL initiated corrective actions or interim compensatory actions.

F.4 RATINGS

The ratings of the first four core functions reflect the status of the review elements of ISM programs at BNFL.

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

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 programmatic objectives and priorities.

1. **Increase the emphasis on formality and rigor to ensure that work control procedural and safety requirements are strictly followed in the field**. Specific actions to consider include:

   - Increase supervisor, worker, and safety personnel awareness of regulatory and BNFL requirements in order to improve identification of safety deficiencies in the field.

   - Use SMEs (e.g., in electrical safety, hot work, waste management, radiological controls) to perform walkdowns to identify non-compliances.

   - Improve the use of the Supervisor Safety Observation Card (SSOC) system.

   - Perform reviews to ensure compliance with OSHA regulations related to open holes at K-33 and other facilities that may have similar problems (including K-29 and K-31).

   - Perform reviews of EWPs to ensure that they reflect hazard controls and requirements for safety reviews, major component removal controls (e.g., a checklist or procedural requirement), applicable MSDSs, and current waste characterization practices.

2. **Establish a program for characterizing concentrations of ozone and nitrogen oxides for BNFL plasma arc cutters.** Specific actions to consider include:

   - Conduct initial baseline ozone and nitrogen oxide sampling of BNFL plasma arc cutters using National Institute of Occupational Safety and Health and/or OSHA sampling and monitoring protocols.

   - Ensure that the initial sampling is reflective of worst-case ozone and nitrogen oxide concentrations, and is representative of the varied types of work activities and plasma arc cutting equipment and ranges of arc currents in use.

   - Based on the results of the baseline sampling, establish a sampling frequency for ozone and nitrogen oxides, as necessary, and include the results in reports similar to those prepared by BNFL Industrial Hygiene for metal fumes.

- Verify that the existing hazard controls (e.g., local and room ventilation) are adequate for worker protection, or modify as necessary. If an ozone hazard is identified, consider using personal alarming ozone monitors.

- Revise BNFL health and safety procedures and EWPs based on the results of the above.

3. **Develop a formal training and qualification program for plasma arc cutters that provides fundamental knowledge of plasma arc cutting operations and hazards, OJT, and performance testing.** Specific actions to consider include:

   - Establish a minimum set of prerequisites for plasma arc cutter training prior to OJT or performance testing, such as required reading and/or classroom instruction, on the BNFL Plasma Arc Cutting procedure and the plasma arc equipment operator's manuals.

   - Incorporate, at a minimum, the following topics into the plasma arc training and qualification program: theory of operation, pre-use inspections, safety hazards (equipment and working environs), PPE, lessons learned, and response to abnormal conditions.

   - Incorporate relevant information from the manufacturer's operating manuals into the training and qualification program, and include the operating manuals as reference for both training and performance testing.

   - Ensure that the performance testing requirements are well documented (e.g., checklists) and are consistent with the content of the BNFL Plasma Arc Cutting procedure and plasma arc equipment operating manuals.

4. **Increase attention on performance of radiological surveys to ensure consistency with BNFL policies and procedures for radiological surveys, RWPs, control of radiological work, and operational controls.** Specific actions to consider include:

   - Ensure that fixed and removable contamination surveys are performed for all posted contamination areas on some scheduled frequency, as well as in locations of any work covered by an RWP prior to, during, and following the work.

   - Ensure that all radiological surveys performed in support of the above are documented. In-progress work-related radiological screenings need not all be documented.

   - Review BNFL policies and procedures and strengthen as necessary to ensure that their language is sufficient to drive implementation of requirements and management expectations.

   - In cases where actions and practices vary significantly from procedural information, ensure appropriate documented justification for deviations.

   - Provide additional training to RCTs on radiological survey and documentation expectations.

5. **Increase emphasis on creating more specific RWPs, with controls and information specifically tailored to individual tasks and job locations.** Specific actions to consider include:

   - Subdivide broad-scope RWPs into multiple discrete RWPs with a more manageable span of control so that controls are sufficiently tailored to the specific work being performed.

- Minimize the use of conditionals (e.g., "as needed") and the need for subjective interpretation of controls by support personnel.

- Include specific information on expected radiological conditions in RWPs based on actual survey data or anticipated conditions. Consider including numerical suspension limits for contamination levels that would trigger use of respiratory protection and air sampling.

6. **Improve the rigor and consistency of radiological air monitoring, contamination control, and external dosime try practices in support of radiological work.** Specific actions to consider include:

   - Provide more prescriptive RWP requirements for air monitoring, such as "Breathing Zone AND Boundary Air Sample Required," rather than the current generic language "Routine Air Sampling" so there is no confusion as to expectations.

   - Provide additional detail in procedures to better define categories and air sampling regimens as well as expectations as to types of air samples required for each. Include information on proper placement of air samplers to ensure representative air sampling.

   - Provide additional training to RCTs on air sampling expectations.

   - Institute a requirement and traffic pattern for personnel exiting BCSs after self-monitoring that requires stepping to an established clean area that does not allow any commingling with personnel who have not yet monitored.

   - Provide enough laundry bins to hold protective clothing during peak doffing times.

   - Establish a formal protocol for proper doffing of respiratory protection, including dust masks, and include it in doffing instructions. Ensure that doffing instructions are posted at BCSs.

   - Establish a formal protocol for proper wearing of TLDs to ensure that consistent and representative shallow-dose results are obtained. It should address body location and whether the TLD may or may not be worn underneath coveralls.

7. **Document a technical basis, including assumptions, limitations, field sampling data, and rationale, for BNFL work practices.** Specific work practices to consider include:

   - Excluding the need to wear respirators if the worker is 20 feet or more from plasma arc cutting activities

   - Exempting some workers in K-31 from wearing dust masks when in transit to PAPR storage locations.

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