Independent Oversight
Environment, Safety,
and Health Inspection
of the

Environmental Management Program at the Oak Ridge National Laboratory

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Office of Security and Safety Performance Assurance

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Abbreviations Used in This Report

AB	Authorization Basis
ACM	Asbestos-Containing Material
AHA	Activity Hazards Analysis
ALARA	As Low As Reasonably Achievable
ANSI	American National Standards Institute
AOP	Abnormal Operating Procedure
BBA	Box Breakdown Area
BJC	Bechtel Jacobs Company
CA	Contamination Area
CBDPP	Chronic Beryllium Disease Prevention Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPEB	Closure Project Evaluation Board
CTA	Central Technical Authority
CVS	Containment Ventilation System
CY	Calendar Year
D&D	Decontamination and Decommissioning
DNFSB	Defense Nuclear Facilities Safety Board
DOE	U.S. Department of Energy
DSA	Documented Safety Analysis
ECP	Employee Concerns Program
EC&P	Environmental Compliance and Protection
EM	DOE Office of Environmental Management
EMS	Environmental Management System
ES&H	Environment, Safety, and Health
ESHR	Environment, Safety, and Health Representative
ESF	Essential System Functionality
ESS	Emergency Shutdown System
FAMMIS	Facility and Maintenance Management Information System
FHA	Fire Hazards Analysis
FR	Facility Representative

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OVERSIGHT

1.0 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight conducted an inspection of environment, safety, and health (ES&H) programs for environmental management program activities at the DOE Oak Ridge National Laboratory (ORNL) during May and June 2006. The inspection was performed by Independent Oversight's Office of Environment, Safety and Health Evaluations. Independent Oversight reports to the Director of the Office of Security and Safety Performance Assurance, who reports directly to the Office of the Secretary of Energy.

Aerial View of ORNL

The DOE Office of Environmental Management (EM) provides funding for and has Headquarters line management responsibility for environmental management program activities at ORNL, which were the focus of this inspection. The DOE Office of Science (SC) is the lead program secretarial officer for ORNL and has line management responsibility for the site. At the site level, the Manager of the Oak Ridge Office (OR) has line management responsibility for the site. Within OR, the Assistant Manager for Environmental Management Operations (OR-AMEM) has responsibility for environmental management program activities.

ORNL is a multi-program science and technology laboratory that is currently managed and operated by University of Tennessee-Battelle, under contract to DOE. ORNL conducts basic and applied research and development in such areas as neutron science, biological systems, energy, advanced materials, and computation. Past activities at ORNL have resulted in a number of locations that require cleanup and remediation. A number of facilities and operations previously owned by ORNL have been turned over to EM for environmental management program activities.

Under a separate prime contract with DOE, Bechtel Jacobs Company (BJC) manages and performs most environmental management program activities at the Oak Ridge Reservation, including major cleanup projects at facilities and operations previously owned by ORNL and other OR sites (e.g., the Y-12 Complex and the East Tennessee Technology Park). BJC is currently working on five priority cleanup projects at ORNL and provides technical support to the transuranic waste treatment effort.

In addition, Foster Wheeler Environmental Corporation (FWENC) operates the Transuranic Waste Processing Center (TWPC) as a privatized effort. The TWPC is located on DOE's Oak Ridge Reservation, but the facility was constructed by and is owned by FWENC. FWENC's workforce at the TWPC consists primarily of subcontractors to FWENC, although FWENC is responsible for safety. DOE has a contract with FWENC to process waste generated at the various facilities at the Oak Ridge Reservation; payment is based on the amount of waste processed by TWPC. The contract is currently being renegotiated.

Environmental management program activities at ORNL involve various potential hazards that need to be effectively controlled. These hazards include exposure to external radiation, radiological contamination, hazardous chemicals, and various physical hazards associated with facility operations (e.g., machine operations, high-voltage electrical equipment, pressurized systems, and noise).

The purpose of this Independent Oversight inspection was to assess the effectiveness of ES&H programs for the environmental management programs at facilities and operations previously owned by ORNL, as currently implemented by EM, OR, BJC, and FWENC. Independent Oversight used a selective sampling approach to evaluate a representative sample of activities, including:

- Implementation of the core functions of integrated safety management (ISM) for selected environmental management program activities, including: (1) surveillance and maintenance by BJC at selected facilities and projects, (2) remedial actions and maintenance by BJC at the Molten Salt Reactor Experiment (MSRE), (3) BJC activities in support of characterizing Tank W-1A for decontamination and decommissioning, and (4) operation and maintenance of the TWPC by FWENC. In evaluating these activities, Independent Oversight focused primarily on implementation of ISM at the facility and activity/task levels.

- EM, OR, BJC, and FWENC feedback and continuous improvement systems.

- Essential safety systems, with primary emphasis on engineering, configuration management, surveillance, testing, maintenance, and operation of safety systems at the MSRE. Independent Oversight also selectively evaluated feedback and improvement processes as applied to essential safety systems.

- EM, OR, BJC, and FWENC effectiveness in managing and implementing selected aspects of the ES&H program that Independent Oversight has identified as focus areas, including environmental management system (EMS) impacts; workplace monitoring of non-radiological hazards; quality assurance in engineering and configuration management programs and processes; safety system component procurement; and the status of implementation of DOE Order 226.1, which delineates an integrated approach to DOE oversight and contractor assurance systems. Independent Oversight selects focus areas—areas that warrant increased attention across the DOE complex—based on a review of operating events and inspection results. Although these topics are not individually rated, the results of focus area reviews are integrated with or considered in the evaluation of ISM core functions and/or essential safety systems.

Sections 2 and 3 discuss the key positive attributes and weaknesses identified during this review. Section 4 provides a summary assessment of the effectiveness of the major ISM elements that were reviewed. Section 5 provides Independent Oversight's conclusions regarding the overall effectiveness of EM, OR, BJC, and FWENC management of ES&H programs, and Section 6 presents the ratings assigned during this review. Appendix A provides supplemental information, including team composition, and Appendix B identifies the specific findings that require corrective action and follow-up.

Four technical appendices (C through F) contain detailed results of the Independent Oversight review. Appendix C provides the results of the review of the application of the first four core functions of ISM for work activities. Appendix D presents the results of the review of feedback and continuous improvement processes and management systems, and includes the discussion of the DOE Order 226.1 focus area. Appendix E presents the results of the review of essential safety system functionality, and two related focus areas (quality assurance in engineering and configuration management programs and processes, and safety system component procurement). Appendix F presents the results of the review of safety management of the other selected focus areas. For each of these areas, Independent Oversight identified opportunities for improvement for consideration by EM, OR, BJC, and FWENC management. The opportunities for improvement are listed at the end of each appendix so that they can be considered in the context of the status of the areas reviewed.

2.0 Positive Attributes

Several positive attributes were identified in ES&H programs, including certain aspects of work control processes, engineering controls, and feedback and improvement processes.

EM uses a variety of appropriate methods to maintain day-to-day operational awareness for the EM activities conducted in facilities previously owned by ORNL and to communicate with OR-AMEM. Such methods include daily reviews of Occurrence Reporting and Processing System (ORPS) and injury reports, requirements for timely notification of certain events, weekly written reports of project and program activities, and quarterly program reports. EM personnel regularly provide safety-related information to EM senior managers that includes pertinent ES&H information about performance metrics, occurrence reports, overviews of any "serious" events, and cross-complex trends. EM also conducts weekly conference calls with EM site managers to solicit information from each site on the status of projects, new ORPS reports, events of interest, lessons learned, significant accomplishments, and support or actions needed by EM. In response to this information, EM senior management has been actively engaged (e.g., requesting additional information about adverse trends) and has directed additional actions on a number of occasions (e.g., issuing safety alerts to field elements that address performance issues).

As part of an effort to improve work planning and control, BJC adopted a single, overarching work control procedure for all work at their facilities. BJC's work control process (BJC-FS-1001) established a common, uniform set of requirements and procedures for planning work within the BJC accelerated cleanup project. Although BJC has continued to experience problems with implementation, the establishment of a common process establishes a uniform set of expectations that can be used across all projects. This standard process is being used by BJC to capture lessons learned from the recent K-25 fall incident. With a standard process, BJC can incorporate needed process changes for all projects, rather than relying on all project managers to fully understand the problems and make changes in the individual project procedures.

BJC processes and systems for removing uranium at MSRE are well-designed to minimize the potential for a release of hazardous material. Most hazardous material transfers are conducted at sub-atmospheric pressure in order to remove the motive force for releasing the hazardous material; most hazardous material systems are designed with double containment (e.g., pipe-within-pipe design); and safety components have a fail-safe design (e.g., emergency shutdown system valves fail closed). In addition, in most respects the BJC and MSRE configuration management, work control, and unreviewed safety question procedures provide an appropriate framework and instructions for ensuring effective configuration management of safety systems. Unreviewed safety question (USQ) screenings and determinations are well documented and have well-justified and appropriate conclusions.

BJC senior management has initiated several effective mechanisms for improving management accountability and the quality of safety assessments. Recognizing that the deficiencies in current safety assessment processes and performance, the BJC President recently established requirements for project managers to compile and analyze assessment and corrective action information in order to determine their effectiveness and improve their quality, and to present these analyses in senior staff meetings. This initiative can be effective in improving the BJC assessment program and fostering management accountability for implementing an effective assessment program. Annual presentations by subject matter experts to senior BJC staff are another effective tool for communicating feedback on the adequacy of safety programs and performance to site managers and for holding subject matter experts accountable for managing and monitoring their program responsibilities.

Aerial View of TWPC

FWENC/TWPC has established and implemented several effective methods for identifying lessons learned from operations activities and events/incidents that contribute to improvement in safety performance and prevention of recurring events. The conduct of formal post-job critiques is effective in providing timely feedback on process and performance weaknesses, fostering good communication between workers and management, and incorporating lessons learned into subsequent work documents and work practices. For example, post-job critiques for waste processing activities are comprehensive and frequent (one or more per day when performing waste processing activities during this assessment). The post-job critiques are performed in accordance with an established pre- and post-job briefing procedure and cover appropriate topics. TWPC management involvement in the entire process is extensive. Post-job critiques are well received by workers, and workers actively contribute to discussion and improvements. The use of a formal work suspension and resumption process provides for a structured, focused, and timely evaluation of incidents, events, and unforeseen conditions that could represent new safety hazards or risks to workers. Documented analysis, specific actions to be taken before work resumption, and signed approval by senior management and ES&H officials before restart provide an important level of protection for workers and reduce the chances of subsequent operational or work control-related incidents.

3.0 Weaknesses

Although many aspects of the safety management programs are effective and mature, there are weaknesses in a number of important aspects of activity-level work definition, hazard analysis and controls, feedback and improvement, and essential safety systems.

At MSRE, a lack of rigor in work planning and control requirements for repetitive maintenance and similar activities perceived as low risk has resulted in inadequate work scope definition, hazards analysis, and implementation of controls for some work. MSRE has an established work control process, which in many cases provides functional equivalency to the BJC corporate work control process. However, for routine and repetitive maintenance, programmed maintenance, fabrication, material handling, and related actions, MSRE's adherence to procedural work control requirements is lacking; in practice, it is based primarily on an informal process, with heavy reliance on the experience of facility staff and skill of the craft to identify and control hazards. Most work observed during the inspection fell into this category, and Independent Oversight identified systematic deficiencies in work scope definition, hazard identification, and specification of controls that relate to lack of formality and ineffective implementation of BJC work control requirements.

The FWENC/TWPC activity hazards analysis (AHA) process does not always provide sufficient guidance or requirements to ensure a comprehensive analysis of hazards and identification of a complete set of controls. The process relies heavily on facility management's and personnel's knowledge, skills, and abilities to analyze hazards, and does not provide a detailed, systematic approach to hazard analysis during pre-job planning. For example, the AHA process does not have minimum criteria for when activity-level or job-specific AHAs are needed, does not have triggers for baseline exposure assessment and monitoring, does not consider environmental hazards, and does not provide a method for ensuring that identified controls are implemented. Although the knowledge and skills of the involved personnel are extensive, some hazards are still missed because there is no systematic application of hazards analysis to all activities.

Some safety systems at MSRE have design flaws and deficiencies in technical surveillance requirements and configuration management. Technical safety requirements for several safety systems have not been adequately derived and documented. The basis for the required vacuum in enclosures subject to hazardous material releases is not supported by formal analysis. Neither the safety analysis nor the technical safety requirements basis discusses or provides criteria for allowable leakage from the emergency shutdown system valves. The technical safety requirements for the water supply pressure for the safety-significant fire sprinkler system is not consistent with the fire protection code requirements, which are referenced in the documented safety analysis. Further, some design flaws have recently been identified for two safety systems that rendered one inoperable (loss of containment ventilation system annunciation system) and that could keep a second system from performing its safety function as designed (fluorine relief system). Weaknesses were also identified in the implementation of some configuration management processes, including clear identification of configuration items, control of engineering drawings, and completeness of work packages for design changes.

BJC has not established the required nuclear maintenance and procurement processes. The major contributor to these weaknesses is the breakdown in transmitting the DOE maintenance order (DOE Order 433.1B) requirements to BJC nuclear facilities. The fundamental requirement that was not completed was the establishment of a MSRE maintenance implementation plan. As a result, MSRE has not rigorously implemented DOE Order 433.1B with a compliant nuclear maintenance management program. For example, MSRE has not established a master equipment list, defined a detailed preventive maintenance program, or established a maintenance deficiencies identification/tracking process. In addition, MSRE has not adequately ensured that the safety-significant containment ventilation system and components are clearly identified and appropriately maintained to meet DOE order requirements; the safety-significant containment ventilation system and fire suppression systems are maintained and modified by support organizations, and their associated work control processes are not adequate for a nuclear facility.

Weaknesses in various BJC feedback and improvement processes and performance are limiting continuous performance improvement. Basic contractor assurance programs are in place, many assessments of safety processes and performance are performed, and safety issues are being identified and addressed. However, assessments do not consistently or adequately evaluate overall performance in various safety program areas. Repeated assessments of work control processes to address suspected problem areas and respond to a serious safety event failed to identify several basic, substantial performance deficiencies in these programs. Discrepancies and lack of rigor in corrective action management, trend analysis of safety data and events, and investigation of injuries and illnesses hinder continuous improvement in safety performance and prevention of recurrence of injuries and events.

Weaknesses in various FWENC feedback and improvement processes and performance are limiting continuous performance improvement. Although FWENC has developed and implemented basic contractor assurance program elements, many of these processes are not fully mature, and implementation deficiencies detract from their effectiveness. Many assessment activities are performed, but improvements are needed in line management involvement, increased focus on observation of work and performance effectiveness rather than compliance, and documentation of the basis for assessment conclusions. Insufficient and inconsistent detail, interfaces, and integration in the various processes and procedures that identify or manage issues result in inconsistent management of issues. Additional rigor and oversight are needed in the analysis of issues to identify accurate causal factors, the development of complete and appropriate corrective actions and recurrence controls, and the documentation of completion of corrective actions.

EM and OR-AMEM have not adequately implemented a number of important management systems that are needed to support an effective oversight program. EM has not fully implemented a number of required ES&H programs, including an employee concerns program and a comprehensive technical qualification program. Similarly, OR-AMEM assessments are deficient in the areas of self-assessments, planning and scheduling assessments, performing management walkthroughs, procedures, corrective action management, and safety system oversight training. For example, most safety system oversight personnel have not yet met their qualification requirements. In addition, OR has not been sufficiently involved with BJC and FWENC on such issues as the applicability of the beryllium rule and the need for a chronic beryllium disease protection program (CBDPP). In a few instances, EM has not been timely in evaluating OR submittals and approving them or providing direction for changes; similarly, there have been instances where OR has not been timely in responding to questions or submittals from its contractors. Some of these deficiencies are longstanding and have been identified by previous internal or external assessments, but not yet corrected. However, the EM and OR efforts to implement DOE Order 226.1 may address some of the identified weaknesses.

4.0 Summary Assessment

The following paragraphs provide a summary assessment of the EM, OR, BJC, and FWENC activities that Independent Oversight evaluated during this inspection. Additional details relevant to the evaluated organizations are included in the technical appendices of this report.

Work Planning and Control

BJC surveillance and maintenance. Work control processes for BJC surveillance and maintenance activities are adequate to ensure that the more hazardous, higher risk, non-repetitive work activities are well defined, that the hazards for these activities are identified and analyzed, and that the controls are appropriate. However, for routine, non-complex, repetitive tasks, there is a greater challenge to ensure that the work scope and the hazard identification and controls are tailored to the specific work activity. In some cases, the work scope is so broad that the work package cites every hazard and control listed on the BJC generic work authorization form, in order to bound the diverse work scope and all possible work conditions. In such cases, workers and/or their supervision selects the hazards and controls for a specific non-complex repetitive work evolution (e.g., waste packaging) informally from the possibilities identified in the work package and related procedures. This approach relies on workers' and supervisors' knowledge and experience, and does not document the agreed-upon, task-specific hazards and/or controls. Also, the potential for worker exposures lacks sufficient analysis to justify the absence of administrative or engineering controls, or the need for personal protective equipment, particularly for longstanding building legacy hazards. In some cases, scopes are adequately defined, hazards analyses are tailored to the work activity, and controls are appropriate, but the controls are not implemented effectively. A knowledgeable and experienced staff with a questioning attitude, extensive pre-job briefs and "tailgate" meetings addressing hazards and controls, workers' willingness to perform work within controls and stop work when uncertainties arise, and extensive management involvement throughout the process have compensated for many of these weaknesses. However, the weaknesses in work definition, hazards analysis, and identification of controls could degrade safety performance, and management attention is needed to effect improvements in worker safety.

Aerial View of MSRE

BJC/MSRE. MSRE has an established work control process, which in many cases provides functional equivalence to the BJC corporate work control process. In particular, operations activities and work that could affect configuration-controlled structures, systems, and components are well planned, with adequate work scope definition, hazard identification, and controls. However, for other work activities at MSRE, including routine and repetitive maintenance, programmed maintenance, fabrication, material handling, and related actions, MSRE's adherence to procedural work control requirements is lacking; in practice, it is based primarily on an informal process, with heavy reliance on experience of facility staff and skill of the craft to identify and control hazards. Implementation deficiencies were noted in many aspects of work control, including inadequate work scope definition, unidentified and/or inadequate analysis of hazards, and insufficient application of controls. In a few cases, controls were not followed as intended or required; however, these were isolated examples, and workers were diligent in following requirements when they were clearly identified.

BJC/Tank W-1A. BJC's operation of Tank W-1A field activities demonstrates a strong commitment to disciplined operations, with processes and procedures consistent with DOE requirements for conduct of operations, work planning, and control. The application of the BJC AHA and work control process requires continued attention, particularly at the activity level, to ensure that discrete work tasks and potential hazards are clearly identified to workers, along with the associated controls. Most work that was observed implemented the hazard controls as intended. However, additional attention is needed to address weaknesses in implementing hazard controls that are not explicitly addressed in work planning documents, or in instances where workers require assistance to complete their assigned tasks.

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FWENC/TWPC. Work control processes for TWPC activities are adequate to ensure activity-level ISM; however, in a few cases, hazards and/or appropriate controls were missed or inadequately identified. Work control processes lack sufficient formality and rigor to ensure consistent hazard identification and control. A knowledgeable and experienced staff with a questioning attitude, extensive pre-job briefs addressing hazards and controls, workers' willingness to perform work within controls and stop work when uncertainties arise, and extensive management involvement throughout the process have compensated for some of these weaknesses. Improved documentation of current ISM processes and practices would result in more consistent performance in accordance with management expectations.

BJC/Essential System Functionality

MSRE is a unique facility in which both new and old safety systems exist to support current operations. The new safety systems were installed to support special decontamination and decommissioning operations that started recently. In most cases, these newer systems were developed, installed, and tested by the current MSRE staff. The older or existing safety systems are normally maintained by support organizations but, in most cases, are surveillance-tested by the current staff. As a result, the MSRE staff is more engaged with the newer safety systems than with the older ones. Because different organizations maintain the older safety systems, the rigor and understanding of nuclear facility requirements differs among these systems, resulting in deficiencies in the fire suppression and containment ventilation systems. There have also been significant breakdowns in the transmission and/or implementation of nuclear requirements from BJC to MSRE, in important elements of maintenance, procurement, and configuration management.

The MSRE documented safety analysis appropriately identifies hazards and identifies an appropriate set of design feature and safety system controls. Further, the process utilized to handle hazardous materials and to mitigate potential accidents are generally well designed. However, technical safety requirements for several important aspects of safety systems have not been adequately derived and documented. Further, some design flaws have recently been identified for two safety systems that rendered one inoperable (loss of containment ventilation system annunciation system) and that could keep a second system from performing its safety function as designed (fluorine relief system). These weaknesses indicate a need for a more detailed documentation of important safety basis assumptions and enhancements to safety system assessments. For the most part, MSRE management has effectively implemented its configuration requirements for generating configuration control memos, design change descriptions and drawing control notices. The USQ procedure is, in most respects, appropriate and well implemented. Weaknesses were identified in the implementation of some configuration management processes, including clear identification of configuration items, drawing control, and attention to detail in documentation of work packages. Further weaknesses were identified in the USQ procedure and the non-conforming item procedure that could result in some facility modifications not receiving an appropriate USQ review.

D&D Activities

The surveillance procedures are adequate. Although a few discrepancies were noted, surveillances are performed when appropriate and are completed in a rigorous manner. A few MSRE maintenance elements are adequately implemented, including performance of work in accordance with a formal work package procedure (OR-502), adequate performance of some preventive maintenance tasks for the containment ventilation exhaust system, use of vendor manuals for newly installed safety systems, and use of the non-conformance report process to resolve procurement deficiencies. However, significant weaknesses were identified in the implementation of several maintenance programs and processes. The major contributor to these weaknesses is the breakdown in the transmission of DOE Order 433.1B requirements to BJC nuclear facilities. As a result, MSRE has not rigorously implemented DOE Order 433.1B by establishing a maintenance implementation plan and defining a nuclear maintenance management program. In addition, MSRE has not established a master equipment list, a detailed preventive maintenance program, or a maintenance deficiencies identification/tracking process. MSRE also has not adequately ensured that the safety significant containment ventilation system and components are clearly identified and appropriately maintained. The safety significant containment ventilation system and fire suppression system are maintained by support organizations, and their associated work control processes are not adequate for a nuclear facility.

MSRE has established an appropriate set of operations procedures. A few weaknesses were discovered in execution, quality, and quality control of some procedures. Errors in these procedures could exacerbate the ineffective implementation of adequate conduct of operations, an area of acknowledged weakness within MSRE. In addition, there are some weaknesses in training documentation, and a systematic approach to training for procedures is not used. Management's recent initiative to require operators to attend a two-hour conduct of operations training course, highlighting the requirements of the MSRE conduct of operations procedure, was a positive step. This step alone, however, is not sufficient to remedy the range of problems associated with the implementation of an effective conduct of operations program at MSRE.

The overall conclusion is that OR-AMEM and BJC management needs to devote more attention to the nuclear operations at MSRE to ensure that the necessary resources are provided to bring operations into full compliance with nuclear facility requirements. MSRE management has appropriately responded to recent events by taking the correct immediate actions, reporting the events, and in most cases developing and implementing appropriate corrective actions. MSRE management has also taken appropriate actions to address some of the deficiencies identified during this Independent Oversight inspection, such as declaring a potentially inadequate safety analysis to evaluate a potential concern.

Feedback and Improvement Systems

EM. EM senior managers demonstrated that they clearly understand their safety management roles and responsibilities, and are engaged in safety decisions and priorities. EM also has a number of effective mechanisms for maintaining operational awareness and several key EM managers have qualified as senior technical safety managers. However, the outdated Functions, Responsibilities, and Authorities Manual; generic position descriptions; and an incomplete set of processes/procedures are not consistent with ISM expectations and reduce the assurance that subordinate EM managers and staff are provided with clear expectations and are accountable for performance. In addition, EM assessments are not sufficiently effective in driving performance improvements and are not well coordinated with OR assessments. Further, a number of ES&H programs (e.g., the employee concerns and technical qualification programs) have not yet been fully or effectively implemented. EM is working to improve the formality and rigor of its oversight program and assessments of field elements, including the development of new procedures and the recent implementation of a new approach to assessments.

OR-AMEM. OR-AMEM roles and responsibilities for ES&H are well described for the most part, and many ES&H responsibilities are being adequately implemented. OR-AMEM considers ES&H performance in the evaluation of contractor performance and award fees. Although OR-AMEM has an assessment program in place that includes walkthroughs, self-assessments, and formal assessments of its contractors, there are a number of deficiencies in the areas of self-assessments, planning and scheduling assessments, performance of management walkthroughs, and procedures. There are also deficiencies in corrective action management and ensuring that corrective actions are completed and effective. With the recent hiring of five new Facility Representatives (FRs), OR-AMEM's FR staffing level conforms to the Federal technical capabilities program staffing methodology, but deficiencies exist in the FR program processes and performance (e.g., documenting and communicating issues, training programs, reporting effectiveness indictors). The employee concerns program is implemented, but assessments are not being performed as required. As discussed in Appendix E, OR-AMEM has an adequate description of its safety system oversight (SSO) program; however, the SSO engineers assigned to MSRE have not been fully qualified. OR-AMEM has identified compensatory measures but has been unable to implement them, and the SSO program is not yet sufficient. OR-AMEM has identified and is attempting to implement a number of oversight/assessment program initiatives, most significantly the development and implementation of ISM project teams to oversee projects. These initiatives are promising but not mature and not sufficient to address some of the weaknesses in assessment program processes and performance. Although most of these deficiencies had been previously identified by OR-AMEM, corrective actions have not been timely or effective in many cases. Collectively, these problems indicate a systemic weakness in the oversight program and warrant a higher level of management attention.

BJC. BJC has established and implemented processes for the various elements of a contractor assurance system as delineated in DOE Order 226.1. Although some of these processes are adequately defined and effectively implemented, process and procedure weaknesses and implementation deficiencies in several areas hinder fully effective safety oversight. BJC conducts a variety of independent and management assessment and inspection activities. Although some of these activities are effective in evaluating programs and performance and driving improvement, some assessment processes have not been sufficiently rigorous, and in some cases they lack sufficient rigor to effectively monitor and evaluate safety performance. Numerous recent independent and management self-assessments of work control programs were not effective in identifying program and performance deficiencies reflected in the recent K-25 accident and the deficiencies identified by this Independent Oversight inspection. Safety deficiencies are being evaluated and corrected, but program effectiveness is hindered by weaknesses in processes and procedures and inadequacies in implementation. BJC has established and implemented a structured, well documented, and generally effective lessons-learned program that shares many lessons with the DOE complex. BJC's total recordable and lost workday occupational injury rates are higher than EM and DOE averages, and although Occupational Safety and Health Administration (OSHA) recordable and DOE reportable occupational injuries and illnesses are adequately managed as required by OSHA and DOE requirements, improvements are needed in documenting the evaluation and disposition of non-recordable, first-aid cases. BJC has established an adequate employee concerns program that appropriately evaluates and resolves worker safety concerns.

BJC has established adequate requirements and procedures for the system engineer program to ensure that MSRE safety systems can continue to perform their intended safety functions. However, there are some weaknesses in the rigor and thoroughness of system engineer walkdowns and assessments. Also, BJC training and qualification requirements for system engineers have not been adequately implemented, and there are a few significant gaps in the training given to the MSRE system engineer. MSRE makes significant efforts to apply lessons learned; however, the process

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for capturing and utilizing lessons from its own work is informal and inconsistent.

FWENC/TWPC. FWENC feedback and improvement processes contain most of the elements of the contractor assurance system delineated in DOE Order 226.1, but these programs are not fully mature. Formal processes and procedures lack sufficient detail, and management expectations and implementation sometimes lack sufficient rigor. Prompt feedback information and lessons learned from daily post work reviews and from formal work suspensions provide effective means to encourage and ensure safe work performance. Although many assessments are performed, much line management safety oversight is informal and many formal assessment activities focus on compliance rather than performance. Issues management and lessons-learned processes and performance need strengthening to provide consistent and well-documented records of effective implementation. However, FWENC has compiled excellent injury and illness statistics and has had few operational safety events and incidents. Many factors have had an impact on the process and performance weaknesses identified in this inspection and on the overall success in minimizing the number and severity of FWENC events and injuries. These factors include a small workforce and narrow spans of control, a limited range of work activities, and the fact that facilities and work areas are few and confined to a small physical plant. Although the rigor and quality of more recent assurance system activities reflect improvement, as does the strengthening of formal processes through recent procedure revisions, management attention is needed to strengthen safety assurance processes and performance to meet the requirements delineated in DOE Order 226.1.

Focus Areas

Environmental management system. OR has clearly defined EMS requirements for contractors and has the necessary resources to ensure that these requirements are implemented. However, the OR-AMEM ISM assessment program does not include EMS. BJC has established an EMS within ISM that sets clear expectations for environmental compliance and protection to be fully integrated into line operations as part of work performance and to achieve pollution prevention/waste minimization goals. Several tools and deployed resources are used to ensure that projects manage environmental aspects effectively during the performance of work activities. Although these tools are effective, the AHA process, which is a key tool for ISM, does not currently include environmental aspects. FWENC operations at the TWPC are not subject to EMS requirements, but they are addressed in the comprehensive environmental compliance and waste minimization program.

Workplace monitoring of non-radiological hazards. BJC and FWENC have made some progress in the development of the non-radiological exposure assessment programs. However, there are deficiencies in the non-radiological exposure assessment program and its implementation for both BJC and FWENC. For BJC, although the BJC Safety and Health Program Description has established overall requirements for compliance with DOE Order 440.1A, guidance is lacking for when and how exposure assessments are to be documented, particularly in cases when the industrial hygienist determines that industrial hygiene monitoring and/or sampling is not required. Once the decision has been made to conduct monitoring and/or sampling, the Industrial Hygiene Analytical System database provides mechanisms for documenting all elements of the exposure assessment, although the rigor of this documentation varies among the BJC industrial hygienists. For FWENC, policies and procedures for implementing DOE Order 440.1 (the revision in the current contract) are not evident, and requirements for a CBDPP have not been addressed. For both BJC and FWENC, work observations indicate that worker exposures to some hazards have not been adequately assessed. In cases where worker exposures have not been evaluated, the appropriateness of controls (if used) is indeterminate. In addition, OR has not ensured that all contractors performing work at ORNL have adequately assessed the potential worker exposure hazards to beryllium or implemented a CBDPP, when required. Although some BJC line managers assume that operations in most of these former ORNL facilities did not historically involve beryllium, there is insufficient data to support that assumption. Continued management attention is needed to ensure the development and implementation of a more effective workplace exposure assessment program.

Quality assurance in engineering and configuration management programs and processes. BJC's engineering design implementing procedures (design criteria, calculations, and drawings) provide acceptable instructions for the generation, review, and approval of important engineering documents. The BJC and MSRE configuration management procedures provide adequate instructions for maintaining the design of safety systems. Some configuration management process weaknesses were identified such as the lack of an overarching engineering manual, flowdown of requirements for identification of configuration documents, and instructions ensuring that non-conforming items receive USQ review when appropriate. However, overall, BJC has established appropriate implementing procedures to support quality assurance of engineering products and effective configuration management.

Safety system component procurement. The procurement processes at MSRE have a number of deficiencies. There is no approved procurement and warehouse procedure. The processes are deficient in documenting the receipt and inspection of safety-significant parts and components, and the chain of custody for safety significant parts is not maintained. MSRE suppliers have not been qualified per BJC procedures. These deficiencies exacerbate the weaknesses in the maintenance program for MSRE safety systems.

Status of implementation of DOE Order 226.1. While many aspects of a DOE Order 226.1-compliant DOE oversight program are in place, EM and OR do not have a comprehensive strategy for their integrated management oversight program that considers baseline requirements, the effectiveness of the contractor assurance program, and operational risks and priorities. At the time of this report, at least three of five EM Headquarters deputy assistant secretaries who were required to complete a gap analysis and an implementation plan had done so. BJC has analyzed the new requirements to identify gaps, but OR has not been timely in providing feedback. For FWENC/TWPC, the order is not applicable to the contractor at this time so no actions have been taken. At this stage, EM/OR has taken some actions to ensure compliance by the milestone date, but the approach is not systematic or managed as a formal project, with clear expectations and milestones. Significant effort remains to ensure that EM/OR and BJC will meet policy and order expectations by the September 15, 2006, milestone.

5.0 Conclusions

Some aspects of EM/OR, BJC, and FWENC ISM systems are conceptually sound, and many aspects are effectively implemented. For the most part, DOE, BJC, and FWENC managers and workers are well qualified and demonstrate their understanding of and commitment to safety.

However, the identified weaknesses in safety system functionality for the systems and areas reviewed at MSRE raise questions about the adequacy of these systems. The significant weaknesses in maintenance and procurement warrant priority management attention. There are also weaknesses in work planning and control at the facilities and activities that were reviewed, and weaknesses were observed in the feedback and improvement programs for all of the organizations that were reviewed on this Independent Oversight inspection.

In some cases, EM, OR, BJC, and/or FWENC have recognized implementation weaknesses and have taken or initiated some appropriate actions. For example, EM and OR are changing their approach to assessments, including development of new processes, to address longstanding deficiencies in DOE line management oversight programs. While much work remains, some of the recent initiatives are appropriate steps toward addressing observed deficiencies.

6.0 Ratings

The ratings reflect the current status of the elements selected for review of EM, OR-AMEM, BJC, and FWENC management of the facilities and operations previously owned by ORNL and the TWPC.

Implementation of Core Functions for Selected Work Activities

ACTIVITY	CORE FUNCTION RATINGS			
	Core Function #1 – Define the Scope of Work	**Core Function #2 – Analyze the Hazards**	**Core Function #3 – Identify and Implement Controls**	**Core Function #4 – Perform Work Within Controls**
BJC/Surveillance and Maintenance	Needs Improvement	Needs Improvement	Needs Improvement	Effective Performance
BJC/MSRE	Needs Improvement	Needs Improvement	Needs Improvement	Effective Performance
BJC/Tank W-1A	Effective Performance	Effective Performance	Needs Improvement	Effective Performance
FWENC/TWPC	Effective Performance	Needs Improvement	Needs Improvement	Effective Performance

Feedback and Continuous Improvement - Core Function #5

EM/OR-AMEM/BJC Feedback and Continuous Improvement Processes .... NEEDS IMPROVEMENT
FWENC Feedback and Continuous Improvement Processes .... NEEDS IMPROVEMENT

Essential System Functionality (BJC/MSRE)

Engineering Design and Authorization Basis .... NEEDS IMPROVEMENT
Configuration Management Programs and Supporting Processes .... NEEDS IMPROVEMENT
Surveillance and Testing .... EFFECTIVE PERFORMANCE
Maintenance and Procurement .... SIGNIFICANT WEAKNESS
Operations .... NEEDS IMPROVEMENT

APPENDIX A
SUPPLEMENTAL INFORMATION

A.1 Dates of Review

Planning Visit	May 22-26, 2006
Onsite Inspection	June 5-15, 2006
Report Validation and Closeout	June 27-29, 2006

A.2 Management

Glenn S. Podonsky, Chief Health, Safety and Security Officer, Office of Health, Safety and Security*
Michael A. Kilpatrick, Deputy Chief for Operations, Office of Health, Safety and Security*
Bradley Peterson, Director, Office of Independent Oversight
Patricia Worthington, Director, Office of Environment, Safety and Health Evaluations
Thomas Staker, Deputy Director, Office of Environment, Safety and Health Evaluations

A.2.1 Quality Review Board

Michael Kilpatrick	Bradley Peterson	Patricia Worthington
Dean Hickman	Robert Nelson	Thomas Staker

A.2.2 Review Team

Pat Worthington, Team Leader		Brad Davy, Deputy Team Leader	
Phil Aiken	Vic Crawford	Ivon Fergus	Ali Ghovanlou
Mike Gilroy	Robert Compton	Al Gibson	Joe Lischinsky
Jim Lockridge	Gordon Quillin	Ed Stafford	Mario Vigliani

A.2.3 Administrative Support

MaryAnne Sirk
Tom Davis

A.3 Ratings

The Office of Independent Oversight uses a three-tier rating system that is intended to provide line management with a tool for determining where resources might be applied toward improving environment, safety, and health. It is not intended to provide a relative rating between specific facilities or programs at different sites because of the many differences in missions, hazards, and facility life cycles, and the fact that these reviews use a sampling technique to evaluate management systems and programs. The rating system helps to communicate performance information quickly and simply. The three ratings and the associated management responses are:

- **Significant Weakness (Red):** Indicates that senior management needs to immediately focus attention and resources necessary to resolve the identified management system or programmatic weaknesses. A Significant Weakness rating normally reflects a number of significant findings identified within a management system

*Formerly the Office of Security and Safety Performance Assurance or program that degrade its overall effectiveness and/or that are longstanding deficiencies that have not been adequately addressed. A Significant Weakness rating, in most cases, warrants immediate action and compensatory measures as appropriate.

- **Needs Improvement (Yellow):** Indicates a need for improvement and a significant increase in attention to a management system or program. This rating is anticipatory and provides an opportunity for line management to correct and improve performance before it results in a significant weakness.

- **Effective Performance (Green):** Indicates effective overall performance in a management system or program. There may be specific findings or deficiencies that require attention and resolution, but that do not degrade the overall effectiveness of the system or program.

APPENDIX B
SITE-SPECIFIC FINDINGS

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

FINDING STATEMENTS	Page
1. Work scopes for some repetitive, non-complex work activities performed by the BJC surveillance and maintenance group or support services are not sufficiently documented and/or tailored to a specific work evolution to ensure that the appropriate hazards and hazard controls can be clearly identified, in accordance with DOE Policy 450.4, *Safety Management System Policy*.	22
2. Worker exposures to potential legacy hazards (e.g. asbestos, lead, beryllium) in some older BJC surveillance and maintenance buildings have not been adequately analyzed in accordance with DOE Policy 450.4, *Safety Management System Policy*, and DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*.	23
3. For some BJC surveillance and maintenance non-complex work activities and/or facilities (including a Category II special nuclear material facility), hazard controls have not been adequately identified or effectively implemented in accordance with DOE Policy 450.4, *Safety Management System Policy*.	25
4. BJC/MSRE has not followed BJC hazards analysis processes and requirements with sufficient rigor to ensure that hazards for all activities are appropriately analyzed, documented, and controlled in accordance with DOE Policy 450.4, *Safety Management System Policy*.	28
5. BJC/MSRE has not ensured that all work activities are planned in accordance with their defined work control process (OR-502), resulting in an informal process for some work that does not ensure that the work scope is properly defined, that hazards are properly identified, and that controls are clearly defined and implemented in accordance with DOE Policy 450.4, *Safety Management System Policy*.	29
6. BJC has not ensured that all required hazard controls for the protection of workers at the Tank W-1A characterization project have been effectively implemented in accordance with BJC procedures, DOE Policy 450.4, *Safety Management System Policy*, and DOE Order 440.1, *Worker Protection Management for DOE Federal and Contractor Employees.*	32
7. The FWENC/TWPC AHA process does not contain a sufficient set of requirements and guidance to ensure that the appropriate hazards analysis is effectively and consistently applied to all activities and that corresponding controls are identified and implemented in accordance with DOE Policy 450.4, *Safety Management System Policy*, and DOE Order 440.1, *Worker Protection Management for DOE Federal and Contractor Employees.*	35
8. FWENC/TWPC management has not performed a complete baseline beryllium inventory as required by 10 CFR 850, Chronic Beryllium Disease Prevention Program, to fully characterize the potential for worker exposures to beryllium.	36
9. FWENC/TWPC management has not established an effective process to ensure that workers are adequately trained to comply with all identified controls and regulatory training requirements in accordance with DOE Policy 450.4 *Safety Management System Policy*, and DOE Order 440.1, *Worker Protection Management for DOE Federal and Contractor Employees*.	38

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

FINDING STATEMENTS	Page
10. The Office of Environmental Management has not implemented a comprehensive technical qualification program in accordance with DOE Manual 360.1-1B, *Federal Employee Training Manual*, and DOE Manual 426.1-1A, *Federal Technical Capabilities Manual*.	47
11. OR-AMEM has not adequately developed and implemented effective assessment, self-assessment, and corrective action processes, as required by DOE Policy 450.4 and DOE Order 414.1C, and has not ensured that assessments required by DOE directives and/or the Code of Federal Regulations are conducted.	49
12. The OR-AMEM Facility Representative program does not meet the DOE and OR requirements contained in DOE Standard 1063-2006, AMEM procedure EM-3.2, the EM Facility Representatives Group Operating Manual, and AMEM procedure EM-3.3 in the areas of surveillances, documenting findings, issues management, training and qualification, program documentation, scheduling, and documentation/reporting of activities.	50
13. BJC's independent and management assessment programs have not been fully defined or effectively implemented to provide consistent assurance that safety processes are adequate and are implemented as required by DOE Policy 450.4, DOE Order 414.1C, and 10 CFR 830, Subpart A, Section 122.	53
14. BJC issues management programs have not been consistently effective in ensuring that safety deficiencies are rigorously analyzed, and that effective corrective actions are implemented to prevent recurrence, as required by DOE Policy 450.4, DOE Order 414.1C, and 10 CFR 830, Subpart A, Section 122.	54
15. FWENC has not established and implemented processes that consistently assess performance and manage issues in an effective manner at TWPC to ensure continuous improvement, as required by DOE Policy 450.4 and 10 CFR 830, Subpart A, Section 122.	58
16. BJC has not adequately derived and documented in the DSA the basis for TSR requirements for the containment ventilation and emergency shutdown safety systems, as required by 10 CFR 830.	70
17. BJC did not adequately implement its configuration management processes for controlling drawings and clearly identifying configuration items, and did not rigorously implement all work control processes for MSRE design changes, as required by 10 CFR 830.	72
18. The BJC USQ procedure does not ensure that appropriate and formal screening is performed, and the BJC non-conforming item processing procedure does not provide adequate instructions to ensure that items dispositioned as "use as is" receive a USQ review, as required by 10 CFR 830.	73

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

FINDING STATEMENTS	Page
19. BJC has not established and implemented the applicable requirements of DOE Order 433.1B and 10 CFR 830 for maintenance and procurement in four general areas; specifically: 1) BJC has not established and implemented a detailed maintenance implementation plan and a nuclear maintenance management program to ensure full compliance with the order requirements; 2) BJC has not adequately maintained the MSRE containment ventilation system exhaust fans/motors, which are categorized as safety significant components by the MSRE DSA; 3) BJC has not ensured that procurement processes, including commercial parts dedication, parts receipt inspection, and warehouse storage/issuance, are adequately defined and documented when performed; and 4) BJC has not implemented the supplier qualification assurance evaluation program as required by procedure BJC-PQ-1208, Supplier Quality Assurance Evaluation Program, procedure BJC-PQ-1650, Graded Approach Application, and 10 CFR 830.	78
20. BJC has not adequately implemented training and qualification programs for its system engineers as required by its system engineer program procedure and by DOE Order 420.1B.	81
21. OR-AMEM has not ensured implementation of its compensatory measures for safety system oversight, and there is insufficient evidence of safety system oversight at MSRE as required by DOE Order 420.1B.	83
22. BJC non-radiological workplace exposures have not been sufficiently analyzed and/or documented for some facilities and for a number of work activities, as required by DOE Order 440.1A.	93
23. FWENC/TWPC non-radiological workplace exposures have not been sufficiently analyzed and/or documented for a number of work activities, as required by DOE Order 440.1A.	93
24. OR has not ensured that all contractors performing work at ORNL have adequately assessed the potential worker exposure hazards to beryllium, or implemented a chronic beryllium disease prevention program, when required by 10 CFR 850.	93

APPENDIX C
WORK PLANNING AND CONTROL

C.1 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight evaluated work planning and control processes and implementation of the core functions of integrated safety management (ISM) for environmental management program activities at the DOE Oak Ridge National Laboratory (ORNL). The Independent Oversight review of the ISM core functions focused on environment, safety, and health (ES&H) programs as applied to selected aspects of the following environmental management program facility- and activity/task-level work activities:

- Surveillance and maintenance by Bechtel Jacobs Company (BJC) at selected facilities and projects (see Section C.2.1)
- Remedial actions and maintenance by BJC at the Molten Salt Reactor Experiment (MSRE) (see Section C.2.2)
- BJC activities in support of characterizing Tank W-1A for decontamination and decommissioning (D&D) (see Section C.2.3)
- Operation and maintenance of the Transuranic (TRU) Waste Processing Center (TWPC) by subcontractors working for the Foster Wheeler Environmental Corporation (FWENC) (see Section C.2.4).

For each area, Independent Oversight reviewed implementation of the core functions of ISM (including activity-level feedback processes), observed ongoing operations, toured work areas, observed equipment operations, conducted technical discussions and interviews with managers and technical staff, reviewed interfaces with ES&H staff, and reviewed ES&H documentation (e.g., plant standards, permits, and safety analyses). The evaluation of activity-level feedback and improvement systems for BJC and FWENC is reflected in the evaluation of the overall feedback and improvement program, as discussed in Appendix D.

C.2 Results

C.2.1 BJC Surveillance and Maintenance Program

The BJC surveillance and maintenance program at ORNL is responsible for managing 75 older and predominately unoccupied buildings, a number of which are scheduled for D&D, and approximately 240 inactive hazardous waste sites, waste piles, and solid waste storage areas (SWSAs). These sites and facilities at ORNL are managed in accordance with environmental requirements under a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) response process requiring interim and closure activities that incorporate applicable and appropriate Resource Conservation and Recovery Act (RCRA) requirements, which the BJC surveillance and maintenance program is responsible for meeting. Three of the ORNL buildings under the responsibility of the surveillance and maintenance group are nuclear facilities that must meet additional surveillance requirements to comply with the documented safety analyses (DSAs) for these buildings. The surveillance and maintenance staff includes groups of chemical operators and laborers who conduct routine maintenance and inspection activities. Work activities requiring specialized crafts, such as roofers, carpenters, plumbers, and painters, are subcontracted, although BJC remains responsible for the performance of the subcontracted work as well as meeting ES&H requirements. Hazards are varied and include radiological, chemical, biological, ergonomic, and standard industrial physical hazards.

This Independent Oversight review focused on routine, low-risk work activities (repetitive) and moderate- to high–hazard, non-routine (non-repetitive) work activities performed by the various BJC surveillance and maintenance group sections. Observed work activities included painting activities at the Hot Storage Garden, roofing work by a BJC subcontractor, routine inspection and housekeeping activities, and the performance of technical surveillance requirements in two of the nuclear facilities.

Core Function #1: Define the Scope of Work

The BJC work control process, as described in BJC-FS-1001 (Rev. 7), governs work activities conducted by the BJC surveillance and maintenance group, whether performed by the BJC staff or by BJC subcontractors. As described in the procedure, BJC surveillance and maintenance work can be either repetitive or non-repetitive. Most work performed by the surveillance and maintenance group is either repetitive, low-risk work (e.g., minor maintenance or a safe maintenance and repair task [SMART]), or non-repetitive, job-specific work. Non-repetitive work activities (typically the more complex, higher risk activities) performed by the surveillance and maintenance group are generally well defined with respect to work scope and boundaries. Two non-repetitive work activities were observed during this inspection, and both activities were well defined, and the allocation of priorities and resources were appropriate. For example, all task elements of the foam roofing project for Building 6556C were adequately described in the work package and accompanying documents (e.g., activity hazards analysis [AHA], fall protection plan, waste management plan, detailed performance narrative submittal). In a second example, initial preparations for the glovebox decontamination and removal from the Gunite and Associated Tanks (GAAT) tent have been well defined in preliminary work packages. In general, for non-repetitive work, work is well defined in a number of documents in the work package, such as the work request, AHA, special work scope descriptions, permits, and work plans.

Whether work is repetitive or non-repetitive, BJC is highly reliant on subcontractors to provide skilled craft, particularly painters, carpenters, electricians, roofers, and machinists, because the surveillance and maintenance group does not have employees with these skill sets. In general, these subcontractors are well integrated into work planning activities, with the BJC staff and the subcontractors working together to plan the work and prepare the work documents. For work that is performed by other DOE contractors (e.g., University of Tennessee [UT]-Battelle), and within facilities operated by the BJC surveillance and maintenance group, BJC is actively involved in the review and approval of work documents, and in monitoring and evaluating work activities to ensure that work is performed within the defined work scope and established controls.

Repetitive-work scopes, however, are often too broadly defined in minor maintenance work packages to ensure that specific work activities are understood and that hazards and controls can be tailored to the daily work. Repetitive work is generally not complex (e.g., housekeeping), and the work is broadly described in work packages. However, even non-complex work may involve many hazards, as indicated in work packages associated with work performed by surveillance and maintenance chemical operators. Some work packages have identified such a broad spectrum of hazards, and are not adequately supported by any tools (e.g., a Safety Task Analysis Risk Reduction Talk, or "STARRT," card; facility access plans; and operating procedures), that line management and workers do not have an effective understanding of the true hazards and controls associated with specific tasks. In addition, some BJC repetitive-work packages attempt to address a broader scope of work than may be permitted by the BJC work control process. For example, some elements of work site preparation for the Hot Storage Garden surface painting job were not included in the work package description (e.g., surface preparation, conducting radiological surveys, and removal of preparation materials). In addition, the work steps incorrectly identified the epoxy as a "gray latex paint," resulting in the misidentification of appropriate controls (i.e., there are flammability and vapor requirements for the use of epoxy that do not exist for latex paint). This lack of clear work definition was partially compensated for in verbal discussions before performing work. In another example, a wide variety of minor maintenance activities performed by the surveillance and maintenance chemical operators (e.g., housekeeping and inspections) are addressed through one work package, although the work package is also supplemented through general operating procedures and facility access control plans. This same work package also addresses other work typically performed by chemical operators, such as fork-truck operations, valve operations, and packaging of waste in a number of different BJC buildings. The scope for this work package is too broad to clearly identify and distinguish the work steps, hazards, and controls associated with any single work activity, such as waste packaging. As a result, neither the hazards nor controls for specific daily work activities can be identified, as discussed in the following sections. The BJC work control process, as described in BJC-FS-1001 (Rev. 7) and work control training provided to workers, does not provide sufficient guidance and examples to set expectations for or boundaries on the types of work activities that can be addressed through a single work package. Interpretation of these requirements has often been subjective and inconsistent among the BJC surveillance and maintenance line managers. (See Finding #1.)

Some environmental activities in support of the surveillance and maintenance program have not been enveloped by the BJC work control process, resulting in environmental support work activities in which the hazards have not been identified or analyzed. A number of the work activities within the surveillance and maintenance group rely on the BJC environmental waste operations group for collection, sorting, sampling, and analyzing of job waste. However, these activities are conducted as "expert-based" and without procedures or work packages. For example, work activities performed by the BJC waste management support group are conducted in Building 3001. These activities may involve the unpacking of bagged hazardous waste, obtaining samples from the waste, etc. These work activities are not defined or addressed in work packages or procedures, and are not reviewed by the cognizant BJC facility manager. As a result, some potential worker hazards may not have been identified or addressed. (See Finding #1.)

FINDING #1: Work scopes for some repetitive, non-complex work activities performed by the BJC surveillance and maintenance group or support services are not sufficiently documented and/or tailored to a specific work evolution to ensure that the appropriate hazards and hazard controls can be clearly identified, in accordance with DOE Policy 450.4, *Safety Management System Policy*.

Summary. In general, non-repetitive work activities are well defined in work packages and accompanying documents. BJC subcontractors, including UT-Battelle workers, are well integrated into the work planning process. For repetitive, non-complex work activities, work scopes are often too broad and complex, or are not sufficiently documented, resulting in hazards and controls that are not tailored to specific work activities, as further described in the following sections. The BJC work control procedure lacks sufficient guidance on limiting the work scope such that hazards and controls can be easily linked to specific work activities.

Core Function #2: Analyze the Hazards

Most hazards associated with BJC surveillance and maintenance activities have been adequately identified and analyzed, and workers are generally well informed of these hazards. For non-repetitive work activities, which involve greater diversity, and a higher degree of hazards and risk, the hazards analysis process is typically sufficient such that activity-level hazards are identified, analyzed, and well documented. For example, the Building 6556C roofing work involved a number of hazards, including fall hazards, chemical exposures during application of the foam roofing material, and potential asbestos and chemical hazards to surrounding areas and personnel resulting from the application of foam roofing material. These hazards were identified, analyzed, and addressed in a variety of documents, including the work package, a fall protection plan, the AHA, and the STARRT card(s). The subcontractor had previously conducted exposure monitoring for potential isocyanides to determine the appropriate respiratory protection requirements for this work activity. In another example, initial preparations for the glovebox decontamination and removal from the GAAT tent considered a wide variety of hazards associated with this activity through the Project Review Committee (PRC) and other planning team meetings.

The BJC surveillance and maintenance group uses several hazards analysis methods to enable a comprehensive review of planned work activities for potential hazards. One such effective hazard identification and analysis process has been the PRC, which reviews most nonrepetitive-work packages. The PRC process allows for all appropriate subject matter experts (SMEs), supervisors, and facility managers to review the work activity as a committee, so that they can identify, analyze, and designate controls for the hazards associated with the work package. Two PRC meetings were observed during this inspection (i.e., the GAAT tent glovebox removal and the POG Air Flow Measurement Test at Building 3038), and each demonstrated an effective discussion of package work steps, hazards, and required controls.

As noted in Core Function #1, for repetitive, non-complex work activities, broad work scopes in work packages have resulted in broadly defined hazards that cannot be linked to a specific work activity or the expected control. For example, the hazards analysis for a single surveillance and maintenance work package applicable to the chemical operators identifies 17 of the potential 18 hazards on the SMART hazards analysis form as being applicable. On the day of the work observation, the only activity being performed under this work package was waste pickup, and some of the hazards identified in the work package, such as cold stress, hand/or power tools, and furniture dollies, were not applicable. Furthermore, the STARRT card for this activity is equally broad and attempts to address hazards and controls that are not applicable to the observed work activity (e.g., fall potential and thermal burns). In a second example, at the Hot Storage Garden, the work scope was so broad that hazards were missed or not adequately identified. Examples of missed hazards include the potential flammability of the epoxy resin and the magnitude of the chemical hazard associated with the preparation of the epoxy resin. (See Finding #1.)

More broadly, worker hazards associated with the building environment in which they work have not been sufficiently analyzed because the non-radiological legacy hazards in these buildings and worker exposures resulting from routine tasks in these buildings have not been adequately characterized. For example, for housekeeping work in Building 7500, neither the non-radiological legacy hazards associated with the building nor the worker exposures associated with the observed task (i.e., sweeping) had been evaluated. Specific concerns are as follows:

- Other than some Building 7500 confined space monitoring data, there is no non-radiological exposure monitoring data for surveillance and maintenance activities conducted within Building 7500.

- With respect to the potential lead exposure hazard from sweeping lead-based paint, there is no exposure data for dry sweeping of paint chips either at Building 7500 or any other facility on site. Although there is exposure data from grinding/scraping of presumed lead-based paint at a different facility, which indicates a negligible exposure, the work activities and content of the lead paint are too different to extrapolate this data for application at Building 7500.

- There is no asbestos exposure data to conclude that workers are not being exposed to airborne asbestos during dry sweeping operations. There is asbestos-containing material (ACM) within Building 7500; however, there is no program to maintain the asbestos in a non-friable condition. Recent bulk sampling data from similar sweeping debris in K-25 demonstrated that several of the samples contained asbestos in amounts greater than one percent, which is the Environmental Protection Agency threshold for designating materials as ACM.

- Concerning the potential for beryllium in these facilities, there has been no beryllium characterization performed in accordance with 10 CFR 850 on the surveillance and maintenance facilities at ORNL (approximately 75 buildings) to determine whether beryllium might be present. The BJC chronic beryllium disease prevention program (CBDPP) excluded the ORNL BJC facilities from the facility characterization for beryllium. The safety basis documents for many of these facilities are based on a facility hazards analysis (FHA) that does not explicitly identify beryllium as a potential hazard (unlike lead or asbestos). (See Section F.2.2.)

FINDING #2: Worker exposures to potential legacy hazards (e.g., asbestos, lead, beryllium) in some older BJC surveillance and maintenance buildings have not been adequately analyzed in accordance with DOE Policy 450.4, *Safety Management System Policy,* and DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*.

Summary. Hazards are generally well defined and analyzed for non-repetitive work activities. However, hazards are only broadly defined for repetitive, non-complex work, resulting in some hazards that are not well defined or sufficiently analyzed. In addition, legacy hazards (e.g., lead, asbestos, and beryllium) for some buildings have not been well characterized, and there is limited worker exposure data to support the absence of hazard controls. Some environmental support activities for surveillance and maintenance activities do not have a formal hazard analysis, because these activities have not been enveloped by the BJC work control process as discussed in Core Function #1.

Core Function #3: Identify and Implement Controls

At the facility level, for the three nuclear facilities that are maintained by the surveillance and maintenance group, BJC has developed and implemented several procedures to better define the requirements and controls for nuclear facilities that are in a shut down. Examples of such procedures for Building 3517 (a Category II special nuclear material facility), include the following:

- The facility access control plan for Building 3517 provides requirements for accessing the facility and instructions for responding to some facility alarms for personnel in the facility at the time of alarm actuation.

- The procedure "Building 3517 General Operating Procedure" provides overall guidance regarding responsibilities and facility requirements.

- The procedure "Conduct of Operations Matrix" for Building 3517 defines the conduct of operations requirements for the facility.

For non-repetitive work activities, work controls were sufficiently identified in work packages, AHAs, and other work-related documents. As noted in Core Functions #1 and #2, non-repetitive work typically requires the identification of job-specific hazard controls, which are well documented in work packages and tailored to the work activity thought STARRT cards, pre-job briefings, and daily tailgate meetings. For example, hazard controls for the roofing work package for Building 6556C are detailed in the AHA and are organized sequentially by work steps.

For some repetitive, non-complex work activities, however, either the hazard controls have not been specified or the controls have not been sufficiently tailored to the specific work activity. For example, in Building 7500, mold, asbestos, and lead were identified in the work package as hazards, and two types of respiratory protection were specified in the work package (i.e., full-face respirators and filtering face masks). However, there is no linkage of controls to hazards to indicate which respirator is required for which hazard, and there are no controls for mold or lead specified in the work package. For the Hot Storage Garden, based on questions from the inspection team, BJC SMEs determined that some of the controls specified in the work package were inadequate, but only after the work had commenced. For example, once the work began, and subsequent hazards analysis was performed, additional controls were implemented, such as a portable eyewash station, full-face respirator, specific mixing and handling instructions, onsite fire extinguisher, and chemical resistant gloves. (See Finding #3.)

In some cases, hazard controls have been identified within a work package (in the AHA for non-repetitive work, through the SMART process for repetitive tasks, or via the STARRT card in either case), but the specified controls have not been effectively implemented in the field. For example, Building 7500 has an identified mold hazard. Door postings have been provided to ensure that workers are aware of the respiratory protection requirements for this mold hazard. For three of the four door postings, the posting is clear that respiratory protection is required for entry into the building. However, for the fourth door, an unapproved modification to the posting has been made to indicate that respiratory protection "may be" required. In another example, the requirement for an eyewash station was identified on the STARRT card for the Hot Storage Garden paint job. However, the eyewash station was located in an adjacent building that required key card access; the building had obstacles in the pathway to the eyewash station; and the location of the eyewash did not meet the American National Standards Institute (ANSI) requirements for eyewash stations. (See Finding #3.)

Building 3517 (a shut-down Category II special nuclear material facility) routinely experiences spurious alarms that actuate local facility alarms and a common alarm in the Waste Operations Control Center (WOCC). After a period of time (less than a few minutes), the WOCC alarms reset themselves, although the local building alarms may continue to be in alarm mode until they are reset after an operator acknowledges the alarm in the facility. During the inspection, at least three spurious alarms occurred in Building 3517. There are no active process systems within Building 3517. Therefore, with the exception of the continuous air monitor alarm, which is monitored by the laboratory shift superintendent, spurious alarms do not receive a routine response, nor are they investigated. As a result of a concern raised by the inspection team, spurious alarms are now being recorded in the WOCC log book. (Previously, there has been no record of spurious alarm occurrences.) BJC Conduct of Operations Guidelines 2-C.6 and 2-C.7 require that instrument alarms be treated as accurate unless proven otherwise, and that an attempt be made to determine the cause of the protection trip before the device is reset. Implementation of these requirements for Building 3517 should have resulted in an investigation and evaluation of these spurious alarms. However, BJC determined these requirements were not applicable to a shut-down nuclear facility, and the requirements were excluded from the Conduct of Operations Applicability Matrix.. The exclusion was subsequently approved by the Oak Ridge Office (OR). BJC has not performed a technical justification to support the assumption that alarm conditions in Building 3517 do not require a response. (See Finding #3.)

FINDING #3: For some BJC surveillance and maintenance work activities and/or facilities (including a Category II special nuclear material facility), hazard controls have not been adequately identified or effectively implemented in accordance with DOE Policy 450.4, *Safety Management System Policy*.

Summary. Controls are generally well defined and implemented for non-repetitive work activities, but are only broadly defined for repetitive work. For repetitive, non-complex work, the prescribed controls are not always evident, because the work package addresses a broad scope with numerous hazards and controls. Some controls have not been implemented effectively, and spurious alarms are routinely experienced at a shut-down Category II special nuclear material facility without a subsequent follow-up or investigation.

Core Function #4: Perform Work Within Controls

Readiness to perform work within the surveillance and maintenance group is verified using plan-of-the-day meetings, pre-job briefings, and daily tailgate meetings. A plan-of-the-day meeting is conducted each morning to review the scheduled work activities for the day and discuss any changed conditions, and to focus on safety topics. All of the surveillance and maintenance groups, management, and ES&H were present at each of the plan-of-the-day meetings. The plan-of-the-day meeting is also one of several mechanisms for authorizing work activities. Once a work activity has been planned and the work package is reviewed and approved, a pre-job briefing is conducted by the responsible line manager. Pre-job briefings were well attended, informative, and comprehensive. However, pre-job briefings are typically only conducted once, although the work activity may be initiated at a later date, and the activity may last several days. The daily tailgate meeting, which is conducted by the work supervisor, has been the mechanism to review the day's planned activities and associated hazards and controls. Tailgate meetings were generally informative and necessary to ensure that work scope, hazards, and controls for the day's activities were communicated and understood. Both pre-job briefings and tailgate meetings included lessons learned pertinent to new or ongoing activities. One noteworthy tailgate meeting was a meeting conducted by the BJC roofing subcontractor. During this tailgate meeting all aspects of the work package (scope, hazards, and controls) were explained by the work supervisor, with significant interaction from the workers. Discussions on "what could change" resulted in an increased focus on higher-risk hazards, such as heat stress and fall protection.

BJC workers, subcontractors, and ES&H support staff performed most surveillance and maintenance work safely and in accordance with established controls. Workers were knowledgeable of their work activities, hazards, and controls and consistently demonstrated a strong safety culture and intent to perform work within established safety controls. In most cases, workers performed activities in accordance with the appropriate procedures, work instructions, radiation work permits (RWPs), AHAs, and other administrative controls. For example, BJC operated the CERCLA Waste Management Area in accordance with BJC waste management procedures and environmental regulatory requirements. Technical safety requirement surveillances at nuclear facilities (i.e., Buildings 3517 and 3038) conducted by surveillance and maintenance chemical operators were performed in accordance with requirements defined in procedures and work packages.

BJC workers are fully aware of their stop-work authority and have demonstrated that they will stop work when appropriate. Surveillance and maintenance supervisors and line managers have also demonstrated the willingness to suspend work when safety questions arose. During plan-of-the-day meetings, BJC workers are alerted to the possibility of changing work conditions, the nature of such condition (e.g., changing weather conditions), and the necessity to stop work if such conditions arise. However, these same instructions are not routinely presented to BJC subcontractors. In part, this may account for a situation when a subcontractor recognized changing hazards at a painting work activity in the Hot Storage Garden, implemented new and more stringent controls (e.g., respiratory protection, chemical gloves), but failed to stop the work or revise the work package to account for the changes in hazards and controls.

Summary. Workers performed most observed activities safely and within established controls. A variety of mechanisms are in place within the BJC surveillance and maintenance program to communicate work activities, hazards, and controls; to authorize work; and to ensure that work is performed safety. With one minor exception, work is typically stopped when the work is outside established work scopes or the hazards and controls have changed.

C.2.2 Remedial Actions and Maintenance at the MSRE

The MSRE operated from 1965 through 1969 to investigate the feasibility of the molten salt reactor concept. The circulating fluid in the reactor was a molten salt mixture composed of various fluorides. Uranium-235, in the form of uranium tetrafluoride (UF4), was the fissile component of the fuel salt that was used to produce a controlled nuclear chain reaction. In 1968, the uranium-235 fuel was replaced with uranium-233, and a small quantity of plutonium was added in 1969. After the reactor was permanently shut down three months later, the molten fuel salt was allowed to cool and solidify, and surveillance and maintenance actions were initiated. Current activities at MSRE are performed in support of the objective of removing the reactor fuel salt in accordance with CERCLA.

Independent Oversight's review of core function implementation at MSRE examined a sample of work activities being performed during the inspection. Prior to the inspection, the facility was engaged in the early part of a campaign that involved the addition of fluorine to effect chemical reactions needed as part of salt removal efforts. During this effort, system overpressure resulted in an unexpected release of fluorine gas in the MSRE south truck bay at the location of the fluorine passivation cabinet. An occurrence report was issued and operations activities were curtailed pending investigation of root causes and corrective actions. Thus, activities observed by Independent Oversight primarily consisted of facility support and maintenance, such as various gauge calibrations, pump maintenance, waste packaging, waste handling and movement, and shop work (e.g., fabrication, welding, leak testing, and related actions). Limited operations activities were also reviewed, including glovebox bag-in and bag-out operations and reactive gas removal system checks.

Core Function #1: Define the Scope of Work

Operations work at MSRE is governed by operating procedures prepared for each system and/or process activity. The scope of activity-level operations work is well defined in task and/or system-specific implementing procedures. Development of operating procedures is governed by a formal procedure development process, which includes requirements for scope, format, content, SME review, and facility-level approval. The operations procedures that were reviewed effectively described unique scopes of work for discrete work activities.

Non-operations work includes maintenance and general facility work activities. The MSRE work authorization procedure, OR-502, defines the work control requirements for non-operations activities, including work scope breakdown and work authorization. The process requirements from this document have been deemed by BJC management to be functionally equivalent to the BJC corporate work control process, BJC-FS-1001. As a result, MSRE uses the OR-502 procedure and not the BJC-FS-1001 procedure. However, Independent Oversight identified deficiencies in both scope and implementation of MSRE's work control process and concluded that the MSRE process in place at the time of the inspection was not functionally equivalent in scope or implementation to the BJC intended process. (See Finding #5.)

The OR-502 work control procedure provides for a work classification system that outlines several basic categories of work at MSRE: changes, modifications, and maintenance that may impact configuration-controlled structures, systems, and components (SSCs) (Categories A and B); changes or modifications to non-SSC process equipment (Category C); and all other maintenance activities (Category D). In addition, "programmed maintenance" is a separate category that is defined in OR-507 but that falls outside the OR-502 work control procedure. Programmed maintenance includes instrumentation and control (I&C) calibrations and other commonly performed periodic preventive maintenance work in MSRE. This type of work is incorrectly excluded from OR-502, resulting in a gap in the MSRE work control process that resulted in incomplete work scope definition for some observed activities, as discussed below. (See Finding #5.)

In general, the activity-level scopes of work for Categories A, B, and C are well defined in facility work packages that use OR-502 work request forms and instructions. The work packages that were reviewed were properly categorized and the work scope definitions were sufficient to adequately identify and analyze hazards.

However, deficiencies in the definition of work scope were identified for other commonly performed work at MSRE, including shop work, repetitive maintenance, programmed maintenance, and several other non-operations work activities. In these cases, MSRE was not able to produce cohesive work packages that met the internal requirements of OR-502 (see Core Function #3). As a result, the scope of work for individual tasks being performed was inaccurate, excessively broad, or not documented, resulting in inadequate hazards analysis (see Core Function #2). For example, MSRE provided general work order MSRE-010 ("Preventative Maintenance") as the package used to perform a fit test of the passivation cabinet fluorine header, and to lubricate a sump pump in a confined space. However, the approved scope of work for MSRE-010 only referenced activities (e.g., changing inlet filters) that did not apply to the work being performed. Similarly, the scope of work for various I&C calibrations was not defined in a specific work package that met BJC or MSRE work control requirements. (See Finding #5.)

Summary. The activity-level scope of work for operations work and tasks that involve process systems or components is generally well defined in operations procedures and facility work packages prepared in accordance with the MSRE facility work authorization procedure. However, there are some deficiencies in defining the scope of work for MSRE Category D work and programmed maintenance, such that hazards are not always effectively and systematically evaluated, and work may not be properly reviewed and authorized by facility management.

Core Function #2: Analyze the Hazards

A BJC procedure (BJC-EH-2010) governs the conduct of hazards analysis at MSRE. The two basic hazards analysis products required by BJC procedures are the AHA and the less rigorous SMART. At MSRE, the AHA is the only hazards analysis product addressed by the governing work control procedure (OR-502). While BJC-EH-2010 authorizes use of the SMART process as an AHA alternative for some repetitive work activities, requirements for using the SMART process are only addressed in BJC-FS-1001, which is not used at MSRE. The current revision of OR-502 does not provide for the use of the SMART process or provide any instructions as to its proper use.

A number of AHAs have been prepared at MSRE, including specific AHAs for all operations procedures and Category A, B, and C work packages. In general, these AHAs adequately addressed most hazards associated with the defined scope of work.

However, a number of inadequacies were identified in MSRE's hazards analyses for Category D work and programmed maintenance. For example, some routine facility work, such as helium bottle changes, had not been subject to a formal hazards analysis and did not have a corresponding AHA. In other cases, such as routine preventive maintenance, the AHA was overly broad and not tailored to the specific task being performed or did not properly address changing hazards resulting from differences in work location (e.g., radiological versus non-radiological areas, location-specific hazards). (See Finding #4.)

Recently, MSRE began to utilize the BJC SMART hazards analysis tool in an attempt to better address hazards posed by these types of work activities and to align itself with the upcoming revision 8 to BJC-FS-1001. However, MSRE's implementation of this initiative is not addressed by internal procedures and does not meet existing MSRE or BJC-FS-1001 requirements for conduct of hazards analysis. For example, SMART work authorization forms were not being prepared for each discrete work evolution that had unique hazards; specific walkdowns were not being conducted; and such accompanying documentation as required work scope cover sheets and STARRT card tailgate briefing records were often not completed and available at the work site. For example, on June 1, 2006, a SMART AHA was prepared for "I&C calibrations throughout MSRE." However, because there is only one SMART form encompassing all possible calibrations, the unique hazards for each job could not be ascertained, as they are dependent on the location of the work. (See Finding #4.)

During the assessment, the Independent Oversight team identified a number of instances in which hazards associated with MSRE work were not properly analyzed and/or documented as part of the required AHA process. For example:

- Overhead hazards from metal protrusions hanging from the ceiling of the passivation cabinet were not identified on the AHA or SMART form for preventive maintenance performed by I&C. These hazards are not normally present when the passivation cabinet is functional and presented a potential head injury and head puncture hazard inside a contamination area during the work. There was no documented evidence to suggest this hazard was evaluated and why head protection was not considered necessary.

- Puncture hazards from sharps and breach of containment from use of plastic bags rather than gloves during reactive gas removal system bag-in and bag-out operations were not identified in the applicable AHA.

- While generic welding fume hazards were identified, the unique nature of chromium-6 hazards for welding on Monel® and stainless steel pipe were not identified in the AHA for shop work, resulting in a questionable basis for the lack of Industrial Hygiene monitoring and the adequacy of ventilation controls. (See Finding #23.)

- Lifting and ergonomic hazards associated with compressed gas cylinder movements were not identified on any AHA or the SMART form provided to the Independent Oversight team.

- Potential chemical and radiological hazards associated with groundwater infiltration and use of pump oils were not identified on the confined space evaluation or SMART form for preventive maintenance in the sump room.

FINDING #4: BJC/MSRE has not followed BJC hazards analysis processes and requirements with sufficient rigor to ensure that hazards for all activities are appropriately analyzed, documented, and controlled in accordance with DOE Policy 450.4, *Safety Management System Policy*.

Summary. AHAs for Category A, B, and C work at MSRE are generally adequate to address hazards posed by the work. However, there are deficiencies (e.g., overly broad AHAs that are not tailored to specific work activities) in hazards analysis for commonly performed routine work, including Category D and programmed maintenance. In addition, some work has not undergone an appropriate level of hazards analysis. In anticipation of a revision to the corporate work control procedure, MSRE prematurely changed how it performs hazards analysis, including use of the SMART process, without appropriate changes to internal procedures governing their use. As a result, a number of hazards associated with MSRE work were not identified or adequately analyzed as part of the work planning process.

Core Function #3: Identify and Implement Controls

BJC appropriately uses a variety of engineering and administrative controls, coupled with personal protective equipment (PPE), to mitigate hazards from many MSRE activities. Engineering controls, such as containment devices (e.g., gloveboxes, hoods, and ventilation systems) and shielding systems are used extensively to control hazards. Engineered controls are complemented by a variety of administrative controls, including work permits, postings, administrative procedures, and work instructions prepared to control particular activities. Postings and boundary controls throughout the facility were clear and legible.

In most cases, radiological controls within MSRE were effective and included surveys, workplace monitoring, job coverage, and sample analysis methods. Radiological surveys are performed routinely throughout MSRE and are supplemented by job-specific surveys and sampling. Radiation control technician (RCT) coverage is provided for work with the potential for radiological exposure or contamination. Radiological instrumentation is sufficient to meet MSRE's needs, and in some cases, state-of-the-art equipment has been procured for certain tasks, such as timely initial analysis of air samples.

While some controls at MSRE are effective and comprehensive, an informal process for control of Category D and programmed maintenance work has led to lack of compliance with facility work control procedures and inconsistent implementation and control. In part, this informality reflects a reliance on the experience of facility staff and skill of the craft working in a facility where hazards and controls are generally understood but not always documented to ensure and demonstrate effective implementation. Independent Oversight's reviews of work packages and ongoing work identified deficiencies in implementation of MSRE and BJC work control requirements such as failure to incorporate documentation required by OR-502, including request for work, facility work authorization, work instructions, and work package documentation indices. Each of these documents has an intended purpose, including definition of scope of work, quality assurance, SME review, management approval, and facility work authorization. The absence of any of this information reduces the effectiveness of work control efforts. Other deficiencies included: work packages that were uncontrolled and residing in employee file cabinets; lack of preparation and use of STARRT cards as required; a burn permit that did not have the proper facility management authorization signatures; and RWPs that were not listed or were incorrectly listed as specific controls for work packages.

FINDING #5: BJC/MSRE has not ensured that all work activities are planned in accordance with their defined work control process (OR-502), resulting in an informal process for some work that does not ensure that the work scope is properly defined, that hazards are properly identified, and that controls are clearly defined and implemented in accordance with DOE Policy 450.4, *Safety Management System Policy*.

As discussed in Core Function #1, programmed maintenance work is excluded from MSRE work control procedure OR-502. While this work is defined and addressed in OR-507, this procedure lacks any information on work control expectations for programmed maintenance, resulting in a work control gap within the MSRE process that allows some work to be performed outside the bounds of either the MSRE or BJC work authorization process (see Finding #3).

Neither BJC nor OR has identified similar problems with implementation of MSRE's work control process. In particular, the informal determination by BJC that MSRE's process is functionally equivalent to the BJC requirements has not addressed implementation and scope deficiencies identified during this review (see Appendix D).

Some work at MSRE is conducted through procurement of services with other DOE prime contractors or subcontractors. The integration of hazards, controls, and work instructions for work performed by non-BJC personnel (e.g., UT-Battelle or such subcontractors as Duratek) at MSRE is not formally addressed by the existing work authorization process, resulting in the potential for unsafe work and/or introduction of unknown hazards to co-located workers. For example, there is no internal requirement to review or verify the adequacy of the non-BJC procedures used, the hazards generated by non-BJC personnel, or worker qualifications except where BJC imposes restrictions (such as utilization of a BJC RWP).

For identified hazards, implementation of controls was generally effective with some exceptions. For example, as discussed in Core Function #2, hazards were not specifically identified; therefore, controls for welding fumes generated during Duratech welding activities in the machine shop were not formally defined. In another example, the facility had on hand two small tubes of calcium gluconate, which is needed to counter the adverse affects of hydrogen fluoride exposure. However, these tubes were expired, and the use, procurement, training, and inspection requirements are not governed by any formal procedure. In a third example, breathing zone air sampling called for in the passivation cabinet RWP was not sufficient to ensure the ability to measure 10 percent of a derived air concentration (DAC) and should have been replaced or supplemented with higher volume air sampling. Because the job duration was short, the air volume drawn was not sufficient to collect enough measurable radioactivity to detect the required 10-percent DAC. The RCT practice of continuing to run a sampler after the work evolution is completed is inappropriate because it would result in an underestimate of the actual air concentration. In a fourth case, the BJC/OR-542 procedure approved in May 2000 defined the actions and responsibilities necessary to manage and control beryllium at MSRE. However, this document, while not revoked, is not accurate and has not been updated to reflect current practices for beryllium control at MSRE. Lastly, the need to engage a ventilation fan in the sump pump room before entry was not clearly identified in the work package or confined space entry permit.

Summary. BJC appropriately uses a variety of engineering and administrative controls, coupled with PPE, to mitigate hazards from many MSRE activities. Radiological controls within MSRE, including surveys, workplace monitoring, job coverage, and sample analysis methods, were generally effective. However, failure to recognize deficiencies with and comply with all aspects of MSRE work control requirements has resulted in improper implementation and over-reliance on informal processes for hazard identification and controls for some work activities. Integration of hazards, controls, and work instructions for work performed by non-BJC personnel at MSRE is not addressed by the BJC work planning process, resulting in the potential for some unsafe work and/or introduction of unknown hazards to co-located workers.

Core Function #4: Perform Work Within Controls

Readiness to perform work in MSRE is implemented on a daily basis utilizing plan-of-the-day schedules, morning meetings, crew briefings, and pre-job briefs. These meetings were effective in conveying relevant information concerning facility status and planned work such that appropriate resources could be assured (e.g., RCTs).

In most cases, workers performed work safely in accordance with established requirements and controls. Workers donned appropriate company work clothing and were diligent about observing facility rules and postings, including frisking in and out of radiological and buffer areas. All workers observed in the high bay had leather gloves in their possession, as required. Non-BJC workers entering MSRE to perform work were properly escorted.

In a few cases, controls were not followed as intended or required. For example, a worker performing asbestos sampling did not wear safety glasses as required. An RCT allowed poor radiological boundary control during the I&C calibration of a gauge in the passivation cabinet in that a worker was allowed to doff his protective clothing within an area being controlled as a contamination area, rather than utilize a step-off pad to the radiation buffer area (RBA). Also, RWP suspension limits for dose rate and beta contamination were not assessed by RCTs during this work. Posted survey results had no dose rate information listed. During work, RCTs took only alpha readings; no radiation level measurements or beta measurements were taken to evaluate against the suspension limits of the RWP. RCTs believed beta background was too high; however, this was not the case as the frisker located at the RBA entrance was within close proximity and within background tolerance to perform a field count for beta activity.

Summary. Readiness to perform work in MSRE is implemented on a daily basis utilizing plan-of-the-day schedules, morning meetings, crew briefings, and pre-job briefs. In most cases, workers performed work safely in accordance with established requirements and controls. Some isolated examples of failure to follow required controls indicate the need for additional attention to detail in some areas.

C.2.3 Tank W-1A Characterization Study Work Control

The Tank W-1A Characterization Study project site is located in central ORNL in the north tank farm. Tank W-1A is located below the ground surface, beneath a protective soil and gravel overburden. The tank is constructed of stainless steel and has a nominal capacity of 4,000 gallons. The cylindrical tank was buried horizontally on top of a concrete foundation pad with two concrete saddles and covered with soil. A CERCLA removal action was initiated in 2001 to remove Tank W-1A and the soil surrounding the tank along with associated piping, valve pits, and related utilities within the area of excavation and then to backfill and restore the site. The original removal action excavation area was approximately 40 by 50 feet and approximately 15 feet below the surface (depth to bedrock). Most of the low-level waste (LLW) soil was removed and disposed at that time. However, approximately 100 cubic yards in an area approximately 20 by 25 feet was not removed due to high concentrations of TRU isotopes (primarily Am-241 and Pu-239/240). The Tank W-1A Characterization Study is being performed to obtain additional information about the site prior to the removal action.

The Independent Oversight team selectively reviewed activity-level work control for ongoing activities; the ongoing activities, however, were limited in scope because of schedule delays encountered by BJC. The observed activities included draining the tank of free liquids, mobilization of sampling and analysis subcontractors at the Tank W-1A site, initial sample collection efforts, and support activities managed by BJC at the Tank W-1A field location.

Core Function #1: Define the Scope of Work

Scopes of work for Tank W-1A sampling operations and related fieldwork activities are generally well defined in project management and implementation plans and procedures, work instructions, and/or sampling/monitoring planning documents. Program plans and work package documents for Tank W-1A provide bounding scopes for the authorized activities that can be conducted in accordance with the existing engineering evaluation/cost analysis. For example, the BJC work package for Tank W-1A pumping provided a concise and completed description of the work to be conducted, with sufficient detail to provide for appropriate hazards analysis. Sampling and analysis plans and procedures provide adequate work scope definition such that hazards and controls can be identified.

Summary. Work control processes are established for Tank W-1A sampling operations, and working documents sufficiently describe the planned activity, scope, schedule, and requirements.

Core Function #2: Analyze the Hazards

The BJC use of Tank W-1A task-specific AHAs and work instructions to supplement both the Tank W-1A site safety plans and general AHA provides a suitable mechanism and protocol for identifying and analyzing most activity-level hazards at the Tank W-1A field location. The AHA process provides an appropriate framework for identifying hazards applicable to specific work scopes. It also provides references to such resources as ES&H requirements, work instructions, and an ES&H representative (ESHR) point of contact. Hazards assessment documentation contained in the work-specific AHA for pumping the tank and the standing AHA for liquid waste tanker truck movement and liquid transfers sufficiently included evaluations of most hazards and established controls for those hazards identified.

Although the hazards assessment documentation was generally complete, a few hazards were not sufficiently identified or analyzed, as discussed below.

BJC had not conducted a sufficient number of noise surveys for workers in the vicinity of the Geoprobe® and equipment at the Tank W-1A sampling location to characterize the potential for producing noise levels in excess of 85 dBA or for levels that would necessitate the use of double hearing protection. Although some noise monitoring data was available for a similar activity at K-25 indicating noise may exceed 85 dBA within 30 feet of the Geoprobe®, limited measurement of actual noise levels had been conducted prior to the initiation of work. Sufficient noise level characterization (including noise dosimetry and sound level measurements on the actual equipment and soils at the work site) is needed to determine appropriate controls. Although some noise monitoring was conducted during a 2005 proof of process demonstration using the Geoprobe®, this data was not available to the ESHR and is needed to determine whether the noise protection offered by the ear plugs in use is adequate. Actual noise levels close to the Geoprobe® unit may require a greater level of protection (i.e., double hearing protection), or a greater stand off distance may be required for individuals not utilizing hearing protection. Additional noise monitoring is currently underway to confirm adequacy of controls.

The BJC STARRT card does not list waste management or environmental compliance as a subject to be discussed at the tailgate briefing. Although the card is used to ensure that workers are briefed on specific applicable hazards just before work begins, environmental concerns beyond housekeeping are not identified.

Summary. Formal mechanisms exist for identifying and analyzing hazards associated with Tank W-1A work activities. With a few exceptions (e.g., noise), hazards have been properly identified and analyzed.

Core Function #3: Identify and Implement Hazard Controls

Tank W-1A operations use engineered controls to control many activity-level hazards. Engineered controls include such items as shielded sample analysis systems, the filtered glovebox enclosure, Geoprobe® design, and fabrication of sample handling equipment, which are tailored to the work activities' potential hazards. Where engineering controls are not sufficient to completely control the hazards, administrative controls are established that are adequate in most cases (see exceptions below). For example, radiological controls for the Geoprobe® sample collection and analysis activities established appropriate boundary controls (i.e., postings, access control point, and perimeter air sampling) for contamination areas (with one exception noted below). Established controls also provided an interface between radiological control zones (i.e., contamination areas for core sampling and core handling/glovebox activities. Additionally, radioactive materials area controls were established for both non-destructive assay sample analysis trailers.

Waste management and pollution prevention aspects of the project were sufficiently addressed in accordance with BJC's ISM program, which includes environmental management system elements. The waste management plan for the project effectively sets controls to meet regulatory requirements for investigation-derived waste and non-contaminated sanitary waste. Additionally, an environmental compliance and protection review checklist was developed to ensure that environmental hazards are analyzed and that resulting controls are established as part of the environmental management system approach. For example, the checklist identified a hazard from soil core samples being inadvertently released due to a ruptured core tube. Therefore, an outer carrier was identified as a control and was subsequently incorporated into the work package. The checklist was reviewed and approved by the environmental compliance and protection lead.

While the combination of engineering and administrative controls can result in effective controls, deficiencies in implementation of work planning and AHA requirements in Tank W-1A characterization operations and associated activities have resulted in inadequate controls during some work evolutions, resulting in potential safety consequences. These deficiencies are discussed in the following paragraphs.

AHAs and work plans do not always contain enough clarity, specificity, and detail with regard to expected hazardous conditions and accompanying required controls. In one example, heat stress prevention controls established for the BJC Tank W-1A pumping activities did not sufficiently address anticipation of the need to adjust work pace based on ambient conditions or PPE. The AHA for the Tank W-1A pumping evolution contained heat/cold stress as an analyzed hazard and established a control of the need for workers to be aware of the potential hazard; additionally, a designated safety individual was present throughout the work activity and water was available to workers. However, the AHA did not provide sufficient instructions to ensure that the BJC requirements for heat stress monitoring and controls were implemented in accordance with BJC procedure BJC-EH-5134. Based on the temperature and humidity, and the PPE worn at the time of the work activity, the BJC procedure required at least a modest work/rest regimen that was not implemented. This potential heat stress concern was compounded when workers skipped a normal break interval in an attempt to reach completion of a procedural step before the normally scheduled lunch break (see Finding #7). Furthermore, based on a subsequent review of documents related to the development of the AHA, the work was assumed to "require very little physical work" and "very little if any PPE"; both of these assumptions were non-conservative. The PPE level required and activities conducted are considered moderate level work in one set of PPE (should have required monitoring and determination of the need for a work/rest regime control) by BJC-EH-5134 (see Finding #6). During subsequent Geoprobe® sampling, more rigorous heat stress prevention controls were employed, including hourly monitoring of ambient conditions and scheduled work/rest intervals, based on temperature and the PPE in use.

In another example, the distribution of temporary electrical service at the Tank W-1A site made good use of junction/distribution boxes, and ground-fault circuit interrupter protection was used extensively (primarily for the connection of radiological air sampling pumps and filtration units); however, workers displayed some inattention to detail in the use of electrical extension cords in two cases. First, several runs of electrical cords were tangled and in areas were workers could traverse, causing a potential tripping hazard. Second, electrical cords were plugged into each other (daisy chaining or piggy backing of portable extension cords). The Occupational Safety and Health Administration (OSHA) requires that equipment be maintained and used in accordance with manufacturer's instructions. Instructions on the extension cord specifically stated "Do not plug into another extension cord." The site ESHR and field work and RCT supervisors were not familiar with those requirements (see Finding #6). These items were corrected by the site RCT lead.

Other examples of deficiencies resulted in workers being unable to comply with radiological (contamination) control requirements. In two cases, workers were not provided sufficient support to effectively implement radiological controls. In the first case the potential for an individual becoming contaminated was exhibited when a stanchion within the Contamination Area (CA) (at the transition to the RBA) was used by a worker for balance while doffing PPE. The worker placed his hand on top of the stanchion while wearing his outer glove (most likely to be contaminated); a subsequent worker was observed also placing an un-gloved (bare) hand (this individual had one glove on and one off) on the same stanchion while attempting to remove his last set of shoe covers before stepping into the RBA. The inadequate design of the boundary transition point, as well as the lack of any posted doffing instructions or verbal guidance to workers, contributed to this potentially unsafe practice. Subsequent placement of additional structures (once called to the attention of RCT supervision) to provide worker stability resolved this deficiency. In a second case, a worker within the CA who was in the heat and waiting for RCT support (suited in PPE) removed his safety glasses and used the back of his gloved hand to wipe sweat from his eye, potentially spreading contamination to his face (see Finding #6). This was brought to the attention of the RCT and field work supervisors and an additional individual was assigned to be outside the CA and reach in with paper towels and wipe the workers' foreheads or provide other assistance to workers.

FINDING #6: BJC has not ensured that all required hazard controls for the protection of workers at the Tank W-1A characterization project have been effectively implemented in accordance with BJC procedures, DOE Policy 450.4, *Safety Management System Policy,* and DOE Order 440.1, *Worker Protection Management for DOE Federal and Contractor Employees.*

Summary. Formal processes have been developed that identify BJC management expectations for identifying and controlling workplace hazards. However, some deficiencies in implementing these processes were identified and resulted in some ineffective or incomplete control measures.

Core Function #4: Perform Work Within Controls

Readiness to perform work was effectively demonstrated during the pre-job briefing for a task to transfer contaminated liquid from Tank W-1A to the tank farm. The briefing covered the AHA, the RWP, the FHA, and a walkdown of the work area. In working through these documents, workers identified discrepancies between the work package and the RWP, which were then resolved by involvement of the appropriate personnel. The workers actually performing the work package were actively engaged in the briefing and requested clarification when necessary. Overall, the briefing reinforced safe work, identified safety concerns for the work area and the work to be performed, and ensured that all involved understood those concerns. BJC conducted a plan-of-the-day meeting for mobilization of tank sampling tasks that provided workers from BJC and several subcontracts with a good update of work package changes resulting from a recent readiness assessment of the work package and procedures. Additionally, BJC conducted two separate STARRT card briefings for two discrete mobilization efforts; this division allowed for a more targeted interchange between workers and line supervision to ensure that workers were aware of the day's tasks, potential hazards, and controls. Effective STARRT card briefings were conducted for both the mobilization of the general site (Tank W-1A) activities and the Geoprobe® track-mounted sampling rig onsite acceptance inspection and safe off loading.

BJC conducted an effective preliminary receipt acceptance (safety) inspection of the Geoprobe® track-mounted sampling rig and associated support equipment before allowing the off loading of the vehicle in the hazardous waste site controlled area. This inspection included an incoming radiological survey, safety checks of lifting and rigging equipment, and visual inspection of such features as out riggers and an emergency safety cutoff. Additionally, inspection dates and such vehicle safety items as fire extinguishers and fuel containers were also inspected.

While workers followed hazard controls in most cases, workers' actions were deficient in two situations. First, two minor exceptions with donning and doffing requirements introduced the potential for individuals to become contaminated. These deficiencies could be attributed to ineffective controls (see discussion in Core Function #3); in each case additional support was necessary to provide assistance to workers to ensure safe work conduct. Second, during the preparation phase of the Tank W-1A pumping evolution, workers were observed using a pocket knife to cut towels into rags to be used for equipment decontamination. Two workers were cutting through these materials in a crude manner (i.e., no scissors or other protective method), with one individual holding the cloth and one using the knife to repeatedly cut the cloth while the first worker pulled the material apart. This activity was conducted without the use of cut resistant gloves (or any gloves at all), contrary to BJC requirements. As discussed in Appendix D, the use of pocket knives was prohibited by BJC in April 2006. When this was brought to their attention, workers donned leather gloves.

Summary. Formal conduct of operations within Tank W-1A field activities, including development of work plans for most activities, documented work instructions, and required training, provides adequate assurance of readiness to perform work. Several work evolutions with well-defined controls were performed in accordance with expectations. In a few cases, inattention to detail was noted with regard to the implementation of some hazard controls.

C.2.4 Operation and Maintenance of the TWPC

FWENC is under a DOE contract to process solid and liquid radioactive waste generated by defense program activities at ORNL and other sites. The waste is processed at the ORNL TWPC for ultimate disposal at the DOE Waste Isolation Pilot Plant (WIPP) and the Nevada Test Site (NTS). FWENC has subcontracted the day-to-day management and operation of the TWPC to EnergX, LLC. About 12 operators, 8 maintenance specialists, and 10 RCTs perform most of the activity-level waste processing and maintenance work, with the guidance and support of management and administrative staff. The principal hazards associated with the work are radiological. Common industrial hazards, including those involving the potential for electric shock, falls, exposure to hazardous chemicals, and fire, are also present in both waste processing and maintenance activities.

The Independent Oversight review focused on operations and maintenance activities associated with processing solid waste and maintaining TWPC facilities. Observed activities included contact-handled waste processing and repackaging in the box breakdown area (BBA), waste receipt activities, routine RCT activities, vendor maintenance work, and other corrective maintenance activities.

Core Function #1: Define the Scope of Work

The scope of activity-level work is generally well defined. Operations procedures, work instructions, recipes (guidelines for specific waste processing techniques), and maintenance work packages specifically describe the scope of work for waste processing activities. Because of the unique nature of each incoming waste container, TWPC personnel perform extensive reviews of accepted knowledge documented in historical research reports and on container travelers, and use an extensive personnel experience base (management and workers with years of waste handling experience from other areas or sites) in planning and scoping of individual methodologies for specific containers.

Processing activities and requirements are adequately defined in appropriate schedules that break down production needs to discrete operations tasks. The scope of maintenance work is adequately defined in work requests and work orders that are included in work packages issued to workers. Maintenance activities are appropriately scheduled, and schedules are constantly monitored and revised when appropriate to address unforeseen circumstances. A graded approach is used for task definition in AHAs. Tasks judged to be of relatively high risk, such as electrical work, are specifically defined in job-specific AHAs, and some tasks involving less risk are more generally defined in standing AHAs without specific task identification beyond the title of the AHA. Although the criteria used to determine the degree of specificity are not defined by procedure, significant management involvement in work planning has resulted in appropriate specificity in AHA task identification.

Summary. Existing procedures and other work documents adequately define the scope of work for most current activities, and project and work schedules adequately define production needs and integrate operations and maintenance activities.

Core Function #2: Analyze the Hazards

Most hazards associated with operations and maintenance activities have been adequately analyzed, and workers are generally well informed of these hazards. At the facility level, the DSA bounds the conditions for incoming waste and processing, and in most cases provides conservative restrictions, such as prohibitions on flammable gas or unvented waste drums. When conditions exceed these restrictions, management takes appropriate action to ensure that activities remain within the safety basis in accordance with an approved procedure. Since contact handled waste processing began in late 2005, the facility has processed three waste drums containing prohibited items, such as sealed containers. In these cases, the prohibited items were segregated and processed in accordance with procedure. In an example during this inspection, a bolted, gasketed, large metal box was discovered that subsequently produced questionable results from atmospheric tests within the box. Management declared a potentially inadequate safety analysis (PISA) on this issue on June 13, 2006. The current DSA hazard scenarios and frequencies for deflagration inside containers were based on vented boxes or boxes with loose fitting lids, and drums less than half this size that are sealed and unvented are not allowed by the current DSA. In addition, the current DSA does not specifically reference the potential for methane production from anaerobic decomposition of organic materials, which, in the judgment of the Independent Oversight team, was the most likely mechanism for the questionable atmospheric readings. Although the PISA only referenced the radiological decomposition mechanism, the unreviewed safety question determination addressed several mechanisms for flammable gas production, including the potential for methane production from anaerobic decomposition.

Activity-level hazards are also generally well analyzed. For example, radiological hazards receive comprehensive analysis for each activity. The radiological control organization performs bounding analyses for specific radiological hazards as part of RWP development, and RCTs perform effective real-time monitoring and analysis of changing radiological hazards based on the predefined bounds in the RWPs. Unique or special industrial safety or health hazards are also appropriately analyzed. For example, asphyxiation hazards associated with nitrogen leakage from the raffinate system were adequately analyzed and controlled. The waste evaporator, dryer, and associated piping and components are currently in dry lay-up and are pressurized with nitrogen to reduce corrosion. The controls resulting from the hazards analysis of nitrogen leaks (lockout/tagout, ventilation, access controls, and measurement of nitrogen makeup rates) resulted in effective mitigation of the asphyxiation hazard.

Although most hazards are adequately analyzed, the AHA process did not provide sufficient guidance or requirements to ensure a comprehensive analysis of hazards in a few cases. The process relies heavily on facility management and personnel experience, knowledge, skills, and abilities to analyze hazards, and does not provide a detailed, systematic approach to hazards analysis during pre-job planning. Although knowledge and experience of waste handling and processing personnel are extensive, some hazards are missed without a systematic application of hazards analysis for all activities. Specific problems with the AHA process include:

- The current AHA process does not provide criteria for when job-specific AHAs are needed.

- Some routine jobs are not formally analyzed, although activity-specific hazards assessment may be needed. For example, a routine job, effluent stack sampling, was performed under the General Operations Activities AHA. However, no activity-specific AHA was performed. An activity-specific AHA may have identified a physical fall hazard (an unguarded ladder opening) not specifically addressed in the general AHA.

- Hazards identified on material safety data sheets are not always assessed as part of pre-job planning or included on AHAs. For example, the general AHA directs workers to read material safety data sheets but does not require identification or analysis of activity-level hazards or controls unique to the work. This general AHA is used for most corrective maintenance activities.

- TWPC does not consider environmental hazards during the AHA process. A Miscellaneous Waste Management Manual has been implemented for use by both support and operating personnel to provide requirements and guidance for proper analysis, but the manual is not referenced in the work packages. Consequently, workers are not always provided with job-specific environmental analysis and the resulting controls. In addition, the environmental group does not review work being performed by outside vendors to determine whether environmental impacts have been identified and controls implemented. For example, an air conditioning repair project involved the addition of Freon (R22), which may be subject to requirements under the Clean Air Act. However, since the Environmental Programs and Permitting Group does not review these types of vendor activities, the potential environmental impacts have not been analyzed.

- The AHA process does not contain criteria that would trigger baseline industrial hygiene surveys or documented exposure assessments. Although DOE Order 440.1 requires a comprehensive and effective industrial hygiene program, including baseline surveys and documented exposure assessments, industrial hygiene monitoring procedures do not establish specific requirements for monitoring, such as sample type, frequency, location, or analysis, and do not include requirements for exposure assessment or documentation of results. For example, exposures to welding fumes have not been analyzed sufficiently to assure that controls used during welding are adequate to maintain exposures within limits. Although welding activities are infrequent, such monitoring and analysis is particularly important due to a recent reduction to the exposure limit for hexavalent chromium. Weld rods containing chromium are available for use in the TWPC maintenance shop. (See Section F.2.2 and Finding #23.)

FINDING #7: The FWENC/TWPC AHA process does not contain a sufficient set of requirements and guidance to ensure that the appropriate hazards analysis is effectively and consistently applied to all activities and that corresponding controls are identified and implemented in accordance with DOE Policy 450.4, *Safety Management System Policy*, and DOE Order 440.1, *Worker Protection Management for DOE Federal and Contractor Employees*.

In addition to weaknesses in the AHA process, TWPC has not adequately analyzed the potential for worker exposures to beryllium. TWPC waste acceptance criteria does not allow the facility to receive waste known to contain beryllium. The facility relies upon characterization data from waste generators and other accepted knowledge to determine whether beryllium is present. In most cases, the existing characterization data addresses specific beryllium components or items; however, beryllium was widely used for decades at ORNL before it was regulated as an environmental concern and when exposure controls and release limits were less restrictive. Consequently, incidental beryllium contamination in the TRU waste during that time may not be identified in waste characterization records. Operators process waste in the BBA (using respiratory protection) and also use the empty TRU waste boxes to process LLW outside the BBA (without respiratory protection). In addition, TWPC operations personnel were using non-sparking tools containing beryllium (beryllium-copper alloy), but management and procurement were not aware of the presence of the beryllium tools, and the beryllium hazards associated with tool use had not been analyzed. Following discovery, facility management suspended use of these tools. Management has indicated that they consider these tools as beryllium articles, which could be excluded from many of the 10 CFR 850, Chronic Beryllium Disease Prevention Program, requirements if the articles do not release beryllium or otherwise result in exposure to airborne concentrations of beryllium during normal use. However, lessons learned across the DOE complex have indicated that surface contamination on these tools can exceed DOE limits and be transferred to items or work surfaces contacting these tools. Although beryllium is potentially in the waste stream, and residual beryllium contamination is potentially in the empty boxes or in areas where non-sparking tools containing beryllium have been used or stored, TWPC has performed no beryllium monitoring to characterize the hazard.

FINDING #8: FWENC/TWPC management has not performed a complete baseline beryllium inventory as required by 10 CFR 850, Chronic Beryllium Disease Prevention Program, to fully characterize the potential for worker exposures to beryllium.

Summary. In general, hazards for TWPC activities are adequately identified and analyzed. However, the lack of specificity in the procedure for activity-level hazards analysis has resulted in incomplete or inadequate hazard analyses in some cases. Additionally, the failure to implement a chronic beryllium disease prevention program as required by 10 CFR 850 has resulted in inadequate analysis of the potential for beryllium exposures to workers. Management attention is needed to ensure that a systematic and complete hazards analysis is performed for all activities.

Core Function #3: Identify and Implement Controls

Many engineering controls have been incorporated into the design of the TWPC processing building because of the radioactive isotopes in the waste stream and the likelihood of high surface and airborne contamination levels created by the waste repackaging process. For example, high ventilation flow rates, airlocks, local ventilation trunks, and other contamination control measures were in the original design of the BBA. In addition, TWPC has implemented temporary engineering controls in the BBA, such as lining walls and floors with disposable coverings to minimize decontamination efforts. However, the facility was originally designed to be temporary, with a limited scope of work under a fixed price contract. It was not designed to meet the current expanded scope and size of waste streams or the extended schedule to complete the mission. Consequently, some engineering shortfalls in the BBA exist, such as limited space, limited mobility of the crane, and lack of better contamination control equipment, such as downdraft work tables. Contract negotiations are currently underway to better address current mission needs, and both DOE and current TWPC management are anticipating engineering improvements in the future. Currently, these shortfalls are adequately addressed with administrative controls and extensive use of such PPE as air supplied respiratory protection and multi-layered anti-contamination clothing. Even without the engineering shortfalls, much of the waste sorting and size reduction activities must be done by hand, so the facility will always heavily rely on administrative controls along with extensive PPE use.

The facility also relies on knowledgeable, experienced, and qualified personnel. Most of the workforce at TWPC has extensive experience in waste handling activities, and facility-specific training is adequate in most cases to inform workers of regulatory required information as well as facility-specific processes, hazards, and controls (see exceptions below). For example, classroom respirator training performed during this inspection was comprehensive and covered the required elements of the applicable Federal regulations. For day-to-day activities, workers are generally well informed of identified controls. Appropriate pre-job briefings are conducted prior to the start of each job, and anticipated hazards and required controls are adequately addressed during these briefings. (See Core Function #4 for an additional discussion of pre-job briefings). Additionally, workers are required to read RWPs before entering radiologically controlled areas, which ensures that radiological controls are effectively communicated to the workers.

Administrative controls, such as procedures, are generally comprehensive and complete. Because of waste certification requirements from WIPP and NTS, the TWPC procedure set is under strict procedure development criteria and has received extensive review. Procedures are well written and contain the appropriate information and level of detail to perform the tasks. Waste and environmental actions are also being effectively imbedded in operating procedures. The procedures are developed in conjunction with the environmental staff and include specific responsibilities for waste management as well as requirements driven by environmental permits. For example, *Receipt of Contact Handled Solid Waste to Contact Handled Staging Area* requires that containers be labeled and listed on the transfer document in order to ensure that only the compliant containers pre-approved for acceptance are allowed into the facility. The procedure appropriately defines how to manage containers and where to place the containers depending upon the waste type. In observed activities, procedural controls were generally appropriate for the hazards.

Radiological hazards are significant at TWPC, and administrative controls for these hazards are extensive. The RWP process is effective in administratively controlling radiological hazards associated with waste handling activities. RWPs included appropriate listings of the bounding conditions for the associated radiological hazards as well as the appropriate controls for conducting the activity authorized by the RWP. In addition, the automated access control system is an effective tool to track exposures, control access, and maintain accountability of workers in radiological areas. The access control system is also effective in ensuring that radiological workers are appropriately signed in on RWPs and that worker training is current for specific radiological tasks prior to granting access. For example, although an administrative tracking system failed to provide advance notice of expiring qualifications, workers with expired respirator qualifications could not sign in to the system to begin work. Further investigation by the facility revealed that several workers' classroom respirator training had expired or was nearing expiration. Consequently, work was paused while the health and safety officer presented the required classroom training.

Electrical hazards are also present at TWPC and are a significant hazard, particularly for maintenance personnel. Administrative controls for these hazards are conservative and complete in job-specific AHAs. For example, electrical hazards were properly controlled during corrective maintenance of heating, ventilation, and air conditioning chillers and preventive maintenance of the uninterruptible power supply for the process building. Job-specific AHAs for this electrical work specified appropriate PPE, voltage-rated tools, and work practices consistent with the recommendations in National Fire Protection Association (NFPA) 70E, Standard for Electrical Safety in the Workplace. The maintenance supervisor ensured that vendor representatives performing the work attended pre-job briefings and implemented the controls specified on the AHAs.

Although most hazard controls are appropriate and complete, three areas were deficient, as discussed below.

First, the TWPC administrative procedure addressing procedure use and compliance states that level 3 procedures and work instructions are to be used for guidance. By not requiring procedure compliance for these requirements, workers are technically allowed to deviate from the intent, safety analysis, and/or management expectations expressed in approved procedures, although management has stated that this is not their intent. In addition, the approved DSA assumes use of defined procedures to accomplish needed tasks, so a system that does not require procedure compliance in all cases has implications on safety analysis assumptions. A system that would allow departure from approved procedures does not meet the intent of the conduct of operations order regarding procedure use and does not meet the intent of 10 CFR 830.120 regarding work being performed using approved instructions, procedures, or other appropriate documentation. Use of unapproved work instructions during an event in the BBA demonstrated that workers did not understand management's intent regarding use of approved procedures and work instructions. Following the event, TWPC management recognized the discrepancies in the administrative procedure as well as some conduct of operations deficiencies and initiated actions to begin the procedure revision process and to provide remedial training on procedure compliance expectations to workers. (See Core Function #4 for further discussion of the event.)

Second, the TWPC AHA process does not always assure that controls are adequately implemented and that appropriate individuals are informed of hazards and controls. For example, the AHA for general operations activities contains several controls applicable to all site personnel; however, not all of the material is included in the General Employee Training, not everyone on site is required to read the AHA, and no other means for communicating these requirements exists. In another example, the AHA for general operations activities requires hearing protection above 85 dBA; however, management has accepted undocumented exceptions to this control inside hood respirators while in the BBA and for routine passage through high-noise areas. In these cases, the analysis of the hazard was informally completed, but the documented control was not corrected. (See Finding #7.)

Third, training and qualification requirements are not adequately addressed in AHAs or other work control documents. The procedures for preparing AHAs, hot work permits, and designated welding area permits do not specify that training and qualification requirements are to be included in AHAs and permits. Consequently, these requirements are not normally included, and training requirements are sometimes missed. As examples:

- AHAs do not normally specify the training required for performing specific tasks. For example, the AHA for general operations activities contains such statements as a “competent person shall inspect ladders and rigging equipment,” and “hot work shall be performed by a qualified person,” but the criteria for establishing competence and qualification are not specified. In another example, job-specific AHAs prepared for electrical work do not specify qualification requirements needed for the task and to meet OSHA requirements and NFPA guidance. (See Finding #7.)

- The qualification requirements for maintenance specialists performing the duties of a fire watch had not been clearly established. The hot work procedure requires a fire watch to be assigned but does not specify qualification requirements for individuals assigned this responsibility, and maintenance workers performing fire watch duties had not received fire extinguisher training. OSHA regulations (1910.252) require fire watches to be trained in the use of fire extinguishers.

- Maintenance specialists had not completed some training that was required by the Foster Wheeler Training Program. For example, six of seven maintenance specialists had not completed required RCRA training.

- Specific OSHA training requirements for forklift operation had not been incorporated in TWPC training requirements, and operators had not been trained on job-specific equipment. Independent Oversight observed operators operating forklifts exceeding the manufacturer’s requirements on fork placement and center of gravity. Following this observation, the facility suspended forklift work until the problem was critiqued and corrective actions were implemented.

FINDING #9: FWENC/TWPC management has not established an effective process to ensure that workers are adequately trained to comply with all identified controls and regulatory training requirements in accordance with DOE Policy 450.4, *Safety Management System Policy,* and DOE Order 440.1, *Worker Protection Management for DOE Federal and Contractor Employees.*

Summary. In most cases, appropriate engineering and administrative controls are established for activity-level hazards. Knowledgeable, experienced, and trained personnel are generally well informed of appropriate controls through such channels as procedures and pre-job briefs. Weaknesses in administrative requirements on procedure use and the AHA and training processes have resulted in incomplete or inadequate controls being implemented in some cases. Continued management attention is needed in these areas to ensure that effective and complete hazard controls are fully implemented for all activities.

Core Function #4: Perform Work Within Controls

Readiness to perform TWPC waste processing work is verified using plan-of-the-day meetings, shift turnover meetings, and pre-job briefs. The shift turnover meetings (morning meetings) cover management expectations for the day as well as the plan-of-the-day schedule and were effective in coordinating resources to accomplish the day’s jobs. In addition to the workers, all applicable organizations were well represented at the shift turnover meeting, and representatives from all groups were actively involved. TWPC management involvement in the entire process was extensive. Pre-job briefs were comprehensive and frequent, even for continuing evolutions, such as BBA activities. For example, operations personnel conducted pre-job briefs both morning and afternoon in most cases for BBA activities. Both shift turnover meetings and pre-job briefs included lessons learned pertinent to new or ongoing activities.

Operators, maintenance specialists, and RCTs performed most waste processing and maintenance activities safely and in accordance with established controls. TWPC workers have extensive experience and consistently demonstrated a strong safety culture and their intent to perform work within established safety controls. In most cases, workers performed activities in accordance with the appropriate procedures, work instructions, RWPs, AHAs, and other administrative controls (see isolated exceptions below). Waste operators were knowledgeable of procedural requirements and performed such activities as size reduction operations in accordance with procedures and AHA controls. RCTs perform effective assessments of current conditions and confirm that such controls as workplace survey and monitoring, posting and labeling, and access restriction are appropriate and in place. They also ensure that in-process radiological surveys and monitoring (area radiation and continuous air monitoring) are in accordance with requirements, and provide the appropriate process completion support (personnel and equipment exit surveys and contamination control and stabilization) in accordance with TWPC and regulatory requirements. Maintenance specialists consistently performed work in accordance with controls specified in RWPs, AHAs, and procedures.

In some cases, workers took actions to further enhance safety that were more conservative than the minimum required controls. For example, maintenance workers performed work on a chiller in accordance with the AHA for general operations activities. The AHA provided general criteria for hearing protection but did not specify whether or not the hearing protection was required for this job. The workers conservatively decided to wear earplugs. In another example, maintenance workers safely installed shims under a work platform. The platform was raised with a pallet jack and placed on blocks so that shims could be bolted between the platform and four roller assemblies. The principal hazard was the platform slipping off the blocks and falling on the mechanics. The AHA did not specifically address this hazard, but operators exercised appropriate care and accomplished the work safely.

TWPC workers also operate two satellite accumulation areas (SAAs) in accordance with site procedures and environmental regulatory requirements. For example, the SAAs are locked to ensure that they are under the control of the generator, weekly inspections are conducted, and hazardous waste containers are closed and properly labeled. Additionally, a universal waste program is being conducted as part of a pollution prevention/waste management program.

Workers are fully aware of their stop-work authority and have demonstrated that they will use it when appropriate. TWPC management has also demonstrated the willingness to suspend work when safety questions arise. Reasons for work suspensions and corrective actions to resume operations following safety questions are appropriate and formally documented in accordance with the applicable work suspension and restart procedure.

Although work performance was strong overall, an event in the BBA revealed a few conduct of operations practices that warrant additional attention. During waste processing, operators discovered out-of-specification atmospheric readings inside a waste container, and several problems related to communications, command and control, and procedure compliance involving both workers and management became evident. Most deficiencies were identified and addressed during the incident investigation, and management issued a work suspension order stopping work until appropriate corrective actions were complete or compensatory measures were in place. Management actions during this review have been effective in addressing the identified deficiencies.

Summary. Although a few deficiencies were identified, workers performed most observed activities safely and within established controls. Most of the observed deficiencies were self-identified, and TWPC management demonstrated effective performance by suspending the work activities, identifying the problems, developing appropriate corrective actions, and implementing the corrective actions through remedial training and other appropriate mechanisms.

C.3 Conclusions

BJC surveillance and maintenance. Work control processes for BJC surveillance and maintenance activities are adequate to ensure that the more hazardous, higher-risk, non-repetitive work activities are well defined, that the hazards for these activities are identified and analyzed, and that the controls are appropriate. However, for routine, non-complex repetitive tasks, there is a greater challenge to ensure that the work scope, hazards, and controls are tailored to the specific work activity. In some cases, the work scope is so broad, that every hazard and control listed on the BJC generic work authorization form is identified in the work package as being applicable in order to bound the diverse work scope and all possible work conditions. Consequently, hazards and controls for a specific non-complex, repetitive work evolution (e.g., waste packaging) are selected informally by workers and their supervisors from the identified possibilities in the work package and related procedures based on their knowledge and experience, but the agreed-upon task-specific hazards and/or controls are not documented. In addition, the potential for worker exposures lacks sufficient analysis to justify the absence of administrative or engineering controls, or the need for PPE, particularly with regard to longstanding, legacy building hazards. When scopes are adequately defined and hazards analyses are tailored to the work activity, controls are appropriate, but in some cases controls have not been implemented effectively. A knowledgeable and experienced staff with a questioning attitude, extensive pre-job briefs and tailgate meetings addressing hazards and controls, a willingness by workers to perform work within controls and stop work when uncertainties arise, and extensive management involvement throughout the process have compensated for many of the identified weaknesses. However, the weaknesses in work definition, hazards analysis, and identification of controls could degrade safety performance and need management attention to effect improvements in worker safety.

BJC/MSRE. MSRE has an established work control process, which in many cases provides functional equivalency to the BJC corporate work control process. In particular, operations activities and work that has the potential to affect configuration-controlled SSCs are generally well planned, with adequate work scope definition, hazard identification, and controls. However, for other work activities at MSRE, including routine and repetitive maintenance, programmed maintenance, fabrication activities, material handling, and related actions, MSRE's adherence to procedural work control requirements is lacking and in practice is based primarily on an informal process, with heavy reliance on the experience of facility staff and skill of the craft to identify and control hazards. Implementation deficiencies were noted in many aspects of work control, including inadequate work scope definition, unidentified and/or inadequate analysis of hazards, and insufficient application of controls. In a few cases, controls were not followed as intended or required; however, these were isolated examples, and workers generally were diligent about following requirements when they were clearly identified.

BJC/Tank W-1A. BJC operation of Tank W-1A field activities demonstrates a strong commitment to disciplined operations, with processes and procedures consistent with DOE requirements in place for conduct of operations, work planning, and control. The application of the BJC AHA and work control process requires continued attention, particularly at the activity level to ensure that discrete work tasks and their potential hazards and associated controls are clearly identified to workers. Most work observed implemented the hazard controls as intended. However, additional attention is needed to address weaknesses in implementation of hazard controls not explicitly addressed in work planning documents or for instances where workers require assistance to complete their assigned tasks.

FWENC/TWPC. Work control processes for TWPC activities are generally adequate to ensure activity-level ISM; however, in a few cases, hazards and/or appropriate controls were missed or inadequate. The work control processes lack sufficient formality and rigor to ensure consistent hazard identification and control. A knowledgeable and experienced staff with a questioning attitude, extensive pre-job briefs addressing hazards and controls, a willingness by workers to perform work within controls and stop work when uncertainties arise, and extensive management involvement throughout the process have compensated for some of the weaknesses. Improved documentation of current ISM processes and practices would result in more consistent performance in accordance with management expectations.

C.4 Ratings

The ratings for the first four core functions are presented separately for the activities reviewed to provide DOE Office of Environmental Management (EM)/OR, BJC, and FWENC management with information on the effectiveness of organizations and the implementation of the first four core functions of ISM.

Implementation of Core Functions for Selected Work Activities

ACTIVITY	CORE FUNCTION RATINGS			
	Core Function #1 – Define the Scope of Work	Core Function #2 – Analyze the Hazards	Core Function #3 – Identify and Implement Controls	Core Function #4 – Perform Work Within Controls
BJC/Surveillance and Maintenance	Needs Improvement	Needs Improvement	Needs Improvement	Effective Performance
BJC/MSRE	Needs Improvement	Needs Improvement	Needs Improvement	Effective Performance
BJC/Tank W-1A	Effective Performance	Effective Performance	Needs Improvement	Effective Performance
FWENC/TWPC	Effective Performance	Needs Improvement	Needs Improvement	Effective Performance

C.5 Opportunities for Improvement

This Independent Oversight inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site 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.

BJC

1. **Refine the BJC work control process to provide an effective, clear, and user-friendly mechanism for tailoring work packages such that hazards and controls can be tailored to specific work tasks.** Specific actions to consider include:

   - For repetitive-work packages, provide guidance on work scope boundaries and linkage of hazards and controls to specific work tasks.
   - Ensure that all work activities, including ES&H support work for which there are potential hazards, are bounded by the work control process.
   - Perform an evaluation of building environmental hazards in the surveillance and maintenance building to assess workers' potential for exposure to legacy hazards (e.g. asbestos, beryllium, lead) when working in these unoccupied facilities.
   - Review specific industrial safety hazards associated with machine shop equipment in vendor manuals and ensure that hazards and controls for unique activities or specific models of equipment are appropriately tailored in the AHAs for shop activities.

2. **Improve the rigor with which hazard controls are defined and implemented.** Specific actions to consider include:

   - Ensure that hazard controls, when defined in a work package, are appropriate to address the hazard, and can be effectively implemented in the field.
   - Communicate to workers, including subcontractors, the importance of working within controls, and the process for addressing changes in hazards and controls.
   - For nuclear facilities under the jurisdiction of the surveillance and maintenance program, ensure that such administrative controls as procedures and alarm response actions are commensurate with the rigor required of a Category II special nuclear material facility,

even if the facility is in standby or has been shut down.

BJC/MSRE

3. **Increase the emphasis on ensuring a systematic approach to work planning and control for Category D work and programmed maintenance.** Specific actions to consider include:

   - Determine root causes for failures to identify MSRE work planning and control deficiencies.

   - Revise OR-502 to include work control requirements for programmed maintenance activities, or formally adopt corporate work control procedure BJC-FS-1001.

   - Revise OR-502 to incorporate proper methods for use of the AHA and/or SMART hazards analysis tool, consistent with BJC requirements, or formally adopt corporate work control procedure BJC-FS-1001.

   - Revise OR-502 to clarify expectations for required documentation to be included in work packages for all categories of work (i.e., are certain requirements eliminated for certain categories of work?), or formally adopt corporate work control procedure BJC-FS-1001.

   - Conduct special training of MSRE staff regarding work planning and control expectations for all categories of work.

4. **Improve the application of existing work planning processes to ensure effective work scope definition, hazards analysis, and application of controls.** Specific actions to consider include:

   - Revise the BJC work planning training module to ensure that expectations for the use of cover sheets, AHAs, and STARRT documentation is clearly understood.

   - When preparing work packages, subdivide existing work scopes such that the unique hazards and controls associated with the work can be ascertained and do not change depending on location of work or other factors.

   - Ensure that specific controls for identified hazards are captured within AHAs, and avoid referring a worker to a user manual, material safety data sheet, or other documents.

   - Develop a procedure to outline formal expectations for performing confined space evaluations and atmospheric testing.

   - Conduct training of staff to reinforce management's expectation that work packages will be available and reviewed before working, and that verbatim compliance is expected or that corrections should be made if errors are found.

   - Conduct additional training of RCTs and field radiological engineers regarding expectations for air sampling including types of air samples required, and job duration and required sensitivity. Revise the air sample procedure to warn against dilution in order to obtain sufficient air volumes.

   - Revise 2000 BJC/OR-542, Beryllium Control Plan for the Molten Salt Reactor Experiment Remediation Project, to reflect current practices concerning the beryllium control plan, and communicate changes to the staff.

   - Develop a facility-specific procedure that identifies potential sources for occupational exposure to hydrofluoric acid at MSRE, and outline expectations for required PPE, first aid treatment and supplies, reporting to medical, emergency planning, and required training for potentially exposed employees. Such a procedure should be coordinated with both BJC and UT-Battelle medical programs and be maintained as a controlled document at MSRE and referenced as needed during work planning efforts.

   - Revise procedures and training for Reactive Gas Removal System glovebox users to ensure that glovebox integrity is maintained during bag-in/bag-out evolutions, including cautions against prolonged use of the bag as a glove and proper sequencing of steps to minimize potential for punctures and breaches.

BJC/Tank W-1A

5. **Review current BJC controls that address the potential effects of heat stress to ensure that requirements and expectations outlined in ES&H requirements and AHAs are sufficiently applied at the working level**. Specific actions to consider include:

   - Identify and document a minimum set of controls to be implemented by default in response to potential heat/cold stress work environments.

   - Provide additional training and guidance to line supervision to ensure that ES&H expectations related to the use of PPE and work/rest regimes are met.

6. **Formalize requirements for proof of process demonstrations to include SME involvement in assessment of activities at field locations.** Specific actions to consider include:

   - Establish a set of operations or tasks conducted during proof of process demonstrations and require SME review and/or workplace monitoring of these activities (e.g., noise generation, welding fume, and chemical use).

   - Document required follow-up actions from proof of process demonstrations and provide administrative controls, such as procedural hold points, to ensure future compliance.

7. **Revise the BJC STARRT card to include waste management or environmental compliance as a hazard to be discussed at the tailgate briefing. Ensure that workers are briefed on environmental concerns beyond housekeeping in addition to specific applicable safety and health hazards and controls before work begins.**

FWENC/TWPC

1. **Strengthen TWPC work control procedures.** Specific actions to consider include:

   - Revise the AHA procedure to add criteria to be used for determining the need for job-specific AHAs.

   - Revise procedures to convey management's expectations for worker involvement in work planning.

   - Establish a mechanism to inform workers of AHA requirements. Ensure that all workers are informed of applicable requirements, including the current requirements in the general AHA for operational activities.

   - Revise the AHA process to provide criteria or "triggers" for review of hazards and controls by SMEs (e.g., environmental/waste management and industrial hygiene specialists).

   - Consider requiring AHAs for new or future revisions of operations and maintenance procedures and surveillances to ensure that all activities governed by procedure receive an activity-level hazards analysis.

2. **Improve TWPC workplace monitoring of exposures to chemical and physical hazards.** Specific actions to consider include:

   - Establish a workplace monitoring program to ensure that exposures are monitored, documented, and controlled in accordance with the requirements of DOE Order 440.1.

   - Require applicable material safety data sheets to be analyzed during pre-job planning to identify applicable hazards and controls, and require that these hazards and controls be specified on AHAs.

   - Strengthen the analysis and control of hazards associated with the exposure of workers to welding fumes. Perform bounding analyses based upon air monitoring results for the types of welding, burning, brazing, and soldering commonly performed, and establish controls to ensure that exposures remain below threshold limit values, including the recently reduced threshold limit value for hexavalent chromium. Use data and analyses from other sites to the extent that these data and analyses are representative of conditions at TWPC.

- Work with DOE to establish a chronic beryllium disease prevention program that meets the requirements of 10 CFR 850.

3. **Strengthen TWPC conduct of operations.** Specific actions to consider include:

   - Revise the TWPC administrative procedure addressing procedure use and compliance to strengthen the requirements for procedural compliance.

   - Ensure that the revised procedure meets management expectations for procedure compliance as well as requirements in the approved DSA and 10 CFR 830.

4. **Establish more rigorous controls for training and qualification of TWPC individuals performing hazardous work.** Specific actions to consider include:

   - Review training requirements specified in the TWPC training program to ensure that requirements listed for each position are consistent with management's expectations and regulatory requirements.

   - Consider making the "General Operations Activity" AHA a part of General Employee Training as "required reading." This AHA, as well as others, should undergo a periodic review to confirm appropriateness and a comprehensive analysis of hazards.

   - Audit training records, and take corrective actions as needed to assure compliance with requirements and expectations.

   - Address training and qualification requirements more specifically in AHAs.

APPENDIX D
FEEDBACK AND CONTINUOUS IMPROVEMENT (CORE FUNCTION #5)

D.1 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight evaluated contractor feedback and improvement processes for environmental management program activities at the DOE Oak Ridge National Laboratory (ORNL). The Independent Oversight team examined five areas:

- The Office of Environmental Management (EM) feedback and improvement processes, including the employee concerns program (ECP), assessments, and issues management as applied to environmental management program activities at ORNL (see Section D.2.1)
- The Oak Ridge Office (OR) feedback and improvement processes, including the ECP, assessments, the Facility Representative (FR) program, and issues management as applied to environmental management program activities at ORNL (see Section D.2.2)
- Bechtel Jacobs Company (BJC) feedback and improvement processes, such as the contractor assurance system assessments, corrective action and issues management, injury and illness investigation and prevention, lessons learned, the ECP, and institutional processes as applied to BJC's environmental management program activities at ORNL, including surveillance and maintenance and the operation and maintenance of the Molten Salt Reactor Experiment (MSRE) (see Section D.2.3)
- Foster Wheeler Environmental Corporation (FWENC) feedback and improvement processes, such as the contractor assurance system assessments, corrective action and issues management, injury and illness investigation and prevention, lessons learned, and institutional processes as applied to FWENC's subcontractors that manage environmental management program activities at the Transuranic Waste Processing Center (TWPC) (see Section D.2.4)
- EM/OR, BJC, and FWENC efforts to implement DOE Order 226.1. This focus area is closely related to the feedback and improvement area (see Section D.2.5).

Independent Oversight interviewed EM/OR, BJC, and FWENC personnel and reviewed various program documents and assessment reports. Feedback and improvement processes at the activity level are also discussed in Appendix E for the essential safety systems at MSRE, and the results are considered in the evaluation of OR and BJC feedback and improvement programs.

D.2 Results

D.2.1 EM Feedback and Improvement

Within EM, the Deputy Assistant Secretary for Integrated Safety Management and Operations Oversight (EM-3.2), who reports to the Chief Operating Officer (EM-3), serves as the senior EM official providing day-to-day operational oversight, feedback, and direction to the OR Assistant Manager for Environmental Management (OR-AMEM). EM-3.2 is responsible for managing EM operational environment, safety, and health (ES&H) and quality assurance programs and ensuring implementation of integrated safety management (ISM).

EM senior managers generally understand their safety management roles and responsibilities. In addition, EM managers have taken a more active role in safety management in the past few years, and have taken some actions to improve safety across EM sites. For example, in December 2005, EM Headquarters issued three safety alerts to field elements addressing safety performance issues. Also, EM has recently been reorganized to improve both functional and line management responsibility accountability, and to reinvigorate the office of the Deputy Assistant Secretary for Safety Management and Operations.

However, there are weaknesses in some of the management systems for ensuring that roles and responsibilities are understood and implemented. The EM Functions, Responsibilities, and Authorities

Manual (FRAM), Revision 3, dated March 31, 2004, has not been updated annually as required, does not reflect the new organization, does not include a number of current DOE directives, and does not reflect the creation of the Energy, Science and Environment Central Technical Authority or Chief of Nuclear Safety. EM did not update the FRAM in 2005 (FRAMs require an annual update) and decided to delay the 2006 update until a planned reorganization became effective (which occurred on May 28, 2006). In addition, EM Headquarters position descriptions are generic and do not always accurately describe assigned ES&H-related roles and responsibilities, and individual development plans are not being maintained for Headquarters personnel. Standard operating policies and procedures are in place for a few processes, but additional implementation direction and guidelines are needed for some important oversight functions (i.e., self-assessments and assessments of field elements). Although EM senior managers demonstrated that they clearly understand their safety management roles and responsibilities, the outdated FRAM, generic position descriptions, and an incomplete set of processes/procedures is not consistent with ISM expectations and reduces the assurance that subordinate EM managers and staff are provided with clear expectations and are accountable for performance.

In February 2006, EM approved its procedure entitled *Personnel Services: Environmental Management Process for Delegation of Safety Authorities*. This policy and procedure describe the formal process by which EM delegates safety responsibilities to field element managers. An August 2004 memorandum of agreement between EM and OR delineates the specific responsibilities delegated to OR. EM maintains responsibility and authority for certain safety management responsibilities and authorities (e.g., approval of safety basis, and startup/restart). Such responsibilities and authorities are normally delegated to a field element, but EM took over those responsibilities from OR a few years ago because of concerns about site management's capabilities to perform those functions. EM-3.2 indicated that delegation of certain safety management responsibilities to site management is currently under consideration.

EM uses a variety of appropriate methods to maintain day-to-day operational awareness for the EM activities conducted in facilities previously owned by ORNL, including daily reviews of Occurrence Reporting and Processing System (ORPS) and injury reports. EM has established field element requirements for timely notification of certain events, weekly written reports of project and program activities and status, 30-60-90-day reports, and quarterly program reports (QPRs). EM-3.2 regularly (weekly and quarterly) provides safety-related information to EM senior managers that addresses pertinent ES&H information about each site, such as performance metrics, occurrence reports, and overviews of any "serious" events. Any identified cross-complex trends or issues are also communicated. EM-3 also conducts weekly conference calls with EM site managers to solicit information from each site on the status of projects, new ORPS reports, events of interest, lessons learned, significant accomplishments, and support or actions needed by EM. In response to this information, EM senior management has been actively engaged (e.g., requesting additional information about adverse trends) and has directed additional action on a number of occasions. For example, in December 2005, EM Headquarters issued three safety alerts to field elements addressing safety performance issues.

However, EM has not been fully effective in ensuring that safety goal and performance measures are used to ensure operational awareness and drive improvements. DOE Policy 450.7, *Department of Energy Environment, Safety, and Health (ES&H) Goals*, requires annual cognizant secretarial officer (CSO)-approved safety goals and site-specific ES&H performance measures and QPRs on performance improvements through the CSO to the Deputy Secretary. EM provided corporate goals for safety and direction for development of site-specific performance measures in December 2004 but has not updated the goals and has not always provided the required quarterly performance reviews. In addition, EM has not been timely in reviewing and approving performance goals submitted by field elements. For example, OR-AMEM submitted its fiscal year (FY) 2006 ES&H Performance Goals in November 2005, but the goals have not yet been approved by EM-3.

EM Headquarters performs some assessments of its field elements and sites. EM conducted a readiness review/requirements review, and an ISM review of EM activities for operations and facilities previously owned by ORNL in FY 2005, and a project review performed by the Office of Headquarters Personnel and Information Technology (EM-43) in FY 2006. EM also used an appropriate process to develop a schedule for upcoming assessments. The schedule was developed by a group of EM Headquarters safety/oversight personnel who examined the available oversight data and determined where EM should place its oversight emphasis.

However, the EM assessment program has not been effectively implemented in some cases, and the assessments have not always contributed to improvements in safety performance. A significant number of Headquarters assessments have been postponed or cancelled this year. The EM-43 project review performed this year was limited in scope (e.g., insufficient evaluation of safety performance), and there is no procedure to govern the conduct of the review. The EM report for the review did not identify findings for corrective actions. In addition, EM Headquarters did not perform any assessments of the adequacy of field element assessment programs, self-assessment programs, or issues management/corrective action programs. The deficiencies in the OR-AMEM oversight program indicate that EM has not effectively assessed and ensured the effectiveness of OR-AMEM processes and procedures. Further, EM Headquarters has not defined a minimum baseline oversight program and has not sufficiently coordinated its oversight efforts with those of OR-AMEM. EM will need to address these concerns as part of its implementation of DOE Order 226.1.

EM has not established and maintained certain required programs that are important elements of a comprehensive oversight, as discussed in the following paragraphs.

Although required by the EM Quality Assurance Program Plan and the EM FRAM, EM does not have a self-assessment program in place at Headquarters to continuously improve appropriate processes or procedures. In addition, EM does not have a corrective action process in place to track deficiencies identified through self-assessments to closure and to ensure the effectiveness of those actions. With some exceptions, corrective action plans are not generally required; discussions at the next scheduled QPR are the typical mechanism for following up on identified recommendations and issues. EM will need to address these concerns as part of its implementation of DOE Order 226.1

EM does not have an ECP in place at Headquarters. The ECP is a requirement of DOE Order 442.1A and is also required by the EM FRAM. EM is taking action to address this deficiency. Specifically, EM recently named an Employee Concerns Officer for Headquarters, has established an electronic employee concerns mailbox, and plans to establish an ECP hotline shortly. Independent Oversight's review indicates that most DOE Headquarters organizations have not established and maintained an ECP with sufficient rigor and adequate documented procedures, indicating that ECPs are a systemic issue that warrants a coordinated approach by DOE Headquarters organizations. Independent Oversight will take action to inform the heads of the Headquarters organizations of the need to establish fully compliant ECPs.

Several EM senior managers have qualified as Senior Technical Safety Manager (STSM), including the senior managers in the EM-3 organization, which has been delegated to implement most EM safety authorities. In addition, EM has a process for delegating safety authorities to Headquarters and field organizations.

While EM has made progress on STSMs, EM does not have a comprehensive technical qualification program (TQP) in place to support training and qualification of Headquarters technical personnel. Based on interviews and document reviews (e.g., position descriptions and performance elements), there are a number of technical personnel at EM Headquarters who perform duties and responsibilities that meet the requirement for inclusion in a TQP (DOE Manuals 360.1-1B and 426.1-1A). The TQP specifically applies to DOE technical employees whose duties and responsibilities require them to provide assistance, guidance, direction, oversight, or evaluation of contractor activities that could impact the safe operation of a defense nuclear facility. EM attempted several years ago to implement a Headquarters TQP, but the effort stalled (EM personnel indicate partially because of objections by the labor union). EM training standard operating procedures (PS 5.2 and PS 5.3) are outdated and do not reflect the current organization and processes. Annual self-assessments have not been conducted.

FINDING #10: The Office of Environmental Management has not implemented a comprehensive technical qualification program in accordance with DOE Manual 360.1-1B, *Federal Employee Training Manual*, and DOE Manual 426.1-1A, *Federal Technical Capabilities Manual.*

EM is working to improve the formality and rigor of its oversight program and assessments of field elements. EM is drafting a standard operating procedure on the *EM Headquarters Oversight Assessment Process*. This procedure is intended to describe a program that meets the requirements of DOE Order 226.1 for the conduct of EM Headquarters self-assessments, assessments of field elements, assessments of contractors, and development of an annual EM Headquarters Assessment Schedule. EM also recently established a program of EM integrated assessments, which use formal criterion review and approach documents that address conduct of engineering; safety basis documentation; conduct of operations; work planning and control; fire protection; criticality safety; radiological protection; and, worker safety and health. To date, one integrated assessment has been performed at the EM's programs at Idaho, which looked at the field element and contractors. Based on the first assessment, some aspects of the integrated assessments represent an improvement in the depth and rigor of EM assessments. For example, the integrated assessment was well documented, and it requires corrective action plans for findings. However, the process is not supported by a formal policy or procedure (under development), and the reviews are not comprehensive. Also, EM has not performed staffing studies to identify the number of personnel needed to sustain an effective assessment program. EM plans to fill the safety-critical functions and positions that were identified by the recent Federal technical capabilities program (FTCP) gap analysis. The Deputy Assistant Secretary for Safety Management and Operations has four excepted service-level vacant positions (which are posted for immediate hire) to provide additional technical capabilities in the areas of occupational safety, quality assurance, and nuclear safety.

D.2.2 OR Feedback and Improvement

Roles and responsibilities for ES&H and quality assurance are generally well described in the OR and AMEM management system descriptions (MSDs) and in OR Order 410, *Quality Assurance.* OR-AMEM staff are generally aware of safety management roles and responsibilities. As a result of a self-assessment finding, OR-AMEM is updating position descriptions to include the safety management roles and responsibilities described in the OR-AMEM MSD.

Many ES&H responsibilities are adequately implemented. OR-AMEM has effective lessons-learned and occurrence reporting processes in place. OR-AMEM reviews and approves annual ISM system descriptions, and technical personnel with ES&H responsibilities are assigned to appropriate functional area qualifications. OR-AMEM has implemented formal processes for communicating requirements and performance expectations (e.g., Gold Chart Metrics, cost performance index/schedule performance index, and Annual Project Milestones) to its contractors (BJC and FWENC).

OR-AMEM processes (e.g., *Monthly Project Performance Review Meeting*, and *Provisional Payment of Fee*) and Quarterly Performance Reviews demonstrate that OR-AMEM regularly monitors and reports on contractor performance. Metrics and milestones are appropriate for communicating program performance and some ES&H performance data to EM senior management. For each of the last three years, OR-AMEM has reduced BJC's award fee because of ES&H concerns, indicating that ES&H is a management priority in the contract performance evaluation.

Assessments program. OR-AMEM has an assessment program in place and conducts walkthroughs, self-assessments, and formal assessments of its contractors. Implementation plans developed for the conduct of formal reviews are generally of good technical quality. However, there are a number of deficiencies in the OR-AMEM assessments:

- Although required by the OR procedures, (i.e., ORO MSD and ORO Order 220), OR-AMEM does not have a formal self-assessment program. Although some self-assessments (e.g., annual ISM) are performed, the OR three-year plan for assessments and the OR-AMEM integrated assessment schedule does not establish or reflect a baseline self-assessment program for OR-AMEM processes and procedures.

- The OR-AMEM formal assessment planning process and schedule do not reflect some assessments required by DOE directives (i.e., DOE Manual 231.1A, twice per year quality checks of injury and illness reporting; DOE Order 420.1B, assessment of contactor fire protection systems every three years, periodic configuration management, and ten-year natural phenomena assessments; DOE Order 440.1A, workplace monitoring, industrial hygiene program assessments; DOE Order 450.1, environmental management system questions in ISM system review, operational assessments; and 10 CFR 850, annual chronic beryllium disease prevention program assessments).

- Most OR-AMEM manager and intermediate supervisors do not participate in assessments or walkthroughs each quarter as required by AMEM procedure EM-3.3, *Integrated Assessment Program*, and do not document their participation

(EM-3.3) in the issues management system (ORION3). Of 14 senior OR-AMEM personnel required to participate and document quarterly walkthroughs, only 3 met the requirement over the last year. There has been an open ORION3 finding on the lack of these reviews since September 2005.

- Project directors and team leaders do not develop and update walkthrough schedules as required by EM-3.3. There are two open ORION3 issues on the lack of such schedules.

- The technical rigor of walkthrough entries varies widely. OR-AMEM technical personnel—project directors or project managers, subject matter experts (SMEs), or FRs—have not been trained or mentored on expectations for an adequate walkthrough entry in ORION3.

- OR-AMEM procedure EM-3.3, *Integrated Assessment Program,* is in need of revision (self-identified by the OR annual ISM self-assessment).

Many of these observations were self-identified by OR-AMEM, but corrective actions have not always been timely or effective. Collectively, these problems indicate a systemic weakness in the oversight program.

FINDING #11: OR-AMEM has not adequately developed and implemented effective assessment, self-assessment, or corrective action processes as required by DOE Policy 450.4 and DOE Order 414.1C, and has not ensured that assessments required by DOE directives and/or the Code of Federal Regulations are conducted.

OR-AMEM has identified and is attempting to implement a number of oversight/assessment program initiatives. Most significantly, as a result of corrective actions from the East Tennessee Technology Park Type B fall accident, OR-AMEM decided to develop and implement ISM project teams to oversee projects. The draft ISM Project Team Oversight Plan for an OR-AMEM site (the K-25/27 decontamination and decommissioning project) is of good technical rigor and, if implemented as written, has the potential to improve OR-AMEM oversight of this project. Other OR-AMEM initiatives include the EM-3.3 procedure revision and the transition to an updated issues management tool (ORION2 to ORION3 transition). These initiatives are promising but not mature and not sufficient to address some of the weaknesses in assessment program processes and performance.

Corrective action process. OR-AMEM's corrective action process is described in EM-3.3, *Integrated Assessment Program.* Some deficiencies are adequately tracked to completion. However, the EM-3.3 procedure does not provide sufficiently specific information and direction to ensure consistent and effective development and approval of corrective action plans, tracking of corrective actions to closure, generation and retention of closure documentation, and subsequent review of the effectiveness of corrective actions. Corrective actions are not always tracked to closure, and evidence packages are not always generated or maintained. Issues (priority 1 or 2 findings) are not always forwarded to contractors as described in EM-3.3 (by formal letter signed by the contracting officer's representative); some deficiencies are forwarded by project managers via e-mail. Minimum requirements of EM-3.3 for evaluating deficiencies are not always met (i.e., requirement for a determination of the extent of the deficiency, direct or contributing causes, root cause if considered systemic, and direction to provide the corrective action plan within two weeks). The closure of DOE-identified corrective actions is often based on assertion of closure by the contractor, without a review of objective evidence of closure by DOE. There is often a considerable amount of time for closure of issues (identified by self-assessments or external assessments) specific to OR-AMEM processes and procedures (see Finding #11).

Facility Representative program. OR-AMEM has a formal FR program in place that is described by EM-3.2, *Facility Representative Program*, and the *EM Facility Representatives Group Operating Manual*. With the hiring of five new FRs in the last year (bringing the total to 18 FRs), OR-AMEM's FR staffing level conforms to the FTCP staffing methodology. FRs have strong technical and operational backgrounds. In addition, most FRs were observed to be present in their assigned facilities and were observing work and asking relevant questions. For example, during this Independent Oversight inspection, FRs were actively engaged in day-to-day oversight of the contractor and actively participated in shift turnover meetings, pre-job briefs, post-job critiques, and event investigation critiques. As a result of FR and DOE SME oversight, the contractor strengthened electrical safety controls to better meet the guidelines in National Fire Protection Association 70E.

However, some deficiencies in the FR program processes and performance have precluded the identification and resolution of issues in environmental management program activities for operations and facilities previously owned by ORNL, such as those discussed in Appendix C. Program documentation for the OR-AMEM FR program is outdated and is not always followed. Although previously identified as a finding during a June 2005 FR program assessment (also an open ORION3 finding since September 2005), procedure EM 3.2, *Facility Representative Program* is in need of revision in that FR re-qualification is required every three years. The FR team leader has not published a formal walkthrough schedule as required by EM 3.3; this was also identified as a finding of the ISM system assessment in 2005, and there has been an open ORION3 action on the finding since September 2005. FRs do not routinely or consistently document the results of walkthroughs in the ORION3 system in accordance with EM-3.3 and FR-OM-04, *Facility Walkthroughs;* the failure to properly document operational awareness data makes trend analysis difficult, and OR-AMEM becomes less effective in prioritizing oversight activities based on risks and operational experience. FRs are required to perform walkthroughs every 12 months with each of the 6 listed SMEs; however, none of the FRs at ORNL has met this requirement, reportedly because SMEs were not available. Sections 3.2.2 and 4.4.14 of EM 3.2 suggest that OR-AMEM should have a duty FR program in place similar to the duty FR programs in place at many DOE sites, but such a program is not fully described, and OR-AMEM does not use a duty FR rotation.

Some FR issues and observations are not effectively communicated across OR-AMEM or to senior management. There is no periodic (weekly or monthly) routine/formal reporting of FR activities or issues across the OR-AMEM organization (SMEs, project managers, project directors, or senior management).

OR-AMEM FR training and qualifications do not meet the requirements of FR-OM-06, *Training and Qualification Program*, and several FRs are not current in qualifications. FR qualification status is not routinely communicated to appropriate OR-AMEM managers. A qualification status report was last updated about a year ago for the OR-AMEM FR program self-assessment. Independent Oversight's review of FR training records identified that two FRs have exceeded their re-qualification dates and that extension letters were not routed or approved by the OR-AMEM (qualifications lapsed on February 2005 and November 2005, respectively). In addition, an FR has been assigned to the "Isotope Circle" for over two years without being issued a facility-specific qualification standard or card, and two FRs have been assigned to K-25/27 for 16 to 24 months without being issued a facility-specific qualification card.

National quarterly performance indicators (IAW DOE-STD-1063-2006, *Facility Representatives*) are forwarded to the FR Program Manager. There is no technical basis for the numbers that are forwarded. OR-AMEM has a procedure (FR-OM-09, *Performance Indicators*) that would meet the requirement, but that procedure is not implemented as written. These performance indicators are used to measure the status of FR programs across the complex, are reported to the Secretarial level within the Department, and are routinely sent (by agreement) to the Defense Nuclear Facilities Safety Board (DNFSB).

Many of these observations were self-identified by OR-AMEM. However, the corrective actions have not always been timely or effective. Collectively, these problems indicate a systemic weakness in the oversight program.

FINDING #12: The OR-AMEM Facility Representative program does not meet the DOE and OR requirements contained in DOE Standard 1063-2006, AMEM procedure EM-3.2, the EM Facility Representatives Group Operating Manual, and AMEM procedure EM-3.3 in the areas of surveillances, documenting findings, issues management, training and qualification, program documentation, scheduling, and documentation/reporting of activities.

OR employee concerns program. The OR implementing directives for the ECP conform to DOE Order 442.1A, *DOE Employee Concerns Program*. The concern log and annual reports that were reviewed were satisfactory. However, the OR ECP does not meet the DOE Order 442.1A requirement for annual management assessment of the ECP; the most recent assessment was dated October 2000. Additionally, OR has not met the OR order requirement for review of contractor ECPs; the most recent assessment was dated October 2000. OR had previously self-identified that required assessments were not performed and has placed assessments of the ECP on the OR three-year schedule.

D.2.3 BJC Feedback and Improvement Systems

Assessments. BJC has established the basic framework of a comprehensive safety self-assessment program, and conducts a variety of independent and management assessment and inspection activities. The integrated assessment program is composed of safety inspections/walkthroughs, management self-assessments, and independent team assessments of project facility, functional areas, and organizations. The requirements and processes for this assessment program are described in procedures for independent and management assessments, in a recently revised (on April 17, 2006) Integrated Assessment and Oversight Program Description and in the ISM System Description. The integrated assessment program has been undergoing significant changes over the past year, including revision of the primary independent assessment approach. The integrated assessment includes management self-assessments that are planned and conducted by line managers and project ES&H staff and are intended to assess the performance and the effectiveness of management systems within the manager's area of responsibility, including assessment of self-directed and subcontracted work activities. Independent assessments include readiness reviews, corrective action effectiveness reviews, extent-of-condition reviews, event reviews, documented safety analysis implementation validation reviews, and senior management reviews.

Senior management reviews are replacing multi-disciplined evaluations of individual projects, organizations, and safety programs that were performed until April 2005 by a team called the Closure Project Evaluation Board. These teams conducted several scheduled assessments annually and typically addressed organization and administration, including management systems and a number of specific functional areas, such as facility and industrial safety, maintenance, engineering, ISM system, and quality. Teams consisted of managers and SMEs from support organizations or other BJC sites or projects. Annually, each manager of projects and functional managers (e.g., quality assurance; ES&H; and Engineering, Procurement, and Construction) compile an assessment schedule, and the BJC Assessment Program Manager coordinates and publishes an independent assessment schedule.

ES&H representatives in each project conduct weekly facility condition inspections using a standardized checklist. The BJC industrial safety SME compiles the results of these inspections for all projects. SMEs in approximately 40 safety topical areas are tasked by procedure with, among other awareness and support responsibilities, assessing the implementation of requirements by participating in Closure Project Evaluation Board and other management-directed assessments.

The independent assessment procedure and the assessment program description also identify SME assessments as part of the program. SMEs and sample documents indicate that some SMEs perform a variety of activities to maintain awareness of conditions and the implementation of their assigned subject areas. Mechanisms in use include periodic meetings with project-level representatives, reviews of issues tracking system data, and compilation and analysis of various performance metrics.

At the end of calendar year (CY) 2004 and CY 2005, the BJC President and General Manager required selected SMEs to make formal presentations to senior management on the status of their subject matter areas. Recently, the BJC President and General Manager has also directed that each manager of projects and functional manager compile assessment data in a standardized matrix describing details of each assessment activity, such as focus area, frequency, and work control or management system elements to be evaluated, together with an analysis of the results and discussion of the effectiveness of corrective actions. This data, presented in a quarterly meeting of senior management peers, can be a very effective tool for improving the value, focus, and quality of assessment activities and for holding managers accountable for assessing programs and performance. At the time of this Independent Oversight inspection, this process had only been piloted for one project.

Although some assessment activities have been effective in evaluating programs and performance and driving improvement, some assessment processes have not been sufficiently defined or are not sufficiently rigorous to drive improvement. In addition, in some cases assessments have not been performed with sufficient rigor to effectively monitor and evaluate safety performance. The breadth and depth of self-assessments varies in quality. Many of the assessments that have been performed are narrowly focused on a single document, criterion, or part of an activity, but few assessments, other than those previously conducted by the Closure Project Evaluation Board, have addressed management systems or cross-cutting functional areas that evaluate performance across an organization, and none addressed institutional level performance. Independent team assessments by the Closure Project Evaluation Board ended early in 2005; none of the senior management reviews have been performed, but are scheduled for later this year. The scope, frequency, and composition of these reviews have yet to be established.

The expectations for safety SMEs to plan and conduct formal assessments of their topical areas (other than participating on the now canceled Closure Project Evaluation Board assessments) are not adequately specified in BJC procedures and program descriptions. In practice, safety SMEs have performed very few formal assessments of their programs and implementation. Further, the Closure Project Evaluation Board assessments were infrequent snapshots of individual projects and did not result in an overall assessment of BJC performance in any topical area. Although procedures require that management assessments be reviewed by managers, this review and feedback is not documented, and only the person responsible for performing the assessment must sign the assessment report. In some cases, multiple subject matter areas have been assigned to one individual (as many as four topical areas), and in some cases senior managers, who have many competing priorities for their time and attention, have been assigned responsibilities as SMEs. The recently established senior management requirements for annual presentations on the status of subject matter areas and the quarterly management assessment presentations by managers of projects and functional managers have not been institutionalized in site procedures or program descriptions.

While Closure Project Evaluation Board assessments provided information about project performance in various safety topical areas, for the reports reviewed by the Independent Oversight team, the evaluations lacked consistently sufficient depth and rigor. Although the reports reflected in-depth and meaningful evaluations in some areas, others were shallow and identified no observations (or findings or insubstantial findings focused on individual compliance items) rather than addressing programmatic adequacy or implementation weaknesses. Work control performance was consistently graded as a "green," although subsequent events and this Independent Oversight inspection identified numerous weaknesses in implementation of BJC work control processes. For example, the March 2005 Closure Project Evaluation Board assessment of the Melton Valley Closure Project, which included MSRE, identified no deficiencies in work control and did not appear to include any samples from the MSRE project.

In addition, numerous other prior independent and project-level management self-assessments of work control program implementation at BJC were not effective in identifying the program and performance deficiencies reflected in the recent K-25 accident or identified during this Independent Oversight inspection. Multiple independent assessments of work control were conducted in 2004, and both independent and project management assessments have been conducted as part of corrective actions to the judgments of need from the recent K-25 accident. However, these assessments focused on review of work packages rather than on overall implementation of work control procedure requirements. The independent assessments did not include any evaluation of MSRE work packages, and the Melton Valley Closure Project management assessment only identified one active work package at MSRE, which was an engineering modification to computer software that involved no safety hazards. None of these assessments, including the 2005 assessment, identified or acknowledged the MSRE exception to compliance with BJC-FS-1001.

Various informal assessments (documented by email) have been performed over the past several years to establish the equivalence of the MSRE work control procedure (OR-502) to the institutional BJC procedure (BJC-FS-1001), but failed to identify the weaknesses discussed in Appendix C of this report. The latest such informal assessment conducted by a manager from the General Maintenance organization determined that the MSRE process was equivalent to the existing revision of the institutional procedure by reviewing various emails and the two procedures and citing the "isolated nature of the MSRE organization." This email also identified gaps between OR-502 Revision 11 and the new Revision 8 to FS-1001 due to be implemented by the remainder of BJC on July 17, 2006. However, there has been no formal management approval of the acceptability of one organization using a separate work control process or formal configuration controls put in place to establish and maintain the equivalence of the outlier process to the institutional process as changes are made. There is no formal open action to evaluate OR-502 or revise it to include the improvements being input to BJC- FS-1001 as a result of corrective actions resulting from the Type B investigation or to formally establish its equivalence with FS-1001.

FINDING #13: BJC's independent and management assessment programs have not been fully defined or effectively implemented to provide consistent assurance that safety processes are adequate and are implemented as required by DOE Policy 450.4, DOE Order 414.1C, and 10 CFR 830, Subpart A, Section 122.

Issues management. BJC has established and implemented processes to manage safety issues, including the documentation, investigation, reporting, and management of corrective actions for incidents and events. Safety deficiencies are being evaluated and corrected and formally tracked to closure. BJC has established formal procedures and processes for managing issues, including ORPS reportable events, causal analysis, and Price-Anderson Amendments Act screening and reporting. BJC has established a robust system for documenting issues, corrective action plans, and closure, and has implemented a database called the Issues and Corrective Action Tracking System (ICATS) that supports effective management of issues and facilitates data analysis. BJC has established an effective Issues/Corrective Action Review Board that evaluates the adequacy of documented issues (observations as well as findings) and selected corrective action plans and provides appropriate feedback to issue initiators and owners. The project quality engineer conducts and documents an effectiveness determination for all issues at closure.

Although BJC has established and implemented generally effective processes for managing safety issues, and deficiencies are being evaluated and corrected, program effectiveness is hindered by weaknesses in processes and procedures and inadequacies in implementation.

Several weaknesses were identified in the documentation of issues management program elements. The various forms for documenting issues, action plans, and closure verification do not have fields for documenting the results of important actions required by the procedure, such as extent of condition, need for lessons learned, and reviews for similar or previously identified issues.

The BJC quarterly occurrence reporting performance analyses (i.e., trend analysis for recurring events) required by DOE Manual 231.1 is not adequately described in procedures and may not capture all incidents required by the DOE manual. Further, potential adverse trends identified in the quarterly reports have not been fully evaluated to determine whether corrective or preventive actions are needed. The only formal instruction for conducting the quarterly occurrence reporting event analysis is a single sentence in the BJC occurrence reporting procedure to conduct an analysis. The performance analyses are only performed on ORPS reportable events, an additional set of non-ORPS events required to be reported to OR and EM in accordance with special directions from these DOE offices, and non-reportable, but Occupational Safety and Health (OSHA) recordable Computerized Accident/Incident Reporting System (CAIRS) data. Other events and incidents are not being captured and included in these analyses as directed by DOE Manual 231.1. The special OR/EM reporting requirements are governed by a General Managers Directive that is not addressed in the BJC event notification and critiques procedure; this directive requires completion of an "incident fact sheet" for these incidents, but the need to conduct critiques or further investigation of these events is not addressed. The performance analysis reports that are provided to the BJC President and General Manager, who forwards them under his signature to OR, have consistently identified "potential recurring events." However, there is no indication of a final determination of whether these are potential or actual recurring events or of any further evaluation or actions to be taken to keep these negative trends/precursors from continuing or performance from degrading. These negative trends/potential recurring events have not been documented as issues in ICATS.

The corrective action for Judgment of Need 1 of the K-25 accident Type B investigation contains a statement that, in addition to managers of projects conducting management assessments of work packages not previously reviewed by the sitewide extent-of-condition review, "inactive" work packages are to be reviewed for adequacy with respect to the established lines of inquiry before July 17, 2006, the effective date of Rev 8 to BJC-FS-1001. The term "inactive" is undefined, and who is to perform these reviews is not specified. The corrective actions for this judgment of need have been closed in ICATS for the Melton Valley closure project and surveillance and maintenance, based on assessments of "active" work packages. However, no "inactive" work packages have been reviewed by either MSRE or Surveillance and Maintenance, and no one in either organization is aware of any plans to conduct such a review.

Monthly trend analysis reports of ICATS data and of ES&H inspection results contain no substantive analysis of what the data means or determination of any needed actions to correct adverse trends or prevent deteriorating performance. No BJC institutional procedures describe the process or expectations for conducting trend analysis.

Institutional and organizational oversight and monitoring of issues management program implementation has been insufficient. No cross-cutting assessments of issues management program adequacy and performance have been conducted in FY 2004, FY 2005, or FY 2006.

FINDING #14: BJC issues management programs have not been consistently effective in ensuring that safety deficiencies are rigorously analyzed and that effective corrective actions are implemented to prevent recurrence, as required by DOE Policy 450.4, DOE Order 414.1C, and 10 CFR 830, Subpart A, Section 122.

Injury and illness investigation and prevention. BJC's record for OSHA recordable injuries and illnesses and lost workday statistics are higher than the average for EM sites and the DOE complex. Reporting and management requirements for BJC employee occupational injury and illnesses are governed by an accident/incident reporting procedure. This procedure specifies prompt reporting of any work-related injuries or illnesses, no matter how minor; documentation of an investigation on an accident/incident report; and completion of a causal analysis checklist by the ES&H representative and the worker's supervisor. Specific direction and guidance are provided for conducting thorough investigations, including interviewing victims and witnesses and preserving and photographing accident scenes. The BJC Manager of Safety then performs classification, recording, and reporting in accordance with CAIRS and OSHA reporting requirements. The accident/incident report provides the basic information on DOE Form 5484.3 required for CAIRS reporting, including event details, analysis of causes, and actions to prevent recurrence.

Senior management has demonstrated their engagement in addressing injuries and illnesses by requiring managers to present details of recordable injuries in monthly staff meetings. Injuries and illnesses and related safety statistics are also discussed at senior management and organizational staff meetings. In response to repetitive lacerations, punctures, and pinch injuries to hands, BJC developed and implemented an extensive hand injury prevention program in September 2005 (expanded in April 2006) that includes requirements for carrying and using gloves, restrictions on types of allowed cutting tools, research and purchase of cut-resistant and specialty gloves, reviews of work tasks involving cutting tools, and discussion of cutting safety in safety meetings.

A sample of occupational injury and illness case files showed that investigations documented on accident/incident reports are generally adequate. However, a number of weaknesses limit the effectiveness of this program, especially with regard to investigation and oversight of subcontractor injuries and illnesses. Many injuries and illnesses reported by BJC involve subcontractors, but the process and requirements for managing subcontractor injuries and illnesses are not addressed in the site procedure. BJC does not require subcontractors to complete the accident/incident report, and records for first-aid cases (i.e., injuries not meeting the criteria for reporting to CAIRS or as OSHA recordable) are limited to the medical report from the clinic, with no investigation information. A number of potentially serious work control-related exposures had no subcontractor investigation information in the files or follow-up/oversight by BJC. Examples of this lack of responsiveness and documentation were personnel responses to a propane cylinder leak and exposure inside a building, mastic organic vapor exposures, and potential asbestos exposures. In addition, for BJC employee incidents, the corrective/preventive actions listed on the accident/incident report are not formally tracked to closure, and results of actions directing further investigation (e.g., sampling, or evaluating hazards or personal protective equipment) are not documented in the files. Cases that are treated with first aid, while not reportable by OSHA regulations or DOE order, can often still be serious, near misses, or precursors to more serious injuries or exposures, occurring due to weaknesses in ISM work control elements. Formal investigations of these events and determinations of whether corrective or preventive actions are warranted are appropriate for reducing the likelihood of future injuries.

No formal assessments have been conducted of injury and illness investigation and reporting program adequacy and implementation assessments for either subcontractors or BJC employees.

Lessons learned. BJC has established and implemented a robust lessons-learned program, with a user-friendly database of information on the intranet, sharing of lessons with the DOE complex, and generally well documented specific corrective actions and process improvements to continuously strengthen the implementation and effectiveness of this program. Many sources of lessons learned are screened for applicability to BJC activities at the institutional level, including commercial product recalls. Lessons distributed by the institutional lessons learned manager often include required actions, feedback of results, and/or confirmation of actions taken. Organizations conduct appropriate evaluations or inspections, with good documentation and oversight by organizational lessons-learned coordinators. A user-friendly, searchable intranet database of lessons learned with links to other sites and tools is available for use by work planners, supervisors, and training personnel. BJC has posted approximately 100 lessons learned to the DOE listserver database in the last two years, including 15 from the Melton Valley closure project.

The institutional procedure needs to more accurately describe the process for managing lessons learned. A procedure upgrade has been postponed pending the issue of the new DOE order for lessons learned. Although the Closure Project Evaluation Board assessment program developed standard lines of inquiry for evaluating lessons-learned programs, this topic has not been included in recent project assessments, and the program manager has performed no assessments of program adequacy or implementation.

Employee concerns. Safety concerns from BJC workers are addressed through two formal processes; the I Care/We Care program managed by a committee of safety, quality, and worker representatives, and the formal ECP administered by the Human Resources organization, which addresses intimidation, harassment, and equal opportunity issues as well as safety concerns. The BJC intranet website for employee concerns identifies informal and formal processes and includes the hotline phone number for BJC and DOE concerns programs.

Although not extensively used by ORNL employees (e.g., only seven concerns in CY 2005 and one to date in 2006), the I Care/We Care program provides an easy and effective means for reporting and resolving safety concerns. Governed by an Occupational Safety procedure, individuals can report safety concerns via phone, email, or hard copy. Anonymous concerns are documented, evaluated, and resolved in the same manner as other concerns. A committee evaluates the concerns and identifies an answer or a course of action for further evaluation or resolution, with member volunteers directing action and monitoring resolution. Disposition of issues is communicated to the concerned individuals and posted on the BJC intranet website. If the individual who reported the concern is known, his/her concurrence with the disposition is sought. Committee actions and resolutions have been timely and generally responsive.

However, additional rigor is needed in ensuring that actions are fully implemented and documented before closure. Several concerns were closed before actions were completed or lacked sufficient documentation or evidence that actions were taken. For example, a complaint about unknown agents causing eye and respiratory irritation was appropriately answered with an action to conduct air sampling, but the concern was closed without any indication that the sampling was performed. In addition, agreement on closure was obtained from the concerned individual's co-workers, because the individual was on vacation. In another case, a question about the useful life of hardhats and suspension systems was inadequately addressed in that the actions taken did not directly communicate BJC policy or provide specific criteria to workers.

A BJC policy document outlines the general program and policies related to the ECP administered by Human Resources, but does not describe requirements and processes for implementing the policy. The ECP is communicated in new employee and refresher training and on posters at official bulletin boards in numerous facilities throughout the site. Few concerns identified through this program directly involve safety issues, and none of the safety concerns involve ORNL organizations within BJC. Files are generally well organized, with folders for each concern, chronological logs of calls and actions, and a database containing information and status for each concern. Investigation report information reflects an appropriate and rigorous approach to resolution of the concerns. However, in several cases, records indicated that cases had been formally closed, but documentation in the file reflected that meetings with concerned individuals and resolution actions were ongoing or had been completed months after the case was designated as closed.

Other feedback and improvement processes. BJC management is exploring a variety of means to improve safety performance, including several actions to address judgments of need from the recent K-25 accident investigation. Six one-day workshops with supervisors and managers on human performance initiatives were presented by the DOE Headquarters Office of Environment, Safety, and Health. Elements derived from these workshops are being included in work control process training being conducted for all BJC employees. The Bechtel corporate ES&H staff is facilitating 12-hour work control process workshops for various project workgroups, specifically addressing alignment of expectations regarding 48 key elements of the BJC-FS-1001 work control process, vertically from the project manager down to the worker performing the activity. In addition, actions are being taken to encourage, strengthen, and expand a behavior-based safety observation program that has been initiated at several projects over the past year. Feedback concerning safety issues is provided to workers during monthly "safety pause" meetings, with basic agendas and presentation materials provided by the ES&H organization. Monthly Zero Accident Council meetings of mangers and worker representatives address emerging safety issues, the status of I Care/ We Care actions, presentations of topical preventive safety messages, and discussion of recent occupational injuries and illnesses.

BJC activity-level feedback and improvement processes. Various feedback mechanisms are incorporated into the BJC work control processes or are implemented primarily by facility managers, supervisors, and workers at the activity level. The specific processes reviewed by Independent Oversight included: shift turnover meetings, pre-job briefs, post-job briefs, event critiques, plan-of-the-day meetings, and application of lessons learned. The work control process contains a requirement to solicit feedback through the Attendance Sheet and Pre-Planning and Pre/Post Job Brief Guide as part of the work package closeout process. In addition, the safety task analysis risk reduction talk (STARRT) card contains a section to be used to record post-job feedback and lessons-learned information. Further, BJC has a systems engineer program that performs a number of activity-level feedback actions.

In some cases, activity-level feedback processes have been used effectively at MSRE, Tank W-1A, and other surveillance and maintenance activities. Lessons learned from various sources were incorporated into pre-job briefings and daily plan-of-the-day meetings. For example, at a recent plan-of-the-day meeting, a groundskeeper question concerning a contamination posting for a soil contamination area prompted BJC management to consider a new policy for work scope definitions.

However, a review of Category A, B and C work packages (i.e., higher-complexity or higher-hazard work) showed that MSRE does not always use the established processes, particularly for work packages that are used repetitively, such as waste management activities. In addition, for other work (Category D and programmed maintenance work), feedback and improvement is mostly conducted on an informal basis because of the lack of formal work packages and inconsistent use of the STARTT card process. In addition, some processes (e.g., STARRT card) have only recently been implemented.

As discussed in Appendix E, BJC has established adequate requirements and procedures for the system engineer program. However, there are weaknesses in the rigor and thoroughness of system engineer walkdowns and assessments and in the implementation of BJC training and qualification requirements for system engineers. BJC makes significant effort to apply lessons learned; however, the process for capturing and utilizing lessons from its own previous similar work is inconsistent.

D.2.4 FWENC/TWPC Feedback and Improvement Systems

Assessments. FWENC has established formal systems for conducting assessments and inspections that include safety programs and performance. Quarterly assessments are identified and include line and support management assessments, independent assessments performed by quality assurance personnel, and, in 2004 and 2005, external corporate independent environment, safety, and quality audits. FWENC assessments (also often called surveillances) were well planned, with detailed checklists of requirements that focus lines of inquiry and provide for documenting compliance and commentary. In general, these assessments have been effective in establishing the level of compliance with requirements for the areas evaluated, including environmental compliance and waste management. FWENC procedures also require weekly safety and health inspections by Operations personnel and monthly inspections by the Health and Safety Officer, with participation by line management once per quarter. Inspections are conducted using a formal checklist and have been effective in identifying and initiating correction of deficient conditions.

Although routine assessment and inspection activities are performed at the TWPC, assessment program effectiveness is limited by process and performance weaknesses. Functional managers are required by procedure to schedule and perform management assessments, but few line managers perform formal assessments. Most assessments are conducted by the quality assurance staff, including surveillances of functional areas, such as conduct of operations and industrial safety. Some administrative and support operations, such as training, maintenance, and records management, are scheduled, but formal assessments are not planned or performed by operations and senior management. Procedures do not adequately identify what the population of functional managers is, and no expectation for frequency is provided. No mechanisms are established to hold functional managers accountable for performing assessments (see Finding #15).

In addition, most FWENC assessments are structured as quality audits focusing on compliance, with insufficient evaluation of overall process or program adequacy or effectiveness. Records reviews are much more prevalent than observation of work activities and field conditions. Many assessments/surveillances do not provide sufficient details of the inspection sample or other basis for conclusions that requirements were or were not met. In a number of cases, failure to meet the specified requirements were inappropriately identified as observations rather than as findings, which would require documentation in the issues management process on a non-conformance report (NCR) or corrective action report (CAR) (see Finding #15).

Issues management/corrective action. FWENC has established formal corrective action, non-conformance reporting, and issue tracking procedures. Safety issues are documented, and corrective actions are identified and tracked to closure. Compliance, programmatic, and performance issues from assessment activities are documented on CARs, and hardware deficiencies are documented on NCRs. Significance determinations and action plans are documented on the associated forms that also provide fields for supervisory documentation of closure, including the evidence used for verification. Operational events and injuries are reported using an Incident/Near Miss Report form and formally investigated with documentation on an Incident Investigation Report form. This form includes fields for documenting immediate and basic causes and corrective actions, with target and actual completion dates. The status of these issues is maintained in a collective database that identifies issue owners and initiation date and projected and actual closure dates.

Although processes are in place and are being used to document and address safety issues, a number of weaknesses were identified in these processes and in implementation.

- **Project procedures inadequately define process steps and documentation to ensure effective and consistent issues management.** For example, the collective tracking database, called the Issues Tracking Matrix, only tracks the status of issues, not the individual actions from the individual reporting (for CARs and NCRs) or investigation forms (for incident reports). The requirements for management of deficiencies identified during ES&H inspections are not adequately or consistently detailed in project procedures. The procedure describes the use of the work order system for the Health and Safety Officer to document and track "substandard condition or work practices," but also describes the use of the project issues corrective action and tracking system for "issues requiring formal corrective actions." The ES&H checklist specifies determination of whether or not the deficiency is a finding, implying the use of CARs to document the deficiency, but the procedure does not address the designation of deficiencies as findings, and CARs are not being used to manage these deficiencies. The procedure states that the checklist and a list of action items are to be completed but does not indicate where the action items are to be documented, and the checklist does not provide for establishing corrective actions. Until March 2006 there was no tracking mechanism for corrective actions for deficiencies identified on the walkdown checklist; they are now tracked on a spreadsheet by the Health and Safety Officer, but the process and tool are not described in any procedure or instruction.

The forms for documenting the disposition of NCRs and CARs contain no fields for documenting causes or extent of condition. Associated procedures identify that cause determinations and recurrence controls are required for issues deemed significant, but do not provide guidance or direction on determining the extent of condition or addressing apparent causes and recurrence controls for all issues. Issues that are identified during an assessment are not required to be included in the issues management process by assessment and surveillance procedures if they can be "fixed" during the assessment period. This process does provide for addressing causes, extent of condition, or recurrence controls; bypasses the formality of documenting the actions taken (other than an annotation in the assessment report that the deficiency was corrected during the assessment); and excludes data from subsequent trend analysis. The Incident Investigation Report form is also used as the documentation and tracking system for closure of specified actions, but lacks the fields for verification of closure and closure evidence provided on CARs and NCRs. Further, management approvals are not required at the time that corrective action plans are determined by the investigators, but are only documented when all work is completed.

- **In some cases, implementation and documentation deficiencies reflect inconsistent and inappropriate management of issues.** A number of deficiencies were noted in the management of issues from incident reports. In several cases, root causes were not accurately identified on the investigation reports, so recurrence controls were inadequate. In one case, only part of the incident was addressed in the analysis and associated corrective actions. In another case, the incident investigation report was not signed off by the investigators identifying the action plan or approved by management until almost four months after the first corrective action was completed and two months after the last action was completed. Tracking of corrective actions is not always performed using the Incident Investigation Report form as specified. In one case, the investigation report form was not signed off but was annotated to refer to an attached investigation report, so there were no specified owners for actions or target completion dates. The seven actions in this case, specified in the attached investigation report, were signed off in April of 2006 as closed on an associated Work Suspension Order, but with a note that only part of one action was complete. The issue was then inappropriately identified as closed on the project Issues Tracking Matrix, and the remaining part of the one corrective action was not still completed at the time of this Independent Oversight inspection. Other examples of lack of rigor in implementation included marking a CAR as "significant" (probably in error, based on the issue) without performing the required causal and extent-of-condition analyses and leaving the verification and closure block on a CAR blank. Weaknesses in the tracking of actions developed as part of internal lessons-learned determinations are discussed in the following section of this report on lessons learned.

- Procedures require that a trend analysis of issues be done annually, but at the close of this Independent Oversight inspection, the analysis for CY 2005 had not yet been approved by management and issued.

FINDING #15: FWENC has not established and implemented processes that consistently assess performance and manage issues in an effective manner at TWPC to ensure continuous improvement, as required by DOE Policy 450.4 and 10 CFR 830, Subpart A, Section 122.

Lessons learned. FWENC quality assurance personnel review externally generated lessons-learned sources and distribute lessons deemed applicable to line and support managers. Internal lessons learned are developed, shared with workers at pre-job meetings, and incorporated into subsequent work procedures. Although a formal procedure describes the basic requirements to screen, evaluate, disseminate/communicate, and apply lessons learned, it does not sufficiently detail process steps and does not address documenting designated actions or actions taken, including feedback to the lessons-learned coordinator. A new work instruction was issued during this inspection to describe a more rigorous process for lessons learned. Although several means have been used to record lessons-learned distribution in the past, records inadequately distinguish between internal and external lessons, no numbering system is employed, and there is no documentation of actions suggested, directed, or taken. FWENC has not forwarded any internally generated lessons learned to the DOE complex lessons-learned program, but distribution to the DOE lessons-learned server is addressed in the new work instruction.

The lack of rigor and detail in the process for managing lessons learned is reflected the results of an otherwise beneficial and effective post-job incident review meeting conducted in May 2006. Specific lessons learned and several appropriate recommended actions were well developed and documented by operations personnel in a memorandum distributed to various managers. However, the proposed actions were never subjected to any formal management review and approval, and neither the issue nor the proposed actions were placed in any more formal action tracking process. Discussions with project personnel indicated that not all of these proposed actions have been implemented, and there is no driver to ensure completion.

Other continuous improvement processes. A formal procedure defines the requirements for the Operations Manager or designee to conduct monthly project safety committee meetings and to conduct daily safety briefings before shift activities begin. Agendas are developed for committee meetings, and minutes are maintained. Meeting minutes indicate that a wide range of safety issues are raised and monitored, with open issues tracked to closure. Typically, 10 to 15 employees attend committee meetings.

FWENC routinely uses a formal work suspension and restart process to address unexpected hazards or conditions or operational incidents or events. A project procedure describes the process to initiate a work suspension order and to conduct and document appropriate evaluations, determination of needed actions, and the approval of the Project Manager and the Health and Safety Officer to restart the work activity. This process has been used on seven occasions in CY 2005 and CY 2006 and reflects an appropriate and structured method for ensuring that work is safely managed when unforeseen conditions arise.

TWPC activity-level feedback and improvement processes. Various feedback mechanisms are incorporated into the TWPC work control processes or are implemented primarily by facility managers, supervisors, and workers at the activity level. The specific processes reviewed by Independent Oversight included shift turnover meetings, pre-job briefs, post-job briefs, event critiques, and assessments by the Environmental Programs and Permitting Group. These mechanisms are generally effectively implemented for waste handling activities at TWPC by FWENC contractors.

Pre-job briefs and shift turnover meetings include pertinent lessons learned from both outside the facility and previous evolutions. Post-job critiques are frequent, thorough, and well received by workers. For example, the post-job critiques were performed in accordance with an established procedure and covered procedures used for the job, activity hazards analyses, training and qualification topics, tools, radiation work permits, waste disposal requirements, and documentation. Event investigation critiques were generally effective in determining facts related to events, although some distractions did occur. Operators and radiological control technicians involved with separate events during the inspection participated in the event critiques, and the meetings resulted in factual results. During one of the critiques, conclusions or defenses were inappropriately discussed a few times before the fact gathering was complete; at times, these discussions detracted from the fact-finding. Currently, TWPC procedures only require an event investigation form to be filled out and do not specifically address conduct of critiques, so personnel participating in the critique process did not have the benefit of established guidance.

The Environmental Programs and Permitting Group effectively performed environmental assessments to ensure that their activities are performed in accordance with requirements. These assessments include a set of referenced requirements based on the Resource Conservation and Recovery Act permit and other environmental regulations, and have identified items that need to be corrected and included follow-up actions to ensure that concerns had been corrected. Similarly, corrective action reports addressing deficiencies in forklift use and conduct of operations appropriately addressed corrective actions needed to ensure that problems were appropriately addressed and that problems did not recur.

D.2.5 Status of Implementation of DOE Order 226.1

DOE issued DOE Policy 226.1, *Department of Energy Oversight Policy*, in June 2005 to establish a single policy that addressed an integrated and coordinated approach to DOE oversight and contractor assurance systems (referred to as "integrated management") in the areas of ES&H, security, cyber security, emergency management, and business operations. DOE Order 226.1, *Implementation of Department of Energy Oversight Policy*, which provides specific requirements for implementing the new policy, was issued in September 2005. The order requires DOE program offices, field elements, and sites to comply with the new policy and order by September 15, 2006.

The intent of the new policy and order is to build on existing DOE oversight and contractor assurance processes while enhancing the strategic approach to the design and coordination of oversight and assurance activities by the DOE program office, DOE field elements, and site contractors. The new policy and order impose new or more stringent requirements in certain areas where DOE and contractor feedback and improvement programs have historically not been consistently effective, such as issues management. The new order also emphasizes a strategic and documented approach to developing and implementing a comprehensive, rigorous, and risk-based program of contractor self-assessments and management assessments, complemented by a coordinated and risk-based program of DOE line management oversight that includes a baseline assessment program that considers the effectiveness of the contractor assurance system, and a judicious balance of baseline assessments, operational awareness activities, targeted reviews for areas of weakness, and self-assessments of DOE line management performance and activities. The DOE line management oversight role is to be performed primarily by the DOE field elements, but with sufficient involvement of the DOE program offices and the National Nuclear Security Administration and Energy, Science and Environment central technical authorities (for higher-hazard nuclear facilities).

Independent Oversight selected implementation of DOE Order 226.1 as a focus area because the DOE requirements in this area are relatively new and require significant coordination among the DOE line management (program offices and field elements) and contractors to ensure that implementation of the new requirements is well coordinated and effective. To assess this area, Independent Oversight interviewed EM/OR and BJC personnel and reviewed various documents and procedures, with particular emphasis on implementation guidance issued by EM and the resulting efforts by OR and BJC.

EM/OR. As part of the implementation plan for DNFSB 2004-1, EM reports that an EM staff member in each of five Deputy Assistant Secretary (DAS) organizations are preparing a gap analysis for EM oversight activities with respect to DOE Order 226.1. EM provided a copy of the gap analysis and implementation plan for the ES&H DAS, EM-3.2. Most gaps have been identified, and identified implementation plan deliverables are expected to be complete by September 15, 2006. A large number of ES&H gaps are expected to be closed by the issuance of an EM-3.2 process description document.

Also as part of the implementation plan for DNFSB 2004-1, EM has directed all EM elements to implement a number of actions (e.g., update of OR Quality Assurance Program Plan to meet DOE Order 414.1C requirements) that are related to the implementation of DOE Policy and Order 226.1. In May 2006, the EM Chief Operating Officer provided direction to all EM elements, including field offices and Headquarters, to perform a formal gap analysis for DOE Order 226.1 requirements and to produce an implementation plan to achieve compliance with the new order by September 15, 2006. The implementation plan was to identify the responsible manager, deliverable, expected completion date, and any outside assistance required necessary meet the milestone date. The memorandum indicated that sites that have already completed a gap analysis with a comparably rigorous approach were not required to repeat the process using the new EM direction and guidance.

The memorandum also indicated that the gap analysis and implementation plans were to be submitted by June 1, 2006. However, OR interpreted the EM memorandum to require contractors' gap analyses and implementation plans to be delivered to EM by August 1, 2006, along with contractor assurance system program descriptions. As a result, EM may not have the necessary information from some contractors in sufficient time to provide feedback on the gap analysis so that OR contractors can make needed changes and address the gaps before the September 15, 2006, milestone.

On June 1, 2006, OR submitted a response to the EM memorandum and its gap analysis. OR's response concluded that OR has documented processes in place to implement DOE Order 226.1 and that OR does not require an implementation plan. However, the results of this inspection (see Section D.2.2) indicate that OR does not meet some of the current requirements for a line management oversight program and that its current oversight processes would not fully satisfy the DOE Order 226.1 provisions.

EM is not currently on track to achieve full compliance with the requirements of DOE Order 226.1 by September 15, 2006. There are weaknesses in the EM and OR line management oversight program (as described in Sections D.2.1 and D.2.2) with respect to current requirements. At the time of the report, at least three of five Headquarters EM Deputy Assistant Secretaries who were required to complete a gap analysis and an implementation plan had done so. EM Headquarters will have only a few months to address any identified gaps. In addition, the gap analysis provided by field elements, such as OR, may not be sufficient to ensure full compliance with DOE Order 226.1. Further, some OR contractor deliverables may not be provided to EM until August 1, 2006, and thus EM may not have complete information in a timely manner to ensure that the contractors have an adequate plan to achieve full compliance by the milestone.

BJC. BJC has many of the elements of a line management oversight program, as defined in DOE Policy and Order 226.1, including assessments and issues management processes. As discussed in Section D.2.3, some aspects of these elements are adequate, but weaknesses are evident in a number of areas.

OR directed BJC to implement the order, conduct a gap analysis, and develop an implementation plan.

BJC completed a gap analysis (which identified eight gaps), developed the implementation plan, input the gaps into ICATS as issues for resolution, and submitted their implementation plan to OR on April 7, 2006. OR has responded to BJC with a notice of "non-concurrence" on their submittal, noting that their review of BJC's submittal was being postponed pending further guidance from EM. OR also directed BJC to submit a matrix of compliant status elements to supplement the identification of gaps and corrective actions in the implementation plan. Independent Oversight's review of the BJC gap analysis revealed that it focused on determining whether processes existed for each requirement in Appendix A of the Contractor Requirements Document in the Order but did not comprehensively analyze the adequacy of assurance program elements.

FWENC. Implementation of DOE Order 226.1 is not a requirement of the current contract between FWENC and the DOE. Thus, OR did not direct FWENC to prepare a gap analysis or implementation plan. OR personnel are preparing a new contract that will govern future operations of the TWPC, and OR indicates that additional safety-related orders, such as DOE Order 226.1, will be included in the next contract.

FWENC feedback and improvement processes contain most of the elements of the contractor assurance system delineated in the order, but these programs are not fully mature and do not meet DOE's expectations for order implementation. Formal processes are used for conducting assessments, communicating lessons learned, and managing safety issues, including events, injuries and illnesses, and nuclear safety rule reporting. However, procedures for these programs need more detail and integration to meet management expectations, requirements, and process steps, and implementation is inconsistent and sometimes lacks sufficient rigor. FWENC is currently performing evaluations to determine the level of compliance of their feedback, improvement, and oversight processes with the requirements of DOE Order 226.1 in anticipation of its being included in their contract as a result of ongoing contract negotiations.

D.3 Conclusions

EM. EM senior managers demonstrated that they clearly understand their safety management roles and responsibilities, and are engaged in safety decisions and in setting priorities. EM also has a number of effective mechanisms for maintaining operational awareness. However, the outdated FRAM, generic position descriptions, and an incomplete set of processes/procedures are not consistent with ISM expectations and reduce the assurance that subordinate EM managers and staff are provided with clear expectations and are accountable for performance. In addition, EM assessments are not sufficiently effective in driving performance improvements in all areas and are not always well coordinated with OR assessments. Further, a number of ES&H programs (employee concerns and technical qualification programs) have not yet been fully or effectively implemented. EM is working to improve the formality and rigor of its oversight program and assessments of field elements, including the recent development and implementation of new procedures.

OR. OR roles and responsibilities for ES&H are generally well described, and many ES&H responsibilities are adequately implemented. OR considers ES&H performance in the evaluation of contractor performance and award fees. OR-AMEM has an assessment program in place and conducts walkthroughs, self-assessments, and formal assessments of its contractors. However, there are a number of deficiencies in the OR-AMEM assessments in the areas of self-assessments, planning and scheduling assessments, performance of management walkthroughs, and procedures. There are also deficiencies in corrective action management and in ensuring that corrective actions are completed and effective. With the recent hiring of five new FRs, OR-AMEM's FR staffing level conforms to the FTCP staffing methodology, but there are deficiencies in the FR program processes and performance (e.g., documenting and communicating issues, training programs, reporting effectiveness indictors). The ECP is implemented, but assessments are not performed as required. As discussed in Appendix E, OR-AMEM has an adequate description of its safety system oversight program. However, the SSO engineers assigned to MSRE have not been fully qualified. OR-AMEM identified compensatory measures but has been unable to implement them, and safety system oversight is not yet sufficient. OR-AMEM has identified and is attempting to implement a number of oversight/assessment program initiatives. Most significantly, OR-AMEM has decided to develop and implement ISM project teams to oversee projects. These initiatives are promising but not mature and not sufficient to address some of the weaknesses in assessment program processes and performance. Most of these deficiencies were previously identified by OR-

AMEM, but corrective actions have not been timely or effective in many cases. Collectively, these problems indicate a systemic weakness in the oversight program and warrant a higher level of management attention.

BJC. BJC has established and implemented processes for the various elements of a contractor assurance system as delineated in DOE Order 226.1. Although some of these processes are adequately defined and effectively implemented, process and procedure weaknesses and implementation deficiencies in several areas hinder fully effective safety oversight. BJC conducts a variety of independent and management assessment and inspection activities. Although some assessment activities are effective in evaluating programs and performance and driving improvement, some assessment processes have not been sufficiently rigorous, and performance in some cases lack sufficient rigor to effectively monitor and evaluate safety performance. Numerous recent independent and management self-assessments of work control programs were not effective in identifying the program and performance deficiencies reflected in the recent K-25 accident and the deficiencies identified by this Independent Oversight inspection. Safety deficiencies are being evaluated and corrected, but program effectiveness is hindered by weaknesses in processes and procedures and inadequacies in implementation. BJC has established and implemented a structured, well documented, and generally effective lessons-learned program that shares many lessons with the DOE complex. BJC's total recordable and lost workday occupational injury rates are higher than EM and DOE averages, and although OSHA recordable and DOE reportable occupational injuries and illnesses are adequately managed as required by OSHA and DOE requirements, improvements are needed in documenting the evaluation and disposition of non-recordable, first-aid cases. BJC has established an adequate ECP that appropriately evaluates and resolves worker safety concerns.

As discussed in Appendix E, BJC has established adequate requirements and procedures for the system engineer program to ensure that MSRE safety systems can maintain their ability to perform intended safety functions. However, there are some weaknesses with respect to the rigor and thoroughness of system engineer walkdowns and assessments. Also, BJC training and qualification requirements for system engineers have not been implemented adequately, and there are a few significant gaps in the training given to the MSRE system engineer. MSRE makes significant effort to apply lessons learned; however, the process for capturing and utilizing lessons from its own work is informal and inconsistent.

FWENC. FWENC feedback and improvement processes contain most of the elements of the contractor assurance system delineated in DOE Order 226.1, but these programs are not fully mature. Formal processes and procedures lack sufficient detail, and management expectations for implementation sometimes lack sufficient rigor. Prompt feedback information and lessons learned from daily post-work reviews and from formal work suspensions provide an effective means to encourage and ensure safe work performance. Although many assessments are performed, much line management safety oversight is informal, and many formal assessment activities focus on compliance rather than performance. Issues management and lessons-learned processes and performance need strengthening to provide consistent and well-documented records of effective implementation. However, FWENC has compiled excellent injury and illness statistics and has had few operational safety events and incidents. Many factors have influenced the process and performance weaknesses identified in this inspection and on the overall success in minimizing the number and severity of FWENC events and injuries. These factors include a small workforce and spans of control, a limited variety of work activities, and the fact that facilities and work areas are few and confined to a small physical plant. Although the rigor and quality of more recent assurance system activities show improvement, as does the strengthening of formal processes through recent procedure revisions, management attention is needed to strengthen safety assurance processes and performance to meet DOE expectations and/or the requirements delineated in DOE Order 226.1.

DOE Order 226.1 implementation. While many aspects of a DOE Order 226.1-compliant DOE oversight program are in place, EM and OR do not have a comprehensive strategy for their integrated management oversight program that considers baseline requirements, the effectiveness of the contractor assurance program, and operational risks and priorities. At the time of the report, at least three of five Headquarters EM DASs who were required to complete a gap analysis and an implementation plan had done so. BJC has analyzed the new requirements to identify gaps, but OR has not been timely in providing feedback. For FWENC/TWPC, the order is not applicable to the contractor at this time, so no actions have been taken. A determination is also needed on whether DOE Order 226.1 should be incorporated into a future contract for TWPC operations. At this stage, EM/OR has taken some actions to ensure compliance by the milestone date, but the approach is not systematic or managed as a formal project, with clear expectations and milestones. Significant effort remains to ensure that EM/OR and BJC will meet policy and order expectations by the September 15, 2006, milestone.

D.4 Ratings

The ratings below for EM/OR and BJC also reflect the feedback and improvement processes for essential safety systems at MSRE, such as the safety system oversight program and system engineer program, as discussed in Appendix E.

EM/OR/BJC Feedback and Continuous Improvement Processes…………………….....NEEDS IMPROVEMENT
FWENC Feedback and Continuous Improvement Processes……………………..…..….NEEDS IMPROVEMENT

D.5 Opportunities for Improvement

This Independent Oversight inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site 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.

Office of Emergency Management

1. **Establish and implement a project management approach to DOE Order 226.1 implementation.** Specific actions to consider include:

   - Complete the gap analyses for each appropriate DAS in EM Headquarters.
   - Evaluate the adequacy of existing gap analyses at the field element and contractor levels.
   - Perform additional gap analysis if existing gap analyses are not sufficiently rigorous or comprehensive.
   - Use a project management approach and techniques to develop a set of actions, milestones, completion dates, and organizational and individual assignments, including interfaces and resource loading.
   - Assign a Headquarters manager to lead the project, and assign points of contact at each field element and contractor organization to coordinate needed action.
   - Ensure that the strategic approach and implementation strategy encompass security, cyber security, and emergency management as well as ES&H.
   - Require monthly reports to Headquarters and field element senior managers on the status, progress, and challenges of the implementation effort.
   - Evaluate contractor implementation plans for DOE Order 226.1 to ensure that management expectations are met.
   - Provide additional direction to contractors on implementation, as needed, based on evaluation of contractor plans.
   - Determine whether DOE Order 226.1 should be included in the next contract for operation of the TWPC.

2. **Enhance EM management systems and oversight processes**. Specific actions to consider include:

   - Expedite revision of the EM FRAM to ensure clear understanding of safety management roles and responsibilities.

- Revise individual position descriptions so that they accurately capture assigned roles and responsibilities.

- Develop and implement required standard operating policies and procedures.

- Establish an ECP in accordance with DOE Order 442.1A.

- Develop and implement a baseline assessment/self-assessment process and schedule.

- Develop and implement an EM Headquarters TQP to ensure that appropriate technical personnel are trained and qualified to perform assigned duties.

OR Assistant Manager for Environmental Management

1. **Enhance OR-AMEM assessment and issues management processes and performance.** Specific actions to consider include:

   - Expedite revision of EM-3.3, Integrated Assessment Program, to include a formal self-assessment process.

   - Develop and implement a baseline schedule for contractor assessments and self-assessment of OR-AMEM processes and procedures, ensuring 1) adequate coverage and capture of directive/rule required assessments, and 2) scope detail and planned periodicity.

   - Develop and implement an effective corrective action process that includes generation/retention of closure packages.

   - Consider requiring that OR-AMEM direct reports (Project Director/Division Director) indicate their approval of action and issue due dates in ORION3.

   - Develop and conduct training on expectations for ORION3 entries (e.g., on adequate walkthrough documentation).

   - Consider requiring team leader review and approval of walkthrough entries each month and ensure appropriate feedback to authors.

   - Ensure that monthly trending analysis is accomplished and documented in accordance with EM-3.3.

   - Ensure that managers and team leaders accomplish and document walkthroughs as required by EM-3.3.

   - Ensure that project directors' and team leaders' walkthrough schedules are produced and maintained as required by EM-3.3.

2. **Enhance OR-AMEM FR processes and performance.** Specific actions to consider include:

   - Revise/update FR program documentation to accurately reflect current processes and inclusion of appropriate requirements (e.g., DOE-STD-1063-2006).

   - Consider establishing an OR-AMEM Duty FR program.

   - Consider requiring periodic (weekly or monthly) reporting of FR activities and issues and ensure distribution across OR-AMEM projects and managers.

   - Ensure that FR training and qualification activities are conducted in accordance with FR-OM-06, Training & Qualification Program.

   - Consider establishing routine reporting of FR training and qualification status to OR-AMEM.

   - Develop and implement an FR continuing training plan in accordance with FR-OM-06.

   - Ensure a defensible basis for FR quarterly performance indicator data.

Bechtel Jacobs Company

1. **Strengthen the self-assessment program to ensure that safety programs, processes, and performance are appropriately and rigorously evaluated based on a structured analysis of activities, conditions, and risks.** Specific actions to consider include:

- Institutionalize, in site procedures, the requirements and processes for the quarterly management assessment presentations and annual SME program evaluations for senior management.

- Provide routine mentoring and monitoring of assessment quality, with consideration of using a grading system to provide specific feedback to assessors and improve performance and assessment value.

- Consider conducting workshops with "hands-on" training on the conduct of assessments and analysis of results for personnel performing management and independent assessment activities.

- Specifically require SMEs to schedule and conduct specific, periodic formal assessments of program adequacy and the compliance and effectiveness of implementation.

2. **Strengthen the issues management process and implementation to ensure the consistent capture, classification, analysis, and management of safety deficiencies through effective resolution.** Specific actions to consider include:

    - Develop a formal procedure for performing safety data trend analysis that emphasizes the narrative analysis and identification and disposition of corrective/preventive actions.

    - Provide details on the process and criteria for doing the performance analysis of occurrence data for evidence of recurring events and for establishing adverse trends and any needed corrective or preventive actions, including tracking disposition in ICATS.

    - Modify issue identification form BJCF-710 to include fields for recording procedurally required determinations of extent of condition, lessons learned, and evidence of similar/previously identified issues.

3. **Strengthen the occupational injury and exposure investigation and reporting processes to ensure that potential precursor events are thoroughly documented and analyzed, with causes determined and appropriate preventive actions identified and implemented.** Specific actions to consider include:

    - Consider revisions or supplements to the Accident/Incident Report form to better support documentation of the incident, investigation details (including causal analysis), and corrective/preventive actions. Ensure that the elements of ISM are addressed in the investigation report.

    - Establish/strengthen institutional oversight processes and controls, especially for subcontractors, to ensure that incident descriptions, investigation details, and corrective/preventive actions are rigorously completed and documented by line supervisors and ES&H representatives.

    - Establish a means to document the evaluation of subcontractor non-OSHA recordable injuries and illnesses that require only first aid, but may be prevented by correcting deficiencies in conditions and work control practices.

    - Consider establishing a more formal method for tracking the completion of corrective/preventive actions. Consider the use of the ICATS system.

4. **Increase the rigor and formality of ECP management.** Specific actions to consider include:

    - Ensure that all actions are completed and evidence provided and/or verified before formally closing I Care/We Care and formal Human Resources managed employee concerns.

    - Institutionalize in a BJC procedure the responsibilities, interfaces, and processes for managing employee concerns handled by Human Resources.

Foster Wheeler Environmental Corporation

1. **Strengthen the self-assessment program to ensure that expectations are clear, self-assessments are effective in identifying and**

correcting deficient conditions and processes, and results are documented. Specific actions to consider include:

- Clarify procedures regarding line management assessment expectations and ensure that required assessments are performed. Develop user-friendly means for line managers to plan and document assessment of work planning and field activities.

- Revise/amplify approaches to assessments to increase focus on overall process or program effectiveness, work performance, and field conditions.

- Increase the rigor of documentation supporting assessment conclusions, including clearly identifying the details, the size of samples, and the description of activities observed or conditions inspected.

2. **Strengthen issues management processes and implementation to ensure the consistent capture, classification, analysis, and tracking of safety deficiencies through effective resolution.** Specific actions to consider include:

   - Evaluate existing procedures to ensure a consistent and rigorous approach to all elements of issues management, including management of safety issues. Separate management approval of the investigation of and corrective action plans for incidents from the overall approval of final disposition and closure.

   - Strengthen the Issues Tracking Matrix to include the tracking of individual corrective actions.

   - Establish/strengthen quality reviews of issues management documents to ensure the adequacy of causal analysis, action plans, and closure/evidence information.

   - Strengthen the corrective action procedure by identifying expectations and guidance for conducting a graded analysis of issues (e.g., extent-of-condition and causes) and considering the analysis results in developing effective action plans that address the specific issue and provide effective recurrence control.

3. **Strengthen lessons-learned processes by expanding the new work instruction to include the processes for screening external lessons learned, identifying and documenting the actions to be taken or actually taken, and providing feedback to the lessons-learned coordinator.**

4. **Strengthen employee safety concerns processes by issuing a TWPC policy or procedure outlining the expectations, responsibilities, authorities, and processes for communicating concerns, the response and resolution to concerns, and appeals avenues available to workers.**

APPENDIX E
ESSENTIAL SYSTEM FUNCTIONALITY

E.1 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight evaluated essential system functionality (ESF) for the safety significant systems at the Molten Salt Reactor Experiment (MSRE). The safety significant systems included the containment ventilation system (CVS), the fire sprinkler system, the hydrogen fluoride detection system, the non-destruction analysis system, and the emergency shutdown system (ESS). Independent Oversight also evaluated the various programmatic functions associated with ensuring that these safety systems are capable of performing their safety functions with a high level of confidence commensurate with their importance to safety, such as configuration management, the unreviewed safety question (USQ) program, maintenance, and operations.

Two of the 2006 focus areas (quality assurance in engineering and configuration management programs, and processes and safety system component procurement) are closely related to ESF and are discussed in this appendix. Independent Oversight's review of focus areas is primarily intended to gather information that DOE can use to address DOE-wide weaknesses. Although focus areas are not rated at individual sites, the results of the reviews of focus areas are considered in the evaluation and ratings of the essential safety systems' elements.

Feedback and improvement systems as applied to the evaluated safety systems were also reviewed. The results are considered in the overall evaluation of feedback and improvement systems as discussed in Appendix D.

The purpose of an ESF assessment is to evaluate the functionality and operability of selected structures, systems, and components (SSCs) that are essential to safe operation of the facility. Independent Oversight reviews include technical evaluations of the selected SSCs' design, engineering, configuration management, operation, maintenance, surveillance, and testing. Additionally, these reviews address a facility's authorization bases (ABs) and related programs, such as the USQ program. ESF assessments are performed at a very detailed technical level that includes system calculations that are the bases for the systems' designs and safety analyses; the documented safety analyses (DSAs) and other related AB documents, such as technical safety requirements (TSRs) and the fire hazards analysis (FHA); drawings; specifications; vendor documents; facility-specific technical procedures; facility walkdowns; and interviews with system engineers, design engineers, maintenance and testing engineers, operators, technical managers, and other technical support personnel. The primary focus of these reviews is verification that the systems' designs and ABs are technically correct, consistent, and in accordance with applicable codes, standards, regulations, and DOE orders, and that the systems are fully capable of performing their design safety functions.

Independent Oversight also evaluated two events that occurred at MSRE in May 2006. One of these events was a release of approximately 5 pounds of fluorine, a highly oxidizing and corrosive gas. The second event was a failure of the facility annunciation system to announce an actual failure of the containment ventilation exhaust fans. As part of this inspection, Independent Oversight evaluated the two recent events to provide perspectives on the adequacy of design and operations of the relevant safety system and the adequacy of the subsequent feedback processes (e.g., investigations and corrective actions) of the Oak Ridge Office (OR) and Bechtel Jacobs Company (BJC).

E.2 Results

E.2.1 Quality Assurance in Engineering and Configuration Management Programs Focus Area

To evaluate quality assurance in engineering and configuration management programs, Independent Oversight reviewed the BJC procedures and processes for engineering design and configuration management, the flowdown of these procedures into MSRE project-specific counterparts, and their application in performance of design changes over the last several years.

BJC's engineering and configuration management programs are generally defined and documented in its quality assurance manual. BJC has developed several individual procedures for implementing important aspects of its engineering program and one overarching procedure for configuration management with several supporting procedures. As discussed below, these procedures generally provide good directions for ensuring quality in configuration management and engineering design.

Engineering design criteria. This procedure provides instructions for establishing all the requirements that an SSC must meet or perform. The procedure provides instructions for obtaining sources of design criteria, including safety basis documents and industrial codes and standards. The procedure also requires appropriate checks, reviews, and control of the resulting record-copies of the design controls.

Engineering calculations. This procedure addresses the method and format for preparing, checking, reviewing, approving, revising, filing, retaining, and releasing project calculations. It provides clear requirements for ensuring quality calculations, including instructions for identifying: (1) all input data, including their source and applicable criteria, (2) references, including revision level, and (3) assumptions (including noting whether any assumptions are unverified). Calculations are required to be sufficiently clear to permit verification. Checking is required for all calculations. Independent checks are appropriately required for safety system calculations. In addition, adequate instructions are provided for control of calculation, including identification of calculations as preliminary, committed, or superseded.

Engineering drawings. This procedure provides requirements for the preparation, review, approval, and control of drawings (including figures, sketches, and project drawings). The instructions are appropriate to support development of quality drawings, including good instructions for review and checking of drawings for general quality, completeness, compliance with contract requirements, and personnel safety. Further, the documents include instructions for drawings provided by subcontractors, and a unique number system is used. In addition, the procedure provides instruction for the control and issuance of completed drawings through the drawing control system.

Engineering process for field changes. This procedure defines the work process and requirements for executing field change requests, field change notices, and design change notices. It provides appropriate instructions for design control during implementation of design changes in the field.

Configuration management. This higher-level BJC procedure establishes a generally effective framework for ensuring quality in configuration management at each of the BJC projects, including establishment of a configuration manager and a change control board. Important features of the configuration management program include identification of configuration items (active safety systems, credited design features, and other defense-in-depth equipment); identification of configuration documents (documents and drawings that are essential to operate, maintain, and test a configuration item); identification of controlled software applications; and development of configuration management plans. BJC has established a subject matter expert for configuration management to support implementation project wide.

Document control. The document control procedure assigns responsibility and provides generally appropriate instructions for numbering, creating, issuing, and maintaining record-copies of documents. This procedure requires that the creation, approval, and issuance process for documents that shall become "records" shall be defined in functional, project, or site-level procedures, or other governing documents.

Work control. This procedure provides appropriate controls to support quality engineering and configuration management for non-routine maintenance and design changes. It requires clear identification of the work type, utilizes a graded approach to ensure that work on a safety system receives extra reviews (e.g., by the configuration control board), and includes an appropriate checklist to ensure that appropriate subject matter experts and/or the responsible organization have reviewed the package. However, the checklist does not identify the necessary contents of the work package (which is one of the purposes of the checklist). (See Sections E.2.3 and E.2.5.)

Graded approach application. This procedure provides appropriate instructions for assigning a facility grade level to facilities based on facility hazard category, remaining life, and the importance of certain facility SSCs important to safety, and assigning a quality level (QL) to work and activities based upon the impact on safety systems.

Control of non-conformance items. This procedure provides generally appropriate instructions for identifying, documenting, reporting, evaluating, and resolving nonconforming items and services to prevent inadvertent use or installation of unacceptable or unqualified items. However, the procedure does not provide appropriate instructions for ensuring that non-conforming items are evaluated in accordance with the BJC USQ process. (See Sections E.2.3 and E.2.5.)

Management of safety basis documents. This procedure establishes the BJC process for managing safety basis documents (SBDs) for all facilities managed by BJC. The procedure provides appropriate directions to support control of the numerous SBDs and establishes accountability for control of SBDs through a single organization – Nuclear Facility Safety (NFS) – and maintenance of a company-level SBD list.

Collectively, these BJC documents provide adequate directions for supporting quality in engineering and configuration management. Furthermore, BJC has taken actions over the last several years to improve its engineering and configuration management. Most recently, in response to an event in December 2005, (caused in part by a modification that did not receive proper engineering review), BJC took action to improve facility manager training to ensure that plant modifications are appropriately treated as design changes. However, notwithstanding these improvements, BJC has not established an overall engineering manual or procedure that defines the engineering organization. Therefore, roles and responsibilities for various aspects of the engineering process are not clearly defined. This is important for engineering work by BJC at ORNL where there is interface and support from various project and company engineering organizations.

Independent Oversight also reviewed the flowdown of BJC design and configuration management procedures into project-specific procedures for MSRE. MSRE has developed project-specific procedures for two of the BJC procedures (work control and configuration management). In most aspects, these MSRE procedures are appropriately incorporated into the BJC process and requirements. For example, the procedures: (1) define and utilize a graded approach for Type A and B work that has explicit configuration management requirements, (2) require review by a USQ-qualified individual, the configuration manager, the configuration control board (in some cases), and quality assurance, (3) require signatures on well-structured checklists, and (4) provide an appropriate process for field changes to work packages to ensure that they get appropriate reviews. However, one important configuration management process in the BJC procedures has not been flowed down to the MSRE configuration management procedure; specifically, configuration documents (i.e., essential documents under rigorous configuration management control) have not been identified, as specified in the BJC procedure. This situation may have contributed to weaknesses in the control of important safety system drawings, as discussed in Section E.2.3 of this appendix.

Summary. BJC's engineering design implementing procedures (design criteria, calculations, and drawings) provide acceptable instructions for the generation, review, and approval of important engineering documents. The BJC and MSRE configuration management procedures provide adequate instructions for maintaining the design of safety systems. Some configuration management process weaknesses were identified, such as the lack of an overarching engineering manual, transmission of requirements for identification of configuration documents, and instructions ensuring that nonconforming items receive USQ review when appropriate. However, overall, BJC has established appropriate implementing procedures to support quality assurance of engineering products and effective configuration management.

E.2.2 Engineering Design and Authorization Basis

Independent Oversight's review of the MSRE engineering design and AB included an evaluation of the overall design of systems supporting the fuel salt disposition process; evaluation of hazards and the identification of safety system controls; and the translation of controls into TSRs.

The MSRE DSA appropriately analyzed the hazardous materials and a wide spectrum of accidents to derive a set of design and safety system controls. The types and amounts of hazardous materials at MSRE are well defined; initial conditions and assumptions in the analysis are well defined; an appropriate spectrum of accidents is evaluated to identify needed controls (design features and safety systems); and, in most instances, the capabilities and limitations of safety systems were explicitly identified and evaluated to determine residual risk.

Further, MSRE has many well-designed processes and systems to minimize the potential for a release of hazardous material. Most processes involving hazardous material (e.g., transfers) are conducted at sub-atmospheric pressure, which removes the motive force for release of the hazardous material; most hazardous material systems are designed with double containment (e.g., pipe-within-pipe design); and safety components have a fail-safe design (e.g., ESS valves "fail closed"). The lead engineer responsible for the design and installation of most of the fuel salt disposition project equipment at MSRE is a very experienced and capable engineer who has been with the project for the past eight years and takes pride and ownership over the design.

Although the systems are generally well designed, some weaknesses were identified with the definition and documentation of some important system design parameters in the DSA and TSRs:

- **The basis for the adequacy of the .15 inch water gauge vacuum in enclosures subject to a hazardous material release is not supported by formal analysis.** The TSR basis states that airflow into the enclosures is the basis for the required vacuum. However, the adequacy of the amount of airflow for possible pressured releases (i.e., failure of fluorine and/or helium cylinders used in the enclosure) into the enclosures has not been analyzed. Contrary to the DSA, the CVS description document states that there is a minimum required flow; however, there is no documentation of the basis for this minimum required flow. This is a particular concern for the passivation cabinet, where pressurized fluorine gas can be (and has been) accidentally released.

- **Neither the DSA nor the TSR basis discusses or provides criteria for the allowable leakage from the ESS valves, which are required to shut during loss of containment events to limit releases of hazardous material.** Since the closure of the valves has been identified in the DSA as an important safety feature, then the allowable leakage should be specified.

- **The TSR for the water supply pressure for the safety significant fire sprinkler system is not consistent with National Fire Protection Association (NFPA)-13 requirements, which are referenced in the DSA.** The TSR-required supply pressures for the sprinkler systems at MSRE are based upon the pipe schedule requirements of NFPA-13 (1999 version), which require 20 pounds per square inch gauge (psig) to be available at the highest sprinkler head (for a coverage area of less than 5,000 square feet). However, if the covered area is greater than 5,000 square feet, the code-required pressure is 50 psig. The MSRE FHA indicates that the covered area is 6,500 square feet for the safety significant system; therefore, the current TSR-required pressure (based upon 20 psig) is non-conservative.

For a Category II special nuclear material facility, the TSR setpoints discussed above are required to be derived by quantitative/formal calculations because of the complexity of the parameters. 10 CFR 830.204, Documented Safety Analysis, states in part "Derive the hazard controls necessary to ensure adequate protection of workers, the public and the environment." MSRE has not established the necessary quantitative documentation to derive and support the setpoints for some of its safety systems; rather, MSRE has provided an informal qualitative justification for the lack of rigorous calculations. Although DOE-STD-3011 allows for the use of a graded approach in deriving DSAs, it still requires the hazard controls to be properly derived and requires quantitative calculation to be used when needed/required. The MSRE approach does not conform to the provision of 10 CFR 830 for properly deriving the above TSR setpoints.

FINDING #16: BJC has not adequately derived and documented in the DSA the basis for TSR requirements for the containment ventilation and emergency shutdown safety systems, as required by 10 CFR 830.

MSRE has taken action to address these weaknesses, including declaring potentially inadequate safety analyses (PISAs) and developing/performing USQ determinations (USQDs) for two of them. BJC's informal initial evaluation of these weaknesses concluded that, although the technical bases for some of the TSR values are not well documented, the values are adequate to ensure that the systems will function to protect workers. This conclusion is based on several factors: (1) there are other supporting safety systems (e.g., hydrogen fluoride detectors) in case of leakage from ventilated enclosures; (2) low-driving forces minimize potential leakage through closed ESS valves; and (3) BJC applied newer (more stringent) fire code requirements to the fire sprinkler system (and, even if there were inadequate sprinkler pressure, the fire department response would adequately mitigate any fire).

The OR Assistant Manager Environmental Management's (OR-AMEM's) review of the DSA appropriately identified and analyzed some important issues and limitations of the safety systems (e.g., seismic vulnerabilities) and made appropriate risk-informed decisions that were clearly documented in a safety evaluation report. Furthermore, during the DSA review, OR-AMEM had discussions with BJC concerning the limitations of the ventilation system to fully mitigate all potential hazardous material release events, recognized the lack of leakage criteria for the ESS valves, and determined that these safety systems were adequate even with these limitations. However, there is no documentation of these discussions and the resulting rationale for the determination that the safety systems were adequate; and the DSA was not modified to explicitly identify all of the safety system functional requirements (and their bases).

In addition, some analysis and design flaws were identified related to the system utilized to transport reagent gases needed to support uranium hexafluoride extraction. Specifically, the regulator connected to the 400-psig, 5-pound fluorine bottle was not designed to prevent inadvertent over-pressurization of the system. Furthermore, a manual valve was incorrectly located such that it could isolate the relief valve, resulting in it not being able to perform its safety function (however, this valve was administratively controlled open). Finally the relief system (i.e., connected piping) was not appropriately designed to handle fluorine gas without failure. These design flaws were identified by MSRE following a release of fluorine (which was caused by inappropriate operator actions). MSRE took actions to appropriately correct most of these deficiencies given the limited life of the project. However, although the design improvements reduced the likelihood of the need for the relief function, it did not correct the design problem that resulted in failure of the relief valve discharge piping, and the function would not be available if needed. Although many design alternatives were formally analyzed to correct this problem, some were not, such as adding a shutoff valve or restricting orifice with a bypass, in part because of BJC's conclusion that failure of the downstream piping was within the MSRE safety basis, that the need for the relief function was unlikely, and that the added complexity and cost of more exotic fixes were not warranted.

A flaw was also identified in the design of one aspect of the safety significant CVS loss-of-flow annunciation system. The design of the speaker volume control for annunciation of ventilation failure did not use measures to identify and/or control the operating status of the volume control knob, such as clearly tagging it or putting a cover on it to prevent inadvertent operation. This design shortcoming resulted in a recent event where this TSR-required aspect of the ventilation system was unknowingly made inoperable. BJC is taking action to correct this deficiency.

Summary. The MSRE DSA appropriately identifies hazards and identifies an appropriate set of design feature and safety system controls. Further, the processes utilized to handle hazardous materials and to mitigate potential accidents are generally well designed. However, TSRs for several important aspects of safety systems have not been adequately derived and documented. Further, some design flaws have recently been identified for two safety systems that rendered one (the CVS) inoperable and a second (the fluorine relief system) potentially unable to perform its safety function as designed.

E.2.3 Configuration Management

Independent Oversight evaluated the following elements of the MSRE configuration management program: (1) the configuration management and work control procedures (and their implementation), (2) system description documents (SDDs), and (3) the USQ screening and determination processes.

Configuration management and work control processes. As discussed earlier, the BJC configuration management and work control procedures, in general, provide an appropriate framework and instructions for ensuring effective configuration management. MSRE has developed a project-specific configuration management procedure and work control procedures that are generally consistent with the BJC procedures and generally effective. However, weaknesses were identified in the lack of flowdown of requirements for identification of configuration documents and lack of instructions ensuring that nonconforming items receive a USQ review when appropriate.

The MSRE configuration management procedure requires the establishment of a list of configuration items and generation of a configuration control memorandum, design change description, and a drawing change notice for design changes affecting configuration items.

The purpose of the configuration item list is to define those SSCs that fall under formal configuration control. The MSRE configuration item list includes most of the equipment and components for each safety system and design feature, but it is not complete and does not list the information in a consistent manner to provide easy use. In particular, the configuration items listed for the fire protection system are not adequately detailed or clear. Further, for the CVS, it is not clear that the fans are included in the configuration management boundaries as required. These omissions can result in confusion as to which components require formal configuration management. Further, the MSRE configuration management procedure does not identify how the configuration item list is to be used in support of safety system maintenance and procurement (e.g., as a master equipment list [MEL], discussed in DOE Guide 433.1).

In general, MSRE management was effectively implementing its configuration requirements for generating configuration control memos, design change descriptions, and drawing control notices. These documents were, in most cases, included in the work control packages. However, drawing change control notices were not always used, and the drawing control process used at MSRE is not consistent with the BJC process and has not been formalized. This situation contributed to several drawing control implementation weaknesses. For example, MSRE has established an informal process for maintaining a "stick file" of drawings for use by operators and engineers. This stick file is not rigorously controlled. A sample of drawings in the stick file versus those from the engineering document control system found many to be several revisions (and years) out of date. Further, in one case, a discrepancy was identified between two drawings of the same safety system, where one of them had been updated to reflect a design modification to a valve and connected piping in the system, while the second had not. In another case, two different revisions of the same drawing were found in the stick files. This lack of control is a concern because these drawings are used to support operations, maintenance, and engineering.

As discussed previously, the work control procedure appropriately requires that: (1) the type of work be identified to ensure the proper level of configuration management, (2) a checklist be filled out that indicates required reviews by pertinent parties, and (3) pertinent information for the design change, such as certifications of compliance and work instructions, be included. In most aspects, the work control procedure was appropriately implemented. For example, the type of work was identified, required signatures were obtained, and required documents (work instructions and certifications) were included.

However, several weaknesses were identified in design change work package documentation. A limited sample of work packages indicates that configuration management of design change documentation is not rigorous. Examples of deficiencies include:

- Work instructions do not result in components being restored to their original configuration (e.g., did not include provisions to remove a lockout and to restore valves to their initial configuration).

- The work type was not appropriately identified in one case (Type C instead of Type B).

- A drawing change notice was not included in the package (where several drawings were impacted). In another case, no drawings were identified as being required, when drawings were actually needed.

- A fabrication package was not used and included in the work package (although basic fabrication information, such as material certifications, was included in the work packages).

- A field change request/notice was not used.

Furthermore, in 2004, design change work was performed on the safety significant fire sprinkler system without utilizing the MSRE work control process; therefore, the work did not receive appropriate reviews (such as review for USQ applicability) and configuration control (such as drawing updates).

FINDING #17: BJC did not adequately implement its configuration management processes for controlling drawings and clearly identifying configuration items, and did not rigorously implement all work control processes for MSRE design changes, as required by 10 CFR 830.

System description documents. An additional configuration management tool required by DOE Order 420.1A is the establishment of a compilation of technical basis documents for safety systems. DOE guidance for establishing this compilation is provided in DOE-STD-3024. BJC has established system description documents for all safety systems at MSRE, and these documents are generally consistent with the DOE standard and include useful information to support such configuration management as system boundaries. However, the documents are not complete. For example, some technical information/references necessary for configuration management have not been included, such as vendor manuals. Further, the SDDs should not include engineering analysis or technical requirements that are not referenced in other formal documents (e.g., CVS minimum flow rates). This situation can cause confusion as to whether these are design requirements. Finally, safety system boundaries are not consistent with the boundaries defined in the configuration item list in some cases.

USQ process and implementation. MSRE uses the BJC USQ procedure. The BJC USQ procedure is generally consistent with 10 CFR 830 requirements and the associated DOE guide and provides good instructions and examples to support implementation. However, some procedure weaknesses were identified. The procedure allows work packages to be "appraised" by USQD-qualified personnel to determine whether a USQD is required; however, guidance and limitations are not provided for this "appraisal." This "appraisal" is in essence equivalent to an informal USQ screening and/or applying an undefined categorical exclusion. It is not clear what criteria are used for this appraisal. Further, there is no documentation of the "appraisal" decision rationale; rather, there is just a signature on the MSRE work package by the USQD-qualified person. The USQ procedure lists this "appraisal" as an example of a type of USQ screen that should be documented. However, BJC company practice has been not to formally treat it as a USQ screen, and therefore BJC USQ-qualified personnel have not been utilizing the screening form to document the screening rationale.

Another procedure weakness concerns the USQD worksheet instructions for how to determine whether a proposed change could "increase the probability of an accident." The worksheet states that the increase must be discernable and that this corresponds to it being greater than the error band in the associated calculation or resulting in a bin change. This direction is not consistent with the DOE USQ guide. Finally, as discussed previously in this appendix, the BJC non-conforming item procedure does not require the evaluator of non-conforming items that are dispositioned as "use as is" to evaluate the change via the USQ process. This resulted in one recent non-conforming item that was dispositioned as "use as is" (a damaged rubber boot in the safety significant ventilation system) not receiving an appropriate USQ review.

To further clarify the requirements of the DOE USQ guide, the section addressing screening is included. Specifically, DOE Guide 424.1-1, Paragraph 3, "Screening", states: "The purpose of USQ screening is to ascertain if it is necessary to expend the valuable time and resources necessary to perform a USQ determination, or if there is reasonable technical justification for not performing a USQ determination. DOE encourages the use of screening to limit the number of matters for which USQ determinations must be performed, provided the reasons for exclusion are documented and well supported. When properly defined and implemented, the screening criteria should assist in reducing the efforts expended for matters of minor significance and should focus efforts more on the more important matters for which Section 830.203 is intended. When an item is screened out from further consideration, the rationale for the screening should be documented and retained with records of USQ actions."

FINDING #18: The BJC USQ procedure does not ensure that appropriate and formal screening is performed, and the BJC non-conforming item processing procedure does not provide adequate instructions to ensure that items dispositioned as "use as is" receive a USQ review, as required by 10 CFR 830.

Independent Oversight reviewed many USQ screens and determinations and concluded that they have been performed very well (i.e., they are well documented and well justified, with appropriate conclusions). The USQ screens and determinations conformed with the BJC USQ procedure and DOE requirements, and they provided a clear description of the proposed change and the potential impacts on the safety basis. The high quality of the USQ screens and determinations can be attributed to the concerted effort made by BJC over the last two years to review USQDs and improve the capabilities of the preparers and reviewers.

Summary. In general, MSRE management has effectively implemented its configuration requirements for generating configuration control memos, design change descriptions, and drawing control notices. The USQ procedure was, in most aspects, appropriate and well implemented. Weaknesses were identified in the implementation of some of the configuration management processes, including clear identification of configuration items, drawing control, and attention to detail in documentation of work packages. Additional weaknesses were identified in the USQ procedure and non-conforming item procedure that could result in some facility modifications not receiving an appropriate USQ review.

E.2.4 Surveillance and Testing

10 CFR 830 requires that surveillances and tests be defined in the TSRs. The TSRs must ensure that safety SSCs and their support systems required for safe operation are maintained, that the facility is operated within safety limits, and that limiting control settings and limiting conditions for operations are met.

MSRE has established an effective surveillance tracking system to ensure that surveillances are performed on time. BJC personnel have access to the Facility and Maintenance Management Information System (FAMMIS) and other database systems (i.e., MIDAS) that assist in scheduling and tracking surveillances and associated work. Observations and interviews confirmed that MSRE schedules and completes surveillances and tests, as well as much other work, with the assistance of University of Tennessee-Battelle (UT-Battelle) and subcontractor personnel, facilities, and equipment.

The team observed the performance of a number of TSR-required surveillances and tests at MSRE and reviewed a sample of completed tests. The surveillance and testing procedures reviewed were generally adequate, but there were two surveillance procedures that lacked the appropriate rigor. These and other discrepancies are described in Section E.2.6.

Over the last few years, surveillances of the safety-related systems were performed on time, and the data sheets were appropriately filled out, with only a few minor exceptions.

Summary. The surveillance procedures are generally adequate. Although a few discrepancies were noted, the surveillances are performed when appropriate and are generally completed in a rigorous manner.

E.2.5 Maintenance and Safety System Component Procurement

Maintenance. Independent Oversight's review of maintenance focused on several aspects of the MSRE programs for maintaining safety systems, including preventive, corrective, and predictive maintenance, as well as the material condition of the systems. In addition to interviewing personnel responsible for maintenance activities, Independent Oversight reviewed the adequacy of maintenance procedures, documentation of performed maintenance activities, and procurement processes.

The MSRE maintenance program was adequately implemented in some areas, including the performance of work in accordance with formal work packages (OR-502) and the performance of some of the preventive maintenance tasks for the containment ventilation exhaust system.

Work packages used for maintenance/modifications at MSRE (OR-502) have some positive attributes. The work package process is defined in a formal procedure (OR-502, MSRE Facility Work Authorization), and is generally being implemented. Packages contain key documents, including the USQ evaluation, work instructions, and available procurement documents, and are reviewed to ensure that the correct documents are included. In general, each step in a work package is signed off as completed by the task lead. Changes to the work packages are correctly made by changing the revision or by deleting portions, with approval signified by initials. In general, appropriate post-maintenance tests are defined and completed.

MSRE has established and implemented some appropriate preventive maintenance tasks to ensure that the CVS exhaust fans are operable. On a quarterly basis the fans' shaft bearing oil reservoir, belt wear, tension, and alignment are checked. On a semi-annual basis vibration measurements are taken at specified locations on the fans/motors. The data is analyzed by the vibration measurement equipment and high readings are noted. The abnormal vibration results have been used to identify problems and correct deficient components (e.g., shaft and/or belt alignment, replace bearings) prior to failure of the fans/motors.

Vendor manuals were available for most newly installed safety systems. The vendor manuals for the safety significant hydrogen fluoride detection system components are readily available. These manuals had been reviewed for preventive maintenance recommendations, as applicable (many of the components do not require preventive maintenance). Vendor manuals were not available for the CVS fans and motors or for the recently replaced bearings.

Weaknesses were identified with the implementation of several maintenance programs and processes. MSRE has not rigorously implemented DOE Order 433.1B by establishing a maintenance implementation plan (MIP) and defining a nuclear maintenance management program. In addition, MSRE has not established an MEL, a detailed preventive maintenance program, and a maintenance deficiencies identification/tracking process or a rigorous procurement process for the safety significant systems at MSRE.

BJC has not ensured that MSRE and other nuclear facilities have the necessary MIP and support programs as required by DOE Order 433.1B. In April 2002, BJC had established an MIP that defined the corporate tasks to be performed to ensure implementation of the DOE maintenance order at each nuclear facility. However, in 2005, the BJC MIP was closed out without completion of the identified open tasks. This closure was approved by OR. No supporting task closeout documentation could be found. As a result, implementation of the DOE maintenance order is not complete for BJC nuclear facilities. For example, at MSRE, the BJC MIP-identified tasks, “Project-specific assessments will be performed to facilitate completion of the Master Equipment List (MEL) and development of Project Level Implementation Plans,” were not completed. MSRE has not defined its nuclear maintenance management program in a procedure. The procedure most related to a nuclear maintenance program is found in the BJC Field Services set of procedures. Field Services, via program description BJC-FS-1035, Nuclear Facility Maintenance Program, establishes a set of general nuclear maintenance program requirements that lack appropriate detail, content, and implementation strategies. No supporting implementing documents for BJC-FS-1035 were defined. MSRE has not conducted a gap analysis of the required elements for a nuclear maintenance program and the current program procedures to establish a list of deficiencies. (See Finding #19.)

MSRE has not adequately ensured that some safety significant systems and components are clearly identified and appropriately maintained. The CVS and its supporting components are identified in the DSA as safety significant. The mechanical components of the system, including the exhaust motor/fans, belts, bearings, and isolation dampers, were being maintained as general service components. Maintenance for these components is performed by UT-Battelle. The following deficiencies were noted:

- Replacement parts, such as belts, bearings, and bearing oil are not being procured and controlled to meet the quality requirements of safety significant components.

- Work packages are not established to control and document corrective maintenance on the system, including post-maintenance testing performance/documentation and maintenance history. One example is the recent bearing replacement for one exhaust fan (SF-2), which was performed without required, formal documentation.

- Preventive maintenance tasks are in place for the fans and motors, but the basis for these tasks had not been defined. Abnormal conditions discovered and/or corrected during preventive maintenance work are not documented, included in maintenance history, and available for analysis.

- The safety significant electric breakers for the exhaust fans and supporting supply breakers do not have preventive maintenance procedures defined and routinely implemented. It is noted that during the summer of 2004 during a planned power outage at MSRE the supply breakers for the exhaust fans were vacuumed and the supply breaker to the motor control center was removed, tested, vacuumed, and returned to service. No testing documentation was available for the main supply breaker. Safety significant bus work is not inspected by thermography to ensure that hot spots are identified and corrected. (See Finding #19.)

MSRE work packages using the OR-502 procedure were not used to control work for the safety significant containment ventilation and fire suppression systems that are maintained by support organizations. In these cases, work is performed for the CVS by UT-Battelle in accordance with the UT-Battelle process as defined in the governing master agreement for services. Additionally, for the fire suppression system, work was performed in accordance with the fire protection service memorandum of understanding. However, these processes do not satisfy the requirements for nuclear maintenance. For example, modification of the safety significant fire suppression system was performed without using the MSRE work package process, and adequate procurement quality assurance was not performed. Details of a recent fire suppression system modification are as follows:

- The flow alarm on the fire suppression system for the office area adjacent to the High bay (Safety Significant system) was modified in 2004 to install a vane type water flow alarm switch. The task involved drilling a hole in the fire header and installing the alarm switch.

- The work package was written and performed by the Fire Department UT-Battelle. The facility manager approved the work.

- Although not documented in the UT-Battelle work package as a best management practice, when the fire department drills a hole in a pipe, it attaches a “coupon” to the place of the modification. This helps ensure that the cut out piece of pipe is not in the pipe, which could later prevent a sprinkler head from working. However, the package does not include a sign-off that no debris (e.g., filings, tools) remains in the pipe before putting it back in service.

- The alarm switch has no procurement certifications.

- Required changes to the controlled drawing were not made based on this modification.

- A USQD was not performed. The USQ requirement was incorrectly screened out because the replacement part was considered an equivalent replacement of the malfunctioning part. However, the screening did not take into consideration that the vane of the flow alarm could break off and block water flow to a sprinkler head, and that during performance of the work, debris could have been left in the pipe that also could block water flow to a sprinkler head. MSRE has declared a PISA to further evaluate/resolve this concern.

- The requirements for commercial dedication of parts used in safety systems were not implemented. The like for kind review was documented in an email and did not take into consideration that the vane/paddle could break off and obstruct flow to an operating sprinkler head.

- The replacement and/or modifications of the shaft bearings for the CVS exhaust fans were not performed using an MSRE work package as required. As a result, appropriate procurement (like for kind), configuration management, and USQ documentation were not completed.

A few CVS maintenance deficiencies were identified with the performance of the current preventive maintenance program. The detailed preventive maintenance tasks are defined in the ORNL FAMMIS. This maintenance is performed by UT-Battelle and interviews were conducted with the UT-Battelle maintenance technician. The following deficiencies were noted:

- Excessive oil, which had spilled and/or leaked from the shaft bearing, is not routinely cleaned up. This makes it difficult during later maintenance tasks and operator inspections to determine whether a new leak is occurring. This indicates poor housekeeping for the CVS fans and motors.

- Oil used in the exhaust fan bearings has not been verified to be appropriate for this use by a vendor manual or bearing manufacturer's recommendation.

- Oil is stored in a locker to prevent an oil spill. There is a significant amount of spilled oil in the bottom of the cabinet. This also indicates poor housekeeping.

- Belt tension is checked by skill of the craft; the belt vendor manual has not been obtained, and tension values have not been determined and accurately measured as part of the preventive maintenance task.

- Exhaust fan dampers require routine greasing, but the dampers are not currently on the preventive maintenance schedule.

A few generic deficiencies were identified with completed MSRE work packages. Work instructions usually include a section detailing prerequisites. In most cases, the completion of the prerequisites section was not signed off, although it is common practice to sign off completion of individual steps in the work instruction. When a part is used to complete a step of the work instruction, the technician does not sign off that the part is as required by the procedure, verifying that the part is uniquely matched to the certificate of conformance or material test certification, though the required certification is usually included in the work package. This signature is needed to show the part's chain of custody through its final use. Work packages do not contain a log of activities, but the expectation is that conditions that deviate from the work instruction will be documented in the remarks section at the end of the work instructions. In a few work packages, deviations from the work instructions were not clearly identified.

Safety system component procurement. Independent Oversight's review of safety system component procurement focused on several aspects of MSRE's programs for procurement of equipment, materials, and services, including processes for determining and documenting procurement and quality assurance requirements for procured items; dedicating and documenting the evaluation of new and/or replacement of commercial grade items for use in safety significant applications; and establishing and applying procurement and quality assurance controls for purchased items and services, including the identification, evaluation, and prevention of suspect/counterfeit items (S/CIs). In addition to interviews with personnel responsible for procurement activities, including responsible engineers, Independent Oversight reviewed the adequacy of engineering and procurement procedures, and documentation of performed procurement activities, for safety significant component applications.

A few examples of acceptable procurement practices were identified at MSRE, as discussed in the following paragraphs.

In some cases, non-conformance report (NCR) corrective actions have defined the appropriate component acceptance tests for replacement components that support procurement quality assurance requirements. An example is the replacement of HCV 2501 valve in Cabinet M. The NCR defined a requirement to bench test the replacement valve before installation. This testing was performed, documented, and included in the work package to the uniquely identified replacement valve. Replacement of the compressed gas bottle station safety significant pressure relief valves was conducted in accordance with an approved work instruction and NCR. The acceptance of the replacement relief valves appropriately included an ORNL Quality Engineering and Inspection pressure relief valve inspection and test and certificate of conformance as required by the system engineer.

S/CI training has been conducted for the MSRE system engineer, quality assurance manager, and UT-Battelle maintenance technician. However, this training was accomplished many years ago, and refresher training could ensure that current information is available to the MSRE staff. Additionally, S/CI information bulletins are provided to MSRE, and inspections and actions are taken to address these bulletins. Two examples were provided in which electric tools and shackles were identified as having product deficiencies. The necessary inspections were performed, and suspect components were removed from service.

The MSRE fabrication package procedure, OR-521, provides an acceptable process to track whether material used for fabrication has supporting certified material test reports. (This assumes that the unique match between parts and certifications has been maintained.)

However, the procurement process at MSRE was found deficient in three important areas. First, MSRE does not have an approved procurement procedure. Over the last several years, procurement processes for MSRE were defined in the MSRE procurement quality procedure, OR-559. This procedure was recently cancelled without identifying and/or implementing any replacement procedures. However, the forms referenced in procedure OR-559 (Commercial Grade Items Procurement Quality Planning MSRE Project and Inspection Report MSRE Project) are still being used to approve and document procurement processes. MSRE is considering reactivating this procedure, with appropriate changes.

Second, MSRE does not sufficiently document the receipt and inspection of safety significant parts and components. As stated above, the Inspection Report MSRE Project form continues to be used for documenting component receipt inspections and is specifically required to be filled out by OR-559. However, in most cases this form is not being filled out as required when parts are received. It is an established informal policy that the engineer ordering safety significant parts will also sign for receipt of these components. In general, the MSRE engineers are not documenting completion of their receipt inspections of delivered parts. The engineers' dual responsibility for purchasing and receiving parts without independent reviews is clearly contributing to the lack of completed receipt inspections.

Third, MSRE does not conduct sufficiently rigorous S/CI inspections during receipt of components. The inspections performed at MSRE during receipt and inspection to prevent suspect/counterfeit parts are not defined as part of a receipt inspection procedure, and completion of these inspections is not documented. In the absence of a procedure, these inspections rely on the expertise of the inspector/engineer.

Several deficiencies also were noted with the conditions/operations of the MSRE warehouse. An MSRE procedure has not been defined and implemented to structure the operation of the MSRE parts warehouse, and the need for such a procedure had not been identified by management. A procedure is needed to define such key areas as material storage requirements, receipt and inspection processes, and warehouse parts issuance. The warehouse is currently run based on the experience of the individual responsible for the warehouse and his understanding of parts storage, receipt, and issuance requirements (e.g., certified material should be segregated from non-certified material, and certification documentation should be matched to each part when issued). The following examples of poor warehouse operations were identified by Independent Oversight:

- A chain of custody for safety significant parts is not maintained in the warehouse via the completion, documentation, and retention of receipt inspections and during the issuance of parts from the warehouse.

- An informal database has been established to track warehouse parts.

- A spare bearing set for exhaust fans is stored in a building as general consumables and was not purchased as certified material. These parts should be evaluated and stored as safety significant material spares.

- A pipe rack has both certified and non-certified material stored in the rack.

- Certified small parts/fittings are stored in a special area, but the area is in disarray. It was in the process of being reorganized, but the person performing the task changed jobs. Similar parts are stored in bins based on part numbers, which have associated certifications. MSRE has not specified how parts in one bin with multiple certifications can be correctly matched to the appropriate certification.

Weaknesses were identified with the use of the main procurement forms identified in OR-559. OR-559 does not explain in detail how to utilize the Commercial Grade Items Procurement Quality Planning form. The first item in most cases is selected which states "Confirmation of the items' published characteristics, applications and codes and standards." The statement is too general to define a detailed receipt inspection. However, OR-559 does provide some detail in how to fill out and utilize the Inspection Report MSRE Project form. In most cases, a certificate of conformance is received from the supplier as required by the procurement request. Receipt of the certificate of conformance is not included as one of the elements to review on the Inspection Report MSRE Project form. The completed Inspection Report MSRE Project form is also supposed to be included as part of the fabrication package, but is not routinely included. In addition, no requirements are defined in OR-559 to ensure that a certificate of conformance is uniquely matched to a component and maintained throughout the procurement process, including part usage. (See Finding #19.)

At the corporate level, BJC has established an acceptable procurement procedure to define the procurement of safety significant parts from qualified suppliers. However, this procedure has not been implemented at MSRE, even though the BJC procedure has been in effect for several years. The procedure BJC-PQ-1208, Supplier Quality Assurance Evaluation Program, applies to the purchase of safety significant, fire protection, or defense-in-depth items. As required by the procedure, prospective suppliers are identified and an assessment or waiver request is submitted to BJC Quality Assurance for approval and listing on the approved supplier list. However, the MSRE suppliers for critical components are not listed on the Quality Assurance approved supplier list as required, and MSRE has not updated the approved supplier list in accordance with the procurement procedure by using the Supplier QA Assessment Results form in several years. Included in the BJC procedure is the specific requirement to develop inspection/test plans for receipt inspection for critical parts and to perform and document the receipt inspections. In many cases, MSRE has not developed specific inspection/test plans for receipt inspections and/or has not documented the results of the inspection/tests during receipt of the critical components. (See Finding #19.)

The following finding consolidates the maintenance and safety system component procurement deficiencies.

FINDING #19: BJC has not established and implemented the applicable requirements of DOE Order 433.1B and 10 CFR 830 for maintenance and procurement in four general areas; specifically: 1) BJC has not established and implemented a detailed maintenance implementation plan and a nuclear maintenance management program to ensure full compliance with the order requirements; 2) BJC has not adequately maintained the MSRE containment ventilation system exhaust fans/motors, which are categorized as safety significant components by the MSRE DSA; 3) BJC has not ensured that procurement processes, including commercial parts dedication, parts receipt inspection, and warehouse storage/issuance, are adequately defined and documented when performed; and 4) BJC has not implemented the supplier qualification assurance evaluation program as required by procedure BJC-PQ-1208, Supplier Quality Assurance Evaluation Program, procedure BJC-PQ-1650, Graded Approach Application, and 10 CFR 830.

BJC has not established a procedure to implement a rigorous S/CI program, and has not established an S/CI controls procedure and integrated these controls into its parts receipt and inspections procedure. However, BJC has established a web page that includes a listing and summary of the various orders and guidance documents associated with S/CI controls.

Procedures for receipt inspections conducted at the BJC warehouse do not specifically address that an inspection for S/CI should be conducted and signed off. Additionally, the BJC web page containing associated DOE S/CI orders and guidance documents does not include information on DOE's suspect bolt list and valves and flanged components; however, it does provide information on electrical components. Updates to the S/CI web pages are in progress.

Summary. A few MSRE maintenance elements were adequately implemented, including performance of work in accordance with a formal work package procedure (OR-502), the adequate performance of some of the preventive maintenance tasks for the CVS, in general the use of vendor manuals for newly installed safety systems, and use of the NCR process to resolve procurement deficiencies. However, significant weaknesses were identified in the implementation of several maintenance programs and processes. The major contributor to these weaknesses is the breakdown in the transmission of DOE Order 433.1B requirements to the BJC nuclear facilities. As a result, MSRE has not rigorously implemented DOE Order 433.1B by establishing an MIP and defining a nuclear maintenance management program. In addition, MSRE has not established an MEL; has not defined a detailed preventive maintenance program; has not established a maintenance deficiencies identification/tracking process; and has not adequately ensured that the safety significant CVS and components are clearly identified and appropriately maintained. The safety significant CVS and fire suppression system are maintained by support organizations, and their associated work control processes are not adequate for a nuclear facility. Further, the procurement processes at MSRE lack an approved procurement and warehouse procedure; are deficient at documenting the receipt and inspection of safety significant parts and components; do not maintain a chain of custody for safety significant parts; and the MSRE suppliers have not been qualified in accordance with BJC procedures.

E.2.6 Operations

The Independent Oversight team evaluated safety system operating activities, procedures, and operator training and their effectiveness at MSRE.

MSRE's daily activity begins with a shift turnover followed by a plan-of-the-day (POD) meeting. In these activities, the status and proposed changes to the operation of the MSRE safety systems were appropriately discussed. The shift turnover and POD meetings observed were generally effective and accomplished the purpose of informing participants of the activities and allowing for necessary coordination among operations staff and of tasks to be performed. Independent Oversight also observed a number of pre-job briefs. The pre-job briefs were professionally conducted, discussed the interfaces with the MSRE safety systems when applicable, identified potential hazards, discussed radiation work permits, and verified required training for the workers.

In general, MSRE has established an appropriate set of operation procedures, including normal operations, alarm response, and other surveillance procedures. Independent Oversight reviewed a number of these procedures to determine whether these procedures and associated training and system controls provide the tools and knowledge necessary for the proper operation of safety systems. A number of procedure-related deficiencies were discovered. Specifically:

- In observing the execution of OR-562, Secondary Containment Pressure Monitoring, Rev. 3, frequent cross-referencing between this procedure and OR-567, TSR-PLC 7 Preoperational Testing, led to some confusion regarding the next step in the procedure.

- In OR-568, Reagent Gas Bottle Change-out, Rev. 5, there is a missing step relating to closing the passivation cabinet door after placing bottles inside the cabinet, and continuing other necessary manipulations through the small access opening on the side of the cabinet. Closing the cabinet door significantly affects the ability of the cabinet to perform its safety function.

- OR-581, Periodic Inspection of Active Safety Systems and Design Features, does not require inspecting the release path down stream of the passivation cabinet relief valve.

- OR-567 does not clearly specify all necessary actions/conditions for successfully performing the ESS functional test.

- The TSR completed surveillance file contained discrepancies. For example, the team discovered three slightly different versions of revision 0 of OR-575, Containment Ventilation System Operation, in this file. Furthermore, an improvement made in revision 0 was not carried to revision 1 of this procedure.

One of the major objectives of procedure training is to provide the appropriate level of knowledge for proper operation of the safety systems. A review of a sample of BJC training records at MSRE indicated that many training modules are inadequate and that the records lack detail. For example, the module on abnormal operating procedures (AOPs) mainly consisted of a presentation of eight PowerPoint slides, covering 46 pages of AOPs. BJC indicated that extensive classroom training on system operations and an additional classroom module on facility alarms obviated the need for the AOP module to be comprehensive. BJC also indicated that extensive on-the-job-training (OJT) was used to familiarize workers with the operations and alarms. However, the Independent Oversight team found insufficient documentation of this OJT activity in the Training Office files. Therefore, training on some BJC safety system operating and other procedures for MSRE lacks the necessary documentation.

The Independent Oversight team observed conduct of operations training and a "safety stand-down" meeting presented to workers. The training focused mainly on principles of conduct of operations and covered some of the deficiencies related to recent events. The safety stand-down meeting appropriately focused on heat stress, which was a timely subject deserving workers' attention during the summer period. Both training sessions observed were well presented.

Summary. In general, MSRE has established an appropriate set of operation procedures. A few weaknesses were discovered in execution, quality, and quality control of some procedures. Errors found in these procedures could exacerbate deficiencies in implementation of conduct of operations, an area of acknowledged weakness within MSRE. In addition, there are some weaknesses in training documentation, and a systematic approach to procedures training is not used. Management's recent initiative to require operators to attend two hours of conduct of operations training, where requirements of the MSRE conduct of operations procedure were highlighted, was a positive step. This step alone, however, is not sufficient to remedy the extent of problems associated with the implementation of an effective conduct of operations, including adherence to procedures at MSRE.

E.2.7 ESF-Related Feedback and Improvement

Bechtel Jacobs Company

Safety system engineer assessments. BJC has developed adequate procedures to implement the requirements of DOE Order 420.1B, *Facility Safety*, for a system engineer program and to ensure that active safety systems of nuclear facilities can maintain their ability to perform their intended safety functions. The program addresses such appropriate topics as: identification of applicable facilities and systems; configuration management of the facilities and systems; assignment of system engineers to active safety systems; roles, responsibilities, and qualifications of the system engineer; and management and oversight of the system engineer program.

MSRE has five active safety systems: ESS, non-destructive analysis system, hydrogen fluoride detector system, CVS, and fire sprinkler system. MSRE did not undertake full comprehensive safety system assessments as required by the DOE implementation plan for Defense Nuclear Facilities Safety Board (DNFSB) Recommendation 2000-2, considering its limited mission and the operations shutdown that would be required. The system assessments conducted were generally focused on operability determinations, but provided sufficient basis for preparing system descriptions.

MSRE has only one system engineer to cover the five safety systems. The scope and frequency of system engineer reviews are defined in facility-specific procedures. The system engineer performs quarterly walkdowns and annual assessments of safety systems. The MSRE system engineer also provides assistance in determining operability concerns that occur during TSR surveillances. The quarterly frequency for system walkdowns is a deviation from the monthly frequency required by BJC's institutional procedure; however, this deviation has been approved by BJC considering the type of TSR surveillances being conducted. These system reviews are performed using checklists provided in facility-specific BJC procedures, and annual assessments include system performance trending. While checklists used for the quarterly walkdowns and annual safety system assessments are generally consistent with the system assessment criteria developed for implementing the DNFSB recommendation, they are not sufficiently detailed for a thorough assessment, and the completed checklists do not always provide the necessary information. For example, degraded conditions that are observed, the extent to which visual inspections are restricted by as low as reasonably achievable (ALARA) concerns, and the basis for conclusions are not addressed and documented.

BJC has described generally adequate training and qualification requirements for system engineers in its procedure for the system engineer program. However, the requirements described at a summary level have not been adequately translated into specific training modules and supplementary reading needs and do not flow down to the system engineer qualification card or to the position assignment form for the MSRE system engineer. For example, these documents do not specify training in or mandatory reading of applicable quality assurance, procurement, and maintenance requirements, and of the facility-specific DSA. Furthermore, except for training on the facility-specific DSA, there is insufficient evidence that the MSRE system engineer has completed training in these areas, which are critical to the design, operation, reliability, and maintenance of safety systems. Also, the requirements do not include training for conducting and documenting the periodic safety system walkdowns and assessments required by the system engineer program. The deficiencies in system engineer training identified during this inspection correlate with weaknesses in safety system procurement and maintenance at MSRE (see Section E.2.5).

The BJC manager of the system engineer program provides oversight of MSRE system engineer activities and routinely reports on the status of system engineer activities to the BJC engineering manager. However, there has been rather limited independent or external assessment of MSRE system engineer functions. The Closure Project Evaluation Board (CPEB) conducted an evaluation of the Melton Valley Closure Project in March 2005, which included the MSRE system engineer program. The evaluation appears to have been a general survey of the status of implementation of the program rather than a performance assessment, and there were no issues identified for the system engineer program. The CPEB evaluation in 2004 did not include MSRE because an operational readiness review (ORR) had been performed in December 2003. However, system engineering was not addressed in the 2003 ORR. CPEB assessments have been discontinued, and instead, senior management assessments will be conducted effective July 2006. An assessment of the program is planned for October 2006.

MSRE management does not conduct a programmatic self-assessment of its system engineer functions. Its schedule of assessments for 2006 includes only the system engineer's annual assessment of safety systems. Thus, there is little peer review or self-assessment of the system engineer program or of the reviews and assessments performed as part of the program. The lack of peer review of system engineer assessments is reflected in inadequate quality of the system assessment documentation, in addition to the lack of thoroughness mentioned previously. For example, there are numerous errors in system assessment documentation, indicating insufficient rigor and attention to detail.

FINDING #20: BJC has not adequately implemented training and qualification programs for its system engineers as required by its system engineer program procedure and by DOE Order 420.1B.

Analysis and resolution of issues. The BJC Issues and Corrective Action Tracking System (ICATS) provides a process for formal analysis, trending, tracking, and closure of issues. However, it contains few issues resulting from safety system surveillances, walkthroughs, or assessments of MSRE safety systems. Generally, the MSRE entries into ICATS are limited to reportable occurrences, NCRs, and externally identified issues. Problems or deficiency issues identified during operational, engineering, and other functional activities at MSRE are entered directly into work request forms for processing and implementation of corrective actions. There is no formal system or process to periodically review work requests to identify any issues that should be examined for instituting compensatory measures; determining causes, extent of condition, trends and patterns, or lessons learned; or tracking corrective actions. Without such a process, there is not sufficient assurance that the ICATS will be effective in analyzing problems to identify all the necessary corrective actions and track them to closure in an appropriately formal manner.

There have been a few reportable occurrences at MSRE during 2006. These include the pressure instability in the fuel processing system on February 6, 2006; the fluorine release operational emergency on May 6, 2006; and the CVS fan and alarm failures on May 11, 2006. In each of these cases it appears that sufficient analysis of the event was performed to understand the causes and implications of the event. In addition, MSRE has appropriately responded to recent events by taking the correct immediate actions, reporting the events, and developing and implementing appropriate corrective actions for most problems. For example, the timely completion of a special conduct of operations training class by all MSRE staff was an appropriate initial response to the conduct of operations deficiencies.

However, weaknesses in some of the corrective actions were identified for the fluorine event. At the time of the review, the corrective actions did not include an action to determine the necessary reviews to be performed before passivation cabinet restart. In general, following the implementation of significant TSR changes, BJC, at minimum, conducts an implementation verification review (IVR). An IVR will provide only limited verification that all programs and processes are ready for startup, especially in the areas of conduct of operations, design, engineering, and work control. An IVR does not provide the depth and breadth of scope required to review the necessary areas of weakness as provided by an ORR or readiness assessment, in accordance with DOE Order 425.1C. Other deficiencies in the fluorine event investigation and subsequent corrective actions were identified, such as DOE Order 425.1C was not evaluated for applicability; the event flowchart was not comprehensive; the engineering analysis and corrective action plan lacked thorough evaluation in some areas (including the consideration of replacing the one rupture disc system with three); and additional operator training has not been defined. On June 22, 2006, BJC prepared a startup notification report for the resumption of fluorine operations in the MSRE passivation cabinet and a draft letter to OR-AMEM proposing that a readiness assessment in accordance with DOE Order 425.1C be performed, with OR-AMEM as the startup authority. Before determining the type of review, OR is awaiting the completion of the review of several MSRE USQDs. The results of the USQD reviews will be taken into account when considering the type and scope of review to be performed for restart. On July 13, 2006, OR formally informed BJC that DOE Order 425.1C is applicable and that BJC needs to submit a startup notification report for the restart of the fluorine operations in the passivation cabinet at the MSRE.

Lessons learned. There is concerted effort at MSRE to incorporate lessons learned into each work package that is developed using the facility work authorization procedure. This effort includes searching DOE and BJC databases, as well as obtaining input at planning meetings and from relevant post-job briefings. For example, several suggested solutions to issues encountered in replacing windows and mirrors on certain equipment (part of the reagent gas removal system) were documented on the post-job debrief for the work and were subsequently utilized. Also, several improvements to procedures and equipment were made following deactivation work on the first fuel salt drain tank; for example, backup ventilation and a hydrogen fluoride detector were added in the passivation cabinet, and procedures were enhanced. Such improvements to work activities are often made directly, without formally documenting them as lessons learned. Similarly, the system engineer described significant feedback from the crafts workers when a system modification is being designed. However, there is little documentation of such feedback.

Given the unique nature of MSRE deactivation operations, the identification of applicable lessons learned from experience at other sites and facilities can be challenging. Recognizing this challenge, MSRE uses an informal lessons learned database that reflects MSRE experience. The database is a collection of commitments, proposed actions, and suggested improvements to address unfavorable conditions experienced during operational activities conducted at MSRE since last year. Although the database is a positive initiative, there is no formal procedure for maintaining and utilizing this MSRE-specific database. For example, the responsibilities of MSRE staff and the capabilities of the database are not defined. Additionally, there is no requirement or process to ensure that all of the proposed improvements are collected, and the suggested ideas and problem solutions may not be reviewed by other knowledgeable staff. Also, the database does not necessarily allow systematic searches for conditions and suggested solutions. Thus, there is no formal system or process for capturing and utilizing the lessons learned from MSRE's own operational and safety system engineering activities.

OR-AMEM

Within OR, the AMEM has responsibility for line management oversight of the environmental management program activities at ORNL, including MSRE. The OR-AMEM implemented a procedure for safety system oversight (SSO) effective December 31, 2005, and the procedure is consistent with the requirements specified in DOE Manual 426.1-1A. OR-AMEM has identified SSO personnel and has defined the systems they are to cover, and facility-specific qualification and training programs have been developed for these personnel. OR-AMEM has also issued a three-year schedule for initial safety system assessments covering all nuclear facilities under its purview.

For MSRE, three SSO engineers are assigned to provide oversight of the five safety systems of the facility. These SSO engineers are not currently fully qualified; however, one of them holds "interim qualification," and all three are scheduled to complete their qualification in October 2007. In August 2005, OR-AMEM decided to take compensatory measures for providing the necessary SSO until the SSO engineers are fully qualified. The measures require the Facility Representative (FR) to provide SSO with the assistance of safety basis staff. However, OR-AMEM did not provide any written expectations or guidance to the FRs on how and the extent to which such interim SSO engineer duties should be incorporated and prioritized with their routine FR responsibilities.

The schedule of initial assessments of MSRE safety systems indicates that an initial assessment of some safety systems would not be completed until September 2008, which would be about three years after the SSO program was established. Also, the schedule for assessments extends far beyond the schedule for completing the ongoing fuel salt disposition mission by mid-2007. The FR conducts routine facility rounds that include limited oversight of safety systems, but OR-AMEM's compensatory measures include minimal documentation of FR surveillances or of any other type of inspections or evaluations of MSRE safety system engineering functions and the contractor's system engineer program. Also, there is no schedule, protocols, or any significant evidence of walkdowns of safety systems by SSO engineers assigned to MSRE.

FINDING #21: OR-AMEM has not ensured implementation of its compensatory measures for safety system oversight, and there is insufficient evidence of safety system oversight at MSRE as required by DOE Order 420.1B.

Summary. BJC has established adequate requirements and procedures for the system engineer program to ensure that MSRE safety systems can maintain their ability to perform intended safety functions. However, there are some weaknesses in the rigor and thoroughness of system engineer walkdowns and assessments. Also, BJC training and qualification requirements for the system engineers have not been implemented adequately, and there are a few significant gaps in the training given to the MSRE system engineer. MSRE makes significant effort to apply lessons learned; however the process for capturing and utilizing lessons learned from its own work is informal and inconsistent. OR-AMEM has an adequate description of its SSO program, but the SSO engineers assigned to MSRE have not been fully qualified. Lastly, OR-AMEM has identified compensatory measures for providing the necessary SSO, but has been unable to implement those measures; therefore, little SSO is currently provided.

E.3 Conclusions

MSRE is a unique facility in which both new and old safety systems exist to support current operations. The new safety systems were required to support special decontamination and decommissioning operations that were recently started. In general, the newer safety systems were developed, installed, and tested by the current MSRE staff. The older or existing safety systems are generally maintained by support organizations, but in most cases are surveillance tested by the current staff. As a result, the MSRE staff is generally more engaged with the newer safety systems than the older ones. Because different organizations maintain the older safety systems, there is a gap in the rigor and understanding of the nuclear facility requirements between the old and new safety systems. This situation has resulted in many deficiencies in the fire suppression and containment ventilation systems. There also have been significant breakdowns in the flowdown and/or implementation of nuclear requirements from BJC to MSRE for maintenance, procurement, and configuration management, and several findings have been identified in these key areas in this report. The overall conclusion is that OR-AMEM and BJC management need to devote more attention to the nuclear operations at MSRE to ensure that the necessary resources are provided to correct the identified deficiencies so that operations will be fully compliant with nuclear facility requirements.

MSRE management has appropriately responded to recent events by taking the correct immediate actions, reporting the events, and in most cases developing and implementing appropriate corrective actions. The timely completion of a special conduct of operations training class by all MSRE staff was an appropriate initial response to the conduct of operations deficiencies. Some weaknesses in the fluorine event corrective actions were identified, such as DOE Order 425.1C was not evaluated for applicability; the event flowchart was not comprehensive; the engineering analysis and corrective action plan lacked thorough evaluation in some areas, including the consideration of replacing the one rupture disc system with three; and additional operator training was not defined.

MSRE management has also taken appropriate actions for some of the deficiencies identified during this Independent Oversight inspection, such as declaring a PISA to evaluate a potential concern.

E.4 Ratings

Engineering Design and Authorization Basis	NEEDS IMPROVEMENT
Configuration Management Programs and Supporting Processes	NEEDS IMPROVEMENT
Surveillance and Testing	EFFECTIVE PERFORMANCE
Maintenance and Procurement	SIGNIFICANT WEAKNESS
Operations	NEEDS IMPROVEMENT

E.5 Opportunities for Improvement

This Independent Oversight inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site 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.

OR-AMEM

1. **Improve documentation of reviews of DSAs.** Specific actions to consider include:
   - Document important comments and resulting decisions affecting safety system functional requirements in a formal comment resolution form or meeting minutes.
   - Ensure that the DSA succinctly identifies the basis for all functional requirements and any system mitigation limitations that were accepted as part of DSA development and OR-AMEM's review.
2. **Improve the SSO program.** Specific actions to consider include:
   - Establish a routine walkdown schedule to ensure that SSO engineers are interfacing with contractor system engineers, as well as providing an interim level of SSO while gaining further knowledge of the safety systems assigned to them.
   - Expedite the training of SSO engineers.
   - Expedite the schedule of assessments of MSRE safety systems commensurate with their importance to the safety of the mission.
   - Enhance the scope of safety system assessments to include reviews of important safety design aspects.
   - Further define the expectations for implementation of SSO compensatory measures, including guidance to FRs on the nature of SSO they are to provide until the assigned SSO engineers are fully qualified.

BJC

1. **Improve instructions for processing drawings through the various project document control centers and the engineering document control center.**
2. **Improve the form and instructions for the BJC work control procedure regarding the identification of the contents of work packages in form BJCF-845.** Specific actions to consider include adding a column on the form for subject matter experts to identify what material is required, and revise the procedure to provide instructions for subject matter experts using the form.
3. **Improve the NCR procedure to include instructions for performing a USQ for non-conforming items dispositioned as "use as is."**

4. **Develop a conduct of engineering manual/procedure that clearly defines the roles and responsibilities for conducting engineering processes.** Include information on the BJC engineering processes, particularly project-level work. Include references to all applicable engineering implementing procedures.

5. **Conduct an assessment(s) of the safety systems' capabilities.** Specific actions to consider include:

   - Review the adequacy of documentation supporting TSR limits.

   - Review systems to ensure that quality assurance requirements for the control of important components (from potential inadvertent operation) are being adequately implemented.

   - Evaluate all possible system configurations to ensure that safety functions (such as relief capability) are properly maintained.

6. **Revise the engineering assessment of the corrective actions addressing the fluorine release event.** Consider formally assessing the cost and benefit of additional alternatives, including the use of an excess flow check valve, automatic isolation valve (at piping rated for full cylinder pressure) that closes upon pressure approaching downstream relief set point or excessive flow, or a restricting orifice (with a manually operated bypass).

7. **Improve the MSRE configuration management procedure and attached configuration item list.** Specific actions to consider include:

   - Revise the procedure to discuss how configuration management documents are identified. Consider including a list of configuration management documents as an attachment.

   - Revise the procedure to describe whether/how the configuration item list is supposed to be utilized to support maintenance/procurement activities.

   - Describe the source documents to be used in developing the list (e.g., DSA).

   - Revise the configuration item list to identify the individual components of all safety systems

8. **Improve drawing control.** Specific actions to consider include:

   - Develop an MSRE-specific drawing control procedure that is consistent with the BJC procedure but that provides implementation details specific to the manner in which MSRE is controlling some aspects.

   - Address control of documents in the MSRE stick file. Consider specifying a reduced number of essential drawings (those needed to support near term operations) to be maintained in the stick file. Furthermore, perform an audit to ensure that the stick file and engineering data control center contain the latest version.

9. **Improve the rigor of the implementation of the work control procedure.** Specific actions to consider include:

   - Provide training to the personnel responsible for developing (and ensuring the adequacy of) work control packages.

   - Strengthen the responsibility and accountability for rigorous adherence to procedure compliance.

10. **Improve SDDs.** Specific actions to consider include:

    - Clearly identify whether the document is intended to meet the requirements of DOE Order 420.1A for compilation of technical documents.

    - Ensure that all appropriate documents are referenced (e.g., vendor manuals and source documents that informed the system description document).

- Ensure that no original design information (e.g., minimum flow values) is included in the SDD. (The SDD should only be a compilation of design information from other sources).

11. **Improve the USQ procedure.** Specific actions to consider include:

    - Clarify the instructions for appraising work packages for USQ applicability. Consider developing a categorical exclusion that could be referenced by the USQ-qualified person in documenting rationale. Also consider providing a simplified screening process for work that is clearly not subject to the USQ process.

    - Revise the USQ procedure to correct instructions for determining whether a change in probability is discernable so that it is consistent with DOE Guide 424.1B.

12. **Improve MSRE operation procedures.** Specific actions to consider include:

    - Clarify instructions for depressurizing the secondary containment in accordance with section 7.2 of procedure OR-567. Consider including steps to re-pressurize in this procedure, or make a clearer linkage between and the applicable prerequisites and steps in procedure OR-562.

    - Revise procedure OR-575, Containment Ventilation System Operation, to provide places for the user to record data values.

    - Revise the procedure on fluorination in accordance with the physical modifications that have been made.

    - Revise procedure OR-581, Periodic Inspection of Active Safety Systems and Design Features, to inspect the vent path downstream of PPR-3.

    - Examine such procedures for weaknesses in revision control mechanisms.

13. **Improve operation procedures training.** Specific actions to consider include:

    - Enhance the training material for AOPs to address each one individually.

    - Revise the training on fluorination operations to include more graphics (e.g., photos, illustrations, and sketches showing the new arrangement and operation of all components containing toxic gas and of piping within and passing through the passivation cabinet).

    - Also in the fluorination operations training, incorporate information on other safety-related upgrades to the area around the passivation cabinet; include graphics showing the location and function of the new and improved hydrogen fluoride leak detection system into an appropriate revised or new training module (for all High Bay workers, not just fluorination operators).

    - Re-train applicable operators/workers on the modified or new training materials.

14. **Improve the system engineer program.** Specific actions to consider include:

    - Improve the rigor of system engineer walkdowns and assessments of MSRE safety systems, especially relative to documenting system conditions and providing rationale for conclusions.

    - Enhance the scope of system engineer assessments of MSRE safety systems to include review of important safety design aspects.

    - Ensure that training in applicable aspects of facility-specific DSAs, quality assurance, procurement, and maintenance, and in conducting and documenting system assessments, is specified in the system engineer qualification card and position assignment form as required training and qualification for system engineers.

- Ensure the quality and thoroughness of documents that are developed during system engineering activities by providing the necessary peer review.

- Assign qualified backup system engineers to MSRE.

- Ensure that the system engineer program, including implementation of qualification and training requirements and the quality of system reviews and assessments, is thoroughly assessed.

- Periodically conduct a cumulative review of work requests to identify any issues that should be formally examined for determining causes, extent of condition, trends and patterns, instituting compensatory measures, lessons learned, or corrective actions.

- Use the ICATS more effectively to capture operational and engineering problems and issues, as well as corrective actions, suggested improvements, and lessons learned.

15. **Reinitiate efforts to implement DOE Order 433.1B**. Specific actions to consider include:

    - Evaluate the last BJC MIP.

    - Update the BJC MIP to ensure that it thoroughly addresses all elements of the order.

    - Implement the identified tasks from the revised BJC MIP.

    - As a priority, take action to implement nuclear maintenance requirements at MSRE. Priority programs to be implemented include establishing an MEL, defining a preventive maintenance program, establishing a maintenance identification/tracking process, and establishing a rigorous procurement process.

16. **Evaluate the current maintenance performed on the containment ventilation and fire suppression systems to ensure that it is performed in accordance with nuclear maintenance requirements.** Specific actions to consider include:

    - Revise preventive maintenance tasks to ensure that deficiencies are documented, and that spare parts are properly procured.

    - Ensure that the MSRE work control system or equivalent is used to control and document completion of maintenance/modifications to these systems.

    - Ensure that major CVS electrical supply panel/breakers are evaluated for proper maintenance as a safety significant component.

    - Ensure that spilt oil from the CVS exhaust fans is removed upon discovery.

    - Determine and use the appropriate belt tensioning value for the CVS exhaust fans, and include it in the appropriate preventive maintenance task.

    - Establish a preventive maintenance task for the exhaust fan dampers.

17. **Improve the clarity of maintenance work packages and work instructions.** Specific actions to consider include:

    - Establish the requirement to sign off the completion of work instruction prerequisites.

    - When safety significant parts are utilized in a work instruction, include a work instruction step and signature to verify that the parts have the appropriate documentation (certificates of conformance, material test reports, and receipt inspection documentation), to ensure the procurement chain of custody process.

    - Establish the use of an activity log for work packages.

18. **Improve the procurement process at MSRE.** Specific actions to consider include:

    - Revise and reissue the current MSRE procurement procedure OR-559. Ensure that the revision incorporates the current CFR 830 requirements for procurement.

- Ensure that receipt and inspection activities are documented. Include a sign off in the documentation that the S/CI review has been conducted.

- Establish a procurement warehouse procedure to ensure that parts are properly received, stored, and reissued. The procedure should ensure that the chain of custody for safety significant parts/components is maintained.

- Ensure that parts previously purchased for general use are updated to safety significant parts as required (e.g., CVS spare bearings).

- Ensure that the procedure BJC-PQ-1208, Supplier Quality Assurance Evaluation Program, is fully implemented. This includes the requirement to develop, implement, and document inspection/test plans for receipt inspections for critical parts.

19. Establish a BJC S/CI control procedure, and fully update the S/CI web page.

APPENDIX F
MANAGEMENT OF SELECTED FOCUS AREAS

F.1 Introduction

The U.S. Department of Energy (DOE) Office of Independent Oversight inspection of environment, safety, and health (ES&H) for environmental management program activities at the Oak Ridge National Laboratory (ORNL) included an evaluation of the effectiveness of the Office of Environmental Management (EM), Oak Ridge Office (OR), Bechtel Jacobs Company (BJC), and Foster Wheeler Environmental Corporation (FWENC) in managing selected focus areas.

Based on previous DOE-wide assessment results, Independent Oversight identified a number of focus areas that warrant increased management attention because of performance problems at several sites. During the planning phase of each inspection, Independent Oversight selects applicable focus areas for review based on the site mission, activities, and past ES&H performance. In addition to providing feedback to EM/OR, BJC, and FWENC, Independent Oversight uses the results of the review of the focus areas to gain DOE-wide perspectives on the effectiveness of DOE policy and programs. Such information is periodically analyzed and disseminated to appropriate DOE program offices, sites, and policy organizations.

The focus areas selected for review at the environmental management program activities at ORNL and discussed in this appendix are:

- Environmental management system (EMS) and pollution prevention programs (see Section F.2.1)

- Workplace monitoring of non-radiological hazards (see Section F.2.2).

One other focus area—the status of DOE Policy 226.1 and DOE Order 226.1 implementation—is closely related to feedback and improvement processes and is discussed in Appendix D. Two focus areas (quality assurance in engineering and configuration management programs and processes, and safety system component procurement) are closely related to essential system functionality and are discussed in Appendix E. The focus areas are not rated separately, but results of the review of the focus areas are considered in the evaluation of integrated safety management (ISM) elements in Appendices C, D, and/or E, where applicable.

F.2 Results

F.2.1 Environmental Management System and Pollution Prevention Program

An executive order and DOE Order 450.1, *Environmental Protection Program*, required DOE sites to implement an EMS by December 31, 2005. Independent Oversight selected the EMS as a focus area for 2006 to provide feedback to DOE management on the effectiveness of implementation of the new EMS program by line organizations at DOE sites across the complex. For the ORNL environmental management program activities, Independent Oversight evaluated OR program management and oversight of EMS activities, and the FWENC environmental compliance program and the implementation of EMS at selected BJC operations at the MSRE, facilities awaiting decontamination and decommissioning (D&D), and the Tank W-1A sampling operation.

OR. The OR EMS program is well defined, and program management and oversight are performed by assistant managers for operations, including the OR Assistant Manager for Environmental Management (OR-AMEM). The EMS lead in the office of the OR-AMEM obtains support from OR's overall lead for EMS as required.

OR certified that the EMS established by BJC fully conformed to the EMS requirements of DOE Order 450.1, and that the requirements were reflected in the site contract and the ISM system and EMS used by BJC. However, the OR-required annual self-assessment of the implementation of ISM for BJC operations performed by the OR-AMEM in 2005 did not include EMS, and the current lines of inquiry for future assessments do not include EMS. OR-AMEM Facility Representatives (FRs) provide routine oversight for BJC operations that include environmental aspects, drawing upon OR environmental subject matter expertise in evaluating environmental compliance concerns.

BJC. BJC has set clear expectations for integrating the EMS into the ISM system. The overall framework for the integration of ISM and EMS is defined in the company-wide environmental management and protection policy (BJC-GM-007), which includes a specific chapter on EMS expectations and strategy, that shows how environmental compliance functions are to be incorporated into performing work safety. BJC has determined what significant environmental consequences can result from performing restoration or D&D actions, and has effectively implemented EMS objectives for minimizing those environmental aspects. In addition, BJC has established a pollution prevention/waste minimization (P2/WM) program and plan, and established several actions, defined within the ISM system description document, for achieving P2/WM objectives.

Several tools have been developed for incorporating environmental aspects into projects and minimizing the project's potential environmental impact. These tools include an environmental compliance and protection (EC&P) review checklist, as defined in the Environmental Compliance and Protection Oversight Program Description (BJC-EH-3001), and a waste management plan, which is required by work control process BJC-FS-1001. In addition, EC&P leads and waste management support personnel have been assigned to support projects, and specific functions are assigned by the work control process to ensure that environmental aspects are considered during development and performance of work activities. As discussed in Appendix C, these tools and environmental and waste management support personnel are being effectively used to minimize environmental impacts and to incorporate P2/WM aspects into work activities. However, the activity hazards analysis (AHA) process, including the safety task analysis risk reduction talk (STARRT) card, which is a key ISM tool, does not currently include environmental aspects. As a result, pre-job briefings using the AHA, and the daily review of STARRT card items, do not serve to reinforce the environmental aspects in the work to be performed.

FWENC. FWENC has implemented an effective environmental compliance program that has many of the elements required in an EMS, such as effective oversight of environmental systems, waste and environmental actions that are imbedded in operating procedures, and a pollution prevention program. However, because compliance with DOE Order 450.1 is not required in FWENC's contract, they are not currently required to develop all elements of an effective EMS. For example, FWENC does not have a formal process to ensure that significant environmental aspects have been risk ranked, and that objectives and targets to address these identified significant environmental impacts have been developed.

Summary. OR has clearly defined EMS requirements for contractors and has the necessary resources to ensure that these requirements are being implemented. However, the OR-AMEM ISM assessment program does not include EMS. BJC has established an EMS within ISM that sets clear expectations for EC&P to be fully integrated into line operations as part of work performance and to achieve P2/WM goals. Several tools and deployed resources are used to ensure that environmental aspects are effectively managed by the projects during performance of work activities. Although these tools are effective, the AHA process, which is a key tool for ISM, does not currently include environmental aspects. Although DOE Order 450.1 is not applicable, FWENC operations at the Transuranic (TRU) Waste Processing Center (TWPC) are performed using a comprehensive environmental compliance and waste minimization program that includes most EMS elements.

F.2.2 Workplace Monitoring of Non-Radiological Hazards

DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, establishes requirements for line management to ensure that workplace monitoring is effectively implemented for Federal and contractor workers, including subcontractors. Worker exposures to chemical, physical, biological, or ergonomic hazards are required to be assessed through appropriate workplace monitoring (including personal, area, wipe, and bulk sampling), biological monitoring, and observations. Monitoring results must be formally recorded, and documentation should include the tasks and locations where monitoring occurred, identification of workers monitored or represented by the monitoring, and identification of the sampling methods and durations, the control measures in place during monitoring (including the use of personal protective equipment), and any other factors that may have affected sampling results.

During this inspection, Independent Oversight reviewed DOE Office of Environmental Management (EM) contractor work activities at ORNL in which workers could potentially be exposed to chemical, physical, biological and ergonomic hazards. In addition, the team reviewed the current state of the

BJC and FWENC non-radiological worker exposure program as defined in procedures, instructions, contract requirements, and various presentations. Although the current FWENC contract lists DOE Order 440.1, and not DOE 440.1A, the workplace monitoring requirements are similar in both documents.

BJC exposure assessment program. The BJC exposure assessment program is defined in Section 6.8, Exposure Monitoring, of the BJC worker safety and health program description, which applies to all BJC project activities and personnel, including subcontractors. This section of the BJC safety and health description establishes the policy, fundamental requirements, and expectations for implementing an exposure assessment program for non-radiological workplace exposures and serves as a roadmap to related subordinate documents such as EH-5560, "Workplace Industrial Hygiene Sampling." Because this section provides limited information (it is less than two pages), and there are few accompanying procedures, implementation practices and documentation depends on the individual industrial hygienist and varies considerably among BJC projects. For example, the BJC safety and health description requires initial exposure monitoring "unless recent objective data can demonstrate conclusively that no employee will be exposed to chemical or physical hazards in excess of the established Time Weighted Averages." However, guidance is lacking on what constitutes "objective data," and how this evaluation is to be performed and documented. A review of BJC work activities indicates that evaluations that determine the need for exposure monitoring are expert-based and seldom documented. As a result, typically there is no documented basis for the performance of exposure monitoring or the decision not to perform exposure monitoring. For example, for dry sweeping activities for paint chips in Building 7500, BJC does not have worker exposure data to indicate whether there is an airborne exposure hazard to lead dust. BJC does have exposure data for a different work activity (i.e., grinding/scraping of lead paint) at a different location. However, because of the number of variables and unknowns (e.g., percent of lead in the paint, local ventilation, personal protective equipment used, etc.), there currently is no documented basis to extrapolate the grinding activity in one building to indicate these exposures will "bound" the exposures resulting from the sweeping activity in a different facility.

Despite these limitations, once the decision has been reached to conduct exposure monitoring, BJC has developed procedures for exposure monitoring and for recording results in the BJC Industrial Hygiene Analytical System (IHAS) database. BJC relies upon a subcontractor to perform exposure monitoring and instrument calibration and maintenance, and these subcontracted activities have generally been conducted and documented in accordance with established practices and procedures. The IHAS database is a well-established, computer-based exposure recording database for documenting the results from exposure monitoring for a variety of workplace stressors, such as exposure to chemicals, noise, biological agents, and heat and cold stress. The IHAS database requires the entry of work activity data (e.g., description of the activity, location, conditions at the time of monitoring, permits in place, and performance by a subcontractor) such that the exposure data can be linked to specific work tasks, and is a useful tool for sorting and trending exposure records.

FWENC exposure assessment program. The scope of FWENC work activities at ORNL is limited to work performed at the TRU/Alpha Low-Level Waste Treatment Project. Correspondingly, the scope of the FWENC exposure monitoring program is limited to activities at the project and is defined in a FWENC industrial hygiene monitoring procedure. This procedure provides information on the use of various industrial hygiene monitoring instrumentation and techniques to conduct monitoring and surveys of personnel who could be exposed to chemical or physical hazards. The procedure also provides a cross-reference to other FWENC procedures required to implement industrial hygiene monitoring, such as procedures on air sampling pumps, detector tubes, or noise monitoring. However, there are no policies and procedures for implementing the exposure assessment requirements of DOE Order 440.1 and the exposure assessment guidance provided in DOE Guide 440.1-3, *Occupational Exposure Assessment*, and the DOE standard for industrial hygiene practices (DOE-STD-6005-2001). The FWENC exposure monitoring program, as defined by the FWENC industrial hygiene monitoring procedure, also lacks provisions for developing exposure profiles, identifying exposure groups, establishing administrative control limits, performing quantitative and qualitative exposure assessments, and linking exposure monitoring to exposure assessments as described in the related DOE references.

Implementation of the BJC and FWENC exposure assessment programs. Although there has been progress at the facility and work-activity levels with respect to implementing the exposure assessment programs for BJC and FWENC, there are considerable gaps in the identification, analysis, and documentation of work exposures to chemical, physical, biological, and ergonomic hazards. Fully implementing and maintaining a workplace exposure and monitoring system, as envisioned in DOE Order 440.1A, for the diverse types of work at ORNL is a significant challenge, but one that is critical to ensure that workers and line managers are fully aware of the hazards and health effects to which they are exposed and the magnitude of those hazards.

The Independent Oversight team identified several workplace exposures from a limited number of work activities observed at the BJC surveillance and maintenance and MSRE projects, and the FWENC TWPC, that were not identified, analyzed, and/or documented. As examples:

- Exposures to welding fumes at the TWPC have not been analyzed sufficiently to ensure that controls used during welding are adequate to maintain exposures within limits. Although welding activities are infrequent, such monitoring is particularly important because of the recent reduction to the exposure limit for hexavalent chromium, a common metal fume associated with welding activities.

- At the TWPC , the potential for beryllium in the various waste streams processed at the center was analyzed through the accepted knowledge process; however, incidental beryllium contamination was not typically addressed when the wastes were originally packaged. Although it is known that beryllium was widely used across ORNL for decades before the hazards were known, potential worker exposures to beryllium when re-packaging this waste, or potential low-level beryllium contamination on surfaces of equipment, facilities, or waste boxes, have not been sufficiently analyzed.

- At MSRE, confined space entries have been conducted in a sump without adequate evaluation and/or documentation that demonstrates that the potential chemical constituents in the sump water pose no risk to workers entering the sump.

- Legacy hazards resulting from routine housekeeping activities (e.g., floor sweeping) within older, unoccupied ORNL buildings (now owned by DOE-EM) have not been sufficiently analyzed to ensure that BJC surveillance and maintenance workers are not exposed to airborne concentrations of lead, asbestos, and beryllium.

One cross-cutting exposure of concern is the lack of a consistent and comprehensive site beryllium characterization program that encompasses all DOE-EM work activities and buildings at ORNL, regardless of the operating contractor. Some contractors working at ORNL have developed and implemented a chronic beryllium disease prevention program (CBDPP), as required by 10 CFR 850. Other contractors, such as FWENC, have not adequately addressed the potential beryllium hazard in the facilities or operations and have not developed such a program or documented a basis for excluding the need for a CBDPP. Furthermore, for those contractors that have implemented a CBDPP, the implementation of their CBDPP has not included all of their work activities. For example, although BJC has implemented a CBDPP and has performed extensive characterization of legacy beryllium contamination at the East Tennessee Technology Park, the CBDPP does not address the 75 older buildings at ORNL in which BJC performs routine surveillance and maintenance activities. BJC assumed responsibility for these buildings in 1998 and, to date, a formal beryllium characterization of these buildings has not been conducted as required by the Beryllium Rule, which was issued in calendar year 2000. In recent years, OR has not been proactive in ensuring consistent implementation of 10 CFR 850 and has not identified or addressed these omissions and oversights on the part of the DOE contractors performing work at ORNL.

Summary. BJC and FWENC have made some progress in the development of the exposure assessment programs. However, there are deficiencies in the non-radiological exposure assessment program and its implementation for both BJC and FWENC. For BJC, although the BJC safety and health program description has established overall requirements for compliance with DOE Order 440.1A, guidance is lacking for when and how exposure assessments are to be documented, particularly in cases when the industrial hygienist determines that industrial hygiene monitoring and/or sampling is not required. Once the decision has been made to conduct monitoring and/or sampling, the IHAS database provides mechanisms for documenting all elements of the exposure assessment, although the rigor of this documentation varies among the BJC industrial hygienists. For FWENC, policies and procedures for implementing DOE Order 440.1 are not evident, and requirements for a CBDPP have not been addressed. For both BJC and FWENC, work observations indicate that worker exposures to some hazards have not been adequately assessed. In cases where worker exposures have not been evaluated, the appropriateness of controls (if used) is indeterminate. In addition, OR has not ensured that all contractors performing work at ORNL have adequately assessed the potential worker exposure hazards to beryllium, or implemented a CBDPP, when required. Continued management attention is needed to ensure the development and implementation of a more effective workplace exposure assessment program.

FINDING #22: BJC non-radiological workplace exposures have not been sufficiently analyzed and/or documented for some facilities and for a number of work activities, as required by DOE Order 440.1A.

FINDING #23: FWENC/TWPC non-radiological workplace exposures have not been sufficiently analyzed and/or documented for a number of work activities, as required by DOE Order 440.1A.

FINDING #24: OR has not ensured that all contractors performing work at ORNL have adequately assessed the potential worker exposure hazards to beryllium, or implemented a chronic beryllium disease prevention program, when required by 10 CFR 850.

F.3 Conclusions

EM/OR and BJC have devoted attention and resources to implementing the EMS, and most aspects are effective. However, OR has not established sufficient processes to assess BJC's EMS, and the EMS is not integrated with one of BJC's key processes (i.e., AHAs). Additional attention is needed to determine whether FWENC needs to fully implement an EMS in accordance with DOE Order 450.1. EM/OR, BJC, and FWENC have devoted attention to improving the exposure assessment program and have made some progress. However, there are some implementation weaknesses and challenges associated with implementation of non-radiological workplace monitoring and documentation of exposure assessments in support of work activities.

F.4 Opportunities for Improvement

This Independent Oversight inspection identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive or mandatory. Rather, they are offered to the site 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.

OR

1. **Establish a proactive role in the assessment of beryllium hazards across all ORNL contractors.** Specific actions to consider include:

   - Ensure that all ORNL contractors have evaluated the potential for beryllium contamination and exposure within their facilities and operations.
   - Provide assistance to ORNL contractors in determining the applicability of the DOE Beryllium Rule (10 CFR 850) at their facilities.
   - Verify that contractor CBDPP plans are current and encompass all facilities and operations for which the contractor has assigned responsibility.

2. **Ensure that the required aspects of EMS are fully implemented by contractors and verified to be effective.** Specific actions to consider include:

   - Revise the self-assessment of the implementation of ISM performed by OR-AMEM to include EMS by updating the lines of inquiry to include EMS elements.
   - Fully evaluate the applicability of DOE Order 450.1 to the privatized TWPC contract and determine whether it should be incorporated into the next contract for operating the TWPC.

- Regardless of the decision on DOE Order 450.1 at TWPC, ensure that environmental expectations are clearly communicated to the TWPC contractor.

BJC and FWENC

1. **Improve the current exposure assessment programs and procedures to clearly communicate how the contractor intends to meet the exposure assessment requirements of DOE Order 440.1A.** Specific actions to consider include:

   - For BJC, document the requirements for performing and documenting exposure assessments.

   - For FWENC, provide policies and procedures that ensure compliance with the non-radiological exposure assessment requirements of DOE Order 440.1A.

2. **Improve the accountability and tools for line management responsibility for conducting non-radiological workplace exposure assessments.** Specific actions to consider include:

   - Include in each line manager's performance appraisal accountability for conducting and documenting workplace exposure assessments.

   - Require line managers to develop as low as reasonably achievable (ALARA)-type goals for conducting and documenting exposure assessments.

   - Ensure that industrial hygiene resources assigned to line management are sufficient and are allocated based on the health risks to workers.

   - Include workplace exposure assessments as a self-assessment to be conducted by line managers.

BJC

1. **Ensure that the pending revisions incorporating environmental compliance and waste management elements into the AHA process are implemented in specific work-related activities.** Specific actions to consider include:

   - Implement the revised AHA process that includes environmental compliance and waste management hazards analysis and the incorporation of controls, including P2/WM.

   - Revise the STARRT card to include key environmental compliance and waste management topics.

   - Use environmental compliance and waste management support personnel during the AHA process to ensure that job-specific environmental aspects and their controls are fully addressed in work-related instructions.

FWENC

1. **Evaluate the elements of an EMS as defined in DOE Order 450.1 as a guide for implementation at the TWPC.** Specific actions to consider include:

   - Perform a gap analysis against DOE Order 450.1.

   - Identify and implement elements that would enhance environmental protection.

Abbreviations Used in This Report (Continued)

FRAM	Functions, Responsibilities, and Authorities Manual
FSAR	Final Safety Analysis Report
FWENC	Foster Wheeler Environmental Corporation
FY	Fiscal Year
GAAT	Gunite and Associated Tanks
HEPA	High-Efficiency Particulate Air
I&C	Instrumentation and Control
ICATS	Issues and Corrective Action Tracking System
IHAS	Industrial Hygiene Analytical System
ISM	Integrated Safety Management
ISMS	Integrated Safety Management System
IVR	Implementation Verification Review
JCO	Justification for Continued Operation
JHA	Job Hazards Analysis
LCO	Limiting Condition of Operation
LLW	Low-Level Waste
MIP	Maintenance Implementation Plan
MEL	Master Equipment List
MSDS	Material Safety Data Sheet
MSRE	Molten Salt Reactor Experiment
NCR	Non-Conformance Report
NDE	Non-destructive Evaluation
NFPA	National Fire Protection Association
NFS	Nuclear Facility Safety
NTS	Nevada Test Site
ORPS	Occurrence Reporting and Processing System
OR	Oak Ridge Office
OR-AMEM	Oak Ridge Office – Assistant Manager Environmental Management
ORNL	Oak Ridge National Laboratory
ORR	Operational Readiness Review
OSHA	Occupational Safety and Health Administration
OJT	On-the-Job Training
P2/WM	Pollution Prevention/Waste Minimization
PISA	Potentially Inadequate Safety Analysis
PPE	Personal Protective Equipment
PRC	Project Review Committee
QA	Quality Assurance
QAP	Quality Assurance Plan
R&D	Research and Development
RBA	Radiation Buffer Area
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RWP	Radiation Work Permit
SAR	Safety Analysis Report
SBD	Safety Basis Document
S/CI	Suspect/Counterfeit Item
SDD	System Description Document
SER	Safety Evaluation Report
SMART	Safe Maintenance and Repair Task
SME	Subject Matter Expert
SPO	Security Police Officer
S/RID	Standards/Requirements Identification Document
SSCs	Structures, Systems, and Components
SSA	Office of Security and Safety Performance Assurance
SSO	Safety System Oversight
STARRT	Safety Task Analysis Risk Reduction Talk
STSM	Senior Technical Safety Manager
SWP	Safe Work Permit
SWSA	Solid Waste Storage Area
TQP	Technical Qualification Program
TSR	Technical Safety Requirement
TWPC	Transuranic Waste Processing Center
USQ	Unreviewed Safety Question
USQD	Unreviewed Safety Question Determination
UT	University of Tennessee
WIPP	Waste Isolation Pilot Plant
WOCC	Waste Operations Control Center