Office of Independent Oversight and Performance Assurance

Focused Review of Environment, Safety and Health at the

Kansas City Plant

Volume I

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OVERSIGHT

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Abbreviations Used in This Report

AHA	Activity Hazards Analysis
AL	Albuquerque Operations Office
CAR	Corrective Action Report
CY	Calendar Year
DOE	U.S. Department of Energy
EPA	Environmental Protection Agency
ESAP	Environmental Self-Assessment Program
ES&H	Environment, Safety, and Health
FM&T	Honeywell Federal Manufacturing & Technologies
FR	Facility Representative
FY	Fiscal Year
HASP	Health and Safety Plan
ISM	Integrated Safety Management
ISO	International Organization for Standardization
IWPF	Industrial Wastewater Pretreatment Facility
JHA	Job Hazards Analysis
KCP	Kansas City Plant
LO/TO	Lockout/Tagout
MDA	Minimum Detectable Activity
MES	Manufacturing Execution System
MOPS	Managers Observing & Promoting Safety

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1.0 Introduction

The Secretary of Energy's Office of Independent Oversight and Performance Assurance (OA) conducted a focused review at the Kansas City Plant (KCP) in November 2001. The review was performed as a combined effort of the OA Office of Environment, Safety and Health Oversight and the OA Office of Emergency Management Oversight. The purpose of this ES&H review was to assess the effectiveness of selected aspects of KCP environment, safety, and health (ES&H) programs and implementation of the U. S. Department of Energy (DOE) integrated safety management (ISM) system. This volume discusses the results of the review of KCP ES&H programs. The results of the review of the KCP emergency management programs are discussed in Volume II of this report, and the combined results are discussed in a summary report.

The National Nuclear Security Administration (NNSA) Deputy Administrator for Defense Programs is the cognizant secretarial office for KCP and has overall Headquarters responsibility for programmatic direction and funding of activities at KCP. Within the NNSA, the Albuquerque Operations Office and its subordinate, the Office of Kansas City Site Operations (OKCSO), have line management responsibility for KCP. OKCSO was formerly named the Kansas City Area Office but was renamed on December 3, 2001. Under contract to DOE, KCP is managed and operated by Honeywell Federal Manufacturing & Technologies (FM&T).

Aerial View of Kansas City Plant

Current site activities performed at KCP include the manufacture of non-nuclear mechanical, electronic, and engineered material components for U.S. national defense systems. KCP encompasses three major complete factories that are involved in developing and producing non-nuclear weapons components. KCP also provides technical support services for national laboratories and government agencies. These services include laboratory testing and analysis, training program development, and vehicle safeguarding. KCP is in the midst of construction and facility reconfiguration projects as part of a multi-year program to downsize and consolidate KCP and to make some areas of KCP available for use by other Federal agencies.

The chemical hazards at KCP include cyanide, alloys containing beryllium, mercury, chromium, acids, caustics, ammonia, and polychlorinated biphenyls (PCBs). Potential physical hazards include machine operations, noise, high-voltage electrical equipment, excavation, pressurized systems, and construction. Additionally, radiation-generating devices and small quantities of radionuclides are used on site.

Specific operations and activities that were evaluated during this review included three types of work activities — production, maintenance, and construction. These work activities were evaluated in terms of the core functions of safety management as delineated in the DOE ISM policy. The environmental protection program was also evaluated based on the core functions of safety management. Furthermore, the OKCSO line and contractor feedback and improvement systems were evaluated.

As discussed in this report, KCP has a good safety and environmental record. Some aspects of the ISM program are effectively implemented. However, increased management attention is needed to enhance hazard analysis and control processes. Improvements are also needed in the OKCSO and FM&T feedback and improvement systems.

Section 2 of this volume provides an overall discussion of the results of the review of the KCP ISM program, including positive aspects, findings, and other items requiring management attention. Section 3 provides OA's conclusions regarding the overall effectiveness of the program. Section 4 presents the ratings assigned as a result of this review. Appendix A provides supplemental information, including team member composition. Appendix B identifies the specific findings that require corrective actions and follow-up. Appendix C discusses the results of the review of the production, maintenance, and construction activities. Appendix D presents the results of the review of the OKCSO and FM&T feedback and continuous improvement programs. Appendix E discusses the evaluation of environmental protection programs at KCP.

2.0 Status and Results

The results of this review indicate that the KCP program has several significant positive attributes (see Section 2.1). However, several weaknesses and areas requiring attention were identified (see Section 2.2).

2.1 Positive Program Attributes

KCP's management commitment to safety, knowledgeable ES&H professionals, and experienced workforce have contributed to a good safety record at KCP. OKCSO and FM&T actively track and trend safety performance data such as the ISM performance measures. Their performance measure results indicate that KCP has a good safety record and generally performs better than industry averages and DOE averages in such measures as worker health and safety, and environmental releases. For example, the KCP injury and illness rates are significantly lower than the DOE averages. Additionally, OKCSO and FM&T have had success in monitoring the ISM performance measures and taking action to improve performance. For example, the ISM performance measures indicate that KCP has achieved a downward trend in injury and illness rates and waste generation over the past five years.

OKCSO and FM&T management have supported processes and programs such as International Organization for Standardization (ISO) 14001 and the DOE voluntary protection program and have utilized these processes to enhance safety programs at KCP. OA's interviews with management, supervisors, and working-level personnel indicate that FM&T personnel have a high regard for performing work activities safely. Interviews confirmed that FM&T personnel are not subjected to a "production over safety" mentality and felt empowered to use their stop-work authority if they encountered any questionable or unsafe condition. FM&T management strongly supports stop-work authorities and responsibilities. FM&T personnel actively use the employee-concerns telephone line to report ES&H concerns and near misses, and members of the FM&T ES&H staff have a good record of promptly addressing employee concerns. On several occasions, ES&H personnel took the initiative to perform non-required actions to enhance safety, such as conducting formal post-job reviews for high-voltage electrical work. KCP's various safety committee meetings are well attended and have resulted in a good exchange of information, the identification and correction of various deficient conditions, and improvements to safety. Notwithstanding weaknesses in procedures and work instructions, the experienced workforce is generally knowledgeable of hazards related to their duties and displayed a high regard for conducting work safely.

KCP management has demonstrated sustained leadership in environmental protection and has effectively applied environmental protection controls. KCP has attained certification for conformance to the internationally recognized ISO 14001 environmental management system standards. KCP is also a charter member of the Environmental Protection Agency's environmental performance track program, which requires sustained superior environmental performance and formalized management systems. KCP environmental policies include a commitment to compliance with regulatory requirements, pollution prevention, and continuous improvement. OKCSO and FM&T management have applied sufficient resources to address significant aspects of the site's operations. Over the past decade, nearly all remedial actions have been accomplished to address legacy waste disposal sites; KCP has reduced local environmental impacts and has improved the efficiency of operations through pollution control and pollution prevention initiatives.

In the environmental protection area, FM&T has established process descriptions and associated work instructions for production and support departments to manage and control work activities in accordance with established regulations, applicable DOE orders, and FM&T policies. Policies, procedures, and directions for

air pollution control (volatile organic compounds and chromium), wastewater discharges, and waste management contain appropriate operational specifications. Additionally, FM&T has effectively applied engineering controls to many aspects of its operations to reduce potential impacts to the environment. Examples include scrubber systems on the ventilation exhaust systems for chromium plating lines, and secondary containment devices for solvent parts washers and plating tanks. Other engineered systems that are used to reduce environmental impacts include a groundwater extraction and treatment system to control contaminant migration through environmental pathways, and the operation of the Industrial Wastewater Pretreatment Facility to manage liquid effluents. A particularly noteworthy application of engineering controls was observed within Department 90, which uses gloveboxes to minimize the spread of radiological contamination, high-efficiency particulate air filters to control air emissions, and secondary containment for an acid bath and liquid process piping to contain any leaks or spills.

KCP has established comprehensive beryllium hazard controls through the KCP beryllium program. KCP has had a beryllium program since the 1960s, and a recent in-depth FM&T quality assurance audit concluded that the program is in full compliance with the new DOE Beryllium Rule (10 CFR 850, issued in January 2000). During the past two years, FM&T has expended significant resources in characterizing plant work areas, developing beryllium decontamination work practices, and implementing programs consistent with the new DOE Beryllium Rule. The program has been proactive in identifying beryllium workers and has demonstrated a conservative approach by allowing all FM&T personnel who believe that they may have been incidentally exposed to enter the beryllium program.

KCP has established an effective predictive maintenance program that reduces the risk to personnel and facilities by reducing unexpected equipment failures. In addition to preventive and corrective maintenance programs, FM&T has established an extensive predictive maintenance program. This program is designed to monitor and analyze equipment performance to detect equipment degradation and replace equipment and components *before* failures occur. As part of this program, the FM&T Maintenance Department performs various activities, such as vibration analysis on rotating equipment, infrared thermography on electrical equipment, and lubricating oil analysis. Due in part to the predictive maintenance program, the Maintenance Department has not had to replace any pump, motor, or fan bearings in the West Boiler House in the past few years. The program reduces the risk of personnel injury and facility damage from sudden equipment failure (e.g., energetic circuit breaker or pump failures). It also reduces the amount of corrective maintenance needed and the inherent risks associated with those activities, as well as reducing the number of challenges to facility safety systems (e.g., emergency power systems that must operate in the event of an electrical component failure causing a loss of primary electrical power).

Production Area - Clean Room

Computer-based work control and hazards analysis processes have increased workers' and line management's access to safety and health information and involvement in hazard identification. FM&T is in the midst of a significant effort to transition from paper-based work control and hazards analysis processes to computer-based systems. This transition is designed to expand access to health and safety information (e.g., material safety data sheets and job hazards analyses) and increase worker involvement in hazard identification and analysis. During the past two years, FM&T has launched the computer-based MAXIMO work control system for maintenance activities and a comparable manufacturing execution system for production activities, and the job hazards analysis process was transitioned from a paper-based system to a computer-based system. The material safety data sheet system is being integrated into the MAXIMO and manufacturing execution systems. A prototype for a computer-based preliminary hazards analysis process,

the hazard identification and control system, has been developed, and implementation is expected during calendar year 2002. Collectively, these computer-based systems provide workers with easier access to a wider spectrum of health and safety information. In addition, the new computer-based systems promote worker involvement because the systems require more input from line managers, production and maintenance personnel, and ES&H professionals in the identification and analysis of hazards and controls. If properly implemented, the new systems could provide an effective framework for addressing the current deficiencies in work control processes (see Section 2.2).

2.2 Program Weaknesses

Deficiencies in KCP hazard identification and analysis programs (i.e., preliminary hazards analysis, job hazards analysis, and exposure assessment programs) have resulted in some hazards not being recognized or adequately analyzed. The principal KCP work activity-level hazards analysis processes are the preliminary hazards analysis, the job hazards analysis, exposure assessments, and various departmental hazards analysis processes. Each of these hazard identification and analysis processes has a number of positive attributes; however, they are deficient in several areas. They do not adequately document some elements of the processes; they do not establish clear thresholds for initiating or updating the processes; and they do not apply these processes to routine work activities that are static and unchanged. Most importantly, these processes are not integrated and adequately applied to individual work activities to ensure that hazards for each work activity have been identified, analyzed, and documented. As a result, some exposure hazards, such as vapors, dust, and noise, had not been analyzed; some confined spaces had not been identified; and potential worker hazards existed. For example, several KCP areas, including the telemetry shop, the environmental testing laboratory, and the analytical and physical testing laboratory, use or store large amounts of carbon dioxide (CO_2), which could expose workers to dangerous levels of CO_2 during routine or abnormal operations. The existing hazards analysis for the CO_2 only assumes that simple displacement of oxygen occurs. The analysis does not account for the toxic properties of CO_2, which occur at much lower concentrations than those required for oxygen depletion. FM&T has not performed any baseline monitoring of CO_2 in these locations and does not perform routine measurements of concentrations in accordance with an established exposure assessment program. Although the telemetry shop does have oxygen sensors that provide adequate warning for oxygen deficiency, the other areas do not have alarms that would reliably notify workers when the CO_2 reaches a level that is immediately dangerous to life and health.

Component Testing Equipment

FM&T has not established an effective process to ensure that all hazard controls that were identified during the hazards analysis process are implemented at the working level. Hazard controls are developed during hazards analysis processes and are appropriate for the hazards in many cases. However, the controls are not always implemented in working-level documents or otherwise communicated to personnel at the working level. Controls are identified in preliminary hazards analysis evaluation reports and are transmitted to the applicable departments; however, there are no requirements that ensure the controls are implemented. The decision on whether to implement the controls usually rests with the process engineers, who may not possess the appropriate ES&H expertise to make these determinations. Similar problems exist with the controls identified in job hazards analyses, chemical hygiene plans, and construction health and safety plans; that is, the relevance or application of controls to a specific work activity is not well defined in some cases. The method for communicating to the workforce any revisions to the controls contained in general process instructions is not consistently effective. Consequently, personnel are not always informed of changes to requirements.

For example, a routine work activity within the Plating Department is the immersion of stainless steel alloy parts in a series of baths, one of which contains a potential carcinogen (sodium dichromate). Although a variety of KCP hazard control processes were applied to this work activity, the minimum controls that are required when performing this work were not adequately specified at the working level. For example, the work instructions did not describe either the hazards or controls for this activity, and did not define what personal protective equipment was suitable. Although the department has twelve job hazards analyses, none were specific to this work activity. A preliminary hazards analysis had never been initiated for this activity. Workers could not identify the minimum personal protective equipment requirements, and worker training did not identify controls for this type of work activity. As a result, although several KCP work processes could be applied to this work activity, none of these processes, individually or collectively, identified the minimum controls that are required to perform this work activity.

Kansas City Plant Roof Area

OKCSO line management has not established and implemented a fully effective oversight program as specified in DOE Policy 450.5, *Line Environment, Safety and Health Oversight*. OKCSO is generally effective in monitoring day-to-day work activities and has taken a proactive step to establish a Facility Representative program. However, informality in programmatic monitoring and assessment, inconsistent documentation of deficiencies in programs and performance, and infrequent communication of oversight results to the contractor have hindered the effectiveness of the oversight program. Few formal assessments of contractor ES&H performance are conducted, and oversight activities lack sufficient focus on formal evaluation of functional area program adequacy and on observation of work activities. Deficiencies and concerns in contractor processes and performance, and their significance, are not consistently and clearly documented. Assessment results are not routinely formally communicated to the contractor for information and action. OKCSO procedures do not adequately define and detail the program and processes for ES&H oversight of the contractor. Overall, insufficient rigor has been employed in OKCSO oversight processes and activities to identify the weaknesses and deficiencies in ISM processes and performance reflected in this OA evaluation.

FM&T feedback and improvement mechanisms have not been fully developed and rigorously implemented to identify and effectively resolve ISM program and performance deficiencies and to drive continuous improvement as specified in DOE Policy 450.4, *Safety Management System Policy*, and DOE Policy 450.5, *Line Environment, Safety and Health Oversight.* Many assessments and audits of ES&H elements are performed, resulting in the identification and correction of deficiencies. However, insufficient rigor in the assessment of programs and performance by both ES&H and line management has resulted in undetected and uncorrected deficiencies. Assessments do not provide for thorough and continuous monitoring of program and procedure adequacy and/or the observation of work activities. ES&H issues are not consistently and effectively managed to ensure that all issues are properly documented, evaluated for significance, and effectively resolved. Many deficient conditions and performance are not formally documented, obscuring accountability for the categorization and resolution of the condition and preventing effective trend analysis. Corrective actions for some events and conditions inadequately resolve the problem or fail to identify or address root causes and recurrence controls. ES&H issues are not routinely evaluated for trends and precursors. Lessons learned are not consistently and effectively used to prepare work packages and train workers, and historical lessons-learned information is not readily accessible. Some feedback and improvement processes and key elements of some assessment processes are not addressed or adequately detailed in KCP procedures, hindering the overall effectiveness of feedback and improvement mechanisms and continuous improvement. The lack of rigorous assessment of the adequacy of ES&H programs, weaknesses in issues management, and inadequate trending of issues have contributed to a failure to identify and correct some systemic and recurring deficiencies in ISM implementation.

3.0 Conclusions

KCP has a generally good safety and environmental record. Some of KCP's programs are notably effective, including several aspects of the environmental management program and the predictive maintenance program. The workforce is experienced and displayed a high regard for safety and environmental compliance. OKCSO and FM&T management support for environmental protection and safety was demonstrated in their aggressive approach to addressing legacy waste disposal sites, reducing pollution, supporting stop-work policies, and ensuring prompt responses to employee concerns.

In many cases, hazards are effectively analyzed and controls are in place for production, maintenance, and construction activities. The ongoing efforts to transition to computer-based hazards analysis processes is a positive step that, if effectively implemented, could address some of the identified weaknesses. However, the work control and hazard control processes are not comprehensive and are not fully effective. The most significant concern is that deficiencies in certain aspects of hazards analysis and control processes result in a situation where FM&T personnel at the working level have not been provided with clear and rigorous expectations in procedures and work instructions for implementing safety provisions during specific work activities. There were also instances of failure to rigorously follow established procedures, and deficiencies in defining the scope of work. Collectively, the identified deficiencies reduce the margin of safety and create a situation where worker and facility safety relies too heavily on individual initiative. ISM requires a more rigorous and formal approach to safety based on clear standards and procedures that incorporate approved safety provisions.

In the environmental protection area, FM&T management has established effective management systems to implement their environmental responsibilities. Nearly all remedial actions have been accomplished to address legacy waste disposal sites, and pollution prevention and pollution control projects have been implemented to reduce local environmental impacts and improve the efficiency of operations. With few exceptions, hazards analysis processes and controls for environmental pathways at KCP were systematic and effectively implemented. However, KCP has not effectively analyzed environmental hazards, established appropriate controls, or implemented requirements in some cases. Operational events involving the failure to implement administrative and engineering controls for operation of the Industrial Wastewater Pretreatment Facility and groundwater extraction system have recently been experienced. Waste management activities at several locations outside the main manufacturing areas were not consistent with established requirements, indicating inattention to detail, lack of training, or lack of appropriate self-assessments by departments controlling these areas. Although deficiencies were identified, the KCP environmental management program has a number of significant positive attributes, and the program is effectively implemented in areas where the most significant potential environmental hazards are located. Most of the deficiencies occurred in specialized technical areas or in locations outside main manufacturing facilities, indicating a need for additional attention in these areas. While corrective actions are warranted, the identified deficiencies are judged to be anomalies in an overall effective environmental protection system.

OKCSO and FM&T have various assessment programs in place. OKCSO management was proactive in establishing a Facility Representative program, which is not mandated at a non-nuclear facility, and the program is generally functioning adequately. OKCSO ES&H personnel are involved in monitoring and evaluating ES&H performance and have identified and documented program and performance deficiencies. FM&T has established a variety of mechanisms to assess ES&H programs and performance and has formal processes to address employee concerns, corrective actions, and lessons learned. These mechanisms are identifying deficient conditions and performance; many corrective actions are

being taken; and lessons learned are regularly disseminated.

However, the OKCSO and FM&T feedback and improvement programs have several significant weaknesses that reduce their effectiveness. Many planned OKCSO formal assessment activities are not being performed, and OKCSO's ES&H oversight is hindered by insufficient rigor in planning and executing assessments and in documenting and communicating findings to the contractor. The contractor is not being consistently held accountable for correcting program and performance deficiencies. There are weaknesses in the FM&T assessment and issues management processes, as well as a lack of rigor in documenting and evaluating deficiencies and in implementing corrective actions. Historical lessons-learned information is not readily accessible or typically employed when developing work instructions or training. These process weaknesses and implementation deficiencies preclude identifying and correcting inadequate ES&H-related processes and performance. The number of deficiencies in facility conditions (e.g., obstructed access to eyewash stations), some of which were readily observable in facility walkdowns, also indicates a lack of attention to detail by line management and ES&H.

Overall, OKCSO and FM&T have had considerable success in using the ISM performance measure as a management tool for monitoring and improving safety performance. KCP has maintained a good safety record, including injury and illness rates significantly lower than DOE averages. OKCSO and FM&T have also examined the ISM performance measure results and have taken actions to further improve performance. These efforts have resulted in a downward trend in injury and illness rates and waste generation over the past five years. Increased management attention is needed to ensure that ISM programs are enhanced and fully effective. In particular, increased attention is needed in the near term to improve the processes for analyzing hazards, establishing controls, and communicating information about required controls to the workforce. Timely improvements are also needed in OKCSO and FM&T line and ES&H assessments, self-assessments, and issues management.

4.0 Ratings

The ratings of the core functions and environmental management program reflect the status of the reviewed elements of the KCP ISM program:

Production, Maintenance, and Construction Activities

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

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

Environmental Protection.....EFFECTIVE PERFORMANCE

APPENDIX A
SUPPLEMENTAL INFORMATION

A.1 Dates of Review

	Beginning	Ending
Planning Meeting	October 17, 2001	October 18, 2001
Onsite Review	November 5, 2001	November 15, 2001
Report Writing	November 19, 2001	December 3, 2001
Validation and Outbrief	December 4, 2001	December 6, 2001

A.2 Review Team Composition

A.2.1 Management

Glenn S. Podonsky, Director, Office of Independent Oversight and Performance Assurance
Michael A. Kilpatrick, Deputy Director, Office of Independent Oversight and Performance Assurance
Charles Lewis, Director, Office of Emergency Management Oversight
Patricia Worthington, Director, Office of Environment, Safety and Health Evaluations
Thomas Staker, Deputy Director, Office of Environment, Safety and Health Evaluations (Team Leader)

A.2.2 Quality Review Board

Michael Kilpatrick
Patricia Worthington
Charles Lewis
Dean Hickman
Robert Nelson

A.2.3 Review Team

Thomas Staker, Team Leader
Bill Eckroade
Ronald Stolberg
Ching-San Huang
Mark Good
Jim Lockridge
Ed Stafford
Robert Compton

A.2.4 Administrative Support

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APPENDIX B
SITE-SPECIFIC FINDINGS

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

FINDING STATEMENT	REFER TO PAGES
Deficiencies in Kansas City Plant hazard identification and analysis programs (i.e., preliminary hazards analysis, job hazards analysis, and exposure assessment programs) have resulted in some hazards not being recognized or adequately analyzed.	19
Honeywell Federal Manufacturing & Technologies (FM&T) has not established an effective process to ensure that all hazard controls that were identified during the hazards analysis process are implemented at the working level.	21
Office of Kansas City Site Operations line management has not established and implemented a fully effective oversight program as specified in DOE Policy 450.5, *Line Environment, Safety and Health Oversight*.	31
FM&T feedback and improvement mechanisms have not been fully developed and rigorously implemented to identify and effectively resolve integrated safety management program and performance deficiencies and to drive continuous improvement as specified in DOE Policy 450.4, *Safety Management System Policy*, and DOE Policy 450.5, *Line Environment, Safety and Health Oversight.*	36

APPENDIX C
CORE FUNCTION IMPLEMENTATION FOR PRODUCTION, MAINTENANCE, AND CONSTRUCTION ACTIVITIES (CORE FUNCTIONS #1-4)

C.1 Introduction

The Office of Independent Oversight and Performance Assurance's (OA's) evaluation of work planning and control and implementation of the first four core functions of integrated safety management (ISM) at the Kansas City Plant (KCP) focused on safety performance during production, maintenance, and construction work activities across several Honeywell Federal Manufacturing & Technologies (FM&T) departments. Examples of observed activities included machining, welding, plating, equipment preventive and corrective maintenance, plant modification work, and construction. In addition, work control systems and their implementation were reviewed. Procedures and policies, such as stop-work policies, were evaluated, and hazard analysis and control systems were examined. This approach enabled OA to evaluate differing missions and functions across the KCP.

C.2 Status and Results

C.2.1 Core Function #1 - Define the Scope of Work

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

At KCP, there are several different mechanisms for performing work within the facility. Manufacturing departments accomplish production work under the manufacturing execution system (MES). Maintenance work is performed using the MAXIMO computerized maintenance management system for predictive, preventive, and corrective maintenance; services; and some construction activities. Facility Engineering directs construction activities that are under project control using facility work orders, construction contracts, and specifications for subcontractors and vendors. Facility Engineering also uses the services of the Maintenance Department for minor construction activities, equipment moves, room rearrangement, partitioning, and utilities work. Other work activities, such as waste processing and treatment, boiler plant operation, and security, are performed under operating procedures and established practices. These systems provide documented methods to request and define work and generally result in well-defined work across the facility.

The MES system is used effectively to define the scope of new and existing production work. Process engineers obtain specifications from the design authority and work with the Production Department to develop a process plan. The process plan clearly defines each step in a production process and provides a sound basis for cost, scheduling, procurement, and initial hazards analysis using the preliminary hazards analysis (PHA) process. Instructions for production work activities are provided for each production part number and are included in the MES and product engineering specifications. Production activities also include laboratory work, such as analytical and physical testing of processes, prototypes, production parts and assemblies, and a variety of other work activities involving chemistry, mechanics, electronics, microelectronics, and metallurgy. Work for these activities is typically defined and documented in laboratory test methods, which provide instructions or specifications on the type of sample or test requested. This system of work definition for production activities is detailed and logical.

FM&T maintenance activities consist of predictive maintenance (e.g., vibration analysis, infrared thermography, and lubricating oil sampling), preventive maintenance, corrective maintenance, and services. Services include such items as steam plant operations, transportation (i.e., movement of equipment and materials throughout the building), and vehicle maintenance (e.g., battery charging, inspections). The computerized MAXIMO work order is used to track maintenance work from customer requests through work completion.

Maintenance procedures provide for the prioritization of work using a formal priority matrix.

The matrix consists of nine priorities, from immediate to routine, within four functional areas: production; environment, safety, and health (ES&H) concerns; security; and facility stewardship. The matrix was readily available to work order initiators and work planners. Maintenance work planners coordinated with production departments to verify priorities and could change priorities based on the type of work being performed and the scheduled workload. Review of work orders and observation of work indicated that work was appropriately prioritized based on safety and risk.

Resource allocation for maintenance activities was adequately managed using experienced team leaders and a number of "crib" areas (i.e., locations where maintenance personnel are stationed) close to production departments or the source of work. For example, the crib that is located in a maintenance area on the roof had a dedicated crew for work activities on the extensive roof area of the main building and outbuildings.

Although many work activities were adequately defined, there were several weaknesses in defining the work on MAXIMO work orders. In many cases, the only stated scope of work was the work order title that was filled in by the customer or organization initiating the work request. These frequently had abbreviated titles or problem statements, such as "drive belt broke," "drive motor making noise," and "replace transformer," rather than a clear, concise statement of the scope and limitations of the work to be performed. Work order titles were not always revised by planners, and no instructions were added to ensure that there was a clear and bounded statement of work for each work order. For example, when troubleshooting, bounding statements were not added so that after the problem was identified, the work order could be returned to planners to revise the scope and identify additional hazards and/or controls as necessary. In one case, this resulted in workers working outside the scope of a work request (see Section C.2.4).

Aerial of Kansas City Plant Roof

Subcontractor construction work is generally well defined in formal contracts, contract terms and conditions, and construction specification drawings. Lower-tier subcontractor work is defined through formal subcontracts or purchase agreements. Facility Engineering work orders for the Stockpile Management Reduction Initiative contained adequate instructions and drawings to define the scope of work activities, but contained limited instructions for performing the various tasks. Allocation of resources for construction jobs was generally adequate and consistent with safety and production priorities.

C.2.2 Core Function #2 - Analyze the Hazards

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

Institutional Hazards Analysis Processes

As a low-hazard industrial facility, hazards at the KCP are comparable to the chemical, physical, and biological hazards at most commercial industrial plants in the United States. In addition, KCP has some minimal radiological hazards associated with the refurbishing of components that may have low-level radioactivity, and also uses some radioactive sources in conjunction with process instrumentation.

In the early 1990s, as a result of recommendations from the U. S. Department of Energy (DOE) Tiger Team assessment, KCP developed a site safety assessment to document KCP processes and identify plant hazards. The site safety assessment was developed in the format of a safety analysis report consistent with DOE Order 5481.1B, *Safety Analysis and Review System* (September 1986), although such a requirement is typically not applied to non-nuclear low-hazard facilities. The first draft of the site safety assessment was completed in 1993 and the document was approved by the Office of Kansas City Site

Operations (OKCSO) in 1995. The site safety assessment included a review of all plant operations to identify and risk-rank potential worker hazards based on the probability of occurrence and the consequences to workers and the public. Although none of the KCP work activities was judged to be significantly hazardous (i.e., a KCP Risk Level 1 hazard), a number of operations received a Risk Level 2 ranking. In 1996, these Risk Level 2 hazards became the bases for the initial set of institutional job hazards analyses (JHAs).

A site safety assessment is not specifically required for KCP, which is classified as a low-hazard non-nuclear facility. Recognizing that a formal safety analysis is not mandatory, FM&T management decided not to regularly update the site safety assessment. It has not been revised since 1995, and management does not plan to revise it again until the current plant renovations are completed in 2005. As a result, the site safety assessment does not accurately reflect those plant operations that have changed since 1995. In the interim, the site safety assessment continues to serve as part of the ES&H baseline against which hazards for emergency management and worker protection are assessed. Several key KCP hazards analysis processes, such as the KCP hazards assessment and the PHAs, are used routinely to ensure that site activities are maintained within the ES&H baseline established by the site safety assessment. Furthermore, KCP procedures require the PHA process to be used to maintain the site safety assessment, although the means for achieving this objective is not documented. The understanding of the basis of a site safety assessment, its application in evaluating current work activities, and the means by which the site safety assessment is updated through the PHA process is expert based, and is not sufficiently documented. An evaluation of the KCP hazards assessment is provided in Volume II of this report, which contains the results of the review of KCP emergency management programs.

KCP has extensively evaluated beryllium hazards and has established a comprehensive beryllium program. During the past two years, KCP has expended significant resources in characterizing plant work areas, developing beryllium decontamination work practices, and implementing programs consistent with the new DOE Beryllium Rule.

Activity-Level Hazards Analysis Processes

At the work activity level, KCP has a number of hazards analysis processes, including PHA, JHA, exposure assessments, and some departmental hazards analysis processes, which are intended to supplement institutional hazards analysis processes. For example, to ensure that workers are aware of hazards in their workplaces, some departments, such as Production Painting, have established additional training and qualification programs for their workers and have implemented hazard identification processes to supplement the JHA, PHA, and exposure assessment programs. Other departments, such as Environmental Operations, supplement the institutional hazards analysis processes by performing job task analyses for each work activity and documenting in a job assignment summary each activity's hazards and the corresponding controls.

Preliminary Hazards Analysis. The PHA is the cornerstone of the KCP risk management pre-planning process and serves as the primary hazard identification and hazards analysis tool for new or modified KCP operations. Several hundred PHAs were conducted during 2001. The PHA is a systematic process that fulfills the requirements for a formal review of ES&H changes that could affect the safety and health of workers or create discharges to the environment. The PHA process is initiated based on a change in an activity, such as a new facility, a modification to an existing facility, a new or modified equipment item or production process, a new material or a new application of an existing material, relocation of contaminated equipment, new business, or work for others. The PHA process has been evolving for the past ten years. Active processes that have not experienced a change during this period would not have a PHA. KCP relies on the site safety assessment to provide a hazards baseline for activities that do not have a PHA.

The PHA process, which provides a systematic mechanism for hazard identification and analysis at the work activity level, has been applied effectively in some cases. However, the implementation of the PHA process is deficient in several areas.

PHA thresholds for some activities are not adequately defined. Although Appendix 1 of the KCP work instruction "How to Process a Preliminary Hazard Analysis" provides guidance on when a PHA is required, the guidance is confusing and, in some cases, insufficient. For example, for a number of activities listed in Appendix 1, the requirement for a mandatory PHA is "no." However, in most cases, the "no" is not accurate because the need for a PHA can be determined only after the PHA checklist is submitted to ES&H for review. Furthermore, the OA team observed that some workers and line managers were not sure when certain activities required a PHA. For example, although most

workers recognized that the introduction of a new hazardous chemical into a process would require a PHA, few workers could determine whether a change in the concentration or quantity of a chemical would require a PHA, although such changes could increase the magnitude of the hazard. In another case, a change in one departmental general process instruction added a process for cleaning and decontaminating work surfaces, which required specific personal protective equipment (PPE) for workers. However, this "process change" failed to generate a PHA, although KCP procedures indicate that a PHA should have been initiated. In addition, PHA thresholds for maintenance activities are not clearly identified in the PHA work instruction. OKCSO Facility Representatives (FRs) also identified this concern during an assessment of the PHA process conducted in 1999.

Completed (or historic) PHAs are not readily available to line management and are difficult to cross-reference to current work activities. The PHA process is a paper system, is not readily accessible to line management, and is performed only by a few PHA experts. Although hundreds of PHAs have been performed, many static work activities do not have a PHA that documents the hazards and controls. Since there have not been any changes in these work processes, a PHA was never generated. The site safety assessment, which is to be used in those cases, is often too generic to be useful in identifying hazards and controls for a specific work activity. PHAs are typically not referenced in work instructions, and for many work processes reviewed by the OA team, it was not possible to determine whether similar PHAs had been performed. In one case, an FM&T safety engineer was performing a "bump test" gas calibration of a multi-gas meter, unaware that a PHA had previously been performed.

PHAs are applied to construction activities during the design stage of the project, or when hazardous waste is generated. Design PHAs are sometimes not linked to construction activities and are not used by FM&T safety engineers to ensure that construction project documents, such as the health and safety plan (HASP), have incorporated concerns that were identified during the PHA process. The HASP is used for identifying and analyzing construction safety and health hazards. However, some HASPs do not provide the level of detail on hazards and controls for specific construction activities comparable to the level of detail typically found in a PHA.

Some elements of the PHA process do not have adequate written instructions to ensure consistency of application, review, approval, and record keeping. Although there is a work instruction for the PHA process, there are no instructions for several fundamental elements of the PHA process—the evaluation report, PHA checklists, and the onsite review. As a result, the purpose, format, and minimum content for these documents are based on verbal instructions or precedents. Furthermore, there is no mechanism to track or resolve corrective actions resulting from the issuance of these reports. In addition, a number of terms or concepts used in the PHA work instruction are not adequately defined and have led to confusion within the FM&T departments. For example, the PHA work instruction requires the originator of an activity to first determine if the activity impacts the department's "ES&H envelope." Only a few of the departments that were reviewed had a documented departmental ES&H envelope. One department had an ES&H envelope, but the envelope did not include the information provided in Appendix 2 of the PHA work instruction, "Items Included in the ES&H Envelope." There are no work instructions for developing, reviewing, and approving departmental ES&H envelopes. FM&T is currently developing an ES&H envelope template.

The PHA process is also designed to document the appropriate hazard controls for an identified hazard. Problems with the identification of hazard controls in PHAs are described in Section C.2.3.

The ES&H staff is developing a computer-based ES&H hazard identification and control system that is intended to replace the existing paper-based PHA process within the next two years. If effectively implemented, the ES&H hazard identification and control system may resolve several of the PHA implementation concerns identified by the OA team.

Job Hazards Analyses. The JHA is a systematic technique that is used during an ES&H review to uncover inherent or potential hazards that are associated with a job. The JHA process has undergone significant changes during the past five years. Prior to 1996, the JHA process was performed, documented, and controlled at the department level. In 2000, the JHA process was restructured such that mandatory JHAs were developed by ES&H at the institutional level and were based on hazards that had been risk-ranked at a Risk Level 2, on a decreasing scale of 1 to 6. Sixty-one mandatory JHA templates were developed for Risk Level 2 activities. In addition, most JHAs became multi-departmental, the JHA process was computerized, and JHAs were incorporated into the

command media system (i.e., the set of documents that defines program requirements and responsibilities) and were thereby more readily accessible to all workers. Each JHA reviewed by the OA team clearly delineated the job steps associated with the task, the associated hazards and controls, and the training requirements, although some training programs (e.g., hazard communications) did not provide sufficient instruction on work area-specific hazards. JHAs now receive an ES&H review, and mandatory JHAs are written and/or championed by the ES&H staff. ES&H carcinogenic control plans and waste acceptance criteria have also been incorporated into the JHA program, which has resulted in greater uniformity across the departments.

Although the JHA program has been improved, concerns remain regarding the use of JHAs to identify and analyze hazards at the work-activity level. For example, mandatory JHAs have been performed only on Risk Level 2 activities extracted from the site safety assessment. (No Risk Level 1 activities were identified in the site safety assessment review process.) JHAs have not been developed for lower risk levels. If a work activity is similar to a mandatory JHA, then a JHA is required for the activity. JHAs for all other activities are voluntary. So, for Risk Level 3 (or lower) activities that are unchanged, the hazards may not have been analyzed or documented in either a JHA or a PHA. There are many activities in the Risk Level range from 3 to 6 for which there are no JHAs or PHAs. For example, if a worker is using a paint containing carcinogens, one or more JHAs on carcinogens may apply, since working with carcinogens was judged a Risk Level 2 activity. However, if the worker is using paint with hazardous solvents that are not carcinogens (a Risk Level 3 activity) there are no JHAs associated with the work. For a painting booth in the maintenance area, neither the painting activity nor the paint booth had a JHA, since both these conditions were less than a Risk Level 2. Furthermore, there were no other processes that identified the hazards and controls associated with the paint booth (e.g., a PHA) or a recent exposure assessment that evaluated and documented the workers' potential exposure from paint vapors. In addition, a number of the production operations reviewed by the OA team involved some potential hazards that were not documented in either a mandatory or a voluntary JHA. For example, JHAs did not address the potential hazards and controls for the application of silver powder in the Production Painting Department, the passivation of corrosion-resistant steels in the Plating Department, or the hazards

Aerial View of West Boiler House

associated with the repackaging of chlorofluorocarbon (CFC) 113 solvents in the Polymer Production Department. Supplementary hazard identification and analysis processes (e.g., PHAs) were seldom identified for these situations, and in most cases, the hazards were not documented in work instructions.

Construction projects require that hazards and their controls be documented in HASPs in accordance with contract terms and conditions. A few construction projects supplement their HASPs with activity hazards analyses (AHAs). However, the combination of HASPs and an occasional AHA is sometimes insufficient to appropriately identify and analyze all hazards. For example, the system did not fully analyze the potential silica dust and noise hazards for the boiler demolition and replacement work being conducted at the KCP West Boiler House and did not identify the asphalt vapor hazard for the KCP roofing project. The construction safe work permit (CSWP) is also used to identify hazards and controls that are unique to some construction projects. During calendar year 2001, approximately 22 CSWPs were written for KCP construction projects with hazards ranging from critical lifts to equipment decontamination. Because there are no instructions or documentation for the CSWP process, the purpose and appropriate application of the CSWP process for hazard identification and analysis are not well defined. The inconsistent description of hazards on completed CSWPs was indicative of weaknesses in establishment and implementation of some construction safety processes. Many

construction activities and associated hazards and controls are described in Facilities Engineering work orders, a process used by the FM&T Facilities Engineering Department. However, there is no clear linkage of the hazards analysis and controls that are documented in Facility Engineering work orders to the PHA, JHA, or CSWP processes used by the FM&T ES&H Department. Furthermore, the work instruction for preparing Facilities Engineering work orders does not adequately address health and safety hazards and controls.

Work planners can use the MAXIMO system to define hazards for maintenance work activities. Results are documented in work packages. Although MAXIMO has a provision to document hazards and their controls, many MAXIMO work orders reviewed by the OA team did not adequately identify or describe all the applicable hazards. The use of the JHA to identify hazards and corresponding controls is not well integrated into the maintenance activities or the MAXIMO system. If a work activity involves work where there is a JHA, the JHA is typically listed on the MAXIMO work order along with all the corresponding hazards. However, the work may not involve all the hazards identified on the JHA, and the craft workers must identify what hazards (from the list) apply to their specific work activity. Of 61 mandatory JHA templates, 6 are dedicated to maintenance activities, and a number of the plantwide JHAs also apply to maintenance activities. Some maintenance JHAs are generic, and JHA information often is not tailored to the specific work activity. For example, typical preventive maintenance activities for heating, ventilating, air conditioning, and chillers require maintenance workers to enter the plenums of air-handling units for preventive and/or corrective maintenance. These activities include inspection, temperature and flow measurements, cleaning coils, greasing bearings, replacing fan belts, and verifying damper and valve operation. The hazards associated with work activities in these plenums had not been identified through MAXIMO or in a JHA, and the plenums had not been identified as confined spaces. Workers did not recognize the spaces as potential confined spaces or realize that a hazardous vapor atmosphere could be created if solvents were used in the space.

Other concerns with the implementation of hazard controls, which are documented in JHAs, are discussed in Section C.2.3.

Exposure Assessments. Another work activity-level hazards assessment mechanism is the exposure assessment process that is performed for individual work areas and work activities. The exposure assessment program is documented in a one-page process description and instruction set, and is initiated by the PHA process. The purpose of an exposure assessment is to identify potential health risks and mitigation requirements, document worker exposure data, and determine whether a mandatory JHA is applicable or whether a voluntary JHA is required. For example, the exposure assessment process applies to chemical sampling, noise and ventilation surveys, laser safety evaluations, and other such processes. The results of an exposure assessment are documented, transmitted to the corresponding department and workers, and incorporated into the PHA evaluation report. Exposure assessments are generally informative and thorough, and they provide useful information on the hazard being evaluated and the details of the engineering, administrative, and PPE controls needed to mitigate the hazard.

Although FM&T performs exposure assessments in support of PHAs or in response to an employee concern, FM&T does not have a risk-based plan or program for routine assessment of plant areas to determine worker exposures to chemicals, noise, ergonomic hazards, heat/cold stress, and non-ionizing radiation. Although such hazards would be assessed as an element of the PHA process, initiation of the PHA process requires a process or material change, and many of the production processes have been static for years and do not have a PHA or exposure assessment. The evaluation team identified several undocumented or unanalyzed hazards that might have been recognized and evaluated if FM&T had an ongoing exposure assessment process. For example, the West Boiler House basement was a posted "hearing protection required" area; however, no historical noise monitoring data could be found in existing exposure assessment records.

In a second example, workers in the Analytical Sciences Department were using a lead solder pot. Although the workers indicated that the pot occasionally emitted vapors, an exposure assessment had not been performed to determine the level of exposure and whether controls, such as local ventilation, were required to mitigate the hazard. After the OA team identified this potential hazard, the department initiated a change order to install a local ventilation system.

In a third example, exposure assessments had not been performed on the Maintenance Department paint booth to ascertain the worker exposure levels to paint vapors. Both the lead solder pot and the paint booth had established processes that had remained unchanged and therefore had not been analyzed by the PHA process. The PHA process would have required an exposure assessment. DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, and the companion technical standard DOE-STD-6005-2001, *Industrial Hygiene Practices*, provide the requirements for an ongoing exposure assessment program for all areas of a plant, based on the potential health risk to the worker. Although neither of these documents is included in the FM&T requirements set, the documents establish DOE expectations consistent with industry standards and good practices that are applicable for all DOE operations regardless of the facility's hazard classification. Furthermore, these DOE guidance documents also stress the importance of documenting "negative exposure assessments," or the absence of chemical or physical exposures to workers, which is not addressed in the FM&T exposure assessment work instruction. The number of exposure assessments conducted has not been sufficient to meet the intent of a DOE exposure assessment program. The limited resources applied to the exposure assessment program are a contributing factor.

In a fourth example, the potential for overexposure to carbon dioxide (CO_2) during routine or abnormal operations has not been adequately analyzed. Several KCP areas, including the telemetry shop, the environmental testing laboratory, and the analytical and physical testing laboratory, use and/or store large amounts of CO_2. The discussion of CO_2 in the site safety analysis is minimal and does not address the chemical toxicity of the CO_2. The hazards analysis assumes that simple displacement of oxygen occurs. The analysis does not account for the toxic properties of CO_2, which occur at much lower concentrations than those required for oxygen depletion. It only assumes that alarm-sounding sensors are in place to warn personnel of any potential oxygen deficiencies. It also assumes that the alarm gives the occupants enough time to evacuate the area. However, there are no CO_2 alarms that would reliably notify workers when a dangerous level of CO_2 is reached. In addition, the environmental laboratory and the analytical and physical testing laboratory have no oxygen sensors. In the environmental laboratory, each shaker enclosure has a fresh air supply and an exhaust system that is vented out the roof to cool its shaker motor. However, there are no alarms to notify operators of a loss of supplied air to the enclosures. If ventilation is lost and operators do not notice the inoperable ventilation system, CO_2 could build up to concentrations above levels that are immediately dangerous to life and health. In response to this observation by the OA team, FM&T personnel reported that they took the following interim measures: they developed work orders to install alarms; they added visual indicators within the shaker enclosures; and they trained personnel who work in the shaker enclosures to ensure that air supplies are operating before entering. Additionally, FM&T personnel reported that work orders were submitted to provide CO_2 detection systems for all affected areas and to provide more sophisticated visual and audible systems for alerting operators when ventilation systems are inoperable.

Ventilation Systems on Roof Area

FM&T ES&H representatives could not recall any analysis of the potential toxic effects of CO_2 in these production areas other than oxygen displacement, and the CO_2 areas are not included in the exposure assessment program. Consequently, FM&T has not performed any baseline monitoring of CO_2 in these production locations and does not routinely measure concentrations during production activities. Considering a current plantwide CO_2 usage rate of approximately 12.7 tons per month, concentrations of CO_2 approaching or exceeding the exposure limit are possible if an undetected leak or catastrophic release occurs. Following notification of this concern, the ES&H Department performed some preliminary baseline CO_2 measurements to ensure that baseline concentrations were below applicable Occupational Safety and Health Administration (OSHA) limits. The ES&H Department also initiated exposure assessments

for CO_2, paint vapors in the Maintenance Department paint booth, and for fumes from the lead solder pot.

FINDING #1: Deficiencies in KCP hazard identification and analysis programs (i.e., PHA, JHA, and exposure assessment programs) have resulted in some hazards not being recognized or adequately analyzed.

Overall, the PHA, JHA, and exposure assessment programs are useful mechanisms for recognizing and evaluating workplace hazards. However, these processes, individually or collectively, do not ensure that hazards for specific work activities have been adequately identified, analyzed, documented, and communicated to workers.

C.2.3 Core Function #3 - Develop and Implement Hazard Controls

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

Hazard controls include engineering controls (e.g., buildings, enclosures, safety systems, ventilation systems, alarm systems, controls, and instrumentation), PPE (e.g., protective clothing and respirators), and administrative measures (e.g., limits, safety requirements embedded in procedures, warning signs, and training). The established levels of controls must be adequate to protect workers, the public, and the environment from all hazards associated with work activities.

In general, hazard controls at KCP are appropriately implemented. Engineering controls, such as ventilation hoods for machining and welding operations, are appropriately installed and routinely used by FM&T personnel. PPE, such as safety glasses, ear protection, and safety shoes, is generally required where appropriate, and FM&T personnel are conscientious about using required equipment. The site safety assessment establishes institutional-level administrative controls, which are supplemented with controls prescribed by PHAs, JHAs, work packages, and procedures. This system provides the framework for a comprehensive set of controls for most hazards at KCP.

KCP has enhanced institutional hazard controls for beryllium. KCP has had a beryllium program since the 1960s. An in-depth KCP quality assurance audit in mid-2001 concluded that the program was in full compliance with the new DOE Beryllium Rule (10 CFR 850, issued in January 2000). In the two years since the rule was issued, KCP has expended significant manpower and resources ($2.6 million) in implementing the new DOE requirements described in the Beryllium Rule. For example, 12,000 surface swipe samples and 11,000 equipment items have been evaluated for beryllium contamination; room-by-room beryllium characterization has been completed; and programs for beryllium decontamination and work practices have been implemented. Beryllium program descriptions and work instructions have been approved, and a number of JHAs and revisions to department chemical hygiene plans have been incorporated to include beryllium controls. The program has been proactive in identifying beryllium workers (149 to date). In addition, FM&T has demonstrated a conservative approach by allowing all KCP personnel who believe that they may have been incidentally exposed to beryllium to enter the beryllium program (1,035 workers to date) and receive medical screening.

Production. Production work activities are governed primarily by the MES, process engineering specifications, and general process instructions. MES work instructions provide the primary directions for production of a specific part. Process engineering specifications provide directions for work on a specific piece of equipment or workstation. For example, a step in an MES work instruction may direct the operator to ultrasonically clean the part in accordance with a process engineering specification for a specific ultrasonic cleaning system. The part-specific and equipment/workstation-specific instructions are supplemented by the general process instructions,

Production Area

which provide generic guidelines and some safety requirements applicable to the entire department.

KCP's system of production procedures and instructions is an effective mechanism for establishing production controls and is being used effectively to control parts production. However, in some cases, task-specific hazard controls (e.g., PPE requirements) and unique hazards associated with work activities are not clearly identified in instructions and procedures used by the workers. The interfaces and requirements between the engineering organization (which generally develops the procedures and instructions) and the ES&H Department are not always sufficient to ensure that safety-related hazard controls are fully evaluated and clearly delineated in working-level procedures and instructions as part of an integrated work control process.

Controls for hazards associated with production activities are generally developed during the PHA process discussed in Section C.2.2 and are usually appropriate. However, in some cases, the controls are not implemented at the work-activity level. FM&T has not established definitive requirements for including identified controls in work documents. ES&H documents the results of a PHA review, including a description of potential process hazards and recommendations for PPE or other controls, in an evaluation report. The ES&H Department then transmits the evaluation report to the originating department; however, there are no requirements to ensure that the hazard controls are implemented. The decision on whether and where to include hazard controls in specific work documents lies with the cognizant process engineer, who may not possess the appropriate ES&H expertise to make that determination. Although some process engineers are proactive in responding to recommendations and action items in the evaluation report, others are not. Consequently, a description of controls for all hazards is not routinely extracted from the PHA and incorporated into work-level documents such as MES work instructions or product engineering specifications. For example, hazard controls for the R-113 repackaging work in the analytical sciences laboratory are identified in the PHA; however, they are not identified in any work documents, such as the product engineering specification for the work activity. Line organizations do not have work instructions that document the purpose of an evaluation report, the report's contents, or the responsibilities of the line organization in responding to the report. There is no formal follow-up process for evaluation report action items and recommendations, and the recommendations are not included in KCP corrective action databases.

Similar problems in linking controls with specific work activities exist with the JHAs. Most JHAs are associated with production work and plantwide activities. Some processes attempt to identify applicable controls from the JHAs through the MES or other work instruction references, and FM&T personnel are usually familiar with the controls specified in JHAs applicable to their jobs. However, JHA controls are rarely incorporated or referenced in product engineering specifications or general process instructions, which are the work documents most often used by production workers. Furthermore, since JHA controls are intended to cover a broad spectrum of work in several departments, the relevance or application of JHA control information to a specific work activity is not well defined. For example, although a JHA on carcinogens is applicable for the Plating Department, the "passivation" work activity, which is integral to the plating process, is not addressed in the JHA, and the controls are therefore indeterminate.

In some cases, hazards are identified in work instructions, but the controls to mitigate the hazards are not. For example, hazard controls for laboratory operations in Department 835 are not documented in laboratory test methods, although the hazards are described. Furthermore, although hazards and controls for laboratory operations are also specified in a chemical hygiene plan, the controls are often not included or are too generic to be applied to a specific work activity. For example, the laboratory test method for "Nitradd or MF-Acid in Process Solutions" states that process solutions containing ammonium bifluoride and strong nitric acid will burn the eyes and skin. However, the laboratory test method does not specify the controls to protect the worker. The chemical hygiene plan also recognizes the hazard with strong acids and requires "appropriate gloves." However, a variety of chemical-resistant gloves are used in the laboratory, and neither the laboratory test method nor the chemical hygiene plan provides any specifics concerning what type of glove is "appropriate."

In some cases, additions or changes to controls in the general process instructions are not effectively communicated to FM&T personnel. Work practices require that the FM&T personnel verify that they have the most recent revision of MES work instructions or process engineering specifications before each use; however, this requirement does not apply to general

process instructions. The work instruction for preparing and revising general process instructions requires the process engineer making the changes to "Notify the affected production and inspection areas," but it does not specify *how* the workers should be notified. Consequently, FM&T personnel are not always informed of changes that might affect safety. For example, a worker in the Plating Department had been performing a weekly hose-down of the plating area with only safety glasses and safety shoes as PPE; the worker was not aware that the general process instruction for the Plating Department was revised effective October 1, 2001, to require a face shield, an apron, and rubber boots, in addition to safety glasses, to perform this task.

Collectively, the deficiencies in implementing controls derived from PHA and JHA processes, the instances of incomplete documentation of hazard controls, and the inadequate communication of general process instruction changes indicate a systemic deficiency in identifying and implementing controls for production activities at the working level.

FINDING #2: FM&T has not established an effective process to ensure that all hazard controls that were identified during the hazards analysis process are implemented at the working level.

Some departments have recognized the limitations of the existing hazard control systems and have developed innovative methods for documenting the hazard controls for their work activities. For example, the Production Painting Department has developed a "PPE Matrix" that correlates PPE requirements for specific production parts that are processed in the department. The Environmental Operations Department has developed "Routine Job Assignments" to identify hazard controls for specific work activities. These supplemental control systems are effective in communicating hazard controls to the FM&T personnel.

Maintenance. For maintenance activities, the MAXIMO system work request package is the primary work control mechanism for identifying and implementing hazard controls, including the incorporation of JHA controls. The MAXIMO system is used in conjunction with permitting processes such as lockout/tagout (LO/TO), hot work permits, confined space permits, and excavation permits. Permits for energized electrical tasks establish administrative hazard controls for maintenance activities.

For most maintenance work request packages, the hazards were adequately identified and analyzed and the hazard controls were generally appropriate. However, deficiencies were identified in controls for several work orders. For example, in a few cases, work orders requiring a LO/TO to work on equipment did not have a LO/TO specified. This has been a continuing concern identified by monthly ES&H reviews of closed MAXIMO work orders. In other work orders, controls for common industrial hazards, such as gloves for working with sharp edges, were not specified. There was also little guidance in maintenance work procedures on how to incorporate JHAs and the corresponding controls into MAXIMO work orders. In some cases, planners would invoke an entire JHA when only a few of the controls would apply to the specific work. Therefore, craft workers had to rely on their experience and training ("skill of the craft") to perform the work planning functions of selecting from a list the controls that applied to the specific work.

Weaknesses were also identified in the implementation of some permitting processes. For example, some permits for energized electrical tasks had significant errors—descriptions of work were missing, and equipment to be worked on was not identified. Most other permits for energized electrical work had numerous administrative errors, including incomplete PPE and barrier information, missing signatures, and missing expiration dates. Without complete information, the FM&T team leaders do not have all the information needed to ensure that their workers can safely perform energized electrical work. For excavations, the Maintenance Department uses an excavation permit, but there are no procedures or instructions on how to fill out the permit or how to perform the excavation safely. Although the excavation permit does not address blind penetrations, it is reportedly used for that purpose and does not contain any instructions. Maintenance Department supervisors indicated that they used some informal protocols for determining when to use the permits (such as 2 inches for penetration into concrete and 6 inches for excavation), but these protocols are not promulgated in any approved procedure or checklist. Some excavation permits are destroyed after use, so the adequacy of these permits cannot be determined by KCP personnel or external auditors. The flowdown of OSHA requirements into a site implementing procedure was inadequate.

Construction. As described in the previous section, hazard controls for construction activities are identified using a system of HASPs, AHAs, and CSWPs. Construction workers learn about these controls through ES&H orientation training based upon the "Construction Safety Handbook," which is an excellent course for new workers. Although the training is a potentially effective control, FM&T construction management did not ensure that all contractor personnel took the orientation training course prior to performing work at KCP. In a June 2001 near-miss event, a subcontractor performed blind penetration work on the roof before workers had received the safety orientation intended to inform them of control requirements. No access restrictions were imposed during installation of rooftop expansion anchors for equipment, and concrete chunks fell to the operating floor. No one was injured, but the corrective action report identified a lack of hazard controls as a contributing cause for the event.

As with PHAs for production and maintenance work, when construction hazard control systems adequately identify the hazards, the appropriate controls are usually implemented. However, because of inadequate programmatic guidance and a lack of rigor in implementing construction safety processes, some hazards are missed and, consequently, adequate hazard controls are not always communicated to the worker. CSWPs also contained deficiencies, such as missing review signatures by both ES&H and line management, and inadequate descriptions of work hazards and PPE. For example, the approved CSWP posted at one of the storm sewer outfall cleanup locations lacked a checkmark for "Hearing Protection," although the FM&T safety engineer who approved the CSWP acknowledged that the location was an obvious noise hazard above the action level for hearing protection. (The vacuum truck that was used to remove sediment from the sewer was the source of the high noise.) In addition, some hazard controls for construction work are not linked to job-specific hazards. For most construction projects, a HASP is the primary mechanism for identifying hazard control requirements. HASPs, however, are somewhat generic in nature and do not have controls or hazards tailored to many specific work activities. For example, a roofing subcontractor did not develop an AHA for an asphalt roofing job. Therefore, there was no documentation for the observed controls that was unique to the asphalt hazard (e.g., double sets of clothing, heavy boots) or any indication that such controls were adequate for the hazards. In another example, the boiler demolition and replacement subcontractor's AHA for work at the West Boiler House did not document the PPE requirements for work activities involving exposures to noise, nuisance dust, and potential silica dust. The OA team observed some subcontractor workers not wearing PPE for these work activities; the job superintendent took immediate action to provide the proper protection to workers.

Engineering Controls. In general, FM&T has appropriately emphasized engineering controls rather than relying on administrative controls and PPE. Engineered controls were initially suitable for the hazard that the controls were designed to mitigate.

However, in some cases, the hazards may have changed since the initial design of the control, and the interface and requirements among operations, engineering, and ES&H personnel have not been sufficient to ensure that the controls are reevaluated when conditions change. For example, the variety of operations at the KCP requires hundreds of local ventilation exhaust systems. There are a variety of systems, including exhaust hoods, snorkel exhausts, and slot hoods, that are used for plating solutions. Initially, the FM&T industrial hygiene organization provided the flow specifications for these exhaust systems based on the expected hazards and use, and verified on an annual basis that the exhaust system and exhaust flow rate were appropriate. However, because of staffing reductions and higher priorities, such as the beryllium program, the industrial hygiene organization has not been able to dedicate the same level of rigor to maintaining the plant's local exhaust ventilation systems. Some systems, such as the maintenance paint booth ventilation system, have not been evaluated since 1995. In other systems, the hazards have changed. For example, when the environmental operations mixing booth was last evaluated in 1996, the controlling hazard was mercury, whereas the current controlling hazards are solvents and oils. Furthermore, although most exhaust systems are labeled with a measured flow rate, production personnel at the working level do not have a means to determine the actual flow rate or acceptable flow rates based on current hazards. Consequently, line management does not have the capability to ensure that personnel are being adequately protected (see Finding #1 in Section C.2.2).

C.2.4 Core Function #4 - Perform Work Within Controls

Readiness is confirmed and work is performed safely.

Performing work safely is heavily dependent on work planning and control stemming from Core Functions 1, 2, and 3. Proper planning ensures that work is properly described, that all hazards are identified and analyzed and that adequate controls have been developed. Work planning and control apply to work packages, operating procedures, day-to-day operations, and any work activity where there is risk to KCP personnel. Employee experience and training, the safety culture, supervision, and oversight are essential to ensuring that work controls are rigorously followed and that work is stopped if there are safety questions or unsafe conditions.

KCP has an excellent safety record and performs better than the DOE average on most performance measures (e.g., lost workday rates). The workforce primarily consists of senior, experienced employees who are proud of the facility and the work that they perform. FM&T personnel perform a wide variety of work that exposes them to potential physical, chemical, and (to a lesser extent) biological and radiological hazards. The excellent safety record is due, in part, to the experienced workforce, a good safety culture, and a very low turnover rate for experienced personnel.

All FM&T personnel who were interviewed were knowledgeable of their stop-work authority and responsibility and stated that they would not hesitate to stop their own work or that of others if they believed that the work was unsafe. This empowerment is the most essential part of any stop-work program and is a strength at KCP. However, the FM&T institutional stop-work guidance contains minimal guidance on raising the issue to management if the work is not stopped; fully documenting the details of the stop-work action; ensuring that the process or system is placed in a safe or shutdown condition as part of the stop-work action; and reviewing stop-work or near-miss situations for event reportability.

OKCSO has a stop-work policy and procedure that communicate expectations to the OKCSO staff, experts, and FRs to immediately stop work when they observe unsafe or imminent danger conditions. The new FR program plan (issued in September 2001) specifically gives stop-work authority to FRs for "construction projects." For all other situations, the FR program plan directs FRs to "recommend stop work" and to locate a supervisor or contracting officer to direct that work be stopped. OKCSO personnel indicated that, in practice, the FRs (and other OKCSO personnel) would feel empowered to stop work if an imminent danger situation was identified when a supervisor or contracting officer was not readily available. OA interviews with FRs generally confirmed that FRs would feel empowered to stop work in such conditions.

The OA team observed numerous production activities in several departments, including reservoir production, the model shop, the large machine shop, the plastics shop, chemical plating, analytical laboratories, and depleted uranium operations. These activities included parts machining, grinding, assembly, welding, plating, and package receiving. FM&T production personnel who were observed during this assessment generally performed work safely and in accordance with work instructions and established controls. FM&T personnel were knowledgeable of the work processes and demonstrated pride in their safety awareness and activities. However, in some cases, FM&T personnel did not follow established laser-safety procedures. In the model shop and reservoir production area, personnel were not performing required laser safety and interlock checks in accordance with procedures.

Machining Equipment

The OA team observed several construction activities by various subcontractors, including boiler replacement and structural upgrades in the West Boiler House; chemical storage building structural upgrades; storm sewer outfall cleanup; new visitor's center access ramp and display cabinets; new outside stairway to polymer building roof; new groundwater pumping

headers for wells to water treatment building; re-roofing on the main building roof; and Stockpile Management Reduction Initiative modifications (machining, electrical final assembly, electromechanical final assembly, final clean bench assembly, welding and encapsulation, and plastics molding). With some exceptions, the activities were performed safely. KCP construction oversight personnel are experienced and knowledgeable of the construction ES&H requirements and activities in progress. They are proactive in monitoring construction activities for compliance with safety requirements. The roofing project had a good heat stress monitoring and control program. The subcontractor had performed periodic monitoring, and FM&T ES&H construction oversight had performed additional monitoring of workers' core body temperature. This program could be shared as a good practice with sites that have similar work conditions and exposures.

During the boiler replacement project in the West Boiler House, work activities associated with power-chiseling refractory brick from the mud drums were not adequately addressed by the subcontractor's generic AHA, resulting in deficient work practices (see Section C.2.2). At the West Boiler House, the OA team also observed an unsafe work practice by a construction subcontractor who was installing brackets for seismic stiffeners on the outside wall of the powerhouse. The worker was balanced with one foot on a bracket and the other foot on portable wooden stairs that were improperly positioned on a non-level surface. When the worker came down from the stairs, the stairs tipped and the worker nearly fell. The project engineer for the structural upgrades documented the action with a written warning notice.

The Maintenance Department, like other FM&T departments, has an excellent safety record. The safety record of the roof crib is notable. A majority of the work is performed on top of the roof and on catwalks and gratings above the roof. The curved sections of the roof present many additional trip, slip, and fall hazards, particularly during snowy and icy conditions. Despite these hazards, no injuries or accidents have been associated with roof work in over three years.

The Maintenance Department also has an active predictive maintenance program. The program includes vibration analysis of rotating equipment (pumps, fans, motors, etc.); infrared thermography of switchgear, breakers, and components; and lubricating oil sampling to predict failures before they occur. The program reduces risk to personnel, equipment, and facilities by reducing unexpected failures and unscheduled corrective maintenance work. Due in part to the predictive maintenance program, the Maintenance Department has not had to replace any pump, motor, or fan bearings in the West Boiler House in the past few years.

While most work activities that were observed were performed with appropriate regard for safety, the OA team identified several deficient work practices that could affect FM&T personnel safety. For example:

- Deficiencies were identified with painting operations in the painting booth located in the Maintenance Department. An individual without respiratory protection was spraying approximately 12 wooden boxes using oil-based paint. Although the individual was careful to stay upwind while painting, two boxes were painted while they were positioned 2 to 3 feet outside the confines of the painting booth. A contributing factor may have been that there is no PHA, JHA, or written guidance for using and operating the painting booth (see Section C.2.2). An exposure assessment of the painting booth was performed during the OA evaluation.

- OA team members observed FM&T personnel working outside the scope of a MAXIMO work order. Workers were removing a drive motor from a lathe in the maintenance shop area under a "troubleshooting" work order. Work was not stopped after troubleshooting was complete to obtain a revision to the work order as required by KCP and maintenance procedures. Work was stopped after the OA team identified the deficiencies. The stated scope of the work request was to "check drive motor making noise" and did not include work planning, hazard identification, analysis, or work instructions for removing and replacing the motor. The craft workers decided to replace the motor under the "troubleshooting" work order without revising the work order. The replacement involved several hazards not identified on the work order, such as LO/TO protection, pinch points, removing the heavy motor, acquiring a new motor, and disposal of the old motor.

- An unsafe work practice was identified during maintenance on a roof-mounted chiller. Personnel entered several potentially confined spaces while performing annual preventive maintenance on the chiller (see Section C.2.2). At one point, one individual was momentarily "locked in" (door shut

and latched from the outside) to take a temperature reading. Although radio contact was maintained, the latched door prevented egress from the space.

- An FM&T engineer was pounding on a floor coating over concrete to obtain a sample and was not wearing the required PPE. When questioned, the supervisor stopped pounding and stated that he forgot to bring safety glasses, but he continued to work with a cold chisel, prying the brittle asphalt-based coating from the floor. ES&H personnel counseled the supervisor shortly after the incident.

- The OA team identified deficiencies in the operation and maintenance of some vehicles (e.g., bicycles, scooters, and forklifts) during the inspection period. Personnel on bicycles and scooters were observed not strictly following KCP requirements for coming to a complete stop at all yellow stop lines. The KCP vehicle safety record is good, and most operators followed requirements. However, a few did not. The team observed scooter operators driving with one hand on the wheel and one hand in their pocket, contrary to KCP requirements. Forklifts were traveling unloaded with their tines level and close to the floor, posing a hazard as the tines could catch on uneven surfaces. There was no documented guidance on this practice. In the first seven months of 2001, there were more than 12 ES&H calls to the employee-concern telephone line to report unsafe vehicle operation, indicating that safe vehicle operation at KCP is a continuing concern. Although the driver inspection sheets indicated that vehicles were being operated, several vehicles did not have the required green sticker to indicate that yearly maintenance inspections were current.

The OA team identified safety deficiencies, initially caused by improper work activities, material movement, or poor housekeeping, that could affect the safety of personnel and facilities. Many of the deficiencies were easily identifiable but were not identified by existing feedback and improvement systems, and some similar deficiencies had been identified by previous audits but had not been corrected (see Appendix D). Examples include:

- Eyewash stations were partially obstructed and had not been inspected as required. The four eyewash stations in the battery charging room had not been inspected at the required weekly interval, and two stations had not been inspected for over a month. Several eyewash stations throughout the building were partially obstructed by material storage within the well-marked clear zone.

- In several areas, improperly stored material (in well-marked clear zones) partially blocked access to power panels, and in one case the material obstructed access to safety information (e.g., emergency contact phone list and the phone list for individuals trained in cardiopulmonary resuscitation).

- Personnel in several departments had been using the machine grinder unsafely by grinding on the sides of wheels and by grinding aluminum. Several grinders were not adjusted in accordance with OSHA and KCP procedures. Additionally, the discharge of a machine grinder was directed toward another work area, creating the potential to throw grinding chips toward other personnel.

- Oil drip pans in the Maintenance Department had not been emptied for some time, unnecessarily adding to combustion loading in the event of a fire.

Most of the deficiencies identified under this core function result from a failure to follow existing procedures. In some cases, however, the deficient work practices resulted from insufficient or unclear controls being provided to the FM&T personnel at the working level. As discussed in Sections C.2.2 and C.2.3, there are weaknesses in analyzing some hazards and in communicating controls to the workforce through procedures, work instructions, training, and other controls. Improved processes for analyzing hazards, establishing controls, and communicating controls to the workforce could have averted these deficiencies and are an essential prerequisite to ensuring that personnel work within controls and perform work safely.

KCP promptly initiated corrective actions for many of the deficiencies identified during the OA evaluation period. For example, the deficiencies with eyewash stations, machine grinders, and obstructed power panels were corrected during this period. Other corrective actions were also proactive. For example, within a few days after deficiencies were identified, the analytical and physical testing laboratory team leader submitted a written memorandum to the FM&T ES&H Department outlining the specific corrective actions that were taken for all items that were identified by the OA team during a walkdown of laboratory facilities.

C.3 Conclusions

Formal procedures and processes are in place and are used to ensure that work at KCP is adequately defined and documented for moderate- and higher-hazard jobs and for most routine work . These systems ensure that production, maintenance, construction, and laboratory work receive the work definitions necessary to identify and analyze the hazards and to establish controls necessary for safe work. However, weaknesses were identified in work definitions associated with routine maintenance activities. In many cases, the work definition did not clearly identify the allowed scope of work to correct the problem or deficiency. Additional attention is warranted to ensure that all hazards are identified and that appropriate controls are established for routine work activities.

The site safety assessment provides a means for documenting an ES&H baseline for KCP operations and work activities. Although the document is outdated, the site safety assessment provides a baseline hazards assessment for evaluating new activities or significant changes in existing activities. Furthermore, the site safety assessment reflects an effort by KCP to protect the safety and health of the public and workforce beyond what is required at most low-hazard non-nuclear DOE facilities. Most FM&T personnel appeared knowledgeable of hazards within their work areas. The PHA, JHA, and exposure assessment programs are useful mechanisms for recognizing and evaluating workplace hazards. For most activities observed, the hazards were well defined and appropriate controls were in place. However, the PHA, JHA, and exposure assessment processes have some gaps, and some hazards could be missed. When applied to specific work activities, individually or collectively, they do not always ensure that hazards for specific work activities have been adequately identified, analyzed, documented, and communicated to workers. For a number of work activities reviewed by the team, the hazards were not clearly documented in a JHA, PHA, or a work instruction. Furthermore, the team identified several hazards associated with maintenance, production, and construction work activities that had not been identified or adequately analyzed.

FM&T has established and implemented processes for developing and implementing hazard controls at the work-activity level for production, maintenance, and construction work. These processes have been effective in some cases. However, in some instances, standards and requirements for these programs are not sufficiently defined. The hazard-control instruments and the specific work process are not well integrated at the working level. Consequently, appropriate controls are not adequately developed or sufficiently communicated to FM&T personnel to ensure safe working conditions in all situations. FM&T has recently recognized many of these deficiencies and is implementing changes in the programs. Increased management attention is needed to ensure that needed improvements are attained.

Overall, KCP has a knowledgeable and highly experienced workforce that displays a high regard for safety, contributing to a good safety record in the production, maintenance, and construction departments. In most areas, there are formally documented programs, processes, and procedures that promote safety when rigorously applied. The recognized higher-hazard activities have generally been well analyzed, and appropriate controls are in place. However, there were a number of instances where safety practices were less than effective, particularly for routine work and for standard industrial hazards that have historically received lower levels of management attention. In addition, the FM&T personnel at the working level have not been provided with clear and rigorous expectations in procedures and work instructions for implementing safety provisions during specific work activities. The combination of insufficient direction and instances of failure to rigorously follow established procedures creates an increased potential for accidents and injuries. The deficiencies identified by the OA team, when viewed collectively, indicate that compliance with established procedures and requirements is not always rigorous. The readily identifiable deficiencies also indicate a degree of complacency and lack of attention to detail by line management and ES&H. A well-documented stop-work program, a self-critical attitude, and a strong corrective action program are essential to safely managing complex work involving standard industry requirements.

Increased OKCSO and FM&T management attention is needed to ensure rigor and attention to detail and to promote continuous improvement in safety practices. In particular, increased attention is needed in the near term to improve the processes for analyzing hazards, establishing controls, and communicating information about required controls to the workforce. As controls are better defined and delineated, increased attention will also be needed to improve procedural compliance and OKCSO and FM&T line and ES&H assessments and self-assessments (see Appendix D).

C.4 Ratings

The ratings of the core functions and environmental management program reflect the status of the reviewed elements of the KCP ISM program.

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

C.5 Opportunities for Improvement

This OA review identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive. Rather, they are intended to be reviewed and evaluated by the responsible National Nuclear Security Administration, Albuquerque Operations Office (AL), OKCSO, and contractor line management and prioritized and modified as appropriate, in accordance with site-specific programmatic objectives.

AL/OKCSO

1. **Ensure that FRs and other OKCSO personnel have the authority to stop work when imminent danger or unsafe conditions are discovered and ensure that this authority is clearly specified in OKCSO policies and procedures**.

   - If necessary, address and/or modify contract provisions.
   - If applicable, extend modification to other DOE sites.

FM&T

1. **Enhance processes for communicating information about hazards and instructions for implementing hazard controls to FM&T personnel at the working level.**

   - Ensure that activity hazards and their controls are adequately identified and documented in work instructions for maintenance and production work activities. Implement a process to make line management accountable for ensuring that appropriate controls that are identified in PHAs and JHAs are implemented in the appropriate work documents, such as MES work instructions, process engineering specifications, and general process instructions. Consider using a mechanism requiring a response to the FM&T ES&H Department for PHA evaluation reports to ensure that appropriate controls have been implemented.

   - Consider establishing more formal documentation of required reading for revisions and new versions of command media and work instructions to ensure that applicable personnel are aware of new or revised requirements or hazard controls.

   - Establish a data field on the MAXIMO work request entitled “Defined Scope of Work” and have work planners develop a concise and bounded scope of work based on the requested work.

   - Develop procedures for performing excavations and blind wall, ceiling, and floor penetrations that incorporate upper-tier requirements and guidance for safely performing those activities. Assess lessons learned from excavation events and penetration events across the DOE complex to ensure that the procedures address the spectrum of potential concerns.

- Consider applicable PHA recommendations during safety engineer and line management evaluations of the adequacy of HASPs submitted by construction contractors.

- Continue the ongoing process of developing, implementing, and improving computer-based work control and hazards analysis systems, such as the hazard identification and control system.

2. Clarify and enhance processes for performing hazards analyses, particularly those associated with perceived lower-hazard operations.

- Develop work instructions for hazards analysis processes that currently have no formal documentation, such as the PHA evaluation report, the onsite review process, and exposure assessment reports.

- Establish a mechanism to encourage FM&T departments to share innovative department-level hazards analysis and control systems, such as the Environmental Operations Department "Job Assignment Summaries" and the Production Painting Department's "PPE Matrix."

- Develop and implement a plantwide exposure assessment strategy to ensure that all plant areas are routinely evaluated, based on risk, for potential worker exposure to hazardous chemicals, noise, non-ionizing radiation, and heat and cold stressors.

- Develop and implement a strategy for evaluating local ventilation exhaust systems that provides line managers with the instruments, instructions, and technical basis necessary to ensure that ventilation flow rates and exhaust system setups are maintained commensurate with the hazards being controlled.

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

D.1 Introduction

The Office of Independent Oversight and Performance Assurance's (OA's) evaluation of feedback and improvement at the Kansas City Plant (KCP) included an examination of both the Office of Kansas City Site Operations (OKCSO) and Honeywell Federal Manufacturing & Technologies (FM&T) programs and performance. The OA team reviewed FM&T institutional processes, such as assessments/inspections, employee concerns, lessons learned, and corrective action/issues management, and activity-specific processes such as post-job reviews. The OA team also examined OKCSO's oversight of FM&T integrated safety management (ISM) processes and implementation, including the Facility Representative (FR) program; environment, safety, and health (ES&H) program management; and the award fee/performance evaluation and measurement process.

D.2 Results

OKCSO Line Management Oversight

OKCSO performs oversight of FM&T ES&H performance primarily through day-to-day monitoring and periodic team assessments by FRs and facility inspections by ES&H program managers. OKCSO annually identifies ES&H-related award fee performance objectives and measures and conducts two interim evaluations, including a final yearly determination of the amount of fees to be awarded. The ES&H-related objectives account for approximately six percent of the contractor's annual award and incentive fees. In addition, OKCSO and the ES&H division of the Albuquerque Operations Office (AL) conduct an annual assessment called the contractor performance assessment program. The resulting KCP performance analysis matrix report documents the evaluation of FM&T's performance, the effectiveness of their ISM system, and the effectiveness of U. S. Department of Energy (DOE) oversight activities.

As a non-nuclear facility, KCP is not specifically required to have an FR program. However, OKCSO management determined that an FR program would benefit the site and proactively decided to establish and support an FR program. The structure, requirements, and methodology of the OKCSO FR program is detailed in a program plan, which was updated in September 2001. The FR program plan details a rigorous two-phase qualification process. Of the four FRs, two are fully qualified; one has completed Phase 1 qualification requirements and serves as the team leader; and one is a new appointee who is starting the qualification process. The three practicing FRs have extensive experience in the plant and knowledge of contractor programs. Annual activity plans that outline a general plan for how the FRs provide periodic and systematic evaluation of FM&T's conduct of operations have been issued for fiscal year (FY) 2001 and FY 2002. The FRs document their observations and day-to-day monitoring activities in messages that are e-mailed to OKCSO ES&H and management staff and in "Field Observation Reports," which are typically also distributed within the OKCSO. Periodic FR team assessments provide a more structured, planned, and extensive evaluation of specific contractor programs. The FRs also lead team inspections of physical conditions in various areas of the plant ("facility reviews") with ES&H program managers (i.e., industrial safety, industrial hygiene, and environmental program managers). The FRs have identified and documented many program and performance deficiencies.

The ES&H program managers monitor contractor performance in their functional areas through day-to-day contact with the contractor staff, reviews of contractor plans and submittals, participation in facility reviews, and support to FR monitoring activities. Day-to-day monitoring activities are not formal and are communicated to the contractor either verbally or via e-mail. The OKCSO Stockpile Management Reduction Initiative construction program manager participated in FM&T-managed onsite reviews and beneficial occupancy inspections of newly completed construction projects. These reviews and inspections identified ES&H concerns and deficiencies that needed

correction before the new facilities were occupied or put into operation.

The FY 2001 performance evaluation management plan delineated a performance objective to improve the effectiveness and efficiency of ISM and to ensure adherence to the ES&H management plan. A 100 percent grade for this performance objective would yield approximately 6 percent of the available award fee and incentive fee. A June 2001 interim evaluation report indicated a generally favorable evaluation of FM&T performance; however, the report identified potential weaknesses in ES&H oversight of subcontractors and concerns with inadequate schedule and compensatory controls for contractor work that generated fumes and dust affecting co-located personnel.

The OKCSO issues an operational plan for every FY, identifying roles, responsibilities, and expectations for accomplishing the mission of the OKCSO and for periodically self-assessing and documenting both group and individual performance against delineated objectives. Seventeen ES&H-related performance objectives and associated measures are identified in the FY 2001 operational plan. Each quarter, OKCSO personnel document the status of performance against these objectives and measures and specify a color-coded rating that indicates whether expectations have been met, whether concerns exist, or whether there are major concerns requiring outside help for resolution.

A number of process and implementation weaknesses are impeding the effectiveness of OKCSO's oversight of FM&T implementation of ISM. For example:

- Although four FR team assessments and four facility reviews per year are specified in the FR program plan, an OKCSO procedure, and activity plans, only one team assessment was performed in calendar year (CY) 2001, and only one team assessment and one facility review were performed in CY 2000. Only two FR team assessments are planned for FY 2002. In addition, monitoring and assessment reports do not reflect an FR focus on the various conduct of operations elements specified as focus areas in the FY 2001 FR activity plan.

- Although the FR program plan indicates that in-depth assessments of specialty areas (i.e., radiological controls, environmental protections, and configuration management) are to be performed by OKCSO specialists, only very limited formal programmatic assessments have been performed in recent years (e.g., limited annual reviews of program elements during the AL/OKCSO contractor performance assessment program evaluation/performance analysis matrix report and a few FR team assessments). The oversight of ES&H disciplines by program managers is informal and mostly undocumented.

- Monitoring and assessment efforts by the OKCSO staff reflect limited observation of work activities and little specific evaluation of ISM guiding principles or core functions. Most written reports reflect a primary focus on plant physical conditions and the adequacy of contractor procedures.

- The OKSCO monitoring and assessment activities are not clearly and consistently documented, and their results are not formally communicated to the contractor for information and action. Although observation reports and FR team assessment reports often identify program and performance deficiencies, in many cases the deficiencies are not clearly highlighted, the significance of deficient conditions is not adequately discussed, and the expectations for resolution of the deficiencies are not defined. Furthermore, OKCSO-identified deficiencies are not described in consistent terms (e.g., they are identified as "conclusions" in observation reports and team assessments, and "findings" and "observations" in facility reviews). In some cases deficiencies ("findings") that were corrected during the evaluation were apparently downgraded to "observations," and no further evaluation by the contractor was required. Some results that were classified as "findings" and that were required to be entered into the contractor's corrective action tracking system (e.g., inadequate housekeeping) appeared to be much less serious than "observations," which were not required to be formally evaluated or tracked in the KCP corrective action tracking system (e.g., unprotected cut conductors hanging from a flex conduit on a wall, and a repeat finding of exposed live electrical components).

- The FR program plan states that observation reports and team assessment reports are to be provided to the contractor's management.

However, discussions with OKCSO and FM&T personnel indicated that observation reports are rarely provided to the contractor, but in some cases they are provided to individual department managers by the FR generating the report. Except for facility review findings, few issues or concerns have been formally transmitted to the contractor for action.

- With the exception of the FR program plan and activity plans and a facility review procedure, OKCSO ES&H oversight processes are only minimally described in formal procedures or instructions. A 1999 procedure providing guidance for ES&H oversight of the contractor lacks detail and does not adequately address communication of findings to the contractor and expectations for how the staff is to perform their oversight functions. No procedures describe OKCSO responsibilities for participating in FM&T onsite reviews or beneficial occupancy inspections for construction projects or the resolution of findings from these evaluations. While generally comprehensive, the FR program plan does not clearly address how deficiencies in contractor programs and performance are communicated to the contractor, what feedback is expected, or how FRs track contractor analysis and corrective actions and validate the issues as effectively resolved.

- The OKCSO has not developed and implemented formal processes to address various requirements in DOE Manual 411.1-1B, *Safety Management Functions, Responsibilities, and Authorities*. Processes not yet established include a formal self-assessment program, corrective action/issues management, and oversight of the contractor lessons-learned program that includes tracking and trending.

- The September 1999 ISM verification report was not a performance-based evaluation of ISM implementation. For example, performance objectives related to hazard identification and controls and to management systems for corrective action and lessons learned focused primarily on the processes and procedures and did not involve significant observations of work or implementation of procedures.

- Although there are several processes that provide for self-assessment of OKCSO's performance, they are not being implemented with the rigor needed to ensure effective continuous improvement. The AL/OKCSO contractor performance assessment program/performance analysis matrix report dated October 29, 2001, identified weaknesses in OKCSO oversight of ES&H functional areas, including the need to focus on the observation of work. The OKCSO Office of Safety and Security is drafting a new oversight plan that includes ES&H activity plans, which will identify and prioritize program elements and schedule reviews. However, OKCSO does not have a formal process for analyzing deficiencies and identifying corrective actions to resolve deficiencies identified by self-assessments. The quarterly results of self-evaluation of the ES&H performance objectives in the FY 2001 operational plan do not reflect a rigorous, self-critical evaluation of performance. Of the 17 ES&H-related objectives, all were rated "green" (meeting expectations), even when the text of the evaluations indicated deficiencies or lack of progress in achieving specified measures and goals.

Overall, OKCSO has some elements of a line oversight program and a self-assessment program in place. As a non-nuclear facility, KCP is not specifically required to have an FR program. Nevertheless, OKCSO has proactively established and supported an FR program, which is identifying deficiencies for corrective action. However, the line management oversight program is not comprehensive and is not fully or effectively implemented. As a result, the feedback and continuous improvement program is not fully effective in identifying and communicating deficient programs and performance to drive continuous improvement.

FINDING #3: OKCSO line management has not established and implemented a fully effective oversight program as specified in DOE Policy 450.5, *Line Environment, Safety and Health Oversight.*

KCP Institutional Programs

Assessments. FM&T employs a variety of independent and self-assessment mechanisms to measure ES&H performance and compliance. These mechanisms include Office of Quality Assurance

(OQA) audits that evaluate implementation of ES&H management processes. FM&T management has also ensured that third-party audits are performed regularly, including voluntary protection program reviews and International Organization for Standardization (ISO) 9000 and ISO 14001 reviews.

The environmental self-assessment program (ESAP) provides 34 ES&H topical modules with checklists for each department to perform bimonthly self-evaluations of the physical conditions of their workplace. Managers are successfully encouraged to participate (by publishing participation data by department) in positive reinforcement field observations in a program called Managers Observing & Promoting Safety (MOPS). ES&H professionals conduct periodic inspections of physical conditions in all areas of the plant. FM&T has established a number of mechanisms to evaluate the effectiveness of environmental performance and the effectiveness of the site environmental management system. Work instructions have been established to require self-assessments in production and support departments, technical inspections by environmental compliance staff, independent audits by the OQA, and third-party reviews for the ISO 14001 certification. The environmental compliance staff performs audits of the analytical service laboratory to ensure attainment of quality requirements. ES&H construction safety engineers conduct reviews of contractor health and safety plans and perform routine monitoring and inspection of construction sites and activities. Other self-assessment processes include monthly MAXIMO work package reviews by the deployed ES&H representative for proper inclusion of hazards and controls and monthly lockout/tagout (LO/TO) surveillances.

A semi-annual management review meeting is held to evaluate the quality and environmental management systems of ISO 9001 and ISO 14001. During these reviews, statistics and the status of a variety of ES&H elements and initiatives are presented and discussed.

Weaknesses in the process scope and focus and inconsistent implementation are hindering the effectiveness of FM&T's assessments in driving continuous improvement. The subject matter experts' performance of ES&H and ESAP inspections has been cyclical and lacks critical analysis of results. FM&T senior management uses this performance data to make decisions regarding the need for changes in policy, resources, or processes. Implementation problems arose during the upgrading of the ESAP software, and few ESAP inspections were performed in 2000 and the early part of 2001. Few subject matter expert ES&H inspections were performed in 2000 and the first half of 2001. The ES&H inspection program work instruction provides few specific instructions on the conduct of inspections, and environmental compliance technical personnel are not documenting the inspection results consistent with the work instruction. The scope of the program does not address air emission controls. Results of subject matter expert ES&H inspections are not used to evaluate the effectiveness of departmental self-assessments. The findings from subject matter expert ES&H and ESAP inspection programs are not analyzed to identify problem areas or adverse trends. Data indicate that some departments are not performing bimonthly ESAP inspections (e.g., 19 departments did not perform ESAPs in the May-June 2001 period, and 12 of those did not complete any assessments in the March-April period). Although overall completion of ESAPs has improved significantly throughout CY 2001, there is no analysis of the data for individual compliance or management attention directed toward departments that are not complying with ESAP procedure requirements.

Although some ES&H subject matter experts are conducting some informal assessments of program implementation, there is no formal assessment process for the ES&H staff to evaluate the adequacy or implementation of ES&H program elements. In addition, OQA audits of ES&H systems generally focus on compliance with specific requirements of process descriptions and work instructions, but do not consistently address the adequacy of these documents or the underlying programs. As a result, many of the findings are administrative in nature, focusing primarily on such subjects as completeness of records, document control, and training, and do not address other important topics, such as the adequacy of policies and implementation of safety provisions. OQA audits evaluate ES&H performance and identify performance deficiencies. However, OQA auditors, in general, are not subject matter experts in the areas being audited, so the depth of their program element assessments is limited.

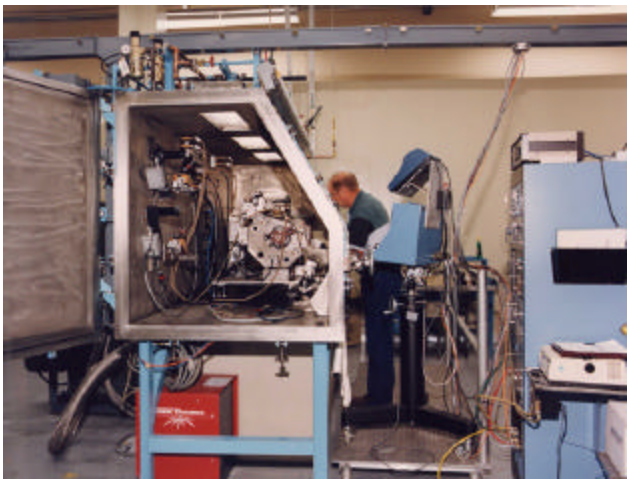
None of the assessment processes focuses on evaluating the implementation of the guiding principles and core functions of ISM or on observing work activities. The FM&T assessment processes have not been successful in identifying programmatic and performance deficiencies related to hazard identification and control and work activities, such as those described in Appendix C. Although approximately ten assessments are contracted annually

with outside parties, some of these reviews lack sufficient depth and rigor. For example, an ES&H management audit conducted in July 2000, which addressed 13 elements of ES&H management and evaluated compliance with ISM requirements, resulted in no findings and only one recommendation, which was related to emergency management. In general, assessments at FM&T focus on implementation of specific steps in a process, but do not adequately examine the adequacy of the process. The focus on implementation may arise in part because assessments of preliminary hazards analysis (PHA) and job hazards analysis (JHA) processes by OKCSO, OQA, and third parties have all identified the processes as exemplary. However, the processes have deficiencies that have not been identified during internal and external reviews, such as the fundamental ISM weakness of inadequate communication of hazards and controls to workers (see Appendix C).

While the positive reinforcement provided by managers who conduct MOPS tours is important and effective, this process provides expectations that managers should be alert to identify, document, or correct unsafe behavior or working conditions. The governing work instruction focuses on the administrative aspects of this process but does not provide any guidance or expectations on what should be included in a MOPS tour. The site corrective action process is not referenced, and tour reports (not defined in the process work instruction) did not reflect any negative observations. There is no other process or expectation that managers routinely conduct formal field inspections to directly assess ES&H performance and working conditions.

Although the MAXIMO reviews provide useful feedback that is improving performance, the reviews are not proceduralized, and therefore their content, processing, and continuity depend on individual initiative and interest, rather than a process-driven management expectation. There is no follow-up on the resolution of identified deficient performance, and no effort is made to identify and rectify repetitive deficiencies by specific individuals or groups. For example, the MAXIMO review data reflects that, in any given month, 7 to 16 percent of reviewed work packages from some maintenance cribs may not have had electrical hazards adequately identified or may not have specified required LO/TO controls.

Employee Concerns. An employee-concerns telephone line is actively used by FM&T personnel to report ES&H concerns and near misses, which are promptly addressed by the ES&H staff. Over 160



Equipment Operations

concerns were logged during the first seven months of CY 2001. Concerns and details concerning their disposition are documented in a computer database. In addition, postings throughout KCP notify FM&T personnel that they have access to the AL employee-concerns program administered by OKCSO. Although the feedback process is generally effective, several deficiencies reflect weaknesses in the FM&T command media and corrective action processes. The work instruction describing the employee-concerns process inadequately addresses the classification of issues and the application of the FM&T corrective action process. Neither the FM&T corrective action process description nor the corrective action work instruction is referenced. Documentation of the "significance" classification of employee concerns is not in accordance with the corrective action process work instruction. All employee concerns logged in CY 2001 have been classified in the concerns database as "de-minimus" (minor) even though many have actually been reported to the Occurrence Reporting and Processing System (ORPS) or were reportable injuries (i.e., events that would be or have been classified as "serious" or higher using the corrective action process significance matrix). Final resolutions and any linkage to other corrective action processes are not consistently documented in the employee-concerns database.

Issues Management and Corrective Action. ES&H-related issues management and corrective action processes and requirements are described in various work instructions that implement the requirements of the FM&T quality assurance manual. Issues are identified in various ways and are primarily documented in assessment reports from OQA, third-party assessments, employee concerns/events, and DOE correspondence. Some issues that were identified

by DOE and third parties and other ES&H deficiencies that are classified as "serious" are documented on Corrective Action Reports (CARs). The deficiencies are then analyzed for causes, and corrective and preventive actions are established. KCP uses its corrective action tracking system to document these CARs and to document the associated analysis, the corrective and preventive actions, and the closure and verification of the corrective actions. In addition, the OQA ES&H system audits specify that findings must be tracked in the KCP corrective action tracking system. An FM&T work instruction describes a formal process to screen events, injuries, and reported ES&H-related deficiencies. The work instruction provides two matrices for assessing significance and risk, resulting in categorization as "1" (minor), "2" or "3" (levels of "serious") or "4" ("imminent"). Issues categorized as "1" do not require documentation of the screening or actions taken, if any, and are not documented on CARs or tracked in the KCP corrective action tracking system. More rigorous processing requirements are applied as the significance category increases. Although often informally processed and documented, corrective actions are implemented for many ES&H program and performance deficiencies categorized as "minor."

Because of process weaknesses and poor implementation, ES&H program and performance deficiencies are not being consistently or rigorously documented, evaluated, and resolved to prevent recurrence. In a sampling of eight ES&H-related CARs from 2001, four did not have a significance category identified. The threshold for categorization of an issue as "minor" is inconsistently applied, and potentially significant programmatic deficiencies (e.g., procedural errors and omissions or failures to follow procedures) are categorized as "minor" unless identified in OQA audits. Findings from previous reviews stating that OKCSO and FM&T had not established an adequate work planning and control system that adequately defines the work, identifies and analyzes hazards, and implements controls (e.g., ISM Core Functions 1 through 3) were categorized as "de-minimus." Deficiencies noted by OQA, AL, and OKCSO as "findings" are documented on CARs and tracked in the tracking system regardless of significance. However, fewer than 20 ES&H-related deficiencies not identified by OQA had been documented on CARs and tracked in the KCP corrective action tracking system in the first ten months of CY 2001. There is no formal process for reviewing decisions regarding evaluation, classification, and disposition of "minor" events, limiting the ability to hold personnel accountable for their decisions. This lack of rigor also impedes effective analysis of ES&H deficiencies for type and trends, and impairs monitoring of the implementation of this portion of the KCP corrective action process.

The documentation, analysis, and disposition of issues classified as "serious" and above are not always rigorous. Various terms and definitions are used by the many assessment sources to describe the results of the ES&H evaluation activities and the severity/ significance of findings. The corrective action process descriptions and instructions do not adequately describe a formal process to assess, categorize, and process these assessment results. FM&T does not consistently and rigorously evaluate external assessments. Some deficiencies that were identified by OKCSO in 1999 were related to pressure safety processes and were not captured and addressed by the FM&T corrective action process. An ES&H staff evaluation of the findings from the August 2000 third-party assessment of hoisting and rigging identified several areas of concern, including a concern that prior inspections had not identified a severe structural deficiency on one crane, and recommended corrective actions. However, no CARs were issued and no corrective and preventive actions were formally developed until September 2001—after this current assessment was discussed with site staff by the OA evaluation team. Furthermore, although the crane with the severe structural deficiency was immediately taken out of service and repaired in August 2000, no CAR was written at the time and the issue was not included in any of the four CARs that were written a year later. Therefore, the issue of why a significant structural deficiency was not identified by the routine FM&T inspection program has not been evaluated. Several of these four CARS are still in "draft" status. In some cases, serious near-miss events that were reported as employee concerns and classified as "de-minimus" did not get documented or evaluated as part of the corrective action program. For example, an event where, during a plating operation, a crane hook was left in contact with an energized planting tank rack causing the hook and cables to heat up until they turned red up to the pulley was not documented on a CAR. Although direct actions were taken to secure the unsafe condition and a MAXIMO ticket was written to repair the crane, the only preventive action indicated was that Facilities Engineering was going to "look into" installing a ground fault device or interlock on the plating line components. No causal analysis was documented, and there was no reference to whether

procedures were followed or whether JHAs and work documents had adequately identified the hazards and corresponding controls. Issues related to work planning and control that were identified in previous reviews and addressed on an FM&T CAR, now closed, still exist today, indicating ineffective corrective actions and recurrence controls.

The specified direct, contributing, and root cause determinations for many CAR evaluations were incorrect or inadequate, indicating inadequate training and understanding of causal analysis. Causal analysis blocks are incorrectly used to record evaluators' opinions that the issue is not a valid deviation from requirements. Root and contributing causes are often just a restatement of the event or condition. There is no system for trending root causes.

Numerous other examples of inadequate corrective actions were identified by the OA evaluation team. For example, the corrective actions for the September 2001 groundwater treatment system ORPS event were not effectively implemented. The OA evaluators identified that the operator did not follow the newly revised procedures, make appropriate logbook entries, or notify FM&T ES&H as required. The issues management processes employed by FM&T allowed this failure to follow procedures to go unreported, and there was no documentation of any corrective or preventive action. No CAR was issued after this deficiency was identified. The completion of the CAR and preventive actions for a construction-related near-miss event in June 2001 were inadequate. The event involved concrete falling to the floor when a subcontractor installed expansion anchors that were too long into the concrete roof. The details of the event and the status of remaining work were incompletely documented on the CAR; the root cause was a restatement of the event; and no warning ticket was issued for the occurrence as required by the construction safety manual. After corrective and preventive actions were implemented, the event was repeated with 10 of 30 additional anchors installed by the contractor, resulting in concrete falling to the floor. Although a watch was in place below and there was no risk to personnel, the actions were clearly inadequate, but work was not stopped. This failure to take and monitor effective corrective action was not documented on the existing CAR or documented in any other manner.

There are no procedures detailing the conduct of beneficial occupancy inspections and onsite reviews, and PHA evaluations and procedures do not adequately detail ES&H staff responsibilities for ensuring that specified corrective actions are taken and that hazard controls are applied. In addition, procedures do not provide for documenting acceptance of the final actions/determinations by process owners.

Although the FY 2001 ES&H management plan states that trend analysis of audit findings and employee concerns is performed, there is no routine, periodic analysis that categorizes or trends ES&H issues. Additionally, there is no written process for performing trend analysis of ES&H issues.

Lessons Learned. Processes for developing and sharing lessons learned at FM&T are both formal and informal. Formal lessons learned and safety alerts posted to the FM&T website are well written, detailed, and illustrated to communicate the event or lesson to the workforce. Lessons learned are disseminated to FM&T personnel through a variety of vehicles, including an internal website; e-mail to approximately 200 managers, supervisors, and technical staff; bulletin boards; and safety meetings and safety committee meetings. Individual team leaders and subject matter experts include lessons learned in training and briefings for work crews or affected FM&T personnel. The deployed ES&H representative for the Maintenance Department performs a rigorous review of lessons learned, publishes a separate lessons-learned report on the ES&H website, and communicates these lessons to maintenance personnel.

However, weaknesses in the lessons-learned process at FM&T impede its effectiveness in ensuring that information is available to FM&T personnel and to those who train workers and plan work activities. The FM&T process description and work instruction for lessons learned inadequately detail the process and do not define or distinguish between "lessons learned" and "safety alerts," the published products of this process. Safety alerts, defined by the coordinator as post-event lessons that require some action, are not addressed in the lessons-learned procedure. There are no procedural action steps for the recipients to review or follow in response to lessons learned or safety alerts. The screening, analysis, and response to lessons learned (or safety alerts) are informal. At best, they are documented via e-mail. There is no documentation of what events or information is screened, who is asked to review them for applicability, the need to issue a lesson learned or safety alert, or the responses to recommended action. Deficiencies in grinding wheels that could result in worker injuries were identified by OA in August 2001. However, the deficiencies were corrected only at the locations where they were identified at that time. Similar deficiencies were identified at other locations on subsequent facility

walkdowns in November 2001, indicating that the lessons learned were either not communicated or did not result in corrective action.

Consistent application of lessons learned by the workforce is hindered by other process weaknesses. No formal response from the line organization is required when a safety alert is issued with a recommended action. Neither the lessons-learned coordinator nor ES&H staff perform formal follow-up to monitor line implementation of corrective actions. With the exception of the Maintenance Department, FM&T divisions and departments do not have any formal mechanisms, processes, or coordinators for assessing and applying lessons learned to their work sites and activities. There is no procedural driver for work planners or training staff to review and incorporate lessons-learned data into their products. Historical lessons-learned information is not available for reference. Lessons learned and safety alerts are retained on the ES&H website for only the current year. Archived lessons learned and safety alerts are accessible only to ES&H staff, and the information is not easily retrievable. Further, there is no search function for the lessons-learned database to facilitate retrieval of relevant information for specific tasks or conditions. With the exception of injuries or ORPS events, few lessons learned are shared interdepartmentally or with the DOE complex.

Other Feedback and Improvement Mechanisms. The Maintenance Department and the second-shift safety committees are effective tools for communicating ES&H issues and concerns between management and workers and for fostering safe work practices. Well-attended monthly meetings with management, union officials, and ES&H professionals provide a forum for communicating performance data, the status of ES&H initiatives, and other ES&H issues. Senior management holds quarterly meetings at which lessons learned are discussed.

KCP Activity-Level Feedback and Improvement

Workers use safety meetings and the employee-concerns telephone line to provide verbal feedback to supervisors and management on ES&H concerns with work activities. Although there are no formal requirements or expectations for post-job reviews in KCP procedures and instructions, there was evidence of some formal feedback at the activity level. For high-voltage work tasks, the electrical team leader conducts and retains documented post-job reviews, including feedback from the work crew on ES&H and ISM concerns. Discussions with responsible personnel indicated that corrective actions were taken for many concerns noted on the post-job reviews associated with high-voltage work tasks. However, the documentation of the issues was not rigorous, and there was no written record or indication of responsible parties, actions taken, or actions to be taken.

FINDING #4: FM&T feedback and improvement mechanisms have not been fully developed and rigorously implemented to identify and effectively resolve ISM program and performance deficiencies and to drive continuous improvement as specified in DOE Policy 450.4, *Safety Management System Policy*, and DOE Policy 450.5, *Line Environment, Safety and Health Oversight.*

Overall, FM&T employs various types of assessments and regularly uses third parties to review its programs. The assessments are identifying deficiencies and are resulting in corrective actions in many cases. However, various deficiencies in the design and implementation of the assessments, lessons learned, and issues management programs hinder the ability to drive improvements and prevent recurrence of deficient conditions.

D.3 Conclusions

The OKCSO has proactively established a functioning FR program that is identifying deficiencies and effectively monitoring day-to-day activities. OKCSO ES&H personnel are also involved in monitoring and evaluating ES&H performance, and some program and performance deficiencies are identified and documented. Some portion of the annual award and incentive fees is based on the level of performance in specified ES&H areas. However, many planned formal assessment activities are not being performed. Further, the effectiveness of OKCSO's ES&H oversight is hindered by insufficient rigor in planning and executing assessments and in documenting and communicating findings to the contractor. Many deficiencies are communicated informally and program evaluations are not rigorous, hindering the processes for holding contractors accountable for correcting program and performance deficiencies.

FM&T has established a variety of mechanisms to assess ES&H programs and performance and has formal processes in place to address employee concerns, corrective actions, and lessons learned. These mechanisms are identifying deficient conditions and performance; many corrective actions are being taken; and lessons learned are being communicated to improve safety at KCP. However, there are numerous weaknesses in assessment and issues management processes, as well as a lack of rigor in documenting and evaluating deficiencies and in implementing corrective actions. Historical lessons-learned information is not readily accessible or typically employed in the development of work instructions or training. These process weaknesses and implementation deficiencies allow inadequate ES&H-related processes and performance to go unidentified, undocumented, unanalyzed, and/or uncorrected.

D.4 Rating

OKCSO and FM&T management need to strengthen and refocus the feedback and improvement processes and ensure rigorous implementation to drive continuous improvement in ES&H performance and full implementation of ISM. As a result, a rating of NEEDS IMPROVEMENT is assigned.

D.5 Opportunities for Improvement

The OA review identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive. Rather, they are intended to be reviewed and evaluated by the responsible National Nuclear Security Administration, AL, OKCSO, and contractor line management and prioritized and modified as appropriate, in accordance with site-specific programmatic objectives.

OKCSO

1. **Enhance and institutionalize OKCSO oversight procedures.**

   - Establish a process to communicate ES&H oversight activity results (both positive and negative) to the contractor on a more formal and periodic basis.

   - Establish processes to more formally assess and document the adequacy of FM&T ES&H programs and their implementation.

   - Establish and employ a consistent descriptive terminology and screening process for deficiencies and concerns, preferably one that is consistent with the contractor's terminology to facilitate consistent treatment of issues.

   - Review the format and content of FR observation reports and team assessment reports to ensure that positive attributes, deficiencies, and opportunities for improvement are clearly delineated.

   - Identify and issue OKCSO procedures for key oversight program elements and activities such as construction oversight (i.e., onsite reviews and beneficial occupancy inspections), ES&H program monitoring and assessments, communication of oversight activities and results to FM&T, and a self-assessment program.

FM&T

1. **Enhance the rigor and discipline of line management and ES&H routine monitoring of activities, facilities, and equipment to identify and resolve obvious safety deficiencies**.

   - Develop a mechanism (or mechanisms) for documenting all issues and tracking their resolutions. The mechanism should be based on a graded approach, but should provide assurance that all issues, regardless of perceived significance, are captured, screened, and addressed and provide data for trending and analysis. NOTE: The KCP corrective action tracking system is currently only used to track corrective actions for a few issues that are determined to be significant, or when directed by OQA or OKCSO auditors, and does not provide evidence that issues have been screened for significance.

   - Establish a formal assessment mechanism for FM&T ES&H professionals to periodically evaluate the adequacy of ES&H program elements and their implementation, including the guiding principles and core

functions of ISM. Assessment topical areas should be prioritized but should result in a comprehensive evaluation of the basic ES&H programs over time (e.g., all key elements of the industrial hygiene program are evaluated over a three-year period).

- Establish a line management self-assessment function that periodically monitors the completeness and quality of permitting functions that affect worker safety. These may include permits for energized electrical tasks, hot work permits, construction safe work permits, excavation permits, and others. Develop and implement additional training and guidance for personnel responsible for preparing, reviewing, and approving permits.

- Either strengthen the MOPS program or establish a separate program that sets clear expectations for managers to perform more rigorous field observations and interactions with workers (i.e., review work packages, walk through a procedure with the workers, observe work activities, and inspect working conditions), including documentation and correction of deficiencies in conditions or performance.

- Establish an accessible, searchable database of historical and current lessons-learned information for use by line management, work planners, and training staff.

2. Enhance the quality of command media and procedures governing ES&H programs and assessments to ensure that expectations are clearly delineated.

- Establish a more rigorous process for developing, reviewing, and approving process descriptions and work instructions, including independent technical reviews and supervisory approval. The current process, which allows new or revised documents to be issued by process owners without such review and approval, has resulted in the issuance of numerous procedures that contain substantial errors and omissions.

- Conduct a rigorous review of command media documents governing ES&H programs to ensure that all required process steps are fully and clearly delineated.

- Establish a consistent set of terminology to describe program and performance deficiencies and concerns regardless of the source, and encourage third-party assessors to apply those definitions to their findings.

APPENDIX E
ENVIRONMENTAL PROTECTION

E.1 Introduction

This section of the report documents the Office of Independent Oversight and Performance Assurance's (OA's) evaluation of the implementation of the first four core functions of integrated safety management as they relate to environmental protection activities performed at the Kansas City Plant (KCP). The purpose of the review was to evaluate the adequacy of KCP management processes to analyze and control potential environmental impacts relating to site operations and legacy hazards. In conducting this evaluation, the OA team reviewed the adequacy and implementation of site policies and procedures, performed facility inspections, evaluated the operation of pollution control equipment, and interviewed environmental protection subject matter experts and operating department personnel. Technical evaluations of site programs were performed in the areas of waste management, groundwater protection, air emission controls for volatile organic compounds (VOCs) and chromium, and liquid process effluent controls.

E.2 Results

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

The nature of defense production, maintenance, construction, and environmental restoration work activities defines the scope of the environmental protection requirements applicable to KCP. KCP is legally required to comply with applicable Federal, state, and local regulations and permits, and is contractually bound to comply with specified U. S. Department of Energy (DOE) orders, which establish technical and management expectations for operations funded and managed by DOE. The Office of Kansas City Site Operations (OKCSO) and Honeywell Federal Manufacturing & Technologies (FM&T) have effectively defined the site environmental protection programs consistent with applicable requirements. OKCSO and FM&T management elected to pursue certification of an environmental management system meeting the specification of International Organization for Standardization (ISO) 14001. This internationally recognized system is composed of a set of standards that require formalized management processes to promote good stewardship of environmental resources. FM&T attained third-party certification for the ISO 14001 management system in May 1997. Semi-annual third-party reviews are performed by the external certifying organization to ensure that the management system requirements are being implemented.

OKCSO and FM&T management have demonstrated sustained leadership in the environmental area through pursuit and implementation of ISO 14001 and through continuous improvements in environmental performance. FM&T is also a charter member of the Environmental Protection Agency's (EPA's) environmental performance track program, which requires sustained superior environmental performance and formalized management systems. FM&T environmental policies are consistent with ISO 14001 specifications and include a commitment to compliance with regulatory requirements, pollution prevention, and continuous improvement. OKCSO and FM&T management have applied sufficient resources to address significant aspects of the site's operations. Over the past decade, nearly all remedial actions have been accomplished to address legacy waste disposal sites. Over this same period, FM&T aggressively pursued pollution prevention and pollution control projects to reduce local environmental impacts and improve efficiencies of operations. These efforts have resulted in broad reductions of waste generation and major reductions of air and water effluents. FM&T has recently implemented several pollution prevention projects, such as reusing onsite soil during the installation of new wells, reusing industrial wastewater for cooling tower makeup through treatment in a reverse osmosis system, and using passive diffusive sampling to collect groundwater samples to reduce generation of purge water.

Notwithstanding FM&T's significant pollution prevention accomplishments, this OA review identified a few areas where further attention is needed to ensure that opportunities to further reduce pollution are considered. The site pollution prevention program plan is outdated and does not represent current management

implementation strategies. Several operational personnel did not demonstrate an appropriate awareness of the site's pollution prevention policies or an understanding of how they can contribute to continuous improvement in this area. Some potential pollution prevention measures have not been pursued. For example, the Department of Energy Acquisition Regulation clause on the "Acquisition of Products Containing Recovered Materials" has not been implemented for construction projects at KCP; the current FM&T construction specifications call for "new" materials only and thus do not promote affirmative procurement policies for buying products that contain recycled components when available or when economically feasible.

In summary, OKCSO and FM&T have effectively defined the site environmental protection programs and have established management strategies to implement requirements. OKCSO and FM&T management have demonstrated sustained leadership in the environmental area through pursuit and implementation of ISO 14001, and through continuous improvements in environmental performance through environmental remediation and implementation of pollution control and prevention projects. FM&T has established appropriate environmental policies and has applied sufficient resources to address significant aspects of the site's operations. Opportunities to further reduce pollution were identified in a few areas.

E.2.2 Core Function #2 - Analyze the Hazards

KCP has evaluated pathways for release of pollutants from routine operations and legacy conditions to the air, surface water, groundwater, and solid wastes. With few exceptions, hazards analysis processes for environmental pathways at KCP were systematic and, where evaluated, effectively performed. FM&T utilizes the preliminary hazards analysis (PHA) system to facilitate analysis of impacts associated with new business ventures, projects, equipment, and materials being introduced into the site. PHA screening forms contain the appropriate environmental criteria that are necessary to facilitate an expert-based review of environmental impacts associated with a proposed change.

FM&T performed a systematic analysis of air emissions to determine the site's regulatory requirements and the levels of pollutant emissions to the atmosphere. OA's review of the calculation of VOC and chromium emissions from the KCP found that the methodologies used for estimates in the emission inventory questionnaire for the year 2000 were appropriate. In many applications, the environmental inventory questionnaire is developed using a mass balance approach, calculating the variance between materials procured through central stores and waste streams quantities generated from those processes. The availability of robust information management tools makes this approach possible. A review of spreadsheet program logic determined that embedded codes for emission calculations were accurate for all areas evaluated. The only concern identified during OA's review of the calculations was the absence of technical documentation of the rationale for engineering judgments for efficiency factors used in the release estimates.

The FM&T Environmental Operations Department is nearing the completion of a systematic analysis of waste streams generated from operational activities. This process is used to establish updated waste acceptance certifications for each waste generated by the plant, including non-regulated solid wastes, hazardous wastes, and small amounts of radioactive wastes. Waste acceptance certifications establish the basis for the management controls that are applied to individual waste streams and containers. A waste acceptance certification is developed by analyzing materials that are used in the waste generating process and the characteristics of the resultant wastes. Sampling and analysis data are used to supplement process knowledge. OA's review of a sample of waste acceptance certifications for several departments determined that the waste acceptance certifications were representative of the materials involved.

There are limited operational activities at KCP that utilize radioactive materials or sources in production or support functions. In Department 90, a process is used to electrochemically etch small depleted uranium parts. The acid solution removes oxide layers and reduces the size. The parts are rinsed in deionized water and are weighed. After a specific weight is reached, the parts are dried using an alcohol bath and argon gas. A small quantity of an alcohol hazardous waste (Solvent L7) is generated in this process. The site lacks an adequate technical basis for demonstrating that this alcohol waste, which has come into direct contact with depleted uranium metal, is free of any uranium contamination and can thus be treated as non-radioactive hazardous waste. The site does

perform radiological analysis of this waste. However, the established minimum detectable activity (MDA) of the liquid scintillation counter used for the analysis is not sensitive enough, as currently configured, to determine whether radioactivity, above background levels, is present in liquid alcohol samples. The stated MDA is 4.6 disintegrations per minute for a five-milliliter sample. This equates to 414 picoCuries per liter of uranium-238 activity, which is approximately 70 percent of the DOE Derived Concentration Guides, or about 17 times the uranium drinking water standard. The possible presence of residual radioactivity at this level cannot be reasonably considered free of DOE-added radioactivity and may therefore be subject to the volumetric release provisions of DOE Order 5400.5, *Radiation Protection of the Public and Environment*, Chapter 2, section 5c(6). A more sensitive analysis method, such as total uranium by fluorimetry or kinetic phosphorescence, could provide better sensitivity and present an MDA that is sufficiently low to determine whether radioactivity levels are above background. In addition, an appropriate data quality objective for background levels of uranium in the alcohol (if any) has not been established.

Notwithstanding the MDA difficulty noted above, the FM&T health physicist performs a radiological analysis for each generated waste container, and has sampled and analyzed virgin alcohol on several occasions. The analytical results for all samples of waste and virgin alcohol, except two, have been below the MDA. In 1999, two waste samples were determined by scintillation analysis to contain activity three times the MDA (equating to 1351 picoCuries per liter uranium activity), indicating a statistically significant measurement of activity above the sensitivity of the scintillation counter. The FM&T health physicist did not resample this material to verify or refute the initial positive analysis results and did not add radiological restrictions to the management and disposal of the sampled alcohol waste.

The small quantities of radioactive wastes generated at the KCP are intended for disposal at the Nevada Test Site (NTS). The main storage areas for radioactive wastes are appropriately posted and controlled. Management developed waste acceptance certifications for radioactive wastes consistent with established work instructions. FM&T continues to generate these wastes, which are put into storage pending shipment. Storage of radioactive wastes has been authorized for up to five years. DOE Order 435.1, *Radioactive Waste Management*, requires that low-level wastes be characterized in sufficient detail to ensure compliance with the waste acceptance requirements of the receiving facility. An August 2001 review of radiological waste streams at the KCP by an NTS contractor identified a number of actions that were required before wastes could be shipped to NTS for disposal, such as developing a formal radiological technical basis for each radiological waste stream to document the radiological content of each waste container. The review also determined that KCP had not performed an analysis to determine whether a solidified low-level waste stream (RAD L1) would meet the DOE Order 435.1 requirement and the NTS waste acceptance criteria of 0.5 percent for free liquids during the long storage periods and during transportation to NTS. Actions to respond to these findings have not been completed.

OKCSO and FM&T have evaluated and analyzed environmental contamination and legacy hazards through implementation of a consent decree with the EPA and subsequently a state of Missouri Resource Conservation and Recovery Act (RCRA) Post Closure Permit. Investigations to characterize other legacy contamination areas have been completed for approximately 40 areas of the plant site. Only one solid waste management unit is still being evaluated. Groundwater contamination represents the most significant legacy hazard at the site. Past operational activities have released substantial quantities of solvents and polychlorinated biphenyls (PCBs) into the soil column. Although former waste disposal sites have been cleaned up, significant quantities of these materials remain below the ground surface to a depth of approximately 40 feet to the bedrock interface. High concentrations of solvents and anaerobically-generated breakdown products have been released into the groundwater in the vicinity of the release points. Lower concentrations have spread on the plant site and to some nearby offsite locations, including discharges of low levels of contaminants (below the site cleanup standards) to the Blue River. Investigations have determined that there are no significant public exposure pathways. OKCSO and FM&T, working with site regulators, have effectively analyzed the nature and extent of groundwater contamination. OA's review of the monitoring well network for the alluvial aquifer determined that the extent of groundwater contaminants has been defined with a high degree of confidence.

Although FM&T has systematically evaluated groundwater contamination pathways from legacy

release and disposal locations, the potential for impacts to groundwater resources underlying production operations has not been systematically evaluated to determine whether vulnerabilities exist and whether surveillance monitoring would be appropriate to promptly detect a release. FM&T has reduced their groundwater contamination vulnerabilities in the past by upgrading plating tank containment structures, reducing reliance on underground transfer lines, eliminating underground storage tanks, using less toxic chemicals in production processes, and minimizing waste inventories. Analyzing facility environmental release pathways and establishing an appropriate groundwater monitoring system are requirements of DOE Order 5400.1, *General Environmental Protection Program.* This order was not retained in the DOE contract with FM&T during the order reduction initiative in the mid 1990s.

The environmental aspects analysis performed by KCP as part of their ISO 14001 environmental management system was systematic and appropriately identified the areas needing management attention and resources. Because of this analysis, important pollution prevention and mitigation actions have been identified for funding and implementation (e.g., boiler replacement and chiller replacement).

In summary, KCP has evaluated pathways for release of pollutants from routine operations and legacy conditions to the air, surface water, groundwater, and solid wastes. With few exceptions, hazards analysis processes for environmental pathways at KCP were systematic and, where evaluated, effectively performed. The environmental aspects analysis performed by KCP as part of their ISO 14001 environmental management system appropriately identified the areas needing management attention and resources. While KCP has limited operational activities that utilize radioactive materials, this review determined that FM&T lacks an adequate technical basis for demonstrating that an alcohol waste from Department 90, which has come into direct contact with depleted uranium metal, is free of any uranium contamination and can thus be treated as nonradioactive hazardous waste.

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

FM&T has established administrative controls for management and environmental protection programs through its command media system. The command media establish process descriptions and associated work instructions for production and support departments to manage and control work activities in accordance with established regulations, applicable DOE orders, and FM&T environmental policies. Command media for air pollution control (VOCs and chromium), wastewater discharges, and waste management contain an appropriate set of operational specifications. Work instructions describe the responsibilities of environmental compliance staff, but generally do not dictate how to perform these functions. Environmental compliance staff have an appropriate level of education and experience to effectively implement their assigned duties.

Command media do not extend down to environmental subcontractors. However, subcontractor requirements are appropriately managed through contract provisions. For example, the environmental monitoring subcontractor is contractually bound to conform to the RCRA post closure permit sampling and analysis plan.

Work instructions have been established within the FM&T command media system to implement waste management requirements at the site, and provide a systematic process for management of waste materials from operational activities. These controls require analysis of all processes generating wastes, the use of compatible containers, labeling of containers in a consistent format to reduce potential errors, the use of a bar-coding system to track waste containers, and placement of wastes in the appropriate interim storage areas with compatible wastes types. FM&T has established controls for non-regulated wastes and recyclable materials that are consistent with the rigorous controls established for regulated wastes.

FM&T has also established appropriate administrative controls for airborne and liquid process effluents. Specific controls have been established for liquid process discharges to the Industrial Wastewater Pretreatment Facility (IWPF), the sanitary sewer, and permitted outfalls to surface streams. A work instruction, "How to Ensure Compliant Wastewater Discharges," establishes specific requirements and limitations on process discharges, and serves to control changes to liquid discharge piping systems in order to maintain an appropriate configuration. FM&T also established a series of work instructions to establish controls for reporting and monitoring of airborne process effluents. Appropriate administrative controls and technical specifications for VOCs and chromium air discharges were incorporated into established work instructions.

FM&T has effectively applied engineering controls in many areas to mitigate or prevent process releases to the environment. For example:

- Scrubbers have been on installed on the ventilation systems for several chromium plating lines to control concentrations of air effluents within regulatory limits.

- Secondary containment devices have been erected for most solvent parts washers, plating tanks, waste tanks, and chemical storage areas.

- A groundwater extraction system and an engineered iron filing wall passive treatment system have been installed to control contaminant migration through environmental pathways.

- FM&T operates the IWPF and groundwater treatment system to manage a variety of waste streams containing hazardous constituents.

- Within Department 90, appropriate engineering controls have been established to control liquid and airborne chemical and radiological pathways from production activities. Engineering controls included: the use of a glovebox to minimize the spread of radiological contamination; high-efficiency air particulate filtration of air emissions; secondary containment around acid etch process equipment; and secondary containment on liquid process piping. The operations use a recirculating system for the rinse water to eliminate liquid waste streams.

Although controls are generally effective, FM&T has not established appropriate work controls to control environmental hazards and to ensure full compliance with environmental requirements in a few important instances For example:

- FM&T has not established appropriate work controls, including quality assurance requirements, for environmental monitoring activities conducted by their staff. FM&T environmental compliance staff perform groundwater monitoring of subsurface well inspections and passive diffusive sampling of groundwater, which generates environmental compliance data. These activities are being performed without the benefit of established work instructions that specify appropriate quality control requirements such as procedures, training, equipment calibration, inspection and testing, and record keeping. (Compliance sampling activities conducted by subcontractors, however, are performed under a formalized quality assurance program.)

- No controls have been established for unsecured offsite phytoremediation "well tubes" that provide a direct pathway to groundwater in the alluvial aquifer. The area is publicly accessible. There are no security devices or locking mechanisms on these tubes to prevent tampering. However, FM&T security conducts daily patrols of the area.

- The radiological work authorization (RWA) is the administrative control for the transfer of acid solutions in the acid etch booth. RWA work instructions were posted in the area as required and operators were familiar with requirements. An important step in the transfer process is the addition of a solidification agent to convert the neutralized acid into a solid in order to meet the NTS waste acceptance criteria for free liquids. The RWA instruction requires the addition of six pounds of the agent. However, the RWA for this process does not include a critical step for the placement of additional quantities of the agent on top of the solidified layer to ensure the capture of all liquids in subsequent pours. Subsequently, a revised RWA, with appropriate instructions, was established.

In summary, FM&T has established administrative controls for management and environmental protection programs through its command media system. Command media for air pollution control (VOCs and chromium), wastewater discharges, and waste management contain an appropriate set of operational specifications. In addition to these administrative controls, FM&T has effectively applied engineering controls in many areas to mitigate or prevent process releases to the environment. Although controls are generally effective, FM&T has not established appropriate work controls to control environmental hazards in a few important instances.

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

Most of the controls established by FM&T command media for environmental protection programs were effectively implemented.

- FM&T departments with solvent cleaning and coating operations were effectively implementing requirements for control and reporting of VOC emissions.

Cleaning Operations

- Chromium scrubbers were operating within the differential pressure tolerances specified in the established work instructions, consistent with regulatory requirements. Logs of differential pressure recordings were maintained as required.

- Satellite accumulation areas in main manufacturing areas were managed consistent with established FM&T work instructions and environmental regulations.

- Central waste storage facilities (90-day storage areas) were managed consistent with Federal regulations with respect to storage time limits, waste segregation, maintenance of aisle space, and secondary containment.

- Based on a sample of plating tanks in Departments 61 and 97, diluted plating rinses were hard piped into established piping systems for transfer to the IWPF, and plating baths containing concentrated wastes were isolated from these waste lines. These practices are consistent with FM&T work instructions for liquid waste discharge controls.

- KCP is meeting their commitments to and the controls established by external regulators. The IWPF has received several "Gold Awards" from the Missouri Water Environmental Association in recognition of its consistent compliance with industrial wastewater pretreatment requirements. The site National Pollutant Discharge Elimination System permit establishes stringent controls on PCB contamination levels. FM&T is aggressively implementing projects to remove PCB sources to ensure compliance with established limits.

Although generally appropriate and effectively implemented, controls were not fully implemented in accordance with established work instructions and regulatory requirements in a few instances. For example:

- A violation of a work instruction requirement regarding the absence of a drip containment system from a cold cleaning tank was identified in Department 93. When this was discovered, a requisition for the fabrication of a secondary containment pan was issued.

- During this review, a problem was experienced with the discharge of dilute wastewater to the dilute cyanide waste treatment system. Because a Department 71 pump for dilute acid/caustic wastewater transfer would not operate, FM&T personnel decided to transfer this waste to the collection system for dilute cyanide wastewater system, which is then transferred to the IWPF's two dilute cyanide wastewater holding tanks. In this configuration, acidic wastewater could be pumped into the dilute cyanide holding tanks and could generate toxic cyanide gas. FM&T management has recognized the seriousness of this event and is performing an investigation.

- Administrative and engineering controls for extraction of contaminated groundwater have not been consistently implemented in the last several months. Because of a September 2001 event where a groundwater extraction well was inappropriately turned off for over 60 days, new reporting expectations have been established. Specifically, groundwater treatment plant operators are required

to report to FM&T ES&H any occurrence where an extraction well is not operating as expected. OA's review of operational logs indicated that plant operators failed to note that well 108 was not operating and, as a result, did not notify ES&H in accordance with the revised General Instruction 28, "Groundwater General Information." Subsequent to this discovery, a notification was made and maintenance of the well was completed. Well 108 is an important well for controlling contaminated groundwater migrating towards the Blue River. System operators were subsequently trained on the revised work instruction.

In several areas outside the main manufacturing areas, waste management activities were not consistent with established requirements. The deficiencies in these areas are indicative of inattention to detail, insufficient or ineffective training, and/or ineffective self-assessments by the departments controlling these areas. For example:

- Some radiological waste materials have been stored in the excess and reclamation storage area for many years. While most waste management activities in this area are effectively managed, several deficiencies were noted. A drum of activated metals that has been in storage for an extended period of time is not labeled on a 2884 form as required by FM&T work instructions to identify the waste type, accumulation start times, and storage time limits. Additionally, several components from disassembly of surplus equipment that contain both small radioactive sources and hazardous constituents (i.e., lead) have been generated. One component consists of a small radioactive source that is physically attached to material containing lead solder. This component was removed from a drum of mixed waste in 1993 and was placed in a plastic bag for storage. Several other components have been removed from excess equipment more recently. Because these components contain both radioactivity and lead, they may be considered mixed waste pursuant to DOE Order 435.1. However, these components are not being managed in accordance with FM&T work instructions and the applicable regulatory framework. In response to this discovery, FM&T management initiated response actions and has reported that all mixed components have been separated.

- Within the health physics laboratory, a non-hazardous scintillation cocktail solution is used for radiological analysis. Solutions used in analysis that are determined to be non-radiological are placed in an appropriately labeled waste container. The radiologically contaminated solutions are placed in a container that is appropriately labeled for radiation, but does not have labeling consistent with FM&T waste management specifications. While the material is not hazardous, the stenciled labeling on the containers incorrectly states that it is a hazardous waste. Additionally, within this lab, a flammable storage cabinet, which is shared between the industrial hygiene and health physics organizations, contains a small amount of a waste chemical labeled "1-(2 methoxphenyl) Piperazine in Toluene - waste." This material is not being stored consistent with waste management work instructions. It does not have an appropriate waste label and is not labeled with respect to its regulatory status or accumulation start date. Further, the storage of chemicals in close proximity to radiological materials presents the potential to generate mixed waste in the event of a spill.

- Two 55-gallon hazardous waste drums labeled as containing F001 and F002 contaminated soil were inappropriately stored at the West Boiler House unloading dock. Labels were marked with an end fill date of May 17, 2001. FM&T work instructions require that waste be removed from a satellite storage area within three days of the end of the fill date. FM&T has moved these drums into a 90-day storage area and is conducting an investigation of their origin. The preliminary investigation indicates that these two drums were reissued or reused without going through proper reissuing procedures and record keeping.

- Inappropriate management of small amounts of solvent and ferric chloride-contaminated rags from waste container maintenance activities was observed in satellite accumulation areas in the basement of Department 71. There were no approved containers for this maintenance waste in the area. The contaminated rags were left in an open pail and on top of drums. The management of solvent contaminated rags in this manner is not consistent with established work instructions and regulatory requirements for satellite accumulation areas.

- Housekeeping conditions were poor in the areas around the compactor in the paper mill 90-day hazardous waste storage area (Building 73). Materials that could have come from hazardous waste containers being compacted were observed to be lying on the ground in the vicinity of the compactor. FM&T work instructions require that hazardous wastes be kept within closed containers.

In summary, administrative and engineering controls for environmental protection were effectively implemented in most areas that were evaluated. In a few instances, this review determined that established controls were not fully implemented in accordance with established work instructions and regulatory requirements. Most notable were waste management deficiencies that were identified in several areas outside the main manufacturing areas. These deficiencies are indicative of inattention to detail, insufficient or ineffective training, and/or ineffective self-assessments by the departments controlling these areas.

E.3 Conclusions

Overall, FM&T management has established effective management systems to implement their environmental responsibilities. FM&T achieved certification of an environmental management system meeting the specification of ISO 14001. OKCSO and FM&T management have applied sufficient resources to address significant aspects of the site's operations. Nearly all remedial actions have been accomplished to address legacy waste disposal sites, and pollution prevention and pollution control projects have been implemented to reduce local environmental impacts and improve efficiencies of operations.

FM&T has evaluated pathways for release of pollutants from routine operations and legacy conditions to the air, surface water, and solid wastes. With few exceptions, hazards analysis processes for environmental pathways at KCP were determined to be systematic and effectively performed. FM&T has established administrative controls for environmental protection programs through its command media system. The FM&T command media for air pollution control, wastewater discharges, and waste management contains an appropriate set of operational specifications. Additionally, FM&T has effectively applied engineering controls in many areas to mitigate or prevent process releases to the environment. Most of the controls established by FM&T command media for environmental protection programs were effectively implemented. FM&T personnel in production departments were familiar with established administrative and technical requirements in nearly all cases.

Although overall effective management systems have been established, FM&T has not effectively analyzed environmental hazards, established appropriate controls, or implemented requirements in some cases. Several waste management deficiencies were identified in locations outside of the main manufacturing areas, including deficiencies in labeling waste, storing waste outside containers, characterizing radiological waste, and managing a small number of components that have both radiological and hazardous constituents. FM&T has not established appropriate groundwater protection work controls, including quality assurance requirements, for environmental monitoring activities conducted by their staff. Additionally, FM&T has not analyzed the potential for operational impacts on groundwater resources or established controls for phytoremediation "well tubes" that provide a direct pathway to groundwater in the alluvial aquifer. Further, several operational events relating to wastewater and groundwater treatment systems have recently occurred in which established controls were not properly implemented.

Although several deficiencies were identified, the KCP environmental management program has a number of significant positive attributes and is effectively implemented in the main manufacturing areas, where the most significant potential environmental hazards are located. Most of the deficiencies occurred in specialized technical areas or in locations outside main manufacturing facilities, indicating a need for additional attention in these areas. While corrective actions are warranted, the identified deficiencies are judged to be anomalies in an overall effective system.

E.4 Rating

While a number of isolated deficiencies were identified, the systems for analyzing and controlling environmental hazards are generally effectively established and implemented. Therefore, a rating of EFFECTIVE PERFORMANCE is assigned.

E.5 Opportunities for Improvement

This OA review identified the following opportunities for improvement. These potential enhancements are not intended to be prescriptive. Rather, they are intended to be reviewed and evaluated by the responsible DOE and contractor line management and prioritized and modified as appropriate, in accordance with site-specific programmatic objectives**.**

FM&T

1. **Strengthen waste management practices associated with radiological waste streams to ensure that FM&T controls are effectively applied to all waste streams**.

   - Use standardized labeling (2844 labels) for all radiological waste containers. These labels serve to identify contents and hazards, the regulatory status of the waste, the generator, the approved waste acceptance certification, accumulation start dates, and storage time limits.

   - Ensure that appropriate characterizations of radiological or potentially contaminated wastes are performed before, or when, wastes are generated to ensure the ability to meet acceptance criteria for the disposal site.

   - For specialized waste materials (e.g., liquid wastes or solidified wastes), make available additional professional health physics expertise and/or use contractor analytical laboratories to assure appropriate decision-making.

   - Consider eliminating the potential generation of mixed wastes during equipment disassembly activities by actions such as physically separating small radioactive sources from components with hazardous constituents at the time of disassembly.

   - For any “mixed” components, ensure that storage practices are consistent with the requirements for both radiological and hazardous constituents.

   - Store radioactive materials and chemicals in separate locations to reduce the potential for generating mixed wastes from spill events.

Abbreviations Used in This Report (Continued)

NNSA	**National Nuclear Security Administration**
NTS	**Nevada Test Site**
OA	**Office of Independent Oversight and Performance Assurance**
OKCSO	**Office of Kansas City Site Operations**
OQA	**Office of Quality Assurance**
ORPS	**Occurrence Reporting and Processing System**
OSHA	**Occupational Safety and Health Administration**
PHA	**Preliminary Hazards Analysis**
PPE	**Personal Protective Equipment**
RCRA	**Resource Conservation and Recovery Act**
RWA	**Radiological Work Authorization**
VOC	**Volatile Organic Compound**