Office of Independent Oversight and Performance Assurance
U. S. Department of Energy

Independent Oversight Lessons Learned Report

Environment, Safety, and Health Evaluations

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Abbreviations Used in This Report

AAAHC	Accreditation Association for Ambulatory Health Care
ALARA	As Low As Reasonably Achievable
CAIRS	Computerized Accident and Injury Reporting System
CFR	Code of Federal Regulations
D&D	Decontamination and Decommissioning
DOE	U.S. Department of Energy
EM	Office of Environmental Management
EMS	Environmental Management System
ES&H	Environment, Safety, and Health
ESF	Essential Systems Functionality
ISM	Integrated Safety Management
ISO	International Organization for Standardization
NNSA	National Nuclear Security Administration
OA	Office of Independent Oversight and Performance Assurance
OA-50	Office of Environment, Safety, and Health Evaluations
OSR	Operational Safety Requirement
SC	Office of Science
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question

OVERSIGHT

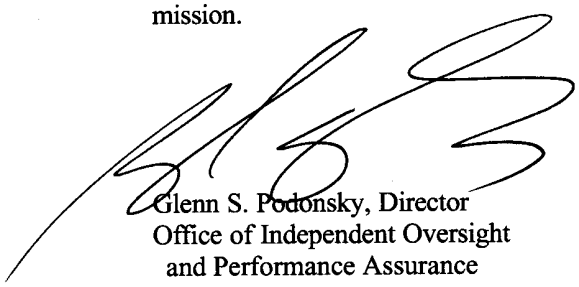
FOREWORD

Since 1984, the Office of Independent Oversight and Performance Assurance (OA) and its predecessor offices within the U.S. Department of Energy have been responsible for evaluating programs of national significance and reporting on their status to the Secretary of Energy, senior Department management, and Congress. This independent internal oversight function is unique in the executive branch of the government and, over the years, has led to notable improvements in safeguards; security; cyber security; environment, safety, and health; and emergency management programs.

This initial *Independent Oversight Lessons Learned Report: Environment, Safety, and Health Evaluations* was developed to provide value-added feedback on the results of our inspection activities. Data from our inspections conducted October 2001 through December 2002 was analyzed to identify common areas of effective performance and areas that need improvement. The eight evaluations of environment, safety, and health programs conducted during this time spanned the range of Departmental missions, involving the National Nuclear Security Administration, the Office of Environmental Management, and the Office of Science.

The results of recent OA inspections indicate that implementation of the Department's integrated safety management system policy has led to significant improvements in environment, safety, and health programs throughout the Department. Environmental protection programs were found to perform effectively at all sites reviewed. However, further improvements are needed in programs and processes for assuring essential system functionality, conducting non-radiological exposure assessments, implementing contractor self-assessments, and ensuring that Departmental requirements are fully communicated to subcontractors.

The Office of Independent Oversight and Performance Assurance will continue to monitor these areas. In addition to evaluating program performance, we will provide essential input to decisions about ongoing line management oversight activities at the site, field office, and Headquarters levels. We also will continue to provide periodic value-added feedback on the analysis of the results of our inspection activities. By these means, we will continue to fulfill our mission of promoting improvement in environment, safety, and health programs and in all functions critical to the success of the Department's mission.



Glenn S. Podonsky, Director
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1.0 Introduction

The Office of Independent Oversight and Performance Assurance (OA) Office of Environment, Safety, and Health Evaluations (OA-50) is responsible for evaluating and reporting on environment, safety, and health (ES&H) performance throughout the U.S. Department of Energy (DOE) complex. This report provides a summary of the observations and insights that resulted from OA inspection activities conducted from October 2001 (when a transfer of function placed OA-50 within OA) through December 2002.

OA-50 performs ES&H management inspections as its primary mechanism for evaluating and reporting on ES&H performance. These inspections are conducted within the framework of DOE's integrated safety management (ISM) policy.

The eight safety management inspections conducted by OA-50 during the reporting period were baseline assessments of ISM programs. The scope of these inspections encompassed selected aspects of DOE site ISM programs, with a focus on implementation of ISM, and DOE contractor and line management performance.

The eight sites inspected by OA during the reporting period are listed in Table 1. The table also identifies the DOE program office that has primary management responsibility for the site—the National Nuclear Security Administration (NNSA), the Office of Environmental Management (EM), or the Office of Science (SC).

Table 1. Sites Inspected by OA-50 During the Reporting Period

SAFETY MANAGEMENT INSPECTION SITE	HEADQUARTERS PROGRAM OFFICE
Kansas City Plant	NNSA
Hanford (Plutonium Finishing Plant)	EM
Los Alamos National Laboratory	NNSA
Argonne National Laboratory	SC
Lawrence Livermore National Laboratory	NNSA
Waste Isolation Pilot Plant	EM
Nevada Test Site	NNSA
Pantex Plant	NNSA

Nuclear Explosives Operations Activities

The scope of all eight inspections included an evaluation of management systems and performance that was based on observation of work activities involving hazards. During some inspections, OA also conducted reviews of essential system functionality. The essential system functionality reviews provided a detailed engineering review of the condition and performance of a sample of essential safety systems, which are relied upon to protect site workers, the public, and the environment. The essential system functionality reviews complement DOE efforts to respond to a Defense Nuclear Facilities Safety Board recommendation.

Any identified ES&H performance deficiencies during OA-50's review of work activities or essential systems are evaluated to determine whether weaknesses in management systems contributed to the deficiencies and to ensure identification of the underlying causes as well as the symptoms. Significant weaknesses require the development and implementation of a corrective action plan that is approved by senior DOE line management.

OA also supported six surveys by the Accreditation Association for Ambulatory Health Care Inc. (AAAHC), which has a program to review and accredit medical programs. Accreditation surveys were performed at: Oak Ridge National Laboratory, Los Alamos National Laboratory, the Pantex Plant, Sandia National Laboratories–New Mexico, Brookhaven National Laboratory, and a consultative survey was performed at Sandia National Laboratories–California.

The remainder of this report is organized as follows: Section 2 provides a summary of OA-50's key observations, based on the results of the recent inspections, and recommendations for improving DOE ES&H programs. Section 3 provides OA-50's overall analysis and briefly discusses the priorities for future OA-50 inspections. Appendix A provides additional details on eight aspects of ISM programs that were focus areas of recent OA-50 inspections, and Appendix B provides supplemental information.

2.0 Results

The results of the past year's inspection activities are summarized in Table 2 on page 6 and show the distribution of ratings for the 8 inspections performed during this reporting period, and in 6 observations that identify the most important trends at the sites inspected.

As seen in the table, approximately 69 percent of the ratings are Effective Performance. Only one element at one site was rated Significant Weakness. These ratings indicate an improving trend across DOE. The ratings also indicate that the institutional ISM programs are well established and functioning adequately, as evidenced by the generally high ratings assigned to the ISM guiding principles (about 90 percent are rated Effective Performance). Environmental protection programs received good ratings on all inspections. However, the ratings also indicate the need for further improvements in the implementation of the ISM core functions and in essential systems; about one-third of the ratings in these areas were less than optimal. Particular attention is needed in ISM core functions #2 and #3 (which address hazards analysis and controls); more than half of the ratings in these areas were less than optimal. Finally, the ratings for the feedback and improvement core function (ISM core function #5) indicated a need for improvement in seven of eight instances.

The following six observations are based on an analysis of the results of the eight inspections performed during this reporting period. They identify trends that are evident at most of the sites inspected. The first two observations address aspects of DOE ISM programs that are generally effective, although some aspects could be further improved. The last four observations address four aspects of ISM that require improvement at several sites. For each observation, OA provides a recommendation that should be considered by the applicable DOE line management and policy organizations. (For site-specific results and recommendations, please refer to the individual inspection reports.)

1. **The implementation of ISM has led to significant improvement in ES&H management.** Although ISM systems are still evolving, the results of OA inspections show an improvement in ES&H performance that is a direct result of the structured approach for integrating safety into day-to-day operations through the DOE ISM policy. The policy has been in place for over six years and has received management support at all levels of DOE and contractor line management. While improvements have been observed in all aspects of ISM implementation, DOE sites have made notable improvements in defining the work (ISM core function #1) and performing work in accordance with established controls (ISM core function #4). The better definition of work and the increased attention to compliance with controls have directly contributed to the observed effective performance at most sites and to a continued trend of improvements in safety, as measured by site-specific performance measures. The safety deficiencies identified during observations of work activities are a key indicator of performance. For work activities where ISM has been implemented, there was a significant decrease in the number of deficiencies identified during OA inspections. At sites with mature ISM systems, decreases in worker illness and injury rates were reported. The involvement of workers in work planning and employee-based safety programs has also contributed to significant improvements in safety at DOE sites (though the integration of ES&H subject matter experts into work planning processes needs improvement). Assignment of roles and responsibilities, accountability mechanisms, and requirements management processes (ISM guiding principles #1, #2, and #5) were also generally effective. While many aspects of ISM are effective, certain aspects of the identification and analysis of hazards and the development and

implementation of controls (ISM core functions #2 and #3) need further improvement. Additionally, although the processes for most work activities (operations, maintenance, and programmatic work) were well defined, some support work activities were not well defined (e.g., setup and breakdown of projects, and maintenance of equipment associated with projects, particularly in the research and development arena). Although some aspects warrant further improvement, the ISM systems in place provide a solid framework for continuous improvement, and most sites are continuing to make progress in addressing remaining weaknesses.

Opportunity for Improvement: Particular emphasis should be placed on the identification and analysis of hazards, the development and implementation of controls, and the integration of ES&H subject matter experts into work planning processes. Additionally, processes for some support activities, including the setup and breakdown of projects, need to be better defined.

2. **Most elements of environmental protection programs reviewed were implemented effectively.** Specifically, waste management, groundwater protection, and radiological environmental monitoring were implemented effectively. Although the overall environmental protection programs were adequate, additional improvements are needed in some aspects of legacy waste characterization, pollution prevention, groundwater protection for potential releases from current operations, and radiological environmental programs.

   Opportunity for Improvement: Review environmental protection programs to determine whether the sites and operations are deficient in the areas where OA-50 identified weaknesses in recent inspections (i.e., legacy waste characterization, pollution prevention, groundwater protection from current operations, and radiological environmental programs).

3. **While essential systems reviewed were found capable of performing their intended function, weaknesses in processes that assure functionality were identified at some sites.** Much progress has been made in the development and implementation of documented safety analyses for nuclear facilities; however, significant effort is still needed in some areas. Although the fire protection and ventilation systems reviewed by OA-50 were capable of performing their intended safety function in both normal and accident conditions, specific deficiencies were identified in certain aspects of the systems. For example, at one facility the fire suppression system standpipes did not have sufficient flow capacity to meet the expectations of the fire department. Additionally, some weaknesses were identified with the unreviewed safety question (USQ) process: the USQ process was not used to evaluate potential inadequacies in the safety analysis; some modifications were not reviewed through the USQ process; and some changes were not screened appropriately. Furthermore, the effectiveness of processes for configuration control, testing, and maintenance of essential safety systems varied in effectiveness, indicating that continued attention is needed in this area.

   Opportunity for Improvement: Efforts to implement 10 CFR 830, Subpart B, and systems engineering processes should lead to further improvements in facility authorization bases and safety systems. Site managers should review USQ processes and their implementation using the existing DOE guidance. Surveillance testing procedures should also be reviewed to assure the establishment of acceptance criteria that provide verification of the functionality of the system, consistent with the authorization basis.

4. **Most contractor self-assessment and corrective action programs were not sufficiently mature and effective to support any reductions in DOE line oversight.** At all but one site, the feedback and improvement programs were rated Needs Improvement. Contractor self-assessments at many sites were not implemented at the prescribed frequency, and when conducted, often lacked the depth and rigor necessary to ensure the adequacy of processes or level of performance. Such management systems as self-assessments, corrective action management, work control, and lessons learned were often not evaluated for effectiveness, and activity-level feedback was often informal and not documented. Additionally, sites often failed to capture all safety deficiencies in corrective action systems. Corrective actions were often prioritized

based on the source rather than the risk or safety significance, and analysis of deficiencies to determine the extent of condition and causes was inadequate. Furthermore, follow-up to determine the effectiveness of corrective actions often was not performed, and data was not reviewed to identify trends. At several sites, DOE line oversight of contractor performance was more effective than the contractor's self-assessment process. However, at most sites, DOE line oversight did not focus on implementation of the contractor's self-assessment and corrective action processes.

Opportunity for Improvement: Facilitate the development and implementation of effective contractor self-assessment and corrective action management processes. These processes need to be evaluated by DOE line management to ensure effectiveness prior to a reduction in DOE line oversight.

5. **The flowdown of ES&H requirements to subcontractors was not always effective.** Although requirements management processes were generally effective in assuring that appropriate requirements were captured in site documents and procedures, in many cases, the contracts for subcontractors did not include the appropriate requirements, or the requirements were not always well defined. Additionally, implementation of applicable requirements was deficient at a number of sites, and training was not always provided to subcontractor employees. Weaknesses in line management oversight of subcontractors contributed to the observed performance.

   Opportunity for Improvement: Effective processes should be established and implemented to assure that ES&H requirements, including training, are properly captured in contracts with subcontractors and that effective oversight is provided to ensure implementation.

6. **Weaknesses were evident in exposure assessment programs for non-radiological hazards.** Although most sites had performed baseline hazards analyses, few sites have regularly updated them. As a result, many of these analyses are outdated and of limited value. In addition, some sites have not developed comprehensive, risk-based sampling strategies for assessing or characterizing workspaces and routine work activities (such as sample preparation, paint booth utilization, and welding). As a result, some potential worker exposures were not analyzed, resulting in insufficient hazard controls, routine monitoring, and medical surveillance. At several sites, inadequate baseline hazards assessments and incomplete employee surveys caused delays in the development and implementation of a site-specific beryllium program, which is required by 10 CFR 850, *Chronic Beryllium Disease Prevention Program.*

   Opportunity for Improvement: Develop and implement protocols for performing exposure assessments consistent with the requirements of DOE Order 440.1A, including a strategy for sampling and monitoring potential worker exposures identified in hazards assessments. The protocols in the DOE *Technical Standard for Industrial Hygiene Practices* and those developed by the American Industrial Hygiene Association Exposure Assessment and Strategies Committee provide appropriate guidance.

Radioactive Liquid Waste Treatment Facility Operations at Los Alamos National Laboratory

Table 2. Focus Areas and Ratings for ES&H Inspections

Focus Areas For ES&H Inspections 10/01 - 12/02	Number of Sites			Effective Performance			Needs Improvement			Significant Weakness		
	NNSA	EM	SC	NNSA	EM	SC	NNSA	EM	SC	NNSA	EM	SC
Safety Management System Ratings												
GP#1 - Line Management Responsibility for Safety	2	1	1	2	1				1			
GP#2 - Clear Roles and Responsibilities	4	2	1	4	2	1						
GP#3 - Competence Commensurate with Responsibility	2	1	1	2		1		1				
GP#4 - Balanced Priorities	2	1	1	2	1	1						
GP#5 - Identification of Standards and Requirements	4	2	1	4	2				1			
Feedback and Improvement												
CF#5 - Feedback and Continuous Improvement	5	2	1		1		5	1	1			
Work Activities, Facility Operations, and Maintenance												
CF#1 - Define Scope of Work	5	2	1	5	2				1			
CF#2 - Analyze the Hazards	5	2	1	3	1		2	1	1			
CF#3 - Develop and Implement Hazard Controls	5	2	1	1	2		4					1
CF#4 - Perform Work Within Controls	5	2	1	5	2				1			
Environmental Protection												
Environmental Protection (Core Functions 1-4)	2	1		2	1							
Essential Systems												
Engineering and Configuration Management	1	1					1	1				
Maintenance	1	1		1	1							
Surveillance and Testing	1	1		1	1							
Operations	1	1			1		1					

3.0 Conclusions and Future Inspection Areas of Emphasis

OA's recent review of ISM systems and ES&H performance at eight sites indicates that overall ES&H performance is improving. Much of the improvement can be attributed to the structured processes mandated by the DOE ISM policy. Performance in most of the ISM component areas was determined effective. For example, all environmental protection programs were given a rating of Effective Performance. The site ISM processes were well defined and implemented for the most part, and in most cases, the deficiencies identified by OA are characterized as deficiencies in implementation of specific aspects of a process and are not indicative of systemic breakdowns in processes. However, two key components of ISM need improvement. First, development and implementation of hazard controls (ISM core function #2 and #3) needs improvement, particularly for exposure assessments, subcontractor activities, USQ processes, and at some sites the implementation and refinement of these processes. Second, feedback and improvement programs (ISM core function #5) require improvement, including DOE line management oversight and contractor feedback and improvement programs.

Based on the results of recent ES&H evaluations, OA-50 will continue focusing on the evaluation of ES&H performance through the observation of work and the evaluation of the functionality of select essential safety systems (including implementation of 10 CFR 830, Subpart B). However, the work of subcontractors will receive more emphasis in future evaluations. Self-assessments for both DOE line organizations and contractors will continue to be a focus area as well. Particular emphasis will be placed on DOE line and contractor efforts to develop and implement effective contractor self-assessment and corrective action processes, especially at sites where DOE line management has already reduced or plans to reduce DOE line oversight.

Because of the improvements in the site ISM programs at the institutional level, OA-50 plans to conduct a tailored review of the ISM guiding principles, based on performance and conditions at sites. However, current efforts to streamline or reduce ES&H requirements will require continued monitoring to ensure that safety is not degraded.

APPENDIX A
FOCUS AREA RESULTS

During the past year, the Office of Independent Oversight and Performance Assurance (OA) primarily focused on selected aspects of integrated safety management (ISM) programs, including:

- Guiding Principle #2, Roles and Responsibilities
- Guiding Principle #5, Requirements Management
- Core Function #5, Feedback and Improvement
- Programmatic Work
- Maintenance
- Subcontractors
- Environmental Protection
- Essential System Functionality (ESF).

These areas were selected based on a review of the past performance of U.S. Department of Energy (DOE) sites, the status of ISM implementation, and other commitments (e.g., implementation plans for Defense Nuclear Facilities Safety Board recommendations).

The 2002 inspections performed by the Office of Environment, Safety, and Health Evaluations (OA-50) considered the identified focus areas during the planning process. The first five focus areas were reviewed on all recent inspections. The last three were reviewed at selected sites, depending on site-specific factors.

This appendix provides a discussion of each of the focus areas, including positive attributes, areas for improvement, and conclusions. For each focus area, OA identifies aspects of ISM that will be emphasized on future OA inspections.

Guiding Principle #2: Roles and Responsibilities

Introduction

The DOE ISM system policy and associated guidance stresses the importance of clear roles and responsibilities for DOE and site contractors in establishing and implementing a comprehensive environment, safety, and health (ES&H) program. DOE requires ES&H-related functions, responsibilities, and authorities to be clearly defined, communicated, understood, and implemented at all levels of DOE and contractor line management. To ensure appropriate implementation of assigned roles and responsibilities, DOE organizations and DOE contractors must have effective processes for holding DOE and contractor organizations and individual line and ES&H managers accountable for safety performance, including performance objectives and appraisal systems.

In the past year, all OA inspections of the guiding principles of safety management have reviewed the effectiveness of DOE and contractor organizations in establishing clear roles and responsibilities for ES&H performance. In these reviews, OA focused on the implementation of assigned responsibilities by DOE and contractor management, accountability systems, contractual performance measures, worker involvement, and processes for resolving safety concerns raised by workers.

Positive Attributes

The DOE/National Nuclear Security Administration (NNSA) line management chain at Headquarters and the field elements have improved their delineation and implementation of responsibilities through the implementation of ISM. At the highest level, the lead program secretarial offices are cognizant of their respective operations, including ES&H. As landlords, these organizations are successfully maintaining and overseeing institutional operations and they have established suitable mechanisms for continuing awareness and involvement in major issues. At the field element level, the functions, responsibilities, and authorities manuals clearly identify ES&H functions and appropriately delegate these functions to various organizations within site offices. The DOE field elements have established and communicated appropriate ES&H policies and expectations for their staff to oversee the contractor, and have made notable progress in using contractual performance objectives and measures as a tool for promoting improvements in ES&H performance. Some sites have developed strong programs for continuing awareness and oversight of the contractor's activities through comprehensive definition and assignments of functions, or through multidisciplinary operation teams assigned to a facility or a group of facilities with similar missions. Most responsibilities are adequately documented in procedures.

Contractor institutional roles and responsibilities are well defined in most cases. The ISM description documents, management plans, facility safety plans, ES&H manuals, implementing procedures, and other such documents adequately address the institutional roles and responsibilities of line management and ES&H organizations. At most sites, senior contractor management are directly involved in implementing important safety functions and responsibilities. Some contractors have established strong programs for supporting the line management organizations by establishing multidisciplinary ES&H teams. With few exceptions, OA inspections indicate that roles and responsibilities and interfaces for other support organizations, such as maintenance and engineering, are adequately defined and implemented. Line management recognizes the importance of strong accountability for safety and appropriately emphasizes accountability in the ISM program. At the institutional level and senior management level, accountability has improved across the complex, and most contractor organizations recognize the need to enhance individual accountability for safety down to the supervisor and worker levels.

Most aspects of contractor work authorization processes are clearly defined and adequately implemented. The work authorization process is one of the most critical elements of ISM implementation and, accordingly, it has received significant management attention across the DOE/NNSA complex. In accordance with a site work authorization process, designated personnel, such as facility managers, are required to plan and conduct the work according to ISM guiding principles and core functions, including such actions as preparing a facility safety plan, implementing facility-related requirements, ensuring that personnel comply with all facility-specific requirements and training, and reviewing work orders for compliance with facility-related requirements. The site processes are appropriately based on a graded approach, with high-hazard projects requiring more stringent hazard control documentation and ES&H review. Most roles and responsibilities for the work authorization process are well understood and appropriately implemented. In projects reviewed by the OA team, the assigned roles and responsibilities were consistent with the guidance and procedures and were well understood by responsible personnel (including authorizing individuals, ES&H support personnel, facility managers, and individuals performing the task).

Line management has established effective mechanisms for obtaining worker input on ES&H-related matters and for resolving safety concerns raised by workers. Workers are involved in work planning and control processes, including the identification of hazards and associated controls. Workers also fully understand their responsibility and authority for stopping work if they identify unsafe conditions. Workers have numerous avenues for raising safety concerns. For example, employee concerns programs receive significant management support and resources; workers are represented on numerous safety committees; and some sites have implemented behavior-based safety programs, which are proving to be effective methods for reducing at-risk behaviors and enhancing safety at the working level. Utilization of behavior-based safety programs across the complex is becoming more prevalent.

Areas for Improvement

DOE field element procedures do not always adequately define the responsibilities and interfaces for some aspects of line management oversight of contractor performance. DOE field element procedures do not clearly define certain organizational interfaces, such as the interfaces between Facility Representatives and ES&H subject matter experts. In addition, DOE field element procedures do not always define responsibilities and expectations for communicating performance deficiencies to contractors, and for ensuring that similar deficiencies do not recur.

Responsibilities and accountability processes are not yet mature enough to ensure that work authorization processes at the task level are consistently implemented in strict compliance with requirements. In some cases, individual responsibilities could not be implemented effectively, or individuals were not strictly adhering to requirements (e.g., signing off on inaccurate or incomplete forms). In other cases, requirements are not fully implemented because the roles and responsibilities are not clearly specified for work that crosses complex organizational boundaries, or because procedures are not updated to reflect organizational changes. Line management has not always clearly articulated expectations for strict compliance with requirements and for responsible individuals to stop work to resolve problems with forms or processes rather than signing off on incomplete or inaccurate forms. Additionally, accountability for

compliance at the task level also needs to be strengthened. Management at most sites has expressed strong commitment to enhancing accountability through better standards for the annual performance appraisals for managers, researchers, and workers; however, these efforts are not fully developed and implemented. Further, accountability for subcontractor safety is not always clearly defined, contributing to performance deficiencies. In most cases, line managers are aware of shortcomings in implementing work processes and are taking actions to ensure that institutional expectations are clearly communicated and enforced. However, responsibilities and accountability for subcontractor performance require additional attention.

Conclusions and Future Inspection Areas of Emphasis

The implementation and maturation of ISM programs have resulted in significant improvements in the clarity of roles and responsibilities for ES&H across DOE sites. Although further improvements are warranted in a few areas, most roles and responsibilities are clearly defined for both DOE and contractor organizations. DOE sites are making significant progress in implementing effective systems to hold organizations and senior managers accountable for ES&H performance. Continued efforts are needed to ensure that accountability processes are effective at the supervisor and working levels, and that management's expectations for strict compliance are clearly communicated to ensure effective implementation of work control processes.

As ISM programs continue to mature, future OA inspections will focus on selected aspects of roles and responsibilities, including:

- Implementation of responsibilities and accountability at the working level
- Significant changes to DOE and/or contractor organizations
- Responsibilities and accountability for subcontractor ES&H performance
- Responsibilities of DOE field elements and interfaces among the field element organizations for DOE line management oversight of contractor and subcontractors, with emphasis on issues management.

Guiding Principle #5: Requirements Management

Introduction

DOE Policy 450.4, *Integrated Safety Management System*, requires that hazards be evaluated before work is performed and that an agreed-upon set of safety standards be established to provide assurance that the public, the workers, and the environment are protected from adverse consequences. Effective implementation of this policy requires a systematic approach to requirements management, including systems for clearly defining applicable requirements and translating them through procedures, processes, and training to individuals performing work.

OA assessed the effectiveness of requirements management programs by observing work and reviewing documents to determine whether appropriate ES&H requirements were specified in contracts, and whether these requirements were adequately conveyed through procedures, processes, and training to individuals performing hazardous work. Requirements management was specifically evaluated on seven of the eight inspections performed during this appraisal period. A rating of Effective Performance was assigned at six of these sites, and one site was rated Needs Improvement. Twenty-seven opportunities for improvement were identified at the seven rated sites.

Positive Attributes

All of the evaluated sites had incorporated appropriate ES&H requirements into prime contracts through standards/requirements identification documents or work smart standards. With few exceptions, the scope of these requirements was sufficient for control of site hazards, and the few deficiencies did not significantly impact safety. Programs established by DOE and its contractors were effective in updating and revising these requirements to address changes in site hazards and to incorporate changes in applicable laws, regulations, standards, and directives into contracts.

DOE sites have devoted significant attention and resources to responding to the new beryllium rule. DOE sites are required to establish a beryllium program in accordance with 10 CFR 850, *Chronic Beryllium Disease Prevention Program*. OA inspections indicate that most sites inspected are developing comprehensive programs as required by this

Scaler Miner Removing Loose Rock in the Waste Isolation Pilot Plant Underground

rule. Some sites have been proactive and rigorous in developing their beryllium programs and have devoted substantial resources and attention to addressing legacy beryllium hazards.

The contractor medical programs accredited by the Accreditation Association for Ambulatory Health Care (AAAHC) this year have successfully implemented program improvements through the performance of self-assessment activities, detailed quality studies, and customer satisfaction surveys. Improvements included enhanced medical services that produced measurable positive health outcomes as well as strategies to address emerging safety and health issues.

Areas for Improvement

Programs, processes, procedures, and training did not consistently convey ES&H requirements to individuals performing hazardous work. Discontinuities in the flowdown of requirements were identified in all levels of implementing documentation (i.e., at the institutional, facility, and task levels). For example, institutional programs did not fully implement the occupational medical requirements of DOE Order 440.1; ES&H requirements applicable to work-for-others and to subcontracted work were not effectively communicated to individuals performing work; lockout/tagout procedures lacked sufficient detail to assure compliance with Occupational Safety and Health Administration requirements; and radiation work permits and postings did not provide sufficient information to workers. As a result, personnel performing tasks were not always provided clear expectations for implementing safety requirements, and requirements were not fully met. The flowdown of requirements to subcontractor employees was a particular concern because measures were not always effective in ensuring that ES&H requirements in the prime contract were tailored and communicated to subcontractor employees.

DOE and prime contractors have not established sufficient programs for systematically monitoring the effectiveness of requirements management or for correcting identified deficiencies. Although adequate contractual requirements are in place, some of the governing procedures lacked formality, were outdated, or were of insufficient scope. Further, contractor responsibilities for program implementation were not always clearly assigned, contributing to inconsistencies in updating requirements. These deficiencies persist, in part, because of insufficient DOE and contractor assessments of the requirements management programs. Some contractors have used self-assessment techniques to assure that requirements included in their work smart standards or standards/requirements identification documents are up to date, and to confirm the implementation of new requirements. Other contractors have used periodic reviews of applicable requirements as an effective means of assuring that requirements and responsibility assignments are current. However, most DOE and site prime contractors have not systematically assessed the effectiveness of requirements management programs on a regular basis. In addition, when assessments were performed, corrective actions were not always timely or effective (see ISM core function #5).

Conclusions and Future Inspection Areas of Emphasis

Appropriate requirements were identified in most DOE contracts, but requirements were not always clearly communicated to workers through processes and procedures. Therefore, personnel performing tasks were not always provided clear expectations for implementing safety requirements. This situation was particularly evident in the flowdown of requirements to subcontractor employees, where the processes were not always sufficient to ensure that ES&H requirements in the prime contract were tailored and communicated to employees of subcontractors. Although some site organizations used self-assessment techniques to improve aspects of requirements management, performance in this area was not systematically monitored at most sites.

On future inspections, OA will continue to focus on DOE and contractor requirements management systems, with particular emphasis on:

- Processes for translating contractual requirements into clear instructions at the working level
- Communication of requirements to subcontractor employees, and DOE and prime contractor processes for monitoring subcontractor implementation of requirements
- DOE and contractor assessments of requirements management systems.

Core Function #5: Feedback and Improvement

Introduction

DOE and contractor feedback and improvement processes—the fifth core function of ISM—provide management with the assurance that the guiding principles and first four core functions of ISM have been adequately defined and effectively implemented. They also identify areas where improvements are needed.

The OA-50 inspections of feedback and improvement processes included evaluations of the adequacy of DOE line management oversight, contractor feedback, and corrective action systems. DOE line oversight elements that were evaluated included day-to-day operational awareness, assessments, and contract performance monitoring, including activities conducted by Facility Representatives, functional area experts, and program personnel. Contractor elements that were evaluated included management self-assessments and independent assessments, the evaluation and resolution of identified program and performance deficiencies, and the application of lessons learned. Assessment elements that were evaluated included formal and informal mechanisms, including such activity-level activities as post-job reviews and workplace surveys. All elements of corrective action and issues management processes were evaluated, including the handling of employee safety concerns.

Although OA observed many improvements in feedback and improvement programs and performance, seven of the eight evaluated sites were rated Needs Improvement. OA identified 13 findings at seven sites that required formal corrective action plans and tracking in the DOE corrective action tracking system. Four of these findings, at four different sites, identified weaknesses in DOE line management oversight of contractor safety performance. Eight of the findings addressed weaknesses in contractor assessment and issues management programs and performance, and one finding identified deficiencies in a lessons-learned program. OA also identified approximately 175 specific potential improvement areas in feedback and improvement programs and performance.

Positive Attributes

With few exceptions, DOE line management has established the framework for an effective DOE field element feedback and improvement program. In most cases, line oversight processes were adequately described in a set of procedures and program descriptions that delineated the activities and responsibilities for conducting ES&H oversight of the contractor. In addition, oversight activities were identifying ES&H program and facility condition deficiencies and fostering continuous performance improvement. Most sites had ongoing initiatives to further strengthen implementation of feedback and improvement processes. A number of DOE sites had initiatives directed at strengthening Facility Representative program implementation. Many sites were also transitioning to an integrated schedule of oversight activities to avoid duplication of efforts and to identify opportunities for joint evaluations.

Most DOE field elements were actively working to establish clear ES&H policies and performance expectations and to drive safety improvements through contractual mechanisms. Safety-related performance objectives and measurable criteria with financial incentives have been built into all contracts at all sites reviewed. A number of DOE site offices were effectively employing the use of contract measures to drive performance improvements in problem areas of contractor operations. These actions were having positive results in focusing contractor management attention and driving continuous improvement.

DOE contractors have established the basic framework for effective feedback at all sites evaluated. While a variety of feedback mechanisms were used, all sites had self-assessment processes where workers, management, and organizations performed walkthroughs, inspections, surveillances, and formal assessments. All sites had also established

independent organizations that perform assessments, staffed by personnel who have no program or implementation responsibilities. Several sites employed external organizations to perform periodic or for-cause independent evaluations. One site has obtained independent certification that their quality management programs were in conformance with ISO 9000. Ten sites have achieved accreditation of their medical program by the AAAHC. Some sites have also achieved recognition by the Voluntary Protection Program and ISO 14001, *Environmental Management Systems Standard*. Assessments by contractor independent assessment organizations were consistently comprehensive and thoroughly examined performance against defined criteria. Additionally, contractors scheduled and performed many valuable, effective assessments. Most sites conducted material condition inspections of all or most facilities. Three sites had established and were implementing worker-managed, behavior-based safety observation programs, which have been effective in increasing worker safety awareness, improving performance, and reducing injuries. All sites had established employee concerns programs, but several sites were especially effective in soliciting, evaluating, and resolving safety concerns from site workers, communicating a very visible management commitment to worker safety. At one site, several thousand formally documented management walkthrough assessments had been performed, reflecting management's commitment to safety. All sites inspected had established corrective action tracking systems to capture, evaluate, and track the resolution of safety deficiencies identified by assessments and other feedback processes. Several sites have established review boards or counterpart committees for feedback and improvement processes or corrective actions, which provide forums for facilitating consistent and effective processing of deficiencies and for identifying trends or areas that may require refocusing of resources and attention.

Areas for Improvement

Inspected sites had a number of weaknesses in common that were limiting the overall effectiveness of DOE oversight to drive continuous improvements in contractor ISM performance. Although the framework for an effective program was found to be in place for most DOE field elements, most DOE line oversight activities were not sufficiently focused on contractor feedback and improvement processes, and weaknesses in those processes were not being identified to drive continuous improvement in contractor operations. With few exceptions, DOE line oversight programs did not sufficiently include and/or conduct formal assessments of the effectiveness of key elements of contractors' feedback and improvement processes, such as self-assessments, corrective actions, performance tracking and trending, and lessons-learned programs. The insufficient focus on assessing contractor feedback programs is particularly significant because most contractor feedback and improvement programs were not fully effective and are directly tied to determining the appropriate level of DOE/NNSA oversight. Implementation of DOE field element line oversight activities often lacked sufficient rigor and depth to identify contractor process weaknesses and to drive continuous improvement. For example, most DOE field element monitoring and assessment activities focused on plant conditions and procedures/records, but did not include sufficient observations of work activities to identify deficiencies in procedural implementation. Most DOE site operations processes had weaknesses in consistently documenting, communicating, and tracking resolution of DOE-identified contractor performance deficiencies. As a result, identified safety issues were not always being captured in contractor corrective action systems for action.

Most DOE field elements did not have an adequate self-assessment program. With the exception of the Facility Representative program, DOE made limited use of internal self-assessments to evaluate the effectiveness of implementation of DOE line management systems for oversight of contractor activities. Although some DOE field elements had established processes and procedures that provided for self-assessment of implementation of DOE oversight activities, in most cases, these self-assessments were not being performed or implemented with enough rigor to ensure effective continuous improvement.

Safety programs and performance were not being evaluated consistently and effectively because of weaknesses in contractor assessment processes. Although most contractors have established extensive assessment programs, implementation of those programs lacks sufficient rigor in many cases. Management self-assessments often lacked the depth or rigor to effectively determine the adequacy of processes or the level of safety performance. Management self-assessment programs often failed to adequately evaluate the adequacy and effectiveness of management systems for such areas as self-assessments, corrective action/issues

management, work control, and lessons learned. Activity-level feedback from post-job reviews was often informal and undocumented, and the resolutions of identified problems were not documented. Achieving continuous improvement requires that effective processes be developed and rigorously implemented to identify areas where improvement is needed and where resources need to be focused.

Many corrective action and issues management processes were not ensuring that identified deficiencies were documented, evaluated, tracked, and resolved in a timely manner. Process and performance weaknesses often resulted in untimely or ineffective evaluation and resolution of program and performance deficiencies, and a failure to ensure implementation of effective recurrence controls. Key deficiencies observed during OA inspections included:

- Failure to capture all safety deficiencies in the corrective action systems
- Insufficient rigor and attention to the resolution of deficiencies, which were sometimes prioritized based on the source of the issue rather than the risk or significance (e.g., treating deficiencies identified by DOE Facility Representatives as more important than self-identified deficiencies)
- Inadequate causal analysis, determination of extent of condition, or identification of corrective actions, such that needed recurrence controls were not identified and specified
- Non-conservative reporting of operational events and identification and analysis of near misses
- Inadequate follow-up of significant issues, to validate the effectiveness of corrective actions
- Inadequate analysis of data, to identify trends or to identify systemic or generic issues
- Failure to identify and document the applicability of lessons learned, needed actions, or actions taken.

Conclusions and Future Inspection Areas of Emphasis

Feedback and oversight processes that are implemented effectively provide the foundation for continuous improvement in safety performance. The basic framework for effective feedback and continuous improvement in safety performance, including DOE line oversight, had been established at the sites inspected by OA, and some elements, such as contractor independent assessments and the DOE Facility Representative programs, were generally sound and well implemented. However, in many cases, feedback and improvement processes lack sufficient rigor or are not implemented effectively, especially in the areas of management assessments and corrective action/issues management. With one exception, contractor feedback and improvement processes are in need of improvement. The implementation of comprehensive, rigorous, and effective contractor self-assessment and corrective action processes will facilitate additional reliance on these programs and appropriate adjustments to DOE oversight.

Future OA inspections will continue to focus on all aspects of DOE and contractor feedback and improvement processes, with particular emphasis on the identified weaknesses.

U1a Facility Underground at Nevada Test Site

Programmatic Work

Introduction

For the purpose of this report, programmatic work refers to work at the site that is performed to accomplish the facility mission. Examples include production/process operations, decontamination and decommissioning (D&D) activities, and research and development.

OA examined selected aspects of programmatic work on all its 2002 inspections. Specific work activities that were observed included experimental and research

activities at laboratories, parts or component production and assembly activities at manufacturing sites, material stabilization and removal activities at sites being deactivated, and decontamination and demolition work at environmental remediation sites. Selective sampling of program work included inspection of the conduct of operations and the effectiveness of safety, health, and radiological protection integration into the site's programmatic core function work processes.

Positive Attributes

Planning processes for programmatic work were generally well established, and mechanisms that provided the necessary framework for identifying hazards and developing hazard controls were in place. Adequate planning processes are in place for most program areas reviewed, including experimental and research activities, manufacturing and assembly sites, and related program work, such as deactivation and facility decontamination activities. The experimental or research activities conducted at most sites used various safety review processes, which resulted in the involvement of technical and safety professionals to adequately identify and address hazards. Manufacturing and assembly sites generally used project team concepts for new processes to ensure that appropriate safety requirements were addressed. Planning processes for deactivation and facility decontamination activities targeted the highest risk materials first, thereby substantially reducing overall risk without compromising safety. While nearly all sites had adequate mechanisms in place, there were varying levels of formality associated with the involvement of appropriate ES&H professionals in planning processes. The formal processes, such as those using ES&H teams, were the most effective in integrating necessary safety reviews into the planning process. In all cases, early involvement of workers and technicians in all phases of the planning process resulted in better program execution.

Institutional health and safety control and radiological control programs were comprehensive and were sufficiently integrated into program work to identify and control the major hazards. For example, nearly all sites had mature, well-organized radiation protection programs that provided radiological protection to workers, in a manner consistent with DOE and industry expectations. Availability of safety and health resources was sufficient in most cases to provide the level of support needed for effective hazard identification and control.

A significant amount of programmatic work was governed by the use of detailed technical procedures to implement the necessary functions and steps. Most sites reviewed by OA had extensive procedure development, review, and approval systems, resulting in high-quality technical procedures. In some cases, product quality assurance requirements dictated the need for high-quality procedures. Attention to detail was evident at most sites, and the resulting procedures provided the proper instructions for workers to safely perform programmatic activities. With relatively few exceptions, hazards unique to the processes were effectively integrated into the technical procedures.

Areas for Improvement

Contractors did not always sufficiently identify, characterize, or document programmatic activity-level hazards, resulting in hazard controls not being identified or incorporated into working-level documents. Several sites had unclear or subjective thresholds for when to involve ES&H subject matter experts in analyzing hazards for some types of work, such as non-routine, short-duration programmatic tasks. Consequently, some hazards and hazard controls were missed. For example, the hazards associated with such ancillary activities as experiment setup, equipment maintenance performed by the researchers or technicians, necessary changes to the process or equipment during project execution, and equipment dismantlement were not always addressed sufficiently. Occasionally, work hazards were identified but not sufficiently characterized, such that the appropriate controls could be assigned. For some laboratory work, legacy hazards and hazards introduced by other concurrent laboratory projects increased the difficulty in identifying hazards and the most effective hazard controls. Many of these instances can be attributed to work scopes that were too broad or inadequately defined. The work scopes did not describe the activity-level work in enough detail to allow for complete hazard identification and subsequent implementation of appropriate controls. For example, institutional standards and safety requirements, such as industrial safety or personal protective equipment requirements, were not always present in the working-level documents used by the workers.

In the radiological area, several sites did not have clear technical bases or procedures to ensure consistent application of DOE radiological safety standards and requirements. For example, the technical justification for not applying certain

controls required by DOE or site requirements, such as extremity monitoring or as-low-as-reasonably-achievable (ALARA) reviews for higher-hazard work, was not always clearly specified during the work planning process. Similarly, some sites were not implementing certain elements of their radiological protection programs in a manner consistent with DOE expectations and/or requirements. This was evident in such areas as posting soil contamination areas, bioassay, control of radiation areas, and, in one case, radiation protection organization and infrastructure. In these cases, interpretation and implementation of DOE radiological safety requirements varied in a non-conservative manner from that provided in DOE implementation guidance, without adequate technical justification.

Weaknesses were evident in exposure assessment programs for non-radiological hazards. Most sites had performed baseline hazards analyses, although few sites regularly update them. As a result, many of these analyses are outdated and of limited value. In addition, some sites have not developed comprehensive, risk-based sampling strategies for assessing or characterizing workspaces and routine work activities. As a result, some potential worker exposures were not analyzed, resulting in insufficient hazard controls, routine monitoring, and medical surveillance. At several sites, inadequate baseline hazards assessments and incomplete employee surveys caused delays in the development and implementation of a site-specific beryllium program, which is required by 10 CFR 850, *Chronic Beryllium Disease Prevention Program.*

Conclusions and Future Inspection Areas of Emphasis

Based on the results of OA reviews conducted during 2002, integration of safety into the work planning and execution of the major programmatic processes was generally well established. With some exceptions, experiment and project review teams were effective at integrating project engineers, workers, and ES&H professionals into the planning process for major work evolutions. The use of ES&H teams at some sites was particularly effective at ensuring that program work had the appropriate hazards analysis and controls. Continued management attention is needed to ensure that hazards analysis and control processes consider all potential hazards that may be introduced by the work, include clear and appropriate thresholds for consistent involvement of ES&H personnel, and address such peripheral program work as experiment setup, program equipment maintenance, and non-routine or small program projects not assigned a review team.

In future inspections, OA will continue to evaluate the application of the ISM core functions to programmatic work. The major emphasis will be on:

- The adequacy of implementation of the established processes
- Application of radiological protection and exposure assessment program requirements within the work control processes.

Maintenance

Introduction

Workers perform maintenance activities in nuclear, radiological, and industrial facilities and maintain equipment and systems necessary to ensure that operations remain within prescribed safety envelopes. Maintenance activities typically include work activities on roads and grounds, buildings, utilities (e.g., electrical, water, sanitary, steam, and air), security detection and protection systems, programmatic equipment, and interfaces with all mission and facility activities. At several sites, maintenance department personnel perform production activities (e.g., welding, tooling, and fabrication) that directly support important mission activities. Most maintenance activities are performed by employees of the site prime contractor, although a few sites use subcontractors to augment their staff or to perform selected maintenance activities.

Currently, DOE Order 430.1, *Life Cycle Asset Management*, is implemented for industrial and radiological facilities at most sites, and DOE Order 4330.4B, *Maintenance Management Program*, Chapter II, is implemented for nuclear facilities at most sites. DOE Order 433.1, *Maintenance Management Program for DOE Nuclear Facilities*, has been issued and will replace DOE Order 4330.4B in accordance with site-specific implementation plans, which are either in place or being developed at the sites evaluated. DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, is also implemented at most sites and addresses several maintenance activity elements.

All OA ES&H inspections during this reporting period examined facility and infrastructure maintenance work activities. OA placed emphasis on maintenance because maintenance activities often involve significant

potential hazards to worker safety. Further, OA's ongoing review of reportable events and near misses across the DOE complex indicates that a significant number of events occur during maintenance activities.

Positive Attributes

For the most part, maintenance personnel at the working level have developed a better understanding of ISM, resulting in improvements in the implementation of safety responsibilities. In most cases, workers understand and use the core functions of ISM during work activities. At some sites, work packages include notes, cautions, and checklist items that are based on the five ISM core functions. Planners and supervisors routinely use the core functions to develop and review work packages, perform job walkdowns, and give pre-job briefings.

Most sites have proactively instituted performance-based safety programs that encompass the maintenance department personnel. The performance-based safety programs, which are run by workers with support and funding by line management, involve workers observing their peers with the goal of improving safety performance by identifying and correcting deficient work practices and promoting safety-conscious behaviors. The performance-based safety programs have contributed to improvements in safety performance, as evidenced at some sites by trend information that shows a reduction in deficiencies in work practices.

There have been significant improvements in work planning and control programs and procedures. Almost all sites have centralized work planning and control processes and procedures that standardize work control processes and/or coordinate separate work control processes. At most sites, maintenance personnel are using uniform procedures and controls in all facilities and buildings. The sites have benefited from the improvements in work control processes in several ways (e.g., standardization results in efficiencies and promotes consistent implementation, and line organizations have developed a better understanding of work control practices). In addition, maintenance workers, ES&H personnel, and subject matter experts are more directly involved in work planning and job walkdowns for higher-hazard activities (i.e., activities other than routine, low-risk work). Workers at many sites perform additional documented pre-job hazard reviews before commencing work. These reviews complement the hazard reviews performed as part of the initial planning process and provide an independent verification that hazards are identified prior to starting work. At some sites, the ES&H organization is an integral part of the work package preparation and review process.

Hazard identification and analysis tools, such as job safety analyses, pre-task hazard reviews, and activity hazards analyses have been improved at all sites evaluated. Checklists for hazard identification and analysis are more comprehensive and useful. Workers, supervisors, and planning personnel are better trained in work package preparation and are working together as part of an integrated approach to work package development. Several sites are transitioning to automated job hazard identification and analysis systems that invoke mandatory controls based on specified job hazards. These systems facilitate the identification of the correct controls based on the hazard and applicable regulatory and DOE requirements. Although evolving, these automated systems are being used effectively in many instances and have the potential to improve the identification of hazards and appropriate controls.

Areas for Improvement

Workplace surveys and exposure assessments were deficient at most sites evaluated. To ensure a safe work environment, workplace surveys and assessments are required by DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*. Safety deficiencies and hazards were readily identified at all sites in facilities, shops, and work areas. Supervisors and workers have not always devoted sufficient attention to obvious safety deficiencies. Exposure assessments for areas that could present a health risk to workers were deficient, and most sites did not have an effective workplace evaluation program.

Many sites have not adequately defined the minimum documentation and controls needed for "skill-of-the-craft" activities. Historically, most DOE sites have not established formal processes for identifying controls for skill-of-the-craft activities. Although some skill-of-the-craft activities are routine, low-risk activities, they involve hazards to workers (e.g., high voltage, confined spaces, and work on ladders or elevated platforms). Some work performed as skill-of-the-craft should have more formal work planning processes and better defined work packages. Blanket work requests, blanket job safety analyses, standing

work orders, and other generic work control and hazard identification and analysis mechanisms continue to lack specificity and are not always tailored to the specific job being performed. Many work activities that involve moderate risk to workers (e.g., energized electrical work and confined space entry) continue to be covered by generic hazard identification documents, without adequate specification of individual hazards for the specific job. Additionally, hazards analysis and risk categorization approaches at many sites do not address the potential higher collective risk of performing many skill-of-the-craft activities concurrently. Several skill-of-the-craft jobs performed together in the same location can result in additional hazards because of overlapping scopes of work. Such situations require additional planning to identify hazards from multiple jobs in the same area. In some cases, several skill-of-the-craft work requests were written for a larger job instead of using an integrated planned work package for the entire job. Each task was analyzed individually and determined to fall into the skill-of-the-craft category; however, when the tasks are viewed collectively, the job could have been a moderate- or high-risk job.

Many work control procedures lack specific criteria or thresholds for involvement of safety professionals and for mandatory walkdowns by workers, job planners, and ES&H personnel. Decisions about whether to involve safety professionals or to conduct walkdowns should be based on clear criteria that reflect the risks of the activity. However, in many cases, such decisions are not adequately addressed by work control procedures. Thus, the decisions are largely dependent on the expertise and initiative of individual workers, supervisors, and planners, resulting in inconsistent implementation. At some sites, work that involves multiple hazards and several union trades working together does not trigger pre-job or planning walkdowns. Work control procedures at most sites refer to worker involvement in job planning, but lack specifics on when and how workers will participate. Work control procedures at many sites do not specify conditions or criteria for performing job walkdowns, or conditions that require the involvement of ES&H professionals and/or subject matter experts.

Work packages for troubleshooting and repair often lacked a clear scope of work or sufficient limits. The definition of or constraints on work that can be performed under troubleshooting work packages, and when a work package must be returned for additional planning, was frequently not specified and was left up to workers and supervisors to decide. On some occasions, workers were performing work that was outside the scope of approved work requests. Further, the scope of work in some cases was not well defined because the specific nature of the repair had not been determined.

Repetitive routine jobs and work packages are not always treated with sufficient rigor. Many of the injuries to workers occur during routine jobs, which are often viewed as low-risk activities. Work packages and documentation for these jobs contained unidentified hazards, numerous errors in work scope, and other administrative errors in completing work package requirements. Many sites do not have an effective work package closure process to verify that completed work packages are correct and complete. Most sites do not use completed work package information as lessons learned to improve procedural compliance and the work control process.

Conclusions and Future Inspection Areas of Emphasis

Overall, there have been significant improvements in maintenance programs at all of the sites evaluated. To a large extent, the improvement is attributed to the development and implementation of formal and rigorous work control and hazards analysis procedures. Although improvements are evident in many areas, additional line management attention is warranted in the areas of workplace surveys and exposure assessments, skill-of-the-craft work activities, and certain aspects of work packages.

In addition to deficiencies identified on previous assessments, future OA inspections of maintenance programs will emphasize the following areas:

- Implementation of DOE Order 433.1, including the integration of programmatic and facility maintenance, which historically has been treated as separate programs at many sites

- Post-job reviews, which are intended to elicit feedback to improve work control systems and maintenance procedures

- Integration of individual processes (e.g., job safety analyses and activity hazards analyses) into the work control system instructions, which is needed so that workers do not have to refer to multiple sets of work controls for a given task.

Subcontractors

Introduction

Most DOE sites use subcontractors to perform certain types of work activities. The majority of subcontracted work is associated with construction, decontamination and demolition of old facilities, and environmental sampling. Subcontractors are also used to augment the maintenance staff, provide technical support services, assist procurement efforts, or provide custodial and vending services.

Most subcontractors are employed through the prime contractor. DOE field offices occasionally use subcontractors to augment their staff in some hard-to-find technical disciplines. When subcontractors are employed through the prime contractor, the prime contractor assumes responsibility for defining the work scope and ES&H requirements, and provides oversight of the subcontractor though subcontractor technical representatives and safety personnel. Frequently, subcontractors will use other subcontractors to complete work activities; therefore, it is common to encounter several tiers of subcontractors. DOE policies and contract provisions call for applicable DOE requirements to flow down from prime contractors to subcontractors and lower-tier subcontractors.

Although subcontracted work represents a fraction of the work performed at DOE sites, OA inspections have emphasized the evaluation of ES&H performance by subcontractors, and DOE and contractor line management oversight of subcontractor activities. OA's emphasis on subcontractors considers several factors. Most importantly, subcontractors often perform activities involving significant hazards (e.g., D&D and construction). In addition, subcontractors are not always familiar with the site, indoctrinated in DOE safety philosophies, familiar with DOE requirements (which can exceed industrial standards), or trained to the same level as prime contractor employees.

Groundwater Monitoring Station at the Pantex Plant

Positive Attributes

The procurement processes for obtaining subcontractors were formal, well documented, and guided by detailed procedures and checklists. At most sites, the procurement of subcontractors is a well-defined process, and the selection criteria consider the subcontractors' safety and health records as well as prior performance. In general, subcontracted work activities are well defined in procurement documents, specifications, and task ordering documents. DOE prime contractors recognize that subcontracted work is often performed on a fixed-price basis and by contractors who may not be familiar with the DOE site, hazards, or work expectations. Consequently, DOE prime contractors, with the support of DOE field offices, have appropriately focused on establishing a well-defined work scope for subcontracted work.

Most subcontractors have implemented a variety of mechanisms for identifying and documenting hazards and controls that are tailored to the work activity. All inspected sites require subcontractors to submit health and safety plans for review and approval by the prime contractor prior to work being authorized. Subcontractors are also required to document activity hazards and controls through some type of activity hazards analysis, job safety analysis, or job hazards analysis. Most sites also require a safety permitting process for the most hazardous work activities (e.g., lockout/tagout, hot work, excavations, and confined spaces). A few sites have implemented a requirement that all site workers (prime contractors and subcontractors) follow the same safety permitting processes, which has helped to clarify and standardize safety requirements as well as roles and responsibilities.

A number of sites have developed effective mechanisms, such as safety handbooks, for communicating safety requirements to subcontractors. Most sites provide subcontractors with an orientation to site safety requirements and work practices, and require subcontractors to successfully complete the same site orientation training courses required of all onsite workers, such as general employee training. At most sites, several tiers of subcontractor oversight of work activities are implemented by the prime contractors through program and project

managers, subcontractor technical representatives, and safety engineers.

Areas for Improvement

Flowdown of ES&H requirements to subcontractors, particularly ES&H requirements unique to DOE operations, has not been effective at a number of sites. At some sites, the ES&H requirements for subcontractors have not been well defined. A few sites have determined that some DOE requirements, which are applicable to the prime DOE contractors, are not applicable to subcontractors performing the same work. This inconsistency in site ES&H requirements has resulted in different safety requirements for workers performing the same work at the same site. In some instances, subcontractors have not implemented specific DOE requirements (e.g., occupational medical, stop-work authority, and occurrence reporting requirements). At a few sites, ISM has not been clearly or adequately incorporated into subcontractor work control processes.

Some activity-level work hazards and/or controls were missed or were not sufficiently identified by subcontractors at most inspected sites. Although subcontractors have developed mechanisms for identification and control of hazards, these processes were not always implemented effectively or performed with the appropriate level of rigor. Worker exposure hazards (e.g., noise and hazardous chemicals) were often inadequately characterized or insufficiently documented. A number of physical hazards (e.g., elevated work, ergonomics, excavation, and electrical hazards) were occasionally missed. More often, the hazard controls were inadequate or not implemented effectively. Onsite subcontractor ES&H resources often are minimal and, in some cases, were insufficient to support assigned work activities. In several cases, ES&H subject matter experts who support subcontractors had minimal training and experience and were not allocated sufficient time to provide the needed level of ES&H support to the work activity. In other examples, subcontractor ES&H resources lacked the sufficient equipment, instrumentation, or training to adequately evaluate workplace exposure hazards (e.g., noise or air contaminants). At all sites evaluated, ES&H training requirements for subcontractors were not clearly identified in work documents, were not consistent with identified hazards, or were not verified prior to performing work.

At some sites, subcontractor performance metrics were not consistently maintained, reported, and/or trended. In a few cases, subcontractor injury and illness data was not captured or was not adequately reported locally or through the DOE Computerized Accident and Injury Reporting System (CAIRS). More often, such data was not tracked or trended locally or used by DOE field offices to develop performance metrics and influence award fees. A few sites have determined that DOE occurrence reporting requirements and thresholds are not applicable to subcontractors; therefore, subcontractor occurrences may not be reported to the same extent as prime contractor occurrences.

Conclusions and Future Inspection Areas of Emphasis

Although work performed by subcontractors has generally been successfully integrated into site work activities, several concerns with subcontractor work were evident at a number of sites evaluated by OA. Limited OA team observations of subcontracted work indicate that subcontracting mechanisms are in place and extensive, and that work activities are generally well defined. As a result of working at DOE sites, many subcontracted companies have improved their overall health and safety programs by adopting DOE site safety and health standards and practices, which are typically more robust than the safety culture under which these companies are accustomed to working (i.e., in general industry). Although subcontractors have developed mechanisms for the identification and control of hazards, activity-level hazards and controls are sometimes missed, insufficiently characterized, or ineffectively implemented.

Although OA has emphasized subcontractor work activities during inspections, continued and increased OA attention is warranted, with emphasis on the following areas:

- Subcontractor injuries, illnesses, and occurrences, which are not consistently or thoroughly reported in DOE record keeping databases and therefore may be providing an incomplete or misleading picture of actual performance

- Flowdown of requirements to subcontractors, particularly in the areas where DOE requirements are more stringent than national standards

- Implementation of requirements at the working level, particularly on the processes for establishing controls

- DOE and contractor line management oversight and monitoring of subcontractor performance.

Environmental Protection

Introduction

Environmental programs at DOE sites comprise a wide range of activities, from managing waste and monitoring emissions created by current operations, to remediating legacy contamination from past operations. Under Federal, state, and local environmental regulations, these programs are subject to external monitoring, inspections, and enforcement actions, with the exception of radiological protection concerns that, under the Atomic Energy Act, are regulated solely by DOE. Because of the potential impact on the public and the environment, many environmental functions receive close scrutiny by regulators and the public.

Most environmental activities are performed by dedicated support personnel who monitor emissions; manage waste storage, treatment, and disposal facilities; conduct remediation of past contamination; and handle environmental compliance actions (e.g., obtaining permits and negotiating cleanup standards). Line operations personnel also have environmental protection responsibilities, including properly managing waste at the point of generation, and ensuring that production activities do not adversely impact the public or the environment. At some sites, environmental functions are performed by subcontractors. DOE field offices provide line management oversight of prime contractors and subcontractors that perform environmental functions.

OA inspections of environmental protection programs in the past year focused on hazardous, non-hazardous, and radioactive waste management. Additional areas selected for evaluation at several sites were groundwater restoration and protection, and environmental surveillance and monitoring, with primary emphasis on radioactive emissions and contamination. OA also evaluated domestic wastewater treatment at a few sites.

Positive Attributes

Many sites are proactively moving forward with implementation of an environmental management system (EMS) and are integrating EMS activities into their respective ISM programs. Several sites were taking actions to enhance their EMS in anticipation of a proposed requirement in draft DOE Order 450.1 *Environmental Protection Program*. A number of sites had implemented either ISO 14001 or equivalent programs as part of their EMS.

Most sites have implemented effective centralized management programs for newly generated hazardous, mixed, and radioactive waste streams. These programs ensure that a path for disposal has been determined for all wastes, that compliant storage is available, and that the waste will be packaged and characterized to meet the waste acceptance criteria for the final disposal site. In most cases, these actions are being performed in accordance with Federal, state, and local environmental regulations for hazardous and mixed waste and DOE Order 435.1, *Radioactive Waste Management*, for low-level, mixed, and transuranic waste. At the point of generation within operating facilities, most sites were managing temporary waste storage areas within internal and external requirements. Legacy waste volumes were being reduced at most sites through re-characterization and re-packaging, to allow shipment to DOE and private disposal sites.

Environmental restoration efforts and groundwater monitoring at most sites were consistent with ISM principles and DOE expectations. Various aspects of the environmental restoration program were particularly effective at several sites, including the extensive groundwater monitoring of suspect areas, tracking the migration of contaminants, and the identification and ongoing remediation of many high-priority groundwater plumes and soil contamination areas. For the most part, DOE field office and site personnel have established professional working relationships with Federal and state regulatory personnel, which facilitates the often extensive coordination and negotiations with regulators.

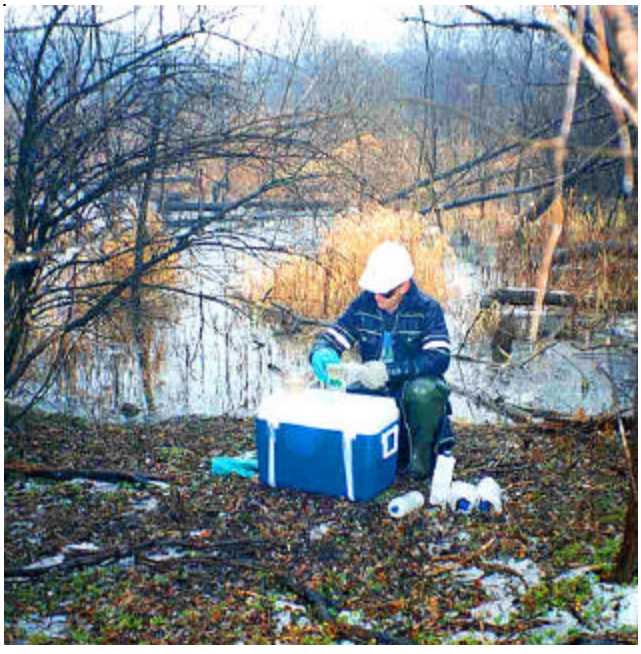
Areas for Improvement

Some sites have deficiencies in controls for wastes. Although most sites were effectively managing sanitary waste, many sites have not fully established controls, such as labeling dumpsters and trash containers (which could be sent to DOE and offsite sanitary landfills) to prevent hazardous or radioactive waste from being placed in them. In addition, several sites were experiencing challenges in achieving the

Secretary of Energy's pollution prevention goals; also, pollution prevention programs were not always comprehensive and proactive. At one site, legacy low-level waste had not been fully characterized to allow offsite disposal and was stored under less than adequate conditions.

Several sites had not fully assessed current operations from a groundwater protection perspective. Most sites are aggressively pursuing groundwater restoration and are monitoring known contaminated areas. However, several sites had not fully implemented DOE Order 5400.1, *General Environmental Protection Program*, requirements for monitoring of activities that have the potential to adversely impact the groundwater. The Order requires a complete analysis of potential impacts from current and abandoned underground lines and tanks that contain hazardous or radioactive liquids. In addition, several sites had not fully integrated groundwater protection programs with the more aggressive groundwater restoration and monitoring activities being conducted under the restoration program.

Some aspects of implementation of radiological environmental monitoring, surveillance, and control programs were deficient. Most sites had adequate environmental monitoring, surveillance, and control programs, which were effective in characterizing emissions and the potential for significant impacts. However, weaknesses in the implementation of these programs were identified in several areas, including characterization of legacy contamination (e.g., posting and control of areas); monitoring and/or analysis of low-level releases to surface waters, sediment, and soil columns; development of data quality objectives in support of radiological sampling and decision-making; and systematic application of the ALARA principle to environmental programs.



Sampling Wetlands

Conclusions and Future Inspection Areas of Emphasis

Sites were working to enhance EMS and to integrate environmental protection functions into ISM. Programs for waste management were generally effective, but further improvements are warranted for sanitary waste controls, legacy waste characterization, and pollution prevention. Restoration monitoring and cleanup actions were effective for identified contaminated groundwater and soil, although work remains to enhance groundwater protection for potential releases from current operations and legacy facilities, and to integrate restoration with groundwater protection. Radiological environmental programs were generally effective; however, improvements in a number of areas are needed for these programs to achieve consistency with DOE expectations and implementation guidance.

Future OA inspections will examine selected aspects of environmental protection programs, with particular emphasis on:

- The effectiveness of DOE Headquarters and field organizations in implementing their responsibilities under the new environmental protection program order (DOE Order 450.1), which is to be released soon
- The effectiveness of the field's implementation of an EMS within the ISM framework
- Radioactive waste management and crosscutting aspects of waste management programs, which provide insights into the effectiveness of ISM between line operations and environmental support functions
- Groundwater restoration and protection and environmental radiation programs at selected sites (e.g., where the hazards are significant, or where performance problems have been experienced).

Essential System Functionality

Introduction

For the purposes of OA inspections, essential systems include safety class systems and other systems that are essential to protecting the public, site workers, or the environment. Many DOE sites have one or more essential systems, such as fire protection systems, ventilation systems, and emergency electrical power.

OA has continued to focus more on reviews of ESF during its inspections. ESF reviews are highly technical, detailed engineering reviews of selected systems at DOE sites. The reviews focus on design, modification, operation, maintenance, and surveillance of the system and the implementation of the authorization basis as it relates to the selected system. OA's reviews of safety-related systems support DOE efforts to respond to Defense Nuclear Facilities Safety Board Recommendation 2000-2, *Configuration Management, Vital Safety Systems*. The reviews also evaluate implementation of 10 CFR 830, Subpart B, by evaluating the adequacy of select aspects of documented safety analysis technical safety requirements (TSRs) and implementation of the USQ process for nuclear facilities.

OA inspections focused on selected site ventilation and fire protection systems that have a clear relationship to safe operation of the facility. ESF review activities in the past year identified 10 findings and 12 opportunities for improvement.

Positive Attributes

The material condition of essential systems reviewed by OA was generally good, and the systems were capable of performing their safety functions. Although many essential systems at DOE sites are aging, DOE sites have adequately maintained or refurbished essential systems and components, for the most part. As a result, the essential systems were functional, with very few exceptions. Although some deficiencies were noted (e.g., configuration management), the systems that OA reviewed during the reporting period were capable of performing their safety functions.

The quality of authorization bases for nuclear facilities has improved significantly over the past several years. Most sites are devoting significant attention and resources to enhancing their authorization basis documents and analysis, many of which had previously been determined to be outdated and/or inaccurate. OA's recent reviews indicate that this attention has improved the quality of authorization basis documents, and further improvements are being made as sites continue efforts to upgrade their authorization bases. Although the OA ESF reviews identified some problems, most sites reviewed had been effective in updating authorization basis documents and had appropriately focused attention on the most important systems. The problems identified were relatively few and increasingly technical in nature.

As the authorization bases have improved, implementation of TSRs and operational safety requirements (OSRs) has improved. Unlike the past, many sites now have current authorization bases and supporting documents as a result of their efforts over the past several years to improve their safety analyses. These sites also demonstrated corresponding improvements in the implementation of safety requirements, in part because the requirements had been clarified and improved.

Areas for Improvement

A few sites have not yet established fully effective programs for establishing and maintaining their authorization bases and associated TSRs and OSRs. Notwithstanding the progress at most sites, a few sites/DOE field elements have not yet developed a program that fully and effectively implements the intent of the rule and DOE orders related to authorization bases. Progress at those sites has been sporadic and is not always sustained, and the technical reviews by DOE have not always been sufficient, resulting in non-conservative assumptions or analysis, and in a few cases, credible scenarios that were not analyzed. At those sites where authorization bases were weak or problematic, deficiencies were also evident in TSR/OSR implementation. For example, OSRs/TSRs did not always adequately verify assumptions in analyses; OSR/TSR limits were not always technically accurate; surveillance procedures were not technically accurate or could not be performed as written; and correct limits were not clearly specified in the surveillance procedures.

Implementation of the unreviewed safety question (USQ) rule (i.e., 10 CFR 830, part 203) was inconsistent across the DOE complex. An essential part of maintaining the authorization basis is the USQ process, which is used to determine whether tests, discovered conditions, or changes to the facility,

operations, or procedures require additional analysis or approval. Despite guidance available from DOE for the past 8 to 10 years, sites continue to have difficulty implementing a technically adequate USQ process, especially for facility modifications. While some sites had a good understanding of the purpose and requirements of the USQ process as found in the rule, some sites did not demonstrate effective implementation of the USQ process. One potential cause of this problem may be the lack of specificity in the process requirements. DOE has published a USQ implementation guide, but sites and facilities are not required to follow that guidance. As a result, some sites have USQ procedures that do not rigorously implement the rule. The use of USQ screenings to avoid more detailed and documented evaluation and analysis is common at many sites. In many cases, screening is implemented in a manner that allows facility modifications to circumvent the more detailed evaluation against the safety basis, as required by the rule. In other cases, evaluation required by the rule is performed informally by the screener and is not sufficiently documented. Consequently, the informal analysis is not subsequently included in the next revision to the safety basis. The problems are often compounded by a lack of experience or knowledge at the DOE site office responsible for approving the contractors USQ process. This lack of experience has not been offset by clear DOE guidance and requirements.

At some sites, procedures for conducting surveillance to assure the continued operability of essential systems did not include adequate criteria or were not implemented as required. Surveillance procedures at several sites did not include specific acceptance criteria for verification of operability. Additionally, surveillance testing at some sites was not conducted at the prescribed frequency.

Conclusions and Future Inspection Areas of Emphasis

Essential systems reviewed by OA were capable of performing their safety functions. Reviews over the past year indicated that authorization bases and implementing requirements at DOE facilities are improving. However, at many sites, much work remains to develop safety basis documents that are consistent with current requirements and processes that assure continued functionality of these systems. These include processes to periodically test the performance of the systems, assure proper configuration, and review changes. In some cases, improvements in technical accuracy and quality may be limited by the technical capabilities and experience of DOE site and field office personnel.

OA will continue to perform ESF reviews during inspections on a selective basis. Areas of emphasis will include:

- The USQ process, including implementation of DOE and site-specific screening guidance
- Implementation of 10 CFR 830, Subpart B, and the quality of authorization bases and associated TSRs/OSRs
- The quality of DOE field office reviews of the authorization bases prior to approval, and DOE line management oversight of essential systems, authorization bases, TSR/OSR implementation, and the USQ process.

APPENDIX B
SUPPLEMENTAL INFORMATION

B.1 Lessons Learned Report Team Composition

B.1.1 OA Management

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