Office of Independent Environment, Safety, and Health Oversight
Environment, Safety and Health

Special Review of the

Rocky Flats Closure Project Site

April 2001

ISM

Integrated Safety Management

Table of Contents

See inside back cover for abbreviations used in this report.

OVERSIGHT

Executive Summary

EVALUATION:	Office of Independent Environment, Safety, and Health Oversight Special Review
SITE:	Rocky Flats Closure Project
DATES:	February-March 2001

Scope

The U.S. Department of Energy (DOE) Office of Independent Environment, Safety, and Health Oversight (EH-2) performed a Special Review at the Rocky Flats Closure Project (RFCP). The Special Review was conducted at the request of the DOE Rocky Flats Field Office (RFFO), which had analyzed recent events and determined that improvements were needed in safety management and performance at RFCP. Kaiser-Hill Company, LLC (KH) is the prime contractor for RFCP. Consistent with RFFO's request, EH-2 focused on two areas of concern:

- **Implementation of the Integrated Work Control Process (IWCP) and Line Management Oversight.** RFCP uses the IWCP, along with institutional safety and health procedures, to apply the DOE integrated safety management system to work activities at its facilities. Because of recent events (e.g., spills and occurrences) and recurring deficiencies in work planning and control, RFFO requested that EH-2 evaluate IWCP and the effectiveness of KH and RFFO line management oversight in addressing work control deficiencies. EH-2 examined application of IWCP in two major RFCP facilities: the 371/374 Closure Project and the 776/777 Closure Project.

- **Internal Dose to Workers in Building 771.** An air sampler in a containment tent was discovered to be past due for calibration on October 17, 2000, by an RFFO Facility Representative, prompting KH to collect fecal bioassay samples from 11 workers associated with work activities in the containment tent. Ten of these bioassays were positive for internal intake of plutonium. Subsequently, in response to a KH offer to test other personnel, 46 workers voluntarily submitted samples and 28 of them tested positive for plutonium intake. These unexplained intakes among a number of Building 771 workers prompted KH to conduct an investigation and RFFO to request the independent EH-2 review of the internal doses.

EH-2 formed two separate teams to conduct separate reviews of the two concerns above. The onsite reviews were conducted in February-March 2001 and the results were analyzed jointly to identify the Safety Issues and Opportunities for Improvement.

Results

Using a project-oriented approach and the IWCP, RFCP has made progress toward the cleanup and closure of the site and the elimination of legacy hazards to workers, the public, and the environment. For example, decontamination and decommissioning of Buildings 771 and 776/777 are well under way, and RFCP recently completed its 100th waste shipment to the Waste Isolation Pilot Plant.

RFFO and KH are aware that the causes of recent internal doses and events need to be addressed, and had implemented or initiated several enhancements prior to this EH-2 independent review. For example, KH is emphasizing line management presence at the workplace and striving to establish a work environment that allows the worker to focus on safe execution of the work, rather than on the time it takes to accomplish the work. Two noteworthy practices (i.e., advanced decontamination and decommissioning training and practices for managing schedule pressures) identified on this review are shown in Table ES-1.

Although RFFO and KH have made several enhancements and others are ongoing, RFCP faces significant challenges in completing the increasingly complex and hazardous

decontamination and decommissioning activities according to the accelerated closure schedule. For example, facility conditions are not always well characterized because of historical events (e.g., fires that spread contamination throughout the facility, and accumulations of plutonium in ductwork and process equipment), and decontamination and decommissioning activities involve many one-of-a-kind tasks with unique hazards. RFFO and KH also face challenges in maintaining a technically competent Federal and contractor workforce in light of the planned 2006 closure date.

Integrated Work Control Process. Many aspects of the RFCP IWCP are functioning effectively. In addition, KH has selected and empowered well-qualified Project Managers. The presence of Project Managers, Deputy Project Managers, Responsible Managers, supervisors, and foremen at the workplace is evident. The workforce is experienced, and worker involvement in work planning is increasing. In addition, the KH Work Control Director is taking several actions to correct programmatic and implementation deficiencies in the IWCP. For example, draft revisions to the job hazards analysis process and craft work documentation process have been developed and are undergoing review, and a RFCP self-identified problem with "troubleshoot-and-repair" work packages is being resolved through changes to the planning process and additional instructions to the craft workers.

If effectively implemented, the RFCP IWCP provides a sound process for ensuring that work is performed safely. However, RFCP has experienced a number of events in the past year (e.g., occurrences, near misses, spills, contamination events, criticality safety procedural non-compliance, and violations of technical safety requirements). Most events resulted from failure to follow procedures and safety controls, failure to stop work when questions about safety requirements and controls arose, or working outside the scope of procedures and work packages. Fortunately, the recent events have not caused any serious injuries; however, some have resulted in near misses and unnecessary radiation exposures and could be precursors to more serious events.

Several factors contribute to the recurring events. Although workers understand that they are empowered to stop work when an unsafe condition is encountered, the recent events indicate that workers do not clearly understand or accept the need to stop work when a procedure or safety control is unclear or cannot be implemented as written. In some cases, deficiencies in programs, such as job hazards analyses, radiological work permits, and training, are hindering establishment of clear and effective work controls that apply to the specific work activity.

Line Management Oversight. RFFO and KH have reacted to the recent discovery of plutonium intakes and completed a number of actions, including RFFO's direction that KH develop a comprehensive corrective action plan to improve safety performance and KH's completion of the investigation of the unplanned internal doses in Building 771. RFFO and KH have also taken action to curtail operations and develop corrective actions when events indicate specific performance problems that could impact safety. Several operations were curtailed during this review.

However, senior RFFO and KH management involvement is often driven by reaction to events, and RFFO and KH line management oversight programs are not proactive and are not well coordinated. While RFFO and KH both have some effective assessment systems in place, neither organization is performing sufficient, formal, programmatic assessments or carefully analyzing the assessment data. As a result, senior RFFO and KH managers are not getting sufficient information to proactively address root causes and prevent events. In addition, management has not always ensured that effective corrective actions are developed and implemented. Some aspects of KH institutional line oversight of environment, safety, health, and quality program implementation has been fragmented as the project-oriented organization was established. Accountability for rigorous performance of the RFFO line management oversight program manual requirements has been lacking in some areas.

Internal Doses at Building 771. KH analysis indicates that worker exposures to plutonium were well below the regulatory limits. Exposures were found to be approximately 2.5 percent of the maximum allowable annual regulatory limit. The EH-2 Team reached conclusions similar to the KH analysis, concluding that the exposures experienced by the workers in Building 771 were primarily chronic in nature and occurred due to routine intake from ambient levels caused by either semi-continuous activities or multiple small events.

Weaknesses were evident in several aspects of radiological controls, including workplace indicators, radiological work permits, airborne monitoring, radiological control technician performance, and radiological control technician supervision. Collectively, these weaknesses indicate that RFCP may not be able to demonstrate that it is meeting the requirement to

control radiation exposures in accordance with the "as low as reasonably achievable" (ALARA) principle. In addition, RFCP has not fully identified and characterized chronic internal exposures.

Some weaknesses were also evident in permanent and temporary ventilation systems used to control airflow and contain contamination. Inadequate engineering planning and consideration for the degraded condition of the Building 771 ventilation system challenges the system's capability to confine plutonium and ensure the proper direction of contaminated airflow during decontamination and decommissioning activities. The use of temporary ventilation systems, such as portable air movers and containment tents, does not always provide adequate ventilation to ensure that contamination in the worker's breathing zone is minimized. For example, tent boundaries were left open (e.g., equipment would not fit within the tent), potentially compromising the tent's engineered ventilation boundary. Also, RFCP has not fully characterized contamination levels in certain areas of Building 771, such as overhead areas and areas that were historically seldom entered.

KH has taken several actions to reduce worker doses. For example, all intrusive decontamination and decommissioning work in Building 771 must be performed with respiratory protection to minimize potential internal exposures. Deficiencies in radiological control technician performance were addressed by replacing the Building 771 radiation protection manager, retraining technicians, and hiring three additional radiological control supervisors.

Safety Issues. Six new Safety Issues were identified during this EH-2 review that require a formal corrective action plan in accordance with DOE Order 414.1A, *Quality Assurance*. The Safety Issues are shown in Table ES-2, including a reference to the report sections that provide more detailed information about each Safety Issue. RFCP has several appropriate ongoing enhancements that address many of the weaknesses, including enhancements to the IWCP. However, strong management commitment and increased line oversight will be required to ensure full and effective implementation of the RFCP IWCP and supporting programs and to prevent recurring performance deficiencies.

Conclusions

RFCP's project-oriented approach and aggressive scheduling have resulted in significant progress in the decontamination and decommissioning of RFCP facilities and stabilizing and removing legacy hazards, which will reduce hazards to the public, workers, and environment. Some projects have instituted innovative measures to manage the balance between safety and mission/schedule priorities, such as the Building 776 practices for minimizing the impact of day-to-day schedule pressure on safety. However, some aspects of institutional programs and line management oversight processes have been fragmented and degraded. RFFO and KH need to continue to focus on implementing effective institutional safety programs, and crosscutting and coordinated line oversight to ensure that all individual projects fully and effectively implement safety requirements; furthermore, they need to take timely and effective corrective actions when deficiencies are identified.

To this end, strong management attention is needed to improve *implementation* of the IWCP, including rigorous procedural adherence and controls tailored to the work activity. Improvements in institutional programs, such as lessons learned, training, job hazards analyses, radioligical work permits, workplace indicators, air monitoring, and engineered controls, are needed to ensure that hazards and controls are clearly identified and understood and that safety programs are properly implemented. Continued management emphasis is needed to enhance the radiological protection program and adapt it to the continually changing hazards as decontamination and decommissioning efforts progress, including critical programmatic reviews by qualified radiological protection professionals. Further, improvements in RFFO and KH management assessments, feedback programs, trend analysis, and corrective action programs are necessary to ensure that senior management receives the information needed to facilitate continuous improvement and prevent recurrences. Increased accountability for effective safety performance and procedural use and adherence is needed at all levels of RFFO and KH. Senior RFFO and KH managers also need to continue efforts, such as the partnering initiative, for communicating safety expectations and jointly reviewing safety performance on a regular basis.

RFFO and KH management recognize that safety management and performance require improvement at RFCP in several areas, including IWCP, radiological controls, and line management oversight. RFFO communicated its concerns in a January 5, 2001, memorandum that required KH to develop a corrective action plan. KH is making progress in addressing RFFO's concerns, as well as those that were self-

identified. However, KH improvement initiatives are in various stages of development and implementation, and their effectiveness has not yet been fully demonstrated across all RFCP Closure Projects.

RFFO was proactive in requesting this Special Review, and RFFO and KH have been responsive to the identified Safety Issues and other deficiencies noted during the Special Review. RFFO and KH had identified similar weaknesses and have already initiated actions to address some of the deficiencies identified during this review. The Safety Issues and Opportunities for Improvement identified in this report are intended to support RFFO's and KH's efforts to prevent accidents that could impact the public, workers, or environment, and to avoid costly operational curtailments that could impede important RFCP efforts to stabilize hazardous materials and remove legacy hazards in a timely manner.

Table ES-1. Noteworthy Practices

Noteworthy practices are particularly effective or innovative activities or programs that enhance safety. Other DOE sites obtain information about noteworthy practices and consider adapting them to their facilities. Two noteworthy practices were identified on this EH-2 Special Review:

- 776/777 Closure Project Managers have implemented measures that are designed to establish an environment where workers can focus on the safe execution of work, rather than day-to-day schedule pressures. They have effectively implemented an innovative practice in which detailed schedule information is not routinely provided to workers or their foremen. This practice is intended to ensure that workers are empowered to stop work if a safety concern is identified and do not feel pressure to sacrifice safety to meet day-to-day deadlines. In this approach, Project Managers have the responsibility to monitor worker's progress in meeting schedule milestones, and are empowered to provide additional work planning and engineering support to work crews that fall behind the schedules established by management. (See Section 2.2 and Core Function #5 in Appendix B.)

- The training course for decontamination and decommissioning workers promotes safety. The extensive use of realistic mockups allows the workers to practice potentially hazardous activities and verifies the workers' ability to safely perform the tasks before conducting them in a hazardous facility. RFCP also emphasizes a team approach for training decontamination and decommissioning workers, where the individuals train and practice with the same group with whom they work in the facilities. (See Section 2.2 and Core Function #4 in Section 2.3 and Appendix B.)

Table ES-2. Safety Issues

DOE Order 414.1A, *Quality Assurance*, establishes a process for addressing and tracking Safety Issues identified by independent oversight evaluations. As used in that Order, the term "Safety Issue" refers to deficiencies in safety programs or weaknesses in safety management systems that require formal tracking and corrective action. The DOE Office of Environmental Management, as the lead program secretarial office, is required to develop a corrective action plan to address the Safety Issues identified during this EH-2 Special Review.

- **Safety Issue #1.** IWCP implementation is not always adequate to ensure that controls are consistently tailored to the specific work performed, that work instructions are clear and include appropriate hazard information, and that work is performed in accordance with the defined scope and controls as required by DOE Policy 450.4, *Safety Management System Policy,* and the RFCP IWCP. (See Section 4 for information that supports this Safety Issue, and Section 2.3 and Appendices A and B for related information.)

- **Safety Issue #2.** Some training program requirements and a number of KH institutional safety requirements and responsibilities described in the Occupational Safety and Industrial Hygiene Manual are not being adequately implemented. (See Section 4 for information that supports this Safety Issue, and Section 2.3 and Appendices A and B for related information.)

- **Safety Issue #3.** Some KH feedback and improvement mechanisms have not been clearly defined and rigorously implemented to provide management with the performance data necessary to prevent recurring events, correct unsatisfactory performance, and drive continuous improvement, as required by DOE Policy 450.5, *Line Environment, Safety and Health Oversight,* and DOE Order 414.1A, *Quality Assurance.* (See Section 4 for information that supports this Safety Issue, and Section 2.2 and Core Function #5 in Section 2.3 and Appendices A and B for related information.)

- **Safety Issue #4.** The RFFO line management oversight program does not meet DOE Policy 450.5, *Line Environment, Safety and Health Oversight,* requirements for conducting coordinated and integrated environment, safety, and health line oversight of the contractor and maintaining sufficient knowledge of program activities to enable informed decisions on safety resources. (See Section 4 for information that supports this Safety Issue and Section 2.2 for related information.)

- **Safety Issue #5.** Because of weaknesses in identifying and characterizing radiological conditions in control areas such as workplace indicators, radiological work permits, and airborne monitoring, RFCP may not be demonstrating that worker exposures are as low as reasonably achievable. (See Section 4 for information that supports this Safety Issue and Section 3.2 for related information.)

- **Safety Issue #6.** Insufficient engineering planning and consideration for the degraded condition of the Building 771 ventilation system challenges the system's capability to confine plutonium and ensure the proper direction of contaminated airflows during decontamination and decommissioning activities as required by DOE Order 420.1, *Facility Safety*. The use of temporary ventilation systems has not been controlled to minimize the potential for plutonium intakes. (See Section 4 for information that supports this Safety Issue and Section 3.3 for related information.)

1.0 Introduction

The U.S. Department of Energy (DOE) Office of Independent Environment, Safety, and Health Oversight (EH-2), within the Office of Environment, Safety and Health, conducted an independent oversight Special Review at the Rocky Flats Closure Project (RFCP). The Special Review was conducted at the request of the Rocky Flats Field Office (RFFO), which is the DOE organizational element with responsibility for the RFCP (formerly known as the Rocky Flats Environmental Technology Site). Kaiser-Hill Company, LLC (KH) is the prime contractor for the RFCP.

EH-2's Special Review at the Rocky Flats Closure Project (RFCP) focused on two concerns identified by the Rocky Flats Field Office (RFFO).

RFFO specifically requested that EH-2 review two distinct areas of concern:

- **Implementation of the Integrated Work Control Process (IWCP) and Line Management Oversight.** RFCP uses the IWCP to apply the DOE integrated safety management (ISM) system to work activities at its facilities. A number of events (e.g., occurrences, near misses, spills, contamination events, and violations of technical safety requirements) in the past year caused RFFO to have concerns about the effectiveness of IWCP at the RFCP. Because some of the events indicated continuing and recurring deficiencies in work planning and control, RFFO also had concerns about the effectiveness of KH's line management oversight in identifying and correcting the root causes of deficiencies.

- **Internal Dose to Workers in Building 771.** In October 2000, a RFFO Facility Representative discovered that an air sampler in a Building 771 containment tent was past due for calibration, prompting KH to collect fecal samples from 11 workers who had worked at that tent. These bioassay results showed that the 11 workers had experienced internal intakes of plutonium. Subsequent samples showed that other workers also tested positive. These bioassay results prompted KH to charter an investigation to determine the causes of the internal doses and identify measures to prevent recurrences. RFFO requested that EH-2 independently evaluate the internal exposures and radiological protection controls in Building 771.

EH-2 modified its appraisal schedule to accommodate RFFO's request. EH-2 formed two separate teams to conduct separate reviews of the two concerns above. One EH-2 team reviewed IWCP, line management oversight, and selected institutional systems from February 20 to March 2, 2001. Section 2 of this report provides the results of the review of IWCP and line management oversight. Another EH-2 team performed an onsite review of the internal doses from February 5 to 16, 2001, and subsequently reviewed the KH investigation report, which was issued on March 15, 2001. Section 3 of this report discusses the results of the review of the internal exposures in Building 771. The two teams then jointly analyzed the results to develop the Safety Issues and Opportunities for Improvement in this report. Section 4 presents the Safety Issues identified during this EH-2 Special Review. Section 5 provides Opportunities for Improvement for consideration by RFFO and KH management.

This report includes four appendices. Appendix A provides detailed results of the evaluation of IWCP for the 371/374 Closure Project using the framework of the five core functions of ISM. Appendix B provides the corresponding results for the 776/777 Closure Project. Issues resulting from this review are summarized in Appendix C. The composition of the two EH-2 teams is provided in Appendix D.

The purpose of this Special Review was to provide feedback to RFFO and Kaiser Hill (KH).

The primary purpose of this Special Review was to provide feedback to RFFO and KH line management. Throughout the evaluation, EH-2 emphasized identifying the factors that contribute to deficiencies and opportunities to improve the existing systems and safety performance. Although the EH-2 field review activities focused on selected Closure Projects, many of the results may be applicable to other Closure Projects at RFCP. RFFO and KH should review the results, including the identified Safety Issues, across all projects to determine whether the results apply to other Closure Projects. Similarly, the Opportunities for Improvement should be considered for applicability and usefulness across the site, not just in the Closure Projects reviewed on this Special Review.

Aerial View of the RFCP

OVERVIEW OF THE ROCKY FLATS CLOSURE PROJECT (RFCP)

SITE: RFCP covers 6,262 acres (approximately 10 square miles). It is located about 16 miles northwest of Denver, Colorado.

MISSION: RFCP's current missions include special nuclear material management, site cleanup, environmental restoration, and decontamination and decommissioning (D&D) of facilities. Activities include plutonium and uranium repackaging, stabilization, and shipments off site to minimize hazards of the material remaining on site; treatment and disposal of low-level, transuranic, and non-radioactive hazardous waste; and D&D of buildings formerly used in nuclear materials production activities.

SITE MANAGEMENT: The lead program secretarial office is the DOE Office of Environmental Management, which has program responsibility for waste management and environmental cleanup efforts at RFCP. The DOE Office of Defense Programs has program management responsibilities for ongoing storage and protection of special nuclear material. The Rocky Flats Field Office manages activities at RFCP. The Kaiser-Hill Company, LLC (a partnership between ICF-Kaiser and CH_2M Hill) is the prime contractor for RFCP.

2.0 Focused Review of the Integrated Work Control Process and Line Management Oversight

EH-2 reviewed the IWCP, line management oversight, and selected aspects of institutional programs and management systems as they are applied in the 371/374 and 776/777 Closure Projects. The 371/374 Closure Project encompasses Buildings 371 and 374 (which are adjacent and connected) and auxiliary buildings and support equipment/utilities in the Building 371/374 complex. The 776/777 Closure Project encompasses Building 776/777 as well as auxiliary buildings and equipment. The Building 371/374 complex is undergoing decontamination and decommissioning (D&D), and is currently used to store and stabilize plutonium, process liquid wastes, process residues, package waste, and certify waste materials for offsite shipment. Building 776/777 is undergoing D&D, including activities such as deactivation and removal of gloveboxes.

EH-2 reviewed activities in the RFCP 371/374 and 776/777 Closure Projects.

EH-2 selected the 371/374 and 776/777 Closure Projects in order to evaluate RFCP facilities that perform different types of activities and the implementation of IWCP by several different KH projects and organizational elements. The 371/374 Closure Project was also chosen because it has diverse missions and activities including operations, nuclear materials handling, deactivation, D&D activities, and waste processing operations. Therefore, the 371/374 Closure Project faces more challenges with coordination and integration of activities than other Closure Projects with a single mission (e.g., D&D). The review included observations of work activities and operations, facility and equipment walkdowns, interviews, document reviews, and examination of safety management program elements (e.g., conduct of operations, industrial safety/industrial hygiene, maintenance, nuclear material accountability, and radiation protection). EH-2 also examined selected aspects of training and qualifications and institutional safety programs. The EH-2 Team coordinated with RFFO to ensure that the scope of the Special Review was appropriate to provide feedback to RFFO management.

This section includes background (Section 2.1) on the factors and events that led to this evaluation. It discusses line management oversight and other selected management systems (Section 2.2) and provides EH-2's evaluation of the effectiveness of the IWCP process in meeting DOE's five core functions of ISM (Section 2.3). The Safety Issues identified during this Special Review are presented in Section 4.

Aerial View of Building 371/374

2.1 Background

A May 1999 EH-2 Focused Safety Management Evaluation determined that RFCP had made improvements in safety management and established a positive trend. However, several Safety Issues were identified in such areas as training programs and adherence to procedures. In addition, the IWCP process was in the developmental stage and had not been fully implemented. Since 1999, RFCP has implemented IWCP and made several revisions based on operating experience. RFCP has also successfully completed their Phase I and II ISM verification reviews, and declared ISM implemented in January 2000.

RFCP has experienced changes in operations and management.

During the two years between the May 1999 evaluation and this March 2001 Special Review, there have been several important changes in RFCP operations and management infrastructure. These include:

- **A new contract with substantially different provisions and incentives**. RFCP transitioned from a management and integration contract, in which a large fraction of the work was performed by subcontractors, to the DOE's first "closure contract." The new contract, which became effective in February 2000, involves six major projects that will be performed by KH and includes various incentives for completing these projects on schedule, including incentive fees for site closure by 2006. It also has contractual provisions for financial penalties for poor safety performance.

Contamination and Damage Following a 1969 Fire in Building 776/777

- **Accelerated schedules and changing work.** RFCP has made progress on the cleanup effort in the past two years, with a focus on completing cleanup efforts prior to the 2006 closure date. The D&D of Buildings 776/777 is well under way, and RFCP recently completed its 100th waste shipment to the Waste Isolation Pilot Plant. The accelerated schedules call for numerous concurrent work activities. Much of the work is one-of-a-kind D&D rather than repetitive operations, necessitating development of tailored job hazards analyses (JHAs) and job-specific application of procedures. Work is performed in facilities that are changing and not always well characterized because of historical events (e.g., fires that spread contamination) and weaknesses in configuration management.

- **Personnel turnover and changing roles**. In the past two years, KH has hired many new Project Managers and safety professionals. Also, a number of safety, project, and facility personnel have joined KH (e.g., former subcontractors were hired in the change from a management and integration contract to a single-contractor closure contract). KH has modified assignments and responsibilities for many safety professionals and line managers as it established the six semi-autonomous projects and reorganized its workforce accordingly. Turnover of key personnel with safety responsibilities at RFFO has been high and resulted in changes in management approaches, priorities, and direction.

During calendar year 2000, RFCP experienced a number of events, near misses, and occurrences. While none of these events resulted in serious injuries, they prompted RFFO to question the adequacy of KH's safety performance. RFFO issued fee reduction penalties in accordance with the provisions of the closure contract in three cases: $60,000 in February 2000 for upsets to the Building 371/374 ventilation system that resulted in spread of contamination, $100,000 in June 2000 for waste drum handling incidents, and $250,000 in November 2000 for inadequate work control and inadequate implementation of the IWCP that contributed to August-October events in the 771 and 776/777 Closure Projects. KH experienced additional events in December 2000, including two criticality safety limit infractions in Building 707. The August-October 2000 events in the 771 and 776/777 Closure Projects and the December 2000 criticality safety infractions in Building 707 focused RFFO and KH attention on work planning and control deficiencies and raised questions about the adequacy of IWCP implementation. Corrective actions were developed and implemented for these events.

Recent events prompted RFFO to take actions to address deficiencies in integrated work control process (IWCP) implementation.

These events prompted the RFFO Manager to send a memorandum to the KH President on January 5, 2001. In that memorandum, RFFO raised concerns about the

adequacy of several aspects of KH safety management performance, including work control, procedure adherence, lessons learned, root cause analysis, understanding of roles and responsibilities, and KH's line management oversight and assessments. RFFO also directed KH to complete corrective actions before resuming certain operations, which KH had voluntarily suspended following the events. KH's action plan in response to the January 5, 2001, RFFO memorandum was finalized and provided to RFFO on April 18, 2001.

RFCP experienced additional events in the past few months. Examples of events that involved the 371/374 and 776/777 Closure Projects are:

- On January 4, 2001, while non-actinide process cooling water was being drained from a tank in the 371/374 Closure Project, two receiving tanks under the control of the Facility Management organization were overfilled, spilling approximately 20 gallons of cooling water and spreading existing contamination within a Radiological Buffer Area.

- On February 20, 2001, the two-person surveillance requirement was violated when a can of Category I special nuclear material was moved between two rooms in Building 371. Several other procedural violations in the nuclear material control and accountability program were also identified, leading to a decision to cease nuclear material handling operations in the 371/374 Closure Project to address concerns and interfaces with this program.

- A drum generated by the 371 Residue Project that was thought to be empty was received by Building 771 Waste Packaging personnel on March 2, 2001. However, a high-resolution gamma scan indicated that the drum contained 8 to 12 grams of plutonium residue. On March 6, 2001, three additional drums from the same shipment were discovered to contain gram quantities of plutonium and thus needed to be categorized as transuranic waste rather than low-level waste. Storing transuranic waste drums outside Building 771 was not in compliance with the authorization basis.

- Several events involving energized electrical sources, radiological intakes, and criticality infractions also occurred.

For each of the events, KH has developed, or is developing, corrective actions. Some corrective actions are complete and others are in progress.

2.2 Line Management Oversight and Selected Other Management Systems

Consistent with RFFO's request, this EH-2 review included a review of KH's line management oversight programs as applied to the 371/374 and 776/777 Closure Projects. This section focuses on KH institutional processes, such as KH independent assessments, quality assurance reviews, and institutional corrective action and lessons-learned programs. Project-level processes (e.g., self-assessments) are discussed in the core function evaluations in Section 2.3 and Appendices A and B. During the assessment, EH-2 also decided to review selected aspects of KH's institutional and project-level training and qualifications programs because information collected early in the review indicated some problems in qualification records. EH-2 also reviewed selected aspects of RFFO line management oversight processes at RFFO's request.

KH Line Management Oversight and Other Management Systems

Many aspects of KH management systems that support IWCP are functioning effectively. In general, RFCP has knowledgeable and experienced Project Managers and workers. Most safety roles and responsibilities are clearly defined and are understood by managers and safety professionals. In most cases, safety requirements are identified in site manuals and procedures, and processes are in place to identify new and modified safety requirements. Significant resources and effort have been devoted to maintaining and updating the site hazards analyses, including safety analysis reports and authorization basis documents (e.g., the basis for interim operations). In several cases, KH has demonstrated that it places high priority on safety. For example, a March-June 2000 slowdown of certain activities was self-imposed by KH management (i.e., not mandated by RFFO) to ensure that projects had established appropriate management systems to safely conduct project work. In another instance during this review, KH curtailed all nuclear material handling activities to address nuclear material control and accountability interfaces and actions. KH senior management has accepted the significant adverse cost and schedule impacts of these actions.

RFCP has made enhancements in the past year.

Enhancements in the past year resulted in improvements in implementing IWCP and are contributing to safety of operations and work activities. For example:

- The work observed by the EH-2 Team in both the 371/374 and 776/777 Closure Projects was conducted with a high regard for safety. While there were limited opportunities to observe work in the 371/374 Closure Project because of the stand-downs of certain operations and the site work schedule, the work observed in both Closure Projects was conducted safely. Furthermore, RFCP personnel made appropriate decisions when procedural or safety-related questions arose during the execution of a work package.

- 776/777 Closure Project Managers have implemented measures that are designed to establish an environment where workers can focus on the safe execution of work, rather than day-to-day schedule pressures. In addition to providing clear expectations for safety, safety performance rewards, and sanctions for unsafe practices, 776/777 Closure Project management has effectively implemented an innovative practice in which detailed schedule information is not routinely provided to workers or their foremen. This practice is intended to ensure that workers are empowered to stop work if a safety concern is identified and do not feel pressure to sacrifice safety to meet day-to-day deadlines. In this approach, Project Managers have the responsibility to monitor progress of the work crews in meeting schedule milestones, and are empowered to provide additional work planning and engineering support to work crews that fall behind the schedules established by management. The effective implementation of this approach is a **Noteworthy Practice**[1].

- The presence of Project Managers, Deputy Project Managers, and foremen at the workplace is evident. RFCP has worked to reduce the administrative burden on managers and supervisors so that they can spend more time observing work, coaching subordinates, and ensuring that safety controls are implemented.

- RFCP is increasingly utilizing the experienced workforce early in work planning and has had success in using the workers to identify potential hazards and controls.

- Certain aspects of worker training are enhancing safety. RFCP provided training on IWCP, procedures, and procedural compliance to its workers in fiscal year (FY) 2000. As discussed elsewhere in this section, aspects of the RFCP training for D&D activities are particularly effective in ensuring that workers have an opportunity to train and practice as a team using mockups before performing potentially hazardous activities in the field.

- The IWCP is maturing and provides a good framework for accomplishing work safely. The recent revision (Revision #3) to the IWCP has led to improvements in work packages. The assignment of "Responsible Managers" for each work package has strengthened accountability and reduced the number of errors. If effectively implemented, the RFCP IWCP provides an effective mechanism for ensuring that work is performed safely. Additional improvements to the IWCP are in progress.

While some enhancements were made in response to each event, the recent events indicate that the enhancements have not fully addressed the root causes of recurring procedural adherence failures and IWCP implementation deficiencies. EH-2's review of the IWCP, recent events, and current processes and procedures identified six Safety Issues (see Section 4).

KH Line Management Oversight and Feedback and Improvement Processes. KH has several feedback and improvement systems at the institutional level and within the various projects. Institutional processes have been established to perform independent environment, safety, and health (ES&H) assessments, track corrective actions, and communicate lessons learned. These processes include approximately 16 designated institutional safety management programs, such as organization and management, criticality safety, work control, and waste management.

[1] Noteworthy practices are particularly effective or innovative activities or programs that enhance safety. Other DOE sites obtain information about noteworthy practices and consider adapting them to their facilities.

Some aspects of the KH line management oversight processes are effectively implemented.

Some aspects of institutional processes are effectively implemented. Formal root cause analyses are comprehensive. Price-Anderson Amendments Act non-compliance dispositions, significant events, and major DOE-identified issues receive focused resources and KH management attention. The "Fix-It-Once" process provides an effective forum for developing effective corrective action plans and recurrence controls for Price-Anderson Amendments Act issues. Many lessons learned are being shared through timely publications to the workforce and incorporation into work documents.

Although RFCP has some elements of an effective institutional line management oversight program, several deficiencies hinder overall effectiveness. **Safety Issue #3** in Section 4 identifies specific deficiencies in utilization of the corrective action program, effectiveness of institutional-level assessments, development and utilization of lessons learned, adequacy of KH independent oversight assessments, and accountability for performing self-assessments. In many cases, the KH institutional assessments have identified deficiencies but have not been fully effective in ensuring that identified deficiencies are addressed and that corrective actions are verified to be effective.

KH institutional assessments have not always resulted in effective corrective actions.

Many of the deficiencies in the feedback and improvement systems occur because KH senior management has not ensured that the institutional program is effectively coordinated, formalized, and implemented as required. As a result, some aspects of the program are not effective in ensuring that identified deficiencies are communicated, tracked, and resolved. Institutional processes, such as Quality Assurance and KH Independent Safety Oversight assessments, institutional analysis and trending of deficiencies, tracking of corrective actions, and dissemination of lessons learned, are not effectively implemented or coordinated with project-level processes. Further, some institutional and project-level procedures are out of date or not rigorously implemented, and many project-level processes are not formalized in procedures. Lack of clear senior management expectations, weak institutional ownership, and insufficient accountability for performance have contributed to the weaknesses in some aspects of the KH line oversight program.

The institutional processes have not ensured consistently effective project-level corrective actions. For example, unclear instructions and/or procedures and insufficient inter-organizational coordination were contributing factors for several of the recent events, but the corrective actions did not adequately address these factors. The initial corrective actions for the February 20, 2001, material control violation and the March 2001 waste drum event did not fully address the weaknesses in clarity of instructions and organizational interfaces that contributed to the events. In addition, in several instances, KH project personnel have used less-than-optimal mechanisms to implement corrective actions. For example, corrective actions for deficient procedures have been issued through memoranda or supplemental orders (e.g., Operations Orders-371/374-164 to address "empty" drum deficiencies) rather than by promptly correcting the deficient procedure. Multiple control documents make it more difficult for workers to understand the applicable requirements and controls and increase the likelihood of performance errors. Subsequent corrective actions are now addressing the organizational issues and should improve interfaces between the various material entities within the building.

Many of the identified problems in training program implementation (discussed later) were identified in internal and/or external assessments. However, some corrective actions have not been completed. Further, the corrective actions for training problems often focused on fixing or encouraging management use of training documentation rather than correcting potential problems in performance and competence. For example, a December 2000 KH management assessment program review identified a significant number of 776/777 Closure Project staff with delinquent training courses, but the initial corrective action focused on improving management understanding of the training program documents rather than ensuring that training was current. KH has developed a revised corrective action plan to comprehensively address training problems.

As discussed in Appendices A and B, project-level assessments and lessons-learned programs are generally effective. Project personnel have recognized that the institutional programs are not sufficiently effective in supporting their projects. In some cases, project personnel have developed supplemental processes, such as project-level tracking systems, that compensate for weak institutional programs. While these efforts mitigate

some of the problems, the weaknesses in the institutional programs lead to inconsistent and incompatible approaches across the projects (e.g., effective sitewide trending is not viable with the multiple tracking systems). KH needs to re-evaluate institutional line management oversight programs to ensure that they effectively support the project and provide for consistently effective programs across RFCP.

KH Staffing, Qualifications, and Training. RFCP has an experienced workforce and many qualified and knowledgeable environment, safety, health, and quality (ESH&Q) professionals. In addition, KH has brought in many well-qualified managers, including personnel with considerable commercial experience, to manage D&D activities. Workers generally demonstrated adequate competence to perform routine tasks. Work observed by the EH-2 Team was conducted with a high regard for safety.

KH recognizes that there are shortages of experienced staff in a few areas (e.g., industrial safety/industrial hygiene and work planners) and has taken steps, such as new hires, to enhance its staffing levels and capabilities. In addition, RFCP projects have undergone organizational and personnel changes in the past year, including numerous changes in key personnel in the Project Engineering, Quality & Compliance, Facility Management, and Facility Disposition organizations. KH recognizes that frequent changes in personnel and organization contribute to a loss of continuity in management direction. KH also recognizes that retaining key personnel will continue to be a challenge, particularly as site closure approaches and personnel seek job opportunities with a longer-term future.

KH has a noteworthy decontamination and decommissioning training program.

RFCP has developed an enhanced D&D training program that uses an appropriate balance of classroom training, hands-on training, and practice using mockups. It also focuses on applying the IWCP and ISM, incorporating lessons learned, and responding to abnormal events. Certain aspects of RFCP's training promote safety and constitute a **Noteworthy Practice**. Specifically, the extensive use of realistic mockups allows the workers to practice potentially hazardous activities and allows verification of the workers' ability to safely perform potentially hazardous D&D. RFCP also emphasizes a team approach to D&D training, in which the individuals train and practice with the same people with whom they work in the facilities.

D&D Training With Mockups

Although many aspects of training are effective, in some cases KH management has not devoted sufficient attention to the staff training program to ensure that required competencies are identified, achieved, and maintained. As a result, in the 776/777 Closure Project, many Lists of Qualified Individuals reflect a significant number of incomplete, inaccurate, and overdue training requirements, as discussed in **Safety Issue #2**. In some of these cases, the workers had completed the required training, but the administrative records were inaccurate. Also, the layout of the information is not conducive to readily identifying whether important training requirements are satisfied. These factors hinder the ability of RFCP managers and supervisors to use the list to verify the qualifications of their staff. In the 371/374 and 776/777 Closure Projects, work foremen did not adequately verify worker training and qualifications before the start of work for some jobs.

Ongoing and Planned KH Management Actions. Although various corrective actions are being made, RFCP faces significant challenges as it attempts to complete increasingly complex and hazardous D&D activities in accordance with the accelerated closure schedule. Maintaining a technically competent contractor workforce through the end of the Closure Project is also a recognized challenge.

KH management has initiated many enhancements to support IWCP.

KH management recognizes that further improvements are needed to preclude recurrences of events and ensure adherence to procedures and proper

implementation of IWCP. In coordination with RFFO, KH has implemented or initiated several enhancements, including:

- Reducing the administrative burden on supervisors and foremen to allow increased supervisory presence in the field
- Designating and training "Responsible Managers," who have overall responsibility and are engaged in IWCP work package development, review, approval, and execution
- Addressing integration of Material Stewardship within the 371/374 Closure Project using outside expertise for objective and independent advice on organizational needs
- Modifying procedures to incorporate nuclear material control and accountability requirements, and training workers and supervisors to implement those procedures at the 371/374 Closure Project
- Improving the integration of engineering in walkdowns and early planning
- Hiring additional planners with appropriate technical background to improve technical work instructions and engineering design information in work packages
- Establishing a work environment that allows workers to focus on the safe execution of the work, rather than on the time it takes to accomplish the work
- Adapting the organizational structure, roles and responsibilities, and project task sequence (e.g., systems engineering approach) to facilitate effective IWCP implementation.
- Strengthening hazard identification and controls (e.g., use of a standardized electrical work package) and use of "cold and dark" operations to address potential unknown electrical safety hazards in D&D operations.

Overall, KH is making progress in addressing the concerns raised by RFFO, and several efforts to improve procedural adherence and IWCP performance are under way. However, these enhancements are in various stages of development and implementation, and their effectiveness has not yet been fully demonstrated. These concerns have been a significant factor in about 75 percent of events in recent years and have long been recognized as a problem in KH and external assessments, including the last three KH annual analyses of common causes of events and deficiencies. Additional emphasis and specific plans are needed to ensure that the leading causes of events are emphasized in the near-term corrective actions.

RFFO Line Management Oversight

The RFFO Field Assessment organization conducts primary day-to-day oversight activities of ES&H through the Facility Representatives and Field Assessors. Lead oversight responsibility for ES&H program activities rests with RFFO Engineering. The observations by RFFO Field Assessors are documented in an Oversight and Evaluations database, which RFFO uses to assess overall contractor performance and focus future oversight activities. Facility Representatives' observations are verbally communicated directly to contractor personnel on an ongoing basis and to contractor facility management in scheduled meetings. Additionally, preliminary notifications are written for more significant events or concerns. Performance deficiencies deemed significant by RFFO management have been communicated in writing (e.g., the three FY 2000 cases where fee reduction penalties were assessed).

Although not formalized and institutionalized, the RFFO assessment program analyzes events and looks for trends. Such analysis led to the RFFO decision to send the January 5, 2001, memorandum that identified a number of RFFO's concerns with safety performance, prompted KH to curtail many operations, and directed KH to develop significant corrective actions.

The RFFO Facility Representative program is functioning, but the overall RFFO line management oversight program is not effectively implemented.

Facility Representatives have demonstrated personal initiative in performing day-to-day line management oversight and have identified performance deficiencies and good practices. The Facility Representatives have the capability to provide effective operational awareness and floor-level safety monitoring of the RFCP contractor. However, as discussed in **Safety Issue #4**, the effectiveness of the Facility Representative program is hindered by the informal processes for communicating program and performance deficiencies and ensuring that deficiencies are adequately resolved.

When conducted, special RFFO assessments and analyses and operational readiness reviews have identified and formally communicated significant safety program and performance deficiencies for resolution by the contractor. Management specialists assigned to monitor and mentor contractor responses to major events and performance issues have provided valuable

assistance to improving performance and promoting a better understanding of contractor processes and problems. However, as discussed under **Safety Issue #4**, the RFFO assessments program has not been implemented as required, the current assessment activities (other than those of the Facility Representative) are minimal, and senior management has not provided clear expectations for RFFO assessment activities or held RFFO managers accountable for performing effective assessments.

The Rocky Flats Closure Contract Section B.6 (Environment, Safety and Health and Safeguards and Security Compliance) provides examples of three categories of events or incidents that could result in fee payment reductions or enforcement actions. This Section also establishes an expectation for continuous improvement. Many of the key RFFO senior managers are in new positions, were not involved in the Closure Contract negotiations, and do not have first-hand knowledge of the discussions and understandings that underlie the Closure Contract safety provisions. Interviews with RFFO and KH senior managers indicate that RFFO and KH had different interpretations and understanding of the meaning and utilization of the examples in Section B.6 of the Closure Contract. RFFO and KH management, however, have taken actions to improve communications regarding safety performance expectations, including use of "partnering initiatives" provided for in Section C.5 of the Closure Contract.

RFFO staff turnover has impacted the effectiveness of RFFO line oversight.

Staff turnover has been an important factor in the deficiencies in the RFFO line management oversight program. Since 1998, RFFO has lost 14 of 33 highly experienced managers and supervisors, ten of whom were in key technical management positions necessary to support informed decisions about, communications with, and direction to the contractor. The Facility Representative attrition rate was also particularly high, going from 23 in 1998 to 12 in 2001. During the same time period, overall staffing levels at RFFO decreased by about 25 percent. The need to assign staff to many temporary positions further impacted RFFO's effectiveness in oversight, assessment, and communications with the contractor.

RFFO management recognizes the challenge and is engaged in efforts to manage the loss of critical experience and skills, and to reorganize the remaining human resources to best assure successful line management oversight of the Closure Project. These efforts include the conduct of a job-task analysis, targeted use of retention bonuses, reassignment of staff to fill critical vacancies, adjustment of roles and responsibilities with commensurate pay-grade adjustments, development and request for approval of a transition plan with enhanced retention tools, continued use of technical contractor support, establishment of agreements with other field offices for technical and administrative support, and development of a reorganization plan to be implemented in the near future. Management actions last year to clarify the Facility Representative roles and responsibilities, increase pay-grades, and offer a retention bonus appear to have reduced the Facility Representative retention problem.

2.3 Rocky Flats Closure Project Integrated Work Control Process

The RFCP IWCP was evaluated using the framework of the five core functions of ISM, as defined in DOE Policy 450.4, *Safety Management System Policy*. The five core functions provide the necessary structure for any work activity that could affect the safety and health of the public, the workers, or the environment. The functions are applied as a continuous cycle, as shown in Figure 1, to systematically integrate safety into the management of work practices at the institutional, facility, project, and activity levels.

This section provides a summary and analysis of the effectiveness of the IWCP based on the results of the review of the 371/374 and 776/777 Closure Projects. Appendices A and B provide more detailed results for the 371/374 Closure Project and the 776/777 Closure Project, respectively.

Core Function #1 - Define the Scope of Work. IWCP processes for defining the scope of work are sound and could in principle lead to definition of work scopes in which project work scopes, system boundaries, prerequisites, and required facility and work site conditions are generally well defined and documented. For example, there is an effective process (i.e., work sets) to break down the scope of work to specific systems and specific types of equipment. The workflow process involves engineering, craft, health and safety, and radiological personnel in defining the scope of work. Facility and

equipment walkdowns reinforce full understanding of the scope of the job by the personnel who will be performing the work.

In a number of instances, the IWCP was adequately applied. Its application in D&D operations was generally effective. In the 776/777 Closure Project, for example, an extra step was introduced to the IWCP to ensure that teams of planners, craft workers, and engineers worked together early to define the work scope. Although not fully mature, other RFCP projects are also adopting and expanding the teaming approach within the IWCP.

Some deficiencies exist in defining and limiting the scope of some work activities. Such problems occurred in both Type I work packages and craft work packages, which do not receive the same level of review as other IWCP work packages. Some of these deficiencies have resulted in reportable events. For example, on January 4, 2001, a 371/374 Closure Project tap and drain evolution resulted in overfilling some tanks and caused a non-actinide spill because the scope of the work package tasks was not adequately defined and did not adequately define interfaces. Work on a similar package was delayed during this review because of similar problems involving work scope limitations.

Guidance to planners is not always sufficient (e.g., RFCP does not have a work planner's guide or similar document that describes how work planning should be performed). As a result, weaknesses in planning persist. Some planners do not yet have sufficient experience and technical background. Interfaces with engineering personnel were not consistently effective, resulting in deficient work packages. Deficiencies were also evident in troubleshooting and repair packages.

Actions are under way at the project and the site levels to prevent recurrence of such problems. Implementation of Revision 3 of the IWCP process manual has strengthened the work definition process. Although deficiencies remain, the participation of varied disciplines in developing work packages, starting with the initial identification of the work scope, is improving work packages. Assigning a responsible manager/ responsible planner to each work package has made the entire process more effective.

Core Function #2 - Analyze Hazards. At the facility level, approved bases for interim operations (BIOs) and authorization agreements are in place. These documents adequately authorize the hazardous work in the 371/374 and 776/777 Closure Projects and bound the dominant hazards.

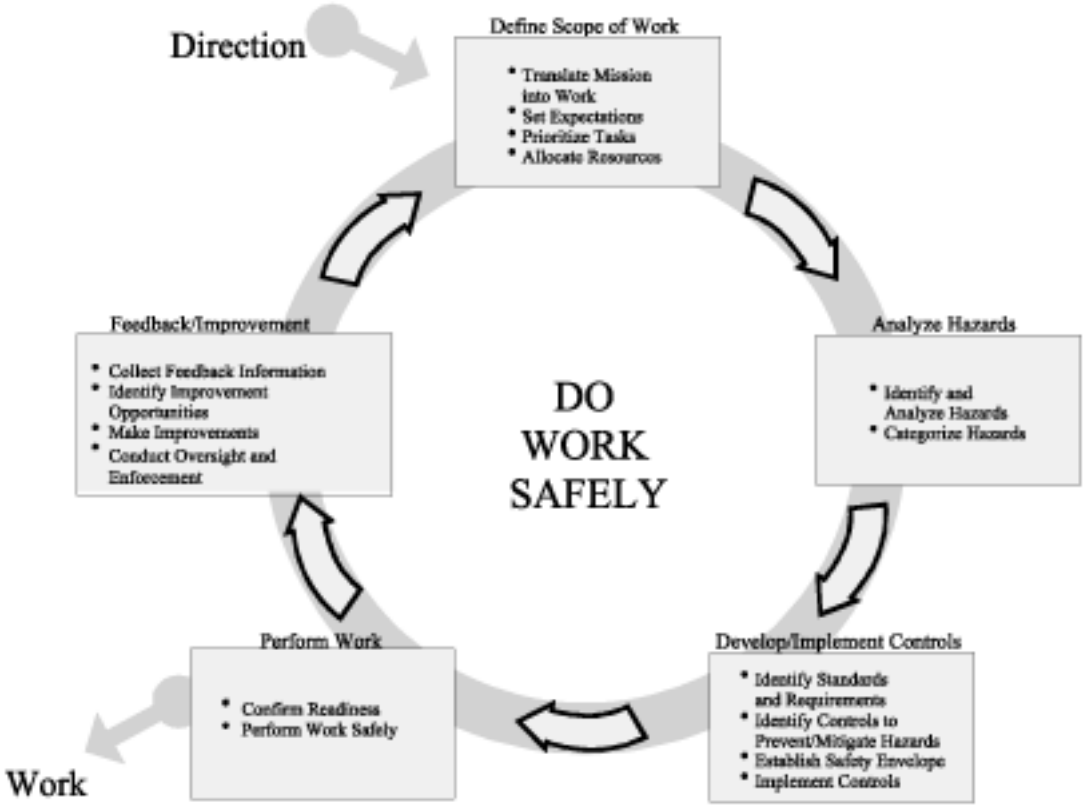


Figure 1. Core Functions of Integrated Safety Management

Piping in Building 371

At the activity level, facility personnel are aware of most workplace hazards. However, IWCP implementation of both the JHA and the radiological work permit (RWP) processes does not ensure that hazards specific to a work activity are identified and documented. Many JHAs and RWPs are too broad and include many different work activities. The specific hazard information relevant to the work steps is not being effectively communicated to the workers. The benefits of having both a general hazard section and specific hazard section in the JHA is frequently negated because the specific hazard section merely refers back to the general hazard section. The cumbersome nature of the JHAs can obscure unique job specific hazards by lumping together all industrial hazards and sometimes duplicating all radiological hazards from the RWP. In other cases, some hazards were not identified and therefore controls to protect workers were not established in JHAs or some other hazard identification and analysis process (e.g., janitorial services and permitted confined spaces in the 371/374 Closure Project). (See **Safety Issue #1** for related information.)

For radiological hazards, there are concerns about the potential for unrecognized and unmonitored plutonium intakes (see **Safety Issue #5**). These concerns include weaknesses in the technical basis for certain workplace indicators[2], inconsistent implementation of some workplace indicators (Core Function #3), a lack of understanding of derived air concentration[3] (DAC)-hour exposure during continuous air monitor alarms, and lack of a workplace indicator for the spread of contamination. As a result of the unanticipated plutonium intakes in Building 771 (see Section 3), site management is taking some actions to address these concerns.

Core Function #3 - Develop and Implement Controls. The IWCP provides requirements to ensure that work is consistently screened against uniform criteria and that appropriate controls are based on job-specific hazards. Controls for hazards are identified and developed early in the IWCP planning process in conjunction with the hazard analysis process, through the JHA. The IWCP requires that controls associated with all hazard identification and analysis processes (Hazard and Discipline Identification Tool process, RWPs, nuclear safety analyses, walkdowns, surveys, etc.) be captured in the JHA so that they can be appropriately integrated into job-specific work instructions. However, the controls specified in JHAs are often too generic to be effective, and are not tailored to the work activity as required by DOE Policy 450.4. As a result, work packages become cumbersome with JHA information that is not applicable to the specific task, hazards for the specific work step are masked, and workers are forced to rely on multiple sets of instructions and controls. This situation increases the potential for performance errors while conducting work.

Similarly, RWPs are not consistently tailored to the work being performed as required by DOE Policy 450.4. Most RWPs are for continuing or broad-scope work, allowing work in areas with multiple radiological conditions without adequately defining the hazards or controls to address each condition. For example, 75 percent of the RWPs for Building 371/374 are either "continuing" RWPs or are for routine, broad-scope work, and lack specific controls for the work being performed.

Also, much of the D&D work in the 776/777 Closure Project is being performed under a single RWP that does not provide job-specific controls. On one job under this RWP, some exhaust hoods were removed, causing a change in airflow in the work area. This change was not addressed by the RWP and not identified as a possible condition in the JHA, and controls designed to detect changes in airflow (e.g., smoke tests) were not required by job-specific RWPs, JHAs, or IWCP work packages. As a result, a portion of the area was not posted as an Airborne Radioactivity Area requiring respiratory protection, and workers without respiratory protection were present in an area with a potential for higher contamination levels.

[2] Workplace indicators are monitored conditions, such as airborne contamination levels at a continuous alpha air monitoring instrument, that provide an indication of the potential for a worker to be exposed.

[3] Derived air concentrations provide a measure of the potential radiation exposure.

Another deficiency is that the hazard controls in as low as reasonably achievable (ALARA) job reviews are not self-evident, nor are the controls from these reviews clearly incorporated into RWPs. Although radiological engineers and operations supervisors are knowledgeable and engaged in the development and implementation of radiological controls, some radiological controls have not been documented on RWPs and have not been consistently evaluated or rigorously applied.

In the absence of specific controls in the work package, the current KH practices rely on the radiological control technicians (RCTs) or RCT supervisor to interpret the RWP and determine the controls needed for each job step. This practice has often been adequate for the work performed to date, which typically involves low contamination levels and reasonably well-characterized hazards. However, the current practices are not as effective for the more complex and hazardous work that is to be performed as RFCP undertakes the more complex and hazardous tasks associated with the latter stages of D&D and encounters highly contaminated areas and equipment that are not well characterized. For example, the current practices do not reliably trigger a review of radiological controls for job-specific activities by engineers or work planners.

At the facility level, building safety operational controls are established in technical safety requirements and operational procedures. Some changes in the 776/777 Closure Project BIO, however, were not adequately tracked, nor were technical surveillance requirement controls sufficiently identified. Several legacy configuration control problems were observed at the 776/777 Closure Project, but an effective Configuration Control Authority minimized the potential impact. Building operations procedures in both facilities are generally well written, although some deficiencies in nuclear material surveillance procedures and failure to maintain surveillance of Category I special nuclear material resulted in a recent operational stand-down in the 371/374 Closure Project. The EH-2 Team observed deficiencies in the use and posting of operator aids in both buildings.

Institutional safety and health programs for some hazards associated with routine work activities are deficient in certain areas. While most RFCP personnel have received considerable ES&H training, institutional-level training is lacking in several safety programs, resulting in some work area training that was incomplete or inadequately documented. In addition, while safety and health procedures have recently been revised, streamlined, and updated to reflect current changes in regulations, some procedures do not contain adequate information to be implemented effectively. Further, chemical inventories are maintained at the facility level, but the accuracy of chemical inventories is not sufficient to ensure that chemical hazards are identified and analyzed as required by site institutional requirements.

Overall, the process for defining and implementing controls is sufficiently addressed in the IWCP program. However, at the activity level, controls described in JHAs and RWPs are not sufficiently tailored to the work being performed as discussed under **Safety Issue #1**. At the facility level, some authorization basis controls require strengthening. At the site level, some institutional programs do not adequately support IWCP implementation. As a result, work packages are difficult for the workers to use, increasing the likelihood of a performance error or non-compliance. Factors that contribute to weaknesses in the integration of controls into work instructions include: insufficient time available for the Responsible Manager to review work packages and improve their content, work planners with limited facility operations experience, lack of beneficial tools for work planners (e.g., a work planner's guide such as used at some other sites to help planners and ensure consistency among planned packages), and limited involvement by safety professionals.

Core Function #4 - Perform Work Within Controls. The need to perform work safely within controls is well understood and accepted by both management and workers at RFCP. Overall, the work observed by the EH-2 Team was performed safely and without incident. (The amount of work observed in the 371/374 Closure Project was limited because of stand-down of activities.) Formal processes are in place for the shift managers or Configuration Control Authorities to review and approve work packages and to authorize work just before the work begins. Shift managers, Configuration Control Authorities, Project Managers, and Facility Managers coordinate various work activities in plan-of-the-day and foremen meetings to resolve potential conflicts. Pre-job briefings were generally comprehensive and covered the necessary topics to ensure readiness to perform work, although in some cases, key personnel such as craft workers and RCTs did not attend the briefings. During actual performance of the work observed, foremen were extensively involved in work activities and provided guidance, direction, and support to the workers as needed to get the jobs done safely. The effectiveness of the D&D workers was enhanced by the skills acquired from the D&D course, a noteworthy training

Glovebox Workstations in Building 371

effort that could be shared with other sites that are beginning D&D activities. The Team observed some performance deficiencies in Building 371 in the conduct of radiological operations, particularly the reliance on continuous air monitors (CAMs) rather than conducting job-specific workplace air sampling in areas with potential or actual contamination and airborne radioactivity.

Recent events involving deficiencies in procedural compliance indicate that work performance deficiencies remain. The work control program is still evolving, as evidenced by the number and scope of IWCP changes. Failure to adhere to procedures is a recognized problem that stems from the longstanding site culture of informal work practices. The causes of procedural non-compliance can include schedule pressure, management tolerance for non-compliance, ineffective or inefficient processes for changing deficient procedures, and unwieldy procedures. Continued management attention and follow-through are needed to ensure that management expectations are implemented with regard to procedure compliance and to foster additional improvements in IWCP implementation.

Core Function #5 - Feedback and Continuous Improvement. RFCP uses many formal and informal feedback and improvement mechanisms, with varying degrees of effectiveness. However, the RFCP feedback and continuous improvement program has not been consistently effective because of weaknesses in procedures, deficiencies in fact-finding processes, insufficient rigor and consistency in implementation of assessment and corrective action programs, and weak management accountability for ensuring effective safety management programs.

At the project level, safety management program personnel conduct formal, scheduled assessments using checklists, and findings are formally screened and tracked to resolution. Although managers and supervisors observe and direct work, they do not routinely document their assessment and monitoring activities. Documentation of useful feedback on post-job review forms to aid future planning efforts, as required by IWCP, has been limited. Program and performance deficiencies are not always documented or conservatively screened for significance and input to sitewide tracking systems, including the Plant Action Tracking System (PATS) and the Radiological Improvement Report process.

Lessons learned from events and external sources are also communicated in a variety of informal and formal ways within projects, and many internal event-related lessons learned are disseminated quickly through "flashes" and e-mail alerts. Safety issues are discussed frequently in various management and ESH&Q counterpart meetings and weekly toolbox safety meetings. Relevant lessons learned are identified in work packages and discussed at pre-evolution briefings. However, the lessons-learned database has not always been kept current and consists of a listing of event notifications rather than analysis or identification of lessons to be learned, and thus it has limited value to work planners.

KH line management oversight assigned to the projects (from the KH Central Office) has not been fully effective because assessment expectations have not been well defined or implemented at a frequency appropriate to risk and prior performance (see **Safety Issue #3**). Similarly, RFFO Facility Representatives assigned to the projects have identified deficiencies in safety performance, but their effectiveness is limited because of the deficiencies in the RFFO program discussed in **Safety Issue #4** and Section 2.2 (e.g., assessment results are not formally transmitted and tracked to resolution).

Collectively, the weaknesses in KH and RFFO line oversight contribute to recurring events and failure to take adequate corrective actions. Managers do not always have sufficient analyses of assessment results and day-to-day monitoring to ensure continuous improvement and prevent performance failures. KH institutional line oversight of ESH&Q program implementation has been fragmented and weakened. Accountability for rigorous performance has been lacking in some areas at both KH and RFFO.

3.0 Review of Internal Doses in Building 771

The EH-2 Team reviewed the circumstances related to the plutonium intakes in Building 771. The internal doses at Building 771 were among the safety concerns referenced in the January 5, 2001, memorandum from the RFFO Manager to KH. The Team inspected the work areas within Building 771 likely to have contributed to the intakes and interviewed RFFO, KH, and affected subcontractor management and employees. Procedures, logs, plant process data, bioassay results, and air sample data were reviewed. Additionally, building ventilation, temporary containment, and facility design and operation were reviewed. The EH-2 Team also observed work practices of D&D workers and RCTs, and reviewed KH preliminary investigation documents.

This section provides background information on the discovery of the internal doses and the subsequent actions by KH (Section 3.1). Due to the status of the KH investigation, the EH-2 Team evaluated the radiological protection program (internal dose evaluation, workplace indicators, and radiological controls) and engineered controls (building ventilation systems and temporary containment systems) in Building 771. Performance in these areas was compared to industry standards and regulatory requirements. EH-2's evaluations of radiological protection programs and engineered controls are discussed in Sections 3.2 and 3.3, respectively. Specific deficiencies identified during the review of the internal dose event were analyzed in combination with information about the 371/374 and 776/776 Closure Projects, and incorporated into **Safety Issues #5 and #6**.

Aerial View of Building 771

The EH-2 Team also examined selected aspects of RFFO and KH line management oversight as it was applied to the Building 771 radiological protection program. The results of the EH-2 Team's review of management oversight in Building 771 were consistent with the broader review of line management oversight discussed in Section 2.2. Information about KH and RFFO line management oversight gathered during the review of the internal dose event was incorporated into **Safety Issues #3 and #4**.

3.1 Background

Building 771 Activities and Regulations. Building 771 was formerly used for various plutonium operations, which have been shut down since 1989. The building structure, process piping, and ducts are contaminated with plutonium and its decay products as a result of historical operations, including fires, spills, and leaks. D&D activities, ongoing in Building 771 since 1999, involve removing and processing actinide liquids; removing and packaging facility sludge; removing and size-reducing all tanks, piping, gloveboxes, and associated components; decontaminating the facilities; and demolishing all structures. To date, all liquid tanks containing plutonium have been drained, 137 gloveboxes have been removed, 36 of 38 liquid systems have been drained, and 30 of 38 liquid systems have been removed. Additionally, plasma-arc cutting for size reduction has begun. RFCP schedules call for completion of the Building 771 D&D effort by 2004.

Protecting workers from exposure to contamination and preventing environmental release of contaminants are among the most significant safety challenges associated with Building 771 D&D activities. For example, the removal of ducts and containment barriers presents a high potential for release of airborne plutonium contamination when equipment is moved or jolted, often for the first time in many years. Consequently, during D&D,

it is necessary to construct temporary containment barriers, such as plastic tents and other specially designed structures. Respirators and a variety of pressurized air-supplied breathing protection systems are also used to minimize internal contamination of personnel.

National and international standards organizations (e.g., the National Council on Radiation Protection and Measurement, and the International Commission on Radiological Protection) and the Code of Federal Regulations (10 CFR 835 for DOE facilities) recognize the possibility of both external and internal doses by establishing permissible dose recommendations and limits. The internal dose limits are set on the basis of committed effective dose equivalent (CEDE) units. Internal doses are added to external doses to determine the total effective dose equivalent, which must remain below the regulatory limits (e.g., 5 rem per year to the whole body).

DOE occupational exposure regulations (10 CFR 835) require the total dose (internal and external) to be controlled according to the ALARA principle. In addition, DOE regulations require individuals to be in an internal dose-monitoring program if they are likely to receive internal doses of 100 mrem CEDE per year or greater. Guidance provided in DOE-STD-1121-98, *DOE Standard Internal Dosimetry*, and RCTP 2001-01, *DOE Office of Worker Protection Policy and Programs Radiological Control Technician Position*, recognizes and describes the limitations of current technology in accurately assessing doses below the minimum detection capability of routine bioassay techniques such as lung counts (typically sensitive to doses of 3 to 4 rem per year). The implementing guides highlight the importance of maintaining effective air sampling programs and workplace indicators to better assess exposures below the detection limits of routine bioassay programs.

The DOE regulation addresses internal exposure controls by requiring the posting and control of entry to areas in which airborne radioactivity exceeds 12 DAC-hours/week or 30 percent of the DAC. Most operating DOE facilities are designed and engineered to keep concentrations of airborne radioactivity well below this level and to keep internal exposures to ALARA levels. Other DOE sites, such as the Hanford Site and the Savannah River Site, have documented that low-level internal exposures of a chronic nature are possible and may be detected with fecal bioassay samples. When engineered controls are not sufficient, workers must wear personal protective equipment, such as anti-contamination clothing and respirators, to reduce exposures. Such personal protective equipment is routinely worn by workers performing D&D at RFCP, even for areas with airborne radioactivity levels below those requiring posting for respiratory protection.

Discovery of the Internal Exposures. On October 17, 2000, a DOE RFFO Facility Representative performing a surveillance in Building 771 discovered that an air sampler used in a containment tent was past due for recalibration. The tent was installed to contain contamination from demolition of gloveboxes and other process equipment. Although recalibration had not been performed on schedule, the air sampler was subsequently calibrated and determined to be operating within specified parameters. However, an administrative review related to the non-compliant sampler found that no air monitoring data results were recorded for the sampler from September 7 to October 17, 2000. Without this air monitoring data, RFCP could not determine the extent of the contamination to which the workers on this operation were exposed.

Bioassays indicated that RFCP workers were experiencing plutonium intakes.

KH management requested that 11 individuals who worked in the containment tent during this period submit bioassay (fecal) samples, as a precautionary measure. By November 23, 2000, preliminary bioassay sample analyses indicated that 10 of the 11 workers were excreting plutonium above established decision levels. Initial investigations did not identify the source of the plutonium or explain the reasons for the positive fecal samples. Also, the initial analytical fecal results were sufficient to provide only an upper limit on the workers' dose. Subsequent KH analysis in November 2001 indicated that the upper bound on their dose from internal exposure was in the range of 1 to 2 rem CEDE, based on no detectable activity on subsequent lung counts for the three individuals with the highest fecal samples analysis results.

KH Actions. KH Building 771 project management conducted an internal investigation to identify the source of the workers' plutonium intakes and instituted a number of corrective actions in response to the positive sample results. Work in Building 771 was initially suspended in the containment tents and later in the building in general, when the source of the internal intakes could not be identified immediately. RCTs who had not properly documented the tent air sample results had their qualifications revoked and were

retrained. Meetings were held to inform workers of the positive sample results and how to mitigate further intakes. Additional samples were requested from other workers who were involved with the tent or other similar activities, and other workers in the building were invited to submit samples if they were concerned about their own exposure status. Fecal analyses were positive for 28 of the 46 volunteers.

KH Building 771 project management conducted internal reviews and assessments during October and November after the discovery of the past-due-for-calibration air sampler. On December 1, 2000, the Project Manager instituted a building-wide safety pause for ten days. A number of corrective actions were initiated and implemented during this period, including surveys of building and work areas, decontamination where loose contamination was detected, requiring the use of respiratory protection for any intrusive D&D activity, and additional training for all personnel assigned to the Building 771 Closure Project.

On December 12, the KH Vice President and Director for Engineering, Environmental, Safety and Quality Programs chartered a review team chaired by the manager of Radiological Engineering. The team consisted of nine full-time members, each having different areas of expertise, and a recognized health physics expert from Texas A&M University, who served as an advisor to the KH team. The review team's mission was to:

- Identify the source of internal radioactivity for the affected workers.
- Reexamine results of the Building 771 Closure Project internal investigation.
- Issue a root cause analysis report and corrective action plan.

The root cause analysis and corrective action plan were issued March 15, 2001. Incomplete records and associated data, plus time-consuming analysis of fecal samples, hindered their investigation.

3.2 Radiological Protection Program

The current internal dosimetry program at RFCP includes annual urine bioassays and periodic (at least biennial) lung counts and is consistent with typical industry and DOE practices. RFCP relies on "workplace indicators" to determine when fecal sampling and other special bioassays should be performed. These indicators are designed to detect internal exposures of 100 mrem CEDE and above, based on any one of a series of monitored conditions occurring in the workplace. These indicators are not designed to, nor will they, detect low levels of chronic exposure, such as occurred at Building 771. The detection of chronic exposures must be provided for with an effective air monitoring program. Characterization studies, including exposure levels to workers in various activities, are essential to quantify the extent of airborne exposure and establish methods to minimize exposure in accordance with the ALARA principle. In combination with the methods for monitoring external exposure, the current radiological protection controls provide assurance that doses in excess of the regulatory limits are prevented or detected.

While the internal monitoring program is designed to meet regulatory requirements of 10 CFR 835, the ability to quantify lower doses (i.e., below the lung count detection level) is limited. Fecal samples can reliably detect intakes below 100 mrem, but only if they are conducted soon after a known, discrete intake. In addition, fecal sampling is inconclusive for routinely assigning low-level, chronic intake doses to workers.

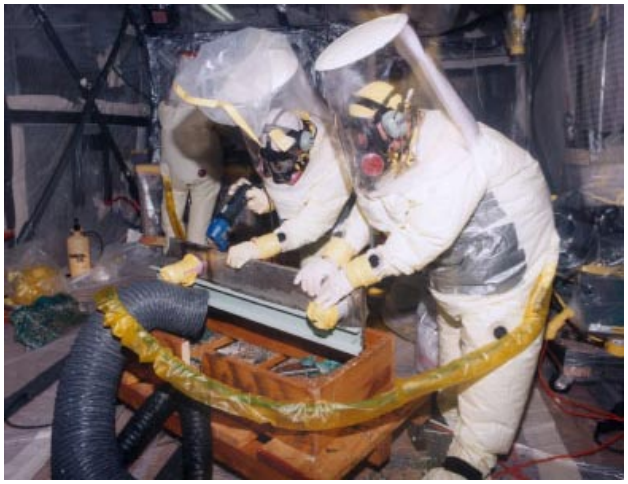
Internal doses are below regulatory limits, based on available information.

The information from bioassays and KH analysis indicates that the internal doses to the Building 771 workers are well below regulatory limits (i.e., 5000 mrem per year total effective dose equivalent). The ability to accurately estimate actual doses to these workers is limited because there is insufficient information about the time(s) of intakes and the particle size of the airborne contamination. Although preliminary upper bound estimates reported by KH in November 2000 indicated that the maximum doses would not exceed 1000 to 2000 mrem CEDE (i.e., 50-year CEDE), the KH final assignments of dose indicate that all but one worker received doses less than 100 mrem CEDE and the maximum dose assigned was 130 mrem CEDE. This equates to approximately 2.5 percent of the maximum allowable annual regulatory limit.

The internal doses resulted from exposure to ambient radioactivity in the air and/or occasional, short-term, localized exposures to unanticipated higher-than-normal radioactivity in the air (e.g., breathing air in an area where dust has been stirred up). The EH-2 Team

based this observation on an analysis of the preliminary fecal sample data, which indicate various elimination patterns, including: a) declining concentrations, b) increasing concentrations, and c) steady-state concentrations. These patterns and the low levels observed in the samples indicate that the intakes can be classed as "chronic" in nature and that they would appear to result from both ambient levels of radioactivity in the air and from intermittent exposures to unanticipated air activity on specific jobs. No specific single event was identified that would impact such a large percentage of the workforce and cause the observed elimination patterns.

Some activities historically conducted without respiratory protection could expose individuals to unknown concentrations of localized contamination with resulting intakes that are not adequately characterized. The EH-2 Team identified some activities that have a high potential for significant levels of loose surface contamination in the workers' "breathing zone," such as performing contamination surveys on glovebox gloves, packaging contaminated waste bags in shipping containers, and conducting initial spill emergency actions. KH has taken action to reduce internal personnel exposure in Building 771 by requiring all intrusive D&D work in that facility to be performed by workers wearing respiratory protection.



D&D Workers in Supplied Air Anti-Contamination Suits

As a part of the radiological protection program, workplace indicators provide a mechanism in which certain radiological conditions and circumstances are evaluated against the potential for intakes by the RCTs. Workplace indicators are the primary means of identifying events that could result in individuals receiving an intake of plutonium that could result in a CEDE of 100 mrem or greater. The indicators include exposure to known concentrations of air resulting in greater than 40 DAC-hour exposures, positive contamination above certain thresholds on various parts of the body, and confirmed CAM/selective alpha air monitor (SAAM) alarms where activity exceeds certain levels, which also represent 40 DAC-hour exposure at the CAM/SAAM. The RFCP Internal Dosimetry Technical Basis Document describes the basis and derivation of the key threshold levels within each workplace indicator that could result in 100 mrem, and thus trigger special bioassay monitoring.

Some workplace indicators may not be sufficiently conservative.

Some workplace indicators may not be sufficiently conservative and may not be effectively implemented in all cases. For example, the workplace indicator for confirmed CAM/SAAM alarms could underestimate the need for special bioassays. This workplace indicator may not be sufficiently conservative to estimate dilution of the air in the space between the worker breathing zone and the monitors. In addition, the workplace indicators are generally being applied by RCTs based on a worksheet; normally, there is little involvement of radiological engineers or health physicists to analyze specific environmental conditions. KH reported that historical experience indicated that special analysis triggered by the workplace indicators resulted in the majority of doses less than 100 mrem CEDE (indicating that the workplace indictors are conservative in most cases). However, an instance where less-than-conservative application of workplace indicators could have resulted in an unmonitored intake occurred in one of the original 11 workers tested. After his fecal sample results were determined to be higher than the other individuals', this worker was identified as being involved in a specific event in which a CAM alarm annunciated. At the time of the event, the worker was wearing anti-contamination clothing but was not wearing a respirator. This condition involved two separate workplace indicators, neither of which met the criteria for triggering a special bioassay. The EH-2 Team believes that the circumstances would have indicated sufficient uncertainty to warrant a precautionary special bioassay. However, no special bioassay was initiated until the October 2000 discovery of the past-due-for-calibration air sampler. While the dose in this instance was ultimately reported to be

60 mrem CEDE (less than the 100 mrem CEDE threshold), this is an example of a situation where workplace indicators may not have been applied in a conservative manner to identify the need for a special bioassay evaluation. Other examples are discussed in **Safety Issue #5** and Appendix A.

In addition, the RFCP radiological protection program did not make effective use of the results of fixed-head air samplers, which routinely detected air activity at an average concentration of 0.2 percent DAC. The data was routinely trended and analyzed, but was not effectively analyzed to identify and communicate to management the potential for chronic exposures. In addition, particle sizes of contaminants were not analyzed and characterized, limiting the ability to characterize the air activity to which workers were exposed.

The instrument that RFCP uses for field contamination surveys (Ludlum 12-1A) is not sufficiently sensitive (500 to 1000 dpm) to adequately characterize lower-level surface contamination levels, which could be of concern. These instruments are routinely used to detect contamination and are not as sensitive as alternative methods (swipe surveys). However, swipe surveys (using a sensitive alpha sample counter, such as a SAC-4 with a sensitivity of about 20 dpm) should be performed often enough during work evolutions, pre-job, and post-job surveys to determine surface contamination levels.

As discussed under **Safety Issue #5**, weaknesses were evident in several aspects of the radiological controls. Specific weaknesses include: a workplace indicator that is inconsistent with the technical basis, lack of a workplace indicator that considers removable surface contamination, insufficient evaluation of workplace indicators, insufficient analysis and trending of air monitoring data, insufficient air monitoring programs, insufficient analysis of radiological conditions (e.g., air activity) needed to estimate doses, and incomplete characterization of contamination. Various factors, such as RCT training deficiencies, contributed to the observed conditions. Collectively, these weaknesses indicate that RFCP may not be fully meeting the requirement to detect and control radiation exposures in accordance with the ALARA principle.

Building 771 line management took aggressive action in reacting to the unexpected plutonium intakes, including a detailed investigation, a corrective action plan, and interim corrective actions (e.g., requiring respirators for D&D work). Also, recent efforts to increase worker involvement have had a positive impact on the radiological protection program. For example, workers correctly identified the inadequacy of conducting airflow surveys annually instead of whenever there is a configuration change that would affect airflow. However, Building 771 line management and radiological protection program personnel have often been reactive rather than proactive in identifying and addressing deficiencies, as evidenced by failure to self-identify deficiencies (e.g., RCT performance, calibration records) that were identified after the discovery of exposures prompted the investigation.

The KH investigation of the plutonium intakes in Building 771 identified deficiencies in RCT performance. Most notably, some RCTs did not log results of measurements of airborne radioactivity and did not log their own entries into radiologically controlled areas on applicable RWPs, even though they knew that these actions were procedurally required. RCT supervisors did not identify and correct these deficient work practices, even though deficiencies had existed for several months. Supervisors should have been aware that survey results were not recorded because they assign surveys and review associated records.

KH is addressing deficiencies in radiological control technician performance.

Several factors may have contributed to the RCT performance deficiencies identified by the KH investigation. First, there were too few RCT supervisors. At one point during the time these infractions occurred, only three RCT supervisors were on staff for over 50 RCTs, and one of these was assigned full-time to plasma-arc cutting. Second, KH management failed to establish and enforce appropriate performance standards for RCTs. KH acknowledged these two weaknesses and recently corrected them by replacing the Building 771 Radiation Safety Manager and hiring three additional RCT supervisors. Third, KH and RFFO line management oversight did not detect the problems until the discovery of the exposures prompted the recent KH investigation. These factors, particularly the weaknesses in line management and technical oversight, are similar to the problems noted by the EH-2 Team's review of IWCP (see Section 2).

3.3 Engineered Controls

Engineered controls, such as ventilation systems that control airflow, are particularly important in Building

771 because of its contamination history. Contamination is pervasive in Building 771 because of a number of incidents during its operating history, most notably a 1957 plutonium metal chip fire that contaminated the entire facility. Completed, current, and planned D&D tasks associated with Building 771 have caused, and will continue to cause, resuspension of contamination, thereby contributing to the background airborne concentrations of plutonium. Building 771 dismantlement activities often expose contaminated areas that were previously inaccessible. Some of the newly accessible areas contain equipment that has a high potential for loose surface contamination, such as piping systems, cable trays, support foundations, and ventilation ducts. For example, during dismantlement, piping systems undergo significant shock, causing the release of contaminated particles from pipe and pipe hangers and the subsequent spread of plutonium through the air to other surfaces within the building. During recent work activities, paint from ventilation ducts, originally painted to immobilize or "fix" contamination from previous events in the building, began to flake off and contaminate working areas.

Some internal exposure hazards are not well characterized.

KH does not currently have sufficient information to accurately characterize internal exposure hazards so that appropriate engineered controls and necessary personal protective equipment can be identified. The importance of assessing the hazard of exposing workers to resuspended plutonium contamination was formally recognized in the KH technical basis document entitled *Resuspension of Plutonium Contamination During Decommissioning Work at the Rocky Flats Environmental Technology Site* (number TBD-00070, dated July 17, 1996). Nevertheless, accurate radiological assessments of Building 771 resuspension hazards are lagging D&D efforts. At the time the facility was shut down, the existing contamination survey database remained limited, and routine surveys performed during facility operation generally did not extend beyond a height of eight feet and thus do not include some potential areas of higher contamination such as conduit, piping, and ducting. As part of their response to the discovery of exposures, KH has taken action to perform additional surveys of Building 771, including overhead areas.

Effective use of heating, ventilation, and air conditioning (HVAC) systems, including both the permanent building ventilation and temporary ventilation used locally at the work site, is important in contamination control. The EH-2 Team reviewed the operation of permanent and temporary ventilation systems and their use in controlling contamination.

The Building 771 permanent confinement system, ventilation/filtration system, and associated Zone II operational area pressure differential controllers are addressed in the Building 771 technical safety requirements and are classed as vital safety systems in accordance with the Defense Nuclear Facilities Safety Board Recommendation 2000-2 implementation plan. The safety function of these systems is to ensure that building pressure remains negative with respect to the outside atmosphere so that radioactive material does not migrate out of the building through an unfiltered exhaust path. The ventilation airflow was designed to go from areas with a relatively low potential for contamination to areas with a higher potential in order to control the spread of contamination. For example, corridors were designed to operate at a higher pressure than the adjoining rooms so that any airborne contamination would be kept within the rooms. The operational area pressure differential controllers control the relative pressures. The basis for operations states that these controllers are Safety Class 3 and provide defense-in-depth for the workers in several of the analyzed events, and the technical safety requirement requires that their safety functions be maintained.

Building 771 ventilation systems have degraded over time.

The Building 771 permanent ventilation systems have degraded over time. For example, two of the four supply fan vortex vanes used for automatic flow control to the process areas have been inoperable since the mid-1980s. Although they are not safety related, the failure of these vanes reduces the system's ability to respond to changes or upsets in the system. The confinement limiting condition for operation allows the building pressure to rise above atmospheric pressure for transient fluctuations lasting less than five minutes; the basis for operation describes such fluctuations as normal for personnel access to or egress from operational area compartments, wind effects, voltage fluctuations, and other normally occurring events. A review of system data from January 1, 2000, to the present indicated 13 transient air pressure fluctuations that caused the air pressure in the ventilation exhaust

plenum to exceed atmospheric pressure. All of these transients were induced by planned plant operations, such as ventilation equipment rotation, diesel generator load tests, and confinement interlock tests. Although the basis for operations allows these short transients, they could contribute to increased background levels of airborne plutonium, and the inoperable supply fan dampers could further increase the problems with transients.

Planning for D&D activities did not adequately address the ability of the ventilation system to maintain airflow in the proper direction to ensure contamination control in Building 771. The original design of the building took into account the airflow from rooms through the gloveboxes when determining minimum required room airflow and air volume turnover rates. However, as the gloveboxes are removed, the original design basis no longer provides an adequate representation of the performance and characteristics of the ventilation system. As D&D progresses, more gloveboxes (and the corresponding glovebox airflows) are removed, requiring more airflow from the room exhaust to maintain the same room airflows and air volume turnover rates. To increase the room exhaust airflow, the pressure differential controllers increase demand to the controlling dampers. However, in the mid-1980s, total building exhaust flow was reduced by about 20 percent. The reasons for the flow reduction could not be readily determined. The building flow reduction, in combination with the inoperable supply fan vortex vanes and removal of gloveboxes, decreased the differential pressures in the process area. As a result, more than 30 percent of the room pressure differential controllers were at maximum (100 percent) or minimum (0 percent) demand (depending on system design) and were not able to maintain airflow in rooms with significant source terms within the designed tolerances or at programmed setpoints. For example, the room being used for size reduction activities (Room 186) and a room where active dismantlement of contaminated gloveboxes was being performed (Room 153) had minimal differential pressure between the rooms and the corridors, calling into question the system's ability to keep the potentially higher airborne levels of plutonium confined to the rooms. The proper direction of the airflow with a door fully open in these cases cannot be assured and, in Room 153, smoke tests had proven that the room was experiencing reverse flow near the bottom of the door with the door fully open. In response to the EH-2 Team observations, the facility increased total building exhaust flow to production era values, resulting in improved room-to-corridor differential pressures. However, many of the room pressure differential controllers continue to remain outside design tolerances, and Room 153 differential pressure was minimal (approximately 0.04 inches water gage). The KH investigation report also identified other deficiencies resulting from the changes in the HVAC systems because of D&D activities. For example, the report identified that in some cases, new room air return paths are established high in the overhead, not near floor level as originally designed. These installations degrade the original design that places room returns low to capture airborne contamination stirred up from the floor, and may contribute to increased contamination levels in worker breathing zones resulting from the upward air flow.

Engineered controls are not always effectively implemented.

KH has not always implemented sufficient engineered controls for Building 771 to minimize the spread of airborne contamination. In some locations, RFCP uses high efficiency particulate air (HEPA) filtered portable air movers as an engineered barrier by "spot" controlling contamination at the source and by providing appropriate air exchanges in tent containment devices. This type of non-permanent equipment is used to supplement permanently installed facility ventilation components while maintaining control of contaminants near their source. The portable air movers are intended to direct airflow from uncontaminated to contaminated areas to prevent the migration of radioactivity to clean areas while minimizing the ambient radioactivity level in a worker's breathing zone. However, the EH-2 Team observed instances where the door(s) between the tent and the inner tent chamber had to remain open to accommodate items for size reduction. In some instances, KH has not sufficiently analyzed the hazards associated with the actual conditions. For example, credible source terms in Room 186 were introduced but not analyzed. In addition, KH has not always ensured that interim controls, such as portable air movers, are formalized and effectively implemented to provide for adequate control of ventilation flow.

As discussed above and in **Safety Issue #6**, airflows are not adequately controlled and there are deficiencies in the analysis and implementation of permanent and temporary ventilation systems. In some cases, analysis of actual conditions was not always adequate (e.g., new source terms were not analyzed)

and changes were not always controlled and analyzed (e.g., conditions were changed and new activities were performed without reevaluating the safety analyses). Also, the mechanisms for controlling the operation of the portable air movers within work areas are not always adequate to maintain operational setpoints and procedural control. Collectively, these deficiencies result in degraded ability to control airflows and adequately control contamination. Therefore, they contribute to the potential for plutonium intakes.

To address ventilation system deficiencies, KH has established more stringent requirements for the use of respirators. However, there is a large reliance on personal protective equipment for worker protection. This reliance needs to be balanced with recent engineering advancements and new techniques for glovebox and pipe size reduction. Further, as discussed in Section 2, increased attention is needed to ensure that controls are clearly identified and communicated and that procedures and work packages are effective and rigorously implemented.

4.0 Safety Issues

Line management is responsible for addressing Safety Issues in accordance with DOE Order 414.1A, *Quality Assurance*. The DOE Headquarters Office of Environmental Management, as the lead program secretarial office, is required to ensure that an adequate corrective action plan is developed.

A total of six Safety Issues were identified during this Special Review by the two EH-2 Teams. The first two Safety Issues were based on the review of IWCP at the 371/374 and 776/777 Closure Projects and selected institutional programs. Safety Issues #3, #4, and #5 incorporate information from both reviews. Safety Issue #6 is based on the deficiencies observed in Building 771.

This EH-2 Special Review indicated that there is variation in the approaches and effectiveness of implementation of IWCP and institutional requirements both across Closure Projects and within each Closure Project (e.g., some organizations and/or lower-tier projects were more effective than others in implementing certain requirements). Some aspects of the specific deficiencies identified in the Safety Issues were more pronounced in one Closure Project, or within a specific lower-tier project or organization. However, most of the identified deficiencies are applicable to varying degrees at both the 371/374 and 776/777 Closure Projects. In addition, deficiencies in institutional safety programs or management systems (e.g., accountability) contribute to the Safety Issues. Further, deficiencies similar to those identified on this EH-2 Review were recently identified in a March 7, 2001, Defense Nuclear Facilities Safety Board staff issue report on thermal stabilization activities at Building 707. Therefore, the identified deficiencies may be applicable at Closure Projects that were not reviewed during this EH-2 Special Review. In developing the corrective action plan, RFFO and KH need to consider whether the deficiencies are applicable sitewide, and ensure that their corrective actions comprehensively consider the entire RFCP.

Addressing the six Safety Issues will require management commitment.

The six Safety Issues identified during this EH-2 Special Review can be addressed in a timely manner by enhancing existing procedures and processes, rigorously implementing the enhanced procedures, providing more training, and increasing accountability for performance. However, strong management commitment, accountability for performance, and increased line oversight will be required to ensure full and effective implementation of the RFCP IWCP and supporting programs, and to prevent recurring deficiencies in performance.

ISSUE #1. IWCP implementation is not always adequate to ensure that controls are consistently tailored to the specific work performed, that work instructions are clear and include appropriate hazard information, and that work is performed in accordance with the defined scope and controls as required by DOE Policy 450.4, *Safety Management System Policy*, and the RFCP IWCP.

Some elements of the IWCP are not well defined or implemented. Specific deficiencies include:

- **IWCP implementation is not adequate to ensure that craft workers always receive clear work instructions, including appropriate hazard information, and that they rigorously adhere to procedures and work scopes**. KH analysis indicates that about 75 percent of RFCP reportable events in the past three years resulted from failure to follow procedures. Most of these failures related to work activities performed under the IWCP. Specific problems with work instructions include:

  – Work on the Building 371/374 D-249 tank-draining job was about to start without discussion of the RWP during the pre-

evolution briefing. The RCT supervisor and job supervisor were unaware of the RWP in the IWCP package. Subsequent review of the package resulted in additional walkdowns, meetings, and revisions after the work package had been initially approved, authorized on the plan-of-the-day, and released for work by the shift manager.

- Many craft work packages have minimal instructions on the scope of work and contain little or no documentation of work actually performed, contrary to IWCP requirements. Many craft work packages were converted to Type 1 work packages during KH reviews because they did not meet craft work thresholds.

- The Building 371/374 Maintenance Manager recalled all "troubleshoot and repair" work orders because of self-identified concerns about insufficient detail, lack of work instructions, and unclear scope and limits.

- Shift managers have to perform multiple reviews of larger work packages as one of the final controls, and have encountered many planning deficiencies.

- **JHAs frequently do not tailor hazard controls to the specific work activity and do not clearly define controls, and the controls identified by the JHAs are not effectively integrated into the workers' instructions.** In general, JHAs adequately identify hazards, but they are not consistently effective in ensuring that controls are specified in a manner that is clear and useful to craft workers. While KH management recognizes that JHAs are a continuing problem and has initiated action to revise the process, the current JHA process and associated work packages have several deficiencies:

  - Many JHAs include several pages of general hazard controls not linked to specific job steps. Frequently, work steps are cross-referenced to most, if not all, of the general hazard controls, thereby blurring the relative importance of hazards specific to the individual job steps.

  - Some job-specific JHAs listed hazards that were not present in the work specified. In other instances, JHAs did not identify specific safety hazards and/or establish appropriate hazard controls in the work packages. In some cases, specific industrial and chemical hazard controls were not referenced to the work steps where the hazards were encountered.

  - Job-specific hazard sections on some JHAs merely reference the general hazard section, defeating the purpose of having both general and job-specific hazard sections.

  - Because the JHAs must be used as part of the work instructions, workers sometimes must flip between the various sections of a voluminous work package to determine guidance on specific hazard controls when performing a work step, increasing the likelihood of performance errors.

  - The JHA preparation guide is not mandatory and is maintained on the RFCP Intranet as an informal, uncontrolled document.

- **Some RWPs are not adequately developed to ensure that hazard controls are tailored specifically to the job task and location.** Many RWPs are either "continuing" RWPs or encompass broad scopes of "routine" work. They do not adequately tailor the controls to the work being performed as required by DOE Policy 450.4, as evidenced by the following deficiencies and examples:

  - Many RWPs (e.g., RWP 01-371-0041) are so general that the specific job cannot be determined from reading the RWP.

  - A single RWP encompasses many different types of work under multiple radiological conditions (e.g., Radiological Buffer Area, Contamination Area, High Contamination Area, Airborne Radioactive Area), and task definition for each condition is not adequate.

  - Controls for some activities, such as "decontamination" and "housekeeping," are not defined, nor are they specified in the RWP.

  - Controls specified in some RWPs (such as air monitoring) can be overridden or modified at the discretion of RCT supervisors; this override

provision can circumvent the IWCP by allowing field modification of preplanned, reviewed, and preapproved hazard controls.

– The RWP procedure is not sufficiently comprehensive to ensure adequate development and implementation of RWPs.

Of the several contributors to the above weaknesses, the most significant is failure to adhere to procedures. The KH common-cause analysis process has solidly linked procedural non-adherence to a majority of occurrences over the past several years. Procedural adherence issues stem from a longstanding site culture of informal work practices, and necessitate aggressive and continuous management actions to address the root causes (e.g., schedule pressure, management tolerance for non-compliance, ineffective or inefficient processes for changing deficient procedures, and performing work outside the scope of the procedures). Another important contributor is work packages that are difficult for the workers to use (e.g., a craft worker must reference several documents within the work package to identify all the hazard information to perform a single step). Difficult-to-use procedures increase the likelihood of a procedural error or non-compliance, and workers may be reluctant to follow unwieldy procedures. Also, the JHA and RWPs are of limited value to the planners and the workers because the controls are not tailored to the major hazards of the specific job and are not fully integrated into craft work instructions. Another important contributor is the weak post-job review feedback process, which has not been eliciting sufficient feedback from craft workers, foremen, and supervisors, and provides only limited information to management about improving and refining the IWCP. Other contributors to the observed weaknesses include insufficient time available for Responsible Managers in some buildings to review work packages and improve their content, work planners with limited experience with facility operations, and the lack of beneficial tools for work planners.

Rigorous adherence to the IWCP and institutional safety requirements is an essential barrier against hazards and is integral to implementing ISM. Unless corrected, the weaknesses in the IWCP controls reduce the effectiveness of important barriers. The events and procedural non-compliances are precursors for more serious events that could injure workers, challenge safety envelopes, or harm the environment.

ISSUE #2. Some training program requirements and a number of KH institutional safety requirements and responsibilities described in the Occupational Safety and Industrial Hygiene (OS&IH) Manual are not being adequately implemented.

- **Some requirements in the OS&IH Manual are not understood or properly implemented by project safety and health line management.**

  - In some cases, upper tier requirements have not flowed down or are not adequately explained in the OS&IH Manual. For example, the Manual chapter on confined spaces does not define confined space or non-permitted space, or the requirements for non-permitted confined spaces (training, posting, etc.).

  - Some line and project safety managers are not familiar with their responsibilities as specified in the OS&IH Manual, are not implementing their responsibilities, or think they are inadequately trained to implement assigned responsibilities (e.g., ergonomics).

  - Some responsibilities assigned in the Manual are too broad to implement effectively and do not reflect the current KH project-based organization. For example, responsibilities are assigned to "supervisor/management" without further specification as to whether the requirements apply to Facility Managers, functional managers, Project Managers, or supervisors.

  - There is no formal process to capture, track, resolve, and communicate interpretations of OS&IH Manual requirements when they are not understood, which is necessary to ensure consistent and adequate sitewide implementation of Manual requirements.

- **Some safety and health training requirements are not being adequately identified or implemented**.

  - The bloodborne pathogens training program, required by the OS&IH Manual and Occupational Safety and Health Administration

(OSHA) regulations (29 CFR 1910.1030), was not established at the institutional level and did not encompass all applicable personnel. Both the Manual and OSHA regulations require initial and annual training for potentially exposed workers (e.g., janitorial staff and Building Emergency Support Team members). The site identified RCTs as an additional exposure group during this evaluation and initiated action to establish a bloodborne pathogen training program.

- Training in the identification and control of some workplace hazards was delinquent (work area-specific hazard communications) or not sufficiently documented (awareness training).

- In some cases, worker training requirements were not consistent with the hazards specified in JHAs. For example, glovebox cleanup work in Building 371 identified hazards of elevated work and falls from ladders, but the KH ladder safety awareness course was not required.

- In other cases, training requirements specific to the work activity were not readily identifiable in the work packages or work procedures, and job specific training for some craft work packages was not well specified.

- **Institutional-level training, qualification, and record keeping requirements for Building 776/777 are not being met in several areas.** The Lists of Qualified Individuals indicate that a significant number of workers have not completed the required training or retraining. Some individuals had completed the training, but were not reflected on the lists. Some courses that are listed as required are no longer offered or are not applicable to the activities performed by the worker. As a result, Lists of Qualified Individuals are not always used by supervisors to verify that workers have competed required training before they perform work, as required by the IWCP, the OS&IH Manual, and the Conduct of Operations Manual. In addition, although job performance measures are required to demonstrate qualification to perform some tasks, many job performance measures have not been completed. The majority of these deficiencies have been identified in previous institutional and facility-level assessments, but corrective actions have not been effective or are not yet completed. Some corrective actions were initiated during this evaluation.

These institutional requirements have not been implemented for a variety of reasons. For example, reductions in the KH ESH&Q staff (affecting the industrial hygiene and safety departments) have limited the resources available for performing safety oversight, developing technical basis documents, or assisting projects in clarifying requirements. In other cases, line management has not received sufficient training on ESH&Q procedures, and some procedures lack sufficient information to implement the requirements. In addition, Building 776/777 managers were unaware of the extent of the training program problem and, therefore, had not taken comprehensive corrective action. Furthermore, the level of detail in many procedures has recently been reduced, increasing the need for clarification of some requirements; however, clarification is provided via informal mechanisms that fall outside of institutional controls. For example, reducing the size of the IWCP procedure resulted in a series of informal clarification documents, which are posted on the RFCP Intranet, and there is no process or instructions for their use, review, approval, or maintenance.

ISSUE #3. Some KH feedback and improvement mechanisms have not been clearly defined and rigorously implemented to provide management with the performance data necessary to prevent recurring events, correct unsatisfactory performance, and drive continuous improvement, as required by DOE Policy 450.5, *Line Environment, Safety and Health Oversight,* and DOE Order 414.1A, *Quality Assurance.*

Some elements of KH feedback and improvement processes are not well defined or implemented, and there is insufficient accountability for performing these functions. Specific deficiencies include:

- **KH self-assessments are not fully effective.** The management assessment program calls for formal assessments of performance in various safety functions. While ESH&Q professionals perform assessments, line managers in the 371/374 Closure Project are not sufficiently involved and do not actively participate in the process as

intended by the institutional procedures. In addition, some 371/374 Closure Project management assessment program assessments did not exhibit the rigor and scope necessary to effectively appraise the associated safety functions. For example, the management assessment program review of the IWCP in the 371/374 Closure Project examines only one completed work package, one procedure, and one operations order every six months, and the acceptance criteria are not rigorous. Findings from management assessment program reviews are not always conservatively screened to determine whether they satisfy the level of significance required for corrective actions and tracking in PATS. The 371/374 Closure Project has recently instituted a workplace monitoring (surveillance) activity for 14 senior managers. However, applicable procedures are not specific, and expectations for the scope, documentation, and dissemination of findings and corrective actions are not clearly delineated.

- **KH institutional assessments have not ensured proper implementation of safety management programs across all projects.** Periodic assessments and tracking and trending of safety management programs are specified in site management directives (GMV-001-99, *Safety Management Program Tracking and Trending*, and Guide-1010TIG, *Technical Infrastructure Guide*) and the OS&IH Manual, but have not been consistently and rigorously performed. Important programs impacted by this deficiency include industrial safety, industrial hygiene, training, the management assessment program, and corrective action implementation. Also, processes for communicating performance indicators and assessment results from individual projects to the institutional owners are weak and informal. For instance, there is no requirement or expectation that project management assessment program reviews or periodic program reviews be transmitted to institutional program owners.

- **KH Independent Safety Oversight assessments do not ensure that all ESH&Q programs are being effectively evaluated commensurate with the level of risk and prior safety performance.** Most FY 2000 and scheduled FY 2001 Independent Safety Oversight assessments were reactive or driven by regulatory requirements (e.g., readiness reviews and Price-Anderson Amendments Act violations). Independent oversight assessment and planning procedures have not been updated to reflect the March 2000 KH organizational changes or current independent assessment processes. Planning has not consistently captured functional program areas. Assessment and monitoring activities by KH Independent Safety Oversight personnel dedicated to specific projects have been primarily informal and undocumented, and findings are typically communicated verbally to project management without screening for input into PATS. There are no provisions for regularly performing Independent Safety Oversight assessments of the radiological control programs' continued effectiveness as facility conditions and hazards change, as D&D efforts progress.

- **The corrective action program is not used effectively to identify trends and drive continuous improvements.** Project staff and institutional program owners do not consistently and rigorously use the site corrective action program to capture program and performance deficiencies for meaningful trend analysis. Deficiencies identified by formal independent oversight assessments and those meeting thresholds for Occurrence Reporting and Processing System and Price-Anderson Amendments Act and associated corrective actions are tracked in PATS. However, some deficiencies identified by the projects are not being conservatively screened for inclusion in PATS, and inconsistencies between PATS and project-specific tracking systems inhibit effective tracking and identification of adverse trends for predictive analysis. For example, some tracking systems contain information on the likely cause of the deficiency, and others do not. In addition, many of the items in the PATS and other site corrective action tracking systems are missing important data, such as corrective action taken or being planned, due dates, completion dates (some reflecting longstanding open items), causal codes, and significance levels. Corrective actions often do not address generic implications or recurrence controls. Little analysis and trending of identified deficiencies is performed at the institutional level. Project-level analysis and trending varies greatly from project to project and is not consistently rigorous or effective in identifying improvements. For example, the 776/

777 Closure Project has a procedure for tracking and trending non-compliant conditions (but no other performance indicators), but the 371/374 Closure Project does not. The level of analysis of deficiencies in the latest 776/777 Closure Project semi-annual Safety Management Program varied from extensive (e.g., several pages of analysis of injury trends) to none. Similarly, other key feedback processes, such as the Radiological Improvement Report program and post-job ALARA reviews, are not rigorously and consistently used to drive improvements.

- **KH institutional-level organizations have not consistently used the site corrective action process to document performance deficiencies and effectively drive continuous improvement.** Although assessments performed for or by site Quality Assurance and Independent Safety Oversight have identified many weaknesses in programs and performance, site procedures were not always followed to ensure that the identified deficiencies were tracked and resolved in the prescribed manner. For instance, an Independent Safety Oversight assessment of work control in Building 771 in September 2000 identified four significant issues, but they were not screened for significance and generic implications as required by site procedures and were not input to PATS for resolution and tracking. Similarly, Quality Assurance assessments of the implementation of the site assessment and corrective action programs conducted in January 2000 and January 2001 identified many of the same program and performance deficiencies identified by this EH-2 Special Review. However, the deficiencies were not screened or input to PATS for resolution at that time. A response to the initial assessment findings concluded that the issues identified were all adequately addressed by the March 2000 KH realignment to a project-oriented organization. Common-cause analyses conducted in 1998, 1999, and 2000 identified procedural non-compliance as a global performance issue that led to many of the events and assessment findings. While some actions were taken following the 1998 common-cause assessment, the actions taken to date have not been aggressive and have not adequately addressed the problems; KH management cites procedural non-compliance as an important contributor to recent events.

- **KH reviews of events and occurrences have not always been thorough.** KH has not consistently performed effective fact-finding meetings to elicit accurate information on the factors that led to an event, and assessments of events and occurrences have not always been thorough or sufficient to identify root causes. KH is aware of these deficiencies, which were identified in the RFFO January 5, 2001, memorandum to KH and in Defense Nuclear Facilities Safety Board staff reports, and has taken actions to address them.

- **The formal institutional lessons-learned program is not being fully utilized to improve work planning and training.** The lessons-learned database is primarily populated with event descriptions from over 1000 site and complex-wide Occurrence Reporting and Processing System notification reports. There are very few database items where events were analyzed and lessons-learned information was developed or summarized in a manner useful to planners, trainers, or supervisors. Except for reportable events, lessons learned are rarely communicated between projects or throughout the site. No documentation or notification is required for line applicability reviews or for actions taken for lessons learned that are put in the database or distributed as Flashes or Alerts. The site lessons-learned procedure was last revised in 1997 and does not reflect current practices.

Collectively, the weaknesses in line management oversight are contributing to inadequate corrective actions and thus to recurring events. Project Managers and senior KH managers do not always have a sufficient analysis of assessment results and day-to-day monitoring to ensure continuous improvement and prevent performance failures. The flattening and restructuring of the KH organization into projects and the lack of a site-level operations officer have concentrated the responsibility and authority for safety management programs and safety-related priorities in the various projects. In addition, as part of their reorganization of the resources to staff the six semi-autonomous projects, KH placed high priority on ensuring that project line management had sufficient ES&H expertise to design, implement, and monitor projects on a day-to-day basis. As a result, KH institutional line oversight of ESH&Q

programs has been weakened, and accountability for rigorous performance has been lacking in some areas.

ISSUE #4. The RFFO line management oversight program does not meet DOE Policy 450.5, *Line Environment, Safety and Health Oversight*, requirements for conducting coordinated and integrated environment, safety, and health line oversight of the contractor and maintaining sufficient knowledge of program activities to enable informed decisions on safety resources.

There are deficiencies in the RFFO program that hinder its effectiveness:

- **Scheduled assessments were not always performed.** Of 68 oversight assessments and self-assessments scheduled for FY 2000, only 17 were performed. Since the beginning of FY 2001, RFFO has performed nine assessments/self-assessments of the contractor and RFFO. However, there was no RFFO assessment schedule (e.g., regular programmatic assessments) at the time of the EH-2 evaluation. Also, the RFFO Facility Representative program does not routinely evaluate the effectiveness of the crosscutting programs such as work control, self-assessment, and corrective actions. RFFO indicated they planned to conduct an additional 23 assessments and a self-assessment by the end of FY 2001.

- **The line ES&H oversight program requirements and expectations have not been fully delineated and communicated to RFFO staff.** RFFO issued portions of RFFO Manual 220.2, *Closure Project Oversight Program Manual*, in October 2000 as a revision to the earlier RFFO orders on line oversight. However, important sections of this Manual have not yet been issued, including sections that address the overall line oversight strategy, planning, performance analysis, lessons learned, technical direction and performance reporting (communication with the contractor), and quarterly performance reporting for fee determination. The current version of the Manual discusses the mechanics of conducting formal assessments, the Oversight and Evaluation program (which encompasses activities conducted by the Facility Representatives), and self-assessments, but does not specify the frequency or scope of these activities. Further, it does not include the roles and responsibilities of the Facility Representative program or reference other RFFO directives that provide this information. RFFO is currently undergoing a realignment of its organization and its safety management/oversight approach to provide more emphasis on safety. As part of this realignment, RFFO plans to revise and streamline the Manual.

- **Performance monitoring observations by the RFFO Facility Representatives are not adequately analyzed, formally communicated to RFFO and contractor management, or tracked to resolution.** RFFO reviews safety performance indicators and statistics, and holds monthly meetings with the contractor to discuss safety performance. However, Facility Representatives' observations are logged in the Oversight and Evaluation database, which RFFO uses to assess contractor performance and focus line oversight activities. However, other than a small number of formal letters (e.g., fee reduction letters), RFFO observations are not communicated in writing to the contractor and are not formally tracked to resolution. In addition, the database is not routinely or formally evaluated by RFFO functional area subject matter experts to identify trends, and RFFO does not routinely perform follow-up evaluations of contractor corrective actions for events. There is no effective process for analyzing and reporting line oversight results to RFFO senior management. The lack of routine, formal communication of observed performance deficiencies to RFFO and contractor management hinders the establishment of a common understanding of performance data and DOE expectations.

Collectively, these deficiencies indicate that the RFFO program is not currently adequate to meet the provisions of DOE Policy 450.5, *Line Environment, Safety and Health Oversight*, which require that the DOE field element "conduct ES&H line oversight in a cost-effective, coordinated, integrated, and efficient manner" and "maintain sufficient knowledge of program activities to make informed decisions on safety resources." Staff turnover, and the associated loss of continuity, has impacted the effectiveness of RFFO line management oversight. Further, RFFO has not always ensured that its managers are held accountable for effectively implementing the provisions of the RFFO

line oversight program (e.g., regular programmatic assessments). RFFO management recognizes a need to significantly improve line management oversight and accountability, and is engaged in efforts to better manage the loss of critical experience and skills to ensure successful line management oversight of the Closure Project.

ISSUE #5: Because of weaknesses in identifying and characterizing radiological conditions in control areas such as workplace indicators, radiological work permits, and airborne monitoring, RFCP may not be demonstrating that worker exposures are as low as reasonably achievable.

Several weaknesses in the radiological control program may result in unnecessary or unmonitored exposures:

- **Evaluations of workplace indicators are not always being performed effectively.** The techniques for assuring that routine internal exposures are detected at the 100 mrem CEDE level are outlined in a series of DOE standards and guides. While these guides provide specific examples and corresponding thresholds, they are intended to be used with professional judgment to evaluate specific facility and exposure conditions (as opposed to a "go – no go" numerical evaluation). KH used these standards and guides to develop detailed and prescriptive procedures, rather than a "graded criteria" approach, when they developed their approach to workplace indicators. If these workplace indicators identify a potential intake, the RCT uses the potential intake factor worksheet to determine, based on the worksheet calculations, whether a special bioassay is required. After the RCT completes the worksheet, it is approved by the supervisor and reviewed by a radiological engineer. However, the radiological engineers and/or health physicists do not routinely evaluate the specific environmental conditions at the work site to determine whether special bioassays are warranted or whether the worksheet calculation is valid.

- **The derivation of the CAM/SAAM airborne alarm workplace indicator is inconsistent with the technical basis.** For this indicator, a value of 600 dpm or greater on the filter following an alarm (which would result from a 40 DAC-hour exposure or 100 mrem calculated CEDE dose) was calculated to represent a potential exposure of 100 mrem, the trigger level for conducting special bioassay samples. The technical basis document for internal dosimetry specifies a dilution factor of 10 to account for the difference between air measured at the location of the CAM/SAAM and that breathed by the worker, and indicates that the dilution factor may be as high as 100. The dilution factor was not applied in the derivation of the 600 dpm workplace indicator.

- **Although recommended by DOE guidance (DOE Standard 1121-98, *Internal Dosimetry*), the site is not using an indicator that considers the existence of removable surface contamination that could be near the workers' breathing zone.** The lack of bioassay monitoring criteria that consider contamination disturbed in the vicinity of the workers' breathing zone may have resulted in the special bioassay program missing some individuals with possible intakes. This deficiency can result in inadequate follow-up. For example, glovebox integrity checks can result in unknown and potentially significant levels of contamination to be disturbed in the worker's breathing zone. In one instance, a Building 371 worker (without respiratory protection) detected over 1 million dpm of activity on a glovebox wipe but had no follow-up bioassay because there was no workplace indicator to trigger a follow-up evaluation.

- **Analysis and trending against specific work applications of some air-monitoring program data are not being performed and utilized to support and enhance workplace indicators.** Although fixed-head air sampler data is being trended, a significant number of air samples are being taken in the facility, using installed CAMs and SAAMs, low-volume samples, high-volume samples, and portable CAMs and SAAMs, but this data is not routinely trended or analyzed to characterize air contamination conditions in the workplace.

- **The analysis of the current air-monitoring program data may not accurately represent what the workers may be exposed to in the work environment.** The EH-2 Team compared the bioassay results with the airborne radioactivity levels KH measured in the facility to determine

whether the concentrations were consistent. Building 771 monitoring data indicated that ambient airborne levels in the non-posted areas (i.e., areas where respirators are not worn) were approximately 0.2 percent of the DAC. However, the airborne radioactivity sample results are average concentrations taken over a seven-day period (168 hours). Higher airborne concentrations, up to four times the average, could reasonably be postulated to occur during actual peak work periods. Also, the dust builds up on the filters over time, and alpha particle absorption is a factor. Further, there is some uncertainty about whether the air samples accurately represent the workers' breathing zone. These factors make it reasonable to postulate up to one percent DAC levels, even for areas where respiratory protection is not required. At one percent DAC chronic exposure, the routine intake may be detectable and is consistent with some of the reported sample results.

- **The radiological control program has not sufficiently characterized and analyzed radiological conditions.** Examples include the following:

  - **Air activity.** The potential levels of ambient air activity that could contribute to chronic intake in work areas were not studied to enhance the placement of portable or permanent air samplers for optimum measurement and documentation of the potential for ambient and chronic exposure.

  - **Fixed-head air sampler.** Air sampler filters were typically changed once a week, thus tending to bias the results to a lower average concentration (i.e., lower levels in off-peak periods mask higher concentrations that could have existed during peak work activities).

  - **Particle sizing.** Particle sizing studies were not performed to characterize the particulate matter to which the workers are exposed. Knowledge of particle size is important when performing prospective bioassay analyses and internal dose evaluations.

  - **Air sampler documentation.** The potential for exposures in Building 771 was not discovered or addressed because RCT workers did not adhere to equipment calibration requirements and essential data documentation. Although data from the air-monitoring program was documented, the results of an important air monitor were not recorded and were not missed for an extended period. In addition, the routine data recorded was evidently not trended to indicate possible internal intakes or other hazardous situations.

  - **Surface contamination survey information not kept as a workplace indicator.** RCTs did not record and document all pre- and post-job surveys as necessary to maintain facility and work area contamination characterization.

  - **RCT failure to follow procedural requirements.** RCTs did not sign in on the RWPs as they joined the work crews.

- **Loose contamination was identified in 15 new areas during the safety stand-down in December 2000.** The KH Project Management Plan for D&D of Building 771 specifies implementing a reconnaissance-level characterization strategy to document an accurate assessment of current radiological hazards. Specifically, the reconnaissance-level characterization strategy requires that surface media scans and samples be performed to characterize total and removable surface contamination. Although effective implementation of the strategy was intended to remedy the limited survey database, KH has not fully characterized the location and degree of building contaminants as specified in the Project Management Plan. Additionally, some post-job surveys required by KH procedures are not being completed.

Many of these deficiencies could be addressed by improved implementation of existing RFCP requirements and procedures. In some cases, insufficient RCT personnel and training deficiencies contributed to the observed conditions. In the transition to D&D operations, RFCP did not place sufficient emphasis on training RCTs in D&D activities and the different conditions and controls that would be encountered. Also, the relatively low number of RCT supervisors for the number of RCTs (e.g., until recently, only three supervisors were assigned for over 50 RCTs in Building 771) and the amount of ongoing work

suggests that span of control is a potential contributor to the observed RCT performance deficiencies. Standards for RCT performance are not clearly delineated, communicated, and enforced. The work packages also lacked effective integration of controls into the work steps in a manner that is readily understandable to the workers and RCTs. Workplace indicators are not always effectively implemented. RFFO and KH management assessments and corrective actions have not been sufficient to identify problems in RCT performance, and problems that were identified were not corrected in a comprehensive and timely manner (see Issues #3 and #4). Weaknesses identified in Safety Issue #1, including insufficient integration of RWP and JHA controls into work steps, also contribute to the deficiencies noted in this Safety Issue. Various ongoing and planned management actions, such as adding RCT supervisors in Building 771, are intended to enhance radiological controls.

ISSUE #6: Insufficient engineering planning and consideration for the degraded condition of the Building 771 ventilation system challenges the system's capability to confine plutonium and ensure the proper direction of contaminated airflows during decontamination and decommissioning activities as required by DOE Order 420.1 *Facility Safety*. The use of temporary ventilation systems has not been controlled to minimize the potential for plutonium intakes.

Several instances of deficient analysis or implementation of permanent and temporary ventilation systems were noted:

- **Airflows are not sufficiently controlled to ensure contamination control during D&D activities.** D&D activities in Building 771, such as removal of gloveboxes, are initiated and performed in rooms without adequate consideration of the impact and effect of aging and degraded permanent ventilation systems. The Building 771 basis for operations allows for transients; however, they could contribute to increased background airborne plutonium levels, and the degraded equipment, such as inoperable supply fan dampers, could further increase the problems with transients. D&D activities in Building 771 continue to decrease the ventilation system's ability to maintain airflow in the proper direction to ensure contamination control. Building 771 D&D activities began with building ventilation flows and differential pressures below historic production values; the adequacy of the reduced values was not analyzed before D&D activities were initiated. More than 30 percent of the controllers were at maximum (100 percent) or minimum (0 percent) demand (depending on system design) and were not able to maintain airflow within the designed tolerances or at programmed setpoints in rooms with significant source terms. In several cases, there was minimal differential pressure between the rooms and the corridors, calling into question the system's ability to keep the potentially higher airborne levels of plutonium confined to the rooms. Although RFCP has increased building ventilation flow to production era values in response to EH-2 Team observations, many controllers continue to remain outside design tolerances. RFCP has not always ensured that interim controls, such as portable air movers, are formalized and effectively implemented to provide for adequate control of ventilation flow.

- **Analysis of actual conditions is not always adequate.** The KH investigation report indicates that the radiological source terms (the gloveboxes) have been removed in rooms that have degraded ventilation systems. However, the report does not mention the introduction of new source terms, such as the size reduction activities in the Room 186 tent, that could generate large amounts of airborne contamination. Also, the facility has attempted, with limited success, to balance airflows to restore or maintain the original air volume turnover rates. With the lower air volume turnover rates and the higher activity levels associated with D&D, background airborne plutonium levels are inherently higher. Operating with the system in a degraded configuration also makes it difficult to mitigate a release. The EH-2 Team observed many instances where the door(s) between the tent and the inner tent chamber had to remain open to accommodate items for size reduction. In such instances, KH has not performed sufficient analysis to demonstrate that relative negative pressure of the tent and inner tent chamber is adequate to prevent the spread of radioactive contamination and the further increase of airborne plutonium levels.

- **Changes are not always controlled and analyzed.** KH conducted a readiness assessment for a specific activity (glovebox #865 size reduction)

in Room 186 in accordance with DOE Order 425.1A and the site's Readiness Determination Manual (MAN-040-RDM). Shortly after completing that specific activity, the project modified the Room 186 soft side containment to allow its use as a multi-purpose size reduction enclosure and conducted various tasks over the next 13 months that were not encompassed by the original analysis, including high-level drum repackaging and size reduction of process vessels, pumps, and piping. However, no additional readiness reviews or evaluations of controls were documented. Events over the last 13 months associated with work in Room 186 indicate significant weaknesses, including improper or inadequate use of engineered controls and improper placement and ineffective use of air-monitoring equipment.

- **The mechanisms for controlling the operation of the portable air movers within work areas are not adequate to maintain operational setpoints and procedural control.** Workers routinely adjust HEPA-filtered portable air mover airflow to maintain pressure differentials for various configurations (i.e., doors open or closed) and work activities. However, workers use skill-of-the-craft and experience to adjust ventilation dampers based on the tent's overall appearance. No special training or qualification to operate this equipment is provided. Furthermore, no consideration is given to potential flow and differential pressure changes within a given containment when using positive-pressure protective gear. Differential pressures between the inner and outer containment, and between the outer containment and the room, are also not measured. Face velocity at the containment entry door is the only performance parameter that is monitored and checked daily before the tent is occupied; however, it is not subsequently verified regardless of work activity or occupancy level.

Aging and D&D are degrading the permanent systems, minimizing the system's responsiveness to upsets, and creating a higher potential for the spread of contamination. Additional efforts are needed to ensure adequate analysis of actual conditions and rigorous implementation of controls, such as portable air movers and containment tents. Insufficient characterization of existing contamination and hazards increases the difficulty in identifying and implementing effective controls. Some deficiencies can be attributed to a need for improved configuration management and a need to recognize when conditions or work activities have changed and thus need to be reanalyzed (e.g., a re-evaluation of the readiness assessment). In addition, there is a tendency to rely on personal protective equipment and to not implement engineered controls, such as barriers that protect the workers from overhead contamination. Further, work packages, controls, and assessment programs in Building 771 have many of the same deficiencies discussed in Section 2, Appendices A and B, and Safety Issues #1-4, contributing to the observed problems in identifying hazards and implementing controls.

5.0 Opportunities for Improvement

The recent events and near misses at RFCP are significant and could be precursors for more serious events if the root causes are not effectively addressed in a timely manner. This EH-2 Special Review identified several Opportunities for Improvement. The purpose of Opportunities for Improvement is to provide line management with feedback that may help address identified issues and identify options, potential solutions, and potential enhancements to their programs. The responsible DOE and contractor line management should review and evaluate the Opportunities for Improvement. However, the Opportunities for Improvement and suggested actions are not intended to limit the initiative and good judgment of line managers. Line management is ultimately responsible for safety and should develop corrective actions in accordance with site-specific programmatic and ES&H objectives. While the Opportunities for Improvement in this section may provide line management with insights about potential corrective actions, the site may identify other mechanisms for addressing identified issues.

1. Strengthen feedback mechanisms, including line management oversight and assessments, to assure continuous improvement in safety management, identify and resolve emerging safety concerns and adverse performance trends, and ensure the effective sharing of lessons learned and noteworthy practices across RFCP projects, facilities, and activities.

Expedite filling the position of KH Chief Operating Officer. Strengthen the central ES&H organization and integrate it within site projects to more effectively provide support and better ensure effective application of contract requirements, policies, and performance expectations.

- Consider establishing a site operations review group, composed of senior management (and ES&H subject matter experts as appropriate) from each of the RFCP projects, to periodically review incidents (including near misses), trends, causal factors, and good practices, and to ensure that lessons learned are instituted sitewide.

- Strengthen line management self-assessment in problem resolution, and focus independent oversight resources to ensure effective implementation of line management self-assessment processes.

- Empower and hold accountable the institutional owners of safety management programs to provide guidance, leadership, oversight, performance analysis, and support to projects. Hold Project Managers accountable for implementing institutional safety management programs.

- Ensure rigor and consistency in the identification, screening, categorization, and capture of program and performance deficiencies in tracking systems to facilitate effective trending and analysis of data.

Continue RFFO and KH efforts to establish formal and frequent communication on contract performance, including expectations for safety performance.

- Consider institutionalizing the RFFO/KH partnering initiative, which has been beneficial in addressing areas of disagreement in performance expectations.

- Continue efforts to strengthen organizational interfaces, particularly at the RFFO and KH Project Manager level, to facilitate communication and definition of safety expectations.

- Consider expanding the use of functional area "centers of excellence" and formal and frequent counterpart interactions to promote sharing of best practices and lessons learned among projects.

- Evaluate oversight models and strategies implemented at other DOE field offices to improve RFFO oversight processes and communication of safety performance information to and from the contractor.

- Accelerate the completion and implementation of the RFFO Oversight manual and hold managers and staff accountable for conducting self-assessment and contractor oversight responsibilities.

- Conduct periodic meetings between RFFO and KH line and institutional safety management leaders to ensure that the scope, frequency, and rigor of line and institutional oversight activities are integrated, are responsive to site performance indicators and assessment results, and correlate to the risks associated with the site work activities.

Capitalize on the successes, initiatives, and lessons learned that are contributing to safe work performance within the projects and apply them to sitewide operations.

- Expand D&D training to include RCT functions, roles, and responsibilities and include appropriate evaluations and/or testing to improve RCT performance, teaming, and work crew effectiveness.

- Expand the use of the "Fix it Once" initiative in evaluating root causes and corrective action plans for more than just sitewide Price-Anderson Amendments Act issues.

- Consider broader application of the 776/777 Closure Project concept of using the Configuration Control Authority to control access to work locations to ensure authorization and coordination of facility work.

- Consider broader application of the 776/777 Closure Project practice of using daily foremen meetings to coordinate the next day's support needs and resolve potential coordination issues in advance.

- Apply techniques and lessons learned from the task force model (Senior Management Review Board, supervisory watches, rigorous procedure reviews, DOE oversight), developed in response to Building 707 criticality safety events, to address the identified programmatic issues on a sitewide basis.

Make more extensive use of "systems engineering" and ISM core functions to analyze and improve implementation of management systems and processes.

- Systematically analyze current informal processes for sharing lessons learned within and between projects. Identify gaps, opportunities for increased rigor and formality, and measures to evaluate lessons-learned effectiveness. Upgrade existing site program procedures.

- Apply an end-to-end systems engineering approach to analyze material flow paths, organizational interfaces, and support required (engineering and other support groups) to complete the 371/374 Closure Project, planning for organizational changes as the project transitions from one phase to another. Use this information to organize the project and immediately move to stabilize the 371 Closure Project organization so that individual groups can more readily focus on day-to-day operations.

- Establish clear roles and responsibilities for all groups involved in Material Stewardship activities (Residues, Plutonium Stabilization and Packaging System, Nuclear Materials Handling and Packaging, Nuclear Materials Measurement, and Nuclear Materials Control) based on a careful analysis of recent nuclear material control and accountability and nuclear material handling events in the 371/374 Closure Project, as well as the flow of nuclear materials and containers within the facility.

- Apply the five core functions of ISM more effectively to analyze events and trends and develop corrective actions.

- Implement a process for formal corrective action within the 371/374 Closure Project to evaluate, address, and track findings resulting from Quality and Compliance surveillance and assessments and other Closure Project assessment activities.

2. Strengthen the implementation of the IWCP work control process to ensure effective control of work and the associated hazards, including defining and adhering to work scope, developing high quality work packages, adhering to work controls, and communicating roles and responsibilities.

Enhance the work planning and control process by modifying and enforcing existing processes, tailoring the document to the needs of the various projects, and developing supplemental guidance. In doing so, avoid major revisions of the IWCP and continue to focus on continuous improvement, where work processes are revised as needed in response to worker feedback, resulting in more tailored, efficient, and value-added work control documents.

- Consider developing a "planners guide" to supplement the IWCP in improving expectations for planners in development of IWCP work packages.

- Consolidate "guidance" information maintained on the RFCP Intranet into procedures, including information such as informal IWCP clarifications, instructions for properly preparing a Work Control Form, and instructions for preparing a JHA.

- Use the quality organization and institutional safety organization to conduct reviews of in-process and completed IWCP work packages to ensure consistency and quality.

- Structure the craft work packages to ensure that work is clearly defined, instructions are adequate, and completed work is documented.

- Ensure that anticipated changes in hazard conditions are clearly flagged in work procedures, requiring work activities to stop and hazard conditions and controls (such as ventilation) reassessed before proceeding.

- Formalize a pre-release work package review by knowledgeable operations personnel such as the shift manager (currently performed as an informal practice).

- Consider a review of the IWCP from a human factors perspective with an emphasis on organizing the information so that workers can easily use it, and clearly delineating important safety controls.

- Strengthen post-job review processes for obtaining feedback and improvement by simplifying and focusing information from the workforce around the five core functions of ISM.

- Hold regular meetings among work planners from various projects to exchange information (e.g., lessons learned and good practices) and promote effective practices across projects. Extend this practice to other safety-related positions such as assessments, quality assurance, and corrective action tracking personnel.

- Consider occasional sharing or peer review of assessment, quality assurance, and training personnel between projects as another method of exchanging information.

Strengthen the use of and adherence to approved procedures in controlling the cleanup work and associated hazards at RFCP, including such factors as procedure quality and usability and the control of changes and interpretations.

- Implement effective corrective actions for root causes of failure to use and adhere to procedures.

- Further improve the quality of work packages and documents for operations, D&D, and the maintenance and testing of safety systems, by involving subject matter experts, *particularly engineering support*, and procedure users early in the development and validation of procedures.

- Ensure that validation of procedures includes field walkdowns (in addition to tabletop reviews) prior to approval, to assure technical accuracy and usability.

- In coordination with RFFO, re-evaluate change control processes and streamline as necessary, to ensure that changes in procedures, safety basis documents, and systems or equipment can be promptly processed to avoid an excessive need for operations orders, unreviewed safety question determinations, justifications for continued operations, and temporary modifications.

- Strengthen and focus KH management assessment program and independent oversight and RFFO Facility Representative activities on procedure quality, use, and adherence, particularly on procedural validation processes.

3. Strengthen the radiological protection program to ensure effective radiological monitoring, contamination control, and program oversight to provide feedback and improvement consistent with risks to workers associated with D&D activities.

Improve the radiological baseline monitoring conditions for establishing accurate doses to workers; upgrade workplace indicators and their implementation, and upgrade routine air monitoring to better define the potential for intakes and their trends. Items to consider include:

- Complete an assessment of the internal doses in Building 771 and establish a baseline. Extend this assessment to other buildings as appropriate.

- Use a statistically-designed sampling program to guide representative sampling of all work groups, including administrative workers who do not enter radiological areas. Perform sampling to define and quantify the current chronic intake levels and hence the extent of the annual internal dose. This characterization study and resulting baseline should be independent of the current routine bioassay program.

- Continue to use fecal sampling for event-driven internal dose evaluations. Use fecal sampling with a technically defensible sampling protocol to define and evaluate the current chronic internal exposure levels. However, it is recognized that fecal sampling for routine chronic internal dose evaluation is not advisable due to inherent uncertainties and difficulties.

- Review the air-monitoring program to ensure that ambient levels in all areas of the plant are routinely measured, documented, trended, and presented as performance measures. A key element of the air-monitoring program should be the concentrations that the workers actually breathe, so that internal dose assignments can be made on the basis of DAC-hours, rather than by fecal sampling. Conduct studies as needed to establish the ratio of fixed sampler results to breathing zone sampler results. Have work crews wear lapel samplers to establish this ratio, particularly when conducting operations that cause significant air movement. Routinely require one or two members of a work group to wear lapel samplers to provide continuing data for evaluation and dose assignment.

- Increase the usage of portable CAMs in addition to low-volume air samplers at work sites and in potential areas of worker exposure during times of non-respirator usage to detect unanticipated "events."

- Routinely characterize chronic internal doses due to ambient air activity levels as conditions change within the facility. Upgrade RFCP workplace indicators to more consistently reflect guidance in DOE-STD-1121-98 and DOE-STD-1128-98.

- Ensure that qualified health physicists and/or radiological engineers routinely review workplace radiological conditions to ensure that special bioassays are conservatively requested.

Continually require characterization of building contamination levels commensurate with the type and sequencing of D&D activities. Implement appropriate controls to mitigate the spread of contamination during D&D. Perform more rigorous pre- and post-job contamination surveys of all areas to minimize re-suspension hazards and the consequent contribution to background plutonium levels in ambient air.

- Ensure that for any radiological survey that detects an unexpectedly high airborne concentration or loose surface contamination, a Radiological Improvement Report is written and the source is determined.

- Address containment materials (drapes, tape boards, sleeving) in pre-job and pre-evolution planning, and discuss work practices and techniques to be used for contamination control.

- Ensure that post-job contamination surveys adequately cover the full extent of the facility/area that could have been affected by the work, especially areas that are now accessible that were

not previously accessible, such as pipe hangers, other piping in the area, and cable trays.

- Perform detailed analyses and reviews of contamination monitoring programs to ensure knowledge of the current potential contamination levels and the controls needed to perform work safely.

- Reduce the contaminated area to the smallest practicable size; in size-reduction rooms, limit the area to the size-reduction tent.

- Conduct more frequent swipe surveys during work evolutions, pre-job, and post-job surveys. Count the swipes using a sensitive alpha sample counter (such as a SAC-4 with a sensitivity of approximately 20 dpm) to determine surface contamination levels.

- Increase the use of portable CAMs in worker breathing zones to ensure that unanticipated exposures are identified and that follow-up is appropriate.

- Evaluate various good practices for contamination control and adopt them as appropriate in RFCP practices, including using "J" seals on umbilical cuts to minimize the potential for contamination leaks, placing easily accessible tool racks in inner tent chambers, improving housekeeping and cleanliness in the facility, further improving practices for doffing protective clothing to minimize touching potentially contaminated areas, using pneumatic pipe cutters rather than manual cutters for piping system(s) removal, using HEPA-filtered vacuum cleaners and wet mops for maintaining facility cleanliness, using Maslin mops to survey large floor areas for contamination, using HEPA filters in waste bags and material containment to prevent air discharge to the room, and performing more frequent smoke (or puffer) tests when using rope boundaries for controlling Airborne Radioactivity Areas to ensure that airflows are in the expected direction.

Improve ISM feedback mechanisms by strengthening oversight of the radiological control program at all levels.

- Increase management surveillance of radiological control practices in the facility.

- Increase radiological control engineers' technical surveillance of work.

- Establish mechanisms for documenting and providing feedback to workers to improve routine radiological practices.

- Establish performance measures for the radiological control program to ensure that all responsibilities are being appropriately discharged, and to assure other oversight program personnel of program effectiveness.

- Consider periodic in-depth reviews of work practices by experienced and skilled professionals not associated with the routine work.

- Apply the appropriate level of readiness reviews to new activities, consistent with site procedures, for each demolition activity.

4. Improve the configuration control of the HVAC system and develop additional engineered controls for ongoing D&D work in Building 771.

Re-evaluate the condition of the building ventilation system in rooms with significant remaining source terms with respect to worker safety and contamination control. Consider other engineered controls including double barrier protection for workers performing D&D activities.

- Ensure that controls are established and enforced for containment tents and portable air movers.

- Ensure that requirements for analyzing modifications to ventilation systems, including containment tents and portable air movers, are clearly established and effectively implemented.

- Evaluate the condition and suitability of a room's permanent ventilation system before using that room for size reduction or other transient D&D activities that may introduce new source terms into the room.

- Consider total containment for any size-reduction facility (similar to the plasma arc inner tent chamber).

- Improve building ventilation to increase room air turnover rates and assure air movement from areas of lesser to greater contamination potential. Consider maximizing building-to-atmosphere differential pressure to provide larger operating bands for individual room controllers.

- Perform work in large size drapes, especially when working overhead (e.g., the recently purchased hydraulic lift scaffolding could be lined with stainless steel floor and sides and could be used like a drape for overhead work).

- Enhance containment of overhead piping during cutting and shearing prior to removal (e.g., instead of taping long pieces of pipe, use sleeving sized to the pipe, and tape and seal at cut points to prevent contamination of the floor or airborne contamination).

- Expand application of RFCP and industry best practices including using localized exhaust in performing work, using mastics and fogs for fixing contamination, protecting sharp edges prior to packaging, and using packaging material that is more impervious to puncture.

APPENDIX A
ASSESSMENT OF CORE FUNCTIONS IN 371/374 CLOSURE PROJECT

EH-2 assessed IWCP in the 371/374 Closure Project using the five core functions of ISM as a framework.

Core Function #1 - Define the Scope of Work

There have been improvements in defining and bounding the scope of work in Building 371/374 IWCP packages. Most work activities are generally well defined and documented in IWCP work packages. Some operations, such as tap and drain activities on systems containing radioactivity, have detailed supporting procedures that define individual steps of the operation. Work definition and supporting documentation prepared under revision 3 of the IWCP have improved over packages reviewed during the 1999 EH-2 Focused Safety Management Evaluation. The quality of the work packages, though evolving, is continuing to improve. The assignment of Responsible Managers to a work package from initiation through completion has strengthened IWCP package ownership and improved work package content. Having the Responsible Managers formally designated and trained with defined responsibilities, and engaging them in IWCP work definition, package development, review, and execution, have strengthened accountability and reduced the errors in work packages and performance. Work planners are taking a more active role in package development, including field walkdowns with craft and engineering personnel to ensure that work is appropriately defined and bounded. Project plans, the conduct of operations manual, the IWCP, and procedures define roles and responsibilities of other safety-significant positions, contributing to an understanding of the various work activities being defined.

Building 371/374 facility and project management have also improved work definition and integration through well attended meetings, such as plan-of-the-day meetings, schedule execution meetings, project resource allocation meetings, and other staff meetings. These meetings are generally effective at defining the day's and week's work, providing a look at upcoming work, and ensuring integration between the numerous project and facility work activities within the building.

Notwithstanding these improvements, weaknesses in work definition and work breakdown instructions have contributed to some recent occurrences. For example, inadequate task definition/instructions and ineffective interfaces between the Facility Management and Facility Disposition organizations contributed to a January 4, 2001, tap and drain occurrence that overfilled tanks, causing a non-actinide spill. Additionally, Responsible Managers and work planners do not always separate larger IWCP work packages into distinct parts to improve the span of control and to help identify and analyze hazards associated with each part of the work package. RFCP and the 371/374 Closure Project are completing a number of corrective actions for this and other occurrences. Completion of the corrective actions should further improve the work control program.

DOE orders require a formal system for the prioritization of equipment maintenance based on risk and the safety category of the equipment. While maintenance work activities are being prioritized, the maintenance prioritization procedure is not being used or followed. This situation was identified as an issue during the 1999 EH-2 Focused Safety Management Evaluation. Prioritization is being accomplished through the plan-of-the-day, scheduling, management, and other meetings. However, the process is not formalized as required by DOE Order 4330,4B. As a result of this concern, KH cancelled the out-of-date maintenance procedure during this EH-2 review.

One area of weakness, also recognized by the facility, is the specificity and documentation of craft work packages. These packages are intended for repetitive, low-risk work, for which limited instruction and documentation are necessary. Several craft work packages contained marginal work definition and instructions for the specified work and little documentation that the work was actually completed. The KH Director of Work Control has distributed for comment a draft change to the IWCP for craft work packages to strengthen the craft work process.

Defining the work also includes managing and allocating appropriate resources to fully understand and define the work. The EH-2 Team identified that line management is not effectively allocating industrial hygiene and industrial safety resources to maximize coverage of IWCP walkdowns, pre-evolution briefings,

and work activities. Improvements are being made in this area as safety positions are filled. During the past three months, the industrial safety/industrial hygiene staff has increased from two to five personnel; however, due to a lack of security clearances and training requirements, the new staff are not yet effectively integrated into work planning and routine work activities. Industrial safety/industrial hygiene supervision recognizes this concern and is developing an integration plan.

In summary, with some exceptions, most work is well defined and documented. The single Responsible Manager concept is good and has improved accountability for and the content of work packages. Task definition and instructions in the many IWCP work packages is improving although some craft work packages are not adequate and require additional improvement in work definition.

Core Function #2 - Analyze the Hazards

The Building 371/374 BIO adequately bounds facility hazards and provides for engineered and administrative controls to maintain safety envelopes. For proposed activities (work, modifications, new systems, etc.), that could impact the facility envelope defined by the BIO, the IWCP and unreviewed safety question determination (USQD) processes provide thresholds to ensure appropriate screening. USQD screening requirements are incorporated into the work classification process with appropriate review by the nuclear safety organization and planning teams, but only for Type 1 and Type 2 work packages. The IWCP categorically excludes all craftwork from USQD screening. Some craftwork packages did not have sufficient information or specificity to ensure that specified work would not affect Safety Category 1/2/3 structures, systems, and components.

In the radiological area, the Building 371/374 radiological engineering ALARA job reviews are identified as a strength. ALARA job reviews for known high-hazard work were comprehensive, detailed, and well documented. Many of these reviews required significant time to develop and required review and approval by the site ALARA Oversight Committee.

Recent changes in the JHA process have not significantly improved the quality or effectiveness of JHAs produced under the IWCP. The following deficiencies identified during a review of the Building 371/374 glovebox maintenance JHA are typical of the problems with the JHA process and implementation (see **Safety Issue #1**):

- The JHA identified a heat stress hazard and indicated that a heat stress hazard evaluation had been performed. However, the work activity did not involve a heat stress hazard, and no heat stress evaluation had been performed or documented by industrial hygiene.

- A broad JHA addressed controls for a High Contamination Area and the use of Saranex-impregnated clothing. The work was not in a High Contamination Area, and Saranex clothing was not appropriate or approved as a control.

- The ergonomic controls in the JHA are generic and have not been tailored to reflect specific ergonomic controls for working within gloveboxes or for moving drums, and no ergonomic hazard evaluation had been performed. (Most Building 371/374 reportable injuries are ergonomic related.)

- Section 4 of the JHA failed to identify hydrochloric acid, which was observed in at least one glovebox.

- The JHA addressed work at elevated heights, yet no work was planned for or performed at elevated heights.

- The JHA did not adequately address respiratory protection requirements and did not address the optional use of respirators when checking the integrity of glovebox gloves.

While high-hazard work was generally effectively planned, hazards for some work activities have not been fully identified and analyzed. Janitorial services are considered routine operations, and are one of several work activities specifically exempted from the IWCP documentation requirements. The IWCP requires those exempt activities to use ISM principles, but offers no implementation guidance. Janitorial hazards, such as the use of chemicals, contact with bloodborne pathogens, and ergonomic hazards, are addressed in Chapters 22, 25, and 26 of the OS&IH Manual. However, since the hazards for janitorial work in Building 371/374 were not systematically identified, analyzed, and documented, the appropriate controls were not implemented. The controls for bloodborne pathogens have not been implemented as required by 29 CFR

1910.1030, and work area-specific hazard communication training has not been provided for all staff members as required by 29 CFR 1910.1200. For some chemicals identified in Material Safety Data Sheets, the personal protective equipment used by workers is less than the personal protective equipment recommended by the chemical manufacturer, and no hazard analysis was documented to justify the personal protective equipment use as required by 29 CFR 1910.132. In another example, two Building 371/374 air handlers were not identified as confined spaces, resulting in a lack of controls (i.e., training, permits, rescue services) during the performance of annual preventive maintenance as required by Chapter 21 of the OS&IH Manual and 29 CFR 1910.146. There has been routine entry into these confined spaces without adequate controls for several years. Building 371/374 management has taken prompt action to properly post the spaces as confined spaces.

Hazard identification for more routine operations is a concern. Programmatic concerns about the technical basis and application of workplace indicators could lead to unrecognized and unmonitored plutonium intakes for some operations in Building 371/374. Several elements may contribute to this issue, and some may be related to intake issues in other buildings, such as Building 771. The elements include:

- There is a lack of bioassay monitoring criteria that considers source terms that could be disturbed in the vicinity of the workers' breathing zone and inconsistent application and development of the workplace indicator for CAM/SAAM alarms. For the CAM/SAAM alarm indicator, the dilution factor information in the technical basis documentation was omitted from the procedural guidance and results in the procedure worksheet being incorrect by a factor of 10 as compared with the technical basis justification.

- There is also evidence of incomplete and inconsistent understanding of CAM/SAAM capabilities, sensitivity, alarm settings, and readouts (in units of exposure in DAC-hours versus concentration in DAC). These uncertainties may affect the ability of radiological protection staff to fully comprehend and assess airborne events.

Inhalation of small quantities of plutonium can result in a CEDE of 100 mrem, which is the trigger level for a special bioassay. The procedure for glove integrity checks in Building 371/374 allows for up to 700 dpm/100 cm^2 near the workers' breathing zone to go undetected, due to the minimum sensitivity of the specified monitoring equipment for the glove checks. Instrumentation that is more sensitive is available, but not specified. In one case, glovebox contamination of 1 million dpm was detected during a glove integrity check in an area where workers were not provided respiratory protection or air sampling; however, a bioassay was not required because the workplace indicator was not triggered (no contamination was noted on the individual).

In Building 371/374, sources of airborne radiological hazards are not always detected or well understood. CAM/SAAM alarms occur in areas where airborne hazards were not anticipated. In some cases, subsequent evaluations have identified but not fully explained the sources and range of potential implications, including differences between CAM location, worker location, and potential intakes. In some cases, CAM alarms have occurred at levels well below CAM minimum sensitivities without further review or explanation of this important anomaly. Discussions with site and building radiation protection personnel indicate a misunderstanding of CAM/SAAM capability, specifically the difference between DAC and DAC-hour readings on the CAM. It was not well understood that when the CAM was set to read DAC-hours, the reading was the integrated exposure at the CAM at the time of alarm.

In summary, processes are in place to identity and analyze hazards in Building 371/374. In general, the IWCP process identifies most work activity hazards; however, the JHA process and implementation do not ensure that hazards associated with specific work activities are clearly identified in work packages. Institutional programs for chemical identification, confined space identification, and hazard identification for the janitorial staff is not adequate.

Core Function #3 - Develop and Implement Controls

Several improvements in the IWCP process have enhanced IWCP work packages. The work packages now contain tables of contents and clearly identify sections for the work packages drawing and specifications, references, material requirements, prerequisites, specific task instructions, etc. Standard work package cover sheets clearly show the prerequisite approvals. Although deficiencies were identified, task

instructions have improved in quality and detail. The IWCP provides a single integrated process for performing most work on site. The JHA is the primary method used for identifying, analyzing, developing, and documenting safety controls for a particular job. Therefore, controls associated with other safety analyses (RWPs, nuclear safety analyses, etc.) must be captured in the JHA to be appropriately integrated into work instructions.

When a JHA is developed for a work activity, the controls are often too generic to be effective. For example, glovebox maintenance work in Building 371/374 included controls for hazards that were not present during the observed work activity (e.g., heat stress and elevated work). However, controls for existing hazards (e.g., contamination and ergonomics) were also not tailored to the work activity. In a similar manner, all troubleshooting and repair work orders in Building 371/374 were recently recalled by the Maintenance Manager due to a lack of specificity of controls. Shift managers also indicated that controls and work instructions in some IWCP packages are inadequately defined and require additional reviews.

Like JHAs, controls specified in RWPs are not tailored to the work being performed as required by DOE Policy 450.4. Approximately 75 percent of all RWPs in Building 371/374 are either "continuing" RWPs or are for routine, broad-scope work, and they lack specific controls for the work being performed. In Building 371/374, multiple radiological conditions (e.g., Radiological Buffer Area, Contamination Area, Airborne Radiation Area) are allowed under a single RWP without adequate task definition for each condition. For example, one RWP will typically identify that the work could be performed in a Radiological Buffer Area, a High Contamination Area, and/or a High Radiation Area without any further explanation. For some work, controls for activities such as "decontamination" and "housekeeping" are not defined, and the specific controls for these activities are not specified in the RWP. For other work activities, such as air monitoring, the controls specified on the RWP can be overridden or modified at the discretion of RCT supervisor, thereby circumventing the pre-planned, reviewed, and approved IWCP process. At the work planning stage, specific controls from some ALARA job reviews are not integrated into the RWP. In other cases, RWPs are incorporated into work packages before the radiological controls are finalized, resulting in unnecessary rework of the work package (see **Safety Issue #1**).

Although radiological engineers and radiological operations supervisors are knowledgeable and engaged in the development and implementation of radiological controls, some radiological controls have not been sufficiently evaluated, or have not been consistently or rigorously applied. For example, for glovebox maintenance work, the use of respiratory protection is optional during glove integrity checks, but neither the hazard nor the control has been fully evaluated. Further, the use of respiratory protection is not addressed in the RWP for this work activity. Additionally the glovebox maintenance procedure has different contamination limits than the site contamination monitoring procedure it references. The glovebox monitoring procedure would allow up to 700 dpm/100 cm^2 (minimum sensitivity for alpha-met detectors) contamination on gloves for a glovebox in an Radiological Buffer Area, rather than the 20 dpm normally allowed.

The OS&IH Manual addresses most non-radiological hazards encountered by Building 371/374 workers. However, controls required for some sitewide ES&H programs are not sufficiently defined, communicated, or implemented. For example, neither the confined space nor ergonomic chapters of the OS&IH Manual have sufficient information for supervisors to understand the requirement. As a result, Building 371/374 organizational elements are not adhering to aspects of these procedures. Line managers and first line supervisors are not adequately managing chemical inventories in accordance with site requirements. The Building 371/374 chemical coordinator estimates that chemical users return fewer than 10 percent of the chemical bar codes that would allow for accurate updating of the chemical inventory. As a result, the Building 371/374 chemical inventory lists approximately 3000 chemicals, when in actuality the chemical inventory is most likely 500 to 1500 chemicals (estimated by the chemical coordinator). In another example, respirators are not adequately stored in some areas of the building (e.g., stored in Contamination Areas or not sealed in bags), and there is no clearly defined or communicated respirator exchange program. A respirator exchange program for chemical cartridges was required in response to 1998 changes in the OSHA respirator standard (29 CFR 1910.134).

Sitewide training programs, while rigorous, do not provide controls for some hazards associated with routine work activities. For example, there is no sitewide training program for bloodborne pathogens. Chapter 25 of the OS&IH Manual, "Bloodborne

Pathogens," and 29 CFR 1910.1030 require training for potentially exposed workers, including Building 371/374 janitors, security personnel, and Building Emergency Support Team members. Furthermore, there is no sitewide training program to provide controls for temperature extremes (e.g., heat/cold stress), although the hazard is identified in some Building 371/374 JHAs. Although heat stress awareness training has been conducted for some Building 371/374 work activities, there is no formal requirement for training and records of such training are not centrally maintained. Ergonomics training was conducted for many Building 371/374 supervisors, but few supervisors who were interviewed were knowledgeable of the ergonomic requirements for supervisors identified in Chapter 26 of the OS&IH Manual.

Building 371/374 operations procedures are generally well written. Controls provided in procedures are developed with the involvement of workers, supervisors, and subject matter experts. For example, residue project workers, subject matter experts, and supervisors are actively engaged in the development and walkdown of procedures and in tabletop exercises. Residue project procedures have also been revised to more clearly incorporate material control and accountability requirements. Workers are knowledgeable concerning their individual roles and responsibilities within each of the operating procedures, but there is a substantial dependence on subject matter experts to assist with important process decisions such as calculating weight percent plutonium in reprocessed residue, and disposition of items prohibited by the Waste Isolation Pilot Plant. An exception to the quality of residue project and nuclear material handling and control operations is that deficiencies exist in implementing procedures used to move, track, and account for nuclear materials within Building 371. The recent nuclear material control and accountability stand-down in Building 371resulted from the failure of project staff to follow procedures and maintain proper surveillance of Category I nuclear materials. A second incident involved the inadvertent transfer of small, but accountable, quantities of plutonium to Building 771 in "empty" drums, resulting in an unusual occurrence based on the conclusion that storage of these drums constituted a technical safety requirement violation for Building 771. Interim corrective actions for these events included revision of residue, nuclear material handling, and nuclear material control operating procedures; additional work instructions for Material Stewardship operators: and a clarification of instruction to residue operators concerning the definition of an "empty" drum to prevent the inadvertent transfer of accountable quantities of plutonium to Building 771.

In summary, overall, hazard controls in Building 371/374 maintenance and operations procedures and work packages continue to improve due to the collective efforts of supervisors, subject matter experts, and workers. However, continued weaknesses in IWCP implementation create the potential for additional performance errors. Recent nuclear material control and accountability events and stand-downs at Building 371/374 indicate continuing weaknesses in work control programs. In some cases, hazard controls have not been developed, because the hazards were not identified or sufficiently analyzed. In other cases, such as with radiological controls and site ES&H programs, some controls have not been understood by line managers or have not been rigorously implemented.

Core Function #4 - Perform Work Within Controls

Although Building 371/374 had several project activities in stand-down, the limited amount of work observed by the Team was performed safely without injury, near misses, or illness. It was apparent that Project Managers, their deputies, supervisors, and foremen spent considerable time in the field observing and supervising day-to-day operations and work activities. Workers and supervisors who were interviewed clearly understood their rights and responsibilities to refuse to do unsafe work and to stop any unsafe work practices that they observed.

Formal processes are in place for the Shift Manager to review and approve work packages and to authorize work just prior to commencement of work. Shift managers, Project Managers, and the Facility Manager provide work coordination for the various work activities to resolve potential interferences. The shift manager verifies that work activities will not interfere with each other and makes frequent building announcements to keep workers aware of changing conditions within the building. The plan of the day is the approved listing of work authorized for that day. Work not listed on the plan of the day cannot commence unless formally added and approved.

The Team identified that due to the Building 371/374 electrical configuration, personnel perform considerable energized electrical work to make connections to panels that cannot be readily

de-energized. The team observed that energized electrical work for the Plutonium Stabilization and Packaging System Project CAMs/SAAMs wiring installation by KH construction was performed in a safe and professional manner. The supervisor, foreman, and electrical craft workers were properly trained and knowledgeable of both the technical and safety aspects of the job. An approved energized electrical permit, appropriate barriers, insulated matting, and proper personal protective equipment were used for the job. The workers performed work inside the energized panel with care.

Though most pre-evolution briefings were comprehensive, improvement is needed in ensuring that necessary personnel attend briefings and are fully involved in ensuring readiness to perform work. One work package was not thoroughly reviewed prior to the start of work, resulting in a lack of knowledge of all designated controls to be utilized. Although most parts of the briefing were very thorough, the D-249 tank level verification package was contained in an RWP that was unknown to workers, the supervisor, and an RCT supervisor and was not discussed during pre-evolution briefing for the work. When questioned by the EH-2 Team, the job was stopped due to that and other questions on the work package. Additional walkdowns with the supervisor, RCTs, engineering, planners, and craft identified addition questions on the work package. Deficiencies in the JHA (e.g., RWP not mentioned) and work instructions contributed to the missed control.

For radiological work, the team observed cases where job-specific air sampling requirements specified in the RWP for breaches on contaminated systems (glovebox bagouts) were not consistently followed or were based on assumptions having an inadequate technical basis. The use of general area continuous air monitors in place of representative work area DAC samples at the discretion of RCT supervision is not supported by procedure or a technical justification (See Core Functions 2 and 3).

Some deficiencies were identified in the conduct of radiological operations. A potential unsafe practice was identified where workers without respirators were standing immediately adjacent to an open door into an Airborne Radiation Area. When the door was shut toward the workers without respirators, the flow tag reversed, indicating that air was flowing from the Airborne Radiation Area toward those workers. There were some instances of improper control of radiological signage. This was a particular problem in Building 371/374 rooms that were constantly posted and deposted as Airborne Radiation Areas during operations such as glovebox bagouts. The Team identified one instance of improper control of radiological material where a box containing records labeled "radioactive material" was found open on two consecutive days. The Team identified the open box, which was then taped closed by an RCT. The same box was again found open the next day, indicating uncontrolled access to the material. Boundary control violations were also identified at several Contamination Area access points with used anti-contamination clothing and bags that were half in and half out of the Contamination Area.

Based on recent events and occurrences, KH and 371/374 Closure Project personnel have failed to integrate and implement proper controls for handling and transfer of nuclear materials and for core training. For example, improper surveillance of Category I nuclear material resulted in a Building 371/374 reportable occurrence. The contributing cause of this event was the lack of integration of the various groups that participate in the movement and counting of nuclear material within Building 371. Corrective actions for these events included performing new inventories, revising many operating procedures, training supervisors and operators, performing tabletop exercises, conducting procedure walkthroughs for operators, and implementing an organizational realignment of the Material Stewardship function within the 371 Closure Project. These actions should improve material handling and integration. However, the changes have yet to be proven effective.

Operation of the Building 371/374 life safety/disaster warning system could contribute to performance errors and is disrupting pre-evolution briefings, important planning and scheduling meetings, and phone calls because music and talk are broadcast through the system to all parts of the building. Regular testing provides a viable alternative to continuous broadcasting, which can adversely affect operations and work activities (recent National Institute for Occupational Safety and Health studies indicate that excessive noise has caused performance problems). The training/discipline on the life safety/disaster warning system could degrade recognition of hazards (through announcements), performance, and emergency response. Many personnel throughout the building continued conversations and card games, and did not stop to listen to the announcements.

In summary, although the level of work activities in the facility was low, work observed by the Team was performed safely and without incident. Due to

the number and scope of IWCP changes, the work control program is still evolving. Recent events indicate that management attention and follow-through are needed to foster additional improvements in the IWCP process and implementation. The corrective actions from recent events should result in improvements in safe work performance. The conduct of radiological operations requires improvement, particularly the basis for workplace air sampling in areas with potential or actual contamination and airborne radioactivity.

Core Function # 5 - Feedback and Improvement

The Building 371/374 Project Manager and Facility Manager have established a good working relationship, have recognized deficiencies in various programs affecting work control and fact finding for occurrences, and have initiated a number of corrective actions. The site has also recognized deficiencies in material handling and lockout/tagout. Although not complete, the corrective actions are a necessary step toward improved work control at the site and within the facility. Some initiatives in progress include:

- The Building 371/374 Project Manager recently initiated a daily management field walkdown program for key managers, guided by a checklist addressing operational and work control activities.

- The Building 371/374 Facility Manager is initiating a draft change to the IWCP that would simplify JHAs and make them more tailored to the job-specific hazards. The simplification would facilitate integrating the hazard controls into the work instructions used by the craft.

- A draft revision to the RFCP lockout/tagout procedure is in progress to address site lockout/tagout deficiencies (not necessarily Building 371/374 issues). Workers who were interviewed had a perception that the lockout/tagout program was different depending on which building they were working in. This may be due to having building-specific procedures, such as the Building 371/374 Operation Order on lockout/tagout, which requires KH construction workers to be familiar with different building-specific lockout/tagout procedures.

- Changes in the Building 371/374 organizational structure for nuclear material handling functions are being evaluated. In the present organization, several aspects of nuclear material handling report to managers outside Building 371, therefore complicating integration of functions within the building.

- Expectations for early involvement of workers, health and safety personnel, engineering, and radiological control personnel in planning of work packages, including walkdowns, are being emphasized. While improving, this area needs continuous emphasis.

- Daily and weekly meeting schedules are being realigned to strengthen integration for project and facility activities.

- Craft and troubleshoot-and-repair work packages are receiving additional scrutiny to ensure strict compliance with the IWCP.

- Fact finding is being improved through improved guidance and training on directives, and increased monitoring of fact-finding meetings by senior project management.

The Building 371/374 Quality and Compliance Program organization is working to improve the Quality Assurance surveillance program to provide feedback to the field and management for improving work-related processes. The Quality and Compliance Program organization conducts surveillance activities and some "fast-scan" assessments. The surveillances are performed in accordance with the institutional procedure, PRO-985 SURV, "Performance of Surveillances," which provides only broad guidelines for implementation of surveillance activities at the 371 Project level. There is no Building 371/374 Project implementing procedure, and much of the surveillance program is largely informal (with the exception of using Quality and Compliance Program organization guidelines and job aids for conducting surveillance activities and reviewing procedures). In January, the Quality organization established a surveillance schedule that is updated monthly. In 2001, about 30 surveillances have been performed to date; they are focused on areas such as pre-evolution briefings, work package review, material handling, and restart of activities (e.g., tap and drain).

Findings from some assessments have been entered into the site tracking system. However, Quality Assurance has only recently begun to follow up on previously identified deficiencies with managers responsible for an action. Building 371/374 practices should be formalized to ensure that a follow-up process for corrective actions is in place.

There are deficiencies in the Building 371/374 assessment programs. The management assessment program, which includes some self-assessment, focuses primarily on maintenance of the authorization basis, and some management assessment program cards are not comprehensive. Deficiencies are tracked in an informal database, and findings are not generally entered into the site corrective action and issues management program. External independent oversight is limited for the Building 371/374 projects and facility, and there is no safety and health self-assessment program in the facility.

Deficient procedures and training for the handling, movement, and surveillance of nuclear materials have resulted in recent reportable events. Work stand-downs, revision of numerous procedures, training, tabletop exercises, and organizational realignment of Material Stewardship are included in the corrective actions. Although most corrective actions were appropriate, the corrective actions for an event involving the inadvertent transfer of drums containing accountable quantities of plutonium from Building 371/374 to Building 771 did not fully address the proper root cause (procedure not defining what constitutes an empty drum, i.e., removal of accountable quantities of plutonium). The corrective actions should provide improvement; however, they have yet to be proven effective.

Discussion with Building 371/374 workers and review of IWCP work packages indicated limited evidence that information from formal post-job reviews is being reflected back into the work control program to provide continuous improvement. Likewise, formal post-job ALARA reviews are not being conducted to foster feedback and continuous improvement of radiological work planning processes, unless those jobs are considered high-hazard jobs. Workers, supervisors, and health and safety personnel are traditionally good sources for feedback on the adequacy of the IWCP and procedures, hazard controls, and unexpected conditions encountered while performing work. Underutilizing or not obtaining post-job review information is a significant missed opportunity to improve the work control process.

Assessment tools, such as the Radiological Improvement Report, are not being effectively used to promote improvement in radiological operations. Personnel involved in events that may have met the threshold for issuing a Radiological Improvement Report failed to initiate such reports during this review. Likewise, supervisors and managers were not proactive in ensuring that Radiological Improvement Reports were issued as required by procedures. For example, a work supervisor and an RCT supervisor were not aware of an RWP contained in an IWCP work package for the D-249 tank job; this situation was not recognized as warranting a Radiological Improvement Report. Additionally, the lack of control of the box of records labeled as radioactive material, found open by the EH-2 Team on two consecutive days, was not considered for an Radiological Improvement Report.

Some significant deficiencies known to the facility are not being entered in the RFCP issues management and corrective action program. For example, all troubleshoot-and-repair work orders were pulled from the field due to concerns about the scope of work and lack of specificity of task instructions to workers. The issue was not initially entered into the RFCP system (immediately corrected by the Facility Manager). Discussion with facility personnel indicated that the RFCP system is cumbersome and not "facility friendly," which may contribute to underutilization.

In summary, the feedback and improvement programs affecting Building 371/374 have only been partially effective in providing feedback and improvement. Missed opportunities in several feedback programs have limited the gain from lessons learned and increased the potential for continued performance errors that could lead to events. Some improvement is evident in programs such as the Quality and Compliance Program surveillances, and initiatives associated with the IWCP program. However, the RFCP issues management and corrective action programs are not being fully utilized for known facility deficiencies. Facility and Project Managers recognize the need for improvement in this area.

APPENDIX B
ASSESSMENT OF CORE FUNCTIONS IN 776/777 CLOSURE PROJECT

EH-2 assessed IWCP in the 776/777 Closure Project using the five core functions of ISM as a framework.

Core Function #1: Define Scope of Work

The EH-2 Team reviewed numerous work packages for Building 776/777 and observed several work activities covering a variety of IWCP work control methods, including Type 1 and 2 work packages, craft work packages, and technical procedures. In general, work scopes within the 776/777 Closure Project complex were well defined, providing clear boundaries and expectations for the work to be accomplished. At the 776/777 Closure Project, the planning organization has developed an iterative workflow process that implements, and in some areas supplements, the IWCP. This process includes multiple walk-downs and involvement by all necessary personnel to ensure that the scope of work is clearly understood at the outset.

Building 776/777 has tailored the IWCP process to begin early characterization of the hazards in conjunction with defining the scope of work. Because of the unique nature of D&D operations, characterization of hazards was considered a significant issue that should be addressed early in work package development. As a result, the work package developers are effectively reducing unnecessary delays that could otherwise occur later in package development. The scoping walk-down is another excellent addition to the process that allows the crafts, planner, and subject matter experts in a team approach to walk through the work area and redefine the scope if necessary. The scoping walk-downs were of benefit to the planners, and useful comments were integrated into the work package as a result.

In summary, the tailoring of the IWCP process to D&D activities through use of scoping walk-downs and the strong commitment to teamwork have resulted in accurate and appropriate consideration of the scope of work.

Core Function #2 - Analyze the Hazards

At the facility level, the 776/777 Closure Project complex has a DOE-approved BIO that meets the requirements of DOE Order 5480.23 for the approved authorization basis. The BIO was approved in October 1999 when it replaced the final safety analysis report. The BIO is comprehensive and addresses the relevant nuclear hazards associated with D&D activities in the 776/777 Closure Project. KH has an effective institutional unreviewed safety question (USQ) process for maintaining the authorization basis. All USQ screenings, evaluations, and determinations can be easily retrieved on the RFCP Intranet.

Some configuration control problems were observed regarding safety-related systems. Safety systems that have failures are evaluated using engineering operability evaluations prepared by Engineering at the request of the Shift Manager/Configuration Control Authority. The determinations no longer include the ambiguous finding of “Conditionally Operable” as they did in 1995, but the active evaluations are not being adequately maintained. At least one of the engineering operability evaluations reviewed in the Configuration Control Authority log (still active) had been in effect since 1997, and the condition it evaluated had been removed by a design modification. Specifically, the engineering operability evaluation was that one of the two banks of 20 cells for the Diesel Generator Start system was adequate. A single bank of 40 cells has since replaced the banks of batteries. USQ screens and evaluations for engineering operability evaluations are performed only when an evaluation concludes that a system is “inoperable,” without regard for the fact that actions taken to make the system operable may, in fact, represent temporary modifications. In addition, existing engineering operability evaluations that were in effect when the BIO was being developed were never evaluated for inclusion in the BIO or reevaluated for deletion after the BIO was implemented.

At the task level, JHAs were performed for the appropriate work packages. Craft workers are normally involved in the development of the JHAs, which are reviewed at several points during work package development.

JHAs are not sufficiently tailored to the work being planned. Most JHAs consist of lengthy hazard descriptions that are generic to the building, such as trip hazards, lighting, and sharp objects, but that are not necessarily applicable to the specific work activity. While important, these generic hazard descriptions tend to mask the hazards specific to the job, such as beryllium, plutonium, or other special handling or ergonomic considerations. In addition, the JHAs are being used improperly as work documents. For example, instead of containing a warning or precautionary note and identifying associated controls within the work instructions, the work instructions often refer back to specific steps of the JHA, causing the workers to continually flip back and forth between documents. Some hazards, such as beryllium and plutonium contamination and associated effects of ventilation changes, receive minimal or generic treatment in the JHAs. Although they are referenced, the hazards' effect on the specific job is not delineated. Planners do not screen generic work package templates to remove statements and actions that are not applicable, thus contributing to the poor usability of work packages.

The dominant building hazards, plutonium and beryllium, have not been fully characterized in the overheads (above eight feet) of some portions of the complex. Efforts to characterize loose contamination in the overhead were in progress during this review. Given the possible problems with historical chronic exposures noted in other buildings, the incomplete characterization hinders the ability to properly assess the hazards to workers performing tasks in these areas. There is a heavy dependence on workplace sampling during work for airborne contamination, but given the widespread potential for frequent and significant changes to airflow in the work area, this sampling may be of limited value.

In summary, deficiencies exist in analyzing hazards. JHAs are too generic and may not address all job-specific hazards. Longstanding problems with building characterization are now being addressed. Significant management attention is needed to ensure that hazard analysis processes are upgraded to acceptable levels.

Core Function #3 - Identify and Implement Controls

At the facility level, the plan for D&D of the facility was to perform the less hazardous, less complex work first and then proceed to the more difficult. This approach has enabled the facility to develop a learning curve, improve teamwork, and set a safety standard for identification and implementation of controls that mitigate the dominant hazards. The upcoming more complex D&D work presents a significant challenge to the team. The facility has an experienced team, which enhances their ability to identify and implement controls for the unique hazards. All crafts personnel performing D&D work have attended the D&D course, which supplements their practical skills and promotes the safe use of the tools and equipment used for D&D.

The 776/777 Closure Project BIO contains a set of technical safety requirements that establish the normal operational controls for the facility. There have been several recent problems related to those technical safety requirements. Some of the controls, primarily surveillance requirements, are not adequately defined by the technical safety requirements, but instead rely on other documents such as the DOE safety evaluation report and the Site Criticality Safety Manual. Changes to the site documents referenced in the technical safety requirements are not always recognized as changes to the authorization basis and are not adequately tracked from initiation of the change to implementation of the change in surveillance procedures and schedules. During this EH-2 review, two technical safety requirement violations were reported. The first was discovered by an KH internal criticality safety assessment that determined the criticality accident alarm system/life safety/disaster warning systems for Building 776/777 had not been tested in accordance with the surveillance requirement. Specifically, Buildings 701, 702, and 703 are within the required coverage area for the Building 776/777 systems, but the systems had not been tested in those buildings as required. The second violation occurred during the surveillance to restore the systems to operable status. A security guard violated a posting and entered an area without permission, escort, or the alarming dosimeters as required by the limiting condition of operation. KH has submitted a revised BIO to RFFO for approval that will clarify many of the technical safety requirements.

At the task level, the facility has fully implemented the IWCP to identify and implement controls to ensure safe work performance. The planner leads a team of engineers, crafts personnel, and health and safety personnel to identify the hazards and incorporate hazard controls. There is full participation by engineers, crafts, industrial hygiene, safety, and radiological control personnel. Hazard controls are generally identified in the work documents. The application of these general

controls and specific controls related to the work is often left up to the work site supervisors and RCT supervisors. Specific controls identified during the planning process are not adequately included in the work instructions at the work step where the control is required. The JHAs are written to cover a wide range of potential hazards, and specific hazards related to specific work steps are not always clearly identified.

The controls developed in planning are enhanced and enforced by the Configuration Control Authority (Shift Manager). These personnel are fully aware of and approve all work operations within the facility. The facility arrangement requires personnel to "check in" with the Configuration Control Authority before any work or tours. The Configuration Control Authority keeps status boards of the entire facility as to postings and hazards, such as Airborne Radiation Areas, High Contamination Areas, and Beryllium Controlled Areas. The Configuration Control Authority is aware of and controls the configuration of all systems within the facility, approves all operations in the facility, ensures that work crews are properly separated so that they do not cause problems/hazards for each other, and maintains a detailed log of ongoing work and any problems associated with the work. This log provides feedback to the project team as to problems and issues that need further evaluation to prevent recurrence.

Undocumented changes in the facility electrical system continue to pose hazards to the workers, leading to some recent problems and near misses. The facility has recognized the potential for encountering undocumented live electrical circuits and has implemented extensive additional controls in a standard electrical work package. Elements of the standard work package to improve controls include isolation as close to the power source as possible, requiring electrical rip-out prior to mechanical rip-out, and the use of state-of-the-art equipment to locate energized circuits prior to intrusion. For Type 2 work packages, similar controls are used. However, even with the extra controls in place and implemented, during the EH-2 review, a false wall was removed and uncovered a previously unknown energized 110 volt double wall outlet. To further enhance safety, the Project Manager is aggressively implementing a "cold and dark" approach to the remainder of Building 776/777 D&D, shutting down all existing electrical service to the facility and powering necessary loads from a new temporary power source with a known and controlled configuration.

The facility does not always maintain adequate operational configuration control. In one case, the load sequencing circuitry for the safety-related emergency diesel generator is in a degraded status, with three of seven of the load sequencing panels out of service. The Stationary Operating Engineers were not cognizant of which panels were out of service. Following notification of the deficiency, the facility performed an engineering calculation to show that the diesel generator remains operable with the degraded circuitry. In another case, an impairment tag over three years old was found on a safety-related fire protection HVAC deluge system. This impairment and its significance were unknown to the operators. Multiple instances of out-of-date information and unapproved operator aids were observed being used by the Stationary Operating Engineers in the control room.

Radiological controls within the facility do not always meet normally accepted standards and good radiological control practices. Much of the D&D work in the facility is being performed on a single RWP. This RWP covers a wide range of radiological conditions and depends on the RCT or RCT supervisor to apply appropriate controls. This practice negates the benefit of detailed advance planning for specific work tasks to assure proper controls. For example, one job being worked under this RWP was removal of two exhaust hoods. For this job, an RCT performs a daily smoke test to determine air flows and the appropriate area to post as an Airborne Radiation Area. A Beryllium Control Area was also posted by industrial hygiene based on this smoke test. Although they provide an important safety control, the smoke tests were not required by a job-specific RWP, JHA, or IWCP work package. Also, the postings and associated respiratory protection requirements for the exhaust hood removal job were implemented as a secondary control based on the potential for airborne activity because of a breach of a containment system. The area exhaust airflow was reduced when the hoods were blanked off, changing the airflow characteristics in the work area. This flow change was not addressed by the RWP and not identified as a potential hazard in the JHA. A subsequent smoke test, prior to the breach of the ventilation system, showed the airflow change, confirming that the boundary of the original posted area did not encompass all areas where contaminated air could be encountered. The RCT then substantially expanded the posted area based on the smoke test prior to hood removal.

Other specific facility radiological controls/practices do not meet normally accepted standards and need improvement, including:

- The practice of donning and doffing respirators multiple times in posted Contaminated Areas without proper contamination survey of gloves and respirator

- The practice of donning and doffing respirators when leaving and entering a High Contamination Area while surveying hands and respirator with a Ludlum 12-1A with a minimum sensitivity of 500-1000 dpm

- Multi-day uses of respirators using an "Electra" without swipe surveys to clear the respirator from a Contaminated Area

- Using brooms and dust mops, which can cause airborne radioactivity, rather than HEPA-filtered vacuum cleaner and Maslin mops for maintaining facility cleanliness.

Overall, the process for defining and implementing controls is sufficiently addressed by the IWCP. However, at the activity level, controls described in JHAs and RWPs are not sufficiently tailored to work being performed. At the facility level, some authorization basis controls, such as technical safety requirements, require strengthening. Management attention is needed to ensure that appropriate controls are consistently implemented for work activities.

Core Function #4 - Perform Work Within Controls

Safely performing work is the result of adequately defining and analyzing work, then identifying and implementing the appropriate controls and supervisory oversight commensurate with the risk of the activities to be performed. A rigorous process is necessary to confirm adequate preparation and readiness to begin work before work is authorized. The formality of the process, the extent of documentation, and the level of approval should be based on the hazards and complexity of work. At the 776/777 Closure Project, implementation of the controls discussed under Core Function #3 has generally resulted in disciplined work practices and processes. Overall, the observed work activities were safely performed in accordance with the IWCP work instructions or the appropriate technical procedures.

At the 776/777 Closure Project, readiness to perform work is confirmed for all activities, including D&D, construction, and utilities activities. Readiness is verified at several points during the preparation for work. Workability walk-downs ensure that IWCP packages are ready before work begins. Foremen meetings the day before the work is planned are particularly effective in ensuring that support personnel are ready and coordination issues are resolved. The plan of the day on the day the work is planned provides a final verification that no conflicts exist. A final approval from the Configuration Control Authority is required before work actually begins.

Comprehensive pre-evolutionary briefs are an important step in establishing readiness for work. Pre-evolutionary briefs observed by the team were comprehensive and covered the topics required by the IWCP. The job foremen were knowledgeable of the contents of the work packages and procedures and gave appropriate attention to hazards associated with the job. Workers were not always attentive, however. For example, in one pre-evolutionary brief for an ongoing craft job, most of the workers were not present at the beginning of the brief, and the foreman focused the brief primarily on the support personnel, such as the RCT. Although the craft workers drifted in during the brief, they carried on separate conversations and did not contribute to the brief.

The presence of the job foremen during performance of the jobs was evident, and the foremen actively oversaw and provided direction to the workers. The foremen ensured that applicable controls were in place and that approvals were obtained. The foremen actively monitored the progress of jobs, maintained the work in compliance with the steps of the applicable work package or procedure, and provided the necessary guidance, direction, and support to the workers as needed to get the jobs done safely. The work observed by the Team was performed professionally and in accordance with the applicable controls and procedures. 776/777 Closure Project management encourages teamwork, and teamwork was evident throughout the facility, from the Project Manager through the worker level. Establishment of D&D teams provided a sense of ownership of the sets by the workers.

Craft skill, experience, and awareness contributed significantly to the ability to perform work safely. An important tool in the development of this knowledge is the RFCP D&D training course. The course provides specialized classroom and hands-on training in the skills needed to perform most types of D&D work. The course includes: hands-on training for hand tools (such as reciprocating and band saws), decontamination work

inside a glovebox with simulated contamination, JHA development for demolition work on a large hydraulic press with complex electronic controls, disassembly of a glovebox with simulated contamination, and size reduction of a waste container in respirators and Premair suits inside a containment tent.

The mockups and labs are realistic and provide hands-on experience for the workers. The workers attend with their supervisors as a crew, which promotes teamwork. RCTs also attend on a voluntary basis, but receive limited benefit from the course because they are not evaluated and do not have a specified curriculum in the course. Overall, the course is a noteworthy effort to prepare workers for the unique hazards associated with D&D work.

In summary, observed work in Building 776/777 was performed safely and without incident. Although weaknesses discussed in the previous core functions jeopardize continued safe work, the competence and experience of the workforce and the support and attention to workplace safety provided by facility management have been effective to date in minimizing unsafe work.

Core Function #5 - Performance Evaluation and Feedback

Management has established a work environment that allows workers to focus on the safe execution of the work, rather than on the time it takes to accomplish the work. Expectations for working safely are conveyed to the workforce by giving awards for safe work practices and disciplinary actions when practices are unsafe. To assure that safety receives priority over schedule, senior management does not share schedule information with D&D workers, RCTs, or foremen. Managers, planners, and engineers are encouraged to provide priority support to D&D crews that fall behind schedule. RCT and D&D foremen spend much time at job sites providing direction, with emphasis on safety. The 776/777 Closure Project practice of not sharing schedule information to ensure that pressures to meet schedules do not adversely impact safety is a **Noteworthy Practice**.

The Project Manager and Deputy frequently visit job sites to reemphasize the importance of working safely. Most workers say that they believe management places high priority on safety and that they raise safety concerns to their supervisors without fear of retribution. KH maintains employee concerns programs to provide different avenues for workers to raise concerns when they prefer not to raise them through their supervisors. Two individuals who recently joined the 776/777 Closure Project workforce expressed reluctance to raise safety concerns based on adverse consequences that they suffered for raising such concerns at other DOE sites.

The formal management assessment program provides effective monitoring of compliance with safety programs, but appropriate corrective actions are not always taken. Functional managers have been assigned responsibility for assessing each of the 17 safety management programs described in the 776/777 Closure Project BIO, assessment criteria and frequencies have been established, and program implementation is being tracked and trended in accordance with procedures. In general, assessments are performed at required frequencies, and commitments for corrective actions are completed on schedule. However, corrective actions are not always effective. Ineffective corrective actions were particularly apparent in the area of training, where significant deficiencies in implementation were identified but not corrected (although subsequently, Project Managers have developed a more comprehensive corrective action plan). Few assessments analyze program effectiveness. For example, assessments of radiation protection do not include analysis of personnel contamination events, air sampling results, bioassay results, or the workplace indicators that trigger special bioassays.

Semiannual safety management program reviews provide integrated assessments of safety program implementation that are of value to Project management. These reviews include analysis of events identified through the management assessment program, occurrence reports, internally reported events, Radiological Improvement Reports, limiting condition for operation violations, Environmental Compliance Action Tracking reports, and Configuration Control Authority log book entries. The semiannual reviews also include program assessments by program managers. The Project Manager uses the semiannual report to monitor safety performance and to identify areas where additional management attention is needed. The semiannual reviews meet or exceed commitments in the 776/777 Closure Project BIO but:

- Some program assessments were not rigorous and self-critical, and did not identify longstanding

deficiencies. For example, an assessment of conduct of operations found no deficiencies in pre-evolution briefings, work packages, or operator aids.

- Several assessment reports do not clearly describe the extent of evaluation or observations performed to reach stated conclusions, and there are inconsistencies in the amount and type of information included by each manager.

- Performance deficiencies identified by management walkthroughs, by RFFO Facility Representatives, and by the KH Independent Assessment staff are not included in semiannual assessments unless these deficiencies are documented in other processes that are assessed.

Until recently, feedback on work packages was not effective. Planners rely on feedback from job foremen on post-job-review forms to identify Opportunities for Improvement of future work packages. The questionnaire on this form does not elicit appropriate feedback and, until recently, most of the feedback received was not useful. A request by management for better feedback appears to have been effective in improving recent feedback.

The Project staff actively seeks safety lessons learned to share at plan-of-the-day meetings, pre-evolution briefs, and toolbox meetings. The 776/777 Closure Project Quality Assurance staff supports this effort by maintaining a file of Safety Flashes and Toolbox Messages for use by the Project Managers. Supervisors take the initiative to discuss with their peers any problems encountered in other areas of the plant and seek additional information on events from sources outside Rocky Flats that may have value for the 776/777 Closure Project. The KH Central Office provides lessons-learned information to the Project in an electronic database, but this information lacks sufficient detail and analysis to be useful. The Central Office does not have a process for assuring that good practices and lessons learned are appropriately implemented within RFCP Closure Projects.

Independent oversight by the KH Central Office Oversight Group has not been fully effective. The KH Oversight Group assigned two staff members to the Project to provide independent oversight but did not define assessment expectations in a structured program, and independent assessments have not critically evaluated ES&H programs at a frequency appropriate to risk and prior performance.

The two RFFO Facility Representatives assigned to the Project have identified deficiencies in safety performance, but the effectiveness of their efforts is limited by lack of a structured RFFO program to define inspection priorities, assess findings, and formally transmit assessment results to KH management. Facility Representatives present their findings to the Project Manager weekly and track the status of corrective actions until the actions are completed. RFFO does not routinely perform integrated assessments of Project safety programs and has not performed such an assessment in the past six months.

APPENDIX C
ISSUES FOR CORRECTIVE ACTION AND FOLLOW-UP

Line management is responsible for correcting deficiencies and addressing weaknesses identified by EH-2 reviews in accordance with DOE Order 414.1A, *Quality Assurance*. Following each review, line management prepares a corrective action plan. EH-2 follows up on significant issues as part of a multifaceted follow-up program that involves follow-up reviews and tracking of individual issues.

This appendix summarizes the significant issues identified in this report of the Special Review of RFCP. The issues identified in Table A-1 will be formally tracked in accordance with DOE Order 414.1A. The DOE Office of Environmental Management and RFFO need to specifically address these issues in their corrective action plan.

Table A-1. Issues Identified in Special Review

IDENTIFIER	ISSUE STATEMENT	Refer to Pages
RFCP-FR-01-01	IWCP implementation is not always adequate to ensure that controls are consistently tailored to the specific work performed, that work instructions are clear and include appropriate hazard information, and that work is performed in accordance with the defined scope and controls as required by DOE Policy 450.4, *Safety Management System Policy*, and the RFCP IWCP.	28-30
RFCP-FR-01-02	Some training program requirements and a number of KH institutional safety requirements and responsibilities described in the Occupational Safety and Industrial Hygiene Manual are not being adequately implemented.	30-31
RFCP-FR-01-03	Some KH feedback and improvement mechanisms have not been clearly defined and rigorously implemented to provide management with the performance data necessary to prevent recurring events, correct unsatisfactory performance, and drive continuous improvement, as required by DOE Policy 450.5, *Line Environment, Safety and Health Oversight*, and DOE Order 414.1A, *Quality Assurance*.	31-34
RFCP-FR-01-04	The RFFO line management oversight program does not meet DOE Policy 450.5, *Line Environment, Safety and Health Oversight*, requirements for conducting coordinated and integrated environment, safety, and health line oversight of the contractor and maintaining sufficient knowledge of program activities to enable informed decisions on safety resources.	34-35
RFCP-FR-01-05	Because of weaknesses in identifying and characterizing radiological conditions in areas such as workplace indicators, radiological work permits, and airborne monitoring, RFCP may not be demonstrating that worker exposures are as low as reasonably achievable.	35-37
RFCP-FR-01-06	Insufficient engineering planning and consideration for the degraded condition of the Building 771 ventilation system challenges the system's capability to confine plutonium and ensure the proper direction of contaminated airflows during decontamination and decommissioning activities as required by DOE Order 420.1 *Facility Safety*. The use of temporary ventilation systems has not been controlled to minimize the potential for plutonium intakes.	37-38

APPENDIX D
TEAM COMPOSITION

The EH-2 Appraisal Process Guide provides the general procedures used by the Office of Independent ES&H Oversight program for conducting inspections and reviews. The composition of the Special Review team, including both the team that reviewed the internal doses in Building 771 and the team that reviewed the IWCP and line management oversight in the 371/374 and 776/777 Closure Projects, is as follows:

Office of Independent ES&H Oversight

S. David Stadler, Ph.D., Deputy Assistant Secretary

Raymond Hardwick, Associate Deputy Assistant Director - Operations

Director, Office of ES&H Evaluations

Patricia Worthington, Ph.D., Director
Thomas Staker, Deputy Director

Director, Office of Special Projects and Investigations

Thomas Rollow, Director
Chip Lagdon, Deputy Director

Internal Doses in Building 771 Team

Thomas Rollow, Team Leader
Chip Lagdon
Rowland Felt
John Eschenberg
Bryce Rich
John Riley
Al Gibson
Dave Berkey
Ed Stafford

IWCP and Line Management Oversight

Robert Freeman, Team Leader
Ali Ghovanlou, Ph.D.
Gerald Bowman, DOE-ID
Tim Martin
Al Gibson
Bob Compton
Bernard Kokenge, Ph.D.
Brad Davy
Mike Gilroy
Ed Stafford
Jim Lockridge
Mark Good
Mario Vigliani
Jack Riley

Communications and Support

Mary Anne Sirk
Barbara Harshman
Tom Davis
Vikki Hanks

Quality Review Board

S. David Stadler
Raymond Hardwick
Frank Russo
Patricia Worthington
Thomas Staker

Abbreviations Used in This Report

ALARA	**As Low As Reasonably Achievable**
BIO	**Basis for Interim Operations**
CAM	**Continuous Air Monitor**
CEDE	**Committed Effective Dose Equivalent**
CFR	**Code of Federal Regulations**
D&D	**Decontamination and Decommissioning**
DAC	**Derived Air Concentration**
DOE	**U.S. Department of Energy**
EH-2	**DOE Office of Independent Environment, Safety, and Health Oversight**
ES&H	**Environment, Safety, and Health**
ESH&Q	**Environment, Safety, Health and Quality**
FY	**Fiscal Year**
HEPA	**High Efficiency Particulate Air**
HVAC	**Heating, Ventilation, and Air Conditioning**
ISM	**Integrated Safety Management**
IWCP	**Integrated Work Control Process**
JHA	**Job Hazards Analysis**
KH	**Kaiser-Hill Company, LLC**
OSHA	**Occupational Safety and Health Administration**
OS&IH	**Occupational Safety and Industrial Hygiene**
PATS	**Plant Action Tracking System**
RCT	**Radiological Control Technician**
RFCP	**Rocky Flats Closure Project**
RFFO	**Rocky Flats Field Office**
RWP	**Radiological Work Permit**
SAAM	**Selective Alpha Air Monitor**
USQ	**Unreviewed Safety Question**
USQD	**Unreviewed Safety Question Determination**